



Reagent Guide

8th Edition



Synthetic Organic Chemistry & Materials Chemistry



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Reagent Guide

8th Edition

Synthetic Organic Chemistry & Materials Chemistry

We have reviewed our product line-ups and organized them according to the research areas of synthetic organic chemistry and materials chemistry. We hope that this reagent guide will be of assistance to your research and development laboratories.

However, this guide is not an all inclusive list of all the reagents we deal in. Please be sure to look up our catalog and visit our website as well to remain updated on the latest information in the various fields of your interest.

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Contents

Synthetic Organic Chemistry

"Topics"

Copper-free Click Reactions.....1

Easily Accessible Crystalline CO Surrogate Reagents.....2

Functional Group Transformation & Introducing Reaction

Oxidation.....3

Reduction.....9

Halogenation.....17

Trifluoromethylation.....23

Trifluoromethylthiolation.....25

Formylation.....26

Cyanation.....29

Amination.....31

Mitsunobu Reaction.....34

Condensation & Active Esterification.....38

Carbon-Carbon Bond Forming Reactions

Carbonyl Olefination.....44

Cross-coupling Reaction Using Transition Metal

Catalysts.....52

Activation of Non-active Bonds.....69

Synthetic Reagents

Metal Reagents for Organic Synthesis.....76

Stable Lewis Acids in Aqueous Media.....89

Ligands.....91

Asymmetric Organocatalysts.....102

Chiral Auxiliaries.....108

Chiral Phase-transfer Catalysts.....110

Optical Resolving Agents.....113

Protection & Derivatization.....120

Ionic Liquids.....130

Fluorous Solvents.....135

Polymer-supported Reagents.....137

Building Blocks

Boronic Acids & Boronic Acid Derivatives.....139

Chiral Building Blocks.....156

Terminal Acetylenes.....180

Azide Compounds.....186

Materials Chemistry

Nanocarbon Materials

Fullerenes.....190

Carbon Nanotubes.....192

Graphene & Graphene Oxide.....194

Nanodiamonds.....196

Nanocarbon Unit Structures.....198

Electronic Materials

Reagents for Solar Cell Research.....201

Reagents for Secondary Battery.....206

Organic Light-Emitting Diode Materials.....213

Organic Transistor Materials.....219

Molecular Conductors.....223

Building Blocks for Semiconducting Polymer.....230

Building Blocks for Small Molecule Semiconductor.....238

Ligands for Functional Metal Complex.....254

Optically Functional Materials

Photochromic Compounds.....259

Liquid Crystal Materials.....262

Building Blocks for Liquid Crystals.....270

Organic Nonlinear Optical Materials.....274

Materials for Near Infrared Absorption.....276

Magnetic Materials

Magnetic Metal Complexes.....277

Organic Radicals.....281

Magnetic Ionic Liquids.....283

Functional Organic Dyes

Coumarin Dyes.....284

Porphyrin & Phthalocyanine Dyes.....286

Perylene Dyes.....289

Cyanine & Squarylium Dyes.....291

Dipyrromethene Dyes.....293

Xanthene Dyes.....294

DCM Dyes.....296

Quinacridone Dyes.....297

Organic-Inorganic Hybrid Materials

Metal-Organic Frameworks (MOFs / PCPs) &

Related Ligands.....298

Organic-Inorganic Perovskite Precursors.....303

Silane Coupling Agents.....305

Self-Assembled Monolayer (SAM)

Forming Agents.....313

Polymer Research Reagents

Polymers.....316

Monomers.....319

Polymerization Inhibitors.....320

Polymerization Initiators.....321

Polymerization Catalysts.....325

Precise Polymerization Reagents.....328

Resin Additives.....333

Photopolymer Research Reagents.....341

Macrocycles for Host-Guest Chemistry

Macrocycles for Host-Guest Chemistry.....342

Other Reagents

Building Blocks for Dendrimers.....348

Derivatizing Reagents for Solubility Improvement...351

Abbreviations.....360

Pressure-Temperature Nomograph.....362

The physical properties of the typical organic solvents /

Freezing mixtures.....363

Periodic Table of the Elements.....364

INDEX.....365

TCI International Offices.....376

TCI Distributors.....377

If you are looking for products in the field of Bioscience & Analytical Science, please see below.

Reagent Guide 8th Edition

Bioscience & Analytical Science

Bioscience

Example :

Antibodies / Sugars / Nucleosides / Amino Acids / Lipids / Terpenes / Steroids etc.

Analytical Science

Example :

GC Derivatizing Reagents / Labeling Reagents for HPLC / Chromatography Columns for HPLC / Derivatization Reagents for Mass Spectrometry etc.

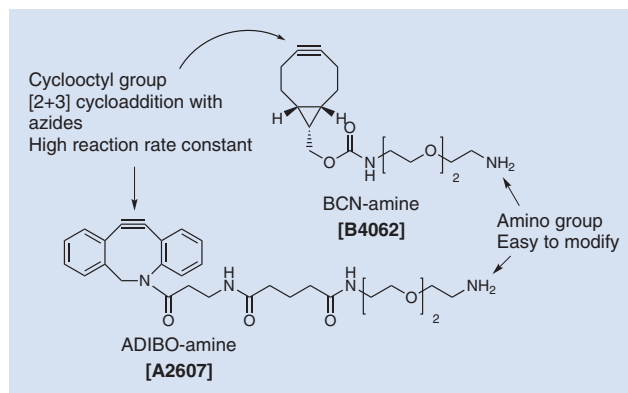
Copper-free Click Reactions

Among the “click chemistry” proposed by K. B. Sharpless in 2001, the Huisgen cyclization using azides and terminal alkynes has been widely used in various research fields such as chemical biology and material science due to its excellent chemoselectivity.¹⁾ Generally, the Huisgen cyclization requires some copper salts to promote the reactions. However, use of the copper salt-mediated click reactions for *in vivo* applications is often highly restricted owing to the toxicity of active oxygen *in vivo* generated by the copper salt. Therefore, the development of advanced click reactions without using any copper salt has been investigated.

In the research fields using copper-free click reactions, a number of studies aimed for *in vivo* applications such as living cells and biological experiments on animals have been reported. To be suitable for such purposes, molecular design of alkyne derivatives has been performed mainly to improve two chemical properties of second order reactions, rate constant and lipophilicity (log P).

In 2004, C. R. Bertozzi *et al.* have reported the copper-free click reaction using highly-strained cyclooctyl groups as reactants. These cyclooctyl compounds satisfy the above mentioned two requests and are widely used as a molecular tool to reveal the metabolic systems.²⁾ Recently, they have been used to construct the microenvironment of hydrogels supporting the basis of regenerative medicine research. Because of that, Bertozzi *et al.* have suggested general and accessible experimental procedures for researchers who don't do major synthetic organic chemistry, and their practical examples can be referred to in the research article.³⁾

Furthermore, van Delft *et al.* have developed more effective cyclooctyl compounds usable for *in vivo* bioorthogonal and 3D imaging.³⁾ For instance, ADIBO-amine and BCN-amine are suitable molecules for the copper-free click reaction in biological research because they have low lipophilicity and high reactivity. Especially, ADIBO-amine is used for PEGylation of proteins and nuclear imaging by positron emission tomography (PET) using a fluorine-18 [¹⁸F] radioisotope. As stated above, ADIBO-amine and BCN-amine are expected to be powerful versatile tools for the copper-free click reaction because they can also be used for surface reforming of solid materials and chemical modification of organic molecules in material science research as well as live imaging and microarray analysis in life science research.



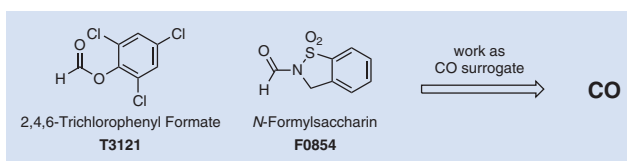
Product No.	Product Name	Unit Size
A2607	9,15-Diaza-18-DBCO-3,6-dioxo-10,14,18-trioxooctadecylamine (ADIBO-amine)	25mg
B4062	N-(1 <i>R</i> ,8 <i>S</i> ,9 <i>S</i>)-Bicyclo[6.1.0]non-4-yn-9-ylmethoxycarbonyl-1,8-diamino-3,6-dioxaoctane (BCN-amine)	25mg 100mg

References

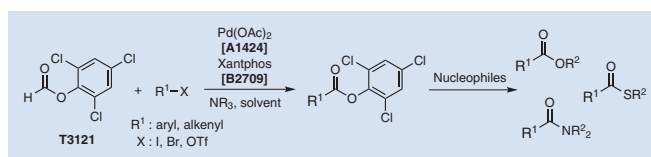
- 1) H. C. Kolb, M. G. Finn, K. B. Sharpless, *Angew. Chem. Int. Ed.* **2001**, 40, 2004.
- 2) N. J. Agard, J. A. Prescher, C. R. Bertozzi, *J. Am. Chem. Soc.* **2004**, 126, 15046.
- 3) E. M. Sletten, C. R. Bertozzi, *Acc. Chem. Res.* **2011**, 44, 666.
- 4) a) J. Dommerholt, S. Schmidt, R. Temming, L. J. A. Hendriks, F. P. J. T. Rutjes, J. C. M. van Hest, D. J. Lefeber, P. Friedl, F. L. van Delft, *Angew. Chem. Int. Ed.* **2010**, 49, 9422.
b) M. F. Debets, S. S. van Berkel, S. Schoffelen, F. P. J. T. Rutjes, J. C. M. van Hest, F. L. van Delft, *Chem. Commun.* **2010**, 46, 97.

Easily Accessible Crystalline CO Surrogate Reagents

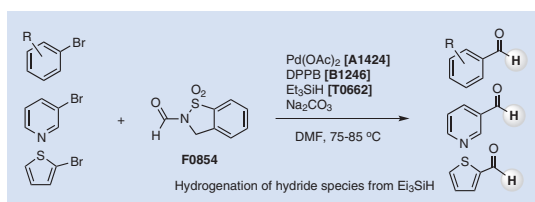
Carbon monoxide (CO) is used as a significant carbonyl group-introducing reagent in organic synthesis. A number of synthetic reactions using CO have been developed. Because CO is a colorless, odorless and toxic gas at room temperature, it is necessary to pay minute attention when using it. For that reason, in the field of the synthetic chemistry using CO, the development of CO surrogate reagents as well as the study of novel synthetic reactions has proceeded.



Manabe *et al.* have investigated novel CO surrogate agents focused on formic acid derivatives and found that 2,4,6-trichlorophenyl formate can act functionally as a CO equivalent.¹⁾ This compound is a stable crystalline solid at room temperature and it rapidly decomposes into CO and 2,4,6-trichlorophenol by treatment with a trialkylamine. *In situ* generated CO is successfully applied to the palladium-catalyzed carbonylation of aryl/alkenyl halides and triflates to give their 2,4,6-trichlorophenol esters. Continuously, the given esters can be transformed into the corresponding carboxylic acid derivatives by the reaction with various nucleophiles. This carbonylation reaction is a highly practical synthetic method since it does not decrease the reaction yields even in gram-scale reactions.²⁾



Subsequently, Manabe *et al.* have developed the reductive carbonylation using *N*-formylsaccharin as a CO equivalent.³⁾ In this reaction, palladium acetate is used as a catalyst and the reductive carbonylation of aryl bromides is accomplished in combination with triethylsilane as a nucleophile. The hydrogen atom on a formyl group of formed aldehydes is introduced by the addition of the hydride species from triethylsilane.



In a case using 2,4,6-trichlorophenyl formate together with other nucleophiles, the carbonylation reaction tends to be complicated because of the nucleophilicity of 2,4,6-trichlorophenol formed as a by-product. However, in the carbonylation reaction using *N*-formylsaccharin, hydrosilanes can be directly used as a nucleophile because the nucleophilicity of formed saccharin is sufficiently inert.

Product No.	Product Name	Unit Size	
T3121	2,4,6-Trichlorophenyl Formate	1g	5g
F0854	<i>N</i> -Formylsaccharin	5g	25g

References

- 1) T. Ueda, H. Konishi, K. Manabe, *Org. Lett.* **2012**, 14, 5370.
- 2) H. Konishi, T. Ueda, K. Manabe, *Org. Synth.* **2014**, 91, 39.
- 3) T. Ueda, H. Konishi, K. Manabe, *Angew. Chem. Int. Ed.* **2013**, 52, 8611.

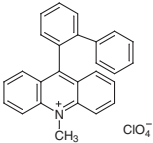
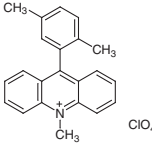
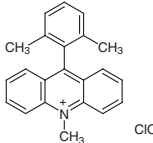
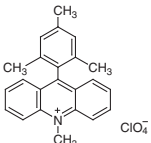
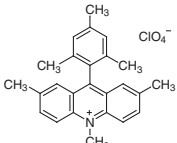
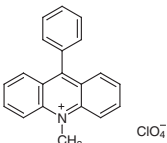
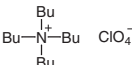
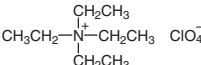
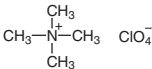
Oxidation

Oxidation, making its target substance lose electrons, is one of the most basic reactions in organic chemistry and is exemplified by the combination with oxygen or a dehydrogenation reaction. In particular, it is often used for the transformation of alcohols to the corresponding aldehydes, ketones or carboxylic acids. Heavy metal compounds, such as chromium (VI) oxide and potassium permanganate, have been exploited for many years. Especially, chromium (VI) oxide has been utilized abundantly, based on the report of the control of oxidation powers by Jones or Sarett.¹⁾ Furthermore, chromium (VI) oxide have been improved as the Collins reagent²⁾, PCC³⁾ and PDC⁴⁾ and are used in many fields. On the other hand, the Dess-Martin periodinane⁵⁾, the Mukaiyama oxidizing agent⁶⁾ and oxoammonium salts have been developed without containing harmful metals. Moreover, oxidation reactions employing inexpensive sodium hypochlorite or molecular oxygen have also been reported in the presence of oxidation catalysts such as tetrapropylammonium perruthenate (TPAP)⁷⁾ and TEMPO⁸⁾. This section shows the typical oxidizers and the catalysts used for oxidation reactions.

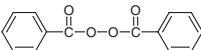
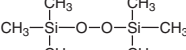
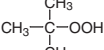
Metal Oxidants		B2134	B1375	B1123
C1944	L0021	O0414	O0308	P1910
				$12\text{MoO}_3 \cdot \text{H}_3\text{PO}_4 \cdot x\text{H}_2\text{O}$
P1742	P0930	P0931	P1088	Q0058
KMnO_4				
S0815	T1803	T1559		

Product No.	Product Name	Unit Size
B2134	Benzeneseleninic Acid	5g
B1375	Bis(4-methoxyphenyl) Selenoxide	1g 5g
B1123	Bis(tetrabutylammonium) Dichromate	10g
C1944	Chloronitrosyl[N,N'-bis(3,5-di- <i>tert</i> -butylsalicylidene)-1,1,2,2-tetramethylethylenediaminato]-ruthenium(IV)	100mg

Product No.	Product Name	Unit Size	
L0021	Lead Tetraacetate (contains Acetic Acid)	25g	500g
O0414	Osmium Catalyst supported on Magnetite (0.07-0.09mmol/g)	1g	
O0308	Osmium Tetroxide (4% in Water)	10mL	
P1910	Phosphomolybdic Acid Hydrate	25g	100g
P1742	Potassium Permanganate	300g	
P0930	Pyridinium Chlorochromate	25g	100g
P0931	Pyridinium Dichromate	25g	100g
P1088	Pyridinium Fluorochromate	5g	
Q0058	Quinolinium Dichromate	10g	25g
S0815	Silver(II) Pyridine-2-carboxylate	1g	5g
T1803	Tetrabutylammonium Perrhenate	1g	5g
T1559	Tetrapropylammonium Perruthenate	1g	5g

Perchlorates		B2897	D3428	D3429
				
M1774	M2072	M1775	T0836	T0839
				
T0841				
				

Product No.	Product Name	Unit Size	
B2897	9-(2-Biphenyl)-10-methylacridinium Perchlorate	1g	5g
D3428	9-(2,5-Dimethylphenyl)-10-methylacridinium Perchlorate	1g	5g
D3429	9-(2,6-Dimethylphenyl)-10-methylacridinium Perchlorate	1g	5g
M1774	9-Mesityl-10-methylacridinium Perchlorate	1g	5g
M2072	9-Mesityl-2,7,10-trimethylacridinium Perchlorate	1g	
M1775	10-Methyl-9-phenylacridinium Perchlorate	1g	5g
T0836	Tetrabutylammonium Perchlorate	25g	100g
T0839	Tetraethylammonium Perchlorate	25g	
T0841	Tetramethylammonium Perchlorate	25g	

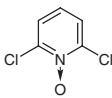
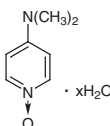
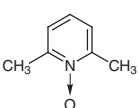
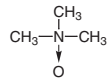
Organic Peroxides		B3152	B3497	B3153
				

C0357	C2223	D3411	M0927

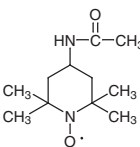
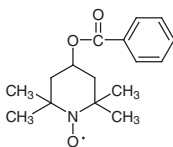
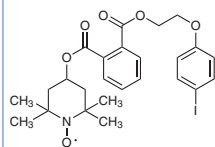
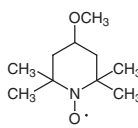
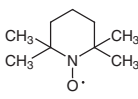
Product No.	Product Name	Unit Size
B3152	Benzoyl Peroxide (wetted with ca. 25% Water)	25g
B3497	Bis(trimethylsilyl) Peroxide (contains Hexamethyldisiloxane) (ca. 30% in Hexane)	5g
B3153	<i>tert</i> -Butyl Hydroperoxide (70% in Water)	100g
C0357	3-Chloroperoxybenzoic Acid (contains ca. 30% Water)	25g 250g
C2223	Cumene Hydroperoxide (contains ca. 20% Aromatic Hydrocarbon)	100g
D3411	Di- <i>tert</i> -butyl Peroxide	100mL
M0927	Monoperoxyphthalic Acid Magnesium Salt Hexahydrate	25g 500g

Hypervalent Iodine Compounds		A2678 	B2539 	B1175
		D2045 	I0330 	I0479
B1616 	B2121 	D4477 	I0330 	I0479
I0072 	I0073 	I0791 	P1015 	P1415

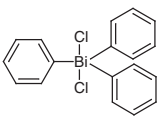
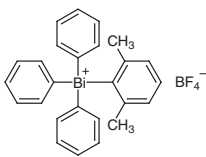
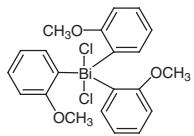
Product No.	Product Name	Unit Size
A2678	1-Acetoxy-5-bromo-1,2-benziodoxol-3(1H)-one (ABBX)	1g
B2539	Barluenga's Reagent	1g
B1175	[Bis(trifluoroacetoxy)iodo]benzene (PIFA)	5g 25g
B1616	[Bis(trifluoroacetoxy)iodo]pentafluorobenzene	1g 5g
B2121	1-(<i>tert</i> -Butylperoxy)-1,2-benziodoxol-3(1H)-one	1g
D4477	Dess-Martin Periodinane (8-12% in Dichloromethane)	25mL 250mL
D2045	Dess-Martin Periodinane	1g 5g 25g
I0330	Iodobenzene Diacetate (PIDA)	10g 25g 250g
I0479	Iodomesitylene Diacetate	5g 25g
I0072	Iodobenzene	5g
I0073	2-Iodobenzoic Acid	10g
I0791	2-Iodoxybenzoic Acid (IBX) (stabilized with Benzoic Acid + Isophthalic Acid)	5g 25g
P1015	Koser Reagent	5g 25g
P1415	Poly[4-(diacetoxyiodo)styrene] (PSDIB)	1g 5g

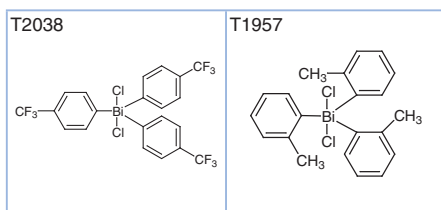
N-Oxides		D3219	D3220	L0069
				
M0981 M2192	P0557	T1362 T0466		
				

Product No.	Product Name	Unit Size	
D3219	2,6-Dichloropyridine <i>N</i> -Oxide	5g	
D3220	4-(Dimethylamino)pyridine <i>N</i> -Oxide Hydrate	1g	5g
L0069	2,6-Lutidine <i>N</i> -Oxide	25g	
M0981	4-Methylmorpholine <i>N</i> -Oxide (50% in Water, ca. 4.8mol/L)	25mL	500mL
M2192	4-Methylmorpholine <i>N</i> -Oxide	5g	25g
P0557	Pyridine <i>N</i> -Oxide	25g	500g
T1362	Trimethylamine <i>N</i> -Oxide Anhydrous	1g	5g
T0466	Trimethylamine <i>N</i> -Oxide Dihydrate	25g	500g

TEMPOs		A1348	H0878	I0908
				
M1197	T1560			
				

Product No.	Product Name	Unit Size	
A1348	4-Acetamido-TEMPO Free Radical	5g	25g
H0878	4-Benzoyloxy-TEMPO Free Radical	1g	5g
I0908	4-[2-[2-(4-Iodophenoxy)ethoxy]carbonyl]benzoyloxy-2,2,6,6-tetramethylpiperidin-1-oxyl		100mg
M1197	4-Methoxy-TEMPO Free Radical	1g	5g
T1560	TEMPO Free Radical	5g	25g

Organic Bismuth Compounds		T1837	T2507	T1956
				



Product No.	Product Name	Unit Size
T1837	Triphenylbismuth Dichloride	5g
T2507	Triphenyl-2,6-xylylbismuthonium Tetrafluoroborate	100mg 1g
T1956	Tris(2-methoxyphenyl)bismuth Dichloride	1g 5g
T2038	Tris(4-trifluoromethylphenyl)bismuth Dichloride	1g
T1957	Tri- <i>o</i> -tolylbismuth Dichloride	1g 5g

Others		A2065	C1806	B2151
			$(\text{NH}_4)_2\text{Ce}(\text{NO}_3)_6$	$\left(\text{Bu}-\text{N}^+\text{Bu} \right)_2 \text{S}_2\text{O}_8^{2-}$
T0617	B0656	B2240	B2188	H0362
C1326	C1327	C0076	T0061	T0970
D0318	H1404	I0074	M2274	M2321
O0310	P0998	T1559		
$2\text{KHSO}_5 \cdot \text{KHSO}_4 \cdot \text{K}_2\text{SO}_4$				

Product No.	Product Name	Unit Size
A2065	4-Acetamido-2,2,6,6-tetramethyl-1-oxopiperidinium Tetrafluoroborate	5g
C1806	Ammonium Cerium(IV) Nitrate	50g 500g
B2151	Bis(tetrabutylammonium) Peroxydisulfate	5g 25g
T0617	Bromanil	5g 25g
B0656	N-Bromosuccinimide	25g 100g 500g
B2240	N- <i>tert</i> -Butylbenzenesulfenamide	1g 5g 25g

Product No.	Product Name	Unit Size	
B2188	<i>N</i> - <i>tert</i> -Butylbenzenesulfinimidoyl Chloride	1g	5g
H0362	<i>tert</i> -Butyl Hypochlorite	25g	500g
C1326	(2 <i>R</i> ,8 <i>aS</i>)-(+)-(Camphorylsulfonyl)oxaziridine [Asymmetric Oxidizing Reagent]	1g	5g
C1327	(2 <i>S</i> ,8 <i>aR</i>)-(-)-(Camphorylsulfonyl)oxaziridine [Asymmetric Oxidizing Reagent]	1g	5g
C0076	Chloramine T Trihydrate	25g	500g
T0061	Chloranil	25g	500g
T0970	<i>o</i> -Chloranil	5g	25g
D0318	Dichloramine T	25g	500g
H1404	2-Hydroxy-2-azaadamantane	200mg	1g 5g
I0074	<i>N</i> -Iodosuccinimide	5g	25g 100g
M2274	1-Methyl-3-[6-(methylsulfinyl)hexyl]imidazolium <i>p</i> -Toluenesulfonate	1g	5g
M2321	1-Methyl-3-[6-(methylthio)hexyl]imidazolium <i>p</i> -Toluenesulfonate	1g	5g
O0310	Potassium Peroxymonosulfate [$>45\%$ (T) as KHSO_5]	25g	500g
P0998	Pyridine - Sulfur Trioxide Complex	25g	100g 500g
T1559	Tetrapropylammonium Perruthenate	1g	5g

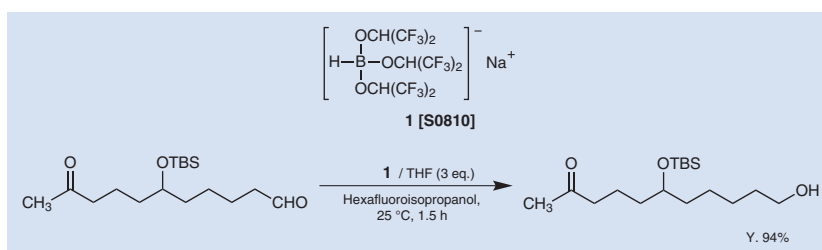
Many oxidizing agents may cause combustion or explosion upon mixture with flammable materials or upon exposure to heat, shock, and friction etc. Sufficient safety measures, such as using safety shields, wearing protective equipment, and using extreme caution should be taken when working with these reagents as well as disposing of the reagents.

References

- 1) K. Bowden, I. M. Heilbron, E. R. H. Jones, *J. Chem. Soc.* **1946**, 39; Review: S. V. Ley, A. Madin, *Comprehensive Organic Synthesis* **1991**, 7, 253.
- 2) J. C. Collins, W. W. Hess, F. J. Frank, *Tetrahedron Lett.* **1968**, 9, 3363.
- 3) E. J. Corey, J. W. Suggs, *Tetrahedron Lett.* **1975**, 16, 2647.
- 4) E. J. Corey, G. Schmidt, *Tetrahedron Lett.* **1979**, 20, 399.
- 5) D. B. Dess, J. C. Martin, *J. Org. Chem.* **1983**, 48, 4155; R. E. Irekand, L. Liu, *J. Org. Chem.* **1993**, 58, 2899.
- 6) J. Matsuo, D. Iida, K. Tatani, T. Mukaiyama, *Bull. Chem. Soc. Jpn.* **2002**, 75, 223.
- 7) W. P. Griffith, S. V. Ley, G. P. Whitcombe, A. D. White, *J. Chem. Soc., Chem. Commun.* **1987**, 1625; Review: S. V. Ley, J. Norman, W. P. Griffith, S. P. Marsden, *Synthesis* **1994**, 639.
- 8) O. L. Lebelev, S. N. Kazarnovskii, *Zhur. Obshch. Khim.* **1960**, 30, 1631; Review: A. E. J. de Nooy, A. C. Besemer, H. van Bekkum, *Synthesis* **1996**, 1153.

Reduction

Reduction is a chemical reaction in which the target substances receive electrons, and is one of the most fundamental reactions in organic chemistry including the deoxygenation reaction and the hydrogenation reaction. The well-known reducing agents include metal hydrides such as LiAlH_4 ¹⁾, boranes used in the hydride reduction, and hydrazine used in the Wolff-Kishner reduction.²⁾ Sodium tris(1,1,1,3,3,3-hexafluoroisopropoxy)borohydride (**1**) is a selective reducing agent developed by Toshima *et al.* Aldehydes are selectively reduced in the presence of ketones and other reducible functions using **1** to afford the corresponding primary alcohols in high yields.³⁾



In addition, the radical reductive reaction using silane compounds tris(trimethylsilyl)silane⁴⁾ and tetraphenyldisilane (TPDS)⁵⁾ as radical reducing agents has been developed avoiding the use of highly toxic tin compounds. This section shows the typical reducing agents.

Table. Comparison of reactivities of hydride reducing agents for carbonyl compounds and imines

Reagents Reactions	NaBH ₃ CN S0396	NaBH ₄ S0480	LiBH ₄ L0186	LiAlH ₄ L0170, L0203	THF · BH ₃ T2346
	NaBH(OCOCH ₃) ₃ S0394				Me ₂ S · BH ₃ D1843
					PhNEt ₂ · BH ₃ D2581
 Imine → Amine					
 Aldehyde → Alcohol					
 Ketone → Alcohol					
 Ester → Alcohol					
 Amide → Amine					
 Carboxylic Acid → Alcohol					

Reactivity : High Middle Low

Metal Hydrides		Aluminum Hydrides	D2972 D2971	L0203 L0170
			$[(CH_3)_2CHCH_2]_2AlH$	$LiAlH_4$
L0159	S0467			
$Li^+ \left[\begin{array}{c} OC(CH_3)_3 \\ \\ H-Al-OC(CH_3)_3 \\ \\ OC(CH_3)_3 \end{array} \right]^-$	$NaAl(OCH_2CH_2OCH_3)_2H_2$			

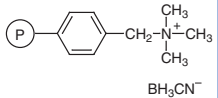
Product No.	Product Name	Unit Size	
D2972	Diisobutylaluminum Hydride (17% in Toluene, ca. 1.0mol/L)	100mL	500mL
D2971	Diisobutylaluminum Hydride (19% in Hexane, ca. 1.0mol/L)	100mL	500mL
L0203	Lithium Aluminum Hydride (Powder)	25g	100g
L0170	Lithium Aluminum Hydride (10% in Tetrahydrofuran, ca. 2.5mol/L)		100mL
L0159	Lithium Tri- <i>tert</i> -butoxyaluminum Hydride (ca. 30% in Tetrahydrofuran, ca. 1.0mol/L)		100mL
S0467	Sodium Bis(2-methoxyethoxy)aluminum Dihydride (70% in Toluene, ca. 3.6mol/L)	25g	100g 500g

Tin Hydrides	T1473
	$\begin{array}{c} (CH_2)_3CH_3 \\ \\ CH_3(CH_2)_3-Sn-H \\ \\ (CH_2)_3CH_3 \end{array}$

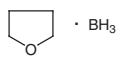
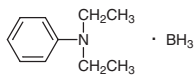
Product No.	Product Name	Unit Size	
T1473	Tributyltin Hydride (stabilized with BHT)	25g	250g

Other Metal Hydrides	S0481	Z0010
	NaH	

Product No.	Product Name	Unit Size	
S0481	Sodium Hydride (60%, dispersion in Paraffin Liquid)	100g	500g
Z0010	Zirconocene Chloride Hydride	1g	5g 25g

Borohydrides		B1139	L0186	L0164
		$\text{Ph}_3\text{P}^- \cdot \text{Cu} \cdot \text{BH}_4$	LiBH_4	$\text{Li}^+ \left[\begin{array}{c} \text{CH}(\text{CH}_3)\text{CH}_2\text{CH}_3 \\ \\ \text{H}-\text{B}-\text{CH}(\text{CH}_3)\text{CH}_2\text{CH}_3 \\ \\ \text{CH}(\text{CH}_3)\text{CH}_2\text{CH}_3 \end{array} \right]^-$
P1719	P1681	P1380	S0480	S0396
	KBH_4	$\left[\begin{array}{c} \text{CH}_3 \\ \\ \text{CH}_3\text{CH}_2\text{CH} \\ \\ \text{BH} \end{array} \right]^- \text{K}^+$	NaBH_4	NaBH_3CN
S0394	S0810	T0917	T0852	T1553
$\text{Na}^+ \text{AcO}-\text{B}(\text{OAc})_2-\text{H}$	$\left[\begin{array}{c} \text{OCH}(\text{CF}_3)_2 \\ \\ \text{H}-\text{B}-\text{OCH}(\text{CF}_3)_2 \\ \\ \text{OCH}(\text{CF}_3)_2 \end{array} \right]^- \text{Na}^+$	$\text{Bu}-\text{N}^+(\text{Bu})_3 \text{BH}_4^-$	$\text{CH}_3-\text{N}^+(\text{CH}_3)_3 \text{BH}_4^-$	$\text{CH}_3-\text{N}^+(\text{CH}_3)_3 \text{AcO}-\text{B}(\text{OAc})_2-\text{H}$

Product No.	Product Name	Unit Size	
B1139	Bis(triphenylphosphine)copper Tetrahydroborate	5g	
L0186	Lithium Borohydride (ca. 3mol/L in Tetrahydrofuran)	100mL	
L0164	Lithium Tri- <i>sec</i> -butylborohydride (ca. 21% in Tetrahydrofuran, ca. 1.0mol/L)	100mL	
P1719	(Polystyrylmethyl)trimethylammonium Cyanoborohydride cross-linked with 10% DVB (30-50mesh) (2.6-3.0mmol/g)	5g	25g
P1681	Potassium Borohydride	25g	100g
P1380	Potassium Tri- <i>sec</i> -butylborohydride (ca. 1.0mol/L in Tetrahydrofuran)	Price on request	
S0480	Sodium Borohydride	25g	100g 500g
S0396	Sodium Cyanoborohydride	5g	25g 250g
S0394	Sodium Triacetoxymethylborohydride	25g	100g
S0810	Sodium Tris(1,1,1,3,3,3-hexafluoroisopropoxy)borohydride	5g	
T0917	Tetrabutylammonium Borohydride	5g	25g
T0852	Tetramethylammonium Borohydride	5g	25g
T1553	Tetramethylammonium Triacetoxymethylborohydride	5g	25g

Boranes		Borane Complexes	B1827	T2346
			$\text{CH}_3-\text{C}(\text{CH}_3)_2-\text{S}(\text{CH}_2)_2-\text{S}-\text{C}(\text{CH}_3)_2-\text{CH}_3 \cdot 2\text{BH}_3$	
D2581	D1843			
	$\text{CH}_3\text{SCH}_3 \cdot \text{BH}_3$			

Product No.	Product Name	Unit Size	
B1827	1,2-Bis(<i>tert</i> -butylthio)ethane Borane	1g	
T2346	Borane - Tetrahydrofuran Complex (8.5% in Tetrahydrofuran, ca. 0.9mol/L) (stabilized with Sodium Borohydride)	100mL	500mL
D2581	<i>N,N</i> -Diethylaniline Borane	25g	100g
D1843	Dimethyl Sulfide Borane	25mL	100mL

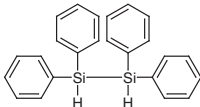
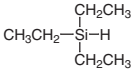
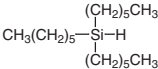
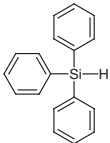
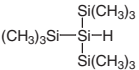
Borane-Amine Complexes	B1264	B4084	B3018	M0898
B1569	D1842	T1180	T1181	

Product No.	Product Name	Unit Size	
B1264	Borane - <i>tert</i> -Butylamine Complex	25g	100g
B4084	Borane - 5-Ethyl-2-methylpyridine Complex	25mL	100mL
B3018	Borane - 2-Methylpyridine Complex	5g	25g
M0898	Borane - Morpholine Complex	5g	25g
B1569	Borane - Pyridine Complex		25mL
D1842	Dimethylamine Borane	25g	500g
T1180	Triethylamine Borane		25g
T1181	Trimethylamine Borane		25g

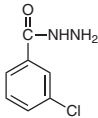
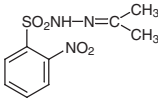
Other Boranes	C1614	C2023 C1615	I0796	I0797

Product No.	Product Name	Unit Size
C1614	(+)- <i>B</i> -Chlorodiisopinocampheylborane (58% in Hexane, ca. 1.6mol/L)	100mL
C2023	(-)- <i>B</i> -Chlorodiisopinocampheylborane (55-65% in Heptane, ca. 1.7mol/L)	100mL
C1615	(-)- <i>B</i> -Chlorodiisopinocampheylborane (60% in Hexane, ca. 1.7mol/L)	100mL
I0796	(+)-Isopinocampheylborane TMEDA Complex	5g
I0797	(-)-Isopinocampheylborane TMEDA Complex	5g

Silanes	C1492	C0778	D2403
D2196	D2406 D2820	D1825	P1291
			T1437

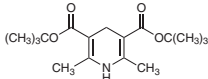
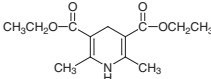
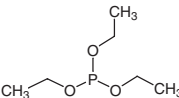
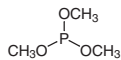
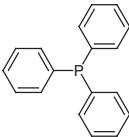
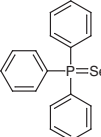
T1896 	T0398 	T0662 	T1334 	T1533 
T0661 	T1463 			

Product No.	Product Name	Unit Size	
C1492	Chlorodiisopropylsilane	5mL	25mL
C0778	Chlorodimethylsilane	25mL	250mL
D2403	Diethoxymethylsilane [Hydrosilylating Reagent]		25mL
D2196	Dimethylphenylsilane		25mL
D2406	Diphenylsilane	5g	25g
D2820	Diphenylsilane	5g	25g
D1825	Methyldiphenylsilane		25mL
P1291	Phenylsilane	5mL	25mL
T1437	1,1,3,3-Tetramethyldisiloxane	25mL	250mL
T1896	1,1,2,2-Tetraphenyldisilane	1g	5g
T0398	Trichlorosilane	5g	25g 500g
T0662	Triethylsilane	25mL	250mL
T1334	Trihexylsilane		10g
T1533	Triisopropylsilane	5mL	25mL 100mL
T0661	Triphenylsilane		25g
T1463	Tris(trimethylsilyl)silane (stabilized with TBBP)	5mL	25mL

Hydrazines, Hydrazides		C2648 	H0697 H0204 H0172 H_2NNH_2	H0169 $\text{H}_2\text{NNH}_2 \cdot 2\text{HBr} \cdot x\text{H}_2\text{O}$
H0170 $\text{H}_2\text{NNH}_2 \cdot 2\text{HCl}$	H0173 $\text{H}_2\text{NNH}_2 \cdot \text{HBr}$	H0174 $\text{H}_2\text{NNH}_2 \cdot \text{HCl}$	I0777 	

Product No.	Product Name	Unit Size	
C2648	3-Chlorobenzohydrazide	5g	25g
H0697	Hydrazine Anhydrous	10g	100g
H0204	Hydrazine Monohydrate (79%)	25g	500g
H0172	Hydrazine Monohydrate	25mL	500mL
H0169	Hydrazine Dihydrobromide Hydrate	25g	500g
H0170	Hydrazine Dihydrochloride	25g	500g

Product No.	Product Name	Unit Size	
H0173	Hydrazine Monohydrobromide	25g	500g
H0174	Hydrazine Monohydrochloride	25g	500g
I0777	N'-Isopropylidene-2-nitrobenzenesulfonylhydrazide		5g

Others		D4311	D3775	H1221
				HI
S0494	T0430	T0488	T0519	T1819
SmI_2				

Product No.	Product Name	Unit Size	
D4311	Di- <i>tert</i> -butyl 1,4-Dihydro-2,6-dimethyl-3,5-pyridinedicarboxylate	1g	5g
D3775	Diethyl 1,4-Dihydro-2,6-dimethyl-3,5-pyridinedicarboxylate	1g	5g
H1221	Hydriodic Acid (57%)		300mL
S0494	Samarium(II) Iodide (ca. 0.1mol/L in Tetrahydrofuran)		25mL
T0430	Triethyl Phosphite	25mL	500mL
T0488	Trimethyl Phosphite		25mL
T0519	Triphenylphosphine	25g	500g
T1819	Triphenylphosphine Selenide		5g

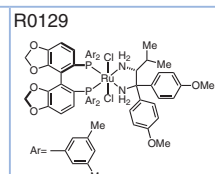
Many reducing agents may spontaneously ignite on contact with air, or may react violently with water to produce flammable gases. Sufficient safety measures, such as using safety shields, wearing protective equipment, and using extreme caution should be taken when working with these reagents as well as disposing of the reagents.

Hydrogenation Catalysts

Product No.	Product Name	Unit Size	
P1785	Palladium 10% on Carbon (wetted with ca. 55% Water)	5g	25g
P1491	Palladium 10% on Carbon (wetted with ca. 55% Water)	5g	25g
P1701	Palladium 5% on Barium Carbonate		10g
P1702	Palladium 5% on Barium Sulfate	5g	25g
P1703	Palladium 5% on Calcium Carbonate (poisoned with Lead)	5g	25g
P1490	Palladium 5% on Carbon (wetted with ca. 55% Water)	5g	25g
P1528	Palladium Hydroxide 20% on Carbon (wetted with ca. 50% Water)	10g	50g
P1786	Palladium on SH Silica Gel (0.1mmol/g)		1g
P1720	Platinum(IV) Oxide		200mg
P1944	Poly(methylphenyl)silane supported Palladium/Alumina Hybrid Catalyst [= Pd] / ($\text{PSi-Al}_2\text{O}_3$)]		1g
R0075	Rhodium 5% on Carbon (wetted with ca. 55% Water)		1g
R0076	Ruthenium 5% on Carbon (wetted with ca. 50% Water)	5g	25g
S0487	Skeletal Nickel Catalyst slurry in Water		50g

Asymmetric Hydrogenation Catalysts

Ruthenium Complex Catalysts for Asymmetric Hydrogenation of Ketones



R0128 	R0131 	R0130 	R0133 	R0132
R0135 	R0134 	R0139 	R0138 	

Product No.	Product Name	Unit Size	
R0129	RuCl ₂ [(<i>R</i>)-dm-segphos [®]][(<i>R</i>)-daipen]	200mg	1g
R0128	RuCl ₂ [(<i>S</i>)-dm-segphos [®]][(<i>S</i>)-daipen]	200mg	1g
R0131	RuCl ₂ [(<i>R</i>)-dm-segphos [®]][(<i>R,F</i>)-dppe]	200mg	1g
R0130	RuCl ₂ [(<i>S</i>)-dm-segphos [®]][(<i>S,S</i>)-dppe]	200mg	1g
R0133	RuCl ₂ [(<i>R</i>)-xylbinap][(<i>R</i>)-daipen]	200mg	1g
R0132	RuCl ₂ [(<i>S</i>)-xylbinap][(<i>S</i>)-daipen]	200mg	1g
R0135	RuCl ₂ [(<i>R</i>)-xylbinap][(<i>R,F</i>)-dppe]	200mg	1g
R0134	RuCl ₂ [(<i>S</i>)-xylbinap][(<i>S,S</i>)-dppe]	200mg	1g
R0139	(<i>R</i>)-RUCY [®] -XylBINAP	200mg	1g
R0138	(<i>S</i>)-RUCY [®] -XylBINAP	200mg	1g

Ruthenium Complex Catalysts for Asymmetric Hydrogenation of Olefins and Functionalized Ketones

Ruthenium Complex Catalysts for Asymmetric Hydrogenation of Olefins and Functionalized Ketones	R0146 Ar =	R0147 Ar =	R0156 Ar =	
R0157 Ar =	R0158 Ar =	R0159 Ar =	R0154 Ar =	R0155 Ar =
R0148 Ar =	R0149 Ar =	R0150 Ar =	R0151 Ar =	

Product No.	Product Name	Unit Size	
R0146	[RuCl(<i>p</i> -cymene)((<i>R</i>)-binap)]Cl	200mg	1g
R0147	[RuCl(<i>p</i> -cymene)((<i>S</i>)-binap)]Cl	200mg	1g
R0156	[RuCl(<i>p</i> -cymene)((<i>R</i>)-dm-segphos [®])]Cl	200mg	1g
R0157	[RuCl(<i>p</i> -cymene)((<i>S</i>)-dm-segphos [®])]Cl	200mg	1g
R0158	[RuCl(<i>p</i> -cymene)((<i>R</i>)-dtbm-segphos [®])]Cl	200mg	1g
R0159	[RuCl(<i>p</i> -cymene)((<i>S</i>)-dtbm-segphos [®])]Cl	200mg	1g

Product No.	Product Name	Unit Size	
R0154	[RuCl(<i>p</i> -cymene)((<i>R</i>)-segphos®)]Cl	200mg	1g
R0155	[RuCl(<i>p</i> -cymene)((<i>S</i>)-segphos®)]Cl	200mg	1g
R0148	[RuCl(<i>p</i> -cymene)((<i>R</i>)-tolbinap)]Cl	200mg	1g
R0149	[RuCl(<i>p</i> -cymene)((<i>S</i>)-tolbinap)]Cl	200mg	1g
R0150	[RuCl(<i>p</i> -cymene)((<i>R</i>)-xylbinap)]Cl	200mg	1g
R0151	[RuCl(<i>p</i> -cymene)((<i>S</i>)-xylbinap)]Cl	200mg	1g

Ruthenium Complex Catalysts for Asymmetric Transfer Hydrogenation of Ketones		R0123 	R0122 	R0125
R0124 	R0127 	R0126 	T3078 	T3077

Product No.	Product Name	Unit Size	
R0123	RuCl[(<i>R,R</i>)-Fsdpen](<i>p</i> -cymene)	200mg	1g
R0122	RuCl[(<i>S,S</i>)-Fsdpen](<i>p</i> -cymene)	200mg	1g
R0125	RuCl[(<i>R,R</i>)-Tsdpen](<i>p</i> -cymene)	200mg	1g
R0124	RuCl[(<i>S,S</i>)-Tsdpen](<i>p</i> -cymene)	200mg	1g
R0127	RuCl[(<i>R,R</i>)-Tsdpen](mesitylene)	200mg	1g
R0126	RuCl[(<i>S,S</i>)-Tsdpen](mesitylene)	200mg	1g
T3078	(<i>R,R</i>)-Ts-DENEB®	200mg	1g
T3077	(<i>S,S</i>)-Ts-DENEB®	200mg	1g

* These products were merchandised under the technical tie-up with TAKASAGO INTERNATIONAL CORPORATION.
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References

- 1) Review: J. Malek, M. Cerny, *Synthesis* **1972**, 217.
- 2) Review: N. Kishner, *J. Russ. Phys. Chem. Soc.* **1911**, 43, 582; L. Wolff, *Ann.* **1912**, 394, 86; R. O. Hutchins, M. K. Hutchins, *Comprehensive Organic Synthesis* **1991**, 8, 327.
- 3) Y. Kuroiwa, S. Matsumura, K. Toshima, *Synlett* **2008**, 16, 2523.
- 4) C. Chatgililoglu, D. Griller, M. Lesage, *J. Org. Chem.* **1988**, 53, 3641.
- 5) O. Yamazaki, H. Togo, S. Matsubayashi, M. Yokoyama, *Tetrahedron Lett.* **1998**, 39, 1921.

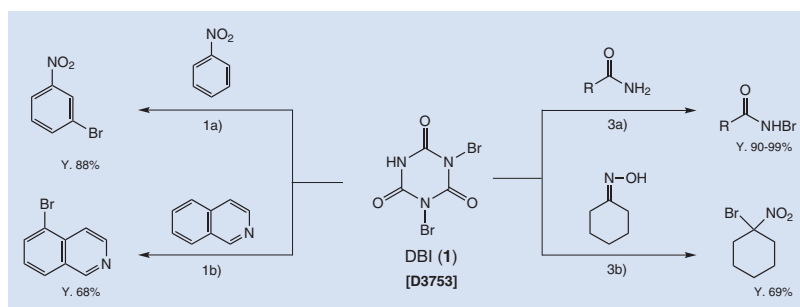
Halogenation

Halogenation is a basic and fundamental transformation in organic chemistry, and halogenated compounds are of extreme importance as building blocks in organic synthesis. The development of modern coupling reactions, such as the Suzuki-Miyaura and Mizoroki-Heck reactions, have greatly increased the demand for halogenated compounds as starting materials. In response to this situation, many novel halogenating reagents have been developed.

The page below shows some examples of brominating and iodinating reagents, which have been released recently in our lineup of products.

Example of brominating products:

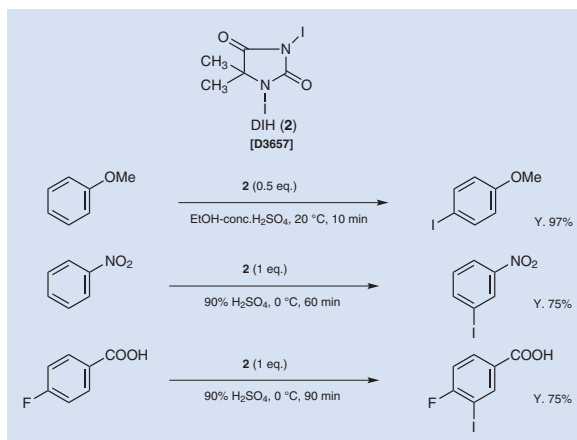
Dibromoisocyanuric acid (DBI) (**1**), which was first reported by Gottardi, is a mild and highly effective brominating reagent,^{1,2)} and has superior brominating ability when compared with *N*-bromosuccinimide (NBS), which is frequently used in organic synthesis. For instance, nitrobenzene was converted to the 3-bromonitrobenzene in 88% yield with **1** in conc. sulfuric acid in 5 min at 20°C,^{1a)} but in only 70% yield with NBS in 50% sulfuric acid in 3 h at 85°C. Thus **1** has been widely used as an effective brominating reagent.³⁾



Example of iodinating products:

1,3-Diiodo-5,5'-dimethylhydantoin (DIH) (**2**), which was first reported by Ozazi, is a useful iodinating reagent.⁴⁾ **2** has higher reactivity and selectivity than molecular iodine or *N*-iodosuccinimide (NIS), which are frequently used for iodination reaction. **2** is a pale yellow solid that does not sublime like molecular iodine, and has low toxicity, which makes it easier to handle. In addition, dimethylhydantoin, which is formed after the reaction, can easily be removed by aqueous extraction.

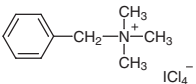
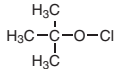
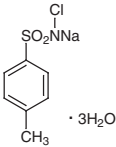
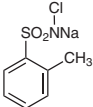
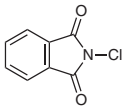
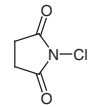
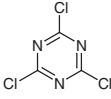
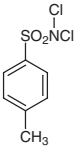
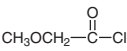
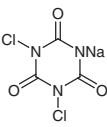
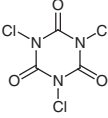
2 reacts smoothly at room temperature with aromatic compounds in the presence of sulfuric acid to give the corresponding iodinated aromatic compounds in a high regioselectivity and a high yield. Moreover, even low-activated substances such as nitrobenzene can easily be iodinated by using sulfuric acid.⁵⁾



Fluorination		B2440	B3664	D1868
D3812	F0335	F0358	F0344	F0225
F0343	F0327	F0346	F0328	H0598
M1573	P1758	P1888	P0999	T1295
	KF	KHF ₂		
T1909	T1592	T1635	T1037 T1339 T1125 T1338	T2027
T2026	T2754	T2023	T2022	

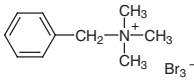
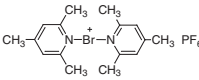
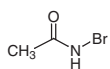
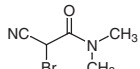
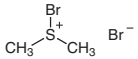
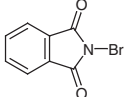
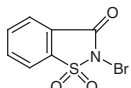
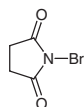
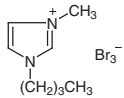
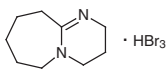
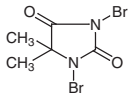
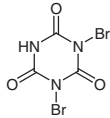
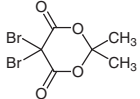
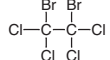
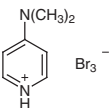
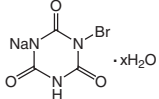
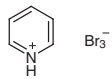
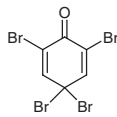
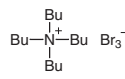
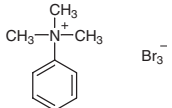
Product No.	Product Name	Unit Size		
B2440	Bis(2-methoxyethyl)aminosulfur Trifluoride	5g	25g	
B3664	4- <i>tert</i> -Butyl-2,6-dimethylphenylsulfur Trifluoride (FLUOLEAD™)			5g
D1868	(Diethylamino)sulfur Trifluoride (DAST)	5g	25g	100g
D3812	1,1'-Difluoro-2,2'-bipyridinium Bis(tetrafluoroborate)			1g
F0335	<i>N</i> -Fluorobenzenesulfonimide (NFSI)		5g	25g
F0358	<i>N</i> -Fluoro- <i>N'</i> -(chloromethyl)triethylenediamine Bis(tetrafluoroborate) (F-TEDA-BF ₄)	5g	25g	100g
F0344	1-Fluoro-2,6-dichloropyridinium Tetrafluoroborate		5g	25g
F0225	2-Fluoro-1-methylpyridinium <i>p</i> -Toluenesulfonate		5g	25g
F0343	1-Fluoropyridinium Tetrafluoroborate		5g	25g
F0327	1-Fluoropyridinium Trifluoromethanesulfonate		5g	25g
F0346	1-Fluoro-2,4,6-trimethylpyridinium Tetrafluoroborate			5g
F0328	1-Fluoro-2,4,6-trimethylpyridinium Trifluoromethanesulfonate		5g	25g
H0598	Ishikawa's Reagent	25g	100g	500g
M1573	Morpholinosulfur Trifluoride (Morph-DAST)		1g	5g

Product No.	Product Name	Unit Size	
P1758	Potassium Fluoride	300g	
P1888	Potassium Hydrogenfluoride	500g	
P0999	Pyridinium Poly(hydrogenfluoride)	25g	100g
T1295	Tetrabutylammonium Bifluoride	5g	25g
T1909	Tetrabutylammonium Difluorotriphenylsilicate	5g	25g
T1592	Tetrabutylammonium Difluorotriphenylstannate	1g	5g
T1635	Tetrabutylammonium Dihydrogen Trifluoride	5g	25g
T1037	Tetrabutylammonium Fluoride Hydrate	25g	100g
T1339	Tetrabutylammonium Fluoride (70-75% in Water)	25g	500g
T1125	Tetrabutylammonium Fluoride (ca. 1mol/L in Tetrahydrofuran)	25mL	100mL
T1338	Tetrabutylammonium Fluoride (ca. 1mol/L in Tetrahydrofuran)	25mL	100mL 500mL
T2027	Tetraethylammonium Fluoride Tetrahydrofluoride		10g
T2026	Tetraethylammonium Fluoride Trihydrofluoride		10g
T2754	Tetramethylammonium Fluoride Tetrahydrate	5g	25g
T2023	Triethylamine Pentahydrofluoride		10g
T2022	Triethylamine Trihydrofluoride		10g

Chlorination		B1543	H0362	C0075
				
C0076	C1374	C0202	C0802	C0291
				
C0460	D0318	D1645	M0094	M0970
				
O0082	D1003	T2048 T2040	T0620	T0611
				

Product No.	Product Name	Unit Size	
B1543	Benzyltrimethylammonium Tetrachloroiodate	5g	
H0362	tert-Butyl Hypochlorite	25g	500g
C0075	Chloramine B Hydrate	25g	500g
C0076	Chloramine T Trihydrate	25g	500g
C1374	o-Chloramine T		25g
C0202	Chloromethyl Methyl Ether	25g	100g 500g

Product No.	Product Name	Unit Size	
C0802	N-Chlorophthalimide	25g	500g
C0291	N-Chlorosuccinimide	25g	100g 500g
C0460	Cyanuric Chloride	25g	500g
D0318	Dichloramine T	25g	500g
D1645	Dichloromethyl Methyl Ether	25g	250g
M0094	Methanesulfonyl Chloride	25g	500g
M0970	Methoxyacetyl Chloride	25g	500g
O0082	Oxaly Chloride	25g	100g 500g
D1003	Sodium Dichloroisocyanurate	25g	500g
T2048	Thionyl Chloride (ca. 1mol/L in Dichloromethane)		500mL
T2040	Thionyl Chloride		500mL
T0620	Trichloroisocyanuric Acid	25g	500g
T0611	Trichloromethanesulfonyl Chloride	5g	25g

Bromination		T1382	B2358	B2553
				
B2414	B0530	B1016	B3311	B1697
				
B2152	B0656	B0662	B3596	D3976
				
D1265	D3753	D1710	D1987	D1787
				
B2148	P1743	P0825	T1235	T1284
				
P0928				
				

Product No.	Product Name	Unit Size	
T1382	Benzyltrimethylammonium Tribromide	5g	25g
B2358	Bis(2,4,6-trimethylpyridine)bromonium Hexafluorophosphate	1g	5g
B2553	Boron Tribromide (17% in Dichloromethane, ca. 1mol/L)		100mL
B2414	Bromine	90g	500g
B0530	<i>N</i> -Bromoacetamide	5g	25g
B1016	2-Bromo-2-cyano- <i>N,N</i> -dimethylacetamide		5g
B3311	Bromodimethylsulfonium Bromide	5g	25g
B1697	<i>N</i> -Bromophthalimide	5g	25g
B2152	<i>N</i> -Bromosaccharin	5g	25g
B0656	<i>N</i> -Bromosuccinimide	25g	100g 500g
B0662	Bromotrichloromethane	25g	500g
B3596	1-Butyl-3-methylimidazolium Tribromide		5g
D3976	1,8-Diazabicyclo[5.4.0]-7-undecene Hydrogen Tribromide		5g
D1265	1,3-Dibromo-5,5-dimethylhydantoin	25g	500g
D3753	Dibromoisocyanuric Acid	5g	25g
D1710	5,5-Dibromomeldrum's Acid (=5,5-Dibromo-2,2-dimethyl-4,6-dioxy-1,3-dioxane)	5g	25g
D1987	1,2-Dibromo-1,1,2,2-tetrachloroethane		25g
D1787	4-Dimethylaminopyridinium Bromide Perbromide	5g	25g
B2148	Monosodium Bromoisocyanurate Hydrate		25g
P1743	Phosphorus Tribromide		300g
P0825	Pyridinium Bromide Perbromide	25g	500g
T1235	2,4,4,6-Tetrabromo-2,5-cyclohexadienone	5g	25g
T1284	Tetrabutylammonium Tribromide	25g	100g 500g
P0928	Trimethylphenylammonium Tribromide	25g	500g

Iodination		B1604	B2539	B2359
C1190	D3657	D4340	H1221	I0604
$\text{ICH}_2\text{CH}_2\text{Cl}$			HI	I_2
I0784	I0074	P2086	T2717	I0308

Product No.	Product Name	Unit Size	
B1604	Benzyltrimethylammonium Dichloroiodate	5g	25g
B2539	Bis(pyridine)iodonium Tetrafluoroborate		1g
B2359	Bis(2,4,6-trimethylpyridine)iodonium Hexafluorophosphate	1g	5g
C1190	1-Chloro-2-iodoethane (stabilized with Copper chip)	1g	5g
D3657	1,3-Diiodo-5,5-dimethylhydantoin	5g	25g
D4340	<i>N,N</i> -Dimethyl- <i>N</i> -(methylsulfanylmethylene)ammonium Iodide	5g	25g

Product No.	Product Name	Unit Size	
H1221	Hydriodic Acid (57%)	300mL	
I0604	Iodine	25g	500g
I0784	N-Iodosaccharin	5g	
I0074	N-Iodosuccinimide	5g	25g 100g
P2086	Pyridine Iodine Monochloride	1g	5g
T2717	Tetramethylammonium Dichloriodate	5g	
I0308	Trimethylsilyl Iodide (stabilized with Aluminum)	5g	25g

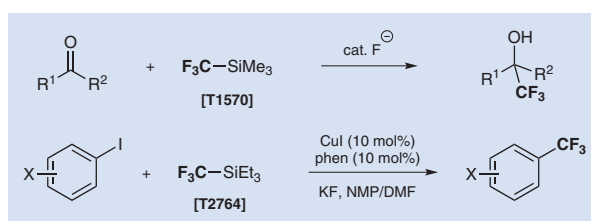
References

- 1) a) W. Gottardi, *Monatsh. Chem.* **1968**, 99, 815; b) W. D. Brown, A. H. Gouliaev, *Synthesis* **2002**, 83.
- 2) S. C. Virgil, in *Encyclopedia of Reagents for Organic Synthesis*, ed. by L. A. Paquette, John Wiley & Sons, Chichester, **2001**, pp. 1560-1561.
- 3) a) Z. P. Demko, M. Bartsch, K. B. Sharpless, *Org. Lett.* **2000**, 2, 2221; b) T. R. Walters, W. W. Zajac Jr., J. M. Woods, *J. Org. Chem.* **1991**, 56, 316.
- 4) O. O. Orazi, R. A. Corral, H. E. Bertorello, *J. Org. Chem.* **1965**, 30, 1101.
- 5) V. K. Chaikovskii, V. D. Filimonov, A. A. Funk, V. I. Skorokhodov, V. D. Ogorodnikov, *Russ. J. Org. Chem.* **2007**, 43, 1291.

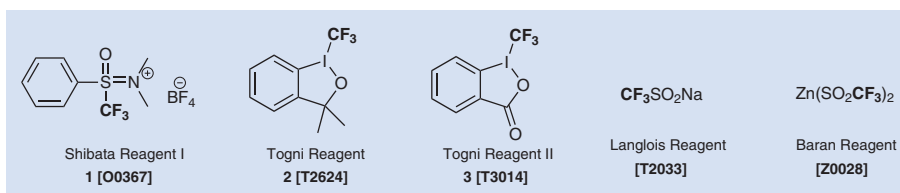
Trifluoromethylation

The size of a fluorine atom is similar to a hydrogen atom but the electric property of it is more electronegative. So, by replacing a hydrogen atom of substances with a fluorine atom, their biological properties can be dramatically changed without a conformational change. Recently, the synthetic and biological studies of fluorinated molecules have attracted a lot of interest in the fields of pharmaceuticals and agrochemicals research. Especially, the synthetic study of the trifluoromethyl group-containing compounds is now actively proceeding.

As a method for direct trifluoromethylation, nucleophilic and electrophilic/radical fluorinating reactions are commonly used. Ruppert-Prakash reagent ((Trifluoromethyl)trimethylsilane) is the most popular nucleophilic trifluoromethylating reagent and which readily reacts with a fluoride ion to release the trifluoromethylanion species. This active species shows nucleophilicity and reacts with carbonyl compounds to proceed with the trifluoromethylation.¹⁾ Also, the nucleophilic trifluoromethylation of aromatic halides can be performed with the use of copper catalysts.²⁾

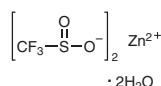


The study of electrophilic trifluoromethylations has lagged compared to that of nucleophilic trifluoromethylations. However, recently some reagents usable for electrophilic trifluoromethylation have been reported. Shibata *et al.* have developed an electrophilic α -trifluoromethylation of β -ketoesters using the fluorinated Johnson reagent **1**.³⁾ The hypervalent iodine(III)-CF₃ reagents **2** and **3** developed by Togni *et al.* are widely used for trifluoromethylations of thiols, alcohols, phosphines, and heteroarenes.⁴⁾ Also, Baran *et al.* have reported the radical trifluoromethylation of heteroarenes using the Langlois reagent or zinc(II) bis(trifluoromethanesulfonate) (Zn(SO₂R)₂) with *tert*-butyl hydroperoxide.⁵⁾



F0311	O0367	P2172	T1336	T2033
T2764	T3014	T2624	T1570	T2883

Z0028



Product No.	Product Name	Unit Size		
F0311	Methyl Difluoro(fluorosulfonyl)acetate	5g	25g	
O0367	[(Oxido)phenyl(trifluoromethyl)-λ ⁴ -sulfanylidene]dimethylammonium Tetrafluoroborate	200mg	1g	
P2172	(1,10-Phenanthroline)(trifluoromethyl)(triphenylphosphine)copper(I)	1g	5g	
T1336	Sodium Trifluoroacetate	25g	100g	500g
T2033	Sodium Trifluoromethanesulfinate	5g	25g	
T2764	Triethyl(trifluoromethyl)silane	1g	5g	
T3014	1-Trifluoromethyl-1,2-benziodoxol-3(1H)-one (contains 60% Diatomaceous earth)	1g	5g	
T2624	1-Trifluoromethyl-3,3-dimethyl-1,2-benziodoxole	1g	5g	
T1570	(Trifluoromethyl)trimethylsilane	5g	25g	
T2883	(Trifluoromethyl)tris(triphenylphosphine)copper(I)	1g	5g	
Z0028	Zinc(II) Bis(trifluoromethanesulfinate) Dihydrate	1g	5g	

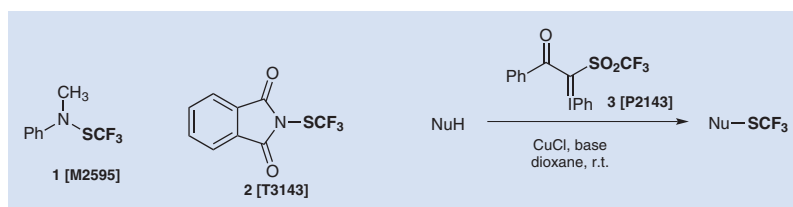
References

- 1) a) I. Ruppert, K. Schlich, W. Volbach, *Tetrahedron Lett.* **1984**, 25, 2195.
b) G. K. S. Prakash, R. Krishnamurti, G. A. Olah, *J. Am. Chem. Soc.* **1989**, 111, 393.
- 2) M. Oishi, H. Kondo, H. Amii, *Chem. Commun.* **2009**, 1909.
- 3) S. Noritake, N. Shibata, S. Nakamura, T. Toru, M. Shiro, *Eur. J. Org. Chem.* **2008**, 3465.
- 4) a) P. Eisenberger, S. Gischig, A. Togni, *Chem. Eur. J.* **2006**, 12, 2579.
b) I. Kieltisch, P. Eisenberger, A. Togni, *Angew. Chem. Int. Ed.* **2007**, 46, 754.
c) P. Eisenberger, I. Kieltisch, N. Armanino, A. Togni, *Chem. Commun.* **2008**, 1575.
d) K. Stanek, R. Koller, A. Togni, *J. Org. Chem.* **2008**, 73, 7678.
e) P. Eisenberger, I. Kieltisch, R. Koller, K. Stanek, A. Togni, *Org. Synth.* **2011**, 88, 168.
- 5) a) B. R. Langlois, E. Laurent, N. Roidot, *Tetrahedron Lett.* **1991**, 32, 7525.
b) Y. Ji, T. Bruecki, R. D. Baxter, Y. Fujiwara, I. B. Seiple, S. Su, D. G. Blackmond, P. S. Baran, *Proc. Natl. Acad. Sci. USA* **2011**, 108, 14411.
c) Y. Fujiwara, J. A. Dixon, R. A. Rodriguez, R. D. Baxter, D. D. Dixon, M. R. Collins, D. G. Blackmond, P. S. Baran, *J. Am. Chem. Soc.* **2012**, 134, 1494.
d) Y. Fujiwara, J. A. Dixon, F. O'Hara, E. Daa Funder, D. D. Dixon, R. A. Rodriguez, R. D. Baxter, B. Herlé, N. Sach, M. R. Collins, Y. Ishihara, P. S. Baran, *Nature* **2012**, 492, 95.

Trifluoromethylthiolation

The trifluoromethylthio group (CF_3S) has attracted attention as a potentially-significant functional group in the pharmaceutical and agrochemical fields because of its strong electron-withdrawing effect and high lipophilicity. Some methods for direct trifluoromethylthiolation have been developed¹⁻⁴⁾ and one of them, copper(I) trifluoromethanethiolate (CuSCF_3) is an effective nucleophilic trifluoromethylthiolating reagent. On the other hand, a simple electrophilic reagent, trifluoromethylsulphenyl chloride (CF_3SCI) is gaseous and highly toxic, so it is hardly used now.

Recently, some electrophilic trifluoromethylthiolating reagents which are safer to use and easier to handle, have been reported. Both *N*-methyl-*N*-(trifluoromethylthio)aniline¹⁾ developed by Billard *et al.* and *N*-(trifluoromethylthio)phthalimide⁴⁾ developed by Rueping are useful electrophilic trifluoromethylthiolating reagents because their states are liquid and solid respectively. In addition, Shibata *et al.* have developed a hypervalent iodonium ylide having a trifluoromethanesulfonyl group **3**, and used it for the electrophilic trifluoromethylthiolation. In this reaction, it seems that the trifluoromethylthiocation species generated *in situ* by the reduction of **3** acts as an electrophilic trifluoromethylthiolating reagent for enamines, indoles and β -ketoesters.³⁾



P2143	C1159	M2595	T3143

Product No.	Product Name	Unit Size	
P2143	Benzoyl(phenyliodonio)(trifluoromethanesulfonyl)methanide	1g	5g
C1159	Copper(I) Trifluoromethanethiolate	1g	5g
M2595	<i>N</i> -Methyl- <i>N</i> -(trifluoromethylthio)aniline	200mg	1g
T3143	<i>N</i> -(Trifluoromethylthio)phthalimide	1g	5g

References

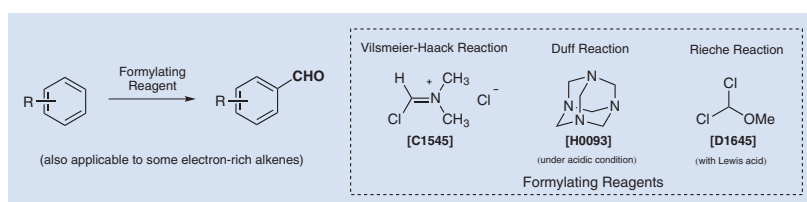
- a) F. Baert, J. Colomb, T. Billard, *Angew. Chem. Int. Ed.* **2012**, *51*, 10382.
b) A. Ferry, T. Billard, E. Bacqué, B. R. Langlois, *J. Fluorine Chem.* **2012**, *134*, 160.
c) Y. Yang, X. Jiang, F.-L. Qing, *J. Org. Chem.* **2012**, *77*, 7538.
d) A. Ferry, T. Billard, B. R. Langlois, E. Bacqué, *Angew. Chem. Int. Ed.* **2009**, *48*, 8551.
- X. Shao, X. Wang, T. Yang, L. Lu, Q. Shen, *Angew. Chem. Int. Ed.* **2013**, *52*, 3457.
- Y.-D. Yang, A. Azuma, E. Tokunaga, M. Yamasaki, M. Shiro, N. Shibata, *J. Am. Chem. Soc.* **2013**, *135*, 8782.
- R. Pluta, P. Nikolaienko, M. Rueping, *Angew. Chem. Int. Ed.* **2014**, *53*, 1650.

Formylation

Formyl group-containing compounds are important building blocks in organic synthesis since the formyl group can be transformed to other various functional groups. Aldehydes are the most typical formyl group-containing compound and are widely used as a substrate for carbon-carbon bond forming reactions such as the aldol reaction and the Wittig reaction.¹⁻²⁾ Also, their oxidation/reduction converts them to the related alcohols and carboxylic acids respectively, while the reductive amination is an efficient functional transformation of the formyl group into amines.³⁻⁵⁾ As above reactions, the formyl group is a versatile precursor of organosynthetic reactions and a number of various formyl group introducing reagents have been developed.

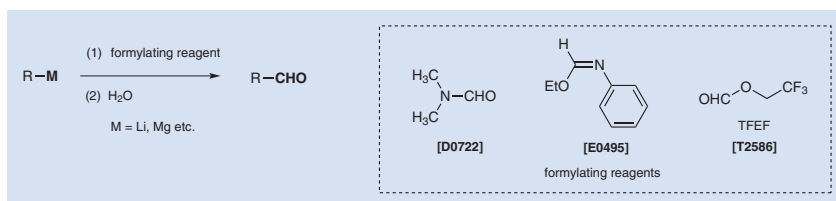
Reagents for the formylation are classified into three types according to their reactivity and substrates: (1) electrophilic aromatic substitution, (2) reaction with carbon nucleophiles, and (3) direct formylation at oxygen or nitrogen atoms.

(1) Electrophilic aromatic substitution



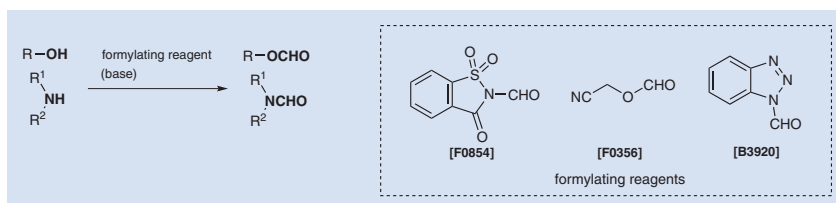
Vilsmeier reagent is a strong electrophile and formylates electron-rich alkenes and aromatic rings by electrophilic aromatic substitution.⁶⁾ This reagent is widely used and can be prepared by the reaction of DMF or *N*-methylformanilide with phosphoryl chloride.⁷⁾ The Duff reaction using hexamethylenetetramine is effective to formylate electron-rich aromatic compounds such as phenols and indoles.⁸⁾ Furthermore, the Riecke reaction using dichloromethyl methyl ether is suitable for formylation at the sterically hindered site of substances.⁹⁾

(2) Formylation by the reaction with carbon nucleophiles

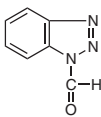
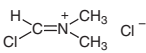
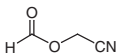
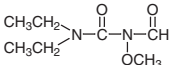
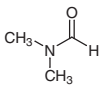
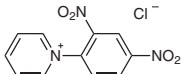
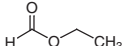
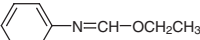
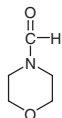
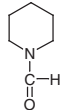
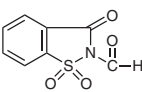
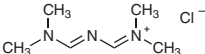
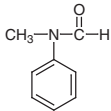
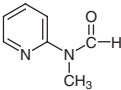
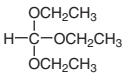
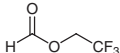
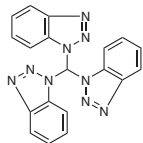


Formyl group-containing compounds can be also synthesized by the reaction of Grignard reagents or organolithium compounds with *N,N*-disubstituted formamides, orthoformates, *N*-methoxymethylaniline and so on (Bouveault/ Bodroux-Chichibabin aldehyde synthesis).^{10,11)} In addition, it is known that the direct C-formylation of ketones can be performed by the reaction of related ketone enolates with TFEF.¹²⁾

(3) O/N-Formylation



N-Formylsaccharin, cyanomethyl formate,¹³⁻¹⁵⁾ and 1-formyl-1*H*-benzotriazole work as *O/N*-formylating reagents, and successfully react with alcohols and amines under mild conditions to afford the desired *O/N*-formylated compounds. Especially, *N*-formylsaccharin can be used not only as a formylating reagent but also as a carbon monoxide introducing reagent (for more details, see the page 2.).

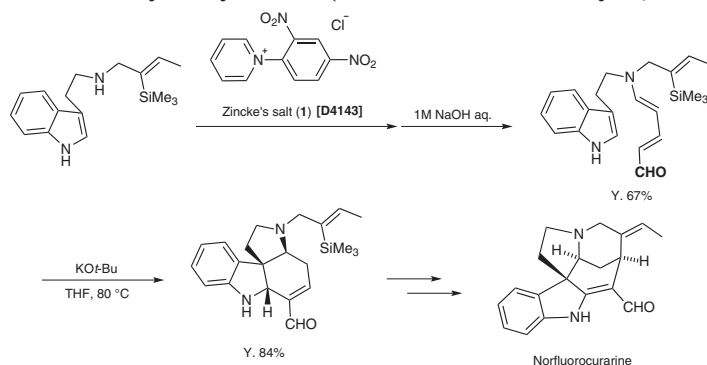
B3920	C1545	F0356	D1645	D2344
				
O0187	D0722	D4143	F0053	E0495
				
F0513	F0157	F0234	F0854	G0393
				
H0093	M0552	M1187	P0018	O0066
				
T2586	O0068	T3141		
				

Product No.	Product Name	Unit Size	
B3920	1H-Benzotriazole-1-carboxaldehyde	1g	5g
C1545	(Chloromethylene)dimethyliminium Chloride	25g	250g
F0356	Cyanomethyl Formate	5g	25g
D1645	Dichloromethyl Methyl Ether	25g	250g
D2344	N-(Diethylcarbamoyl)-N-methoxyformamide		1g
O0187	Diethyl Phenyl Orthoformate	5g	25g
D0722	N,N-Dimethylformamide	25mL	100mL 500mL
D4143	1-(2,4-Dinitrophenyl)pyridinium Chloride		1g
F0053	Ethyl Formate	25mL	500mL
E0495	Ethyl N-Phenylformimidate	5g	25g
F0513	Formic Acid		300mL
F0157	4-Formylmorpholine	25g	500g
F0234	1-Formylpiperidine	25mL	100mL 500mL
F0854	N-Formylsaccharin	5g	25g
G0393	Gold's Reagent	5g	25g
H0093	Hexamethylenetetramine	25g	500g
M0552	N-Methylformanilide	25g	500g
M1187	N-Methyl-N-(2-pyridyl)formamide	1g	5g
P0018	Paraformaldehyde	25g	500g
O0066	Triethyl Orthoformate	25mL	500mL
T2586	2,2,2-Trifluoroethyl Formate		5g
O0068	Trimethyl Orthoformate	25mL	500mL
T3141	Tris(1H-benzotriazol-1-yl)methane	200mg	1g

References

- 1) T. Mukaiyama, K. Narasaka, K. Banno, *Chem. Lett.* **1973**, 1011.
- 2) S. G. Levine, *J. Am. Chem. Soc.* **1958**, *80*, 6150.
- 3) Seyden-Penne, "Reductions by Alumino- and Borohydrides in Organic Synthesis", 2nd ed., Wiley-VCH, New York, **1997**.
- 4) B. S. Bal, W. E. Childers Jr, H. W. Pinnick, *Tetrahedron* **1981**, *37*, 2091.
- 5) A. F. Abdel-Magid, K. G. Carson, B. D. Harris, C. A. Maryanoff, R. D. Shah, *J. Org. Chem.* **1996**, *61*, 3849.
- 6) a) Tasneem, *Synlett* **2003**, 138.
b) R. A. Aungst Jr, C. Chan, R. L. Funk, *Org. Lett.* **2001**, *3*, 2611.
- 7) A. Miyawaki, D. Kikuchi, M. Niki, Y. Manabe, M. Kanematsu, H. Yokoe, M. Yoshida, K. Shishido, *J. Org. Chem.* **2012**, *77*, 8231.
- 8) a) J. C. Duff, E. J. Bills, *J. Chem. Soc.* **1932**, 1987.
b) J. C. Duff, E. J. Bills, *J. Chem. Soc.* **1934**, 1305.
c) J. C. Duff, E. J. Bills, *J. Chem. Soc.* **1941**, 547.
d) J. C. Duff, E. J. Bills, *J. Chem. Soc.* **1945**, 276.
- 9) A. Rieche, H. Gross, E. Höft, *Chem. Ber.* **1960**, *93*, 88.
- 10) L. I. Smith, M. Bayliss, *J. Org. Chem.* **1941**, *6*, 437.
- 11) L. I. Smith, J. Nichols, *J. Org. Chem.* **1941**, *6*, 489.
- 12) G. H. Zayia, *Org. Lett.* **1999**, *1*, 989.
- 13) T. Cochet, V. Bellosta, A. Greiner, D. Roche, J. Cossy, *Synlett* **2011**, 1920.
- 14) J. Deutsch, H.-J. Niclas, *Synth. Commun.* **1993**, *23*, 1561.
- 15) G. Bélanger, J. Boudreault, F. Lévesque, *Org. Lett.* **2011**, *13*, 6204.
- 16) N. U. Hofsløkken, L. Skattebøl, *Acta Chem. Scand.* **1999**, *53*, 258.
- 17) V. V. Mezheritskii, M. S. Korobov, O. M. Golyanskaya, N. I. Omelichkin, L. G. Minyaeva, G. S. Borodkin, A. A. Milov, A. V. Tsukanov, A. D. Dubonosov, *Russ. J. Org. Chem.* **2012**, *48*, 241.
- 18) N. Akikusa, K. Mitsui, T. Sakamoto, Y. Kikugawa, *Synthesis* **1992**, 1058.
- 19) D. Comins, A. I. Meyers, *Synthesis* **1978**, 403.

Zincke Aldehyde Synthesis (introduction of 4-formyl-1,3-butadienyl group)



1-(2,4-Dinitrophenyl)pyridinium chloride (Zincke salt, **1**) reacts with secondary amines to afford the corresponding 5-amino-2,4-pentadienals (Zincke aldehydes).¹⁾ This type of reaction has been applied to the synthesis of various indole alkaloids.²⁾ For example, Vanderwal *et al.* have reported the total synthesis of norfluorocurarine, a Strychnos alkaloid.³⁾

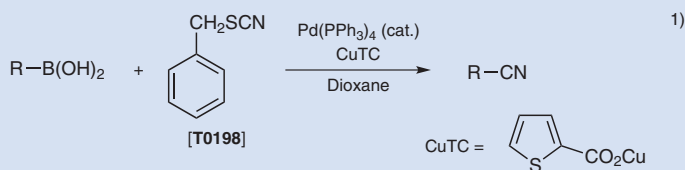
- 1) T. Zincke, W. Wurker, *Liebigs Ann. Chem.* **1905**, 338, 107.
- 2) D. B. C. Martin, L. Q. Nguyen, C. D. Vanderwal, *J. Org. Chem.* **2012**, *77*, 17.
- 3) D. B. C. Martin, C. D. Vanderwal, *J. Am. Chem. Soc.* **2009**, *131*, 3472.

Cyanation

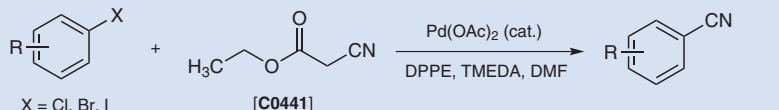
A cyano group is a strong electron withdrawing group and a number of cyanating reagents are widely used in organic synthesis. The cyano group is converted to other functional groups such as carboxylic acids or amides by hydrolysis, and is also converted to amines or aldehydes by reduction with some reducing reagents. Furthermore, alkyl nitriles which are typical cyano group containing compounds are transformed into related ketones by reaction with carbon nucleophilic agents such as Grignard reagents or organolithium reagents. This synthetic method is efficient to synthesize the asymmetric ketones. On the other hand, the cyano group can be used for cycloaddition reactions with other multiple bonds. For instance, alkyl nitriles are additionally cyclized with azides to give the tetrazoles.

As introducing methods for the cyano group, the reaction of potassium cyanide with alkyl halides is a typical synthetic method and the copper cyanide-mediated Sandmeyer reaction and the Rosenmund-von Braun reaction have been known for a long time. Recently, cyanation reactions using palladium catalysts with some cyanating reagents have been developed. In addition, benzyl thiocyanate¹⁾, ethyl cyanoacetate²⁾, *tert*-butyl isocyanide³⁾ and acetone cyanohydrin⁴⁾ play as cyanide ion sources and can be used for the direct cyanation of various substances.

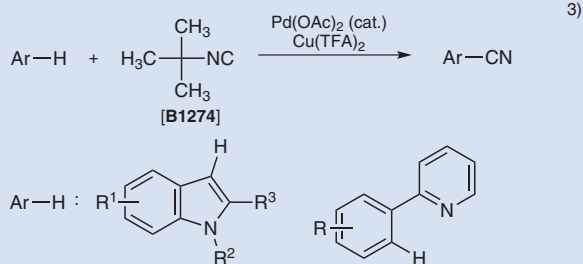
Pd-catalyzed Cross-coupling Cyanation Using Boronic Acids



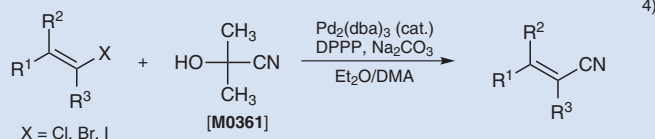
Pd-catalyzed Cyanation of Aryl Halides

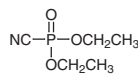
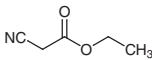
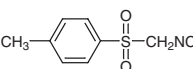
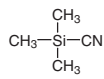


Pd-catalyzed C-H Cyanation



Pd-catalyzed Cyanation of Alkenyl Halides



M0361	T0198	B1274	C3003	C1952
				CuCN
C1242	C0441	P1613	T1046	T0990
		KCN		

Product No.	Product Name	Unit Size		
M0361	Acetone Cyanohydrin	25mL	500mL	
T0198	Benzyl Thiocyanate	25g	500g	
B1274	tert-Butyl Isocyanide	5mL	25mL	
C3003	2-Chlorobenzyl Thiocyanate	1g	5g	
C1952	Copper(I) Cyanide	25g	300g	
C1242	Diethyl Cyanophosphonate	5g	25g	
C0441	Ethyl Cyanoacetate	25g	500g	
P1613	Potassium Cyanide		25g	
T1046	p-Toluenesulfonylmethyl Isocyanide		5g	25g
T0990	Trimethylsilyl Cyanide	25mL	100mL	500mL

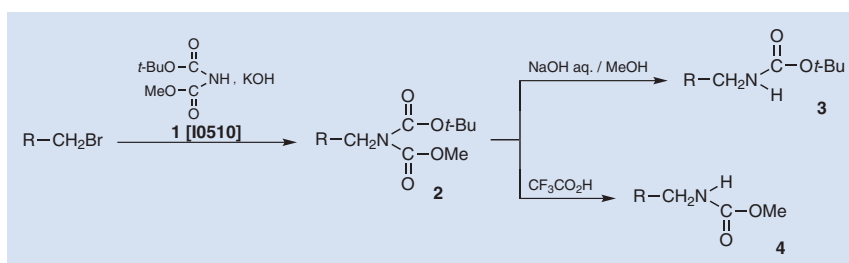
References

- 1) Z. Zhang, L. S. Liebeskind, *Org. Lett.* **2006**, *8*, 4331.
- 2) S. Zheng, C. Yu, Z. Shen, *Org. Lett.* **2012**, *14*, 3644.
- 3) J. Peng, J. Zhao, Z. Hu, D. Liang, J. Huang, Q. Zhu, *Org. Lett.* **2012**, *14*, 4966.
- 4) K. J. Powell, L.-C. Han, P. Sharma, J. E. Moses, *Org. Lett.* **2014**, *16*, 2158.

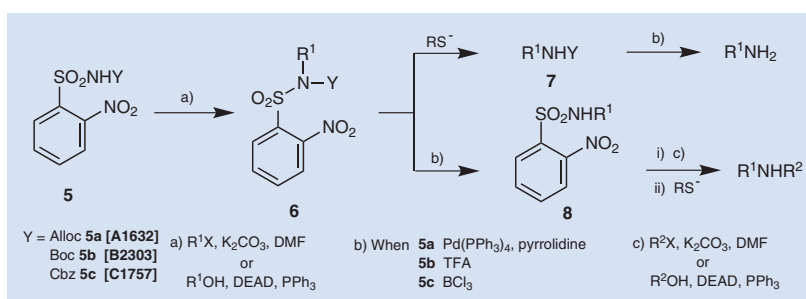
Amination

The Gabriel reagent is widely used as a nucleophilic aminating agent since its reactivity is reliable and its handling is easy.¹⁾ A variety of aminating agents analogous to the Gabriel reagent have been reported.

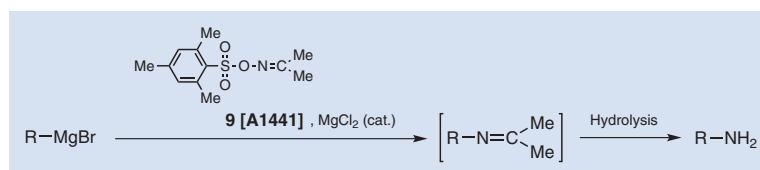
The potassium salt of imide **1** reacts with alkyl halide to give imide **2**. **2** is treated with base or acid to give either *N*-Boc-amine **3** or *N*-methoxycarbonylamine **4**, respectively. Moreover, **1** also serves as an acid nucleophile in the Mitsunobu reaction to allow for the conversion of hydroxy groups to amino groups. Therefore, **1** is a useful reagent to give monoprotected amines.²⁾



Fukuyama and co-workers have demonstrated various reactions using the *N*-substituted sulfonamide **5**.³⁾ Smooth reactions of **5** occur with alkyl halides under basic conditions and alcohols under Mitsunobu conditions to provide *o*-nitrobenzenesulfonyl (*o*-Ns) amines **6**. The various *o*-Ns amines (Alloc, Boc, Cbz) **6** obtained from these reactions can be selectively deprotected, under the appropriate conditions, to afford the monoprotected amines **7** and **8**. Furthermore, **7** can be converted to the primary amine in high yields via a second deprotection. **8** can be converted to the secondary amine in high yields by repeating the alkylation and deprotection process.⁴⁾



On the other hand, acetoxime *O*-(2,4,6-trimethylphenyl)sulfonate **9** has been reported as a useful electrophilic aminating agent. **9** reacts with Grignard reagents in the presence of a catalytic amount of magnesium chloride to afford primary amines in good yields.⁵⁾



A1441	A1632	A1137	A2457	A1341

B3380	B2303	B1648	B2857	I0510
C1757	I0497	B1734	D2361	D1899
D1672	M1182	H0093	H0258	H0196
H0530	M0886 M0343	P1235	P0403	D2479
T1184				

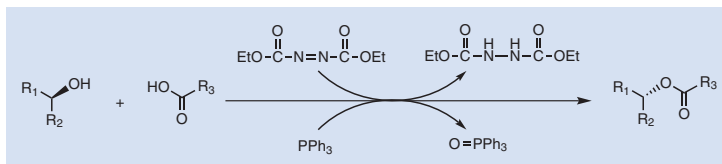
Product No.	Product Name	Unit Size		
A1441	Acetoxime <i>O</i> -(2,4,6-Trimethylphenyl)sulfonate	5g	25g	
A1632	<i>N</i> -Allyloxycarbonyl-2-nitrobenzenesulfonamide		5g	
A1137	4-Amino-1,2,4-triazole	25g	250g	
A2457	2-Azido-1,3-dimethylimidazolium Hexafluorophosphate		5g	
A1341	Azidomethyl Phenyl Sulfide		5g	
B3380	2-Bromoisobutyramide		5g	25g
B2303	<i>N</i> -(<i>tert</i> -Butoxycarbonyl)-2-nitrobenzenesulfonamide	1g	5g	25g
B1648	<i>N</i> -(<i>tert</i> -Butoxycarbonyl)- <i>p</i> -toluenesulfonamide		10g	25g
B2857	<i>tert</i> -Butyl [Bis(4-methoxyphenyl)phosphinyloxy]carbamate		1g	5g
I0510	<i>tert</i> -Butyl Methyl Iminodicarboxylate			5g
C1757	<i>N</i> -Carbobenzoxy-2-nitrobenzenesulfonamide		5g	25g
I0497	Di- <i>tert</i> -butyl Iminodicarboxylate		5g	25g
B1734	Diethyl <i>N</i> -(<i>tert</i> -Butoxycarbonyl)phosphoramidate			5g
D2361	Diethyl Phosphoramidate			25g
D1899	<i>N</i> , <i>O</i> -Dimethylhydroxylamine Hydrochloride	25g	100g	500g
D1672	Diphenylphosphoryl Azide	5g	25g	250g
M1182	Ethyl <i>O</i> -Mesitylsulfonylacetohydroxamate	1g	5g	25g
H0093	Hexamethylenetetramine		25g	500g
H0258	Hydroxylamine Hydrochloride		25g	500g
H0196	Hydroxylamine Sulfate		25g	500g
H0530	Hydroxylamine- <i>O</i> -sulfonic Acid	25g	100g	500g
M0886	<i>O</i> -Methylhydroxylamine Hydrochloride (ca. 40% in Water, ca. 5.4mol/L)		25mL	500mL
M0343	<i>O</i> -Methylhydroxylamine Hydrochloride	25g	100g	500g
P1235	Phthalimide DBU Salt			25g

Product No.	Product Name	Unit Size	
P0403	Phthalimide Potassium Salt	25g	500g
D2479	Sodium Diformylamide		25g
T1184	Trimethylsilylmethyl Azide	1g	5g

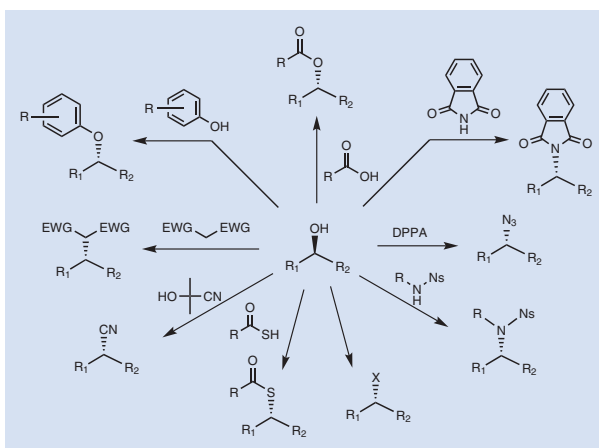
References

- 1) S. Gabriel, *Ber.* **1887**, *20*, 2224; M. S. Gibson, R. W. Bradshaw, *Angew. Chem. Int. Ed. Engl.* **1968**, *7*, 919; U. Ragnarsson, L. Grehn, *Acc. Chem. Res.* **1991**, *24*, 285.
- 2) J. D. Elliott, J. H. Jones, *J. Chem. Soc., Chem. Commun.* **1977**, 758; C. T. Clarke, J. D. Elliott, J. H. Jones, *J. Chem. Soc., Perkin Trans. 1* **1978**, 1088; J. M. Chong, S. B. Park, *J. Org. Chem.* **1993**, *58*, 7300.
- 3) T. Fukuyama, M. Cheung, T. Kan, *Synlett* **1999**, 1301.
- 4) T. Kan, A. Fujiwara, H. Kobayashi, T. Fukuyama, *Tetrahedron* **2002**, *58*, 6267.
- 5) E. Erdik, M. Ay, *Synth. React. Inorg. Met.-Org. Chem.* **1989**, *19*, 663.

Mitsunobu Reaction

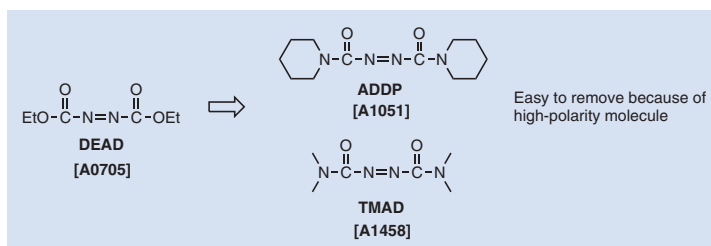


The Mitsunobu reaction is a unique dehydration-condensation reaction of alcohols with various organic acids, which together with azodicarboxylate esters and triphenylphosphine are generally used as dehydration-condensation reagents.¹⁾ The Mitsunobu reaction is carried out under mild conditions and alcohols with a chiral center are inverted with the Walden-inversion. Acid components such as carboxylic acids, phenols, active methylene compounds and imides are applicable for this transformation. Therefore, the Mitsunobu reaction is one of the most useful synthetic methods in organic synthesis.

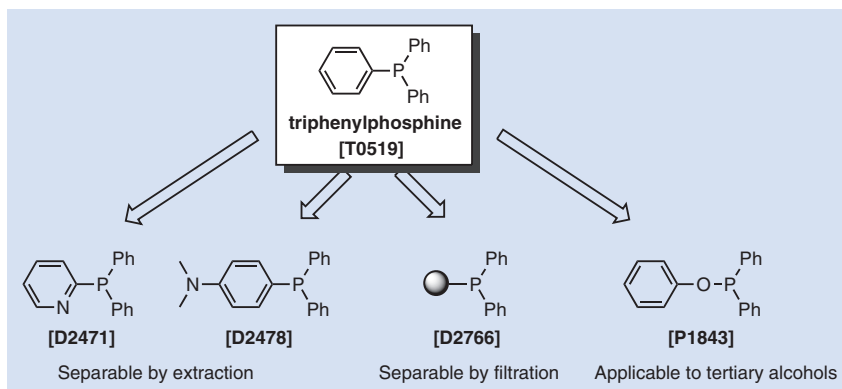


Also, synthetic applications of the Mitsunobu reaction have been widely studied due to its excellent chemical reactivity and various improved synthetic methods have been reported as follows.²⁾

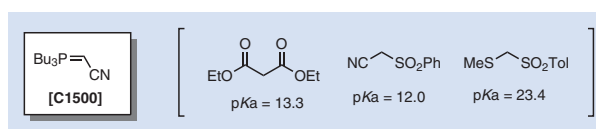
1) The basicity of the azodicarboxamide derivatives is higher compared to that of azodicarboxylate esters, and its chemical property expands the availability of the acids into weaker acids with high pK_a value. In addition, after the reactions, these reagents can be easily removed by column chromatography or extraction because they are high-polarity molecules.³⁾



2) By using phosphines with a base moiety⁴⁾ or diphenylphosphinopolystyrene resins⁵⁾ instead of triphenylphosphine, the generated phosphine oxides can be easily removed. In addition, phenoxydiphenylphosphine is an effective agent when sterically hindered tertiary alcohols are employed.⁶⁾



3) Tsunoda *et al.* have reported that cyanomethylene tributyl phosphorane is an effective agent for improving the Mitsunobu reaction.⁷⁾ It plays roles of both azodicarboxylate esters and tributylphosphine independently, and enables the Mitsunobu reaction to proceed even when using nucleophiles such as active methylene compounds with high pK_a values as well as typical organic acids. However, it is necessary to pay attention when this reagent is used with ketones or aldehydes because it behaves like a Wittig reagent.⁸⁾



4) It has been reported that the stoichiometry used for the amounts of azodicarboxylate esters can be reduced to catalytic amounts of one by using iodobenzene diacetate or iron phthalocyanine as a reoxidant.⁹⁾ This method can reduce the hydrazide by-product to a minimum.

Azodicarboxylates & Amides		A1458	A1051	B3364
		$Me_2N-C(=O)-N=N-C(=O)-NMe_2$	$C_6H_{11}N-C(=O)-N=N-C(=O)-N(C_6H_{11})$	$CH_3OCH_2CH_2O-C(=O)-N=N-C(=O)-OCH_2CH_2OCH_3$
A1332	A0776	D3544	A0705	A1246
$Cl_3CH_2CO-C(=O)-N=N-C(=O)-OCH_2Cl_3$	$BnO-C(=O)-N=N-C(=O)-OBn$	$tBuO-C(=O)-N=N-C(=O)-O^tBu$	$EtO-C(=O)-N=N-C(=O)-OEt$	$iPrO-C(=O)-N=N-C(=O)-O^iPr$
A0882				
$MeO-C(=O)-N=N-C(=O)-OMe$				

Product No.	Product Name	Unit Size		
A1458	1,1'-Azobis(<i>N,N</i> -dimethylformamide)	1g	5g	
A1051	1,1'-(Azodicarbonyl)dipiperidine	5g	25g	
B3364	Bis(2-methoxyethyl) Azodicarboxylate		5g	
A1332	Bis(2,2,2-trichloroethyl) Azodicarboxylate		5g	
A0776	Dibenzyl Azodicarboxylate (40% in Dichloromethane, ca. 1.7mol/L)		25g	
D3544	Di- <i>tert</i> -butyl Azodicarboxylate (20% in Toluene)		25g	
A0705	Diethyl Azodicarboxylate (40% in Toluene, ca. 2.2mol/L)	25g	100g	250g
A1246	Diisopropyl Azodicarboxylate (40% in Toluene, ca. 1.9mol/L)	25g	100g	250g
A0882	Dimethyl Azodicarboxylate (40% in Toluene, ca. 2.7mol/L)		25g	

Phosphines (Mitsunobu Reaction)		D2411	D1019	D2478
D2766	D2471	I0583	P1843	T1912
T0361	T1165	T1005	T0503	T0519

Product No.	Product Name	Unit Size		
D2411	Dicyclohexylphenylphosphine	1g	5g	
D1019	Diethylphenylphosphine	1mL	5mL	
D2478	4-(Dimethylamino)phenyldiphenylphosphine	1g	5g	
D2766	4-Diphenylphosphinomethyl Polystyrene Resin cross-linked with 2% DVB (200-400mesh) (0.5-1.0mmol/g)		5g	
D2471	Diphenyl-2-pyridylphosphine	1g	5g	
I0583	Isopropylidiphenylphosphine	1g	5g	
P1843	Phenoxydiphenylphosphine	5g	25g	
T1912	Tri- <i>tert</i> -butylphosphine		5g	
T0361	Tributylphosphine	25mL	100mL	500mL
T1165	Tricyclohexylphosphine (contains Tricyclohexylphosphine Oxide) (ca. 18% in Toluene, ca. 0.60mol/L)		25mL	
T1005	Trihexylphosphine		25mL	
T0503	Tri- <i>n</i> -octylphosphine	25mL	100mL	500mL
T0519	Triphenylphosphine		25g	500g

Modified New Mitsunobu Reaction (Tsunoda Reagent)	C1500

Product No.	Product Name	Unit Size		
C1500	Cyanomethylenetriethylphosphorane	1g	5g	25g

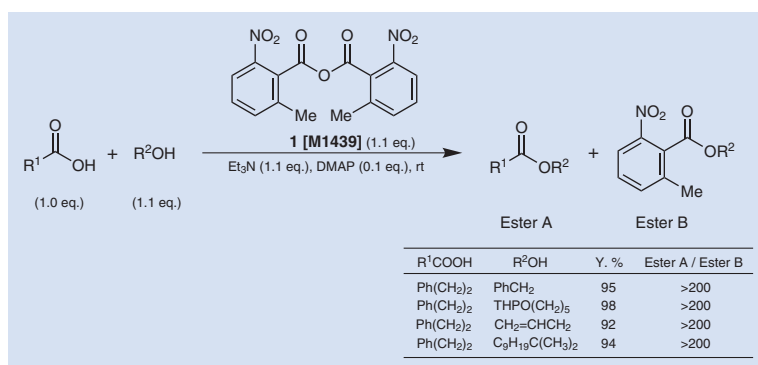
References

- 1) O. Mitsunobu, *Synthesis* **1981**, 1.
- 2) T. Onozawa, *TCIMAIL* **1999**, number 104, 10.
- 3) a) T. Tsunoda, Y. Yamamiya, S. Ito, *Tetrahedron Lett.* **1993**, 34, 1639.
b) T. Tsunoda, J. Otsuka, Y. Yamamiya, S. Ito, *Chem. Lett.* **1994**, 539.
c) S. Ito, T. Tsunoda, *Pure & Appl. Chem.* **1994**, 66, 2071.
d) T. Tsunoda, Y. Yamamiya, Y. Kawamura, S. Ito, *Tetrahedron Lett.* **1995**, 36, 2529.
- 4) a) L. D. Arnold, H. I. Assil, J. C. Vederas, *J. Am. Chem. Soc.* **1989**, 111, 3973.
b) A. R. Tunoori, D. Dutta, G. I. Georg, *Tetrahedron Lett.* **1998**, 39, 8751.
- 5) R. A. Amos, R. W. Emblidge, N. Havens, *J. Org. Chem.* **1983**, 48, 3598.
- 6) Review: T. Mukaiyama, K. Kuroda, Y. Maruyama, *Heterocycles* **2010**, 80, 63.
- 7) T. Tsunoda, M. Nagaku, C. Nagino, Y. Kawamura, F. Ozaki, H. Hioki, S. Ito, *Tetrahedron Lett.* **1995**, 36, 2531.
- 8) T. Tsunoda, H. Takagi, D. Takaba, H. Kaku, S. Ito, *Tetrahedron Lett.* **2000**, 41, 235.
- 9) a) T. Y. S. But, P. H. Toy, *J. Am. Chem. Soc.* **2006**, 128, 9636.
b) D. Hirose, T. Taniguchi, H. Ishibashi, *Angew. Chem. Int. Ed.* **2013**, 52, 4613.

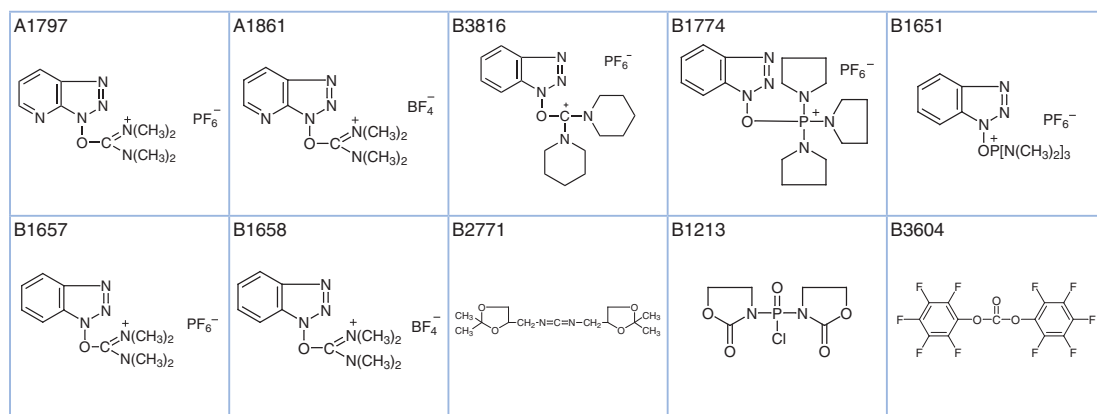
Condensation & Active Esterification

The synthesis of carboxylic esters is one of the most fundamental and important processes for producing useful compounds in organic chemistry. The classical esterification reaction is condensation of a carboxylic acid and an alcohol under acidic conditions. This is an equilibrium reaction, and in order to effectively generate the ester, the equilibrium need to be shift toward the ester. To achieve this equilibrium shift requires adding one of the substrates in large excess and the removal of the generated water by distillation. However, when both carboxylic acid and alcohol are expensive and not easily available, it is not economical to use one of the substrates in large excess. Thus the classical esterification method is not the best method to use in such a case. Furthermore, when the substrate is unstable to heat, the classical method does not always yield the desired results.

Since esterification is a basic reaction that is applied to many different types of substrates, there is a need for alternative methods which proceed under mild conditions without the need for using large excess of one of the substrates. Over the years, there has been much research done by many chemists, and many useful methods have been reported.

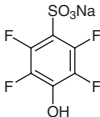
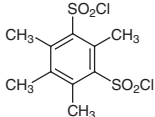
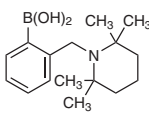
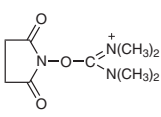
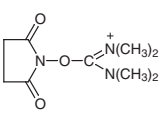
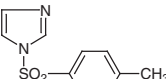
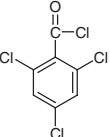
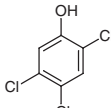
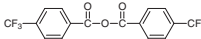
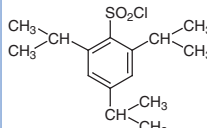
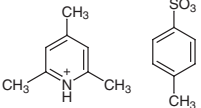


Shiina and co-workers have reported a method using 2-methyl-6-nitrobenzoic anhydride (**1**). This esterification procedure is quite simple. Triethylamine, a catalytic amount of 4-dimethylaminopyridine, and **1** were dissolved in a solvent. The carboxylic acid was added and stirred, and finally a nearly equimolar amount of alcohol was added and the reaction stirred under room temperature. Through this reaction process, the desired ester (ester A) is obtained in high yields. The nitro group on the condensation reagent **1** promotes and facilitates the esterification under room temperature. The introduction of substituents at the two ortho positions of benzene ring controls the generation of byproduct (ester B). These two effects synergistically act to produce the desired ester in excellent yield and high purity. This reaction can also be applied to intramolecular esterification, and can afford lactones in high yields.



B3817 	B3927 	C1298 	B1036 	B2680
B0832 	C1574 	C1124 	C1362 	C0119
C1988 	C1926 	C1131 	C1639 C1408 	C1651
C0905 	C0903 	C0906 	C1379 	C1375
C1957 	C2551 	C2733 	C1500 	C0793
D0436 	D3262 	C1242 	D2039 	D3263
D1393 	D0254 	D3293 	D2919 	D4029
D1601 	D1450 	D2898 	D2899 	D1771

D3683	D2038	D1720	D1672	D2201
C1407	D1114	D2477	T1906	D1662
D2222	E0916	E0363	E0847	F0239
F0225	F0726	H0468	H0528	H0395
B0249 H0623	H1304	M1186	M0071	M0670
M1439	M1116	T0681	N0477	N0634
O0200	O0390	T0648	P1626	P2231
P1042	P1320 P1319	P1768	P0939	Q0016

S0836	T1562	T2908	T2929	T2224
				
T1017	T1985	T0340	T1413	T0389
				
T1593	T0459	T1122		
				

Product No.	Product Name	Unit Size	
A1797	O-(7-Azabenzotriazol-1-yl)-N,N,N',N'-tetramethyluronium Hexafluorophosphate	5g	25g
A1861	O-(7-Azabenzotriazol-1-yl)-N,N,N',N'-tetramethyluronium Tetrafluoroborate	1g	5g
B3816	O-(Benzotriazol-1-yl)-N,N,N',N'-bis(pentamethylene)uronium Hexafluorophosphate	1g	5g
B1774	1H-Benzotriazol-1-yloxytripyrrolidinophosphonium Hexafluorophosphate	5g	25g
B1651	1H-Benzotriazol-1-yloxytris(dimethylamino)-phosphonium Hexafluorophosphate	5g	25g 100g
B1657	O-(Benzotriazol-1-yl)-N,N,N',N'-tetramethyluronium Hexafluorophosphate	5g	25g 100g
B1658	O-(Benzotriazol-1-yl)-N,N,N',N'-tetramethyluronium Tetrafluoroborate	5g	25g
B2771	1,3-Bis(2,2-dimethyl-1,3-dioxolan-4-ylmethyl)carbodiimide (This product is only available in Japan.)		1g
B1213	Bis(2-oxo-3-oxazolidinyl)phosphinic Chloride	5g	25g
B3604	Bis(pentafluorophenyl) Carbonate		5g
B3817	N,N,N',N'-Bis(tetramethylene)-O-(N-succinimidyl)uronium Hexafluorophosphate	1g	5g
B3927	2,6-Bis[(2,2,6,6-tetramethyl-1-piperidinyl)methyl]phenylboronic Acid (contains varying amounts of Anhydride)	200mg	1g
C1298	N-(2-Bromobenzyloxycarbonyloxy)succinimide		10g
B1036	2-Bromo-1-ethylpyridinium Tetrafluoroborate	5g	25g
B2680	Bromotripyrrolidinophosphonium Hexafluorophosphate	5g	25g
B0832	N-tert-Butyl-5-methylisoxazolium Perchlorate	1g	5g
C1574	tert-Butyl 2,4,5-Trichlorophenyl Carbonate		5g
C1124	N-Carbobenzyloxysuccinimide	25g	250g
C1362	2,2'-Carbonylbis(3,5-dioxo-4-methyl-1,2,4-oxadiazolidine)		5g
C0119	1,1'-Carbonyldiimidazole	25g	250g
C1988	O-(6-Chlorobenzotriazol-1-yl)-N,N,N',N'-tetramethyluronium Hexafluorophosphate	1g	5g
C1926	O-(6-Chlorobenzotriazol-1-yl)-N,N,N',N'-tetramethyluronium Tetrafluoroborate	5g	25g
C1131	N-(2-Chlorobenzyloxycarbonyloxy)succinimide		10g
C1639	2-Chloro-1,3-dimethylimidazolinium Chloride (ca. 25% in Dichloromethane)		25g
C1408	2-Chloro-1,3-dimethylimidazolinium Chloride	5g	25g
C1651	2-Chloro-1,3-dimethylimidazolinium Hexafluorophosphate	5g	25g
C0905	2-Chloro-3-ethylbenzoxazolium Tetrafluoroborate	5g	25g
C0903	2-Chloro-1-methylpyridinium Iodide		25g
C0906	2-Chloro-1-methylpyridinium p-Toluenesulfonate		25g
C1379	1-(Chloro-1-pyrrolidinylmethylene)pyrrolidinium Hexafluorophosphate	5g	25g
C1375	1-(Chloro-1-pyrrolidinylmethylene)pyrrolidinium Tetrafluoroborate		5g
C1957	Chloro-N,N,N',N'-tetramethylformamidinium Hexafluorophosphate	1g	5g
C2551	Chlorotripyrrolidinophosphonium Hexafluorophosphate	5g	25g
C2733	(1-Cyano-2-ethoxy-2-oxoethylidenaminoxy)dimethylaminomorpholinocarbenium Hexafluorophosphate (This product is only available in Japan.)		5g
C1500	Cyanomethylenetriethylphosphorane	1g	5g 25g
C0793	1-Cyclohexyl-3-(2-morpholinoethyl)carbodiimide Metho-p-toluenesulfonate		5g 25g
D0436	N,N'-Dicyclohexylcarbodiimide	25g	400g
D3262	3-(Diethoxyphosphoryloxy)-1,2,3-benzotriazin-4(3H)-one		5g
C1242	Diethyl Cyanophosphonate	5g	25g
D2039	3,4-Dihydro-3-hydroxy-4-oxo-1,2,3-benzotriazine	10g	25g

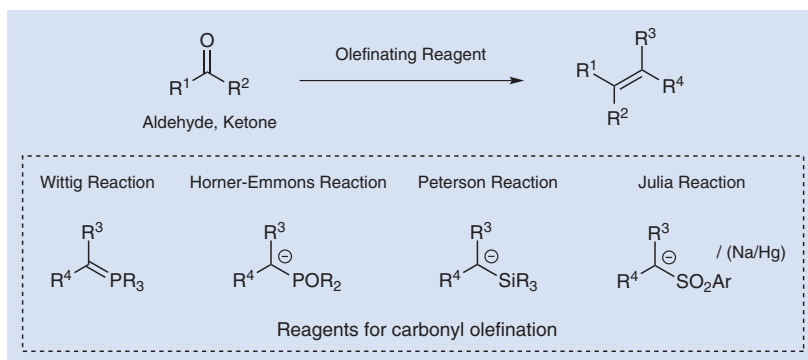
Product No.	Product Name	Unit Size	
D3263	<i>O</i> -(3,4-Dihydro-4-oxo-1,2,3-benzotriazin-3-yl)- <i>N,N,N',N'</i> -tetramethyluronium Tetrafluoroborate	5g	25g
D1393	3,4-Dihydro-2 <i>H</i> -pyrido[1,2- <i>a</i>]pyrimidin-2-one	5g	25g
D0254	<i>N,N'</i> -Diisopropylcarbodiimide	25g	250g
D3293	Dimesitylammonium Pentafluorobenzenesulfonate	1g	5g
D2919	4-(4,6-Dimethoxy-1,3,5-triazin-2-yl)-4-methylmorpholinium Chloride	5g	25g
D4029	1-(3-Dimethylaminopropyl)-3-ethylcarbodiimide	5g	25g
D1601	1-(3-Dimethylaminopropyl)-3-ethylcarbodiimide Hydrochloride	5g	25g 250g
D1450	4-Dimethylaminopyridine	25g	100g 500g
D2898	(4 <i>R</i> ,5 <i>R</i>)-1,3-Dimethyl-4,5-diphenyl-2-[(<i>S</i>)-1-benzyl-2-hydroxyethylimino]imidazolidine		100mg
D2899	(4 <i>S</i> ,5 <i>S</i>)-1,3-Dimethyl-4,5-diphenyl-2-[(<i>R</i>)-1-benzyl-2-hydroxyethylimino]imidazolidine		100mg
D1771	2,6-Dimethylpyridinium <i>p</i> -Toluenesulfonate		25g
D3683	Diphenylammonium Trifluoromethanesulfonate	1g	5g 25g
D2038	Diphenyl (2,3-Dihydro-2-thioxo-3-benzoxazolyl)phosphonate	5g	25g
D1720	<i>N,N</i> -Diphenyl-4-methoxybenzamide		5g
D1672	Diphenylphosphoryl Azide	5g	25g 250g
D2201	4,6-Diphenylthieno[3,4- <i>d</i>]-1,3-dioxol-2-one 5,5-Dioxide		5g
C1407	Di-2-pyridyl Carbonate		5g
D1114	2,2'-Dipyridyl Disulfide	5g	25g 250g
D2477	4,4'-Dipyridyl Disulfide		5g 25g
T1906	<i>O,O'</i> -Di-2-pyridyl Thiocarbonate		1g
D1662	Di(<i>N</i> -succinimidyl) Carbonate	5g	25g
D2222	2,2'-Dithiobis(5-nitropyridine)		5g
E0916	<i>O</i> -[(Ethoxycarbonyl)cyanomethyleneamino]- <i>N,N,N',N'</i> -tetramethyluronium Tetrafluoroborate	1g	5g
E0363	1-Ethoxycarbonyl-2-ethoxy-1,2-dihydroquinoline		25g
E0847	Ethyl Cyano(hydroxyimino)acetate		25g
F0239	<i>N</i> -[(9 <i>H</i> -Fluoren-9-ylmethoxy)carbonyloxy]succinimide	5g	25g
F0225	2-Fluoro-1-methylpyridinium <i>p</i> -Toluenesulfonate	5g	25g
F0726	Fluoro- <i>N,N,N',N'</i> -tetramethylformamidinium Hexafluorophosphate	1g	5g
H0468	1-Hydroxybenzotriazole Monohydrate	25g	200g 500g
H0528	<i>N</i> -Hydroxy-5-norbornene-2,3-dicarboximide		25g 250g
H0395	<i>N</i> -Hydroxyphthalimide	25g	100g 500g
B0249	<i>N</i> -Hydroxysuccinimide		25g
H0623	<i>N</i> -Hydroxysuccinimide	25g	100g 500g
H1304	<i>N</i> -Hydroxysulfosuccinimide Sodium Salt	200mg	1g
M1186	2,4-Mesitylenedisulfonyl Dichloride	5g	25g
M0071	2-Mesitylenedisulfonyl Chloride	25g	500g
M0670	9-Methyl-3,4-dihydro-2 <i>H</i> -pyrido[1,2- <i>a</i>]pyrimidin-2-one		25g
M1439	2-Methyl-6-nitrobenzoic Anhydride	1g	5g 25g
M1116	6-Methyl-2 <i>H</i> -pyrido[1,2- <i>a</i>]pyrimidin-2-one		5g
T0681	4-Nitrophenyl Trifluoroacetate	5g	25g
N0477	3-Nitro-1,2,4-triazole		5g
N0634	2-(5-Norbornene-2,3-dicarboximido)-1,1,3,3-tetramethyluronium Tetrafluoroborate	5g	25g
O0200	1,1'-Oxalyldiimidazole	1g	5g
O0390	<i>O</i> -[2-Oxo-1(2 <i>H</i>)-pyridyl]- <i>N,N,N',N'</i> -tetramethyluronium Tetrafluoroborate	1g	5g
T0648	Pentachlorophenyl Trichloroacetate		25g
P1626	Pentafluoroanilinium Trifluoromethanesulfonate	1g	5g 25g
P2231	Pentafluorophenyl 4-Nitrobenzenesulfonate		1g 5g
P1042	Phosphorus Pentoxide - Methanesulfonic Acid	25g	500g
P1320	Propylphosphonic Acid Anhydride (Cyclic Trimer) (48% in <i>N,N</i> -Dimethylformamide, ca. 1.6mol/L)		25g
P1319	Propylphosphonic Acid Anhydride (Cyclic Trimer) (50% in Ethyl Acetate, ca. 1.7mol/L)	25g	100g
P1768	3-Pyridinecarboxylic Anhydride	1g	5g
P0939	4-Pyrrolidinopyridine	5g	25g
Q0016	Quinoline-8-sulfonyl Chloride	5g	25g
S0836	Sodium 2,3,5,6-Tetrafluoro-4-hydroxybenzenesulfonate	1g	5g
T1562	2,4,5,6-Tetramethylbenzenedisulfonyl Dichloride		5g
T2908	2-[(2,2,6,6-Tetramethyl-1-piperidyl)methyl]phenylboronic Acid (contains varying amounts of Anhydride)		1g
T2929	<i>N,N,N',N'</i> -Tetramethyl- <i>O</i> -(<i>N</i> -succinimidyl)uronium Hexafluorophosphate	5g	25g
T2224	<i>N,N,N',N'</i> -Tetramethyl- <i>O</i> -(<i>N</i> -succinimidyl)uronium Tetrafluoroborate	1g	5g
T1017	1 <i>H</i> -Tetrazole	5g	25g
T1985	1-(<i>p</i> -Toluenesulfonyl)imidazole	5g	25g
T0340	1,2,4-Triazole	25g	100g 500g
T1413	2,4,6-Trichlorobenzoyl Chloride	5g	25g
T0389	2,4,5-Trichlorophenol	25g	500g
T1593	4-Trifluoromethylbenzoic Anhydride		10g
T0459	2,4,6-Triisopropylbenzenesulfonyl Chloride	25g	500g
T1122	2,4,6-Trimethylpyridinium <i>p</i> -Toluenesulfonate		25g

References

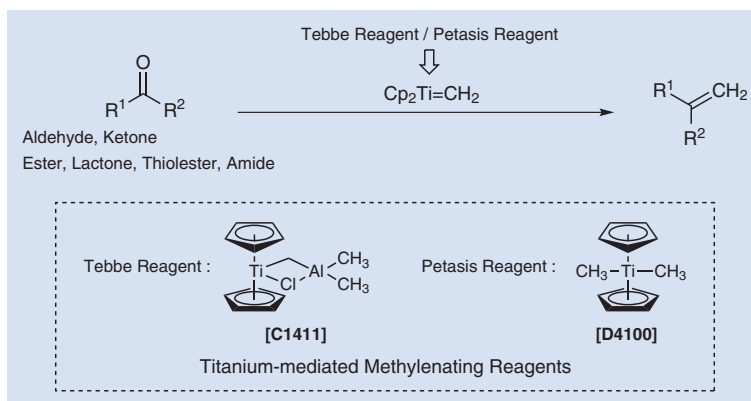
- 1) I. Shiina, R. Ibuka, M. Kubota, *Chem. Lett.* **2002**, 286.
- 2) I. Shiina, M. Kubota, R. Ibuka, *Tetrahedron Lett.* **2002**, 43, 7535.
- 3) J. Tian, N. Yamagiwa, S. Matsunaga, M. Shibasaki, *Org. Lett.* **2003**, 5, 3021.
- 4) I. Shiina, H. Oshiumi, M. Hashizume, Y. Yamai, R. Ibuka, *Tetrahedron Lett.* **2004**, 45, 543.
- 5) I. Shiina, M. Kubota, H. Oshiumi, M. Hashizume, *J. Org. Chem.* **2004**, 69, 1822.
- 6) I. Shiina, *Chem. Rev.* **2007**, 107, 239.
- 7) Tokyo Kasei Kogyo Co., Ltd., Jpn. Kokai Tokkyo Koho 2003 335731, **2003**.

Carbonyl Olefination

Carbonyl olefination is one of the most fundamental conversions in organic synthesis and a variety of synthetic methods have been developed. Particularly, synthetic methods focused on the chemical properties of heavy-atoms such as phosphorus, silicon and sulfur atoms had long been studied. One of them, the Wittig reaction is the representative carbonyl olefination reaction. Other similar reactions, the silicon-mediated Peterson olefination and two sulfur-based “Julia” carbonyl olefinations named the Julia-Lythgoe olefination and the Julia - Kocienski olefination are also useful olefinating methods. Among them, as the Wittig and Horner-Emmons reactions are the most general carbonyl olefinations, a number of improved synthetic applications have also been investigated. Some of them allow providing easier work-up procedures and increasing the stereoselectivity of the double bond of olefins. They are even now widely used for this transformation.

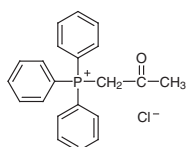


In the 1990s, organotitanium species-promoted carbonyl olefinations had been studied and various successful methods were reported. The biggest advantage of the use of organotitanium species in carbonyl olefination is that not only aldehydes and ketones, but also esters and lactones can be transformed to the corresponding olefins. Furthermore, the basicities of the organotitanium species are weaker compared to that of Wittig type bases and these chemical properties enable easily enolizable substrates to be used in carbonyl olefinations and to produce the desired olefins with high yields.

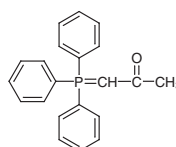


Wittig Reaction

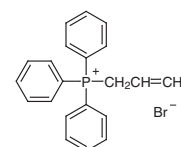
A1305



A1439



A1007

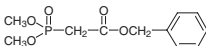
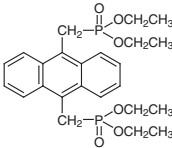
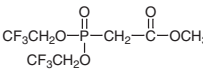
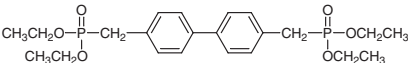
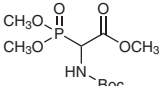
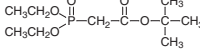
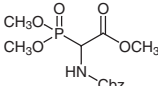
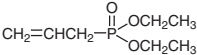
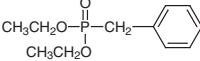
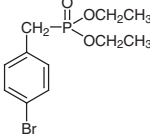
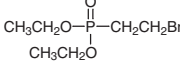
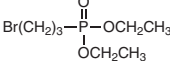
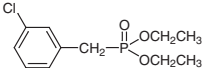
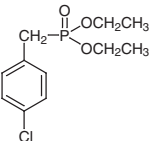
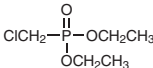
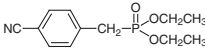
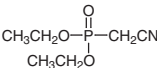
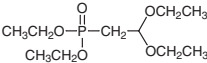
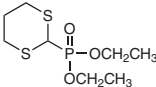
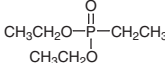
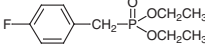
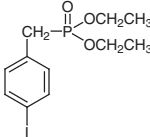
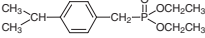
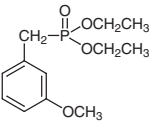
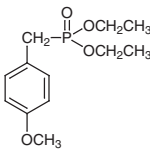
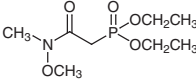
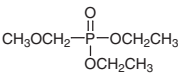


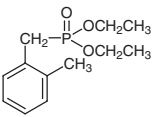
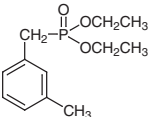
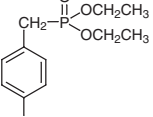
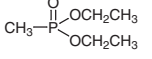
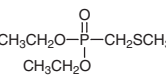
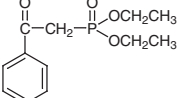
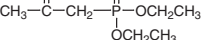
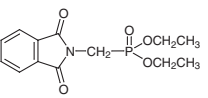
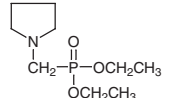
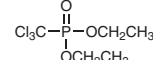
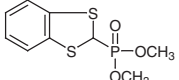
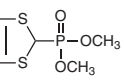
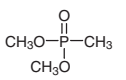
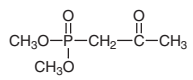
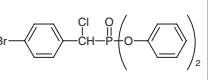
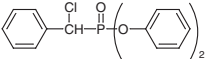
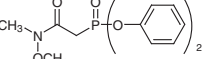
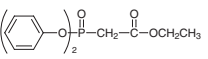
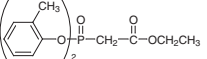
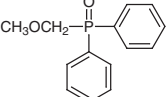
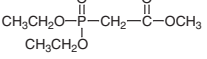
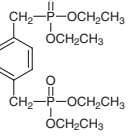
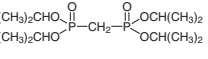
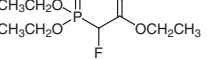
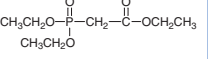
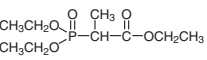
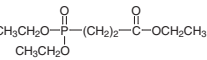
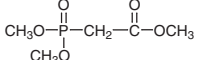
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E0421 	E0407 	E0382 	E0549 	T1944
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T1458 	T1510 	T1498 	T2001 	T1958
T2002 	T2565 	P1438 	P1200 	T1506
T1644 				

Product No.	Product Name	Unit Size	
A1305	Acetonitriletriphenylphosphonium Chloride	25g	
A1439	(Acetylmethylene)triphenylphosphorane	25g	
A1007	Allyltriphenylphosphonium Bromide	25g	
A1012	Allyltriphenylphosphonium Chloride	25g	
A0862	Amyltriphenylphosphonium Bromide	25g	
B2025	Benzyltriphenylphosphonium Bromide	25g	250g
B0824	Benzyltriphenylphosphonium Chloride	25g	500g
B1206	(Bromomethyl)triphenylphosphonium Bromide	5g	25g
B1208	3-Bromopropyltriphenylphosphonium Bromide	25g	
B3928	(<i>tert</i> -Butoxycarbonylmethyl)triphenylphosphonium Bromide	25g	
B0970	Butyltriphenylphosphonium Bromide	25g	250g
C1061	4-(Carboxybutyl)triphenylphosphonium Bromide	25g	250g
C1759	(2-Chlorobenzyl)triphenylphosphonium Chloride	25g	
C1009	(Chloromethyl)triphenylphosphonium Chloride	5g	25g
C1286	Cinnamyltriphenylphosphonium Bromide	25g	
C1739	(Cyanomethyl)triphenylphosphonium Chloride	25g	100g
C1378	Cyclopropyltriphenylphosphonium Bromide	5g	
D2907	(2,4-Dichlorobenzyl)triphenylphosphonium Chloride	25g	
D4072	(3,4-Dimethoxybenzyl)triphenylphosphonium Bromide	5g	
D1654	2-Dimethylaminoethyltriphenylphosphonium Bromide	5g	25g
D1655	2-(1,3-Dioxan-2-yl)ethyltriphenylphosphonium Bromide	5g	25g
D2056	2-(1,3-Dioxolan-2-yl)ethyltriphenylphosphonium Bromide	5g	25g
D2164	(1,3-Dioxolan-2-yl)methyltriphenylphosphonium Bromide	5g	25g
E0421	4-Ethoxybenzyltriphenylphosphonium Bromide	5g	
E0407	Ethoxycarbonylmethyl(triphenyl)phosphonium Bromide	25g	250g
E0382	Ethyltriphenylphosphonium Bromide	25g	500g
E0549	Ethyltriphenylphosphonium Iodide	25g	250g
T1944	Ethyl (Triphenylphosphoranylidene)acetate	25g	250g
C1641	Ethyl 2-(Triphenylphosphoranylidene)propionate	5g	
F0331	(Formylmethyl)triphenylphosphonium Chloride	25g	
H0545	Heptyltriphenylphosphonium Bromide	25g	500g
H0540	Hexyltriphenylphosphonium Bromide	25g	500g
H1240	(2-Hydroxybenzyl)triphenylphosphonium Bromide	5g	25g
I0552	Isopropyltriphenylphosphonium Iodide	5g	25g
M1326	Methoxycarbonylmethyl(triphenyl)phosphonium Bromide	25g	
M0828	(Methoxymethyl)triphenylphosphonium Chloride	25g	100g
M0779	Methyltriphenylphosphonium Bromide	25g	100g
M0253	Methyltriphenylphosphonium Iodide	25g	500g
T1363	Methyl (Triphenylphosphoranylidene)acetate	25g	100g
N0700	(1-Naphthylmethyl)triphenylphosphonium Chloride	5g	25g

Product No.	Product Name	Unit Size
N0701	(4-Nitrobenzyl)triphenylphosphonium Bromide	25g
P1182	Phenacyltriphenylphosphonium Bromide	25g
T2718	Tributyl(1,3-dioxolan-2-ylmethyl)phosphonium Bromide	5g
T1458	2-(Trimethylsilyl)ethoxymethyltriphenylphosphonium Chloride	5g 25g
T1510	(2-Trimethylsilylethyl)triphenylphosphonium Iodide	5g
T1498	(3-Trimethylsilyl-2-propynyl)triphenylphosphonium Bromide	1g 5g
T2001	(Triphenylphosphoranylidene)acetaldehyde	5g 25g
T1958	(Triphenylphosphoranylidene)acetonitrile	5g 25g
T2002	2-(Triphenylphosphoranylidene)acetophenone	5g
T2565	(Triphenylphosphoranylidene)ketene	1g 5g
P1438	Triphenylpropargylphosphonium Bromide	5g 25g
P1200	Triphenylpropylphosphonium Bromide	25g 500g
T1506	Triphenyl(tetradecyl)phosphonium Bromide	25g
T1644	Triphenylvinylphosphonium Bromide	5g

Horner-Emmons Reaction		B2815 	B2801 	B1714 
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C1595 	D3335 	D4588 	D3323 	C1430 
D2423 	D4074 	E0483 	D3324 	D3689 
D3325 	D3326 	D4000 	D3708 	D3873 

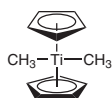
D3327	D3328	D3336	D3827	M1208
				
D3339	D3174	P1193	P1258	D4607
				
D3992	D3981	M0943	O0208	D3875
				
D3824	D3709	D2547	D2548	M1210
				
D2873	T1582	M1319	F0340	D1523
				
T2135	D1524	P1265		
				

Product No.	Product Name	Unit Size	
B2815	Benzyl Dimethylphosphonoacetate	1g	5g
B2801	9,10-Bis(diethylphosphonomethyl)anthracene	1g	5g
B1923	4,4'-Bis(diethylphosphonomethyl)biphenyl	1g	5g
B1714	Bis(2,2,2-trifluoroethyl) (Methoxycarbonylmethyl)-phosphonate	1g	25g
B4011	N-(tert-Butoxycarbonyl)-2-phosphonoglycine Trimethyl Ester	1g	5g
B2814	tert-Butyl Diethylphosphonoacetate	1g	5g
C2440	N-Carbobenzyloxy-2-phosphonoglycine Trimethyl Ester	1g	5g
D3069	Diethyl Allylphosphonate	1g	5g
B1795	Diethyl Benzylphosphonate		25g
D3688	Diethyl (4-Bromobenzyl)phosphonate	5g	25g
B1781	Diethyl 2-Bromoethylphosphonate	5g	25g
D4434	Diethyl (3-Bromopropyl)phosphonate	1g	5g
C1595	Diethyl (3-Chlorobenzyl)phosphonate	1g	5g
D3335	Diethyl (4-Chlorobenzyl)phosphonate	5g	25g

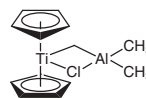
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D4588	Diethyl (Chloromethyl)phosphonate	1g	5g
D3323	Diethyl (4-Cyanobenzyl)phosphonate	5g	25g
C1430	Diethyl Cyanomethylphosphonate	5g	25g
D2423	Diethyl 2,2-Diethoxyethylphosphonate	5g	25g
D4074	Diethyl (1,3-Dithian-2-yl)phosphonate		5g
E0483	Diethyl Ethylphosphonate		25g
D3324	Diethyl (4-Fluorobenzyl)phosphonate	5g	25g
D3689	Diethyl (4-Iodobenzyl)phosphonate	5g	25g
D3325	Diethyl (4-Isopropylbenzyl)phosphonate		5g
D3326	Diethyl (3-Methoxybenzyl)phosphonate	5g	25g
D4000	Diethyl (4-Methoxybenzyl)phosphonate	5g	25g
D3708	Diethyl (<i>N</i> -Methoxy- <i>N</i> -methylcarbamoylmethyl)phosphonate	1g	5g
D3873	Diethyl (Methoxymethyl)phosphonate	5g	25g
D3327	Diethyl (2-Methylbenzyl)phosphonate	5g	25g
D3328	Diethyl (3-Methylbenzyl)phosphonate	5g	25g
D3336	Diethyl (4-Methylbenzyl)phosphonate	5g	25g
D3827	Diethyl Methylphosphonate	5g	25g
M1208	Diethyl (Methylthiomethyl)phosphonate	5g	25g
D3339	Diethyl (2-Oxo-2-phenylethyl)phosphonate	1g	5g
D3174	Diethyl (2-Oxopropyl)phosphonate	5g	25g
P1193	Diethyl (Phthalimidomethyl)phosphonate	5g	25g
P1258	Diethyl 1-Pyrrolidinemethylphosphonate		5g
D4607	Diethyl (Trichloromethyl)phosphonate	5g	25g
D3992	Dimethyl 1,3-Benzodithiol-2-ylphosphonate		1g
D3981	Dimethyl 2-(1,3-Dithiole)phosphonate	1g	5g
M0943	Dimethyl Methylphosphonate	25g	500g
O0208	Dimethyl (2-Oxopropyl)phosphonate	5g	25g
D3875	Diphenyl 4-Bromo- α -chlorobenzylphosphonate	5g	25g
D3824	Diphenyl α -Chlorobenzylphosphonate	1g	5g
D3709	Diphenyl (<i>N</i> -Methoxy- <i>N</i> -methylcarbamoylmethyl)phosphonate	1g	5g
D2547	Ethyl Diphenylphosphonoacetate	1g	5g
D2548	Ethyl Di- α -tolylphosphonoacetate		1g
M1210	Methoxymethyl(diphenyl)phosphine Oxide	5g	25g
D2873	Methyl Diethylphosphonoacetate	5g	25g
T1582	Tetraethyl <i>p</i> -Xylylenediphosphonate	5g	25g 100g
M1319	Tetraisopropyl Methylene diphosphonate		25g
F0340	Triethyl 2-Fluoro-2-phosphonoacetate		1g 5g
D1523	Triethyl Phosphonoacetate	25g	100g 500g
T2135	Triethyl 2-Phosphonopropionate		25g
D1524	Triethyl 3-Phosphonopropionate		25g 250g
P1265	Trimethyl Phosphonoacetate		25g 250g

Organotitanium Reagents

D4100



C1411



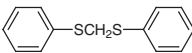
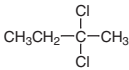
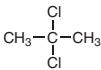
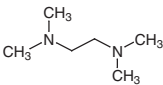
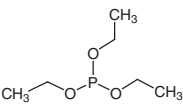
T2052

TiCl₄

T0616



Product No.	Product Name	Unit Size	
D4100	Dimethyltitanocene (5% in Tetrahydrofuran/Toluene)		100g
C1411	Tebbe Reagent (ca. 0.5mol/L in Toluene)		25mL
T2052	Titanium(IV) Chloride (14% in Dichloromethane, ca. 1.0mol/L)	100mL	500mL
T0616	Titanocene Dichloride	5g	25g

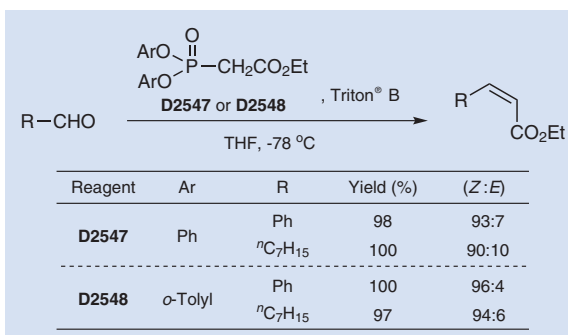
Others		B0041 	B1444 	B0527 $\text{BF}_3 \cdot \text{CH}_3\text{CH}_2\text{OCH}_2\text{CH}_3$
B0396 $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{Li}$	D0184 	D0192 CH_2Br_2	D1106 	D0400 
D0610 CH_2I_2	T0147 	T0430 		

Product No.	Product Name	Unit Size	
B0041	Benzenethiol	25mL	500mL
B1444	Bis(phenylthio)methane	5g	25g
B0527	Boron Trifluoride - Ethyl Ether Complex	25mL	100mL 500mL
B0396	Butyllithium (ca. 15% in Hexane, ca. 1.6mol/L)	100mL	500mL
D0184	1,1-Dibromoethane (stabilized with Copper chip)		5g
D0192	Dibromomethane	25g	500g
D1106	2,2-Dichlorobutane		10mL
D0400	2,2-Dichloropropane		10mL
D0610	Diiodomethane (stabilized with Copper chip)	25g	100g 500g
T0147	N,N,N',N'-Tetramethylethylenediamine	25mL	500mL
T0430	Triethyl Phosphite	25mL	500mL

Z-Selective Horner-Emmons Reagent

Horner-Emmons reagents are efficient olefinating reagents for the preparation of α,β -unsaturated esters. Generally, their reaction with aldehydes affords the *E*-isomer of the related olefins preferentially. So, to obtain the *E*-isomer selectively, it is required to investigate the reaction conditions and other effective olefinating reagents.

Ando had studied the *Z*-preferential Horner-Emmons reaction on the basis of detailed analysis of its reaction mechanism, and resultantly it was found that the *Z*-isomer of α,β -unsaturated esters was given with high stereoselectivity by use of ethyl (diaryl)phosphonoacetates as olefinating reagents.¹⁾ In this synthetic method, quaternary ammonium hydroxides stable to water are available as a base, and it doesn't require any special experimental-equipment/-technique. In addition, this method gives *Z*- α,β -unsaturated esters with extremely high stereoselectivity, so ethyl (diaryl)phosphonoacetates are the practical Horner-Emmons reagents.



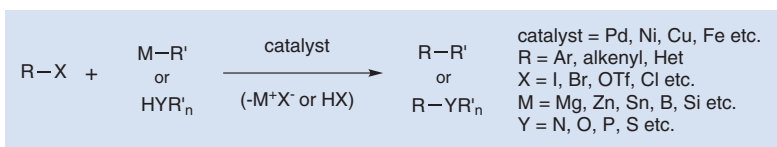
Product No.	Product Name	Unit Size	
D2547	Ethyl Diphenylphosphonoacetate	1g	5g
D2548	Ethyl Di- <i>o</i> -tolylphosphonoacetate		1g

References

- 1) a) K. Ando, *Tetrahedron Lett.* **1995**, 36, 4105.
- b) K. Ando, *J. Org. Chem.* **1997**, 62, 1934.
- c) K. Ando, T. Oishi, M. Hirma, H. Ohno, T. Ibuka, *J. Org. Chem.* **2000**, 65, 4745.

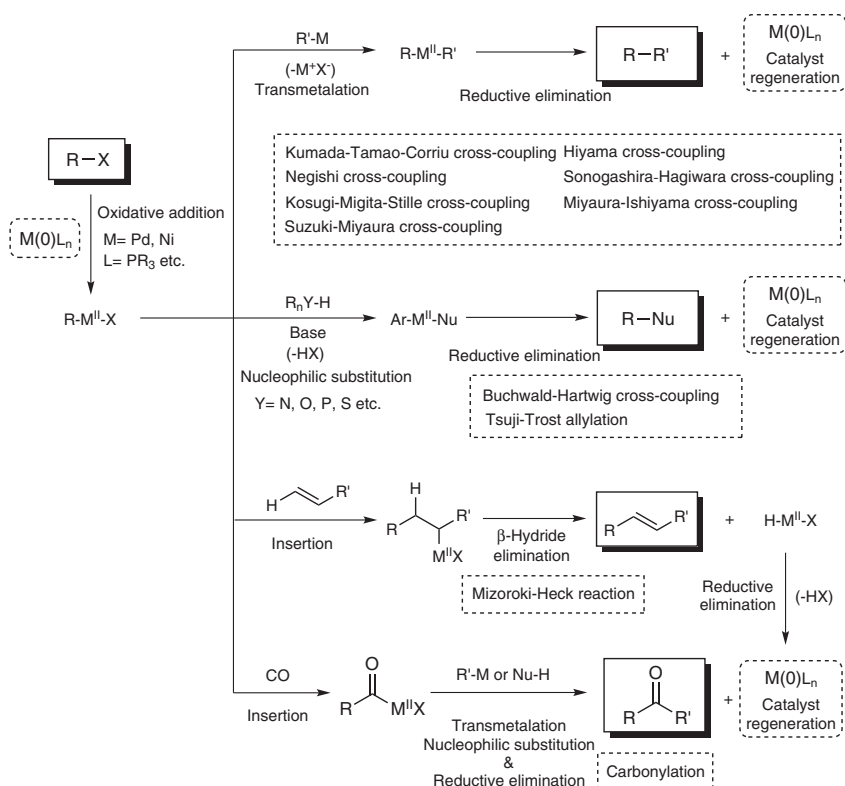
Cross-coupling Reaction Using Transition Metal Catalysts

Cross-coupling reactions using late transition metal catalysts represented by nickel and palladium metals have been widely used for introducing various functional groups into unsaturated substances such as aromatic rings, alkenes, alkynes and so on. In these reactions, carbon-carbon bond forming reactions can be performed by the combination of electrophilic carbon species of aryl/vinyl halides and organometallic agents of Grignard reagents and organoboron compounds. Also, the use of nucleophilic hetero atoms such as phenols and amines is efficient to form carbon-hetero atom bonds. By the development of these synthetic methods, substitution reactions to sp^2 carbon and sp carbon are easily accomplished while it had been difficult to perform these transformations by classical synthetic reactions without using metal catalysts.



Recently, transition metal mediated cross-coupling reactions have been widely used as useful synthetic tools and applied to the synthesis of various functional molecules such as bioactive compounds and biaryls for liquid crystal materials. As a feature of these transformations, it is found that there are many name reactions for each kind of nucleophile used for coupling reactions. And then in 2010, for making a great contribution to develop the metal-based cross-coupling reactions, Richard F. Heck, Ei-ichi Negishi and Akira Suzuki jointly received the Nobel Prize in chemistry, verifying the usefulness of the transition metal mediated cross-coupling reactions.

The following shows the synthetic properties of palladium/nickel catalyzed cross-coupling reactions commonly used with the chemical equations.



Cross-coupling reactions using palladium/Nickel catalysts

Chemical properties and reactivities for organic halides (R-X)

X : I > Br ≈ OTf > Cl >> F	
I	Reactive without phosphine ligands at room temperature
Br	In many cases heating is required for the reactions to proceed.
OTf	Formation of cationic complexes is unfavorable for metal exchange reactions. Effective to add some salts like LiCl for the reactions to proceed
Cl	Only in a special case will the reactions proceed. Use of highly active catalysts Use of heteroaromatic chlorides (R = heteroaromatic rings)
R	The order of the reactivity as follows: Electron-withdrawing group > electron-donating group Electron-withdrawing group is effective for oxidative addition.

Chemical properties for Ni/Pd catalysts

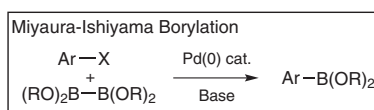
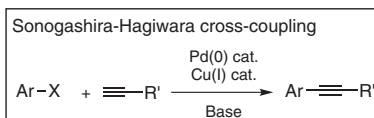
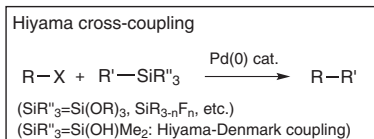
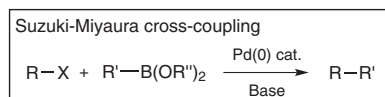
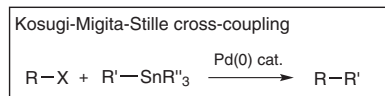
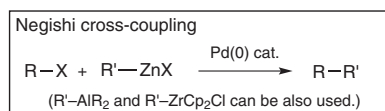
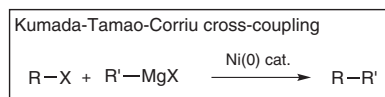
Ni	High reactivity but low stability
	Inexpensive and easy to remove
Pd	Chemically stable and easy to handle
	Little by-product Expensive and hard to remove

Effect of ligand (L) for reactivity

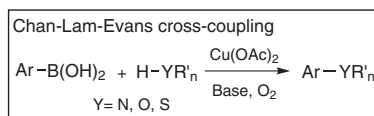
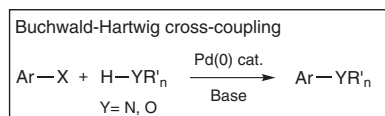
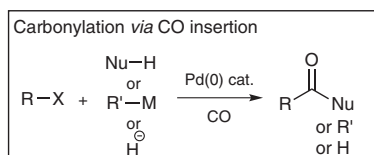
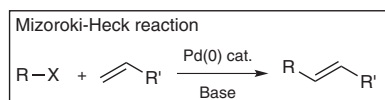
High electron-donation	Improves oxidative addition
High bulky ligand	Improves reductive elimination

As a means for preventing deactivation of catalysts, it is effective to carry out the reaction under inert gas (argon, nitrogen) conditions. In addition, performing degasification of the solvent before the reaction is more effective.

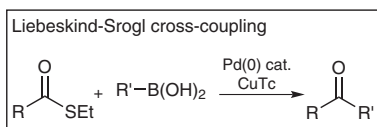
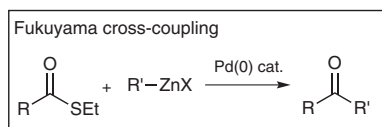
The late transition metal catalyzed cross-coupling reactions are collected based on the reaction modes and show as general synthetic schemes as follows.

Cross-coupling reactions *via* the transmetalation

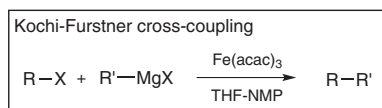
Cross-coupling reactions forming carbon-hetero atom bonds

Cross-coupling reactions *via* the insertion

Cross-coupling reactions *via* the oxidative addition of thioesters



Cross-coupling reactions forming carbon sp^3 – carbon sp^3 bonds



Palladium Catalysts

The study of coupling reactions using organopalladium complexes has been advanced as well as that using organonickel complexes. Generally, the reactivity of organopalladium complexes is lower compared with organonickel complexes. However, they have higher chemical stability for oxidations and this makes them easy to use. Therefore, palladium complexes are most commonly used for cross-coupling reactions.

(1) Palladium complexes generally used in cross coupling reactions

Palladium-phosphine complexes are well used in cross-coupling reactions and commercially available. $\text{Pd}(\text{PPh}_3)_4$ and $\text{PdCl}_2(\text{PPh}_3)_2$ are used without any treatment. Also, palladium catalysts are used prepared *in situ* from the precursors such as $\text{Pd}(\text{OAc})_2$ and $\text{Pd}_2(\text{dba})_3 \cdot \text{CHCl}_3$, with appropriate amounts of phosphines. When using divalent palladium complexes such as $\text{Pd}(\text{OAc})_2$, once they are reduced to zero-valent palladium species by some organometallic reagents, phosphines and amines, then their catalytic reactions can start.

Palladium-phosphine complexes:

$\text{Pd}(0)$: $\text{Pd}(\text{PPh}_3)_4$, $\text{Pd}[\text{P}(t\text{-Bu})_3]_2$ etc.

$\text{Pd}(II)$: $\text{PdCl}_2(\text{PPh}_3)_2$, $\text{PdCl}_2[(o\text{-tolyl})_3\text{P}]_2$, $\text{PdCl}_2(\text{dppf})$, $\text{PdCl}_2(\text{dppe})$, $\text{PdCl}_2(\text{dppp})$, etc.

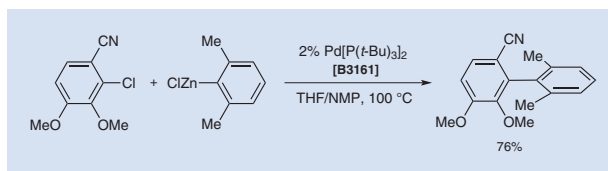
Precursors of palladium catalysts:

$\text{Pd}(0)$: $\text{Pd}_2(\text{dba})_3 \cdot \text{CHCl}_3$, $\text{Pd}(\text{dba})_2$ etc.

$\text{Pd}(II)$: $\text{Pd}(\text{OAc})_2$, $\text{PdCl}_2(\text{CH}_3\text{CN})_2$, $\text{PdCl}_2(\text{PhCN})_2$, $[\text{PdCl}(\text{allyl})]_2$, Na_2PdCl_4 , PdCl_2 etc.

(2) Higher activity palladium catalysts

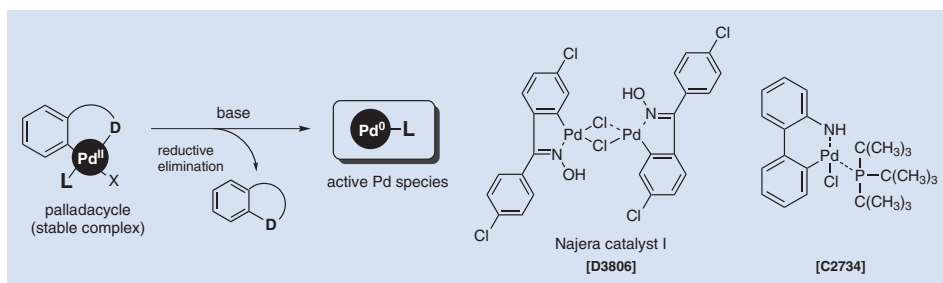
Generally, cross coupling reactions are promoted by using electron-rich and sterically hindered ligands. For example, palladium catalysts when coordinated by tertiary alkyl phosphines such as the *tert*-butyl group, cyclohexyl group and so on are used, show high catalytic activities in cross-coupling reactions. They are effective to use when low reactive aryl chlorides or sterically hindered aromatic halides are employed as reagents. The monomer state of sterically hindered alkyl phosphines is chemically unstable, but they are stabilized by coordinating them with palladium complexes.



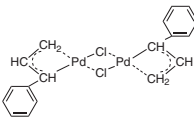
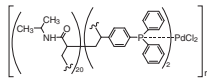
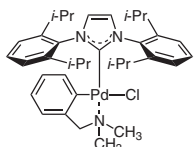
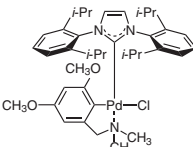
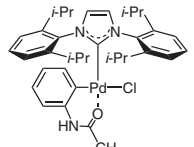
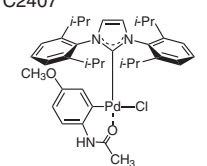
Recently, *N*-heterocarbene (NHC) ligands have been used for cross-coupling reactions because they activate palladium catalysts more effectively than tertiary alkyl phosphines. Palladium-NHC complexes show not only high activity but also high structural stability. In addition, they keep their complex formation without decomposition even after work-up, which is an advantage because it makes removing these complexes easy.

(3) Palladacycle catalysts

In some cases the active palladium species can't be efficiently prepared by the combination of palladium complexes and ligands. To solve this problem, palladacycle catalysts have been developed and used for more efficient preparation of active palladium species. As a property, they easily release the coordinated ligand with treatment of some bases, and afford the related zero-valent active palladium species. On the other hand, they form structurally stable complexes caused by their cyclic structures constructed of the ligand with intramolecular coordinating ability and the palladium species. In addition, their catalytic ability is improved by the addition of bases and they show high turnover frequency.



Palladium Catalysts		A1479	B2029	B1676
				$(\text{CH}_3\text{CN})_2\text{PdCl}_2$
B1668	B3224	B1374	B3160	B2031
B2016	B2064	B2192	B2161	B2018
B3161	B2055	B2042	B1667	B2026
C2734	D2604	D3806	P1785 P1491 P1490	A1424
			Pd	$\left[\text{CH}_3\text{-C(=O)-O}^- \right]_2 \text{Pd}^{2+}$

P2106	P1489	P2017	P1528	P1870
$[\text{Pd}(\text{CH}_3\text{COO})_2]_3$	PdCl_2		$\text{Pd}(\text{OH})_2$	$\left[\text{CF}_3\text{C}(=\text{O})\text{O}^- \right]_2 \text{Pd}^{2+}$
P1425	P1944	C2372	C2406	C2387
	$\text{Pd} / (\text{PSi-Al}_2\text{O}_3)$			
C2407	S0540	T1350	T2184	
	Na_2PdCl_4	$\left[(\text{C}_6\text{H}_5)_3\text{P} \right]_4 \text{Pd}$	$\left[\text{C}_6\text{H}_5\text{CH}=\text{CH}-\text{C}(=\text{O})-\text{CH}=\text{CH}-\text{C}_6\text{H}_5 \right]_3 \text{Pd}_2$	

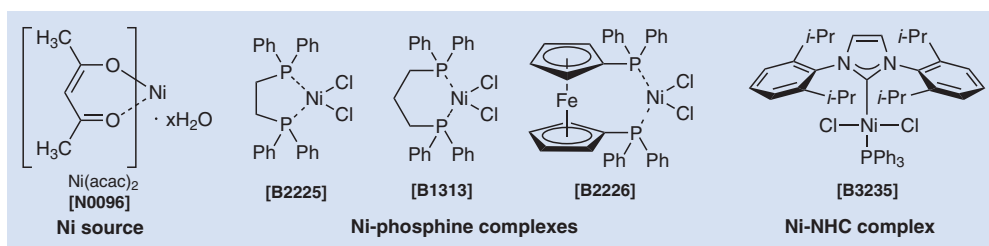
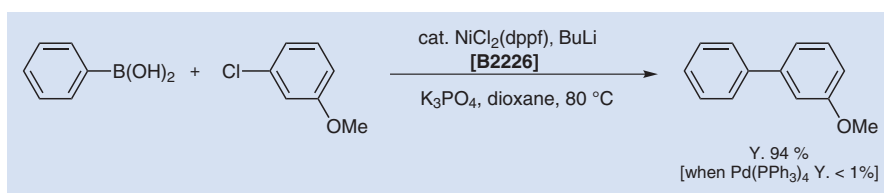
Product No.	Product Name	Unit Size	
A1479	Allylpalladium(II) Chloride Dimer	500mg	1g
B2029	Benzylbis(triphenylphosphine)palladium(II) Chloride	100mg	1g
B1676	Bis(acetonitrile)palladium(II) Dichloride	1g	5g
B1668	Bis(benzonitrile)palladium(II) Dichloride	1g	5g
B3224	Bis[1,2-bis(diphenylphosphino)ethane]palladium(0)	1g	5g
B1374	Bis(dibenzylideneacetone)palladium(0)	1g	5g
B3160	[1,1'-Bis(di- <i>tert</i> -butylphosphino)ferrocene]palladium(II) Dichloride	1g	5g
B2031	[1,4-Bis(diphenylphosphino)butane]palladium(II) Dichloride	1g	5g
B2016	[1,2-Bis(diphenylphosphino)ethane]palladium(II) Dichloride	1g	5g
B2064	[1,1'-Bis(diphenylphosphino)ferrocene]palladium(II) Dichloride Dichloromethane Adduct	1g	5g 25g
B2192	[1,3-Bis(diphenylphosphino)propane]palladium(II) Dichloride	1g	5g
B2161	Bis(methyldiphenylphosphine)palladium(II) Dichloride	1g	5g
B2018	Bis(2,4-pentanedionato)palladium(II)	1g	5g
B3161	Bis(tri- <i>tert</i> -butylphosphine)palladium(0)	250mg	1g
B2055	Bis(tricyclohexylphosphine)palladium(II) Dichloride	1g	5g
B2042	Bis(triphenylphosphine)palladium(II) Diacetate	1g	5g
B1667	Bis(triphenylphosphine)palladium(II) Dichloride	1g	5g 25g
B2026	Bis(tri- <i>o</i> -tolylphosphine)palladium(II) Dichloride	1g	5g
C2734	Chloro[(tri- <i>tert</i> -butylphosphine)-2-(2-aminobiphenyl)]palladium(II)	1g	5g
D2604	Dichloro(1,5-cyclooctadiene)palladium(II)	1g	5g
D3806	Najera Catalyst I	250mg	1g
P1785	Palladium 10% on Carbon (wetted with ca. 55% Water) [Useful catalyst for coupling reaction, etc.]	5g	25g
P1491	Palladium 10% on Carbon (wetted with ca. 55% Water)	5g	25g
P1490	Palladium 5% on Carbon (wetted with ca. 55% Water)	5g	25g
A1424	Palladium(II) Acetate	1g	5g
P2106	Palladium(II) Acetate Trimer	1g	5g
P1430	Palladium Catalyst Set (includes useful 7 Palladium catalysts) Palladium(II) Acetate / Allylpalladium(II) Chloride Dimer / Bis(benzonitrile)palladium(II) Dichloride / Bis(dibenzylideneacetone)palladium(0) / [1,1'-Bis(diphenylphosphino)ferrocene]palladium(II) Dichloride Dichloromethane Adduct / Bis(triphenylphosphine)palladium(II) Dichloride / Tetrakis(triphenylphosphine)palladium(0)	1g	5g
P1489	Palladium(II) Chloride	1g	5g
P2017	Palladium(II)(<i>π</i> -cinnamyl) Chloride Dimer	200mg	1g
P1528	Palladium Hydroxide 20% on Carbon (wetted with ca. 50% Water)	10g	50g
P1870	Palladium(II) Trifluoroacetate	1g	5g
P1425	Poly[<i>N</i> -isopropylacrylamide- <i>co</i> -4-(diphenylphosphino)styrene] Palladium(II) Dichloride (ratio, acrylamide:phosphine=20:2)	100mg	1g
P1944	Poly(methylphenyl)silane supported Palladium/Alumina Hybrid Catalyst [=Pd / (PSi-Al ₂ O ₃)]	1g	5g
C2372	SingaCycle™-A1 (This product is unavailable in the U.S.)	200mg	1g
C2406	SingaCycle™-A2 (This product is unavailable in the U.S.)	200mg	1g
C2387	SingaCycle™-A3 (This product is unavailable in the U.S.)	200mg	1g
C2407	SingaCycle™-A4 (This product is unavailable in the U.S.)	200mg	1g
C0540	Sodium Tetrachloropalladate(II)	1g	5g

Product No.	Product Name	Unit Size		
T1350	Tetrakis(triphenylphosphine)palladium(0)	1g	5g	25g
T2184	Tris(dibenzylideneacetone)dipalladium(0)	1g	5g	

Nickel Catalysts

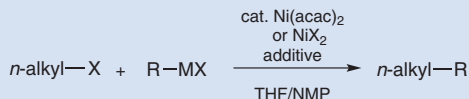
Nickel catalysts are routinely used for cross-coupling reactions as well as palladium catalysts. In 1972, Kumada and Tamao had reported that nickel catalysts promoted cross-coupling reactions of Grignard reagents with aryl halides or vinyl halides with the proposal their catalytic cycle. The result of this research has contributed to further development of cross coupling reactions.¹⁾

Nickel catalysts are generally inexpensive and show high activities even when using low reactive substrates in cross-coupling reactions. For example, in the presence of butyl lithium, zinc metal or phosphines as a co-reductant, $\text{NiCl}_2(\text{dppf})$ catalyzed cross-coupling reactions of aryl chlorides/mesylates with aryl borates successfully proceeding to afford the desired biaryls in good yields.²⁾ Recently, it has been reported that *N*-heterocyclic carbene (NHC) – nickel complexes show high catalytic activity in cross-coupling reactions.



On the other hand, similar to iron and cobalt catalysts, nickel catalysts are used for the cross coupling reactions of alkyl halides with organometallic species such as organomagnesium, organozinc and organoboric acid compounds. This synthetic means is effective for producing the carbon sp^3 – carbon sp^3 bond. In this reaction, phosphine ligands are less effective and an optimization of the reaction conditions suitable for each substrate was investigated. In a case using primary alkyl halides as a reactant, the coupling reactions are accelerated by using NMP as a solvent and addition of alkenes with electron-withdrawing groups. It is also effective to add butadienes as additives because the reactivity of the coupling reactions improves through the formation of nickel - bis-allyl complexes. The proceeding of cross-coupling reactions with secondary alkyl halides is harder relative to primary alkyl halides, so pyridyl-type chelate ligands such as phenanthrolines, Pybox and diamines are used for promoting those reactions. This has been applied to asymmetric reactions and natural products synthesis.³⁾

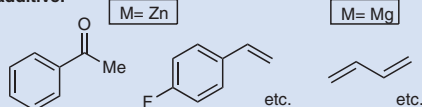
Cross coupling of primary alkyl halides



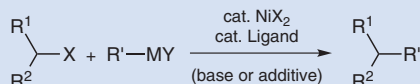
X= I, Br

R= *n*-alkyl, *s*-alkyl, benzyl, aryl

additive:



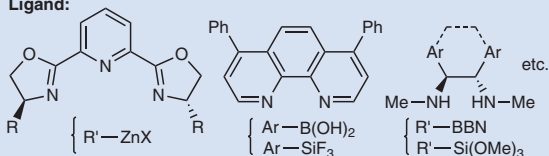
Cross coupling of secondary alkyl halides



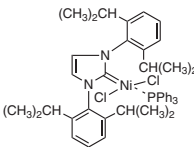
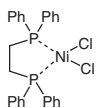
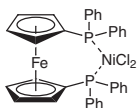
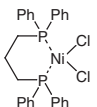
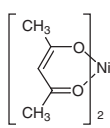
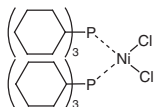
X= I, Br, MY= ZnX, B(OH)₂, BBN, SiF₃, Si(OMe)₃ etc.

R'= alkyl, aryl, alkenyl

Ligand:



Nickel Catalysts

		B3235	B2225	B2226
				
B1313	N0096	B3534	B1571	S0487
				Ni

Product No.	Product Name	Unit Size	
B3235	[1,3-Bis(2,6-diisopropylphenyl)imidazol-2-ylidene]triphenylphosphine Nickel(II) Dichloride	200mg	1g
B2225	[1,2-Bis(diphenylphosphino)ethane]nickel(II) Dichloride	1g	5g 25g
B2226	[1,1'-Bis(diphenylphosphino)ferrocene]nickel(II) Dichloride	1g	5g
B1313	[1,3-Bis(diphenylphosphino)propane]nickel(II) Dichloride	5g	25g
N0096	Bis(2,4-pentanedionato)nickel(II) Hydrate	25g	500g
B3534	Bis(tricyclohexylphosphine)nickel(II) Dichloride	1g	5g
B1571	Bis(triphenylphosphine)nickel(II) Dichloride	10g	100g
S0487	Skeletal Nickel Catalyst slurry in Water [Active catalyst for Hydrogenation]		50g

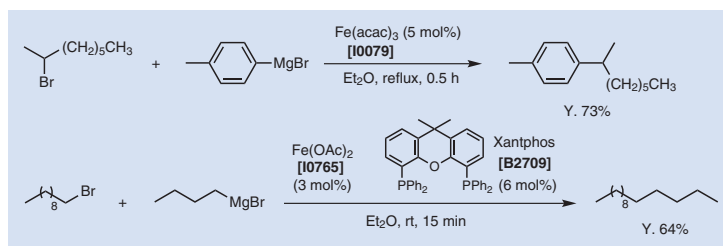
References

- 1) K. Tamao, K. Sumitani, M. Kumada, *J. Am. Chem. Soc.* **1972**, 94, 4374.
- 2) a) V. Percec, J.-Y. Bae, D. H. Hill, *J. Org. Chem.* **1995**, 60, 1060.
b) S. Saito, M. Sakai, N. Miyaura, *Tetrahedron Lett.* **1996**, 37, 2993.
c) S. Saito, S. Oh-tani, N. Miyaura, *J. Org. Chem.* **1997**, 62, 8024.
d) A. F. Indolese, *Tetrahedron Lett.* **1997**, 38, 3513.
e) K. Inada, N. Miyaura, *Tetrahedron* **2000**, 56, 8657.
- 3) Review
a) M. R. Netherton, G. C. Fu, *Adv. Synth. Catal.* **2004**, 346, 1525.
b) F. Glorius, *Angew. Chem. Int. Ed.* **2008**, 47, 8347.
c) A. Rudolph, M. Lautens, *Angew. Chem. Int. Ed.* **2009**, 48, 2656.

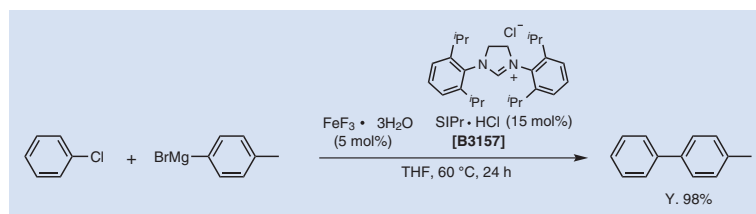
Iron Catalysts

Including palladium catalysts, which are frequently used for the Suzuki-Miyaura coupling reaction, transition metal catalysts, such as nickel, copper, or rhodium, have been widely used for organic synthesis. However, the percentages of these metals in the earth's crust are extremely small, and their prices are rather expensive.¹⁾ On the other hand, iron is abundant and less expensive, therefore, more and more chemists have focused their attention to organic synthesis using iron compounds as a catalyst.

For instance, with regards to the reactions of Grignard reagents with alkyl bromides, Hayashi *et al.*²⁾ and Chai *et al.*³⁾ have reported the synthetic methods using $\text{Fe}(\text{acac})_3$ as a catalyst, $\text{Fe}(\text{OAc})_2$ as a catalyst and Xantphos as a ligand, respectively, by which the desired coupling products can be obtained in good yields.



Furthermore, Nakamura *et al.* have reported the method using the *N*-heterocyclic carbene *in situ* generated from $\text{SIPr} \cdot \text{HCl}$, which suppresses the generation of the homo-coupling products, thereby leading to an excellent yield of the desired product.⁴⁾



Thus, synthetic technologies using iron catalysts are being actively developed. It can be expected that iron catalysts will exhibit their own catalytic properties in addition to replacing other metal catalysts in the near future.

Iron Catalysts			D2571	I0765	T1686
H0555	I0079	T0750			

Product No.	Product Name	Unit Size		
D2571	<i>N,N'</i> -Bis(salicylidene)ethylenediamine Iron(II)	5g	25g	
I0765	Iron(II) Acetate	5g	25g	
T1686	Tris(dibenzoylmethanato) Iron	5g	25g	
H0555	Tris(hexafluoroacetylacetonato)iron(III)			1g
I0079	Tris(2,4-pentanedionato)iron(III)	25g	100g	500g
T0750	Tris(trifluoro-2,4-pentanedionato)iron(III)			5g

References

- 1) J. Emsley, in *The Elements*, 3rd ed., Oxford Univ. Press, New York, **1998**.
- 2) T. Nagano, T. Hayashi, *Org. Lett.* **2004**, 6, 1297.
- 3) K. G. Dongol, H. Koh, M. Sau, C. L. L. Chai, *Adv. Synth. Catal.* **2007**, 349, 1015.
- 4) T. Hatakeyama, M. Nakamura, *J. Am. Chem. Soc.* **2007**, 129, 9844.

Copper Catalysts

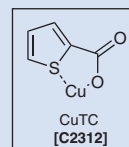
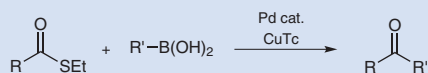
Copper-mediated coupling reactions have been known as a traditional reaction. For instance, homocouplings of aryl halides and alkynes are called the Ullmann reaction and the Glaser coupling respectively, and both of these were discovered over a hundred years ago. Around the same time, carbon-heteroatom bond forming reactions such as the Ullmann ether synthesis and the Goldberg amination were also reported. In early studies of these classical copper-mediated coupling reactions, there were a number of disadvantages needing improvement such as use of over stoichiometric amounts of copper reagents, harsh reaction conditions, and low substrate generality. However, copper-mediated coupling reactions can be carried out at a lower cost compared with using palladium catalysts. So, various modified methods have been studied and more practical reactions have been developed.

Recent advances in the Ullmann-type reactions using aryl halides have been achieved under milder reaction conditions and reducing the amount of copper catalyst by the choice of suitable solvents, bases, and ligands. Also, investigation of effective ligands for these reactions has been developed and found that the diamine and dicarbonyl compounds effectively play as a ligand in preventing side reactions and deactivating a monovalent copper catalyst.

Ullmann-type Coupling			
$\text{Ar-X} + \text{Nu} \xrightarrow[\text{under Ar or N}_2]{\text{Cu(I) source, Ligand, base, } \Delta} \text{Ar-Nu}$ X = I, Br		Cu(I) source: CuI, Cu₂O, CuBr, (CuOTf)₂·C₆H₆, CuCl etc. Cu(I) complex: CuTc, Cu(MeCN)₄PF₆ etc. solvent: DMSO, DMF, NMP, dioxane, MeCN, toluene etc. base: K₂CO₃, K₃PO₄, Cs₂CO₃, DIPEA, Et₃N etc.	
Nu:	Ligand	Nu:	Ligand
$\text{HN} \begin{matrix} \diagup \text{R} \\ \diagdown \text{R}' \end{matrix}$ $\text{O} \begin{matrix} \diagup \text{R} \\ \diagdown \end{matrix}$ $\text{HN} \begin{matrix} \diagup \text{R} \\ \diagdown \end{matrix}$ $\text{HN} \begin{matrix} \diagup \text{R} \\ \diagdown \end{matrix}$	 etc.	HO-Ar HO-R	 etc.
HS-R	 etc.	NaI $(\text{X} = \text{Br})$	 etc.

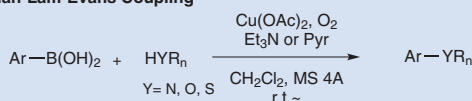
For instance, CuTc (copper(I) 2-thiophenecarboxylate) catalyzed the Ullmann coupling and can proceed at room temperature without having to apply heat. CuTc also acts as a co-catalyst of palladium catalyzed reactions. In a case of the Liebeskind-Srogl cross-coupling reaction, CuTc assisted activation of thioesters plays an important role in promoting the coupling reaction.

Liebeskind-Srogl Cross-coupling Reaction



Furthermore, the coupling reaction of aryl boronic acids with amines, phenols, and thiols promoted by a divalent copper and an oxygen from the air as a reoxidant, is known as the Chan-Lam-Evans coupling. This is a halogen-free coupling reaction and the stirring efficiency is important for the reaction to proceed due to reoxidizing the copper catalyst by an oxygen in the air. The rate of this reaction is generally slow and requires several days to complete the reaction, while it is carried out at room temperature.

Chan-Lam-Evans Coupling



Copper Catalysts		C0384	B1513	B3834 B1677
C2304	C2422	A1540	C2346	C1952
				CuCN
C2410	C2312	T1292	T1442	D3891
$\text{Cu}(\text{BF}_4)_2$				
D2542	D4395	T2665	T2666	
	Li_2CuCl_4	$(\text{CH}_3\text{CN})_4\text{Cu}^+ \text{PF}_6^-$	$(\text{CH}_3\text{CN})_4\text{Cu}^+ \text{BF}_4^-$	

Product No.	Product Name	Unit Size	
C0384	Bis(2,4-pentanedionato)copper(II)	25g	250g
B1513	Bis(1,3-propanediamine) Copper(II) Dichloride	1g	10g
B3834	Bis(8-quinolinolato)copper(II) (purified by sublimation)		1g
B1677	Bis(8-quinolinolato)copper(II)		25g
C2304	Chloro[1,3-bis(2,6-diisopropylphenyl)imidazol-2-ylidene]copper(I)	200mg	1g
C2422	Chloro(1,3-dimesitylimidazol-2-ylidene)copper(I)	200mg	1g

Product No.	Product Name	Unit Size	
A1540	Copper(I) Acetate	5g	25g
C2346	Copper(II) Acetate Monohydrate	25g	500g
C1952	Copper(I) Cyanide	25g	300g
C2410	Copper(II) Tetrafluoroborate (ca. 45% in Water)		500g
C2312	Copper(I) 2-Thiophenecarboxylate	1g	5g
T1292	Copper(II) Trifluoromethanesulfonate	5g	25g
T1442	Copper(I) Trifluoromethanesulfonate Benzene Complex	1g	5g
D3891	Dichloro(1,10-phenanthroline)copper(II)	1g	5g
D2542	Di- μ -hydroxo-bis[(<i>N,N,N',N'</i> -tetramethylethylenediamine)copper(II)] Chloride	5g	25g
D4395	Dilithium Tetrachlorocopper(II) (ca. 2.5% in Tetrahydrofuran, ca. 0.1mol/L)	100mL	500mL
T2665	Tetrakis(acetonitrile)copper(I) Hexafluorophosphate		5g
T2666	Tetrakis(acetonitrile)copper(I) Tetrafluoroborate	1g	5g

References

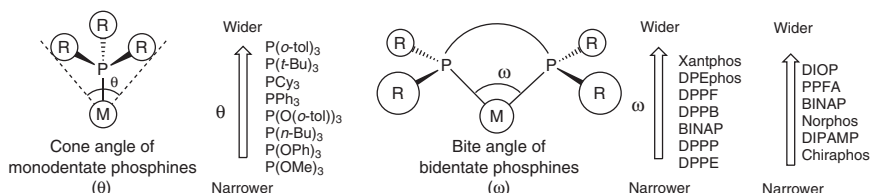
1) Review

- S. V. Ley, A. W. Thomas, *Angew. Chem. Int. Ed.* **2003**, 42, 5400.
- G. Evano, N. Blanchard, M. Toumi, *Chem. Rev.* **2008**, 108, 3054.
- S. U. Tekale, V. B. Jadhav, V. P. Pagore, S. S. Kauthale, D. D. Gaikwad, R. P. Pawar, *Mini-Rev. Org. Chem.* **2013**, 10, 281.

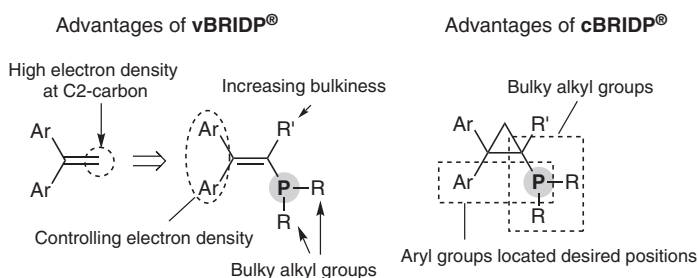
Phosphine Ligands

Phosphines are a three-valent phosphorus compound and act as a 'soft' σ -donating ligand with an unshared electron pair. This gives solubilization and stabilization to organometallic complexes by forming complexes with various transition metal species including latter-period transition metals and others, and is also used for controlling the reactivity and selectivity of the transition metal promoted reactions.

Electron density and bulkiness of phosphine ligands are greatly related to the reactivity of their forming metal complexes. Generally, the phosphine ligands with high electron density increase the reactivity of oxidative addition from a metal center, and their bulkiness improves the reductive elimination. For example, trialkylphosphines especially *tert*-butyl or cyclohexyl group substituted phosphines show the highest electron density while the electron density of triarylphosphines and phosphite are sequentially decreasing. On the other hand, as an index of the bulkiness of phosphine ligands, that of monodentate phosphine ligands shows the cone angle (θ) while bidentate phosphine ligands show the bite angle (ω). As the angle of the phosphine ligands is wider, their steric effect is greater and they are regarded as more bulky phosphine ligands. A monodentate phosphine ligand of tri(*o*-tolyl)phosphine, and bidentate phosphine ligands of 1,1'-bis(diphenylphosphino)ferrocene and Xantphos are known as representative bulky phosphine ligands.

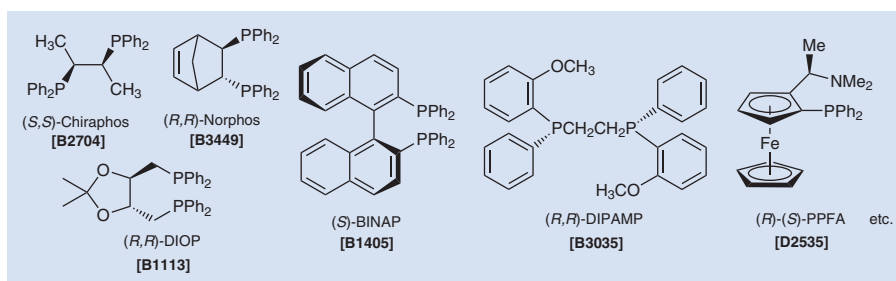


Electron rich and bulky trialkylphosphine ligands such as tributylphosphine and tricyclohexylphosphine are highly effective to use for cross-coupling reactions due to their functionally promoting the process of catalytic cycles, both the oxidative addition and reductive elimination. For instance, aryl chlorides have low reactivity against the oxidative addition of transition metals so it generally doesn't proceed. However, successful oxidative addition of them can be accomplished by the use of bulky trialkylphosphine ligands. In this way, trialkylphosphines have excellent chemical properties but they are unstable in air. So, it is required to handle them in a glove box. As an improvement of this disadvantage, the salt of phosphonium borates is used as a precursor of phosphine ligands. These can be treated in air and after neutralization the generated alkylphosphines are available in the reactions. Recently, alkyl group-substituted biarylphosphine ligands with higher activity have been developed and used in cross-coupling reactions. Also, unique phosphine ligands with high electron density but chemically stable in air named BRIDPs^(®) have been developed.⁽²⁾

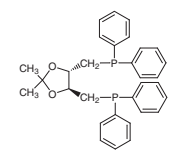
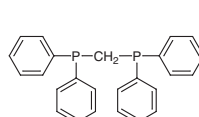
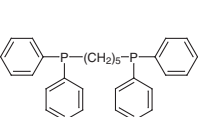
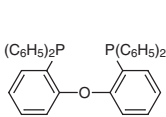
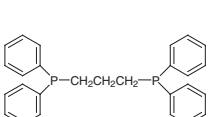
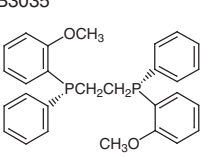
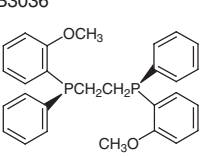
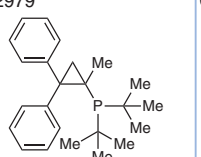
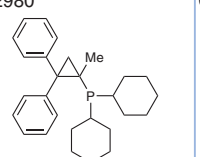
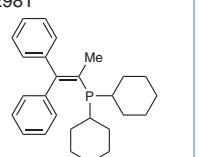
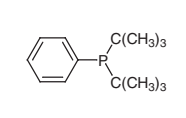
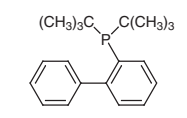
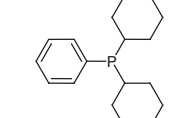
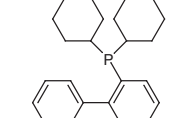
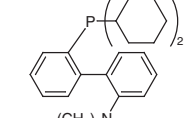
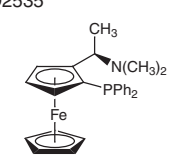
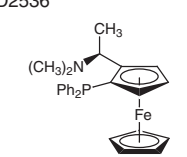
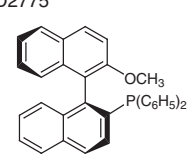
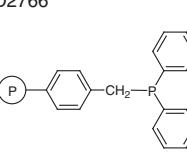
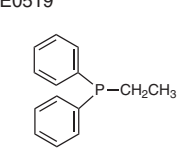
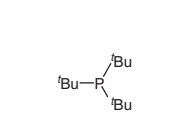
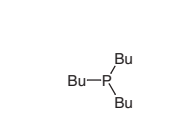
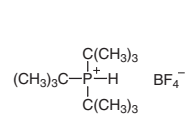
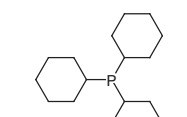
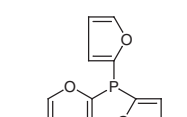
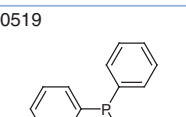
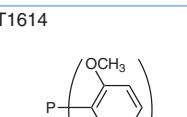
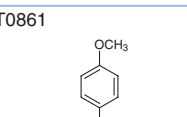
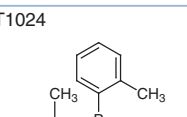
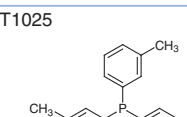
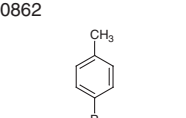


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Generally, phosphines are widely used as a ligand for nickel or palladium catalysts in cross-coupling reactions. They are also effective ligands for rhodium, iridium and gold catalysts and used in catalytic reactions such as hydrogenation and cyclization reactions. Furthermore, a number of optically active phosphine ligands with chiral carbon centers, axial chirality, P-chiral center and so on, have been developed. These ligands are applied to catalytic asymmetric reactions such as asymmetric hydrogenations, asymmetric allylations, asymmetric conjugate additions, asymmetric cycloadditions and asymmetric cross-coupling reactions by the combination with various transition metal species.



Phosphine Ligands		B2711	B2710	B3449
B3450	B1406	B1405	B1246	B2704
B2709	B1137	B2027	B1959	B1113

B1112	B1982	B1960	B2867	B1138
				
B3035	B3036	C2979	C2980	C2981
				
D3940	D3387	D2411	D3388	D3389
				
D2535	D2536	D2775	D2766	E0519
				
T1912	T0361	T2584	T1165	T1643
				
T0519	T1614	T0861	T1024	T1025
				
T0862				
				

Product No.	Product Name	Unit Size	
B2711	1,1'-Bis(di- <i>tert</i> -butylphosphino)ferrocene	100mg	1g
B2710	1,1'-Bis(diisopropylphosphino)ferrocene	100mg	1g
B3449	(2 <i>R</i> ,3 <i>R</i>)-(-)-2,3-Bis(diphenylphosphino)bicyclo[2.2.1]hept-5-ene ((2 <i>R</i> ,3 <i>R</i>)-(-)-Norphos)		100mg
B3450	(2 <i>S</i> ,3 <i>S</i>)-(+)-2,3-Bis(diphenylphosphino)bicyclo[2.2.1]hept-5-ene ((2 <i>S</i> ,3 <i>S</i>)-(+)-Norphos)		100mg
B1406	(<i>R</i>)-(+)-2,2'-Bis(diphenylphosphino)-1,1'-binaphthyl ((<i>R</i>)-(+)-BINAP)	1g	5g
B1405	(<i>S</i>)-(-)-2,2'-Bis(diphenylphosphino)-1,1'-binaphthyl ((<i>S</i>)-(-)-BINAP)	1g	5g

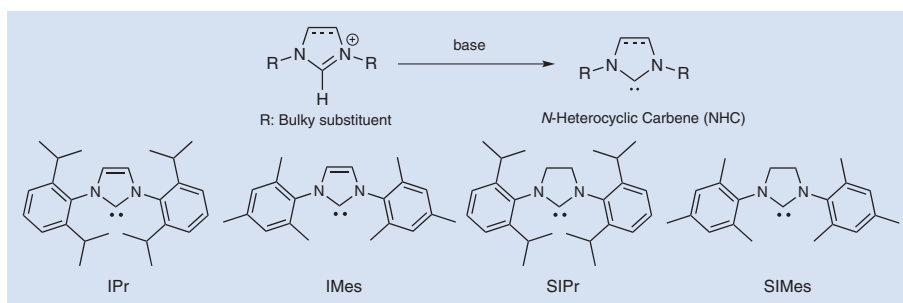
Product No.	Product Name	Unit Size		
B1246	1,4-Bis(diphenylphosphino)butane	5g	25g	
B2704	(2 <i>S</i> ,3 <i>S</i>)-(-)-Bis(diphenylphosphino)butane ((<i>S,S</i>)-Chiraphos)	100mg	1g	
B2709	4,5-Bis(diphenylphosphino)-9,9-dimethylxanthene (Xantphos)	1g	5g	
B1137	1,2-Bis(diphenylphosphino)ethane	10g	25g	
B2027	1,1'-Bis(diphenylphosphino)ferrocene	1g	5g	25g
B1959	1,6-Bis(diphenylphosphino)hexane	1g	5g	5g
B1113	(2 <i>R</i> ,3 <i>R</i>)-(-)-1,4-Bis(diphenylphosphino)-2,3- <i>O</i> -isopropylidene-2,3-butanediol ((-)-DIOP)			1g
B1112	(2 <i>S</i> ,3 <i>S</i>)-(+)-1,4-Bis(diphenylphosphino)-2,3- <i>O</i> -isopropylidene-2,3-butanediol ((+)-DIOP)			1g
B1982	Bis(diphenylphosphino)methane	5g	25g	
B1960	1,5-Bis(diphenylphosphino)pentane			1g
B2867	Bis[2-(diphenylphosphino)phenyl] Ether	5g	25g	
B1138	1,3-Bis(diphenylphosphino)propane	5g	25g	
B3035	(<i>R,R</i>)-1,2-Bis[(2-methoxyphenyl)phenylphosphino]ethane ((<i>R,R</i>)-DIPAMP)		100mg	
B3036	(<i>S,S</i>)-1,2-Bis[(2-methoxyphenyl)phenylphosphino]ethane ((<i>S,S</i>)-DIPAMP)	100mg	1g	
C2979	cBRIDP®	200mg	1g	
C2980	Cy-cBRIDP®	200mg	1g	
C2981	Cy-vBRIDP®	200mg	1g	
D3940	Di- <i>tert</i> -butylphenylphosphine		5g	
D3387	2-(Di- <i>tert</i> -butylphosphino)biphenyl		1g	
D2411	Dicyclohexylphenylphosphine	1g	5g	
D3388	2-(Dicyclohexylphosphino)biphenyl	1g	5g	
D3389	2-(Dicyclohexylphosphino)-2'-(dimethylamino)biphenyl	1g	5g	
D2535	(<i>R</i>)- <i>N,N</i> -Dimethyl-1-[(<i>S</i>)-2-(diphenylphosphino)ferrocenyl]ethylamine ((<i>R</i>)-(<i>S</i>)-PPFA)		100mg	
D2536	(<i>S</i>)- <i>N,N</i> -Dimethyl-1-[(<i>R</i>)-2-(diphenylphosphino)ferrocenyl]ethylamine ((<i>S</i>)-(<i>R</i>)-PPFA)		100mg	
D2775	(<i>S</i>)-(-)-2-Diphenylphosphino-2'-methoxy-1,1'-binaphthyl	100mg	1g	
D2766	4-Diphenylphosphinomethyl Polystyrene Resin cross-linked with 2% DVB (200-400mesh) (0.5-1.0mmol/g)		5g	
E0519	Ethylidiphenylphosphine		5g	
T1912	Tri- <i>tert</i> -butylphosphine		5g	
T0361	Tributylphosphine	25mL	100mL	500mL
T2584	Tri- <i>tert</i> -butylphosphonium Tetrafluoroborate	1g	5g	
T1165	Tricyclohexylphosphine (contains Tricyclohexylphosphine Oxide) (ca. 18% in Toluene, ca. 0.60mol/L)		25mL	
T1643	Tri(2-furyl)phosphine	1g	5g	
T0519	Triphenylphosphine	25g	500g	
T1614	Tris(2,6-dimethoxyphenyl)phosphine		25g	
T0861	Tris(4-methoxyphenyl)phosphine	5g	25g	
T1024	Tri(<i>o</i> -tolyl)phosphine	5g	25g	
T1025	Tri(<i>m</i> -tolyl)phosphine	5g	25g	
T0862	Tri(<i>p</i> -tolyl)phosphine	5g	25g	

References

- 1) J. F. Hartwig, in *Organotransition Metal Chemistry: From Bonding to Catalysis*, Univ Science Books, **2009**.
- 2) Reviews for alkylbiaryl phosphine ligands :
 - a) R. Martin, S. L. Buchwald, *Acc. Chem. Res.* **2008**, *41*, 1461.
 - b) D. S. Surry, S. L. Buchwald, *Angew. Chem. Int. Ed.* **2008**, *47*, 6338.
- 3) Review for BRIDPs® : K. Suzuki, Y. Hori, Y. Nakayama, T. Kobayashi, *J. Synth. Org. Chem. Jpn.* **2011**, *69*, 1231.

N-Heterocyclic Carbene (NHC) Ligands

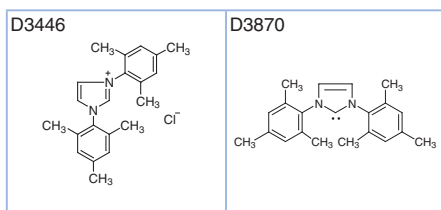
N-Heterocyclic carbene (NHC) is a cyclic carbene species with two neighboring nitrogen atoms. NHC was discovered by Wanzlick *et al.* in 1968, and in 1991, it was isolated and structure determined by Arduengo *et al.* So, for their achievements, NHC is also called as the Wanzlick-Arduengo type carbene. Generally, NHC is hard to isolate as a single carbene monomer because it easily dimerizes or reacts with water to decompose. However, NHC is conformationally stabilized by introducing bulky substituents on the nitrogen atoms of NHC. NHC substituted by a mesityl groups or 2,6-diisopropylphenyl groups is commonly used as a ligand for organometallic complexes.



A characteristic property of NHC ligands is their high coordinating ability caused by their bulkiness and strong electron-donating property. Their effect is stronger relative to trialkylphosphines, and allows the formation of metal-NHC complexes by ligand exchange reactions of metal-phosphine complexes with NHC ligands. In this way, NHC ligands strongly form complexes with some metals, and also produce coordinative unsaturation species by pushing out a *trans* position ligand coordinated with the metal center. Therefore, metal complexes coordinated by NHC ligands are highly active species but chemically stable and easy to handle, so they are expected to have a high turnover frequency.

Metal-NHC complexes can be prepared by a complex-forming reaction of metal complexes having anionic ligands such as acetate ions with NHC which was previously prepared from imidazolium salts and bases. They can be also prepared *via* the carbene-exchange reaction of silver-carbene complexes prepared from silver(I) oxide and imidazolium salts. This method is effective to use when bases are unavailable for preparing NHC. Metal-NHC complexes have been used for various chemical transformations such as cross-coupling reactions, cycloaddition reactions and C-H bond activation reactions since they have been successfully applied in metathesis reactions. In addition, NHC is used as an organocatalyst for benzoin condensations and acyloin condensations *via* the umpolung process.

N-Heterocyclic Carbene Ligands		B3506	B3157	D3611
B3465	B3158	D3711	D3472	D3882



Product No.	Product Name	Unit Size	
B3506	1,3-Bis(2,6-diisopropylphenyl)imidazolin-2-ylidene		1g
B3157	1,3-Bis(2,6-diisopropylphenyl)imidazolium Chloride (SIPr · HCl)	500mg	5g
D3611	1,3-Bis(2,6-diisopropylphenyl)imidazolium Chloride (IPr · HCl)	500mg	5g 25g
B3465	1,3-Bis(2,6-diisopropylphenyl)imidazol-2-ylidene (IPr)		1g 5g
B3158	1,3-Bis(2,4,6-trimethylphenyl)imidazolium Chloride (SImes · HCl)		1g 5g
D3711	1,3-Di- <i>tert</i> -butylimidazolium Tetrafluoroborate (tBu · HBF ₄)		1g 5g
D3472	1,3-Di- <i>tert</i> -butylimidazol-2-ylidene (tBu)		1g 5g
D3882	1,3-Dicyclohexylimidazolium Chloride (lcHex · HCl) (This product is only available in Japan.)		1g 5g
D3446	1,3-Dimesitylimidazolium Chloride (IMes · HCl)		1g 5g
D3870	1,3-Dimesitylimidazol-2-ylidene (IMes)		1g 5g

References

- 1) S. P. Nolan, in *N-Heterocyclic Carbenes in Synthesis*, Wiley-VCH, Weinheim, **2006**.
- 2) J. F. Hartwig, in *Organotransition Metal Chemistry: From Bonding to Catalysis*, Univ Science Books, **2009**.

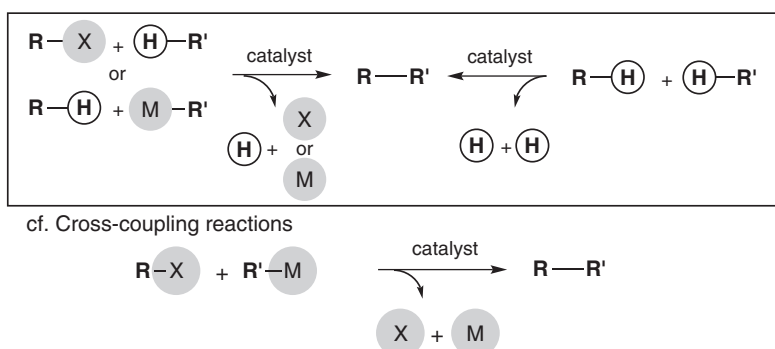
Bases & Additives		B2695 D0905	B0468	B1018
B0709	C2430	C2160	C2204	D3134
			CsF	
D0925	D1599	L0204 L0222	M0508	P0221
		LiCl		
P0081	P1748	P1758	S0560	S0485
		KF		CH ₃ ONa

T0054	T0057	Z0015
$\text{CH}_3(\text{CH}_2)_3\text{N}^+(\text{CH}_2)_3\text{CH}_3 \text{ Br}^-$	$\text{CH}_3(\text{CH}_2)_3\text{N}^+(\text{CH}_2)_3\text{CH}_3 \text{ I}^-$	Zn

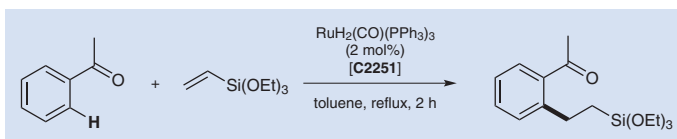
Product No.	Product Name	Unit Size		
B2695	Bathophenanthroline (purified by sublimation)			1g
D0905	Bathophenanthroline		1g	5g
B0468	2,2'-Bipyridyl	25g	100g	500g
B1018	1,8-Bis(dimethylamino)naphthalene [for Dehydrohalogenation]	1g	5g	25g
B0709	<i>tert</i> -Butylamine	25mL	100mL	500mL
C2430	Cesium Acetate		25g	100g
C2160	Cesium Carbonate		25g	100g
C2204	Cesium Fluoride		25g	100g
D3134	4,4'-Di- <i>tert</i> -butyl-2,2'-bipyridyl		1g	5g
D0925	Diisopropylamine	25mL	100mL	500mL
D1599	<i>N,N</i> -Diisopropylethylamine	25mL	100mL	500mL
L0204	Lithium Chloride Anhydrous		25g	300g
L0222	Lithium Chloride (2.3% in Tetrahydrofuran, ca. 0.5mol/L)			100mL
M0508	1-Methylimidazole	25g	100g	500g
P0221	1,10-Phenanthroline Monohydrate		1g	25g
P0081	1,10-Phenanthroline Hydrochloride Monohydrate			25g
P1748	Potassium Carbonate			300g
P1758	Potassium Fluoride			300g
S0560	Sodium Carbonate			300g
S0485	Sodium Methoxide		100g	500g
T0054	Tetrabutylammonium Bromide	25g	100g	500g
T0057	Tetrabutylammonium Iodide	25g	100g	500g
Z0015	Zinc (Powder)			300g

Activation of Non-active Bonds

Recently, development of the methodology for activation of unreactive bonds with transition metals and applications for functional transformations have been actively performed. In this study, C-H bond activation is studied as low environmental load type of reactions because this type of reaction proceeds with the cross-coupling reactions without using halides or nucleophilic organometallic species, thereby decreasing the number of reaction steps. A reasonable expression for these functional transformations is "C-H bond transformation" or "C-H bond functionalization".



In 1993, Murai *et al.* reported that the *ortho*-position of a C-H bond of aromatic ketones was activated by the action of catalytic amounts of carbonyl(dihydrido)tris(triphenylphosphine)ruthenium(II) and consequently added to olefins site-selectively. After this report, the study of C-H bond activation reactions dramatically progressed.



Functional transformation *via* the activation of unreactive bonds is classified into two types of synthetic modes. One is a method to activate by the assist of intramolecular chelation from the directing group in which the activation of unreactive bonds is performed by oxidative addition of lower-valent metal species. The other method is to cleave relatively high acidic C-H bonds with higher-valent metal species. In this method, it is often necessary to use reoxidants for reproducing higher-valent metal species. Even in reactions using higher-valent metal species, the assist of intramolecular chelation from the directing group is effective for performing the activation of unreactive bonds regioselectively.

Metal species utilized for functional transformation *via* the activation of unreactive bonds are palladium, ruthenium, rhodium, iridium and so on, with most of them being noble metals. Recently, relatively inexpensive metals such as nickel, copper and iron have also been used in these transformations. Much research has been performed and a number of useful transformations such as arylations, alkenylations, alkynylations, carbonylations and heteroatom functionalizations have been reported. Many of them activate C-H bonds on unsaturated carbons of aromatic rings or alkenes to transform into other functional groups. However, currently, cleavage of C-H bonds on sp^3 carbon which are generally harder to activate are being studied and successful transformations have been developed. There are various ways to activate unreactive bonds. The detail of these chemical properties and reactivities are explained as follows.

Palladium		B1676 $(\text{CH}_3\text{CN})_2\text{PdCl}_2$	B1374 	B2018
B3292 	B2055 	D4333 	A1424 $[\text{CH}_3\text{C}(=\text{O})\text{O}^-]_2 \text{Pd}^{2+}$	P1870 $[\text{CF}_3\text{C}(=\text{O})\text{O}^-]_2 \text{Pd}^{2+}$

Product No.	Product Name	Unit Size	
B1676	Bis(acetonitrile)palladium(II) Dichloride	1g	5g
B1374	Bis(dibenzylideneacetone)palladium(0)	1g	5g
B2018	Bis(2,4-pentanedionato)palladium(II)	1g	5g
B3292	1,2-Bis(phenylsulfonyl)ethane Palladium(II) Diacetate	200mg	1g
B2055	Bis(tricyclohexylphosphine)palladium(II) Dichloride	1g	5g
D4333	Dichloro[9,9-dimethyl-4,5-bis(diphenylphosphino)xanthene]palladium(II)	200mg	1g
A1424	Palladium(II) Acetate	1g	5g
P1870	Palladium(II) Trifluoroacetate	1g	5g

Ruthenium		B1902 	C2251 	D2751
H1010 	R0074 RuCl_3	T2181 	D1997 	

Product No.	Product Name	Unit Size	
B1902	Benzeneruthenium(II) Chloride Dimer	1g	5g
C2251	Carbonyl(dihydrido)tris(triphenylphosphine)ruthenium(II)	250mg	1g
D2751	Dichloro(<i>p</i> -cymene)ruthenium(II) Dimer	1g	5g
H1010	(Hexamethylbenzene)ruthenium(II) Dichloride Dimer	1g	5g
R0074	Ruthenium(III) Chloride	1g	5g
T2181	Triruthenium Dodecacarbonyl	100mg	1g
D1997	Tris(triphenylphosphine)ruthenium(II) Dichloride	1g	5g

Rhodium		B3961	B2091	C2253
C2461	B1045	N0453	P1788	R0069
R0161	T2054	T2055	T1551	
T2658	T2659	T2660	T2661	T1544
T0931				

Product No.	Product Name	Unit Size	
B3961	Bis(1,5-cyclooctadiene)rhodium(I) Tetrafluoroborate	100mg	1g
B2091	Bis[η-(2,5-norbornadiene)]rhodium(I) Tetrafluoroborate	100mg	1g
C2253	Chlorobis(cyclooctene)rhodium(I) Dimer	100mg	500mg
C2461	Chlorobis(ethylene)rhodium(I) Dimer		200mg
B1045	Chloro(1,5-cyclooctadiene)rhodium(I) Dimer	100mg	1g
N0453	Norbornadiene Rhodium(I) Chloride Dimer		100mg
P1788	(Pentamethylcyclopentadienyl)rhodium(III) Dichloride Dimer	200mg	1g
R0069	Rhodium(II) Acetate Dimer	100mg	1g
R0161	Rhodium(II) Octanoate Dimer	200mg	1g
T2054	Tetrakis[N-phthaloyl-(R)-tert-leucinato]dirhodium Bis(ethyl Acetate) Adduct		100mg
T2055	Tetrakis[N-phthaloyl-(S)-tert-leucinato]dirhodium Bis(ethyl Acetate) Adduct		100mg
T1551	Tetrakis[N-phthaloyl-(S)-phenylalaninato]dirhodium Ethyl Acetate Adduct		100mg
T2658	Tetrakis[N-tetrachlorophthaloyl-(R)-tert-leucinato]dirhodium Bis(ethyl Acetate) Adduct		50mg
T2659	Tetrakis[N-tetrachlorophthaloyl-(S)-tert-leucinato]dirhodium Bis(ethyl Acetate) Adduct		100mg
T2660	Tetrakis[N-tetrafluorophthaloyl-(R)-tert-leucinato]dirhodium Bis(ethyl Acetate) Adduct		50mg
T2661	Tetrakis[N-tetrafluorophthaloyl-(S)-tert-leucinato]dirhodium Bis(ethyl Acetate) Adduct		100mg
T1544	Tetrakis(triphenylacetato)dirhodium(II) Dichloromethane Adduct		100mg
T0931	Tris(triphenylphosphine)rhodium(I) Chloride	1g	5g

Iridium		C2252	C3040	C2985
C1807	C2662	C2824	I0616	T2557
			$\text{IrCl}_3 \cdot x\text{H}_2\text{O}$	

Product No.	Product Name	Unit Size	
C2252	Carbonylchlorobis(triphenylphosphine)iridium(I)	200mg	1g
C3040	Carbonylhydridotris(triphenylphosphine)iridium(I)	200mg	1g
C2985	Chlorobis(cyclooctene)iridium(I) Dimer	200mg	
C1807	Chloro(1,5-cyclooctadiene)iridium(I) Dimer	250mg	1g
C2662	(1,5-Cyclooctadiene)(methoxy)iridium(I) Dimer	200mg	1g
C2824	(1,5-Cyclooctadiene)(pyridine)(tricyclohexylphosphine)iridium(I) Hexafluorophosphate	100mg	
I0616	Iridium(III) Chloride Hydrate	1g	5g
T2557	Tris(2,4-pentanedionato)iridium(III)	1g	

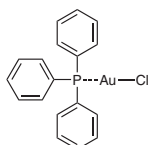
Nickel		B2225	B2226	B1313
N0096	B3534	B1571	B0034	N0850
				NiCl_2
T0276	N0861			

Product No.	Product Name	Unit Size	
B2225	[1,2-Bis(diphenylphosphino)ethane]nickel(II) Dichloride	1g	25g
B2226	[1,1'-Bis(diphenylphosphino)ferrocene]nickel(II) Dichloride	1g	5g
B1313	[1,3-Bis(diphenylphosphino)propane]nickel(II) Dichloride	5g	25g
N0096	Bis(2,4-pentanedionato)nickel(II) Hydrate	25g	500g
B3534	Bis(tricyclohexylphosphine)nickel(II) Dichloride	1g	5g
B1571	Bis(triphenylphosphine)nickel(II) Dichloride	10g	100g

Product No.	Product Name	Unit Size
B0034	Nickel(II) Benzenesulfonate Hexahydrate	25g
N0850	Nickel(II) Chloride Anhydrous	25g 500g
T0276	Nickel(II) <i>p</i> -Toluenesulfonate Hexahydrate	25g
N0861	Nickel(II) Trifluoromethanesulfonate	1g 5g

Gold

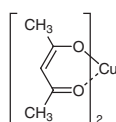
T2994



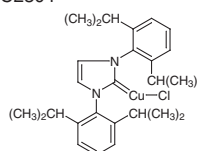
Product No.	Product Name	Unit Size
T2994	(Triphenylphosphine)gold(I) Chloride	200mg 1g

Copper

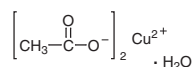
C0384



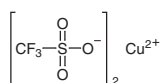
C2304



C2346



T1292



Product No.	Product Name	Unit Size
C0384	Bis(2,4-pentanedionato)copper(II)	25g 250g
C2304	Chloro[1,3-bis(2,6-diisopropylphenyl)imidazol-2-ylidene]copper(I)	200mg 1g
C2346	Copper(II) Acetate Monohydrate	25g 500g
T1292	Copper(II) Trifluoromethanesulfonate	5g 25g

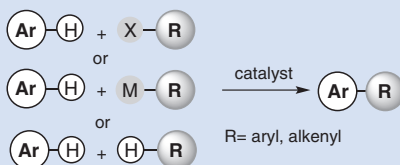
Typical Reaction Modes by C-H Bond Cleavage

Arylations and alkenylations

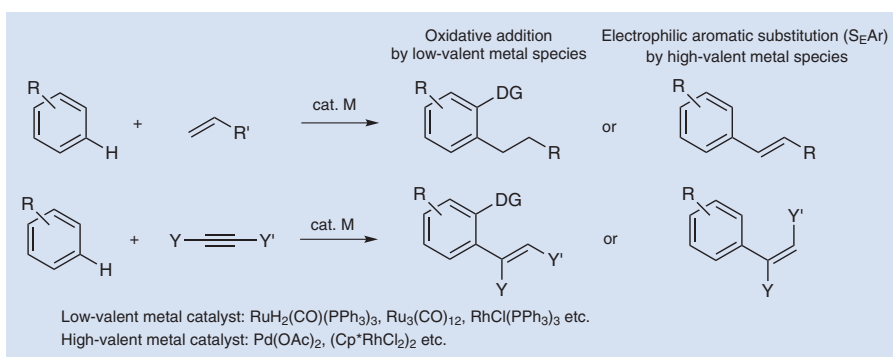
I. Ar-H/Ar-X Coupling (Pd, Ni, Cu, Fe etc.)
(X= I, Br etc.)

II. Ar-H/Ar-M Coupling (Ru, Rh, Pd, Ni etc.)
(M= B etc.)

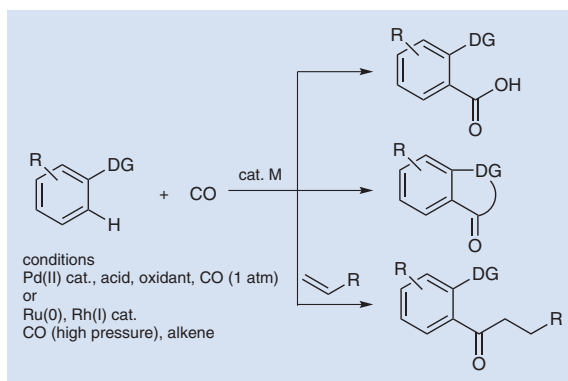
III. Ar-H/Ar-H Coupling (Pd(II), Rh(III) etc.)
cross-dehydrogenative coupling (CDC)



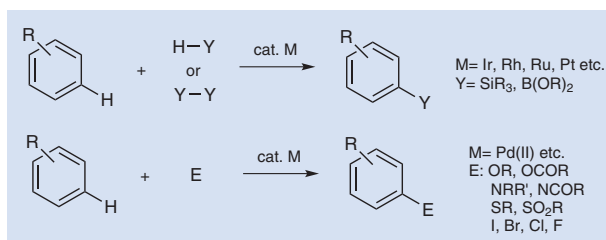
Addition of alkenes and alkynes



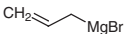
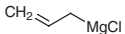
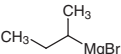
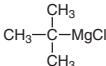
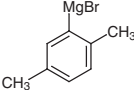
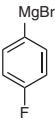
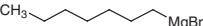
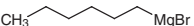
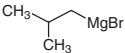
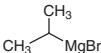
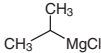
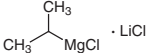
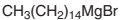
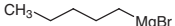
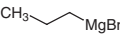
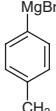
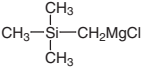
Carbonylations *via* CO insertion



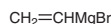
Heteroatom functionalizations



Metal Reagents for Organic Synthesis

Grignard Reagents		A0963 	A1554 	B1883 B3976 
B1933 	B1884 	B1148 B1147 	B0726 	C1504 
C1505 	C2039 	D3551 	E0497 E0134 	E0778 E0135 
F0673 	H0822 	H0821 	I0517 	I0518 
I0543 I0542 	I0654 	M0362 M0785 	M0364 	O0240 
P1251 	P1177 	P2025 	P1381 	P0191 
P0880 	T1698 	T1699 	T1700 	T1451 T2609 

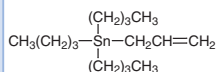
V0053



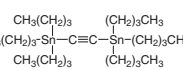
Product No.	Product Name	Unit Size
A0963	Allylmagnesium Bromide (ca. 13% in Ethyl Ether, ca. 0.7mol/L)	100mL
A1554	Allylmagnesium Chloride (ca. 11% in Tetrahydrofuran, ca. 1.0mol/L)	100g
B1883	Benzylmagnesium Bromide (ca. 12% in Tetrahydrofuran, ca. 0.6mol/L)	Price on request
B3976	Benzylmagnesium Bromide (ca. 18% in Tetrahydrofuran, ca. 0.9mol/L)	100g
B1933	Benzylmagnesium Chloride (ca. 16% in Tetrahydrofuran, ca. 1mol/L)	250g
B1884	sec-Butylmagnesium Bromide (ca. 16% in Tetrahydrofuran, ca. 1mol/L)	100g
B1148	tert-Butylmagnesium Chloride (23% in Tetrahydrofuran, ca. 2mol/L)	250g
B1147	tert-Butylmagnesium Chloride (26% in Ethyl Ether, ca. 2mol/L)	250g
B0726	Butylmagnesium Chloride (23% in Tetrahydrofuran, ca. 2mol/L)	250g
C1504	Cyclohexylmagnesium Bromide (ca. 18% in Tetrahydrofuran, ca. 1mol/L)	100g
C1505	Cyclopentylmagnesium Bromide (ca. 18% in Tetrahydrofuran, ca. 1mol/L)	100g
C2039	Cyclopropylmagnesium Bromide (ca. 10% in Tetrahydrofuran, ca. 0.7mol/L)	100g
D3551	(2,5-Dimethylphenyl)magnesium Bromide (20% in Tetrahydrofuran, ca. 1mol/L)	100g
E0497	Ethylmagnesium Bromide (13% in Tetrahydrofuran, ca. 1mol/L)	250g
E0134	Ethylmagnesium Bromide (39% in Ethyl Ether, ca. 3mol/L)	250g
E0778	Ethylmagnesium Chloride (ca. 1.0mol/L in Tetrahydrofuran) activated with Zinc Chloride (ca. 10mol%)	250g
E0135	Ethylmagnesium Chloride (ca. 18% in Tetrahydrofuran, ca. 2mol/L)	250g
F0673	4-Fluorophenylmagnesium Bromide (ca. 19% in Tetrahydrofuran, ca. 1.0mol/L)	250g
H0822	Heptylmagnesium Bromide (21% in Tetrahydrofuran, ca. 1mol/L)	250g
H0821	Hexylmagnesium Bromide (20% in Tetrahydrofuran, ca. 1mol/L)	250g
I0517	Isobutylmagnesium Bromide (17% in Tetrahydrofuran, ca. 1mol/L)	250g
I0518	Isopropylmagnesium Bromide (15% in Tetrahydrofuran, ca. 1mol/L)	250g
I0543	Isopropylmagnesium Chloride (ca. 11% in Tetrahydrofuran, ca. 1mol/L)	250g
I0542	Isopropylmagnesium Chloride (ca. 13% in Ethyl Ether, ca. 1mol/L)	250g
I0654	Isopropylmagnesium Chloride - Lithium Chloride (15% in Tetrahydrofuran, ca. 1mol/L)	100mL
M0362	Methylmagnesium Bromide (12% in Tetrahydrofuran, ca. 1mol/L)	250g
M0785	Methylmagnesium Bromide (35% in Ethyl Ether, ca. 3mol/L)	250g
M0364	Methylmagnesium Iodide (33% in Ethyl Ether, ca. 2mol/L)	100g
O0240	n-Octylmagnesium Bromide (ca. 22% in Tetrahydrofuran, ca. 1mol/L)	250g
P1251	Pentadecylmagnesium Bromide (ca. 15% in Tetrahydrofuran, ca. 0.4mol/L)	250g
P1177	Pentylmagnesium Bromide (18% in Tetrahydrofuran, ca. 1mol/L)	250g
P2025	Phenylmagnesium Bromide (16% in Tetrahydrofuran, ca. 1mol/L)	250g
P1381	Phenylmagnesium Chloride (27% in Tetrahydrofuran, ca. 2mol/L)	250g
P0191	Phenylmagnesium Iodide (ca. 42% in Ethyl Ether, ca. 2mol/L)	250g
P0880	Propylmagnesium Bromide (ca. 27% in Tetrahydrofuran, ca. 2mol/L)	250g
T1698	o-Tolylmagnesium Bromide (ca. 17% in Tetrahydrofuran, ca. 0.9mol/L)	100g
T1699	m-Tolylmagnesium Bromide (19% in Tetrahydrofuran, ca. 1mol/L)	100g
T1700	p-Tolylmagnesium Bromide (19% in Tetrahydrofuran, ca. 1mol/L)	100g
T1451	Trimethylsilylmethylmagnesium Chloride (20% in Ethyl Ether, ca. 1mol/L)	100mL
T2609	Trimethylsilylmethylmagnesium Chloride (ca. 18% in Tetrahydrofuran, ca. 1mol/L)	100mL
V0053	Vinylmagnesium Bromide (14% in Tetrahydrofuran, ca. 1mol/L)	100g

Alkyl Metal Reagents

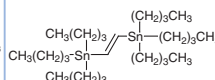
A1222



B1974



B1975



B1832	B4209	B0396	D0223	D0305
D1340	D3902 D3214	D1338	D1373	E0648
H0842	M1655	M0589	M0258	M0744
P1429	C1411	T2009	T0058	T0919
T1750	T0363	T0678	T1473	T1865
T1866	T1794	T0783 T0925	T0784	T0782 T1575
T0958				

Product No.	Product Name	Unit Size	
A1222	Allyltributyltin	5g	25g
B1974	Bis(tributylstannyl)acetylene	1g	5g
B1975	<i>trans</i> -1,2-Bis(tributylstannyl)ethylene	1g	5g
B1832	Bis(tributyltin)	5g	25g
B4209	<i>tert</i> -Butyllithium (ca. 18% in Pentane, ca. 1.9mol/L)		100mL
B0396	Butyllithium (ca. 15% in Hexane, ca. 1.6mol/L)	100mL	500mL

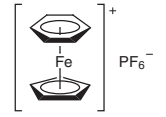
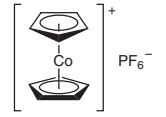
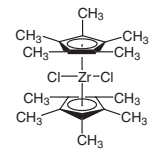
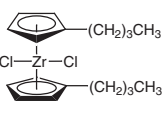
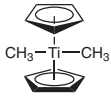
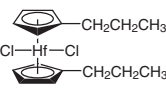
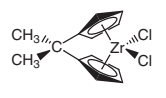
Product No.	Product Name	Unit Size	
D0223	Dibutyltin Dichloride	25g	500g
D0305	Dibutyltin Oxide	25g	100g 500g
D1340	Diethylaluminum Chloride (ca. 15% in Hexane, ca. 0.87mol/L)		100mL
D3902	Diethylzinc (ca. 15% in Toluene, ca. 1mol/L)		100mL
D3214	Diethylzinc (ca. 17% in Hexane, ca. 1mol/L)		100mL 500mL
D1338	Dimethyltin Dichloride	25g	100g 500g
D1373	Di- <i>n</i> -octyltin Oxide	25g	500g
E0648	Ethylaluminum Dichloride (17% in Hexane, ca. 1mol/L)		100mL
H0842	Hexyllithium (30% in Hexane, ca. 2.3mol/L)		100mL
M1655	Methylolithium (ca. 3-5% in Ethyl Ether, ca. 1-2mol/L)		100mL
M0589	Methylmercuric Chloride		5g
M0258	Methylmercuric Iodide		25g
M0744	Monobutyltin Oxide	25g	500g
P1429	Phenyllithium (ca. 16% in Butyl Ether, ca. 1.6mol/L)		100mL
C1411	Tebbe Reagent (ca. 0.5mol/L in Toluene)		25mL
T2009	Tetraallyltin	1g	5g
T0058	Tetrabutyltin	25g	500g
T0919	Tetramethyltin	5g	25g
T1750	Tributylethynyltin		1g 5g
T0363	Tributyltin Chloride	25g	100g 500g
T0678	Tributyltin Fluoride		25g
T1473	Tributyltin Hydride (stabilized with BHT) [Reducing Reagent]	25g	250g
T1865	Tributyl(trimethylsilylethynyl)tin	5g	25g
T1866	Tributyl(trimethylsilylmethyl)tin		5g
T1794	Tributylvinyltin	1g	5g 25g
T0783	Triethylaluminum (15% in Hexane, ca. 1.0mol/L)		100mL
T0925	Triethylaluminum (15% in Toluene, ca. 1.1mol/L)		100mL
T0784	Triisobutylaluminum (15% in Hexane, ca. 0.50mol/L)		100mL
T0782	Trimethylaluminum (15% in Hexane, ca. 1.4mol/L)		100mL
T1575	Trimethylaluminum (15% in Toluene, ca. 1.8mol/L)		100mL
T0958	Trimethyltin Chloride	5g	25g

Metallocenes		Ferrocenes		
			A0775	A1601
B0886	B2711	B4272	B2710	B3196
B2027	B3374	B2226	B2064	B3197
B3501	B3476	B2227	B2063	B0885

F0312 	F0313 	B0913 	B0915 	D2829
D1272 	D2951 	D1271 	D2537 	D2538
D2535 	D2536 	D1273 	D2528 	D2529
D3822 	E0394 	D0444 	F0406 	F0280
F0165 	F0664 	B0914 	F0320 	F0286
F0166 	F0167 	H0941 	H0463 	H0464
I0749 	S0820 	T2545 	T2546 	V0064

Product No.	Product Name	Unit Size	
A0775	Acetylferrocene	10g	25g
A1601	Aminoferrocene	100mg	1g
B0886	Benzoylferrocene	5g	25g
B2711	1,1'-Bis(di- <i>tert</i> -butylphosphino)ferrocene	100mg	1g
B4272	1,1'-Bis(dichlorophosphino)ferrocene	200mg	1g
B2710	1,1'-Bis(diisopropylphosphino)ferrocene	100mg	1g

Product No.	Product Name	Unit Size	
B3196	(<i>R,R'</i>)-2,2'-Bis(diphenylphosphino)-1,1'-biferrocene	100mg	500mg
B2027	1,1'-Bis(diphenylphosphino)ferrocene	1g	5g 25g
B3374	[1,1'-Bis(diphenylphosphino)ferrocene]cobalt(II) Dichloride		1g 5g
B2226	[1,1'-Bis(diphenylphosphino)ferrocene]nickel(II) Dichloride		1g 5g
B2064	[1,1'-Bis(diphenylphosphino)ferrocene]palladium(II) Dichloride Dichloromethane Adduct	1g	5g 25g
B3197	(<i>S,S'</i>)-2,2'-Bis[(<i>S</i>)-4-isopropylloxazolin-2-yl]-1,1'-biferrocene	100mg	500mg
B3501	1,1'-Bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)ferrocene	1g	5g
B3476	Bromoferrocene	1g	5g
B2227	<i>N</i> -(<i>tert</i> -Butoxycarbonyl)aminoferrocene		1g
B2063	<i>tert</i> -Butylferrocene	1g	5g
B0885	Butylferrocene	10g	25g
F0312	Cyclohexenylferrocene		25g
F0313	Cyclopentenylferrocene		25g
B0913	1,1'-Diacetylferrocene		5g
B0915	1,1'-Dibenzoylferrocene	5g	25g
D2829	1,1'-Dibromoferrocene	1g	5g
D1272	1,1'-Dibutylferrocene	1g	5g
D2951	1,1'-Dibutylferrocene	5g	25g
D1271	<i>N,N</i> -Dimethylaminomethylferrocene	5g	25g
D2537	(<i>R</i>)- <i>N,N</i> -Dimethyl-1-[(<i>S</i>)-1',2-bis(diphenylphosphino)ferrocenyl]ethylamine		100mg
D2538	(<i>S</i>)- <i>N,N</i> -Dimethyl-1-[(<i>R</i>)-1',2-bis(diphenylphosphino)ferrocenyl]ethylamine		100mg
D2535	(<i>R</i>)- <i>N,N</i> -Dimethyl-1-[(<i>S</i>)-2-(diphenylphosphino)ferrocenyl]ethylamine		100mg
D2536	(<i>S</i>)- <i>N,N</i> -Dimethyl-1-[(<i>R</i>)-2-(diphenylphosphino)ferrocenyl]ethylamine		100mg
D1273	1,1'-Dimethylferrocene	5g	25g
D2528	(<i>R</i>)-(+)- <i>N,N</i> -Dimethyl-1-ferrocenylethylamine	200mg	1g
D2529	(<i>S</i>)-(-)- <i>N,N</i> -Dimethyl-1-ferrocenylethylamine	200mg	1g
D3822	(<i>S</i>)-1-(Diphenylphosphino)-2-[(<i>S</i>)-4-isopropylloxazolin-2-yl]ferrocene	200mg	1g
E0394	Ethylferrocene		5g
D0444	Ferrocene	25g	100g 500g
F0406	Ferroceneacetic Acid		1g 5g
F0280	Ferroceneboronic Acid (contains varying amounts of Anhydride) [Cyclic boronating reagent for GC/MS]	100mg	1g
F0165	Ferrocenecarboxylic Acid	1g	5g 25g
F0664	1,1'-Ferrocenediboronic Acid (contains varying amounts of Anhydride)		1g
B0914	1,1'-Ferrocenedicarboxylic Acid	1g	5g
F0320	3-Ferrocenoylpropionic Acid		25g
F0286	(Ferrocenylmethyl)dodecyldimethylammonium Bromide		5g
F0166	(Ferrocenylmethyl)trimethylammonium Bromide	1g	5g
F0167	(Ferrocenylmethyl)trimethylammonium Iodide		5g
H0941	(Hydrazinocarbonyl)ferrocene [for HPLC Labeling]		1g
H0463	1-Hydroxyethylferrocene	1g	5g
H0464	Hydroxymethylferrocene	1g	5g
I0749	(<i>S</i>)-(4-Isopropylloxazolin-2-yl)ferrocene		1g
S0820	<i>N</i> -Succinimidyl Ferrocenecarboxylate	200mg	1g
T2545	(<i>R</i>)-(<i>p</i> -Toluenesulfinyl)ferrocene	1g	5g
T2546	(<i>S</i>)-(<i>p</i> -Toluenesulfinyl)ferrocene		1g
V0064	Vinylferrocene		1g

Others	B1951 	C1589 	D3307 	D3321 
	D4100 	D3286 	H0914 	I0645 
	D1574 			

R0078 	C1411 	T1658 	T0616 	V0090
Z0009 	Z0010 	Z0007 		

Product No.	Product Name	Unit Size	
B1951	η -Benzene(η -cyclopentadienyl)iron(II) Hexafluorophosphate	1g	5g
C1589	Bis(cyclopentadienyl)cobalt(III) Hexafluorophosphate	1g	
D3307	Decamethylzirconocene Dichloride	1g	
D3321	1,1'-Dibutylzirconocene Dichloride	1g	5g
D4100	Dimethyltitanocene (5% in Tetrahydrofuran/Toluene)	100g	
D3286	1,1'-Dipropylhafnocene Dichloride	1g	
H0914	Hafnocene Dichloride	1g	5g
I0645	1,1'-Isopropylidenezirconocene Dichloride	100mg	
D1574	Nickelocene	1g	5g
R0078	Ruthenocene	1g	
C1411	Tebbe Reagent (ca. 0.5mol/L in Toluene)	25mL	
T1658	Titanocene Bis(trifluoromethanesulfonate)	100mg	1g
T0616	Titanocene Dichloride	5g	25g
V0090	Vanadinocene Dichloride	1g	
Z0009	Zirconocene Bis(trifluoromethanesulfonate) Tetrahydrofuran Adduct	1g	5g
Z0010	Zirconocene Chloride Hydride	1g	5g
Z0007	Zirconocene Dichloride	5g	25g

Half Metallocenes	C2201 	C1994 	C1995 	I0646
P1651 				

Product No.	Product Name	Unit Size	
C2201	Cyclopentadienylbis(triphenylphosphine)ruthenium(II) Chloride	1g	5g
C1994	Cyclopentadienyltitanium(IV) Trichloride	1g	5g
C1995	Cyclopentadienylzirconium(IV) Trichloride	1g	5g
I0646	(Indenyl)titanium(IV) Trichloride	1g	
P1651	(Pentamethylcyclopentadienyl)titanium(IV) Trichloride	1g	

Typical Metal Reagents

Li (Lithium)

Product No.	Product Name	Unit Size	
B4209	<i>tert</i> -Butyllithium (ca. 18% in Pentane, ca. 1.9mol/L)	100mL	
B0396	Butyllithium (ca. 15% in Hexane, ca. 1.6mol/L)	100mL	500mL
B4697	Butyllithium (ca. 20% in Cyclohexane, ca. 2.3mol/L)	100mL	500mL
P1049	Dilithium Phthalocyanine		1g
D4395	Dilithium Tetrachlorocopper(II) (ca. 2.5% in Tetrahydrofuran, ca. 0.1mol/L)	100mL	500mL
H0842	Hexyllithium (30% in Hexane, ca. 2.3mol/L)		100mL
L0060	Lithioncarmine (powder)		1g
L0191	Lithium Acetate	25g	500g
A1478	Lithium Acetoacetate	1g	5g
L0203	Lithium Aluminum Hydride (Powder)	25g	100g
L0170	Lithium Aluminum Hydride (10% in Tetrahydrofuran, ca. 2.5mol/L)		100mL
L0267	Lithium Bis(pentafluoroethanesulfonyl)imide		1g
B2542	Lithium Bis(trifluoromethanesulfonyl)imide	25g	250g
H0915	Lithium Bis(trimethylsilyl)amide (ca. 26% in Tetrahydrofuran, ca. 1.3mol/L)	100mL	500mL
L0186	Lithium Borohydride (ca. 3mol/L in Tetrahydrofuran)		100mL
L0210	Lithium Bromide	25g	100g 500g
L0253	Lithium <i>tert</i> -Butoxide (ca. 10% in Tetrahydrofuran, ca. 1mol/L)		100mL
L0224	Lithium Carbonate	25g	500g
L0204	Lithium Chloride Anhydrous	25g	300g
L0222	Lithium Chloride (2.3% in Tetrahydrofuran, ca. 0.5mol/L)		100mL
L0171	Lithium Diisopropylamide (ca. 20% in Tetrahydrofuran/Ethylbenzene/Heptane, ca. 1.5mol/L)	100mL	500mL
F0171	Lithium Formate Monohydrate	25g	500g
L0146	Lithium Hexafluorophosphate	25g	100g
H1057	Lithium 1,1,2,2,3,3-Hexafluoropropane-1,3-disulfonimide	1g	5g
L0225	Lithium Hydroxide Anhydrous	25g	100g 500g
H0580	Lithium DL-2-Hydroxybutyrate	5g	25g
L0144	Lithium L-Lactate		25g
P0659	Lithium Pyruvate Monohydrate [Guaranteed for Standard to GOT, GPT]		25g
S0237	Lithium Stearate	25g	500g
L0133	Lithium Tetrafluoroborate		25g
L0158	Lithium Tetrakis(pentafluorophenyl)borate - Ethyl Ether Complex	1g	5g
L0159	Lithium Tri- <i>tert</i> -butoxyaluminum Hydride (ca. 30% in Tetrahydrofuran, ca. 1.0mol/L)		100mL
L0164	Lithium Tri- <i>sec</i> -butylborohydride (ca. 21% in Tetrahydrofuran, ca. 1.0mol/L)		100mL
L0190	Lithium Triethylborohydride (ca. 12% in Tetrahydrofuran, ca. 1.0mol/L)	100mL	500mL
T1548	Lithium Trifluoromethanesulfonate		25g
L0240	Lithium Trifluoro(trifluoromethyl)borate - Dimethyl Carbonate Complex	1g	5g
M1655	Methylolithium (ca. 3-5% in Ethyl Ether, ca. 1-2mol/L)		100mL
L0080	(2,4-Pentanedionato)lithium	25g	500g
P1429	Phenyllithium (ca. 16% in Butyl Ether, ca. 1.6mol/L)		100mL

Na (Sodium)(excluding simple sodium salts)

Product No.	Product Name	Unit Size	
C0075	Chloramine B Hydrate	25g	500g
C0076	Chloramine T Trihydrate	25g	500g
C1374	<i>o</i> -Chloramine T		25g
D1331	5,5-Diphenylhydantoin Sodium Salt	25g	500g
D0923	Dipicrylamine Sodium Salt (contains 10% Water)		1g
D1930	Disodium Dimercaptomaleonitrile	1g	5g
P0973	Disodium Phthalocyanine	1g	5g
M0632	2-Mercaptopyridine <i>N</i> -Oxide Sodium Salt (40% in Water, ca. 3.3mol/L)	25g	500g
M0096	Methyl Mercaptan Sodium Salt (ca. 15% in Water)	25g	500g
S0489	Sodium Azide		100g
H0894	Sodium Bis(trimethylsilyl)amide (contains 2-Methyl-2-butene) (38% in Tetrahydrofuran, ca. 1.9mol/L)	100mL	500mL
S0480	Sodium Borohydride	25g	100g 500g
S0396	Sodium Cyanoborohydride [Reducing Agent]	5g	25g 250g
D1003	Sodium Dichloroisocyanurate	25g	500g
D2479	Sodium Diformylamide		25g
D0716	Sodium Dimethyldithiocarbamate Dihydrate	25g	500g
S0548	Sodium Ethoxide (ca. 20% in Ethanol)		500mL
S0547	Sodium Ethoxide		100g
E0195	Sodium Ethylxanthate	25g	500g
S0392	Sodium Hexafluorophosphate		25g
S0481	Sodium Hydride (60%, dispersion in Paraffin Liquid)	100g	500g
M0057	Sodium 2-Mercaptobenzothiazole	25g	500g

Product No.	Product Name	Unit Size	
S0486	Sodium Methoxide (ca. 5mol/L in Methanol)	100mL	500mL
S0485	Sodium Methoxide	100g	500g
S0540	Sodium Tetrachloropalladate(II)		1g
A5131	Sodium Tetrakis(4-fluorophenyl)borate Hydrate [Precipitation reagent for Cs and titrimetric reagent for nonionic surfactants]	1g	5g
A5130	Sodium Tetraphenylborate [Precipitation reagent for K]	1g	10g
T0193	Sodium 2-Thiobarbiturate	25g	500g
S0394	Sodium Triacetoxymethylborohydride	25g	100g
B0131	<i>o</i> -Sulfobenzimide Sodium Salt Dihydrate	25g	500g

K (Potassium)(excluding simple potassium salts)

Product No.	Product Name	Unit Size	
A1490	Acesulfame K	25g	100g 500g
B1124	Bismuthiol II Hydrate		5g 25g
B4377	Bismuth Tripotassium Dicitrate		1g 5g
C0714	Carbazole Potassium Salt		25g
I0223	Indigodisulfonic Acid Dipotassium Salt		1g
I0019	Indigotetrasulfonic Acid Tetrapotassium Salt Hydrate		1g
I0220	Indigotrisulfonic Acid Potassium Salt	1g	5g
N0428	4-Nitrocatechol Sulfate Dipotassium Salt Hydrate [Substrate for Sulfatase]		1g
P0097	Phenolphthalein Disulfate Potassium Salt Hydrate	1g	5g
P0179	<i>N</i> -Phenylglycine Potassium Salt	25g	500g
P0403	Phthalimide Potassium Salt	25g	500g
P1480	Potassium Allyltrifluoroborate	1g	5g
H0893	Potassium Bis(trimethylsilyl)amide (11% in Toluene, ca. 0.5mol/L)	100mL	500mL
P1681	Potassium Borohydride	25g	100g
P1807	Potassium (Bromomethyl)trifluoroborate	1g	5g
P1008	Potassium <i>tert</i> -Butoxide	25g	100g 500g
P2155	Potassium [[[<i>tert</i> -Butoxycarbonyl]amino]methyl]trifluoroborate	1g	5g
B0747	Potassium Butylxanthate		25g
P1613	Potassium Cyanide		25g
E0194	Potassium Ethylxanthate	25g	100g 500g
G0160	Potassium Guaiacolsulfonate Hemihydrate		25g
H0817	Potassium Hexafluoroarsenate		10g
H1058	Potassium 1,1,2,2,3,3-Hexafluoropropane-1,3-disulfonimide	1g	5g
H0652	Potassium Hyaluronate from Cockscornb		1g
P0309	Potassium Hydrogen Phthalate	25g	500g
I0023	Potassium 3-Indoleacetate	1g	25g
P1808	Potassium (Iodomethyl)trifluoroborate	1g	5g
I0177	Potassium Isopropylxanthate		25g
P2153	Potassium (Methoxymethyl)trifluoroborate		1g
T1083	Potassium Monomethyl Terephthalate	25g	500g
N0006	Potassium 1-Naphthaleneacetate		25g
O0056	Potassium Oleate	25g	500g
O0164	Potassium Oxonate	5g	25g
P0534	Potassium Propylxanthate		25g
R0058	Potassium Rhodizonate		1g
S0057	Potassium Sorbate	25g	500g
S0164	Potassium Sulfamate		100g
P2168	Potassium Tetracyanoborate		200mg
A5132	Potassium Tetrakis(4-chlorophenyl)borate [Anion for the neutral carrier type ion electrode]	1g	5g
P1380	Potassium Tri- <i>sec</i> -butylborohydride (ca. 1.0mol/L in Tetrahydrofuran)	Price on request	
P2114	Potassium Trifluoroacetate		25g
P1692	Potassium Trifluoro(trifluoromethyl)borate	1g	5g 25g
P0475	Potassium Trihydrogen Dioxalate Dihydrate [for Determination of pH]	25g	500g
P1479	Potassium Vinyltrifluoroborate	1g	5g
P0988	Pyridoxylidene-L-glutamic Acid Dipotassium Salt		1g
P0989	Pyridoxylidene-L-isoleucine Potassium Salt		1g
S0156	Sinigrin Hydrate		100mg
S0903	Sinigrin		100mg
A5107	TBPE (=Tetrabromophenolphthalein Ethyl Ester Potassium Salt) [Sensitive spectrophotometric reagent for amines, quaternary ammonium salts and other cations]		1g
T0036	Tetrabromofluorescein Potassium Salt		25g
F0027	Uranine K		25g

Rb (Rubidium)

Product No.	Product Name	Unit Size
F0172	Formic Acid Rubidium Salt	5g

Cs (Cesium)

Product No.	Product Name	Unit Size
C2430	Cesium Acetate	25g 100g
C2202	Cesium Bromide	25g
C2160	Cesium Carbonate	25g 100g
C2203	Cesium Chloride	25g 100g
C2204	Cesium Fluoride	25g 100g
C2205	Cesium Iodide	25g

Be (Beryllium)

Product No.	Product Name	Unit Size
B0454	Bis(2,4-pentanedionato)beryllium(II)	5g
B4720	Bis[2-(2-pyridinyl)phenolato]beryllium(II)	200mg

Mg (Magnesium)

Product No.	Product Name	Unit Size
A0963	Allylmagnesium Bromide (ca. 13% in Ethyl Ether, ca. 0.7mol/L)	100mL
A1554	Allylmagnesium Chloride (ca. 11% in Tetrahydrofuran, ca. 1.0mol/L)	100g
A0484	8-Anilino-1-naphthalenesulfonic Acid Magnesium(II) Salt Hydrate	25g
A5353	ANS-Mg (=Magnesium 8-Anilino-1-naphthalenesulfonate) [Hydrophobic fluorescent probe]	1g
B1883	Benzylmagnesium Bromide (ca. 12% in Tetrahydrofuran, ca. 0.6mol/L)	Price on request
B3976	Benzylmagnesium Bromide (ca. 18% in Tetrahydrofuran, ca. 0.9mol/L)	100g
B1933	Benzylmagnesium Chloride (ca. 16% in Tetrahydrofuran, ca. 1mol/L)	250g
H0556	Bis(hexafluoroacetylacetonato)magnesium(II) Hydrate	1g
M0001	Bis(2,4-pentanedionato)magnesium(II)	25g
T0749	Bis(trifluoro-2,4-pentanedionato)magnesium(II) Hydrate	5g
B1884	sec-Butylmagnesium Bromide (ca. 16% in Tetrahydrofuran, ca. 1mol/L)	100g
B1148	tert-Butylmagnesium Chloride (23% in Tetrahydrofuran, ca. 2mol/L)	250g
B1147	tert-Butylmagnesium Chloride (26% in Ethyl Ether, ca. 2mol/L)	250g
B0726	Butylmagnesium Chloride (23% in Tetrahydrofuran, ca. 2mol/L)	250g
B4643	sec-Butylmagnesium Chloride - Lithium Chloride (15% in Tetrahydrofuran, ca. 1.2mol/L)	100mL
C0780	Chlorophyll (Total Chlorophyll: ca. 6.0%)	25g
C1504	Cyclohexylmagnesium Bromide (ca. 18% in Tetrahydrofuran, ca. 1mol/L)	100g
C1505	Cyclopentylmagnesium Bromide (ca. 18% in Tetrahydrofuran, ca. 1mol/L)	100g
D4683	Di-sec-butylmagnesium - Lithium Chloride (13% in Tetrahydrofuran, ca. 0.8mol/L)	100mL
D3551	(2,5-Dimethylphenyl)magnesium Bromide (20% in Tetrahydrofuran, ca. 1mol/L)	100g
E0094	Ethylenediaminetetraacetic Acid Magnesium Disodium Salt Hydrate	25g
E0497	Ethylmagnesium Bromide (13% in Tetrahydrofuran, ca. 1mol/L)	250g
E0134	Ethylmagnesium Bromide (39% in Ethyl Ether, ca. 3mol/L)	250g
E0778	Ethylmagnesium Chloride (ca. 1.0mol/L in Tetrahydrofuran) activated with Zinc Chloride (ca. 10mol%)	250g
E0135	Ethylmagnesium Chloride (ca. 18% in Tetrahydrofuran, ca. 2mol/L)	250g
F0673	4-Fluorophenylmagnesium Bromide (ca. 19% in Tetrahydrofuran, ca. 1.0mol/L)	250g
H0822	Heptylmagnesium Bromide (21% in Tetrahydrofuran, ca. 1mol/L)	250g
H0821	Hexylmagnesium Bromide (20% in Tetrahydrofuran, ca. 1mol/L)	250g
I0517	Isobutylmagnesium Bromide (17% in Tetrahydrofuran, ca. 1mol/L)	250g
I0518	Isopropylmagnesium Bromide (15% in Tetrahydrofuran, ca. 1mol/L)	250g
I0543	Isopropylmagnesium Chloride (ca. 11% in Tetrahydrofuran, ca. 1mol/L)	250g
I0542	Isopropylmagnesium Chloride (ca. 13% in Ethyl Ether, ca. 1mol/L)	250g
I0654	Isopropylmagnesium Chloride - Lithium Chloride (15% in Tetrahydrofuran, ca. 1mol/L)	100mL
E0396	Magnesium(II) 2-Ethylbutyrate	25g
G0276	Magnesium(II) Gluconate Hydrate	25g 500g
M0938	Magnesium 4-Nitrobenzyl Malonate Hydrate	25g
P0108	Magnesium Phenoxycetate Dihydrate	25g
P1018	Magnesium(II) Phthalocyanine	1g
M2209	Magnesium Porphyrin	100mg
S0238	Magnesium(II) Stearate	25g 250g
T1304	Magnesium Trifluoromethanesulfonate	5g 25g
M0362	Methylmagnesium Bromide (12% in Tetrahydrofuran, ca. 1mol/L)	250g
M0785	Methylmagnesium Bromide (35% in Ethyl Ether, ca. 3mol/L)	250g
M0364	Methylmagnesium Iodide (33% in Ethyl Ether, ca. 2mol/L)	100g
M0927	Monoperoxyphthalic Acid Magnesium Salt Hexahydrate	25g 500g
O0240	n-Octylmagnesium Bromide (ca. 22% in Tetrahydrofuran, ca. 1mol/L)	250g

Product No.	Product Name	Unit Size	
P1251	Pentadecylmagnesium Bromide (ca. 15% in Tetrahydrofuran, ca. 0.4mol/L)	250g	
P1177	Pentylmagnesium Bromide (18% in Tetrahydrofuran, ca. 1mol/L)	250g	
P2025	Phenylmagnesium Bromide (16% in Tetrahydrofuran, ca. 1mol/L)	250g	
P1381	Phenylmagnesium Chloride (27% in Tetrahydrofuran, ca. 2mol/L)	250g	
P0191	Phenylmagnesium Iodide (ca. 42% in Ethyl Ether, ca. 2mol/L)	250g	
P0880	Propylmagnesium Bromide (ca. 27% in Tetrahydrofuran, ca. 2mol/L)	250g	
T1698	<i>o</i> -Tolylmagnesium Bromide (ca. 17% in Tetrahydrofuran, ca. 0.9mol/L)	100g	
T1699	<i>m</i> -Tolylmagnesium Bromide (19% in Tetrahydrofuran, ca. 1mol/L)	100g	
T1700	<i>p</i> -Tolylmagnesium Bromide (19% in Tetrahydrofuran, ca. 1mol/L)	100g	
T2966	Trimagnesium Dicitrate Nonahydrate	25g	500g
T1451	Trimethylsilylmethylmagnesium Chloride (20% in Ethyl Ether, ca. 1mol/L)	100mL	
T2609	Trimethylsilylmethylmagnesium Chloride (ca. 18% in Tetrahydrofuran, ca. 1mol/L)	100mL	
V0053	Vinylmagnesium Bromide (14% in Tetrahydrofuran, ca. 1mol/L)	100g	

Ca (Calcium)

Product No.	Product Name	Unit Size	
A0422	4-Aminosalicylic Acid Calcium Salt Heptahydrate	25g	500g
A2476	Atorvastatin Calcium Salt Trihydrate	1g	5g
C0930	Bis(2,4-pentanedionato)calcium(II)		25g
A0738	Calcium Alginate	25g	500g
C2789	Calcium Dobesilate Hydrate		1g
G0037	Calcium Gluconate Monohydrate	25g	500g
G0232	Calcium DL-Glycerate Hydrate		10g
G0095	Calcium Glycerophosphate Hydrate	25g	500g
G0200	Calcium Glycolate		25g
H0917	Calcium 3-Hydroxy-3-methylbutyrate Hydrate		25g
H0651	Calcium 2-Hydroxy-4-(methylthio)butyrate		25g
L0006	Calcium Lactobionate Hydrate		25g
L0043	Calcium Levulinate Dihydrate		25g
O0076	Calcium Mesoxalate Trihydrate		5g
M0548	Calcium Methacrylate Hydrate		25g
M0549	Calcium Methanesulfonate	25g	500g
K0021	Calcium 3-Methyl-2-oxobutyrate Hydrate		5g
K0022	Calcium 3-Methyl-2-oxovalerate Hydrate	5g	25g
K0023	Calcium 4-Methyl-2-oxovalerate Hydrate	5g	25g
P0012	Calcium D-Pantothenate	25g	500g
C2003	Calcium Phthalate Hydrate	5g	25g
P0503	Calcium Propionate	25g	500g
S0054	Calcium Sorbate		25g
S0236	Calcium Stearate	25g	500g
T0002	Calcium DL-Tartrate Tetrahydrate		25g
T0004	Calcium <i>meso</i> -Tartrate Trihydrate	1g	25g
T0902	Calcium Thioglycolate Trihydrate	25g	500g
T1799	Calcium L-Threonate		25g
C0849	4-Chlorobenzoyl-L-tryptophan Calcium Salt		25g
D1869	Diethylenetriaminepentaacetic Acid Calcium Trisodium Salt Hydrate		25g
E0088	Ethylenediaminetetraacetic Acid Calcium Disodium Salt Hydrate	25g	500g
F0372	Fenoprofen Calcium Salt Dihydrate		25g
L0075	Lithol Rubin BCA		25g
P0274	Phosphocholine Chloride Calcium Salt Tetrahydrate	25g	250g
P0410	Phytin	25g	500g

Ba (Barium)

Product No.	Product Name	Unit Size	
A0760	Barium Acrylate Monomer		25g
C0078	Barium Chloranilate Trihydrate		25g
C0978	Barium 2-Cyanoethylphosphate Hydrate [Phosphorylating Agent]	5g	25g
D0876	Barium Diphenylamine-4-sulfonate	1g	5g 25g
E0085	Barium Disodium Ethylenediaminetetraacetate Hydrate		25g
S0235	Barium Stearate	25g	500g
G0052	D-Glucose 6-Phosphate Barium Salt Heptahydrate	100mg	1g
I0039	Inosine 5'-Monophosphate Barium Salt Hydrate		100mg
L0074	Lake Red CBA		25g
M0046	Mannose-6-phosphate Barium Salt Hydrate		100mg
P0257	6-Phosphogluconate Barium Salt Hydrate	Price on request	
P0258	3-Phospho-D-glyceric Acid Barium Salt Dihydrate		1g
R0026	Ribose-5-phosphate Barium Salt Hydrate	100mg	1g

Al (Aluminum)

Product No.	Product Name	Unit Size	
A0244	Aluminum <i>sec</i> -Butoxide	25g	500g
A0804	Aluminum <i>tert</i> -Butoxide		5g
A1831	Aluminum(III) Chloride	100g	500g
A0245	Aluminum Ethoxide	25g	250g
A1200	Aluminum Glycinate	25g	500g
A0246	Aluminum Isopropoxide	100g	500g
B1895	Bis(2-ethylhexanoato)hydroxyaluminum	25g	250g
D1340	Diethylaluminum Chloride (ca. 15% in Hexane, ca. 0.87mol/L)		100mL
D2972	Diisobutylaluminum Hydride (17% in Toluene, ca. 1.0mol/L)	100mL	500mL
D2971	Diisobutylaluminum Hydride (19% in Hexane, ca. 1.0mol/L)	100mL	500mL
E0648	Ethylaluminum Dichloride (17% in Hexane, ca. 1mol/L)		100mL
L0203	Lithium Aluminum Hydride (Powder)	25g	100g
L0170	Lithium Aluminum Hydride (10% in Tetrahydrofuran, ca. 2.5mol/L)		100mL
L0159	Lithium Tri- <i>tert</i> -butoxyaluminum Hydride (ca. 30% in Tetrahydrofuran, ca. 1.0mol/L)		100mL
M1211	Methylaluminum Bis(2,6-di- <i>tert</i> -butyl-4-methylphenoxide) (0.4mol/L in Toluene)		50mL
M0468	Mucicarmine		25g
M0469	Mucicarmine Solution acc. to Mayer		500mL
C1167	Phthalocyanine Chloroaluminum		1g
P2280	Polydimethylsilane supported Palladium/Alumina Hybrid Catalyst [=Pd / (PMPSi-Al ₂ O ₃)]	1g	5g
P1944	Poly(methylphenyl)silane supported Palladium/Alumina Hybrid Catalyst [=Pd / (PSi-Al ₂ O ₃)]		1g
S0467	Sodium Bis(2-methoxyethoxy)aluminum Dihydride (70% in Toluene, ca. 3.6mol/L)	25g	100g 500g
C1411	Tebbe Reagent (ca. 0.5mol/L in Toluene)		25mL
T0783	Triethylaluminum (15% in Hexane, ca. 1.0mol/L)		100mL
T0925	Triethylaluminum (15% in Toluene, ca. 1.1mol/L)		100mL
T0784	Triisobutylaluminum (15% in Hexane, ca. 0.50mol/L)		100mL
T0782	Trimethylaluminum (15% in Hexane, ca. 1.4mol/L)		100mL
T1575	Trimethylaluminum (15% in Toluene, ca. 1.8mol/L)		100mL
A0241	Tris(2,4-pentanedionato)aluminum(III)	25g	100g 500g
T2238	Tris(8-quinolinolato)aluminum (purified by sublimation)		5g
T1527	Tris(8-quinolinolato)aluminum	25g	250g
A1267	Tris(trifluoro-2,4-pentanedionato)aluminum(III)		5g 25g

Ga (Gallium)

Product No.	Product Name	Unit Size	
G0359	Gallium(III) Chloride Anhydrous	5g	25g

In (Indium)

Product No.	Product Name	Unit Size	
I0778	Indium(III) Chloride Anhydrous	5g	25g
I0020	Tris(2,4-pentanedionato)indium(III)		10g

Tl (Thallium)

Product No.	Product Name	Unit Size	
C0954	Cyclopentadienyl Thallium		5g
T1351	Thallium(III) Trifluoroacetate		10g

Sn (Tin)

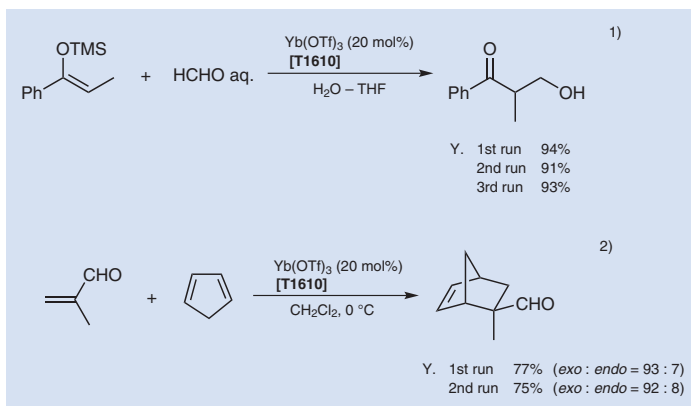
Product No.	Product Name	Unit Size	
A2170	Allenyltributyltin		1g
A1222	Allyltributyltin	5g	25g
A1491	Allyltriphenyltin	5g	25g
B4685	4,8-Bis(2-butyl- <i>n</i> -octyloxy)-2,6-bis(trimethylstannyl)benzo[1,2- <i>b</i> :4,5- <i>b'</i>]dithiophene		200mg
B4437	4,8-Bis[5-(2-ethylhexyl)thiophen-2-yl]-2,6-bis(trimethylstannyl)benzo[1,2- <i>b</i> :4,5- <i>b'</i>]dithiophene		200mg
B4378	4,8-Bis(<i>n</i> -octyloxy)-2,6-bis(trimethylstannyl)benzo[1,2- <i>b</i> :4,5- <i>b'</i>]dithiophene		200mg
T0650	Bis(2,4-pentanedionato)tin(IV) Dichloride		25g
B1974	Bis(tributylstannyl)acetylene	1g	5g
B1975	<i>trans</i> -1,2-Bis(tributylstannyl)ethylene	1g	5g
B0907	Bis(tributylstannyl) Sulfide	1g	5g
B1832	Bis(tributyltin)	5g	25g
B4536	2,5-Bis(trimethylstannyl)thieno[3,2- <i>b</i>]thiophene	200mg	1g
B4453	4,7-Bis(5-trimethylstannyl-2-thienyl)-2,1,3-benzothiadiazole		200mg
D2466	Dibutyltin Bis(trifluoromethanesulfonate)		5g

Product No.	Product Name	Unit Size		
D0302	Dibutyltin Diacetate	25g	100g	500g
D0223	Dibutyltin Dichloride		25g	500g
D0303	Dibutyltin Dilaurate	25g	100g	500g
D0304	Dibutyltin Maleate (so called) [for PVC stabilizer]		25g	500g
D0305	Dibutyltin Oxide	25g	100g	500g
D1338	Dimethyltin Dichloride		25g	500g
D4649	Dimethyltin Oxide		25g	100g
D1373	Di- <i>n</i> -octyltin Oxide		25g	500g
D2358	Diphenyltin Sulfide [Activator for <i>O</i> -Glycoside Synthesis]			1g
H1312	Hexamethylditin		1g	5g
M1494	Methyl Tributylstannyl Sulfide		25g	100g
M0744	Monobutyltin Oxide		25g	500g
P1282	Phenyltin Trichloride		5g	25g
S0909	SnAP-TM Reagent		200mg	1g
T2009	Tetraallyltin		1g	5g
T1592	Tetrabutylammonium Difluorotriphenylstannate		1g	5g
T0058	Tetrabutyltin		25g	500g
T0919	Tetramethyltin		5g	25g
T0165	Tetraphenyltin			25g
T2053	Tin(IV) Chloride (ca. 1.0mol/L in Dichloromethane)			100mL
T3149	Tin(II) 2-Ethylhexanoate		100g	500g
T2940	Tin(IV) 2,3-Naphthalocyanine Dichloride		200mg	1g
P1024	Tin(II) Phthalocyanine		1g	5g
P0997	Tin(IV) Phthalocyanine Dichloride			1g
T1194	Tin(II) Trifluoromethanesulfonate	1g	5g	25g
T3191	Tributyl(1-ethoxyvinyl)tin		1g	5g
T1750	Tributylethynyltin		1g	5g
T1797	Tributyl(2-furyl)tin			5g
T2995	Tributyl(4-methoxy-2-pyridyl)tin		1g	5g
T3046	Tributyl(1-phenyl-5-pyrazolyl)tin		1g	5g
T1736	Tributyl(2-pyridyl)tin	1g	5g	25g
T1798	Tributyl(2-thienyl)tin		5g	25g
T0677	Tributyltin Acetate			25g
T0363	Tributyltin Chloride	25g	100g	500g
T0678	Tributyltin Fluoride			25g
T1473	Tributyltin Hydride (stabilized with BHT) [Reducing Reagent]		25g	250g
T1865	Tributyl(trimethylsilylethynyl)tin		5g	25g
T1866	Tributyl(trimethylsilylmethyl)tin			5g
T1794	Tributylvinyltin	1g	5g	25g
T1742	Trimethyl(2-pyridyl)tin		1g	5g
T1928	Trimethyl(4-pyridyl)tin		1g	5g
T0958	Trimethyltin Chloride		5g	25g
T0447	Triphenyltin Chloride			5g

Pb (Lead)

Product No.	Product Name	Unit Size		
E0093	Ethylenediaminetetraacetic Acid Lead(II) Disodium Salt Hydrate	25g		500g
L0279	Lead(II) Iodide [for Perovskite precursor]		1g	5g
N0339	Lead Naphthenate			25g
L0230	Lead(II) Phthalocyanine (purified by sublimation)		200mg	1g
P0766	Lead(II) Phthalocyanine		1g	25g
L0021	Lead Tetraacetate (contains Acetic Acid)		25g	500g
T0164	Tetraphenyl Lead			5g

Stable Lewis Acids in Aqueous Media



The Lewis acid-catalyzed C-C bond forming reactions have been of great interest in organic synthesis. While various kinds of Lewis acid-promoted reactions have been developed, these reactions must be carried out under strict anhydrous conditions. The presence of even a small amount of water stops the reaction, because most Lewis acid immediately react with water rather than the substrates and decompose or deactivate.

Recently, Kobayashi and co-worker have found that certain metal triflates are stable Lewis acids in aqueous media. The reaction of silyl enol ethers with commercial formaldehyde solution smoothly proceeds in aqueous media by the certain metal triflates, especially $\text{Yb}(\text{OTf})_3$ to give the corresponding aldol adducts in high yields. Moreover, the triflates can also be used in organic solvents in many reactions. In all cases, the reaction is completed by only a catalytic amount of the triflate, and the catalyst can be easily recovered after the reaction was completed and can be reused. On the other hand, in asymmetric synthesis, chiral Lewis acid which was prepared by $\text{Sc}(\text{OTf})_3$, chiral binaphthol and an amine affords chiral Diels-Alder adduct in the reactions of dienophiles and dienes. Then, the certain metal triflates, especially $\text{Yb}(\text{OTf})_3$, $\text{Sc}(\text{OTf})_3$, etc. are expected to be useful as new types of Lewis acid catalysts in many organic reactions.

From the view points of green chemistry, these are also remarkably effective Lewis Acids as non-toxic and nonflammable water can be used as reaction solvent.

T1918 $\left[\begin{array}{c} \text{O} \\ \parallel \\ \text{CF}_3-\text{S}-\text{O}^- \\ \parallel \\ \text{O} \end{array} \right]_3 \text{Ce}^{3+}$	T1292 $\left[\begin{array}{c} \text{O} \\ \parallel \\ \text{CF}_3-\text{S}-\text{O}^- \\ \parallel \\ \text{O} \end{array} \right]_2 \text{Cu}^{2+}$	T1708 $\left[\begin{array}{c} \text{O} \\ \parallel \\ \text{CF}_3-\text{S}-\text{O}^- \\ \parallel \\ \text{O} \end{array} \right]_4 \text{Hf}^{4+}$	I0778 InCl_3	T1293 $\left[\begin{array}{c} \text{O} \\ \parallel \\ \text{CF}_3-\text{S}-\text{O}^- \\ \parallel \\ \text{O} \end{array} \right]_3 \text{La}^{3+}$
T1919 $\left[\begin{array}{c} \text{O} \\ \parallel \\ \text{CF}_3-\text{S}-\text{O}^- \\ \parallel \\ \text{O} \end{array} \right]_3 \text{Nd}^{3+}$	T1663 $\left[\begin{array}{c} \text{O} \\ \parallel \\ \text{CF}_3-\text{S}-\text{O}^- \\ \parallel \\ \text{O} \end{array} \right]_3 \text{Sc}^{3+}$	T1331 $\text{CF}_3-\text{S}(=\text{O})_2-\text{OAg}$	T1920 $\left[\begin{array}{c} \text{O} \\ \parallel \\ \text{CF}_3-\text{S}-\text{O}^- \\ \parallel \\ \text{O} \end{array} \right]_3 \text{Tm}^{3+}$	T1610 $\left[\begin{array}{c} \text{O} \\ \parallel \\ \text{CF}_3-\text{S}-\text{O}^- \\ \parallel \\ \text{O} \end{array} \right]_3 \cdot x\text{H}_2\text{O}$
T1921 $\left[\begin{array}{c} \text{O} \\ \parallel \\ \text{CF}_3-\text{S}-\text{O}^- \\ \parallel \\ \text{O} \end{array} \right]_3 \text{Y}^{3+}$	T1294 $\left[\begin{array}{c} \text{O} \\ \parallel \\ \text{CF}_3-\text{S}-\text{O}^- \\ \parallel \\ \text{O} \end{array} \right]_2 \text{Zn}^{2+}$			

Product No.	Product Name	Unit Size	
T1918	Cerium(III) Trifluoromethanesulfonate	5g	25g
T1292	Copper(II) Trifluoromethanesulfonate	5g	25g
T1708	Hafnium(IV) Trifluoromethanesulfonate	1g	5g
I0778	Indium(III) Chloride Anhydrous	5g	25g
T1293	Lanthanum(III) Trifluoromethanesulfonate	5g	25g
T1919	Neodymium(III) Trifluoromethanesulfonate	5g	25g
T1663	Scandium(III) Trifluoromethanesulfonate	1g	5g
T1331	Silver Trifluoromethanesulfonate	10g	25g
T1920	Thulium(III) Trifluoromethanesulfonate		5g
T1610	Ytterbium(III) Trifluoromethanesulfonate Hydrate	5g	25g
T1921	Yttrium(III) Trifluoromethanesulfonate	5g	25g
T1294	Zinc(II) Trifluoromethanesulfonate		25g

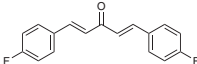
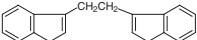
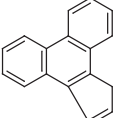
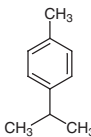
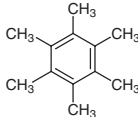
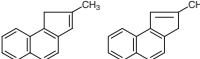
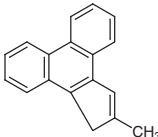
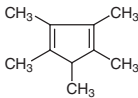
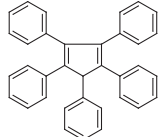
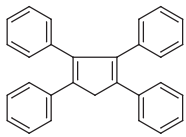
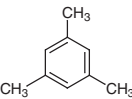
References

- 1) Aldol reactions in aqueous media
S. Kobayashi, *Chem. Lett.* **1991**, 2187; S. Kobayashi, I. Hachiya, *Tetrahedron Lett.* **1992**, 33, 1625.
- 2) Reusable catalysts for Michael and Diels-Alder reactions
S. Kobayashi, I. Hachiya, T. Takahori, M. Araki, H. Ishitani, *Tetrahedron Lett.* **1992**, 33, 6815.
- 3) Reviews: S. Kobayashi, *Synlett* **1994**, 689; S. Kobayashi, I. Hachiya, *Yuki Gosei Kagaku Kyokaishi (J. Synth. Org. Chem., Jpn.)* **1995**, 53, 370; T. Ogino, T. Onozawa, *Yuki Gosei Kagaku Kyokaishi (J. Synth. Org. Chem., Jpn.)*, **1998**, 56, 71; K. Ishikawa, *TCIMAIL* **2000**, number 107, 2; S. Kobayashi, T. Hamada, S. Nagayama, K. Manabe, *J. Braz. Chem. Soc.* **2001**, 12, 627; S. Kobayashi, *Pure Appl. Chem.* **2007**, 79, 235.

Ligands

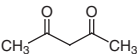
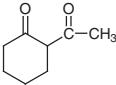
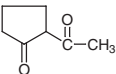
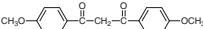
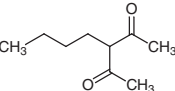
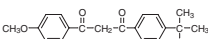
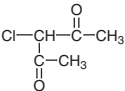
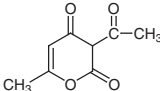
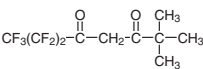
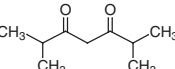
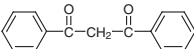
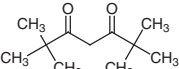
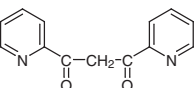
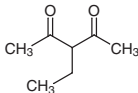
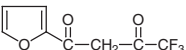
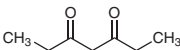
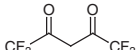
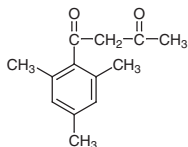
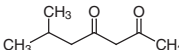
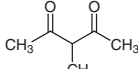
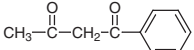
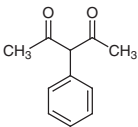
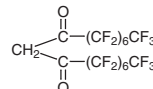
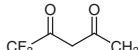
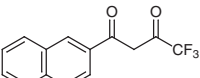
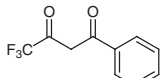
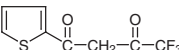
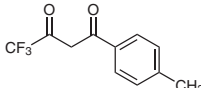
Phosphine Ligands (see p.62)

N-Heterocyclic Carbene (NHC) Ligands (see p.66)

Ene Ligands		A0005	B2283	B2281
				
C0572	C0468	C0503	C0505	C1689
				
C0513	D0443	H0084	H0087	I0016 I0354
				
M1425	M1411	N0346	N0166	P1292
				
P1633	T1333	T0470		
				

Product No.	Product Name	Unit Size		
A0005	Acenaphthylene		25g	
B2283	<i>trans,trans</i> -1,5-Bis(4-fluorophenyl)-1,4-pentadien-3-one	5g	25g	
B2281	1,2-Bis(3-indenyl)ethane	1g	5g	
C0572	1,3,5-Cycloheptatriene		25mL	
C0468	1,4-Cyclohexadiene (stabilized with BHT)	10mL	25mL	
C0503	1,5-Cyclooctadiene [stabilized with Octadecyl 3-(3',5'-Di- <i>tert</i> -butyl-4'-hydroxyphenyl)propionate]	25mL	100mL	500mL
C0505	1,3,5,7-Cyclooctatetraene (stabilized with HQ)	1mL	5mL	
C1689	1 <i>H</i> -Cyclopenta[fl]phenanthrene	100mg	1g	
C0513	<i>p</i> -Cymene	25mL	500mL	
D0443	Dicyclopentadiene (stabilized with BHT) [precursor to Cyclopentadiene]	25mL	500mL	
H0084	1,5-Hexadiene	25mL	500mL	
H0087	Hexamethylbenzene		5g	
I0016	Indene	25mL	100mL	500mL
I0354	Indene		25mL	

Product No.	Product Name	Unit Size	
M1425	2-Methylbenzo[<i>e</i>]indene (mixture of 1 <i>H</i> - and 3 <i>H</i> -form)	100mg	1g
M1411	2-Methylcyclopenta[<i>f</i>]phenanthrene	100mg	1g
N0346	2,5-Norbornadiene (stabilized with BHT)	25mL	100mL 500mL
N0166	2-Norbornene	25g	400g
P1292	1,2,3,4,5-Pentamethylcyclopentadiene	5mL	25mL
P1633	1,2,3,4,5-Pentaphenyl-1,3-cyclopentadiene	100mg	1g
T1333	1,2,3,4-Tetraphenyl-1,3-cyclopentadiene	1g	5g
T0470	1,3,5-Trimethylbenzene	25mL	500mL

Diketone Ligands		P0052 	A0881 	A0869 
B1733 	B1457 	B3382 	C1277 	D0039 
D1729 	D2413 	D0910 	D1678 	D2512 
E0405 	F0083 	H1395 	H0476 	M1272 
M0597 	M1132 	P0160 	P1297 	T2037 
T0434 	T1583 	T0437 	T0438 	T2997 

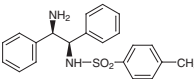
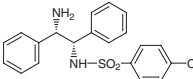
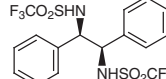
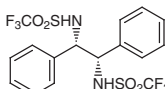
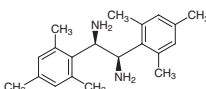
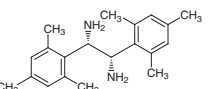
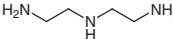
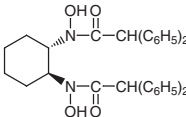
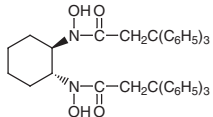
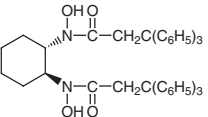
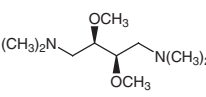
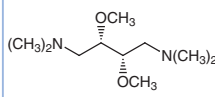
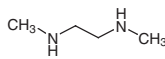
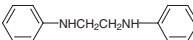
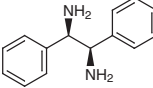
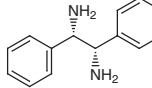
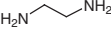
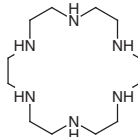
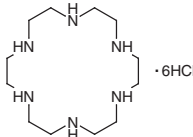
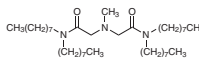
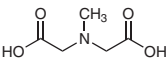
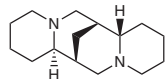
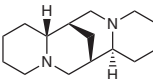
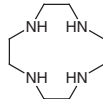
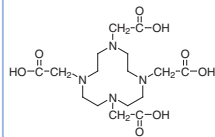
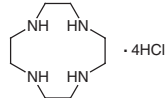
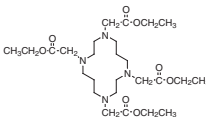
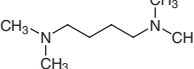
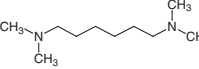
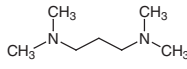
Product No.	Product Name	Unit Size	
P0052	Acetylacetone	25mL	500mL
A0881	2-Acetylcyclohexanone	10mL	25mL
A0869	2-Acetylcyclopentanone		25mL
B1733	1,3-Bis(4-methoxyphenyl)-1,3-propanedione	5g	25g
B1457	3-Butyl-2,4-pentanedione		5mL
B3382	1-(4- <i>tert</i> -Butylphenyl)-3-(4-methoxyphenyl)-1,3-propanedione	25g	100g
C1277	3-Chloroacetylacetone		25g
D0039	Dehydroacetic Acid	25g	500g
D1729	2,2-Dimethyl-6,6,7,7,8,8,8-heptafluoro-3,5-octanedione		5g
D2413	2,6-Dimethyl-3,5-heptanedione	5g	25g
D0910	1,3-Diphenyl-1,3-propanedione	25g	500g
D1678	Dipivaloylmethane	5g	25g
D2512	1,3-Di(2-pyridyl)-1,3-propanedione	1g	5g
E0405	3-Ethyl-2,4-pentanedione		5mL
F0083	2-Furoyltrifluoroacetone	5g	25g
H1395	3,5-Heptanedione	5g	25g
H0476	Hexafluoroacetylacetone	5g	25g
M1272	1-(2-Mesitylene)-1,3-butanedione	5g	25g
M0597	6-Methyl-2,4-heptanedione		5mL
M1132	3-Methyl-2,4-pentanedione	5mL	25mL
P0160	1-Phenyl-1,3-butanedione	25g	100g 500g
P1297	3-Phenyl-2,4-pentanedione	1g	5g
T2037	9 <i>H</i> ,9 <i>H</i> -Triacontafluoro-8,10-heptadecanedione		100mg
T0434	Trifluoroacetylacetone	25g	100g
T1583	4,4,4-Trifluoro-1-(2-naphthyl)-1,3-butanedione	5g	10g 25g
T0437	4,4,4-Trifluoro-1-phenyl-1,3-butanedione		25g
T0438	4,4,4-Trifluoro-1-(2-thienyl)-1,3-butanedione	25g	500g
T2997	4,4,4-Trifluoro-1-(<i>p</i> -tolyl)-1,3-butanedione	5g	25g

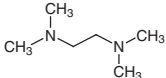
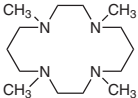
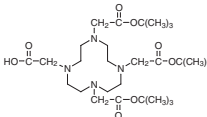
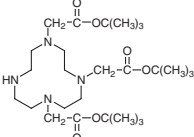
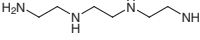
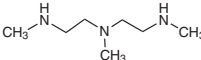
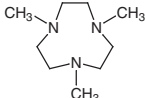
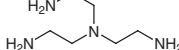
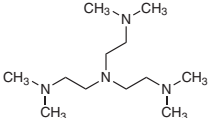
Salen Ligands

		B2652	B2653	B4418
B2619	B3015	H0199	D2572	D1307
D1422				

Product No.	Product Name	Unit Size	
B2652	(1 <i>R</i> ,2 <i>R</i> ,4 <i>R</i> ,5 <i>R</i>)-2,5-Bis(3,5-di- <i>tert</i> -butyl-2-hydroxybenzylideneamino)bicyclo[2.2.1]heptane		100mg
B2653	(1 <i>S</i> ,2 <i>S</i> ,4 <i>S</i> ,5 <i>S</i>)-2,5-Bis(3,5-di- <i>tert</i> -butyl-2-hydroxybenzylideneamino)bicyclo[2.2.1]heptane		100mg
B4418	(<i>R</i> , <i>R</i>)-(-)- <i>N,N'</i> -Bis(3,5-di- <i>tert</i> -butylsalicylidene)-1,2-cyclohexanediamine	5g	25g
B2619	<i>N,N'</i> -Bis(3,5-di- <i>tert</i> -butylsalicylidene)-1,1,2,2-tetramethylethylenediamine	1g	5g
B3015	<i>N,N'</i> -Bis(5-hydroxysalicylidene)ethylenediamine	1g	5g
H0199	<i>N,N'</i> -Bis(salicylidene)ethylenediamine	25g	500g

Product No.	Product Name	Unit Size	
D2572	<i>N,N'</i> -Bis(salicylidene)-1,2-phenylenediamine	5g	25g
D1307	<i>N,N'</i> -Bis(salicylidene)-1,2-propanediamine		25g
D1422	<i>N,N'</i> -Bis(salicylidene)-1,3-propanediamine		25g

Amine Ligands		A1548	A1699	D2520
				
D2521	B2316	B2317	D0134	D0493
				
D3716	D3719	D3720	D2395	D2396
				
D0720	D0887	D2176	D2175	E0077
				
H1070	H1215	H0093	M2476	M2090
				
Q0062	S0884	S0461	T1874	T1875
				
T1426	T2540	T1289	T0537	T0548
				

T0147	T1877	T1876	T1878	T2642
				
T2541	T0429	B4304	T1879	T1243
				
T2898				
				

Product No.	Product Name	Unit Size	
A1548	(<i>R,R</i>)- <i>N</i> -(2-Amino-1,2-diphenylethyl)- <i>p</i> -toluenesulfonamide	1g	
A1699	(<i>S,S</i>)- <i>N</i> -(2-Amino-1,2-diphenylethyl)- <i>p</i> -toluenesulfonamide	1g	
D2520	(<i>R,R</i>)- <i>N,N'</i> -Bis(trifluoromethanesulfonyl)-1,2-diphenylethylenediamine	1g	
D2521	(<i>S,S</i>)- <i>N,N'</i> -Bis(trifluoromethanesulfonyl)-1,2-diphenylethylenediamine	1g	
B2316	(1 <i>R</i> ,2 <i>R</i>)-1,2-Bis(2,4,6-trimethylphenyl)ethylenediamine	100mg	500mg
B2317	(1 <i>S</i> ,2 <i>S</i>)-1,2-Bis(2,4,6-trimethylphenyl)ethylenediamine	100mg	500mg
D0134	1,4-Diazabicyclo[2.2.2]octane	25g	100g 500g
D0493	Diethylenetriamine	25mL	500mL
D3716	(1 <i>S</i> ,2 <i>S</i>)- <i>N,N'</i> -Dihydroxy- <i>N,N'</i> -bis(diphenylacetyl)cyclohexane-1,2-diamine	100mg	
D3719	(1 <i>R</i> ,2 <i>R</i>)- <i>N,N'</i> -Dihydroxy- <i>N,N'</i> -bis(3,3,3-triphenylpropionyl)cyclohexane-1,2-diamine	100mg	
D3720	(1 <i>S</i> ,2 <i>S</i>)- <i>N,N'</i> -Dihydroxy- <i>N,N'</i> -bis(3,3,3-triphenylpropionyl)cyclohexane-1,2-diamine	100mg	
D2395	(<i>R,R</i>)-(-)-2,3-Dimethoxy-1,4-bis(dimethylamino)butane	1g	5g
D2396	(<i>S,S</i>)-(+)-2,3-Dimethoxy-1,4-bis(dimethylamino)butane	1g	5g
D0720	<i>N,N'</i> -Dimethylethylenediamine	5mL	25mL
D0887	<i>N,N'</i> -Diphenylethylenediamine	25g	
D2176	(1 <i>R</i> ,2 <i>R</i>)-(+)-1,2-Diphenylethylenediamine	1g	5g
D2175	(1 <i>S</i> ,2 <i>S</i>)-(-)-1,2-Diphenylethylenediamine	1g	5g
E0077	Ethylenediamine Anhydrous	25mL	500mL
H1070	1,4,7,10,13,16-Hexaazacyclooctadecane	100mg	
H1215	1,4,7,10,13,16-Hexaazacyclooctadecane Hexahydrochloride	100mg	
H0093	Hexamethylenetetramine	25g	500g
M2476	2,2'-(Methylimino)bis(<i>N,N</i> -di- <i>n</i> -octylacetamide)	1mL	5mL
M2090	<i>N</i> -Methyliminodiacetic Acid	5g	25g
Q0062	Quinuclidine	200mg	1g
S0884	(+)-Sparteine	1g	
S0461	(-)-Sparteine	1g	
T1874	1,4,7,10-Tetraazacyclododecane	1g	5g
T1875	1,4,7,10-Tetraazacyclododecane-1,4,7,10-tetraacetic Acid	200mg	1g
T1426	1,4,7,10-Tetraazacyclododecane Tetrahydrochloride	1g	5g
T2540	Tetraethyl 1,4,8,11-Tetraazacyclotetradecane-1,4,8,11-tetraacetate	200mg	
T1289	<i>N,N,N',N'</i> -Tetramethyl-1,4-diaminobutane	25mL	
T0537	<i>N,N,N',N'</i> -Tetramethyl-1,6-diaminohexane	25mL	500mL
T0548	<i>N,N,N',N'</i> -Tetramethyl-1,3-diaminopropane	25mL	500mL
T0147	<i>N,N,N',N'</i> -Tetramethylethylenediamine	25mL	500mL
T1877	1,4,8,11-Tetramethyl-1,4,8,11-tetraazacyclotetradecane	200mg	1g
T1876	1,5,9-Triazacyclododecane	100mg	
T1878	1,4,7-Triazacyclononane	200mg	1g 5g
T2642	Tri- <i>tert</i> -butyl 1,4,7,10-Tetraazacyclododecane-1,4,7,10-tetraacetate	100mg	1g
T2541	Tri- <i>tert</i> -butyl 1,4,7,10-Tetraazacyclododecane-1,4,7-triacetate	200mg	
T0429	Triethylenetetramine	25mL	500mL

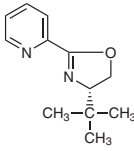
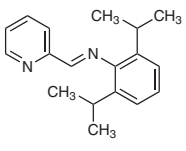
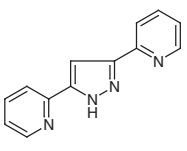
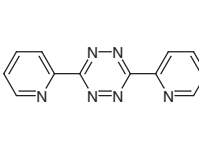
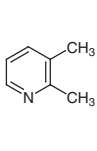
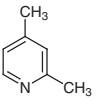
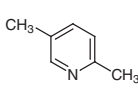
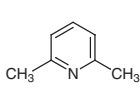
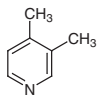
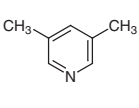
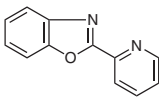
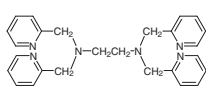
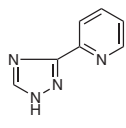
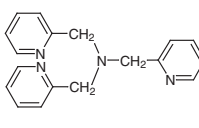
Product No.	Product Name	Unit Size
B4304	<i>N,N',N''</i> -Trimethyldiethylenetriamine	5mL
T1879	1,4,7-Trimethyl-1,4,7-triazacyclononane (stabilized with NaHCO ₃)	1g 5g
T1243	Tris(2-aminoethyl)amine	25mL 100mL
T2898	Tris[2-(dimethylamino)ethyl]amine	1g 5g

Imine Ligands		A0261	B3197	B4196
D4273	D4168	D4652	D3822	F0893
H0973	H0291	I0001	I0795	I0567
D2823	I0582	M1390	M1401	M1402
O0234	O0319	P1947	P1795 P0355	S0328
A5019	S0267	T1495	T1438	T1815
T1832	T1497	T1360	T1730	T1729

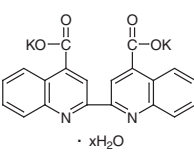
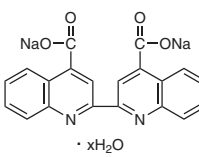
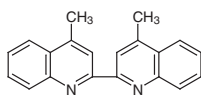
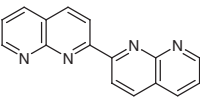
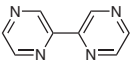
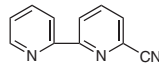
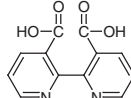
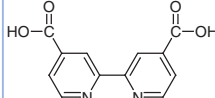
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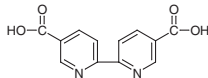
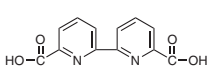
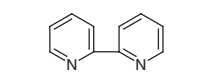
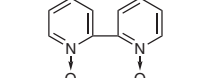
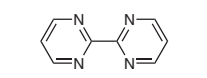
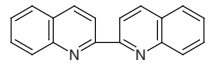
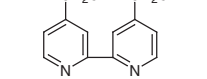
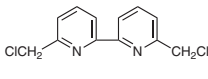
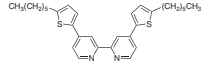
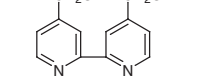
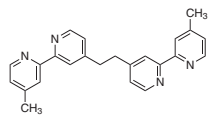
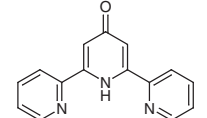
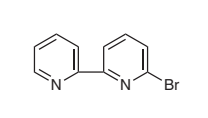
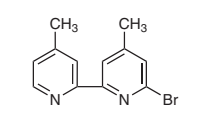
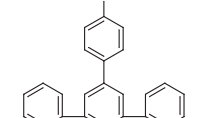
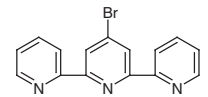
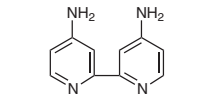
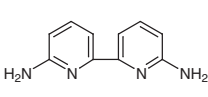
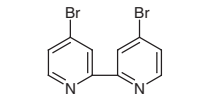
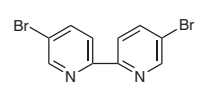
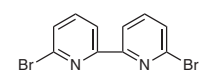
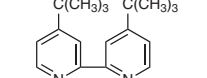
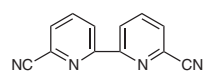
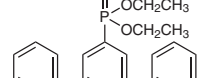
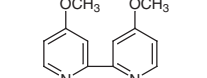
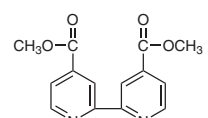
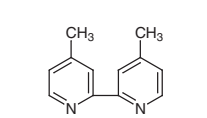
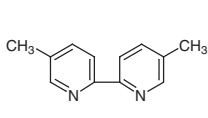
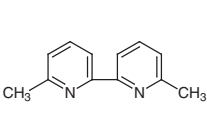
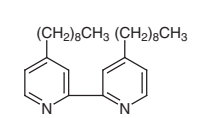
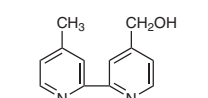
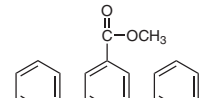
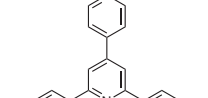
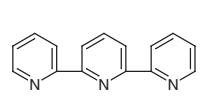
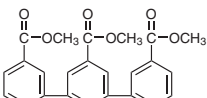
Product No.	Product Name	Unit Size	
A0261	<i>N,N'</i> -Bis(2-aminobenzal)ethylenediamine	1g	
B3197	(<i>S,S'</i>)-2,2'-Bis[(<i>S</i>)-4-isopropylloxazolin-2-yl]-1,1'-biferrocene	100mg	500mg
B4196	(<i>S,S</i>)-4,6-Bis(4-isopropyl-2-oxazolin-2-yl)- <i>m</i> -xylene	20mg	
D4273	2,2'-Diamino-4,4'-bithiazole	200mg	1g
D4168	2,4-Dibromo-6-[[[(4 <i>S</i> ,5 <i>S</i>)-4,5-dihydro-4,5-diphenyl-1-tosyl-1 <i>H</i> -imidazol-2-yl]methyl]-[(<i>S</i>)-1-phenylethyl]amino]methyl]phenol	50mg	
D4652	<i>trans</i> -2,6-Diisopropyl- <i>N</i> -(2-pyridylmethylene)aniline	200mg	1g
D3822	(<i>S</i>)-1-(Diphenylphosphino)-2-[(<i>S</i>)-4-isopropylloxazolin-2-yl]ferrocene	200mg	1g
F0893	4-Fluoro- <i>N</i> -salicylideneaniline	1g	5g
H0973	2-(2-Hydroxyphenyl)benzothiazole	5g	25g
H0291	2-(2-Hydroxyphenyl)benzoxazole	1g	25g
I0001	Imidazole	25g	100g
I0795	(<i>R,R</i>)-(+)-2,2'-Isopropylidenebis(4- <i>tert</i> -butyl-2-oxazoline)	100mg	
I0567	(<i>S,S</i>)-(-)-2,2'-Isopropylidenebis(4- <i>tert</i> -butyl-2-oxazoline)	100mg	1g
D2823	(<i>R,R</i>)-2,2'-Isopropylidenebis(4-phenyl-2-oxazoline)	250mg	1g
I0582	(<i>S,S</i>)-2,2'-Isopropylidenebis(4-phenyl-2-oxazoline)	250mg	1g
M1390	2,2'-Methylenebisbenzothiazole	5g	25g
M1401	(+)-2,2'-Methylenebis[(3 <i>aR</i> ,8 <i>aS</i>)-3 <i>a</i> ,8 <i>a</i> -dihydro-8 <i>H</i> -indeno[1,2- <i>d</i>]oxazole]	100mg	500mg
M1402	(-)-2,2'-Methylenebis[(3 <i>aS</i> ,8 <i>aR</i>)-3 <i>a</i> ,8 <i>a</i> -dihydro-8 <i>H</i> -indeno[1,2- <i>d</i>]oxazole]	100mg	500mg
O0234	2,3,7,8,12,13,17,18-Octaethylporphyrin	100mg	1g
O0319	2,3,7,8,12,13,17,18-Octafluoro-5,10,15,20-tetrakis(pentafluorophenyl)porphyrin	100mg	
P1947	(4 <i>S</i> ,4' <i>S</i>)-2,2'-(Pentane-3,3'-diyl)bis(4-benzyl-4,5-dihydrooxazole)	200mg	1g
P1795	Phthalocyanine (purified by sublimation)	1g	
P0355	Phthalocyanine	25g	
S0328	2-Salicylideneaminophenol	5g	25g
A5019	Salicylideneamino-2-thiophenol	1g	5g
S0267	<i>N</i> -Salicylideneaniline	25g	
T1495	5,10,15,20-Tetrakis(4-carboxymethoxyphenyl)porphyrin	100mg	
T1438	5,10,15,20-Tetrakis(2,6-dichlorophenyl)porphyrin	100mg	
T1815	5,10,15,20-Tetrakis(3,5-dihydroxyphenyl)porphyrin	100mg	1g
T1832	5,10,15,20-Tetrakis(3,5-dimethoxyphenyl)porphyrin	100mg	
T1497	5,10,15,20-Tetrakis(4-hydroxyphenyl)porphyrin	100mg	
T1360	5,10,15,20-Tetrakis(4-methoxyphenyl)porphyrin	100mg	1g
T1730	5,10,15,20-Tetrakis(pentafluorophenyl)porphyrin	100mg	
T1729	5,10,15,20-Tetrakis(2,4,6-trimethylphenyl)porphyrin	100mg	1g
T1358	<i>meso</i> -Tetraphenylchlorin	100mg	
T1359	Tetraphenylporphyrin (Chlorin free)	1g	
T2222	5,10,15,20-Tetra(4-pyridyl)porphyrin	1g	
T0830	2-(4-Thiazolyl)benzimidazole	25g	250g
T2993	Tris[(1-benzyl-1 <i>H</i> -1,2,3-triazol-4-yl)methyl]amine	1g	5g

Pyridine Ligands		B3510	B3934	B4228
B2217	B2218	B4227	B2219	B2220

B4104	D4652	D2037	D3640	L0063
				
L0085	L0065	L0067	L0066	L0068
				
P2098	T1487	P2100	T2671	
				

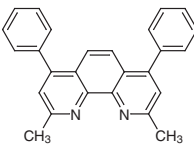
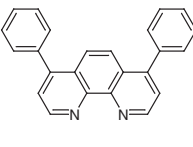
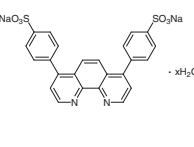
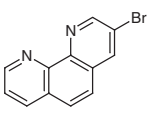
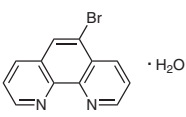
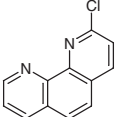
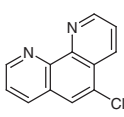
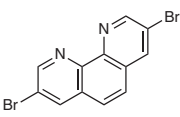
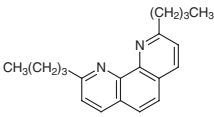
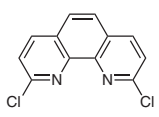
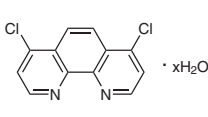
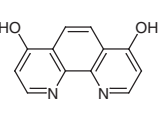
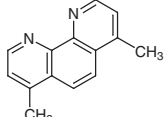
Product No.	Product Name	Unit Size	
B3510	2,6-Bis(2-benzimidazolyl)pyridine	1g	5g
B3934	2,6-Bis[(2 <i>R</i> ,4 <i>S</i> ,5 <i>S</i>)-1-benzyl-4,5-diphenylimidazolidin-2-yl]pyridine		50mg
B4228	2,6-Bis[(2 <i>S</i> ,5 <i>S</i>)-4,4-diphenyl-1-aza-3-oxabicyclo[3.3.0]octan-2-yl]pyridine		50mg
B2217	(<i>R,R</i>)-2,6-Bis(4-isopropyl-2-oxazolin-2-yl)pyridine	250mg	1g 5g
B2218	(<i>S,S</i>)-2,6-Bis(4-isopropyl-2-oxazolin-2-yl)pyridine		500mg 5g
B4227	2,6-Bis[(2 <i>S</i> ,4 <i>S</i>)-4-methyl-5,5-diphenyloxazolidin-2-yl]pyridine		50mg
B2219	(<i>R,R</i>)-2,6-Bis(4-phenyl-2-oxazolin-2-yl)pyridine	250mg	1g
B2220	(<i>S,S</i>)-2,6-Bis(4-phenyl-2-oxazolin-2-yl)pyridine	250mg	1g
B4104	(<i>S</i>)-4- <i>tert</i> -Butyl-2-(2-pyridyl)oxazoline	1g	5g
D4652	<i>trans</i> -2,6-Diisopropyl- <i>N</i> -(2-pyridylmethylene)aniline	200mg	1g
D2037	3,5-Di(2-pyridyl)pyrazole	1g	5g
D3640	3,6-Di(2-pyridyl)-1,2,4,5-tetrazine	1g	5g
L0063	2,3-Lutidine		25mL
L0085	2,4-Lutidine		25mL 500mL
L0065	2,5-Lutidine	5mL	25mL 500mL
L0067	2,6-Lutidine		25mL 500mL
L0066	3,4-Lutidine		25mL 500mL
L0068	3,5-Lutidine		25mL 500mL
P2098	2-(2-Pyridyl)benzoxazole	1g	5g
T1487	<i>N,N,N',N'</i> -Tetrakis(2-pyridylmethyl)ethylenediamine	1g	5g
P2100	2-(1 <i>H</i> -1,2,4-Triazol-3-yl)pyridine	200mg	1g
T2671	Tris(2-pyridylmethyl)amine	1g	5g

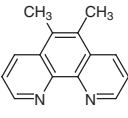
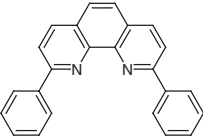
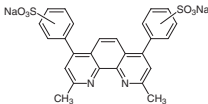
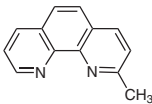
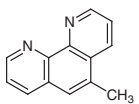
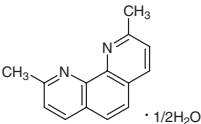
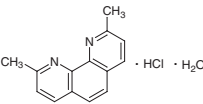
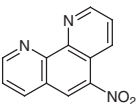
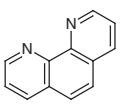
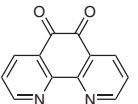
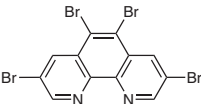
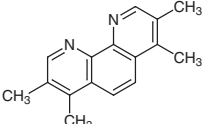
Bipyridine & Terpyridine Ligands		B1077	B4509	B0841
				
B1423	B4297	B4557	B3622	B1876
				

B3502	B3533	B0468	B3859	B2496
				
B0470	B3572	B4645	B4420	B3511
				
B3973	B3297	B4114	B3732	B3218
				
B3219	D2892	D2913	D3919	D4358
				
D3988	D3134	D4541	D4511	D3886
				
D4635	B0852	B2138	B0842	D3917
				
H1347	M2464	P2202	T0024	T2959
				

Product No.	Product Name	Unit Size	
B1077	2,2'-Bicinchoninic Acid Dipotassium Salt Hydrate	1g	5g
B4509	Bicinchoninic Acid Disodium Salt Hydrate	1g	5g
B0841	2,2'-Bi-4-lepidine		100mg
B1423	2,2'-Bi(1,8-naphthyridine)		100mg
B4297	2,2'-Bipyrazine		100mg
B4557	2,2'-Bipyridine-6-carbonitrile	200mg	1g

Product No.	Product Name	Unit Size	
B3622	2,2'-Bipyridine-3,3'-dicarboxylic Acid	1g	5g
B1876	2,2'-Bipyridine-4,4'-dicarboxylic Acid	100mg	1g
B3502	2,2'-Bipyridine-5,5'-dicarboxylic Acid		1g
B3533	2,2'-Bipyridine-6,6'-dicarboxylic Acid	1g	5g
B0468	2,2'-Bipyridyl	25g	100g 500g
B3859	2,2'-Bipyridyl 1,1'-Dioxide		5g
B2496	2,2'-Bipyrimidyl	200mg	1g
B0470	2,2'-Biquinoline	1g	5g
B3572	4,4'-Bis(chloromethyl)-2,2'-bipyridyl		1g
B4645	6,6'-Bis(chloromethyl)-2,2'-bipyridyl	200mg	1g
B4420	4,4'-Bis(5-hexyl-2-thienyl)-2,2'-bipyridyl		200mg
B3511	4,4'-Bis(hydroxymethyl)-2,2'-bipyridine	1g	5g
B3973	1,2-Bis(4'-methyl-2,2'-bipyridin-4-yl)ethane	200mg	1g
B3297	2,6-Bis(2-pyridyl)-4(1 <i>H</i>)-pyridone		1g
B4114	6-Bromo-2,2'-bipyridyl	1g	5g
B3732	6-Bromo-4,4'-dimethyl-2,2'-bipyridyl	1g	5g
B3218	4'-(4-Bromophenyl)-2,2':6',2''-terpyridine	1g	5g
B3219	4'-Bromo-2,2':6',2''-terpyridine	1g	5g
D2892	4,4'-Diamino-2,2'-bipyridyl	200mg	1g
D2913	6,6'-Diamino-2,2'-bipyridyl		250mg
D3919	4,4'-Dibromo-2,2'-bipyridyl	1g	5g
D4358	5,5'-Dibromo-2,2'-bipyridyl		1g
D3988	6,6'-Dibromo-2,2'-bipyridyl	1g	5g
D3134	4,4'-Di- <i>tert</i> -butyl-2,2'-bipyridyl	1g	5g
D4541	6,6'-Dicyano-2,2'-bipyridyl		1g
D4511	Diethyl 2,2':6',2''-Terpyridine-4'-phosphonate		200mg
D3886	4,4'-Dimethoxy-2,2'-bipyridyl	1g	5g
D4635	Dimethyl 2,2'-Bipyridine-4,4'-dicarboxylate	1g	5g
B0852	4,4'-Dimethyl-2,2'-bipyridyl	1g	5g 25g
B2138	5,5'-Dimethyl-2,2'-bipyridyl	1g	5g 25g
B0842	6,6'-Dimethyl-2,2'-bipyridyl	100mg	1g 5g
D3917	4,4'-Dinonyl-2,2'-bipyridyl	1g	5g
H1347	4-Hydroxymethyl-4'-methyl-2,2'-bipyridyl	200mg	1g
M2464	Methyl 2,2':6',2''-Terpyridine-4'-carboxylate		100mg
P2202	4'-(4-Pyridyl)-2,2':6',2''-terpyridine		200mg
T0024	2,2':6',2''-Terpyridine	100mg	1g
T2959	Trimethyl 2,2':6',2''-Terpyridine-4,4',4''-tricarboxylate		200mg

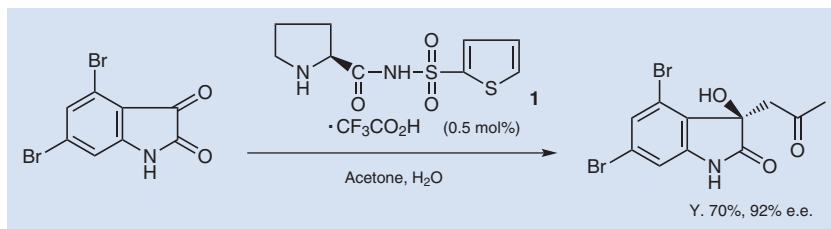
Phenanthroline Ligands		B2694 D0711	B2695 D0905	B0989
				
B2632	B0429	C1560	C0786	D3209
				
D2565	D4186	D4421	D3869	D0772
				

D1559	D3849	B0985	M2512	M0300
				 · xH ₂ O
D0771	N0423	N0214	P0221 P0879	P1973
 · 1/2H ₂ O	 · HCl · H ₂ O		 · H ₂ O	
T3133	T0847			
				

Product No.	Product Name	Unit Size	
B2694	Bathocuproine (purified by sublimation)	1g	5g
D0711	Bathocuproine	1g	5g
B2695	Bathophenanthroline (purified by sublimation)		1g
D0905	Bathophenanthroline	1g	5g
B0989	Bathophenanthrolinedisulfonic Acid Disodium Salt Hydrate		1g
B2632	3-Bromo-1,10-phenanthroline		200mg
B0429	5-Bromo-1,10-phenanthroline Monohydrate	200mg	1g
C1560	2-Chloro-1,10-phenanthroline	100mg	1g
C0786	5-Chloro-1,10-phenanthroline	100mg	1g
D3209	3,8-Dibromo-1,10-phenanthroline	200mg	1g
D2565	2,9-Dibutyl-1,10-phenanthroline	100mg	1g
D4186	2,9-Dichloro-1,10-phenanthroline	200mg	1g
D4421	4,7-Dichloro-1,10-phenanthroline Hydrate	200mg	1g
D3869	4,7-Dihydroxy-1,10-phenanthroline		1g
D0772	4,7-Dimethyl-1,10-phenanthroline		100mg
D1559	5,6-Dimethyl-1,10-phenanthroline	100mg	1g
D3849	2,9-Diphenyl-1,10-phenanthroline		1g
B0985	Disodium Bathocuproinedisulfonate	100mg	1g
M2512	2-Methyl-1,10-phenanthroline		1g
M0300	5-Methyl-1,10-phenanthroline Hydrate	100mg	1g
D0771	Neocuproine Hemihydrate	1g	25g
N0423	Neocuproine Hydrochloride Monohydrate	1g	5g 25g
N0214	5-Nitro-1,10-phenanthroline		1g
P0221	1,10-Phenanthroline Monohydrate	1g	25g
P0879	1,10-Phenanthroline Monohydrate		25g
P1973	1,10-Phenanthroline-5,6-dione	1g	5g
T3133	3,5,6,8-Tetrabromo-1,10-phenanthroline		100mg
T0847	3,4,7,8-Tetramethyl-1,10-phenanthroline		1g

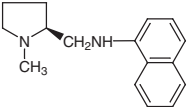
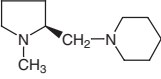
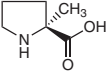
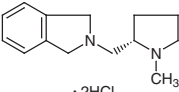
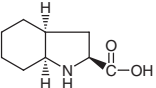
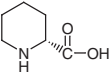
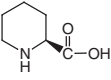
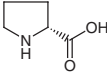
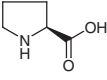
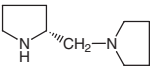
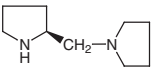
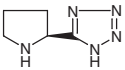
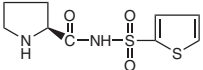
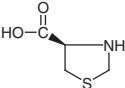
Asymmetric Organocatalysts

Eder *et al.* and Hajos *et al.* separately reported an intramolecular asymmetric aldol reaction which employed proline as the only asymmetric catalyst at the beginning of the 1970s.¹⁾ This reaction was considered to be a special case at that time. Later in 2000, List *et al.* reported an intermolecular asymmetric aldol reaction which used proline as a catalyst.²⁾ List's report received broad attention and served as a trigger to make research active for asymmetric organic catalysts. Therefore, varieties of asymmetric organic catalysts have been developed and the research has been applied to many areas.³⁾ The proline derivative **1**, having the heterocyclic ring was developed by Nakamura *et al.* It shows high TON as an asymmetric catalyst for obtaining a chiral aldol adduct.⁴⁾



Compared with conventional metal complex catalysts, asymmetric organic catalysts are considered to be environmentally friendly and are expected to be further developed because they are stable, easy to handle and free of harmful metals.

Prolines and Their Analogs		A1301	A0945	A1043
B3440	D3803	D3804	D3185	D3186
D2365	D2735	F0818	H1407	H0784
H0768	I0589	I0395	M1169	M1161

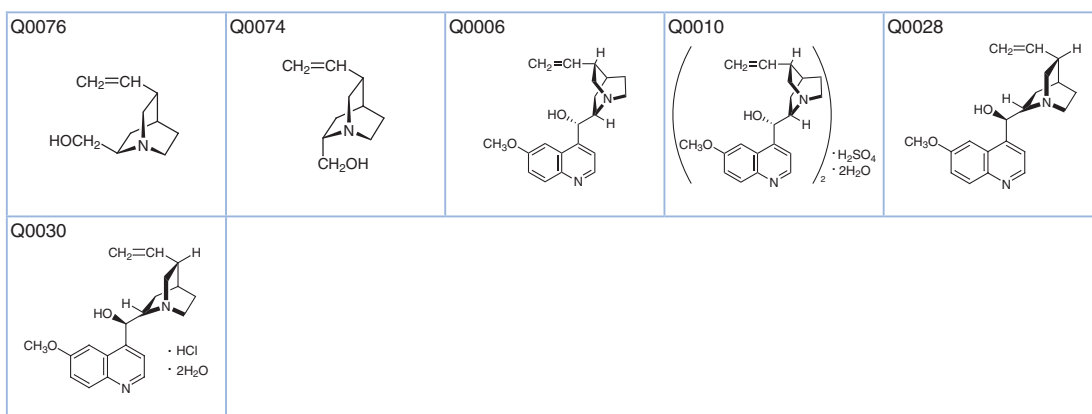
M1097	M1183	M2077	M1995	O0370
				
P1830	P1404	P0994	P0481	P1925
				
P1241	P1784	T3080	T0219	
				

Product No.	Product Name	Unit Size	
A1301	(S)-(-)-2-Aminomethyl-1-ethylpyrrolidine	1g	5g
A0945	(S)-(+)-2-(Anilinomethyl)pyrrolidine	1g	5g
A1043	L-Azetidine-2-carboxylic Acid	100mg	1g
B3440	<i>trans</i> -4-(<i>tert</i> -Butyldiphenylsilyloxy)-L-proline	1g	5g
D3803	(R)-(+)-2-(Diphenylmethyl)pyrrolidine		1g
D3804	(S)-(-)-2-(Diphenylmethyl)pyrrolidine		1g
D3185	(2 <i>R</i> ,5 <i>R</i>)-2,5-Diphenylpyrrolidine	100mg	
D3186	(2 <i>S</i> ,5 <i>S</i>)-2,5-Diphenylpyrrolidine	100mg	
D2365	(R)-(+)- α,α -Diphenyl-2-pyrrolidinemethanol	1g	5g
D2735	(S)-(-)- α,α -Diphenyl-2-pyrrolidinemethanol	1g	5g
F0818	<i>trans</i> -4-Fluoro-L-proline		50mg
H1407	(2 <i>S</i>)- <i>N</i> -[(1 <i>S</i>)-1-(Hydroxydiphenylmethyl)-3-methylbutyl]-2-pyrrolidinecarboxamide	200mg	1g
H0784	(R)-(-)-2-[Hydroxy(diphenyl)methyl]-1-methylpyrrolidine	1g	5g
H0768	(S)-(+)-2-[Hydroxy(diphenyl)methyl]-1-methylpyrrolidine	100mg	1g
I0589	(R)-(+)-Indoline-2-carboxylic Acid		1g
I0395	(S)-(-)-Indoline-2-carboxylic Acid	1g	5g
M1169	(R)-2-(Methoxymethyl)pyrrolidine	1g	5g
M1161	(S)-2-(Methoxymethyl)pyrrolidine	1g	5g
M1097	(S)-(-)-1-Methyl-2-(1-naphthylaminomethyl)pyrrolidine		1g
M1183	(S)-(-)-1-Methyl-2-(1-piperidinomethyl)pyrrolidine	1g	5g
M2077	α -Methyl-L-proline	1g	5g
M1995	(S)-2-[(1-Methyl-2-pyrrolidinyl)methyl]isoindoline Dihydrochloride	1g	5g
O0370	(2 <i>S</i> ,3 <i>aS</i> ,7 <i>aS</i>)-Octahydro-1 <i>H</i> -indole-2-carboxylic Acid	1g	5g
P1830	D-Pipecolic Acid	5g	25g
P1404	L-Pipecolic Acid	1g	5g
P0994	D-Proline	5g	25g
P0481	L-Proline	25g	250g
P1925	(R)-(-)-1-(2-Pyrrolidinylmethyl)pyrrolidine		1g
P1241	(S)-(+)-1-(2-Pyrrolidinylmethyl)pyrrolidine	1g	5g
P1784	(S)-5-(Pyrrolidin-2-yl)-1 <i>H</i> -tetrazole	100mg	500mg
T3080	<i>N</i> -(2-Thiophenesulfonyl)-L-prolinamide		100mg
T0219	L-Thioprolinamide	25g	500g

Other Amino Acids		A0177	A0179	B3398
M0102	M0099	P0135	P0134	T2937
T0228	T0230	T0539	T0541	

Product No.	Product Name	Unit Size	
A0177	D-Alanine	5g	25g
A0179	L-Alanine	25g	250g
B3398	O-tert-Butyl-L-threonine	1g	5g
M0102	D-Methionine	1g	5g
M0099	L-Methionine	25g	100g
P0135	D-Phenylalanine	5g	25g
P0134	L-Phenylalanine	25g	250g
T2937	O-TBDPS-D-Thr-N-Boc-L-tert-Leu-Diphenylphosphine		100mg
T0228	D-(+)-Threonine	25g	500g
T0230	L-(-)-Threonine	25g	100g
T0539	D-Tryptophan	5g	25g
T0541	L-Tryptophan		25g

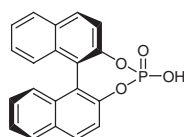
Cinchona Alkaloids		B1683	B1689	B1684
B1685	C0347	C0348	C0349	C0350
C0351	D4306	D4305	H0752	I0728



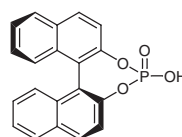
Product No.	Product Name	Unit Size	
B1683	<i>N</i> -Benzylcinchonidinium Chloride	10g	
B1689	<i>N</i> -Benzylcinchoninium Chloride	5g	
B1684	<i>N</i> -Benzylquinidinium Chloride	5g	
B1685	<i>N</i> -Benzylquininium Chloride	5g	
C0347	Cinchonidine	25g	250g
C0348	Cinchonidine Dihydrochloride	25g	
C0349	Cinchonidine Sulfate Dihydrate	25g	
C0350	Cinchonine	25g	200g
C0351	Cinchonine Hydrochloride Hydrate	25g	
D4306	<i>N</i> -(9-Deoxy- <i>epi</i> -cinchonidin-9-yl)picolinamide	100mg	
D4305	<i>N</i> -(9-Deoxy- <i>epi</i> -cinchonin-9-yl)picolinamide	100mg	
H0752	Hydroquinidine Hydrochloride	25g	250g
I0728	β -Isocupreidine	1g	
Q0076	Quinidine	100mg	1g
Q0074	Quinidine	100mg	1g
Q0006	Quinidine	5g	25g
Q0010	Quinidine Sulfate Dihydrate	5g	25g
Q0028	Quinine	25g	100g
Q0030	Quinine Hydrochloride Dihydrate	25g	

Chiral Phosphoric Acids

B1143



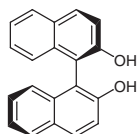
B1144



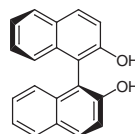
Product No.	Product Name	Unit Size	
B1143	(<i>R</i>)-(-)-1,1'-Binaphthyl-2,2'-diyl Hydrogen Phosphate	100mg	1g 5g
B1144	(<i>S</i>)-(+)-1,1'-Binaphthyl-2,2'-diyl Hydrogen Phosphate	100mg	1g

Chiral Diols

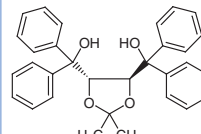
B1142

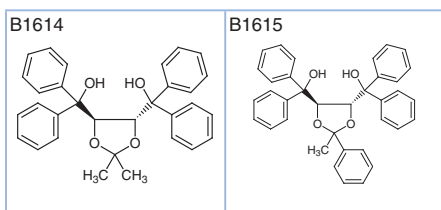


B1100



B2048





Product No.	Product Name	Unit Size	
B1142	(<i>R</i>)-(+)-1,1'-Bi-2-naphthol	5g	25g
B1100	(<i>S</i>)-(-)-1,1'-Bi-2-naphthol	5g	25g
B2048	(+)-4,5-Bis[hydroxy(diphenyl)methyl]-2,2-dimethyl-1,3-dioxolane	1g	5g
B1614	(-)-4,5-Bis[hydroxy(diphenyl)methyl]-2,2-dimethyl-1,3-dioxolane	1g	5g
B1615	(+)-4,5-Bis[hydroxy(diphenyl)methyl]-2-methyl-2-phenyl-1,3-dioxolane	1g	

Chiral Phase-transfer Catalysts (see p.110)

Others		B3296	B3549	B3592
B3593	C0015	C0972	D3983	D3984
E0974	I0807	L0272	L0236	L0137
T1215				

Product No.	Product Name	Unit Size	
B3296	(+)-Benzotetramisole	200mg	1g
B3549	(-)-Benzotetramisole	1g	
B3592	(<i>R</i>)-Benzyl-2-[4-(trifluoromethyl)phenyl]-6,7-dihydro-5 <i>H</i> -pyrrolo[2,1- <i>c</i>][1,2,4]triazolium Tetrafluoroborate	200mg	1g
B3593	(<i>S</i>)-Benzyl-2-[4-(trifluoromethyl)phenyl]-6,7-dihydro-5 <i>H</i> -pyrrolo[2,1- <i>c</i>][1,2,4]triazolium Tetrafluoroborate	200mg	1g

Product No.	Product Name	Unit Size		
C0015	(+)-10-Camphorsulfonic Acid	25g	100g	500g
C0972	(-)-10-Camphorsulfonic Acid	25g	100g	500g
D3983	(+)-(5a <i>R</i> ,10b <i>S</i>)-5a,10b-Dihydro-2-(2,4,6-trimethylphenyl)-4 <i>H</i> ,6 <i>H</i> -indeno[2,1- <i>b</i>][1,2,4]-triazolo[4,3- <i>d</i>][1,4]oxazinium Chloride Monohydrate			100mg
D3984	(-)-(5a <i>S</i> ,10b <i>R</i>)-5a,10b-Dihydro-2-(2,4,6-trimethylphenyl)-4 <i>H</i> ,6 <i>H</i> -indeno[2,1- <i>b</i>][1,2,4]-triazolo[4,3- <i>d</i>][1,4]oxazinium Chloride Monohydrate			100mg
E0974	(1 <i>R</i> ,3 <i>S</i> ,5 <i>R</i> ,7 <i>R</i> ,8a <i>S</i>)-7-Ethylhexahydro-1-(6-hydroxy-4-quinoliny)-3,7-methano-1 <i>H</i> -pyrrolo[2,1- <i>c</i>][1,4]oxazine			100mg
I0807	(<i>R,R</i>)-2-Iodo-1,3-bis[1-(mesitylcarbamoyl)ethoxy]benzene			200mg
L0272	Lappaconitine Hydrobromide	200mg		1g
L0236	D-(-)-Leucinol		1g	5g
L0137	L-(+)-Leucinol		5mL	25mL
T1215	Levamisole Hydrochloride	10g		25g

References

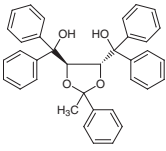
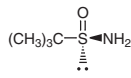
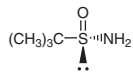
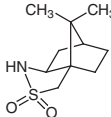
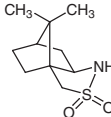
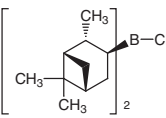
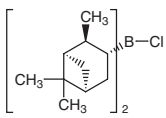
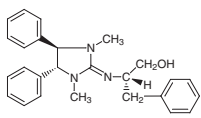
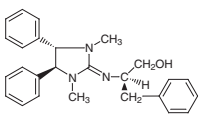
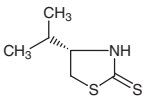
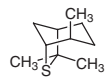
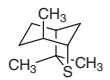
- 1) U. Eder, G. Sauer, R. Wiechert, *Angew. Chem. Int. Ed. Engl.* **1971**, *10*, 496; Z. G. Hajos, D. R. Parrish, *J. Org. Chem.* **1974**, *39*, 1615.
- 2) B. List, R. A. Lerner, C. F. Barbas III, *J. Am. Chem. Soc.* **2000**, *122*, 2395.
- 3) Review: K. N. Houk, B. List, *Acc. Chem. Res.* **2004**, *37*(8), 487-631, "Asymmetric Organocatalysis" (special edition); H. Pellissier, *Tetrahedron* **2007**, *63*, 9267; A. Berkessel, H. Gröger, in *Asymmetric Organocatalysis — from Biomimetic Concepts to Applications in Asymmetric Synthesis*, Wiley-VCH, Weinheim, **2005**.
- 4) S. Nakamura, N. Hara, H. Nakashima, K. Kubo, N. Shibata, T. Toru, *Chem. Eur. J.* **2008**, *14*, 8079.

Chiral Auxiliaries

Chiral Oxazolidinones		B1786	B1754	B2165
B2166	I0761	I0762	I0572	I0451
I0594	I0573	P1307	P1308	

Product No.	Product Name	Unit Size	
B1786	(<i>R</i>)-4-Benzyl-2-oxazolidinone	5g	25g
B1754	(<i>S</i>)-4-Benzyl-2-oxazolidinone	5g	25g
B2165	(<i>R</i>)-(-)-4-Benzyl-3-propionyl-2-oxazolidinone	1g	5g 25g
B2166	(<i>S</i>)-(+)-4-Benzyl-3-propionyl-2-oxazolidinone	1g	5g
I0761	(4 <i>R</i>)-(+)-4-Isopropyl-5,5-diphenyl-2-oxazolidinone	1g	5g
I0762	(4 <i>S</i>)-(-)-4-Isopropyl-5,5-diphenyl-2-oxazolidinone	1g	5g
I0572	(<i>R</i>)-4-Isopropyl-2-oxazolidinone	1g	5g 25g
I0451	(<i>S</i>)-4-Isopropyl-2-oxazolidinone	1g	5g 25g
I0594	(<i>R</i>)-(-)-4-Isopropyl-3-propionyl-2-oxazolidinone	1g	5g
I0573	(<i>S</i>)-(+)-4-Isopropyl-3-propionyl-2-oxazolidinone	1g	5g
P1307	(<i>R</i>)-(-)-4-Phenyl-2-oxazolidinone	5g	25g
P1308	(<i>S</i>)-(+)-4-Phenyl-2-oxazolidinone	5g	25g

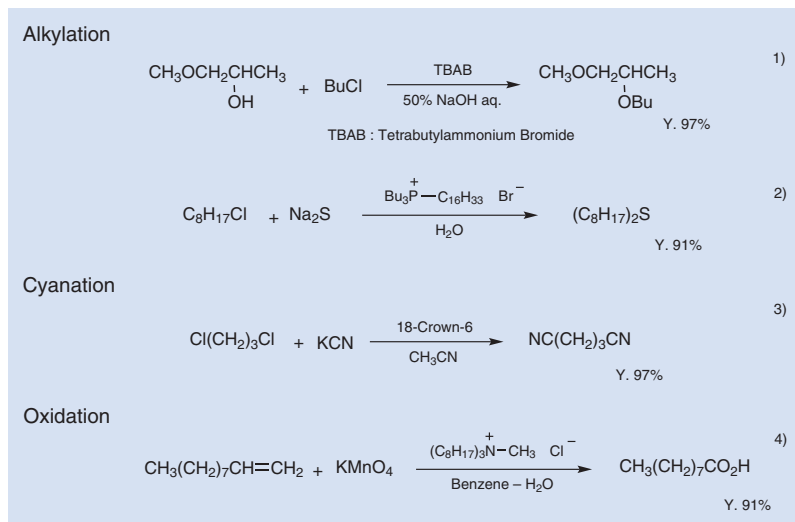
Others		A1534	A1535	B2103
B2104	P1371	P1372	B2048	B1614

B1615	B2907	B2908	C1324	C1325
				
C1614	C2023 C1615	D2898	D2899	I0575
				
T2578	T2579			
				

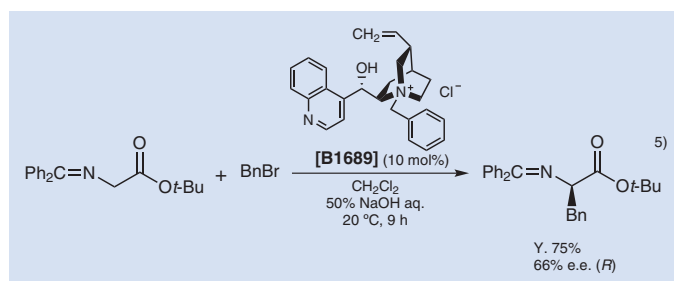
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A1534	Acetic Acid (1 <i>R</i> ,2 <i>S</i>)-2-[<i>N</i> -Benzyl- <i>N</i> -(mesitylenesulfonyl)amino]-1-phenylpropyl Ester [Reagent for double aldol reaction]	1g	5g
A1535	Acetic Acid (1 <i>S</i> ,2 <i>R</i>)-2-[<i>N</i> -Benzyl- <i>N</i> -(mesitylenesulfonyl)amino]-1-phenylpropyl Ester [Reagent for double aldol reaction]	1g	5g
B2103	(1 <i>R</i> ,2 <i>S</i>)-2-[<i>N</i> -Benzyl- <i>N</i> -(mesitylenesulfonyl)amino]-1-phenyl-1-propanol	1g	5g
B2104	(1 <i>S</i> ,2 <i>R</i>)-2-[<i>N</i> -Benzyl- <i>N</i> -(mesitylenesulfonyl)amino]-1-phenyl-1-propanol	1g	5g
P1371	(1 <i>R</i> ,2 <i>S</i>)-2-[<i>N</i> -Benzyl- <i>N</i> -(mesitylenesulfonyl)amino]-1-phenylpropyl Propionate [Reagent for <i>anti</i> -selective asymmetric aldol reaction]	1g	5g
P1372	(1 <i>S</i> ,2 <i>R</i>)-2-[<i>N</i> -Benzyl- <i>N</i> -(mesitylenesulfonyl)amino]-1-phenylpropyl Propionate [Reagent for <i>anti</i> -selective asymmetric aldol reaction]	1g	5g
B2048	(+)-4,5-Bis[hydroxy(diphenyl)methyl]-2,2-dimethyl-1,3-dioxolane	1g	5g
B1614	(-)-4,5-Bis[hydroxy(diphenyl)methyl]-2,2-dimethyl-1,3-dioxolane	1g	5g
B1615	(+)-4,5-Bis[hydroxy(diphenyl)methyl]-2-methyl-2-phenyl-1,3-dioxolane	1g	5g
B2907	(<i>R</i>)-(+)- <i>tert</i> -Butylsulfinamide	1g	5g
B2908	(<i>S</i>)-(-)- <i>tert</i> -Butylsulfinamide	1g	5g
C1324	(+)-10,2-Camphorsultam	1g	5g
C1325	(-)-10,2-Camphorsultam	1g	5g
C1614	(+)- <i>B</i> -Chlorodiisopinocampheylborane (58% in Hexane, ca. 1.6mol/L)	100mL	5g
C2023	(-)- <i>B</i> -Chlorodiisopinocampheylborane (55-65% in Heptane, ca. 1.7mol/L)	100mL	5g
C1615	(-)- <i>B</i> -Chlorodiisopinocampheylborane (60% in Hexane, ca. 1.7mol/L)	100mL	5g
D2898	(4 <i>R</i> ,5 <i>R</i>)-1,3-Dimethyl-4,5-diphenyl-2-[(<i>S</i>)-1-benzyl-2-hydroxyethylimino]imidazolidine	100mg	5g
D2899	(4 <i>S</i> ,5 <i>S</i>)-1,3-Dimethyl-4,5-diphenyl-2-[(<i>R</i>)-1-benzyl-2-hydroxyethylimino]imidazolidine	100mg	5g
I0575	(<i>S</i>)-4-Isopropylthiazolidine-2-thione	1g	5g
T2578	(1 <i>R</i> ,4 <i>R</i> ,5 <i>R</i>)-4,7,7-Trimethyl-6-thiabicyclo[3.2.1]octane	1g	5g
T2579	(1 <i>S</i> ,4 <i>S</i> ,5 <i>S</i>)-4,7,7-Trimethyl-6-thiabicyclo[3.2.1]octane	1g	5g

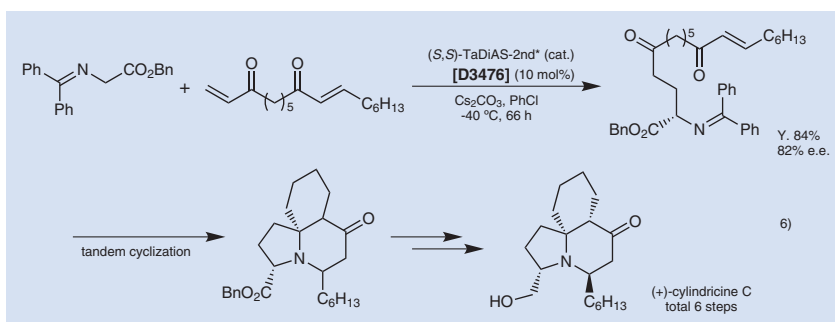
Chiral Phase-transfer Catalysts

A phase-transfer catalyst enables the reaction in a heterogeneous system between general organic compounds soluble in organic solvents and compounds soluble in water such as inorganic salts. The reaction can be accomplished in a biphasic system of an inexpensive nonpolar aprotic solvent and water without using DMSO or DMF which are high-polar solvents. A phase-transfer catalyst is soluble in both solvents, and it carries anions of inorganic salts into organic solvents and returns them into the water phase. Reactions usually progress under mild conditions with easy work-up procedures. For this reason, they are also used industrially. Typical phase-transfer catalysts are quaternary ammonium salts, crown ethers, and phosphonium compounds etc. Reaction examples are shown as follows.¹⁻⁴⁾



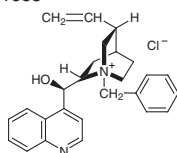
The asymmetric synthesis is realized using optically-active phase-transfer catalysts. The asymmetric synthesis using the cinchona alkaloid derivative as a phase-transfer catalyst was reported in the 1980s.⁵⁾ Shibasaki *et al.* succeeded in the total synthesis of cylindricine C involving the asymmetric Michael addition catalyzed by tartaric acid derivatives.⁶⁾ In this section, we introduce the cinchona alkaloid derivatives and the tartaric acid derivatives as the asymmetric phase-transfer catalysts.



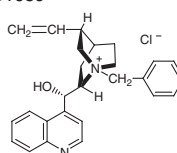


Cinchona Alkaloid Derivatives

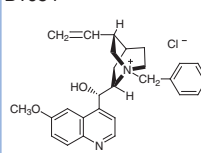
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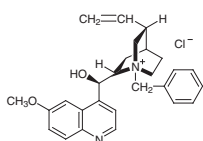
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B1684



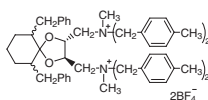
B1685



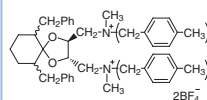
Product No.	Product Name	Unit Size
B1683	N-Benzylcinchonidinium Chloride	10g
B1689	N-Benzylcinchoninium Chloride	5g
B1684	N-Benzylquinidinium Chloride	5g
B1685	N-Benzylquininium Chloride	5g

Tartaric Acid Derivatives

D3475



D3476



Product No.	Product Name	Unit Size
D3475	6,10-Dibenzyl-N,N'-dimethyl-N,N',N'',N'''-tetrakis(4-methylbenzyl)-1,4-dioxaspiro[4.5]decane-(2R,3R)-diylbis(methylammonium) Tetrafluoroborate [(R,R)-TaDiAS-2nd]	200mg 1g
D3476	6,10-Dibenzyl-N,N'-dimethyl-N,N',N'',N'''-tetrakis(4-methylbenzyl)-1,4-dioxaspiro[4.5]decane-(2S,3S)-diylbis(methylammonium) Tetrafluoroborate [(S,S)-TaDiAS-2nd]	200mg 1g

References

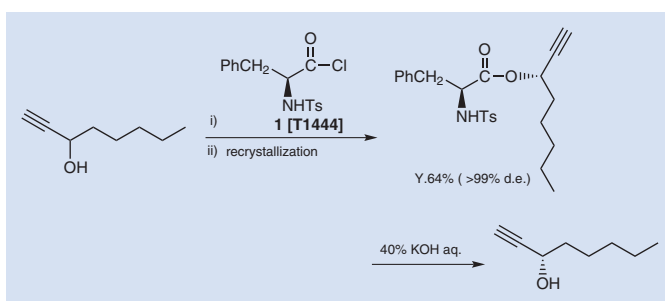
- 1) H. H. Freedman, R. A. Dubois, *Tetrahedron Lett.* **1975**, 16, 3251.
- 2) D. Landini, F. Rolla, *Synthesis* **1974**, 565.
- 3) F. L. Cook, C. W. Bowers, C. L. Liotta, *J. Org. Chem.* **1974**, 39, 3416.
- 4) C. M. Starks, *J. Am. Chem. Soc.* **1971**, 93, 195.
- 5) M. J. O'Donnell, W. D. Bennett, S. Wu, *J. Am. Chem. Soc.* **1989**, 111, 2353.
- 6) T. Shibuguchi, H. Mihara, A. Kuramochi, S. Sakuraba, T. Ohshima, M. Shibasaki, *Angew. Chem. Int. Ed.* **2006**, 45, 4635; H. Mihara, T. Shibuguchi, A. Kuramochi, T. Ohshima, M. Shibasaki, *Heterocycles* **2007**, 72, 421.
- 7) Review:
Phase-Transfer Catalysts M. Makosza, *Pure Appl. Chem.* **2000**, 72, 1399; J. M. McIntosh, *J. Chem. Educ.* **1978**, 55, 235; P. Varughese, *J. Chem. Educ.* **1977**, 54, 666; G. W. Gokel, H. D. Durst, *Synthesis* **1976**, 168; A. C. Knipe, *J. Chem. Educ.* **1976**, 53, 618; J. Dockx, *Synthesis* **1973**, 441.
Asymmetric Phase-Transfer Catalysts K. Nagasawa, *Farumashia* **2003**, 39, 670; K. Maruoka, T. Ooi, *Chem. Rev.* **2003**, 103, 3013.

Optical Resolving Agents

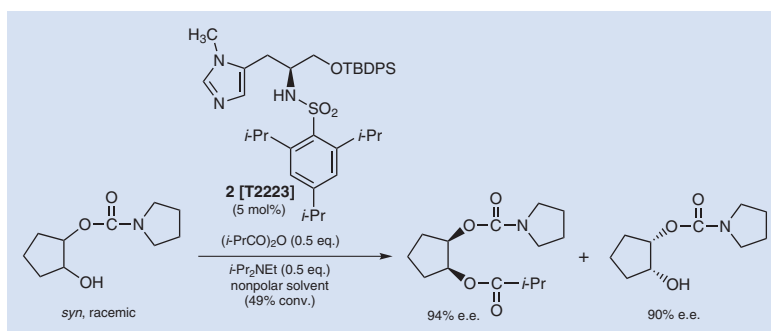
The optical resolution is the method of separating enantiomers from racemates. There are currently many methods to obtain optically active compounds. These methods include asymmetric synthesis, use of chiral building blocks, and optical resolution. In recent years, there has been rapid improvements in asymmetric synthesis, with many reports of success.

Optical resolution is widely used, as it is an easy and practical method. One of the most common optical resolution methods utilizes diastereomer which are obtained from the reaction of racemic compounds and an optical resolving agents. The differences of physical properties between diastereomers are utilized in this method. The optical resolving agents are often easily obtained from natural products. For example, alkaloids are used for the optical resolution of racemic acids and tartaric acid is used for the optical resolution of racemic bases. In both cases, diastereomeric salts are formed. When alcohols are to be resolved, the alcohols are reacted with phthalic anhydride to form half ester. The resulting carboxylic acid (half ester) is often then reacted with alkaloids to form diastereomeric salts, which are then resolved.

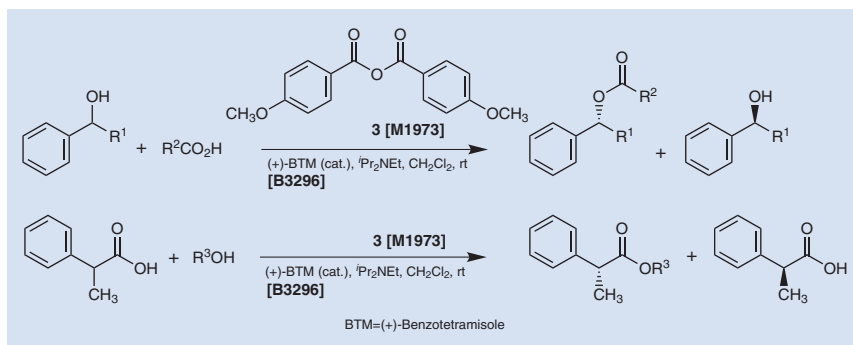
Recently, Ikegami and co-workers have reported a new resolution method for alcohols using amino acid derivatives.¹⁾ According to their report, racemic 1-octyn-3-ol is reacted with (*S*)-*N*-*p*-toluenesulfonylphenylalanyl chloride (**1**), to produce diastereomeric ester. This diastereomeric ester is recrystallized four times from mixed solution of ethanol and hexane, giving the resolved ester with a theoretical yield of 64% (>99% d.e.). Finally, (*S*)-1-octyn-3-ol is obtained by hydrolysis of pure diastereomeric ester (>99% e.e.). This method is drawing attention as an easy and accurate way to optically resolve alcohols.



On the other hand, it has been reported that optical resolution is achieved by catalytic amount of chiral source. Ishihara and co-workers have studied minimal artificial enzymes to overcome various problems of enzymatic reactions and to use optical resolution. One reagent that has been developed is *N*^c-(2,4,6-triisopropylbenzenesulfonyl)-*O*-(*tert*-butyldimethylsilyl)-*π*-methyl-L-histidinol (**2**). They reported that this reagent was a very effective catalyst for kinetic resolution of racemic alcohols by selective acylation²⁾. This reagent can also be used as catalyst for the kinetic resolution of 1,2-diols, β -hydroxycarboxylic acids, and 2-amino alcohols after the suitable derivatization.



Shiina and co-workers developed the kinetic resolution of racemic alcohols and racemic carboxylic acids using 4-methoxybenzoic anhydride (PMBA) (**3**) and a Birman-type asymmetric catalyst⁽³⁾ [(+)-benzotetramisole, (+)-BTM].⁽⁴⁾ For example, in the reaction of racemic alcohols with achiral carboxylic acids, first the mixed anhydrides are formed from PMBA and the carboxylic acids. Subsequently the mixed anhydrides and one enantiomer of racemic alcohol react preferentially to form optically active esters and optically active alcohols using catalyst (+)-BTM. If this reaction is performed replacing the reactive substrates with racemic carboxylic acids and achiral alcohols, the kinetic resolution proceeds efficiently and optically active esters and optically active carboxylic acids can be obtained. The optical resolution of an anti-inflammatory agent, ibuprofen, has been achieved as an example of this reaction.

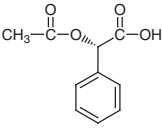
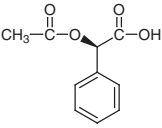
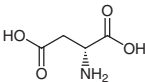
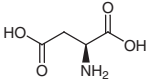
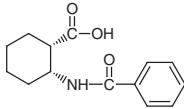
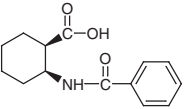
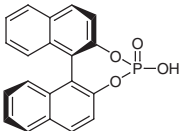
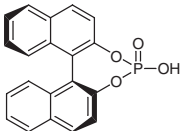
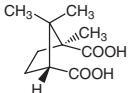
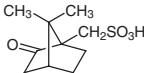
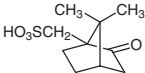
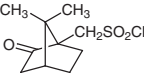
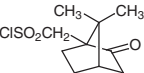
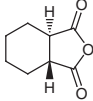
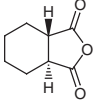
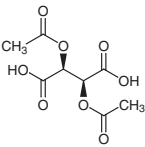
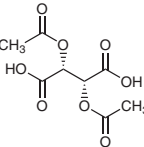
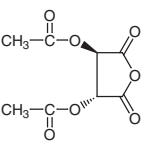


for Resolution of Acids		A1230	A1231	A1017
A1029	A0526	A0528	B3296	B3549
B1119	B1118	B0946 B0670	B0671	C0347
C0348	C0349	C0350	C0351	C0791

D1588	H0752	L0129	L0131	L0128
L0071	M0826	M0545	N0543	N0482
N0481	P1289	P1028	P0794	P0793
P1118	Q0006	Q0010	Q0028	Q0030
S0249	S0257	S0093	S0094	T1380
T1381				

Product No.	Product Name	Unit Size	
A1230	(1 <i>R</i> ,2 <i>S</i>)-(-)-2-Amino-1,2-diphenylethanol	1g	5g
A1231	(1 <i>S</i> ,2 <i>R</i>)-(+)-2-Amino-1,2-diphenylethanol	1g	5g
A1017	D-(-)- <i>threo</i> -2-Amino-1-(4-nitrophenyl)-1,3-propanediol	25g	500g
A1029	D-(-)-Arginine	1g	5g
A0526	L-(+)-Arginine	25g	100g 500g
A0528	L-(+)-Arginine Hydrochloride	25g	500g
B3296	(+)-Benzotetramisole	200mg	1g
B3549	(-)-Benzotetramisole		1g
B1119	(+)- <i>cis</i> -2-Benzylaminocyclohexanemethanol	1g	5g
B1118	(-)- <i>cis</i> -2-Benzylaminocyclohexanemethanol	1g	5g
B0946	Brucine Anhydrous		25g
B0670	Brucine Hydrate		25g
B0671	Brucine Hydrochloride Monohydrate		5g
C0347	Cinchonidine	25g	250g

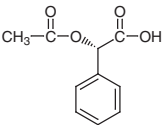
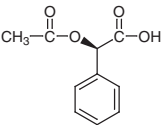
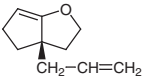
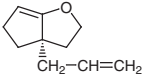
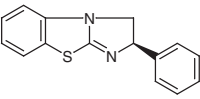
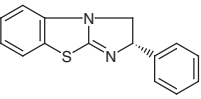
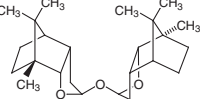
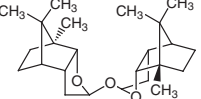
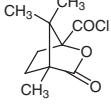
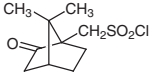
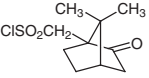
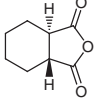
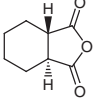
Product No.	Product Name	Unit Size	
C0348	Cinchonidine Dihydrochloride	25g	
C0349	Cinchonidine Sulfate Dihydrate	25g	
C0350	Cinchonine	25g	200g
C0351	Cinchonine Hydrochloride Hydrate	25g	
C0791	Cinchonine Sulfate Dihydrate	25g	
D1588	(+)-Dehydroabietylamine	5g	25g
H0752	Hydroquinidine Hydrochloride	25g	250g
L0129	L-(+)-Lysine	5g	25g
L0131	L-(+)-Lysine Dihydrochloride	25g	
L0128	D-(-)-Lysine Monohydrochloride	5g	25g
L0071	L-(+)-Lysine Monohydrochloride	25g	500g
M0826	(+)-Menthol	25g	500g
M0545	(-)-Menthol	25g	100g 500g
N0543	(S)- α -Methyl-4-nitrobenzylamine Hydrochloride	1g	
N0482	(R)-(+)-1-(1-Naphthyl)ethylamine	1g	5g
N0481	(S)-(-)-1-(1-Naphthyl)ethylamine	1g	5g
P1289	D-Phenylalaninol	5g	25g
P1028	L-Phenylalaninol	5g	25g
P0794	(R)-(+)-1-Phenylethylamine	25mL	100mL 500mL
P0793	(S)-(-)-1-Phenylethylamine	25mL	100mL 500mL
P1118	(S)-1-Phenyl-2-(p-tolyl)ethylamine	5g	25g
Q0006	Quinidine	5g	25g
Q0010	Quinidine Sulfate Dihydrate	5g	25g
Q0028	Quinine	25g	100g
Q0030	Quinine Hydrochloride Dihydrate	25g	
S0249	Strychnine	25g	
S0257	Strychnine Hydrochloride Hydrate	25g	
S0093	Strychnine Nitrate	25g	
S0094	Strychnine Sulfate Pentahydrate	25g	
T1380	(R)-(+)-1-(p-Tolyl)ethylamine	1mL	
T1381	(S)-(-)-1-(p-Tolyl)ethylamine	1mL	5mL

for Resolution of Bases		A1454 	A1453 	A0545 
A0546 	B1121 	B1120 	B1143 	B1144 
C0012 	C0015 	C0972 	C0998 	C1308 
C1417 	C1418 	D2636 	D1386 	D1911 

D2645 	D1398 D3826 	D1354 D3492 	D1853 	D1417
D1387 	G0057 	G0059 	M0021 	M0022
M0662 	M0661 	M1221 	M0990 	M1021
I0334 	I0335 	M1622 	M0824 	I0336
I0398 	P1354 	P0573 	Q0009 	T0026
T0025 	T1702 	T1163 		

Product No.	Product Name	Unit Size	
A1454	(+)-O-Acetyl-L-mandelic Acid	5g	25g
A1453	(-)-O-Acetyl-D-mandelic Acid	5g	25g
A0545	D-Aspartic Acid		25g
A0546	L-Aspartic Acid	25g	500g
B1121	(+)-cis-2-Benzamidocyclohexanecarboxylic Acid		5g
B1120	(-)-cis-2-Benzamidocyclohexanecarboxylic Acid		5g
B1143	(R)-(-)-1,1'-Binaphthyl-2,2'-diyl Hydrogen Phosphate	100mg	1g
B1144	(S)-(+)-1,1'-Binaphthyl-2,2'-diyl Hydrogen Phosphate	100mg	1g
C0012	(+)-Camphoric Acid	25g	100g
C0015	(+)-10-Camphorsulfonic Acid	25g	100g
C0972	(-)-10-Camphorsulfonic Acid	25g	500g
C0998	(+)-10-Camphorsulfonyl Chloride	10g	25g
C1308	(-)-10-Camphorsulfonyl Chloride	5g	25g
C1417	(+)-trans-1,2-Cyclohexanedicarboxylic Anhydride	100mg	1g

Product No.	Product Name	Unit Size	
C1418	(-)- <i>trans</i> -1,2-Cyclohexanedicarboxylic Anhydride	100mg	1g
D2636	(+)-Diacetyl-D-tartaric Acid		5g
D1386	(-)-Diacetyl-L-tartaric Acid		25g
D1911	(+)-Diacetyl-L-tartaric Anhydride		25g
D2645	(-)-Diacetyl-D-tartaric Anhydride	5g	25g
D1398	(+)-Dibenzoyl-D-tartaric Acid Monohydrate	25g	500g
D3826	(+)-Dibenzoyl-D-tartaric Acid	25g	250g
D1354	(-)-Dibenzoyl-L-tartaric Acid Monohydrate	25g	500g
D3492	(-)-Dibenzoyl-L-tartaric Acid	25g	250g
D1853	(<i>R</i>)-(-)- <i>N</i> -(3,5-Dinitrobenzoyl)- α -phenylglycine	1g	5g
D1417	(+)-Di- <i>p</i> -toluoyl-D-tartaric Acid	25g	250g
D1387	(-)-Di- <i>p</i> -toluoyl-L-tartaric Acid	25g	250g
G0057	D-Glutamic Acid	25g	250g
G0059	L-Glutamic Acid	25g	500g
M0021	D-(+)-Malic Acid	5g	25g
M0022	L-(-)-Malic Acid	25g	100g 500g
M0662	D-(-)-Mandelic Acid	25g	100g 500g
M0661	L-(+)-Mandelic Acid	25g	250g
M1221	(+)-Menthyl Chloroformate	5mL	25mL
M0990	(-)-Menthyl Chloroformate	5mL	25mL
M1021	(<i>S</i>)-(+)-2-(6-Methoxy-2-naphthyl)propionic Acid	25g	500g
I0334	(<i>R</i>)-(+)- α -Methylbenzyl Isocyanate	1g	5g 25g
I0335	(<i>S</i>)-(-)- α -Methylbenzyl Isocyanate		1g 5g
M1622	(<i>R</i>)-(+)- <i>N</i> -(α -Methylbenzyl)phthalamic Acid	1g	5g
M0824	(<i>S</i>)-(-)- <i>N</i> -(α -Methylbenzyl)phthalamic Acid		1g
I0336	(<i>R</i>)-(-)-1-(1-Naphthyl)ethyl Isocyanate	1g	5g
I0398	(<i>S</i>)-(+)-1-(1-Naphthyl)ethyl Isocyanate	1g	5g
P1354	D-Pyroglutamic Acid	5g	25g
P0573	L-Pyroglutamic Acid	25g	500g
Q0009	D-(-)-Quinic Acid	5g	25g
T0026	D-(-)-Tartaric Acid	25g	500g
T0025	L-(+)-Tartaric Acid	25g	500g
T1702	(2 <i>R</i> ,3 <i>R</i>)-Tartranilic Acid	1g	5g
T1163	(+)- α -(2,4,5,7-Tetranitro-9-fluorenylideneaminoxy)propionic Acid		1g

for Resolution of Alcohols & Thiols		A1454	A1453	A2128
				
A1984	B3296	B3549	B1219	B1220
				
C1022	C0998	C1308	C1417	C1418
				

M0573	M0571	M1221	M0990	I0334
I0335	N0581	I0336	I0398	N0582
T1444	T2223			

Product No.	Product Name	Unit Size	
A1454	(+)-O-Acetyl-L-mandelic Acid	5g	25g
A1453	(-)-O-Acetyl-D-mandelic Acid	5g	25g
A2128	(R)-5-Allyl-2-oxabicyclo[3.3.0]oct-8-ene	1g	5g
A1984	(S)-5-Allyl-2-oxabicyclo[3.3.0]oct-8-ene		1g
B3296	(+)-Benzotetramisole	200mg	1g
B3549	(-)-Benzotetramisole		1g
B1219	Bis[(2R,3aS,4R,7aS)-octahydro-7,8,8-trimethyl-4,7-methanobenzofuran-2-yl] Ether		100mg
B1220	Bis[(2S,3aR,4S,7aR)-octahydro-7,8,8-trimethyl-4,7-methanobenzofuran-2-yl] Ether		100mg
C1022	(-)-Camphanic Chloride	1g	5g
C0998	(+)-10-Camphorsulfonyl Chloride	10g	25g
C1308	(-)-10-Camphorsulfonyl Chloride		5g
C1417	(+)-trans-1,2-Cyclohexanedicarboxylic Anhydride	100mg	1g
C1418	(-)-trans-1,2-Cyclohexanedicarboxylic Anhydride	100mg	1g
M0573	(-)-Menthoxycetic Acid		5g
M0571	(-)-Menthoxycetyl Chloride		10g
M1221	(+)-Menthyl Chloroformate	5mL	25mL
M0990	(-)-Menthyl Chloroformate	5mL	25mL
I0334	(R)-(+)-α-Methylbenzyl Isocyanate	1g	5g
I0335	(S)-(-)-α-Methylbenzyl Isocyanate		1g
N0581	N-(1-Naphthalenesulfonyl)-L-phenylalanyl Chloride		5g
I0336	(R)-(-)-1-(1-Naphthyl)ethyl Isocyanate		1g
I0398	(S)-(+)-1-(1-Naphthyl)ethyl Isocyanate		1g
N0582	N-(4-Nitrophenylsulfonyl)-L-phenylalanyl Chloride		5g
T1444	N-(p-Toluenesulfonyl)-L-phenylalanyl Chloride		5g
T2223	N ^a -(2,4,6-Triisopropylbenzenesulfonyl)-O-(tert-butyl)phenyl-L-histidinol		100mg

References

- 1) S. Hashimoto, S. Kase, A. Suzuki, Y. Yanagiya, S. Ikegami, *Synth. Commun.* **1991**, *21*, 833; Tokyo Kasei Kogyo Co., Ltd., Jpn. Kokai Tokkyo Koho 04 273835, **1992**.
- 2) K. Ishihara, Y. Kosugi, M. Akakura, *J. Am. Chem. Soc.* **2004**, *126*, 12212.
- 3) V. B. Birman, X. Li, *Org. Lett.* **2006**, *8*, 1351.
- 4) I. Shiina, K. Nakata, *Tetrahedron Lett.* **2007**, *48*, 8314; I. Shiina, K. Nakata, Y. Onda, *Eur. J. Org. Chem.* **2008**, 5887.

Protection & Derivatization

In organic synthesis, when a reaction is to be carried out selectively at one functional group of a multifunctional compound, other reactive functional groups must be converted into inactive functional groups and protected temporarily. Therefore, appropriate use of protecting agents is very important to the synthetic strategy. Useful protecting agents must have properties as follows:

- The protecting agents must selectively react with the desired functional group requiring protection.
- The protecting groups must be introduced in high yields without any side reactions.
- The protected functional groups should be stable under various reaction conditions.
- The protecting groups must be chemoselectively deprotected under specific conditions without deprotection of other kinds of protecting groups.

Especially in the synthesis of structurally complex compounds, designing the synthetic strategies such as selection of protecting groups and the efficient deprotection process are key steps to achieve. It is expected that a wide variety of protecting agents are available.

The following shows various kinds of protecting agents available for purchase. They are classified from the viewpoint of deprotection conditions. Please make use of this list for your study of organic synthesis.

Silylation

Silyl groups are the most commonly used protecting groups to protect hydroxy groups, and also used for the protection of carboxyl groups and amino groups. TMS and TES groups are commonly used as general protecting groups, while TIPS, TBS (TBDMS) and TBDPS groups are used for introducing bulky substituents. Silyl protecting groups are usually deprotected by acid or fluoride ion mediated hydrolysis.

A2298 	A2299 	A0729 	B2334 	B1906
B1688 	B1773 	B1699 	B1436 	B0995
B3565 	B1043 	B2697 	T1525 	B1223
B3566 	B2898 	B1663 	D2262 	T2116

T0589	C0306	C2411	D2469	D3135
D1608	D2334	T1468	D1594	I0324
M1199	M0536	T1689	T1078	T1588
T2591	T0585	T1277	T1535	T1573
T0871				

Product No.	Product Name	Unit Size	
A2298	Allyl(<i>tert</i> -butyl)dimethylsilane	5g	
A2299	Allyltriethylsilane	5g	
A0729	Allyltrimethylsilane	25mL	250mL
B2334	Benzylchlorodimethylsilane	5g	
B1906	<i>N,O</i> -Bis(<i>tert</i> -butyldimethylsilyl)acetamide	5g	
B1688	1,2-Bis(chlorodimethylsilyl)ethane	5g	25g
B1773	1,2-Bis[(dimethylamino)dimethylsilyl]ethane	5g	
B1699	1,2-Bis(dimethylsilyl)benzene	5mL	
B1436	<i>tert</i> -Butoxydiphenylchlorosilane (stabilized with CaCO ₃)	5mL	25mL
B0995	<i>tert</i> -Butyldimethylchlorosilane	5g	25g 100g
B3565	<i>tert</i> -Butyldimethylsilane	5g	
B1043	1-(<i>tert</i> -Butyldimethylsilyl)imidazole	1g	5g
B2697	<i>tert</i> -Butyldimethylsilyl <i>N</i> -Phenylbenzimidate	5g	
T1525	<i>tert</i> -Butyldimethylsilyl Trifluoromethanesulfonate	5g	25g
B1223	<i>tert</i> -Butyldiphenylchlorosilane	5mL	25mL 100mL
B3566	<i>tert</i> -Butyldiphenylsilane	5g	
B2898	<i>tert</i> -Butyldiphenylsilyl Trifluoromethanesulfonate	1g	5g
B1663	<i>tert</i> -Butylmethoxyphenylsilyl Bromide	1g	
D2262	Chlorodiethylisopropylsilane	1g	5g
T2116	Chloro(dimethyl)hexylsilane	5g	25g
T0589	Chlorotriethylsilane	5g	25g 100g
C0306	Chlorotrimethylsilane	25mL	100mL 500mL
C2411	Chlorotris(trimethylsilyl)silane	5g	
D2469	Di- <i>tert</i> -butyldichlorosilane	5g	

Product No.	Product Name	Unit Size	
D3135	Di- <i>tert</i> -butylsilyl Bis(trifluoromethanesulfonate)	1g	5g
D1608	1,3-Dichloro-1,1,3,3-tetraisopropylidisiloxane	5g	25g
D2334	1,3-Dichloro-1,1,3,3-tetramethyldisiloxane	5g	25g
T1468	Diethylisopropylsilyl Trifluoromethanesulfonate	1g	5g
D1594	Dimethylisopropylchlorosilane	5mL	25mL
I0324	Isopropenyloxytrimethylsilane		5mL
M1199	1-Methoxy-1-trimethylsilyloxypropene	1g	5g
M0536	<i>N</i> -Methyl- <i>N</i> -trimethylsilylacetamide	10g	25g
T1689	Triethylsilyl Trifluoromethanesulfonate	5g	25g
T1078	Triisopropylsilyl Chloride	5mL	25mL 250mL
T1588	Triisopropylsilyl Trifluoromethanesulfonate	5g	25g
T2591	<i>N</i> -[2-(Trimethylsilyl)ethoxycarbonyloxy]succinimide	1g	5g
T0585	<i>N</i> -Trimethylsilylimidazole	25g	100g
T1277	<i>N</i> -(Trimethylsilyl)morpholine	5mL	25mL
T1535	3-Trimethylsilyl-2-oxazolidinone		5g
T1573	4-Trimethylsilyloxy-3-penten-2-one		25mL
T0871	Trimethylsilyl Trifluoromethanesulfonate	5g	25g 250g

● Acylation

Acyl protecting groups are used for the protection of hydroxy groups and amino groups. Acetyl (Ac), benzoyl (Bz), and pivaloyl (Piv) groups are commonly used. Pivaloyl group can selectively protect less sterically-hindered hydroxy groups due to its steric-hindrance. Generally, it is stable under acidic conditions and oxidative conditions. Acyl protecting groups are deprotected under basic conditions or reductive conditions (DIBAL, LAH, etc.).

A2301	B0105	B3571	B3567	T0872
M2594	P1894	P0677	T0670	

Product No.	Product Name	Unit Size	
A2301	3-Acetylthiazolidine-2-thione		5g
B0105	Benzoyl Chloride	25mL	500mL
B3571	3-Benzoylthiazolidine-2-thione	1g	5g
B3567	Benzoyl Trifluoromethanesulfonate		5g
T0872	S-Ethyl Trifluoroacetate		5mL
M2594	Methyl Pentafluorophenyl Carbonate		1g
P1894	Pentafluorophenyl Trifluoroacetate	5g	25g
P0677	Pivaloyl Chloride	25mL	500mL
T0670	1-(Trifluoroacetyl)imidazole	5g	25g

● Acetalization & Thioacetalization

Acetals and thioacetals are used for the protection of hydroxy groups and thiol groups, the same as for carbonyl groups of aldehydes and ketones. The protecting groups are introduced by the reaction of alcohols or thiols with carbonyl compounds under acidic conditions. Acetals are stable under basic conditions and reductive conditions, and are inert against nucleophiles such as organometallic reagents. The deprotections are carried out by hydrolysis under acidic conditions. Thioacetals are usually stable in both acidic and basic aqueous solutions, and deprotected by hydrolysis with the assist of mercury salts.

In addition, it is known that dithiosylates can be used for converting active methylene compounds into cyclic dithioacetals and the given cyclic dithioacetals are further transformed into carbonyl groups by hydrolysis. Also, the starting methylene groups are given by reductive desulfurization.^{1,2)}

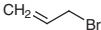
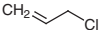
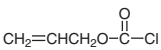
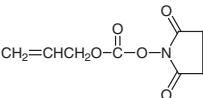
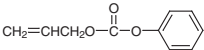
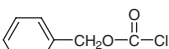
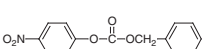
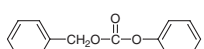
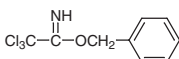
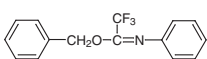
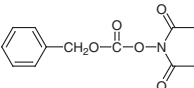
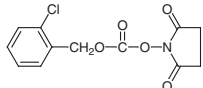
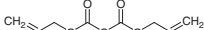
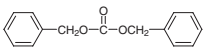
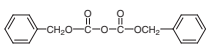
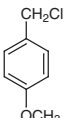
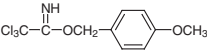
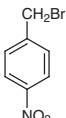
A0480 	A1247 	B2379 	B1151 	B1257
B3563 	B3577 	D0555 	D0626 	D4208
E0478 	E0479 	E0471 	E0105 	I0303
P1378 	P0763 	D2390 		

Product No.	Product Name	Unit Size	
A0480	<i>p</i> -Anisaldehyde	25mL	500mL
A1247	<i>p</i> -Anisaldehyde Dimethyl Acetal	25mL	500mL
B2379	Benzaldehyde		500g
B1151	1,3-Benzodithiolium Tetrafluoroborate		5g
B1257	Benzyl Isopropenyl Ether	1mL	5mL
B3563	1,3-Bis(trimethylsilyloxy)propane	5g	25g
B3577	<i>tert</i> -Butyl[4-(dimethoxymethyl)phenoxy]dimethylsilane		5g
D0555	3,4-Dihydro-2 <i>H</i> -pyran	25mL	100mL 500mL
D0626	2,4-Dimethoxybenzaldehyde	25g	500g
D4208	3-(1,3-Dithian-2-ylidene)-2,4-pentanedione	1g	5g
E0478	Ethylenedioxybis(trimethylsilane)		25g
E0479	Ethylenedithiobis(trimethylsilane)		5g
E0471	Ethylene Di(thiosylate) [Protecting Reagent for Active Methylene]	5g	25g
E0105	Ethylene Glycol	25g	500g

Product No.	Product Name	Unit Size	
I0303	2-Methoxypropene	25mL	500mL
P1378	(Phenylthio)trimethylsilane	5g	25g
P0763	1,3-Propanedithiol	25mL	100mL
D2390	Trimethylene Di(thiotosylate) [Protecting Reagent for Active Methylene]	5g	25g

● Allyloxycarbonyl, Benzyloxycarbonyl, Benzyl & Allylation

Allyloxycarbonyl (Alloc), benzyloxycarbonyl (Cbz), benzyl (Bn) and allyl groups are commonly used for the protection of amino groups. These protecting groups are generally deprotected by palladium catalysts.

B0643 	C0274 	A1268 	A2302 	A2303 
B0411 	B0412 	C0176 B3021 	C1591 	B3574 
B1483 	B3234 	C1124 	C1131 	P1277 
C1600 	P1281 	M0676 	M2016 	N0181 

Product No.	Product Name	Unit Size	
B0643	Allyl Bromide	25g	500g
C0274	Allyl Chloride	25mL	500mL
A1268	Allyl Chloroformate	25g	500g
A2302	N-(Allyloxycarbonyloxy)succinimide	5g	25g
A2303	Allyl Phenyl Carbonate	5g	25g
B0411	Benzyl Bromide (stabilized with Propylene Oxide)	25g	100g 500g
B0412	Benzyl Chloride (stabilized with ε-Caprolactam)	25g	500g
C0176	Benzyl Chloroformate (30-35% in Toluene)	25mL	500mL
B3021	Benzyl Chloroformate	25g	250g
C1591	Benzyl 4-Nitrophenyl Carbonate		5g
B3574	Benzyl Phenyl Carbonate	5g	25g
B1483	Benzyl 2,2,2-Trichloroacetimidate		25g
B3234	Benzyl 2,2,2-Trifluoro-N-phenylacetimidate	1g	5g
C1124	N-Carbobenzyloxysuccinimide	25g	250g

Product No.	Product Name	Unit Size	
C1131	<i>N</i> -(2-Chlorobenzoyloxycarbonyloxy)succinimide	10g	
P1277	Diallyl Dicarbonate	1g	5g
C1600	Dibenzyl Carbonate	1g	5g
P1281	Dibenzyl Dicarbonate	5g	25g
M0676	4-Methoxybenzyl Chloride (stabilized with Amylene)		25mL
M2016	4-Methoxybenzyl 2,2,2-Trichloroacetimidate		5g
N0181	4-Nitrobenzyl Bromide	25g	500g

● 2,2,2-Trichloroethoxycarbonylation

2,2,2-Trichloroethoxycarbonyl (Troc) group is used as a protecting group for hydroxy groups and amino groups. Troc group is generally deprotected by the treatment with zinc powder or by electrolysis.

T2713	C0795

Product No.	Product Name	Unit Size	
T2713	<i>N</i> -(2,2,2-Trichloroethoxycarbonyloxy)succinimide		5g
C0795	2,2,2-Trichloroethyl Chloroformate	25g	250g

● Methoxymethylation

Methoxymethyl (MOM) group is generally used for the protection of hydroxy groups. They are stable against bases and reducing agents because of their acetal structure. MOM group is deprotected by acid catalyzed hydrolysis.

C1339	C0202	C2412	M0680	M0681

Product No.	Product Name	Unit Size	
C1339	2-(Chloromethoxy)ethyltrimethylsilane (stabilized with Diisopropylethylamine)	5mL	25mL
C0202	Chloromethyl Methyl Ether	25g	100g 500g
C2412	Chloromethyl 2,2,2-Trichloroethyl Ether		5g
M0680	2-Methoxyethoxymethyl Chloride	25mL	500mL
M0681	(2-Methoxyethoxymethyl)triethylammonium Chloride		5g

● *tert*-Butoxycarbonylation

tert-Butoxycarbonyl (Boc) group is one of the most commonly used protective groups for amino groups in peptide synthesis. It is also used for the protection of hydroxy groups. It is stable under basic hydrolysis conditions and catalytic reduction conditions, and is inert against various nucleophiles. It is deprotected under acidic conditions commonly with trifluoroacetic acid.

B0916 	B0988 	C1573 	B1089 	B1969
C0933 	B3590 	C1574 	D3878 D3879 D3880 D1547 	

Product No.	Product Name	Unit Size	
B0916	<i>N</i> - <i>tert</i> -Butoxycarbonylimidazole	10g	
B0988	2-(<i>tert</i> -Butoxycarbonyloxyimino)-2-phenylacetonitrile	5g	25g
C1573	<i>N</i> -(<i>tert</i> -Butoxycarbonyloxy)phthalimide		5g
B1089	2-(<i>tert</i> -Butoxycarbonylthio)-4,6-dimethylpyrimidine	5g	25g
B1969	1- <i>tert</i> -Butoxycarbonyl-1,2,4-triazole	5g	25g
C0933	<i>tert</i> -Butyl Carbamate	25g	250g
B3590	<i>tert</i> -Butyl Phenyl Carbonate	5g	25g
C1574	<i>tert</i> -Butyl 2,4,5-Trichlorophenyl Carbonate		5g
D3878	Di- <i>tert</i> -butyl Dicarboxate (ca. 30% in Dioxane)	100g	500g
D3879	Di- <i>tert</i> -butyl Dicarboxate (ca. 30% in Tetrahydrofuran)	100mL	500mL
D3880	Di- <i>tert</i> -butyl Dicarboxate (ca. 30% in Toluene)	100g	500g
D1547	Di- <i>tert</i> -butyl Dicarboxate	25g	100g 500g

● 9-Fluorenylmethyloxycarbonylation

9-Fluorenylmethyloxycarbonyl (Fmoc) group is one of the most commonly used protecting groups for amino groups in solid phase peptide synthesis as well as the Boc group. It is readily deprotected by secondary amines such as piperidine while it is stable under acidic conditions. Therefore, when a molecule contains the Fmoc group and the Boc group, only the Boc group can be selectively removed under acidic conditions.

F0239 	F0197 	F0936
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Product No.	Product Name	Unit Size	
F0239	<i>N</i> -[(9 <i>H</i> -Fluoren-9-ylmethoxy)carbonyloxy]succinimide	5g	25g
F0197	9-Fluorenylmethyl Chloroformate	5g	25g 100g
F0936	9-Fluorenylmethyl Pentafluorophenyl Carbonate	1g	5g

● Tritylation

Trityl (Tr) groups are mainly used for the protection of hydroxy groups. They can selectively protect less sterically-hindered substrates due to their steric-hindrance. They are relatively stable against bases, oxidizing agents, reducing agents and nucleophiles, and the deprotection is carried out under acidic hydrolysis conditions.

B1702 	D2504 	D1612 	D2915 	M0790
T1071 	T1526 	T0512 	C0308 	

Product No.	Product Name	Unit Size		
B1702	9-Bromo-9-phenylfluorene	5g	25g	
D2504	2-Chlorotrityl Chloride		25g	
D1612	4,4'-Dimethoxytrityl Chloride	5g	25g	
D2915	4-(Dimethylamino)-1-(triphenylmethyl)pyridinium Chloride		5g	
M0790	4-Methoxytrityl Chloride	25g	250g	
T1071	4,4',4''-Tris(benzoyloxy)trityl Bromide	5g	25g	
T1526	4,4',4''-Tris(4,5-dichlorophthalimido)trityl Bromide		1g	
T0512	Trityl Bromide	25g	100g	
C0308	Trityl Chloride	25g	100g	500g

● Others

A2555 	B1122 B0994 	B1128 	B1655 	B1496
D2461 	D2159 	D0835 	D1463 	C1415
C0683 	I0060 	M0071 	M0802 	M1004

M0441 	N0142 	N0507 	C1400 	N0363
P2188 	P1782 	P1614 	P1902 	T1485
T0272 	T0998 	T1606 	T3177 	T1146
T2590 	T2872 	T2544 	T1237 	T1467

Product No.	Product Name	Unit Size	
A2555	5-Acetyl-1,3-dimethylbarbituric Acid		5g
B1122	Bansyl Chloride (10% in Hexane)	1mL	5mL
B0994	Bansyl Chloride	1g	5g
B1128	1,2-Benzenedisulfonyl Dichloride	1g	5g 25g
B1655	Benzenesulfonyl Isocyanate		5g
B1496	<i>tert</i> -Butyl 2,2,2-Trichloroacetimidate	5mL	25mL
D2461	Dibenzosuberyl Chloride	5g	25g
D2159	Dimethylthiophosphinoyl Chloride	1g	5g
D0835	2,4-Dinitrofluorobenzene	25g	500g
D1463	2,4-Dinitrophenylsulfenyl Chloride		5g
C1415	Diphenylphosphinic Chloride	10g	25g
C0683	<i>N</i> -Ethoxycarbonylphthalimide	25g	500g
I0060	Iodomethane (stabilized with Copper chip)	10mL	100mL 300mL
M0071	2-Mesitylenesulfonyl Chloride	25g	500g
M0802	4-Methoxybenzenesulfonyl Chloride	25g	100g 500g
M1004	4'-Methoxyphenacyl Bromide		5g 25g
M0441	4-(Methylthio)phenol	25g	250g
N0142	2-Nitrobenzenesulfonyl Chloride	25g	100g 500g
N0507	4-Nitrobenzenesulfonyl Fluoride	Price on request	
C1400	4-Nitrophenyl Chloroformate	25g	250g
N0363	2-Nitrophenylsulfenyl Chloride	25g	100g
P2188	Pentafluorophenyl Trifluoromethanesulfonate	200mg	1g
P1782	Phenacyl Bromide	25g	500g
P1614	Phthalic Anhydride		500g
P1902	2-(1 <i>H</i> -Pyrazol-5-yl)aniline		1g
T1485	<i>p</i> -Toluenesulfonyl Anhydride	5g	25g
T0272	<i>p</i> -Toluenesulfonyl Chloride	25g	500g
T0998	<i>p</i> -Toluenesulfonyl Isocyanate	25g	500g
T1606	Triethyloxonium Tetrafluoroborate (15% in Dichloromethane, ca. 1mol/L) [Ethylating Reagent]		100mL
T3177	1-(Trifluoromethanesulfonyl)imidazole	1g	5g
T1146	Trimethylsilyldiazomethane (ca. 10% in Hexane, ca. 0.6mol/L)	10mL	25mL 100mL
T2590	1-[2-(Trimethylsilyl)ethoxycarbonyloxy]benzotriazole	1g	5g

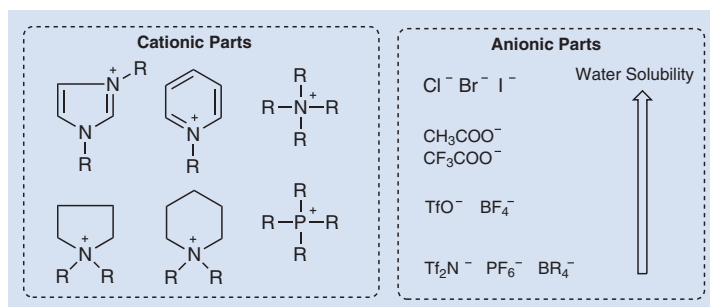
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T2872	4-[2-(Trimethylsilyl)ethoxycarbonyloxy]nitrobenzene		5g
T2544	2-(Trimethylsilyl)ethyl 3-Nitro-1 <i>H</i> -1,2,4-triazole-1-carboxylate	1g	5g
T1237	Triphenylmethanesulfonyl Chloride		10g
T1467	Triphosgene	25g	250g

References

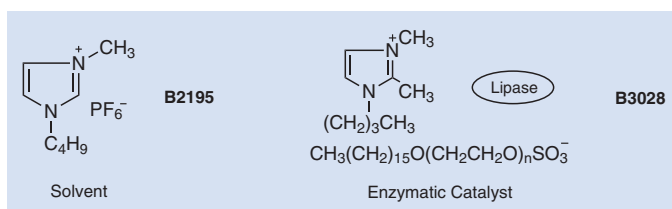
- 1) R. B. Woodward, I. J. Pachter, M. L. Scheinbaum, *J. Org. Chem.* **1971**, 36, 1137.
- 2) R. J. Bryant, E. McDonald, *Tetrahedron Lett.* **1975**, 3841.
- 3) Review: *Protective Groups in Organic Synthesis*. 3rd ed., ed. by T. W. Greene, P. G. M. Wuts, John Wiley & Sons, Inc., New York, **1999**.

Ionic Liquids

Ionic liquids are organic salts in the liquid state at room temperature and have gained much attention as green reaction solvents taking the place of organic solvents in organic synthesis because of their properties such as almost no vapor pressure and non-flammability. Typical cations are imidazolium, pyridinium, quaternary ammonium and quaternary phosphonium. On the other hand, typical anions are halide, triflate, tetrafluoroborate and hexafluorophosphate.

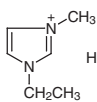
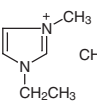
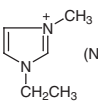
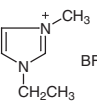
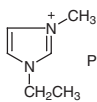
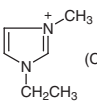
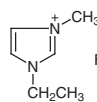
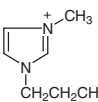
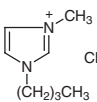
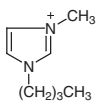
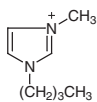
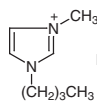
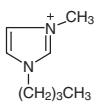
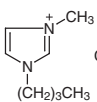
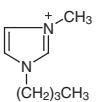
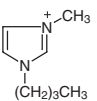
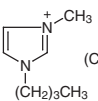
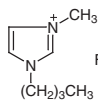
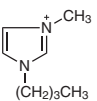
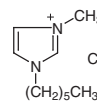
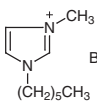
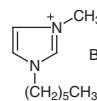
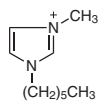
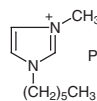
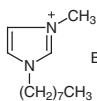
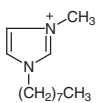
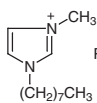
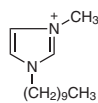
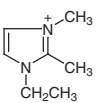
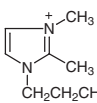
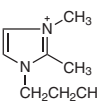
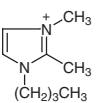
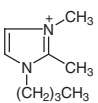
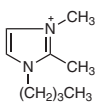
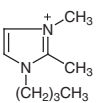
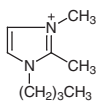
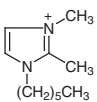


The characteristic feature of ionic liquids is high flexibility for their own molecular design. Their physical properties of melting points, viscosity and electric conductivity can be controlled by the combination of both cationic and anionic ions. In addition, by introducing functional moieties into ionic liquids, they are expected to be used for not only organic solvents but also a wide range of usages such as organocatalysts, metal-scavengers, electrolytes and lubricants.



Recently, SILC (Supported Ionic Liquid Catalyst), wherein catalysts consisting of some metals such as palladium and ruthenium supported on silica gel or alumina gel with the use of ionic liquids, has attracted attention. Generally, ionic liquids have higher viscosity compared to organic solvents, and this property often makes the isolation of reaction products difficult. In contrast, SILC is solid state and can be easily removed from the reaction products by filtration. Furthermore, the collected SILC after the reactions is usable repeatedly.

Imidazolium Salts		D3341	D3240	E0490
		mp 125 °C	Liquid	mp 84 °C
E0543	E0556	E0755	E0494	E0836
mp 74 °C	mp 79 °C	Liquid	Liquid	Liquid

E0754  Liquid	E0650  Liquid	E0680  Liquid	E0496  Liquid	E0493  mp 61 °C
E0599  Liquid	E0706  Liquid	M1440  Liquid	B2194  mp 41 °C	B2193  mp 77 °C
B2708  Liquid	B3596  mp 8 °C	B2337  Liquid	B3542  Liquid	B2195  Liquid
B2320  Liquid	B2477  Liquid	B2672  Liquid	B4091  Liquid	H1097  Liquid
H1227  Liquid	H1099  Liquid	H1423  Liquid	H1098  Liquid	M1904  Liquid
M2062  Liquid	M2063  Liquid	D4351  Liquid	E0753  Liquid	D3903  Solid
D4289  Liquid	B2473  mp 99 °C	B2475  fp 34 °C	B4182  mp 44 °C	B2474  mp 38 °C
B3159  Liquid	H1286  Solid			

Product No.	Product Name	Unit Size	
D3341	1,3-Dimethylimidazolium Chloride	5g	25g
D3240	1,3-Dimethylimidazolium Dimethyl Phosphate	5g	25g
E0490	1-Ethyl-3-methylimidazolium Chloride	5g	250g
E0543	1-Ethyl-3-methylimidazolium Bromide	5g	25g
E0556	1-Ethyl-3-methylimidazolium Iodide	5g	25g
E0755	1-Ethyl-3-methylimidazolium Methanesulfonate	5g	25g
E0494	1-Ethyl-3-methylimidazolium Trifluoromethanesulfonate	5g	25g
E0836	1-Ethyl-3-methylimidazolium Trifluoro(trifluoromethyl)borate	5g	25g
E0754	1-Ethyl-3-methylimidazolium Hydrogen Sulfate	5g	25g
E0650	1-Ethyl-3-methylimidazolium Ethyl Sulfate	5g	25g
E0680	1-Ethyl-3-methylimidazolium Dicyanamide	1g	5g
E0496	1-Ethyl-3-methylimidazolium Tetrafluoroborate	5g	25g
E0493	1-Ethyl-3-methylimidazolium Hexafluorophosphate	5g	25g
E0599	1-Ethyl-3-methylimidazolium Bis(trifluoromethanesulfonyl)imide	5g	25g
E0706	1-Ethyl-3-methylimidazolium Tetrachloroferrate	5g	25g
M1440	1-Methyl-3-propylimidazolium Iodide	5g	25g
B2194	1-Butyl-3-methylimidazolium Chloride	5g	25g
B2193	1-Butyl-3-methylimidazolium Bromide	5g	25g
B2708	1-Butyl-3-methylimidazolium Iodide	5g	25g
B3596	1-Butyl-3-methylimidazolium Tribromide	5g	25g
B2337	1-Butyl-3-methylimidazolium Trifluoromethanesulfonate	5g	25g
B3542	1-Butyl-3-methylimidazolium Trifluoro(trifluoromethyl)borate	5g	25g
B2195	1-Butyl-3-methylimidazolium Tetrafluoroborate	5g	25g
B2320	1-Butyl-3-methylimidazolium Hexafluorophosphate	5g	25g
B2477	1-Butyl-3-methylimidazolium Bis(trifluoromethanesulfonyl)imide	5g	25g
B2672	1-Butyl-3-methylimidazolium Tetrachloroferrate	5g	25g
B4091	1-Butyl-3-methylimidazolium Thiocyanate	5g	25g
H1097	1-Hexyl-3-methylimidazolium Chloride	5g	25g
H1227	1-Hexyl-3-methylimidazolium Bromide	5g	25g
H1099	1-Hexyl-3-methylimidazolium Tetrafluoroborate	5g	25g
H1423	1-Hexyl-3-methylimidazolium Bis(trifluoromethanesulfonyl)imide	5g	25g
H1098	1-Hexyl-3-methylimidazolium Hexafluorophosphate	5g	25g
M1904	1-Methyl-3- <i>n</i> -octylimidazolium Bromide	5g	25g
M2062	1-Methyl-3- <i>n</i> -octylimidazolium Chloride	5g	25g
M2063	1-Methyl-3- <i>n</i> -octylimidazolium Hexafluorophosphate	5g	25g
D4351	1-Decyl-3-methylimidazolium Bis(trifluoromethanesulfonyl)imide	5g	25g
E0753	1-Ethyl-2,3-dimethylimidazolium Bis(trifluoromethanesulfonyl)imide	5g	25g
D3903	1,2-Dimethyl-3-propylimidazolium Iodide	5g	25g
D4289	2,3-Dimethyl-1-propylimidazolium Bis(trifluoromethanesulfonyl)imide	5g	25g
B2473	1-Butyl-2,3-dimethylimidazolium Chloride	5g	25g
B2475	1-Butyl-2,3-dimethylimidazolium Tetrafluoroborate	5g	25g
B4182	1-Butyl-2,3-dimethylimidazolium Trifluoromethanesulfonate	5g	25g
B2474	1-Butyl-2,3-dimethylimidazolium Hexafluorophosphate	5g	25g
B3159	1-Butyl-2,3-dimethylimidazolium Bis(trifluoromethanesulfonyl)imide	5g	25g
H1286	1-Hexyl-2,3-dimethylimidazolium Iodide	5g	25g

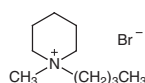
Pyridinium Salts		E0544	E0171	B1329
				
		Solid	mp 120 °C	mp 132 °C
B1743	B3232	B2196	P1393	B3425
				
mp 104 °C	Liquid	mp 75 °C	Solid	Solid

B3104 Solid	E0681 Liquid	E0682 Liquid	B3426 mp 160 °C	B2700 mp 137 °C
B2701 mp 42 °C				

Product No.	Product Name	Unit Size	
E0544	1-Ethylpyridinium Chloride	5g	25g
E0171	1-Ethylpyridinium Bromide		25g
B1329	1-Butylpyridinium Chloride	10g	25g
B1743	1-Butylpyridinium Bromide	5g	25g
B3232	1-Butylpyridinium Tetrafluoroborate	5g	25g
B2196	1-Butylpyridinium Hexafluorophosphate	5g	25g
P1393	1-Propylpyridinium Chloride		5g
B3425	1-Butyl-3-methylpyridinium Chloride	1g	5g
B3104	1-Butyl-3-methylpyridinium Bromide	5g	25g
E0681	1-Ethyl-3-methylpyridinium Ethyl Sulfate	5g	25g
E0682	1-Ethyl-3-(hydroxymethyl)pyridinium Ethyl Sulfate		5g
B3426	1-Butyl-4-methylpyridinium Chloride	5g	25g
B2700	1-Butyl-4-methylpyridinium Bromide	5g	25g
B2701	1-Butyl-4-methylpyridinium Hexafluorophosphate	5g	25g

Piperidinium Salts

B3424

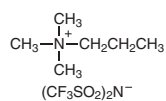


Solid

Product No.	Product Name	Unit Size	
B3424	1-Butyl-1-methylpiperidinium Bromide	5g	25g

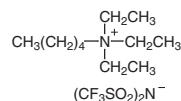
Ammonium, Phosphonium, Sulfonium Salts

T2761



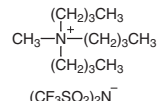
Liquid

A2274



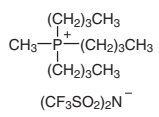
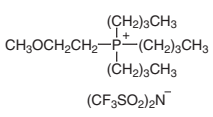
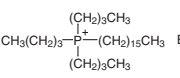
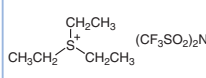
Liquid

T2679

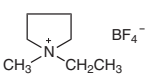
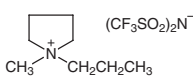
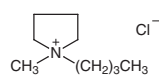
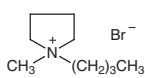
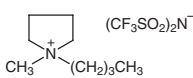


Liquid

T0055 mp 70 °C	T0054 mp 103 °C	M1660 Liquid	C1966 Solid	T1124 mp 104 °C
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T2680  Liquid	T2564  Liquid	H1047  mp 61 °C	T2314  Liquid
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Product No.	Product Name	Unit Size	
T2761	Trimethylpropylammonium Bis(trifluoromethanesulfonyl)imide	5g	25g
A2274	Amyltriethylammonium Bis(trifluoromethanesulfonyl)imide		5g
T2679	Tributylmethylammonium Bis(trifluoromethanesulfonyl)imide	5g	25g
T0055	Tetrabutylammonium Chloride	5g	25g 100g
T0054	Tetrabutylammonium Bromide	25g	100g 500g
M1660	Methyltri- <i>n</i> -octylammonium Bis(trifluoromethanesulfonyl)imide		5g
C1966	Cyclohexyltrimethylammonium Bis(trifluoromethanesulfonyl)imide		5g
T1124	Tetrabutylphosphonium Bromide	25g	100g 500g
T2680	Tributylmethylphosphonium Bis(trifluoromethanesulfonyl)imide		5g
T2564	Tributyl(2-methoxyethyl)phosphonium Bis(trifluoromethanesulfonyl)imide		5g
H1047	Tributylhexadecylphosphonium Bromide		25g
T2314	Triethylsulfonium Bis(trifluoromethanesulfonyl)imide		5g

Pyrrolidinium Salts		E0977  Solid	M2098  Liquid	B3358  Solid
B3427  Solid	B2851  Liquid			

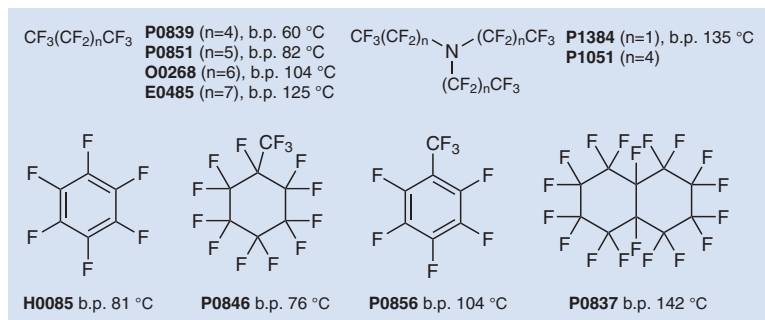
Product No.	Product Name	Unit Size	
E0977	1-Ethyl-1-methylpyrrolidinium Tetrafluoroborate	5g	25g
M2098	1-Methyl-1-propylpyrrolidinium Bis(trifluoromethanesulfonyl)imide	5g	25g
B3358	1-Butyl-1-methylpyrrolidinium Chloride	5g	25g
B3427	1-Butyl-1-methylpyrrolidinium Bromide	5g	25g
B2851	1-Butyl-1-methylpyrrolidinium Bis(trifluoromethanesulfonyl)imide	5g	25g

References

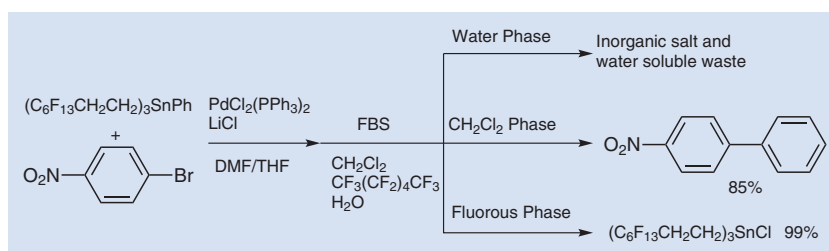
- 1) F. Kerton, R. Marriott, in *Alternative Solvents for Green Chemistry*, RSC Publishing, **2009**.
- 2) P. Wasserscheid, T. Welton, in *Ionic Liquids in Synthesis*, Wiley-VCH, Weinheim, **2003**.

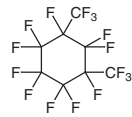
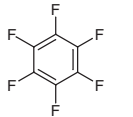
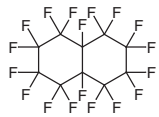
Fluorous Solvents

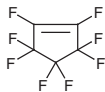
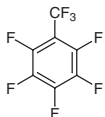
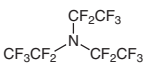
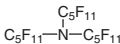
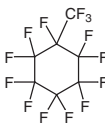
Solvents containing fluorine with a relatively large component in molecules are called fluorous solvents. Most fluorous solvents have high thermostability and chemostability and are low in toxicity.



The characteristic feature of fluorous solvents is that they mix with neither common organic solvents nor water at room temperature thus forming biphasic systems, and they dissolve fluorine-rich compounds well. To utilize these features, a method of separation and purification called a fluorous biphasic system (FBS) has been developed. In this synthetic manner, after the reaction of substrates having a perfluoroalkyl group with some reactants in a mixture of fluorous/organic solvents, the fluorous compounds can be selectively recovered from phase-separated fluorous layer. On the other hand, organic compounds without fluorine containing functional groups are recovered from the phase-separated organic layer, so that the FBS allows some purification processes such as column chromatography to be omitted. For example, Curran *et al.* applied FBS to the Stille coupling reaction of organotin compounds having a fluoroalkyl group with aryl bromides. Generally, organotin byproducts are hard to remove but fluorinated organotin byproducts in FBS are easily dissolved in the phase-separated fluorous layer, and can be simply removed by extraction.



D2669 $\text{CF}_3\text{CHFCHFCF}_2\text{CF}_3$	E0485 $\text{CF}_3(\text{CF}_2)_7\text{CF}_3$	P0074 $\text{CF}_3(\text{CF}_2)_3\text{N}(\text{CF}_2)_3\text{CF}_3$	H0946 $\text{CF}_3(\text{CF}_2)_7\text{Br}$	P1755 $\text{CF}_3(\text{CF}_2)_{10}\text{CF}_3$
P1420 	P0851 $\text{CF}_3(\text{CF}_2)_5\text{CF}_3$	H0085 	P0837 	O0268 $\text{CF}_3(\text{CF}_2)_6\text{CF}_3$

O0292	P0856	P1348	P1051	P0839
				$\text{CF}_3(\text{CF}_2)_4\text{CF}_3$
P0846	T1012			
	$\text{CF}_3\text{CF}_2\text{CF}_2\text{CF}(\text{CF}_3)_2$			

Product No.	Product Name	Unit Size	
D2669	2 <i>H</i> ,3 <i>H</i> -Decafluoropentane	25g	500g
E0485	Eicosafluorononane		10g
P0074	Heptacosafuorotributylamine [for Mass spectrometry]	25g	100g
H0946	Heptadecafluoro- <i>n</i> -octyl Bromide	5g	25g
P1755	Hexacosafuorododecane		1g
P1420	Hexadecafluoro(1,3-dimethylcyclohexane)		25g
P0851	Hexadecafluoroheptane (mixture of isomers)	10g	25g
H0085	Hexafluorobenzene	25g	250g
P0837	Octadecafluorodecahydronaphthalene		25g
O0268	Octadecafluorooctane		10g
O0292	Octafluorocyclopentene		50g
P0856	Octafluorotoluene	5g	25g
P1348	Pentadecafluorotriethylamine	5g	25g
P0867	Perfluoro(2-butyltetrahydrofuran) (so called)		25g
P1051	Perfluorotriamylamine (so called)		25g
P0839	Tetradecafluorohexane	10g	25g 250g
P0846	Tetradecafluoromethylcyclohexane		25g 100g
T1012	Tetradecafluoro-2-methylpentane		25mL

References

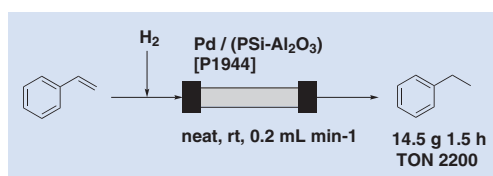
- 1) F. Kerton, R. Marriott, in *Alternative Solvents for Green Chemistry*, RSC Publishing, **2009**.
- 2) M. Hoshino, P. Degenkolb, D. P. Curran, *J. Org. Chem.* **1997**, *62*, 8341.

Polymer-supported Reagents

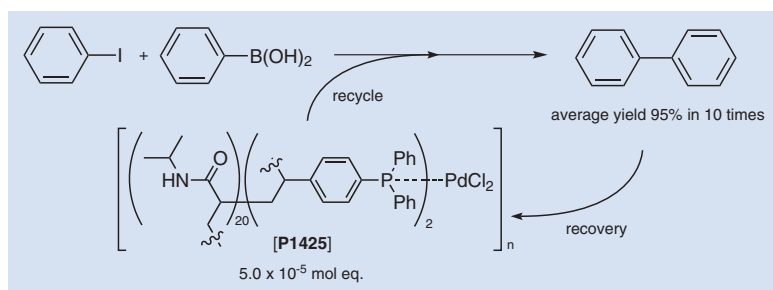
The utility of polymer-supported reagents was discovered by Merrifield and recently, over 300 recyclable polymer-supported reagents have been reported. The ideal polymer-supported reagents need to satisfy the conditions that their reactivity is comparable to the related liquid-phase reactions, and they are separable, recoverable and recyclable after the reactions. By utilizing the above mentioned characteristics, the polymer-supported reagents are used in the synthetic means shown below.

- 1) Resins for solid-phase reactions
- 2) Scavengers for excess agents
- 3) Easily reusable polymer-supported organic and organometallic catalysts
- 4) Immobilization of barely-separable/harmful reagents

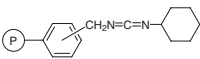
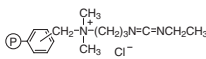
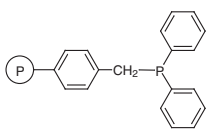
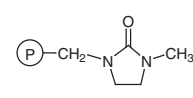
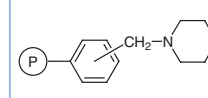
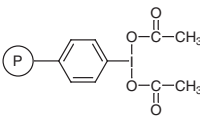
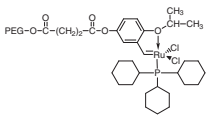
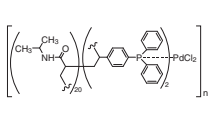
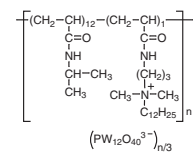
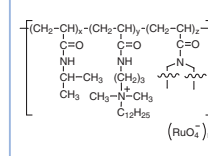
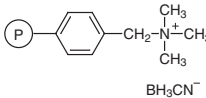
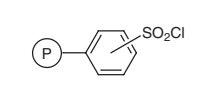
Also, the polymer-supported reagents are used in continuous plug flow reactors. Kobayashi *et al.* have developed a polysilane-supported palladium catalyst ($\text{Pd}/(\text{PSi-Al}_2\text{O}_3)$) and introduced it into the continuous plug flow reactors to perform hydrogenations under hydrogen gas flow conditions, Suzuki-Miyaura coupling reactions, Sonogashira coupling reactions and hydrosilylations.



On the other hand, Ikegami *et al.* have developed an amphiphilic polymer-supported palladium catalyst with affinity for water and organic solvents and applied it for organic synthesis. Palladium-supported poly(*N*-isopropylacrylamide) (PNIPAAm) (P1425), polymer-supported tungsten (P1697) and polymer-supported ruthenium (P1698) show amphiphilicity and incorporate both hydrophilic/hydrophobic substrates and reagents to make the reactions proceed smoothly. These catalysts are applicable to Suzuki-Miyaura coupling reactions, oxidative cyclizations of ω -unsaturated alcohols and carboxylic acids in the presence of hydrogen peroxide, and oxidations by molecular oxygen. After completion of these reactions, they can be recycled and reused.



A2006	B2372	B2370	B2371	B2292

C2141 	D3525 	D2766 	M1452 	M1857 
P1415 	P1427 	P1425 	P1697 	P1698 
P1944 Pd / (PSi-Al ₂ O ₃)	P1719 	S0545 		

Product No.	Product Name	Unit Size	
A2006	N-(2-Aminoethyl)aminomethyl Polystyrene Resin cross-linked with 1% DVB (50-100mesh) (3.1-3.5mmol/g)	5g	25g
B2372	N-(4-Benzyloxytrityl)-N'-(2-nitrobenzenesulfonyl)-1,4-diaminobutane Resin cross-linked with 1% DVB (200-400mesh) (0.9-1.1mmol/g)		1g
B2370	N-(4-Benzyloxytrityl)-N'-(2-nitrobenzenesulfonyl)-1,2-diaminoethane Resin cross-linked with 1% DVB (200-400mesh) (0.9-1.1mmol/g)		1g
B2371	N-(4-Benzyloxytrityl)-N'-(2-nitrobenzenesulfonyl)-1,3-diaminopropane Resin cross-linked with 1% DVB (200-400mesh) (0.9-1.1mmol/g)		1g
B2292	Bis(trifluoromethanesulfonyl)methyltetrafluorophenyl Polystyrene Resin cross-linked with 2% DVB (200-400mesh) (0.9-1.2mmol/g)		100mg
C2141	N-Cyclohexylcarbodiimidomethyl Polystyrene Resin cross-linked with 1% DVB (50-100mesh) (1.4-1.6mmol/g)		5g
D3525	1-(3-Dimethylaminopropyl)-3-ethylcarbodiimide Resin cross-linked with 1% DVB (50-100mesh) (1.0-1.3mmol/g)		5g
D2766	4-Diphenylphosphinomethyl Polystyrene Resin cross-linked with 2% DVB (200-400mesh) (0.5-1.0mmol/g)		5g
M1452	3-Methyl-2-oxoimidazolidin-1-ylmethyl Polystyrene Resin cross-linked with 1% DVB		1g
M1857	Morpholinomethyl Polystyrene Resin cross-linked with 1% DVB (50-100mesh) (2.9-3.5mmol/g)		5g
P1415	Poly[4-(diacetoxyiodo)styrene]	1g	5g
P1427	Polyethylene Glycol-bound Ruthenium Carbene Complex		100mg
P1425	Poly[N-isopropylacrylamide-co-4-(diphenylphosphino)styrene] Palladium(II) Dichloride (ratio, acrylamide:phosphine=20:2)		100mg
P1697	Poly[[N-isopropylacrylamide-co-[N-[3-(dodecyldimethylammonio)propyl]acrylamide]]-phosphotungstate]	200mg	1g
P1698	Poly[[N-isopropylacrylamide-co-[N-[3-(dodecyldimethylammonio)propyl]acrylamide]-co-(1,3,5-triacryloylhexahydro-1,3,5-triazine)]perruthenate]	200mg	1g
P1944	Poly(methylphenyl)silane supported Palladium/Alumina Hybrid Catalyst [=Pd / (PSi-Al ₂ O ₃)]		1g
P1719	(Polystyrylmethyl)trimethylammonium Cyanoborohydride cross-linked with 10% DVB (30-50mesh) (2.6-3.0mmol/g)	5g	25g
S0545	Sulfonyl Chloride Polystyrene Resin cross-linked with 1% DVB (50-100mesh) (4.5-5.3mmol/g)	5g	25g

References

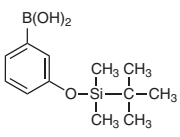
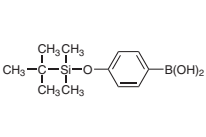
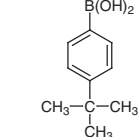
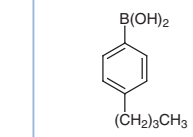
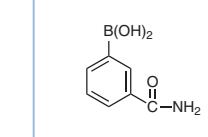
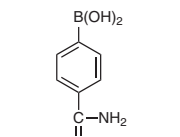
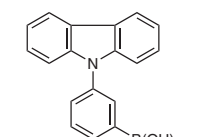
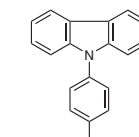
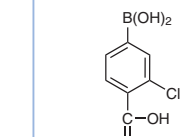
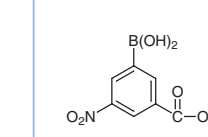
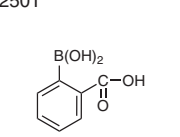
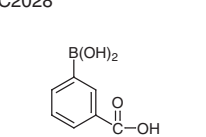
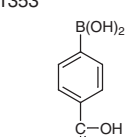
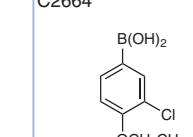
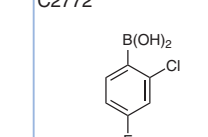
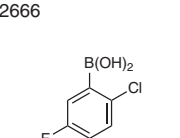
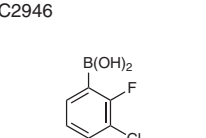
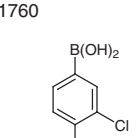
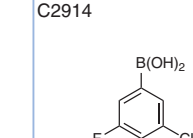
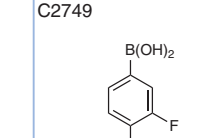
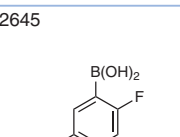
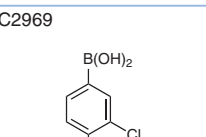
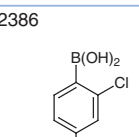
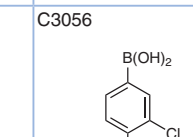
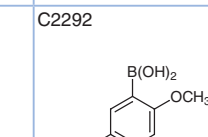
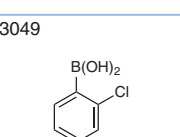
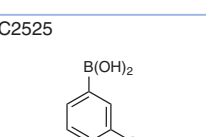
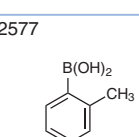
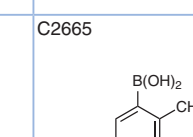
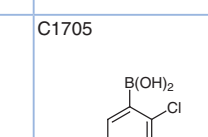
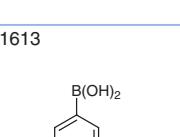
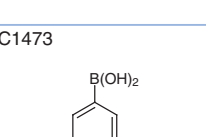
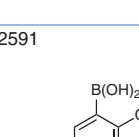
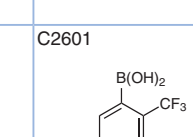
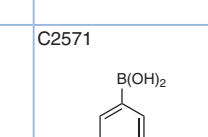
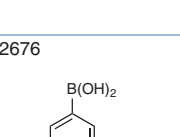
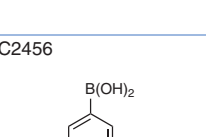
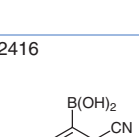
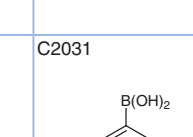
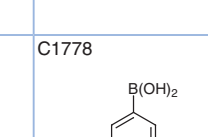
- 1) J.-W. Lee, T. Mayer-Gall, K. Opwis, C. E. Song, J. S. Gutmann, B. List, *Science* **2013**, *341*, 1225.
- 2) H. Oyama, R. Akiyama, H. Hagio, T. Naito, S. Kobayashi, *Chem. Commun.* **2006**, 4297.
- 3) a) Y. M. A. Yamada, K. Takeda, H. Takahashi, S. Ikegami, *J. Org. Chem.* **2003**, *68*, 7733.
 b) Y. M. A. Yamada, K. Takeda, H. Takahashi, S. Ikegami, *Org. Lett.* **2002**, *4*, 3371.
 c) Y. M. A. Yamada, H. Tabata, M. Ichinohe, H. Takahashi, S. Ikegami, *Tetrahedron* **2004**, *60*, 4087.
 d) H. Hamamoto, Y. Suzuki, Y. M. A. Yamada, H. Tabata, H. Takahashi, S. Ikegami, *Angew. Chem. Int. Ed.* **2005**, *44*, 4536.

Boronic Acids & Boronic Acid Derivatives

Alkyl & Alkenylboronic Acids		B0529	C2188	C2893
C2442	E0913	F0280	F0664	H0913
	$\text{CH}_3\text{CH}_2\text{B(OH)}_2$			$\text{CH}_3(\text{CH}_2)_4\text{B(OH)}_2$
I0597	I0787	M1553	O0452	P2267
		$\text{CH}_3\text{B(OH)}_2$	$\text{CH}_3(\text{CH}_2)_7\text{B(OH)}_2$	$\text{CH}_3(\text{CH}_2)_4\text{B(OH)}_2$
P1942	T2498			
$\text{CH}_3\text{CH}_2\text{B(OH)}_2$				

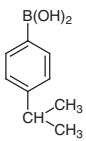
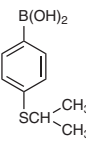
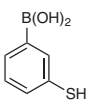
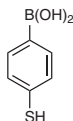
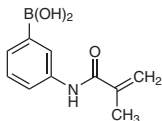
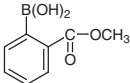
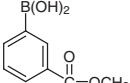
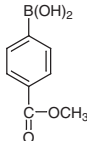
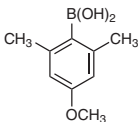
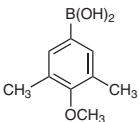
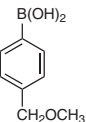
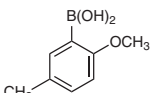
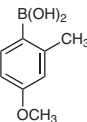
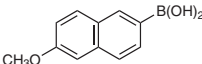
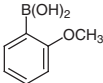
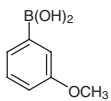
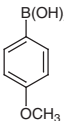
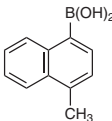
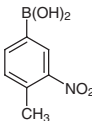
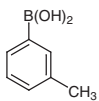
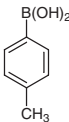
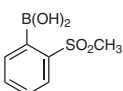
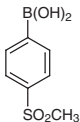
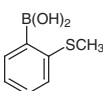
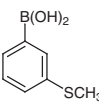
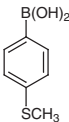
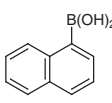
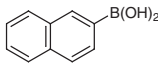
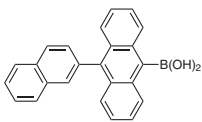
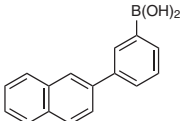
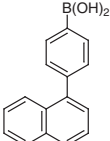
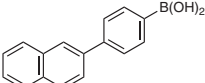
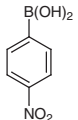
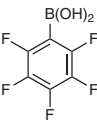
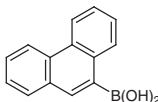
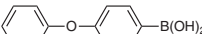
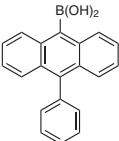
Product No.	Product Name	Unit Size		
B0529	Butylboronic Acid (contains varying amounts of Anhydride)	1g	5g	25g
C2188	Cyclohexylboronic Acid (contains varying amounts of Anhydride)		1g	5g
C2893	1-Cyclopentenylboronic Acid (contains varying amounts of Anhydride)		1g	5g
C2442	Cyclopentylboronic Acid (contains varying amounts of Anhydride)		1g	5g
E0913	Ethylboronic Acid (contains varying amounts of Anhydride)		1g	5g
F0280	Ferroceneboronic Acid (contains varying amounts of Anhydride)	100mg		1g
F0664	1,1'-Ferrocenediboronic Acid (contains varying amounts of Anhydride)			1g
H0913	Hexylboronic Acid (contains varying amounts of Anhydride)		1g	5g
I0597	Isobutylboronic Acid (contains varying amounts of Anhydride)		5g	25g
I0787	Isopropylboronic Acid (contains varying amounts of Anhydride)		5g	25g
M1553	Methylboronic Acid (contains varying amounts of Anhydride)		1g	5g
O0452	n-Octylboronic Acid (contains varying amounts of Anhydride)		1g	5g
P2267	Pentylboronic Acid (contains varying amounts of Anhydride)		5g	25g
P1942	Propylboronic Acid (contains varying amounts of Anhydride)	1g	5g	25g
T2498	2,4,6-Trivinylboroxin - Pyridine Complex		1g	5g

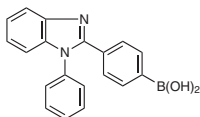
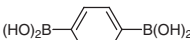
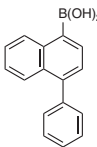
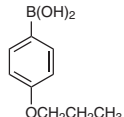
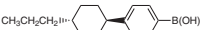
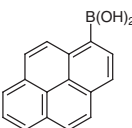
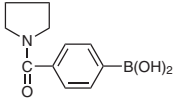
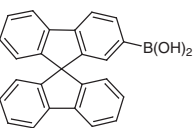
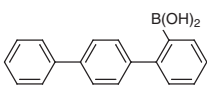
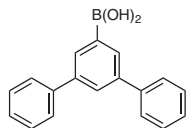
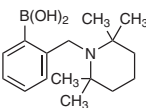
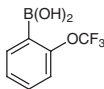
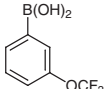
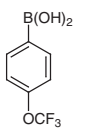
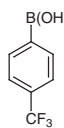
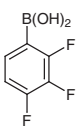
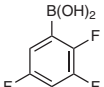
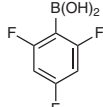
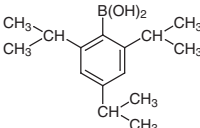
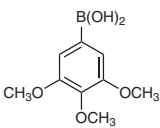
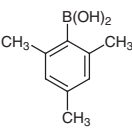
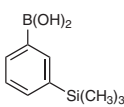
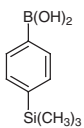
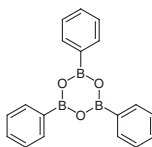
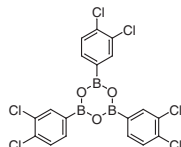
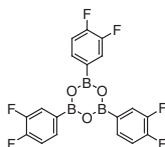
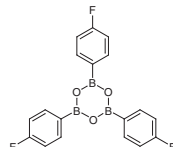
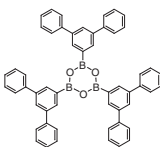
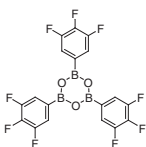
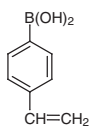
Arylboronic Acids		A2453	A2818	A1942
A1907	A2745	A1281	A1774	A2336
A1843	A2328	B4725	B3779	B3683
B4639	B4590	B3056	B2145	B2488
B2489	B2294	B2490	B3927	B3022
B1886	B2860	B3600	B3814	B4463
B2889	B2890	B1858	B4279	B4335
B4726	B4772	B4700	B4640	B4727

B3726 	B3739 	B2251 	B2589 	C2992 
C2570 	C2967 	C2926 	C2523 	C2385 
C2501 	C2028 	C1353 	C2664 	C2772 
C2666 	C2946 	C1760 	C2914 	C2749 
C2645 	C2969 	C2386 	C3056 	C2292 
C3049 	C2525 	C2577 	C2665 	C1705 
C1613 	C1473 	C2591 	C2601 	C2571 
C2676 	C2456 	C2416 	C2031 	C1778 

D4670	D4263	D3434	D2494	D3044
D3357	D3783	D2909	D4681	D3523
D3391	D3436	D3087	D3081	D3853
D3521	D3522	D3861	D3512	D3513
D4428	D4013	D4194	D3974	D3516
D3514	D3517	D3633	D3110	D3396
D3537	E0877	E0848	E0868	E1124
E1107	E0723	E0724	E0725	E0818

E0720 	F0785 	F0954 	F0977 	F0951
F0941 	F0876 	F0919 	F0775 	F0683
F0915 	F0712 	F0666 	F0697 	F0976
F0407 	F0404 	F0361 	F0942 	F1006
F0816 	F0788 	F0830 	F0834 	B1873
F0445 	F0446 	H1357 	H1489 	H1345
H1244 	H1204 	H1495 	H1402 	H1184
H1185 	H1228 	I0830 	I0806 	I0887

I0620 	I0950 	M2417 	M2418 	M2676 
M1905 	M1906 	M1907 	M2244 	M2685 
M2677 	M2311 	M2255 	M2256 	M1261 
M1322 	M1252 	M2457 	M1127 	M1313 
M1314 	M1126 	M2678 	M1972 	M1570 
M1793 	M1458 	N0630 	N0649 	N0929 
N1009 	N0798 	N0946 	N0811 	N0563 
N0812 	P1904 	P1093 	P1974 	P1984 

P2158 	B0857 	P1358 	P2290 	P1968 
P2162 	P1625 	P2105 	S0831 	T2412 
T2792 	T2908 	T2413 	T2362 	T1773 
T1800 	T1793 	T1788 	T2574 	T2874 
T2804 	T2654 	T2837 	T1960 	T2663 
T2664 	T2640 	D3435 	T2430 	T1814 
T1887 	T1929 	V0075 		

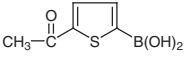
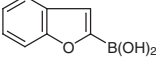
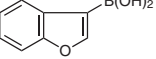
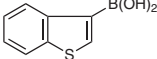
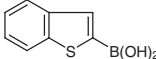
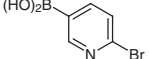
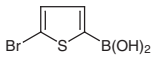
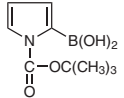
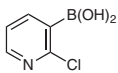
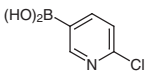
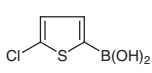
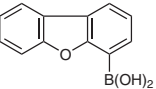
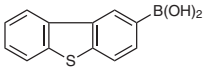
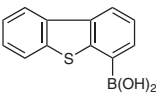
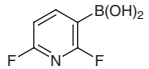
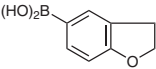
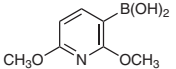
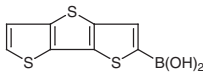
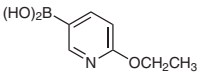
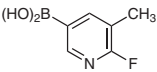
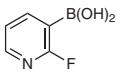
Product No.	Product Name	Unit Size	
A2453	3-Acetamidophenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
A2818	4-Acetoxyphenylboronic Acid (contains varying amounts of Anhydride)	200mg	1g
A1942	3-Acetylphenylboronic Acid (contains varying amounts of Anhydride)	5g	25g
A1907	4-Acetylphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g

Product No.	Product Name	Unit Size	
A2745	3-Amino-4-methylphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
A1281	3-Aminophenylboronic Acid Monohydrate (contains varying amounts of Anhydride)	1g	5g 25g
A1774	3-Aminophenylboronic Acid Hemisulfate	1g	5g 25g
A2336	4-Amylphenylboronic Acid (contains varying amounts of Anhydride)		5g
A1843	2-Anthraceneboronic Acid (contains varying amounts of Anhydride)	250mg	1g
A2328	9-Anthraceneboronic Acid (contains varying amounts of Anhydride)	1g	5g
B4725	4-(Benzyloxycarbonyl)phenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
B3779	2-Benzyloxy-4-fluorophenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
B3683	2-Benzyloxy-5-fluorophenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
B4639	4-Benzyloxy-3-fluorophenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
B4590	2-Benzyloxyphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
B3056	3-Benzyloxyphenylboronic Acid (contains varying amounts of Anhydride)	5g	25g
B2145	4-Benzyloxyphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
B2488	2-Biphenylboronic Acid (contains varying amounts of Anhydride)	5g	25g
B2489	3-Biphenylboronic Acid (contains varying amounts of Anhydride)	5g	25g
B2294	4-Biphenylboronic Acid (contains varying amounts of Anhydride)	5g	25g
B2490	4,4'-Biphenyldiboronic Acid		1g
B3927	2,6-Bis[(2,2,6,6-tetramethyl-1-piperidinyl)methyl]phenylboronic Acid (contains varying amounts of Anhydride)	200mg	1g
B3022	2,4-Bis(trifluoromethyl)phenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
B1886	3,5-Bis(trifluoromethyl)phenylboronic Acid (contains varying amounts of Anhydride)	1g	5g 25g
B2860	4'-Bromo-4-biphenylboronic Acid (contains varying amounts of Anhydride)		1g
B3600	2-(Bromomethyl)phenylboronic Acid (contains varying amounts of Anhydride)		1g
B3814	3-(Bromomethyl)phenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
B4463	4-Bromo-1-naphthaleneboronic Acid (contains varying amounts of Anhydride)		1g
B2889	2-Bromophenylboronic Acid (contains varying amounts of Anhydride)		5g
B2890	3-Bromophenylboronic Acid (contains varying amounts of Anhydride)	1g	5g 25g
B1858	4-Bromophenylboronic Acid (contains varying amounts of Anhydride)	1g	5g 25g
B4279	3-[(<i>tert</i> -Butoxycarbonyl)amino]phenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
B4335	4-[(<i>tert</i> -Butoxycarbonyl)amino]phenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
B4726	3-(<i>tert</i> -Butoxycarbonyl)phenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
B4772	4-(<i>tert</i> -Butoxycarbonyl)phenylboronic Acid (contains varying amounts of Anhydride)	200mg	1g
B4700	2-Butoxyphenylboronic Acid (contains varying amounts of Anhydride)		1g
B4640	3-Butoxyphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
B4727	4-Butoxyphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
B3726	3-(<i>tert</i> -Butyldimethylsilyloxy)phenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
B3739	4-(<i>tert</i> -Butyldimethylsilyloxy)phenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
B2251	4- <i>tert</i> -Butylphenylboronic Acid (contains varying amounts of Anhydride)	5g	25g
B2589	4-Butylphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
C2992	3-Carbamoylphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
C2570	4-Carbamoylphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
C2967	3-(9 <i>H</i> -Carbazol-9-yl)phenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
C2926	4-(9 <i>H</i> -Carbazol-9-yl)phenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
C2523	4-Carboxy-3-chlorophenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
C2385	3-Carboxy-5-nitrophenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
C2501	2-Carboxyphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
C2028	3-Carboxyphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
C1353	4-Carboxyphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
C2664	3-Chloro-4-ethoxyphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
C2772	2-Chloro-4-fluorophenylboronic Acid (contains varying amounts of Anhydride)	5g	25g
C2666	2-Chloro-5-fluorophenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
C2946	3-Chloro-2-fluorophenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
C1760	3-Chloro-4-fluorophenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
C2914	3-Chloro-5-fluorophenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
C2749	4-Chloro-3-fluorophenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
C2645	5-Chloro-2-fluorophenylboronic Acid (contains varying amounts of Anhydride)		5g
C2969	3-Chloro-4-hydroxyphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
C2386	2-Chloro-4-methoxyphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
C3056	3-Chloro-4-methoxyphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
C2292	5-Chloro-2-methoxyphenylboronic Acid (contains varying amounts of Anhydride)	5g	25g
C3049	2-Chloro-4-methylphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
C2525	3-Chloro-4-methylphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
C2577	4-Chloro-2-methylphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
C2665	5-Chloro-2-methylphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
C1705	2-Chlorophenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
C1613	3-Chlorophenylboronic Acid (contains varying amounts of Anhydride)	5g	25g
C1473	4-Chlorophenylboronic Acid (contains varying amounts of Anhydride)	5g	25g
C2591	2-Chloro-5-(trifluoromethyl)phenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
C2601	4-Chloro-2-(trifluoromethyl)phenylboronic Acid (contains varying amounts of Anhydride)	1g	5g

Product No.	Product Name	Unit Size	
C2571	4-Chloro-3-(trifluoromethyl)phenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
C2676	3-Cyano-4-fluorophenylboronic Acid (contains varying amounts of Anhydride)		1g
C2456	4-Cyano-3-fluorophenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
C2416	2-Cyanophenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
C2031	3-Cyanophenylboronic Acid (contains varying amounts of Anhydride)		5g 25g
C1778	4-Cyanophenylboronic Acid (contains varying amounts of Anhydride)	1g	5g 25g
D4670	3,5-Dibromophenylboronic Acid (contains varying amounts of Anhydride)		5g 25g
D4263	2,4-Dibutoxyphenylboronic Acid (contains varying amounts of Anhydride)		1g 5g
D3434	2,3-Dichlorophenylboronic Acid (contains varying amounts of Anhydride)		5g 25g
D2494	2,4-Dichlorophenylboronic Acid (contains varying amounts of Anhydride)	1g	5g 25g
D3044	2,5-Dichlorophenylboronic Acid (contains varying amounts of Anhydride)		5g 25g
D3357	2,6-Dichlorophenylboronic Acid (contains varying amounts of Anhydride)		5g
D3783	3,4-Dichlorophenylboronic Acid (contains varying amounts of Anhydride)		5g 25g
D2909	3,5-Dichlorophenylboronic Acid (contains varying amounts of Anhydride)		5g
D4681	4-(Diethylcarbamoyl)phenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
D3523	2,3-Difluorophenylboronic Acid (contains varying amounts of Anhydride)		5g 25g
D3391	2,4-Difluorophenylboronic Acid (contains varying amounts of Anhydride)		5g 25g
D3436	2,5-Difluorophenylboronic Acid (contains varying amounts of Anhydride)		5g 25g
D3087	2,6-Difluorophenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
D3081	3,5-Difluorophenylboronic Acid (contains varying amounts of Anhydride)		5g 25g
D3853	2,3-Dimethoxyphenylboronic Acid (contains varying amounts of Anhydride)		5g
D3521	2,4-Dimethoxyphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
D3522	2,5-Dimethoxyphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
D3861	2,6-Dimethoxyphenylboronic Acid (contains varying amounts of Anhydride)		5g 25g
D3512	3,4-Dimethoxyphenylboronic Acid (contains varying amounts of Anhydride)		5g 25g
D3513	3,5-Dimethoxyphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g 25g
D4428	4-(Dimethylamino)phenylboronic Acid (contains varying amounts of Anhydride)		1g 5g
D4013	3-(Dimethylamino)phenylboronic Acid Hydrochloride (contains varying amounts of Anhydride)	1g	5g
D4194	3-(Dimethylcarbamoyl)phenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
D3974	9,9-Dimethylfluoren-2-boronic Acid (contains varying amounts of Anhydride)	1g	5g
D3516	2,3-Dimethylphenylboronic Acid (contains varying amounts of Anhydride)		5g
D3514	2,4-Dimethylphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
D3517	2,5-Dimethylphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g 25g
D3633	2,6-Dimethylphenylboronic Acid (contains varying amounts of Anhydride)		1g 5g
D3110	3,4-Dimethylphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
D3396	3,5-Dimethylphenylboronic Acid (contains varying amounts of Anhydride)		5g 25g
D3537	4-(Diphenylamino)phenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
E0877	2-(Ethoxycarbonyl)phenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
E0848	3-(Ethoxycarbonyl)phenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
E0868	4-(Ethoxycarbonyl)phenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
E1124	4-Ethoxy-3-fluorophenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
E1107	6-Ethoxy-2-naphthaleneboronic Acid (contains varying amounts of Anhydride)	1g	5g
E0723	2-Ethoxyphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
E0724	3-Ethoxyphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
E0725	4-Ethoxyphenylboronic Acid (contains varying amounts of Anhydride)		5g
E0818	2-Ethylphenylboronic Acid (contains varying amounts of Anhydride)		5g
E0720	4-Ethylphenylboronic Acid (contains varying amounts of Anhydride)	5g	25g
F0785	2-Fluoro-4-biphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
F0954	3-Fluoro-5-hydroxyphenylboronic Acid (contains varying amounts of Anhydride)		1g
F0977	5-Fluoro-2-hydroxyphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
F0951	4-Fluoro-3-(methoxycarbonyl)phenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
F0941	2-Fluoro-6-methoxyphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
F0876	3-Fluoro-4-methoxyphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
F0919	4-Fluoro-3-methoxyphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
F0775	5-Fluoro-2-methoxyphenylboronic Acid (contains varying amounts of Anhydride)	5g	25g
F0683	2-Fluoro-4-methylphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
F0915	2-Fluoro-5-methylphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
F0712	3-Fluoro-4-methylphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
F0666	4-Fluoro-2-methylphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
F0697	4-Fluoro-3-methylphenylboronic Acid (contains varying amounts of Anhydride)	5g	25g
F0976	5-Fluoro-2-methylphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
F0407	2-Fluorophenylboronic Acid (contains varying amounts of Anhydride)	1g	5g 25g
F0404	3-Fluorophenylboronic Acid (contains varying amounts of Anhydride)		5g 25g
F0361	4-Fluorophenylboronic Acid (contains varying amounts of Anhydride)		5g 25g
F0942	3-Fluoro-4'-propyl-4-biphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
F1006	2-Fluoro-3-(trifluoromethyl)phenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
F0816	2-Fluoro-4-(trifluoromethyl)phenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
F0788	2-Fluoro-5-(trifluoromethyl)phenylboronic Acid (contains varying amounts of Anhydride)	1g	5g

Product No.	Product Name	Unit Size		
F0830	4-Fluoro-3-(trifluoromethyl)phenylboronic Acid (contains varying amounts of Anhydride)	1g	5g	
F0834	5-Formyl-2-methoxyphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g	
B1873	2-Formylphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g	
F0445	3-Formylphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g	25g
F0446	4-Formylphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g	
H1357	4-Hexyloxyphenylboronic Acid (contains varying amounts of Anhydride)		5g	
H1489	4-Hexylphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g	
H1345	2-(Hydroxymethyl)phenylboronic Acid (contains varying amounts of Anhydride)	1g	5g	
H1244	3-(Hydroxymethyl)phenylboronic Acid (contains varying amounts of Anhydride)	1g	5g	
H1204	4-(Hydroxymethyl)phenylboronic Acid (contains varying amounts of Anhydride)	1g	5g	25g
H1495	4-Hydroxy-2-methylphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g	
H1402	6-Hydroxy-2-naphthaleneboronic Acid (contains varying amounts of Anhydride)	1g	5g	
H1184	2-Hydroxyphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g	
H1185	3-Hydroxyphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g	
H1228	4-Hydroxyphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g	
I0830	4-Iodophenylboronic Acid (contains varying amounts of Anhydride)		5g	
I0806	4-Isopropoxyphenylboronic Acid (contains varying amounts of Anhydride)		5g	
I0887	3-Isopropylphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g	
I0620	4-Isopropylphenylboronic Acid (contains varying amounts of Anhydride)		5g	
I0950	4-(Isopropylthio)phenylboronic Acid (contains varying amounts of Anhydride)	1g	5g	
M2417	3-Mercaptophenylboronic Acid (contains varying amounts of Anhydride)	1g	5g	
M2418	4-Mercaptophenylboronic Acid (contains varying amounts of Anhydride)	1g	5g	
M2676	3-Methacrylamidophenylboronic Acid (contains varying amounts of Anhydride)	1g	5g	
M1905	2-(Methoxycarbonyl)phenylboronic Acid (contains varying amounts of Anhydride)	1g	5g	
M1906	3-(Methoxycarbonyl)phenylboronic Acid (contains varying amounts of Anhydride)	1g	5g	25g
M1907	4-(Methoxycarbonyl)phenylboronic Acid (contains varying amounts of Anhydride)	1g	5g	25g
M2244	4-Methoxy-2,6-dimethylphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g	
M2685	4-Methoxy-3,5-dimethylphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g	
M2677	4-(Methoxymethyl)phenylboronic Acid (contains varying amounts of Anhydride)	1g	5g	
M2311	2-Methoxy-5-methylphenylboronic Acid (contains varying amounts of Anhydride)	5g	25g	
M2255	4-Methoxy-2-methylphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g	
M2256	6-Methoxy-2-naphthaleneboronic Acid (contains varying amounts of Anhydride)		5g	
M1261	2-Methoxyphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g	25g
M1322	3-Methoxyphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g	25g
M1252	4-Methoxyphenylboronic Acid (contains varying amounts of Anhydride)		5g	25g
M2457	4-Methyl-1-naphthaleneboronic Acid (contains varying amounts of Anhydride)	1g	5g	
M1127	4-Methyl-3-nitrophenylboronic Acid (contains varying amounts of Anhydride)	1g	5g	
M1313	2-Methylphenylboronic Acid (contains varying amounts of Anhydride)		5g	25g
M1314	3-Methylphenylboronic Acid (contains varying amounts of Anhydride)	1g	5g	25g
M1126	4-Methylphenylboronic Acid (contains varying amounts of Anhydride)		5g	25g
M2678	2-(Methylsulfonyl)phenylboronic Acid (contains varying amounts of Anhydride)	1g	5g	
M1972	4-(Methylsulfonyl)phenylboronic Acid (contains varying amounts of Anhydride)	1g	5g	
M1570	2-(Methylthio)phenylboronic Acid (contains varying amounts of Anhydride)	1g	5g	
M1793	3-(Methylthio)phenylboronic Acid (contains varying amounts of Anhydride)		5g	
M1458	4-(Methylthio)phenylboronic Acid (contains varying amounts of Anhydride)	1g	5g	
N0630	1-Naphthaleneboronic Acid (contains varying amounts of Anhydride)	1g	5g	25g
N0649	2-Naphthaleneboronic Acid (contains varying amounts of Anhydride)	1g	5g	25g
N0929	10-(2-Naphthyl)anthracene-9-boronic Acid (contains varying amounts of Anhydride)		1g	
N1009	3-(2-Naphthyl)phenylboronic Acid (contains varying amounts of Anhydride)	1g	5g	
N0798	4-(1-Naphthyl)phenylboronic Acid (contains varying amounts of Anhydride)	1g	5g	
N0946	4-(2-Naphthyl)phenylboronic Acid (contains varying amounts of Anhydride)	200mg	1g	
N0811	2-Nitrophenylboronic Acid (contains varying amounts of Anhydride)	1g	5g	
N0563	3-Nitrophenylboronic Acid (contains varying amounts of Anhydride)	5g	25g	
N0812	4-Nitrophenylboronic Acid (contains varying amounts of Anhydride)	1g	5g	
P1904	Pentafluorophenylboronic Acid (contains varying amounts of Anhydride)	1g	5g	
P1093	9-Phenanthreneboronic Acid (contains varying amounts of Anhydride)	1g	5g	
P1974	4-Phenoxyphenylboronic Acid (contains varying amounts of Anhydride)	5g	25g	
P1984	10-Phenyl-9-anthraceneboronic Acid (contains varying amounts of Anhydride)		1g	
P2158	4-(1-Phenyl-1H-benzimidazol-2-yl)phenylboronic Acid (contains varying amounts of Anhydride)	1g	5g	
B0857	Phenylboronic Acid (contains varying amounts of Anhydride)	5g	25g	250g
P1358	1,4-Phenylenediboronic Acid (contains varying amounts of Anhydride)	1g	5g	25g
P2290	4-Phenylnaphthalene-1-boronic Acid (contains varying amounts of Anhydride)		1g	5g
P1968	4-Propoxyphenylboronic Acid (contains varying amounts of Anhydride)	5g	25g	
P2162	4-(trans-4-Propylcyclohexyl)phenylboronic Acid (contains varying amounts of Anhydride)		1g	5g
P1625	1-Pyreneboronic Acid (contains varying amounts of Anhydride)	1g	5g	25g
P2105	4-[(1-Pyrrolidinyl)carbonyl]phenylboronic Acid (contains varying amounts of Anhydride)		1g	5g
S0831	9,9'-Spiro[9H-fluorene]-2-boronic Acid	1g	5g	
T2412	2- <i>p</i> -Terphenylboronic Acid (contains varying amounts of Anhydride)		1g	

Product No.	Product Name	Unit Size
T2792	5'- <i>m</i> -Terphenylboronic Acid (contains varying amounts of Anhydride)	1g
T2908	2-[(2,2,6,6-Tetramethyl-1-piperidyl)methyl]phenylboronic Acid (contains varying amounts of Anhydride)	1g
T2413	2-(Trifluoromethoxy)phenylboronic Acid (contains varying amounts of Anhydride)	1g 5g
T2362	3-(Trifluoromethoxy)phenylboronic Acid (contains varying amounts of Anhydride)	5g
T1773	4-(Trifluoromethoxy)phenylboronic Acid (contains varying amounts of Anhydride)	5g 25g
T1800	2-(Trifluoromethyl)phenylboronic Acid (contains varying amounts of Anhydride)	1g 5g 25g
T1793	3-(Trifluoromethyl)phenylboronic Acid (contains varying amounts of Anhydride)	1g 5g
T1788	4-(Trifluoromethyl)phenylboronic Acid (contains varying amounts of Anhydride)	1g 5g
T2574	2,3,4-Trifluorophenylboronic Acid (contains varying amounts of Anhydride)	5g
T2874	2,3,5-Trifluorophenylboronic Acid (contains varying amounts of Anhydride)	5g
T2804	2,4,6-Trifluorophenylboronic Acid (contains varying amounts of Anhydride)	1g 5g
T2654	2,4,6-Triisopropylphenylboronic Acid (contains varying amounts of Anhydride)	1g 5g
T2837	3,4,5-Trimethoxyphenylboronic Acid (contains varying amounts of Anhydride)	1g
T1960	2,4,6-Trimethylphenylboronic Acid	1g 5g
T2663	3-(Trimethylsilyl)phenylboronic Acid (contains varying amounts of Anhydride)	5g
T2664	4-(Trimethylsilyl)phenylboronic Acid (contains varying amounts of Anhydride)	1g 5g
T2640	2,4,6-Triphenylboroxin	5g 25g
D3435	2,4,6-Tris(3,4-dichlorophenyl)boroxin	5g 25g
T2430	2,4,6-Tris(3,4-difluorophenyl)boroxin	5g 25g
T1814	2,4,6-Tris(4-fluorophenyl)boroxin	10g
T1887	2,4,6-Tris(<i>m</i> -terphenyl-5'-yl)boroxin	100mg
T1929	2,4,6-Tris(3,4,5-trifluorophenyl)boroxin	1g 5g
V0075	4-Vinylphenylboronic Acid (contains varying amounts of Anhydride)	1g 5g

Heteroarylboronic Acids		A2364	B2978	B4522
				
B4774	B2893	B3307	B2862	B4063
				
C2560	C2589	C2288	C2066	D4567
				
D4373	D4057	D4006	D4711	D4690
				
D3823	E1115	F0984	F0739	F0935
				

F0770 	F0859 	F0548 	F0611 	F0549
F0394 	F0438 	I0803 	M2159 	M2029
M2335 	M2035 	M1850 	P2169 	P2001
P1673 	P1594 	P1759 	Q0080 	Q0087
Q0086 	T2621 	T1772 	T1975 	T3188

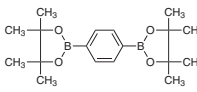
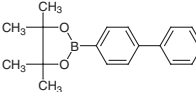
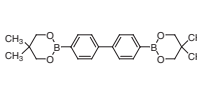
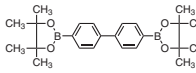
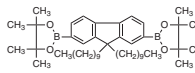
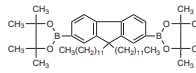
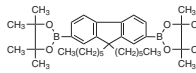
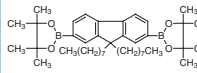
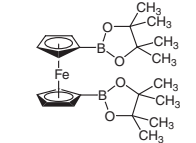
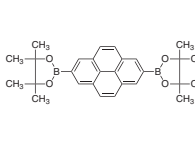
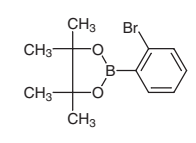
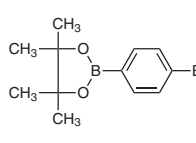
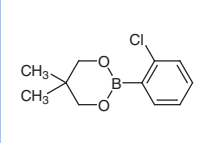
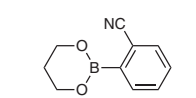
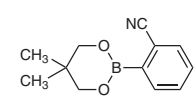
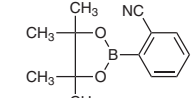
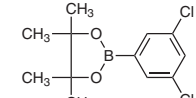
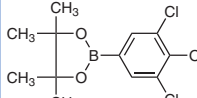
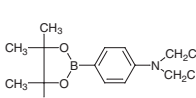
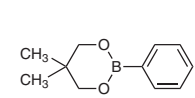
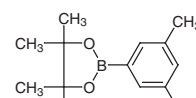
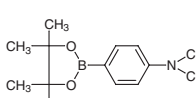
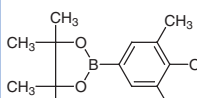
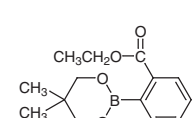
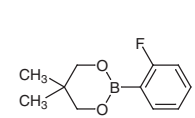
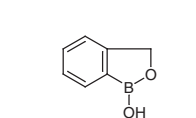
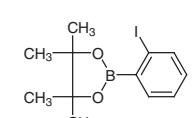
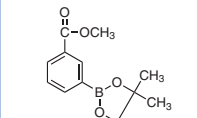
Product No.	Product Name	Unit Size	
A2364	5-Acetyl-2-thiopheneboronic Acid (contains varying amounts of Anhydride)	5g	25g
B2978	Benzofuran-2-boronic Acid (contains varying amounts of Anhydride)		1g
B4522	Benzofuran-3-boronic Acid (contains varying amounts of Anhydride)	1g	5g
B4774	Benzo[b]thiophene-3-boronic Acid (contains varying amounts of Anhydride)	1g	5g
B2893	Benzo[b]thiophene-2-ylboronic Acid (contains varying amounts of Anhydride)	1g	5g
B3307	2-Bromopyridine-5-boronic Acid (contains varying amounts of Anhydride)	1g	5g
B2862	5-Bromo-2-thiopheneboronic Acid (contains varying amounts of Anhydride)	1g	5g
B4063	1-(<i>tert</i> -Butoxycarbonyl)-2-pyrroleboronic Acid (contains varying amounts of Anhydride)	1g	5g
C2560	2-Chloropyridine-3-boronic Acid (contains varying amounts of Anhydride)	1g	5g
C2589	2-Chloropyridine-4-boronic Acid (contains varying amounts of Anhydride)	1g	5g
C2288	2-Chloropyridine-5-boronic Acid (contains varying amounts of Anhydride)	1g	5g
C2066	5-Chloro-2-thiopheneboronic Acid (contains varying amounts of Anhydride)	1g	5g
D4567	Dibenzofuran-4-boronic Acid (contains varying amounts of Anhydride)	1g	5g
D4373	Dibenzothiophene-2-boronic Acid (contains varying amounts of Anhydride)	1g	5g
D4057	Dibenzothiophene-4-boronic Acid (contains varying amounts of Anhydride)	1g	5g
D4006	2,6-Difluoro-3-pyridineboronic Acid (contains varying amounts of Anhydride)	1g	5g
D4711	2,3-Dihydrobenzofuran-5-boronic Acid (contains varying amounts of Anhydride)		200mg
D4690	2,6-Dimethoxypyridine-3-boronic Acid (contains varying amounts of Anhydride)	1g	5g
D3823	Dithieno[3,2- <i>b</i> :2',3'- <i>d'</i>]thiophene-2-boronic Acid (contains varying amounts of Anhydride)	200mg	1g
E1115	2-Ethoxypyridine-5-boronic Acid (contains varying amounts of Anhydride)	1g	5g
F0984	2-Fluoro-3-methylpyridine-5-boronic Acid (contains varying amounts of Anhydride)		1g
F0739	2-Fluoropyridine-3-boronic Acid (contains varying amounts of Anhydride)	5g	25g
F0935	2-Fluoropyridine-4-boronic Acid (contains varying amounts of Anhydride)	1g	5g
F0770	2-Fluoropyridine-5-boronic Acid (contains varying amounts of Anhydride)	1g	5g

Product No.	Product Name	Unit Size	
F0859	5-Fluoropyridine-3-boronic Acid (contains varying amounts of Anhydride)	1g	5g
F0548	5'-Formyl-2,2'-bithiophene-5-boronic Acid (contains varying amounts of Anhydride)	1g	5g
F0611	5-Formyl-2-furanboronic Acid (contains varying amounts of Anhydride)	1g	5g
F0549	5-Formyl-2-thiopheneboronic Acid (contains varying amounts of Anhydride)	1g	5g
F0394	2-Furylboronic Acid (contains varying amounts of Anhydride)	1g	5g
F0438	3-Furylboronic Acid (contains varying amounts of Anhydride)	1g	5g
I0803	6-Indoleboronic Acid (contains varying amounts of Anhydride)	1g	5g
M2159	2-Methoxypyridine-3-boronic Acid (contains varying amounts of Anhydride)	1g	5g
M2029	2-Methoxypyridine-5-boronic Acid (contains varying amounts of Anhydride)	1g	5g
M2335	2-Methoxy-5-pyrimidylboronic Acid (contains varying amounts of Anhydride)	1g	5g
M2035	3,4-(Methylenedioxy)phenylboronic Acid (contains varying amounts of Anhydride)	5g	25g
M1850	5-Methyl-2-thiopheneboronic Acid (contains varying amounts of Anhydride)	1g	5g
P2169	9-Phenylcarbazole-2-boronic Acid (contains varying amounts of Anhydride)	200mg	1g
P2001	9-Phenylcarbazole-3-boronic Acid (contains varying amounts of Anhydride)	5g	25g
P1673	3-Pyridylboronic Acid (contains varying amounts of Anhydride)	1g	5g
P1594	4-Pyridylboronic Acid (contains varying amounts of Anhydride)	1g	5g
P1759	5-Pyrimidylboronic Acid (contains varying amounts of Anhydride)	100mg	1g
Q0080	Quinoline-3-boronic Acid (contains varying amounts of Anhydride)	1g	5g
Q0087	Quinoline-5-boronic Acid (contains varying amounts of Anhydride)		200mg
Q0086	Quinoline-8-boronic Acid (contains varying amounts of Anhydride)	200mg	1g
T2621	Thieno[3,2- <i>b</i>]thiophene-2-boronic Acid (contains varying amounts of Anhydride)		1g
T1772	2-Thiopheneboronic Acid (contains varying amounts of Anhydride)	1g	5g
T1975	3-Thiopheneboronic Acid (contains varying amounts of Anhydride)		5g
T3188	2-(Trifluoromethyl)pyridine-5-boronic Acid (contains varying amounts of Anhydride)		1g

Alkyl & Alkenylboronic Acid Esters		A2086	A2574	A2157
B3448	B4103	B3199	C2707	C3101
C2276	D3596	D3738	D3649	E1116
E1074	M2071	T2297		

Product No.	Product Name	Unit Size	
A2086	2-Allyl-4,4,5,5-tetramethyl-1,3,2-dioxaborolane	1g	5g
A2574	2-Allyl-5,5-dimethyl-1,3,2-dioxaborinane (stabilized with Phenothiazine)	1g	5g
A2157	2-Allyl-4,4,5,5-tetramethyl-1,3,2-dioxaborolane (stabilized with Phenothiazine)	1g	5g
B3448	2-Benzyl-4,4,5,5-tetramethyl-1,3,2-dioxaborolane	1g	5g
B4103	Bis[(pinacolato)boryl]methane	1g	5g
B3199	2-(Bromomethyl)-4,4,5,5-tetramethyl-1,3,2-dioxaborolane	1g	5g

Product No.	Product Name	Unit Size		
C2707	2-(1-Cyclohexenyl)-4,4,5,5-tetramethyl-1,3,2-dioxaborolane		1g	5g
C3101	2-Cyclohexenyl-4,4,5,5-tetramethyl-1,3,2-dioxaborolane		1g	5g
C2276	2-Cyclopropyl-4,4,5,5-tetramethyl-1,3,2-dioxaborolane		1g	5g
D3596	Dibutyl Vinylboronate (stabilized with Phenothiazine)		1g	5g
D3738	Diisopropyl Allylboronate		1g	5g
D3649	Diisopropyl (Bromomethyl)boronate		1g	5g
E1116	2-Ethyl-4,4,5,5-tetramethyl-1,3,2-dioxaborolane		1g	5g
E1074	2-Ethynyl-4,4,5,5-tetramethyl-1,3,2-dioxaborolane		200mg	1g
M2071	2-(4-Methoxybenzyl)-4,4,5,5-tetramethyl-1,3,2-dioxaborolane			5g
T2297	4,4,5,5-Tetramethyl-2-vinyl-1,3,2-dioxaborolane (stabilized with Phenothiazine)	1g	5g	25g

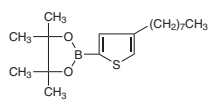
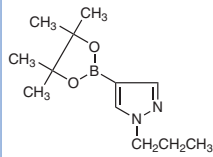
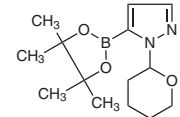
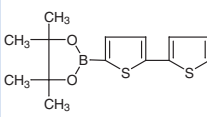
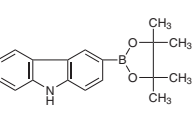
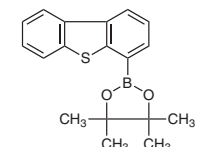
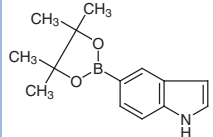
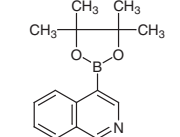
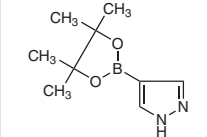
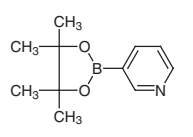
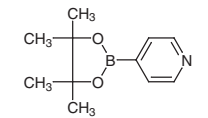
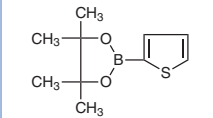
Arylboronic Acid Esters		B4633	B3019	B3151
				
B4166	B4588	B4624	B4029	B3582
				
B3501	B3956	B2828	B4771	C2004
				
C2993	C2823	C2621	D4575	D4201
				
D3601	D4195	D3533	D3832	D2853
				
E0667	F0531	H1280	I0653	M2665
				

N0824 	P1855 	T1950 	T3028 	T1951
T3196 	T2923 	T3162 	T2841 	T2945
T3031 	T1952 	T1953 	T1954 	T3224
T3218 	N1006 	T3089 	T3219 	T2888
T3103 	T3261 	T2428 		

Product No.	Product Name	Unit Size	
B4633	1,4-Benzenediboronic Acid Bis(pinacol) Ester	5g	25g
B3019	2-(4-Biphenyl)-4,4,5,5-tetramethyl-1,3,2-dioxaborolane		5g
B3151	4,4'-Bis(5,5-dimethyl-1,3,2-dioxaborolan-2-yl)biphenyl		1g
B4166	4,4'-Bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)biphenyl	1g	5g
B4588	2,7-Bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)-9,9-didecylfluorene		1g
B4624	2,7-Bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)-9,9-didodecylfluorene		1g
B4029	2,7-Bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)-9,9-dihexylfluorene		1g
B3582	2,7-Bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)-9,9-di-n-octylfluorene		1g
B3501	1,1'-Bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)ferrocene	1g	5g
B3956	2,7-Bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)pyrene	1g	5g
B2828	2-(2-Bromophenyl)-4,4,5,5-tetramethyl-1,3,2-dioxaborolane	1g	5g
B4771	2-(4-Bromophenyl)-4,4,5,5-tetramethyl-1,3,2-dioxaborolane	1g	5g
C2004	2-(2-Chlorophenyl)-5,5-dimethyl-1,3,2-dioxaborinane		1g
C2993	2-Cyanophenylboronic Acid 1,3-Propanediol Ester	1g	5g
C2823	2-(2-Cyanophenyl)-5,5-dimethyl-1,3,2-dioxaborinane (This product is only available in Japan.)	1g	5g
C2621	2-(2-Cyanophenyl)-4,4,5,5-tetramethyl-1,3,2-dioxaborolane (This product is only available in Japan.)	1g	5g
D4575	2-(3,5-Dichlorophenyl)-4,4,5,5-tetramethyl-1,3,2-dioxaborolane	1g	5g
D4201	2,6-Dichloro-4-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)phenol	1g	5g
B3601	N,N-Diethyl-4-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)aniline	1g	5g
D4195	5,5-Dimethyl-2-phenyl-1,3,2-dioxaborinane	5g	25g
D3533	2-(3,5-Dimethylphenyl)-4,4,5,5-tetramethyl-1,3,2-dioxaborolane		5g
D3832	N,N-Dimethyl-4-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)aniline	1g	5g

Product No.	Product Name	Unit Size	
D2853	2,6-Dimethyl-4-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)phenol	1g	5g
E0667	Ethyl 2-(5,5-Dimethyl-1,3,2-dioxaborinan-2-yl)benzoate		1g
F0531	2-(2-Fluorophenyl)-5,5-dimethyl-1,3,2-dioxaborinane		1g
H1280	2-(Hydroxymethyl)phenylboronic Acid Cyclic Monoester	1g	5g
I0653	2-(2-Iodophenyl)-4,4,5,5-tetramethyl-1,3,2-dioxaborolane		1g
M2665	Methyl 3-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)benzoate	1g	5g
N0824	2-Nitro-4-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)aniline		1g
P1855	2-Phenyl-4,4,5,5-tetramethyl-1,3,2-dioxaborolane	5g	25g
T1950	4'-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)acetanilide		1g
T3028	3-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)aniline	1g	5g
T1951	4-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)aniline	1g	5g
T3196	4-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)anisole	5g	25g
T2923	4-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)benzaldehyde	1g	5g
T3162	3-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)benzoic Acid	1g	5g
T2841	4-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)benzoic Acid		1g
T2945	4-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)benzyl Bromide	1g	5g
T3031	4'-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)biphenyl-4-ol	1g	5g
T1952	2-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)phenol	1g	5g
T1953	3-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)phenol	1g	5g
T1954	4-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)phenol	1g	5g
T3224	4-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)phenyl Acetate	1g	5g
T3218	4,4,5,5-Tetramethyl-2-(1-naphthyl)-1,3,2-dioxaborolane	1g	5g
N1006	4,4,5,5-Tetramethyl-2-(2-nitrophenyl)-1,3,2-dioxaborolane	1g	5g
T3089	4,4,5,5-Tetramethyl-2-(3-perylenyl)-1,3,2-dioxaborolane	200mg	1g
T3219	4,4,5,5-Tetramethyl-2-(<i>m</i> -tolyl)-1,3,2-dioxaborolane	1g	5g
T2888	4,4,5,5-Tetramethyl-2-(<i>p</i> -tolyl)-1,3,2-dioxaborolane	1g	5g
T3103	4,4,5,5-Tetramethyl-2-[4-(trifluoromethyl)phenyl]-1,3,2-dioxaborolane (This product is only available in Japan.)	1g	5g
T3261	4,4,5,5-Tetramethyl-2-[3-(triphenylen-2-yl)phenyl]-1,3,2-dioxaborolane	200mg	1g
T2428	2-[2-(Trifluoromethyl)phenyl]-4,4,5,5-tetramethyl-1,3,2-dioxaborolane		5g

Heteroarylboronic Acid Esters		B4364	B4158	B3573
B3363	B3200	B3749	B4051	D3772
D4290	D4291	O0428	H1298	H1294
M2650	M2339	M2681	O0439	O0410

O0411 	P2277 	T3215 	T2518 	T3117 
T2336 	I0590 	I0739 	T2756 	T2345 
T2349 	T2924 			

Product No.	Product Name	Unit Size	
B4364	1-Benzyl-4-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)pyrazole	1g	5g
B4158	2,6-Bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)benzo[1,2- <i>b</i> :4,5- <i>b'</i>]dithiophene		1g
B3573	4,7-Bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)-2,1,3-benzothiadiazole		1g
B3363	5,5'-Bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)-2,2'-bithiophene		5g
B3200	5-Bromo-5'-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)-2,2'-bithiophene		1g
B3749	2-Bromo-3-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)pyridine	1g	5g
B4051	1-(<i>tert</i> -Butoxycarbonyl)-1,2,3,6-tetrahydro-4-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)pyridine		1g
D3772	3,5-Dimethyl-4-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)isoxazole	1g	5g
D4290	3-Dodecyl-2-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)thiophene	1g	5g
D4291	4-Dodecyl-2-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)thiophene	1g	5g
O0428	9-(9-Heptadecanyl)-2,7-bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)carbazole	200mg	1g
H1298	3-Hexyl-2-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)thiophene	1g	5g
H1294	4-Hexyl-2-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)thiophene		5g
M2650	2-Methoxy-5-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)pyridine	1g	5g
M2339	1-Methyl-4-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)pyrazole	1g	5g
M2681	1-Methyl-5-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)pyrazole	1g	5g
O0439	9- <i>n</i> -Octyl-2,7-bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)carbazole		200mg
O0410	3- <i>n</i> -Octyl-2-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)thiophene	1g	5g
O0411	4- <i>n</i> -Octyl-2-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)thiophene	1g	5g
P2277	1-Propyl-4-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)pyrazole	1g	5g
T3215	1-(Tetrahydropyran-2-yl)-5-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)pyrazole		1g
T2518	5-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)-2,2'-bithiophene	1g	5g
T3117	3-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)carbazole		1g
T3236	4-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)dibenzothiophene		1g
I0590	5-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)-1- <i>H</i> -indole		1g
I0739	4-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)isoquinoline		1g
T2756	4-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)pyrazole		1g
T2345	3-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)pyridine	1g	5g
T2349	4-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)pyridine		1g
T2924	2-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)thiophene		1g

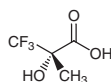
Chiral Building Blocks

Carboxylic Acids		A1299	A1334	A1647
A1648	A2153	A1457	A1450	A1377
A0826	A1688	A1689	A2286	A1438
A1043	B1121	B1120	B4142	B4005
B1756	B1757	B3538	B3539	B4202
B3177	B3178	B1635	B4141	B3700
B4083	C1584	C1612	C2109	C1377

C1663	C2738	C1365	C1372	C1371
C1655	C1373	C1953	C1954	C2569
D3825	D2636	D1386	D0083	D1573
D1377	D3490	D3491	D1398 D3826	D1354 D3492
D2539	D4375	D3677	D2702	D2686
D1417	D1387	E0993	E0994	F0818
F0721	G0265	H1224	H0937	H1339
H0758	H0933	I0589	I0395	L0026

L0144	M0021	M0022	M0662	M0661
M1366	M1021	M0830	M0829	M1228
M1229	M1226	M1227	N0327	N0303
N0673	N0686	O0370	O0089	O0064
O0281	O0276	P0820	P1288	P1981
P1168	P1219	P0936	P1830	P1404
N0654	N0678	Q0009	T0026	T0025
T1740	T1741	T1515	T0219	T1900

T1901

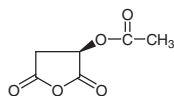


Product No.	Product Name	Unit Size	
A1299	(S)-(-)-2-Acetoxypyrrolidine-2-carboxylic Acid	5g	25g
A1334	(S)-(-)-3-(Acetylthio)-2-methylpropionic Acid	5mL	25mL
A1647	D-2-Allylglycine Hydrochloride	200mg	1g
A1648	L-2-Allylglycine Hydrochloride	200mg	1g
A2153	D-2-Aminoadipic Acid	1g	5g
A1457	L-2-Aminoadipic Acid	1g	5g
A1450	(S)-(+)-2-Amino-4-bromobutyric Acid Hydrobromide	1g	5g
A1377	(R)-(-)-2-Aminobutyric Acid	1g	5g
A0826	(S)-(+)-2-Aminobutyric Acid	1g	5g
A1688	(1R,2R)-2-Aminocyclohexanecarboxylic Acid		100mg
A1689	(1S,2S)-2-Aminocyclohexanecarboxylic Acid		100mg
A2286	(1S,3R)-3-Aminocyclohexanecarboxylic Acid		200mg
A1438	(S)-(-)-4-Amino-2-hydroxybutyric Acid	5g	25g
A1043	L-Azetidine-2-carboxylic Acid	100mg	1g
B1121	(+)-cis-2-Benzamidocyclohexanecarboxylic Acid		5g
B1120	(-)-cis-2-Benzamidocyclohexanecarboxylic Acid		5g
B4142	(S)-Benzylsuccinic Acid	5g	25g
B4005	(R)-2-Bromo-3-methylbutyric Acid		5g
B1756	(R)-(+)-2-Bromopropionic Acid	5g	25g
B1757	(S)-(-)-2-Bromopropionic Acid	5g	25g
B3538	(1R,3S)-3-(tert-Butoxycarbonylamino)cyclohexanecarboxylic Acid		1g
B3539	(1S,3R)-3-(tert-Butoxycarbonylamino)cyclohexanecarboxylic Acid		1g
B4202	(S)-1-(tert-Butoxycarbonyl)-4,4-difluoro-2-pyrrolidinecarboxylic Acid	200mg	1g
B3177	(2S,4R)-1-(tert-Butoxycarbonyl)-4-fluoro-2-pyrrolidinecarboxylic Acid	200mg	1g
B3178	(2S,4S)-1-(tert-Butoxycarbonyl)-4-fluoro-2-pyrrolidinecarboxylic Acid	200mg	1g
B1635	trans-N-(tert-Butoxycarbonyl)-4-hydroxy-L-proline		5g
B4141	N-(tert-Butoxycarbonyl)-4-oxo-L-proline	1g	5g
B3700	(S)-1-(tert-Butoxycarbonyl)-2-piperidinecarboxylic Acid	1g	5g
B4083	N-(tert-Butoxycarbonyl)-L-pyrroglutamic Acid	5g	25g
C1584	(3S)-2-Carbobenzoxo-1,2,3,4-tetrahydroisoquinoline-3-carboxylic Acid		5g
C1612	3-Chloro-L-alanine Hydrochloride	1g	5g
C2109	(R)-2-Chlorobutyric Acid	1g	5g
C1377	(S)-2-Chlorobutyric Acid	1g	5g
C1663	2-Chloro-D-mandelic Acid	1g	5g
C2738	2-Chloro-L-mandelic Acid	5g	25g
C1365	(S)-2-Chloro-3-methylbutyric Acid	1g	5g
C1372	(2S,3S)-2-Chloro-3-methylvaleric Acid	1g	5g
C1371	(S)-2-Chloro-4-methylvaleric Acid	1g	5g
C1655	(R)-(+)-2-Chloropropionic Acid	1g	5g
C1373	(S)-(-)-2-Chloropropionic Acid	1g	5g
C1953	(1R,2R)-1,2-Cyclohexanedicarboxylic Acid	1g	5g
C1954	(1S,2S)-1,2-Cyclohexanedicarboxylic Acid	1g	5g
C2569	L-2-Cyclohexylglycine	1g	5g
D3825	3,4-Dehydro-L-proline	100mg	1g
D2636	(+)-Diacetyl-D-tartaric Acid		5g
D1386	(-)-Diacetyl-L-tartaric Acid		25g
D0083	(S)-(+)-2,4-Diaminobutyric Acid Dihydrochloride		1g
D1573	(R)-(-)-2,3-Diaminopropionic Acid Hydrochloride	100mg	1g
D1377	(S)-(+)-2,3-Diaminopropionic Acid Hydrochloride	100mg	1g
D3490	(+)-Di-p-anisoyl-D-tartaric Acid		25g
D3491	(-)-Di-p-anisoyl-L-tartaric Acid		25g
D1398	(+)-Dibenzoyl-D-tartaric Acid Monohydrate	25g	500g
D3826	(+)-Dibenzoyl-D-tartaric Acid	25g	250g
D1354	(-)-Dibenzoyl-L-tartaric Acid Monohydrate	25g	500g
D3492	(-)-Dibenzoyl-L-tartaric Acid	25g	250g
D2539	D-(-)-2-(2,5-Dihydroxyphenyl)glycine	5g	25g
D4375	(S)-(-)-6,7-Dimethoxy-1,2,3,4-tetrahydroisoquinoline-3-carboxylic Acid Hydrochloride	1g	5g
D3677	(S)-(+)-2,2-Dimethylcyclopropanecarboxylic Acid	1g	5g

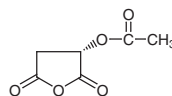
Product No.	Product Name	Unit Size	
D2702	(+)-Dipivaloyl-D-tartaric Acid	1g	5g
D2686	(-)-Dipivaloyl-L-tartaric Acid	5g	25g
D1417	(+)-Di- <i>p</i> -toluoyl-D-tartaric Acid	25g	250g
D1387	(-)-Di- <i>p</i> -toluoyl-L-tartaric Acid	25g	250g
E0993	(<i>R</i>)-(-)- α -[[[4-Ethyl-2,3-dioxo-1-piperazinyl]carbonyl]amino]benzeneacetic Acid	1g	5g
E0994	(<i>R</i>)-(-)- α -[[[4-Ethyl-2,3-dioxo-1-piperazinyl]carbonyl]amino]-4-hydroxybenzeneacetic Acid	1g	5g
F0818	<i>trans</i> -4-Fluoro-L-proline		50mg
F0721	<i>O</i> -Formyl-D-mandeloyl Chloride		25g
G0265	(<i>S</i>)-(-)-2-Guanidinoglutamic Acid		100mg
H1224	D-Homoserine	1g	5g
H0937	(<i>R</i>)-(+)-2-(4-Hydroxyphenoxy)propionic Acid		5g
H1339	(<i>S</i>)-2-Hydroxy-4-phenylbutyric Acid	1g	5g
H0758	4-Hydroxy-D-(-)-2-phenylglycine	25g	500g
H0933	(<i>S</i>)-(+)-2-Hydroxy-4-phthalimidobutyric Acid		5g
I0589	(<i>R</i>)-(+)-Indoline-2-carboxylic Acid		1g
I0395	(<i>S</i>)-(-)-Indoline-2-carboxylic Acid	1g	5g
L0026	L-Leucic Acid	1g	5g 25g
L0144	Lithium L-Lactate		25g
M0021	D-(+)-Malic Acid		5g 25g
M0022	L-(-)-Malic Acid	25g	100g 500g
M0662	D-(-)-Mandelic Acid	25g	100g 500g
M0661	L-(+)-Mandelic Acid	25g	250g
M1366	(<i>R</i>)-(-)-2-Methoxy-2-(1-naphthyl)propionic Acid		100mg
M1021	(<i>S</i>)-(+)-2-(6-Methoxy-2-naphthyl)propionic Acid	25g	500g
M0830	(<i>R</i>)-(-)- α -Methoxyphenylacetic Acid	100mg	1g 5g
M0829	(<i>S</i>)-(+)- α -Methoxyphenylacetic Acid	1g	5g
M1228	(<i>R</i>)-(-)-2-Methylglutamic Acid		5g
M1229	(<i>S</i>)-(+)-2-Methylglutamic Acid		5g
M1226	(<i>R</i>)-(+)-Methylsuccinic Acid	5g	25g
M1227	(<i>S</i>)-(-)-Methylsuccinic Acid		5g
N0327	D-Norleucine	1g	10g
N0303	L-Norleucine	100mg	1g 5g
N0673	D-Norvaline	1g	5g 25g
N0686	L-Norvaline		1g 5g
O0370	(2 <i>S</i> ,3 <i>aS</i> ,7 <i>aS</i>)-Octahydro-1 <i>H</i> -indole-2-carboxylic Acid	1g	5g
O0089	L-Ornithine Dihydrochloride	1g	5g
O0064	L-Ornithine Monohydrochloride	25g	250g
O0281	(<i>R</i>)-(-)-5-Oxotetrahydrofuran-2-carboxylic Acid	1g	5g
O0276	(<i>S</i>)-(+)-5-Oxotetrahydrofuran-2-carboxylic Acid	1g	5g
P0820	D-2-Phenylglycine	25g	500g
P1288	L-2-Phenylglycine	25g	100g
P1981	D-(+)-3-Phenyllactic Acid	1g	5g
P1168	L-(-)-3-Phenyllactic Acid	1g	5g
P1219	(<i>R</i>)-(-)-2-Phenylpropionic Acid	1g	5g
P0936	(<i>S</i>)-(+)-Phenylsuccinic Acid		1g
P1830	D-Pipecolic Acid	5g	25g
P1404	L-Pipecolic Acid	1g	5g
N0654	(<i>R</i>)-(-)-3-Piperidinecarboxylic Acid	1g	5g
N0678	(<i>S</i>)-(+)-3-Piperidinecarboxylic Acid	1g	5g
Q0009	D-(-)-Quinic Acid	5g	25g
T0026	D-(-)-Tartaric Acid	25g	500g
T0025	L-(+)-Tartaric Acid	25g	500g
T1740	(<i>R</i>)-(+)-Tetrahydrofuran-2-carboxylic Acid	5g	25g
T1741	(<i>S</i>)-(-)-Tetrahydrofuran-2-carboxylic Acid	1g	5g 25g
T1515	(<i>S</i>)-(-)-1,2,3,4-Tetrahydroisoquinoline-3-carboxylic Acid	5g	25g
T0219	L-Thioprolin	25g	500g
T1900	(<i>R</i>)-3,3,3-Trifluoro-2-hydroxy-2-methylpropionic Acid		1g
T1901	(<i>S</i>)-3,3,3-Trifluoro-2-hydroxy-2-methylpropionic Acid		1g

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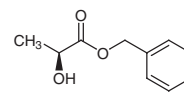
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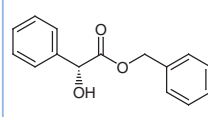
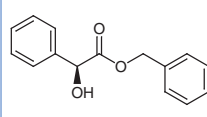
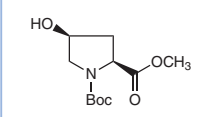
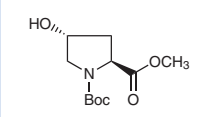
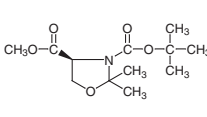
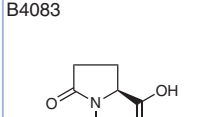
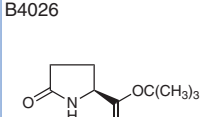
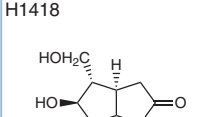
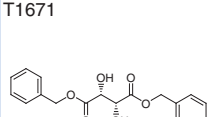
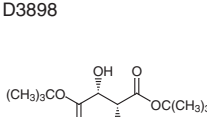
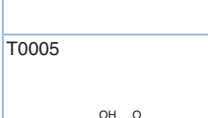
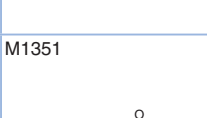
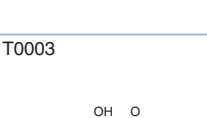
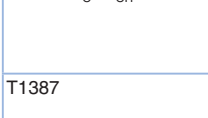
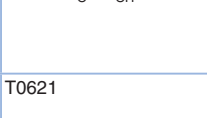
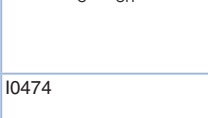
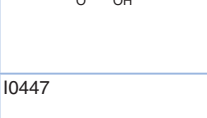
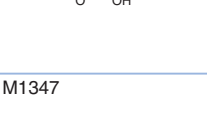
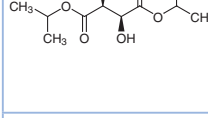
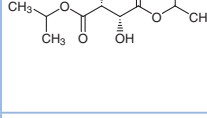
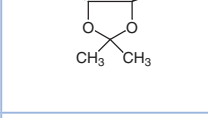
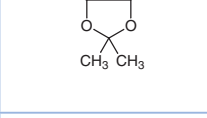
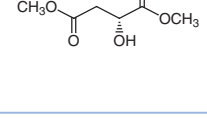
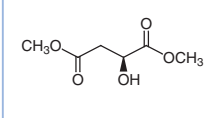
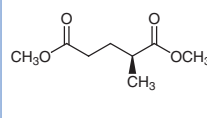
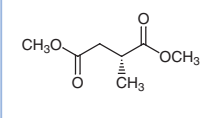
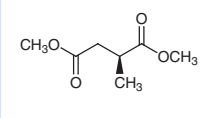
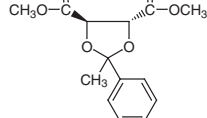
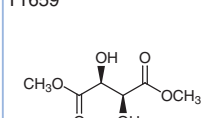
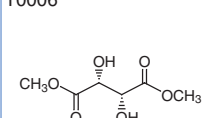
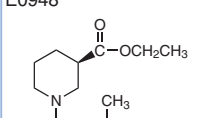
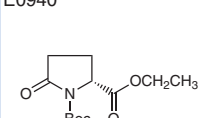
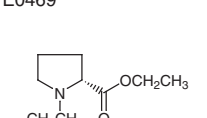
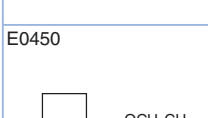
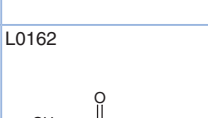
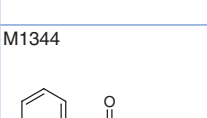
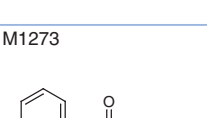


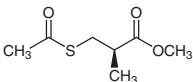
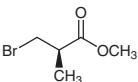
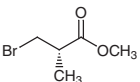
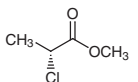
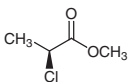
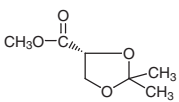
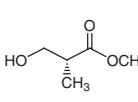
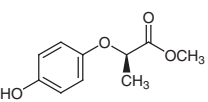
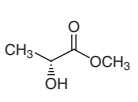
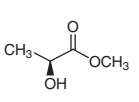
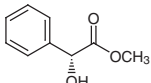
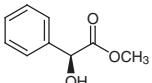
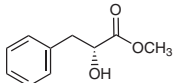
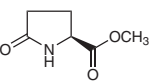
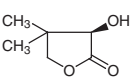
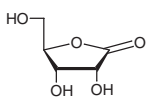
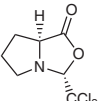
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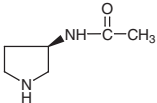
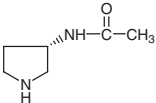
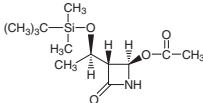
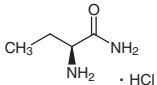
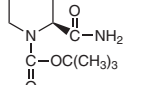
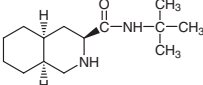
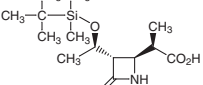
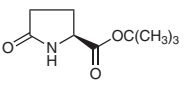
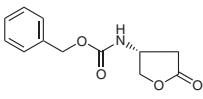
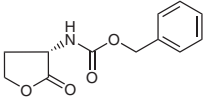
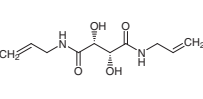
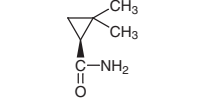
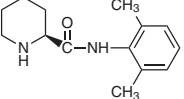
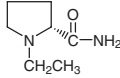
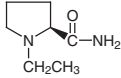
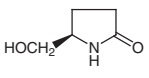
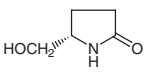
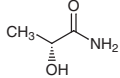


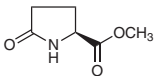
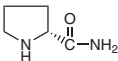
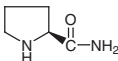
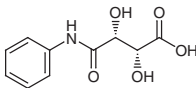
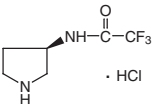
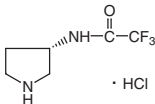
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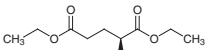
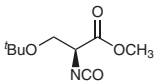
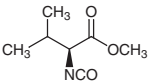
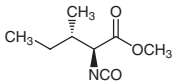
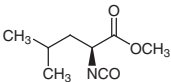
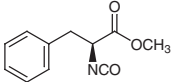
Product No.	Product Name	Unit Size	
A2124	(+)-O-Acetyl-D-malic Anhydride	1g	5g
A1101	(-)-O-Acetyl-L-malic Anhydride	5g	25g
L0161	Benzyl (S)-(-)-Lactate	5g	25g
M1354	Benzyl D-(-)-Mandelate	5g	25g
M1355	Benzyl L-(+)-Mandelate	5g	25g
B3987	N-(tert-Butoxycarbonyl)-cis-4-hydroxy-L-proline Methyl Ester	1g	5g
B3843	N-(tert-Butoxycarbonyl)-trans-4-hydroxy-L-proline Methyl Ester	1g	5g
B1755	(S)-(-)-3-tert-Butoxycarbonyl-4-methoxycarbonyl-2,2-dimethyl-1,3-oxazolidine	1g	5g 25g
B4083	N-(tert-Butoxycarbonyl)-L-pyroglutamic Acid	5g	25g
B4026	tert-Butyl L-Pyroglutamate	1g	5g
H1418	(-)-Corey Lactone	200mg	1g
T1671	Dibenzyl L-Tartrate		25g
D3898	Di-tert-butyl L-(+)-Tartrate		1g
T0005	Dibutyl L-(+)-Tartrate	25g	500g
M1351	Diethyl D-(+)-Malate	5g	25g
M1348	Diethyl L-(-)-Malate	5g	25g
T1195	Diethyl D-(-)-Tartrate	25g	250g
T0003	Diethyl L-(+)-Tartrate	25g	500g
T1387	Diisopropyl D-(-)-Tartrate	25g	250g
T0621	Diisopropyl L-(+)-Tartrate	25g	500g
I0474	Dimethyl (+)-2,3-O-Isopropylidene-D-tartrate		5g
I0447	Dimethyl (-)-2,3-O-Isopropylidene-L-tartrate		5g 25g
M1347	Dimethyl D-(+)-Malate		5g 25g
M1343	Dimethyl L-(-)-Malate		5g 25g
M1230	Dimethyl (S)-(+)-2-Methylglutarate		5g
M1231	Dimethyl (R)-(+)-Methylsuccinate		5g
M1232	Dimethyl (S)-(-)-Methylsuccinate		5g
P1189	Dimethyl (2R,3R)-2,3-O-(1-Phenylethylidene)-L-tartrate		5g
T1659	Dimethyl D-(-)-Tartrate	5g	25g
T0006	Dimethyl L-(+)-Tartrate		25g
E0948	Ethyl (R)-1-(tert-Butoxycarbonyl)-3-piperidinecarboxylate		5g
E0940	Ethyl N-(tert-Butoxycarbonyl)-D-pyroglutamate	1g	5g

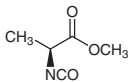
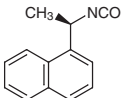
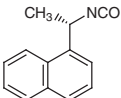
Product No.	Product Name	Unit Size	
E0469	Ethyl (<i>R</i>)-(+)-1-Ethyl-2-pyrrolidinecarboxylate	1g	5g
E0450	Ethyl (<i>S</i>)-(-)-1-Ethyl-2-pyrrolidinecarboxylate	1g	5g
H0904	Ethyl (<i>R</i>)-2-Hydroxy-4-phenylbutyrate		5g
L0162	Ethyl L-(-)-Lactate	25g	500g
M1344	Ethyl D-(-)-Mandelate	5g	25g
M1273	Ethyl L-(+)-Mandelate	5g	25g
N0655	Ethyl (<i>R</i>)-(-)-3-Piperidinecarboxylate	5g	25g
N0679	Ethyl (<i>S</i>)-(+)-3-Piperidinecarboxylate	5g	25g
T1241	Ethyl L-(-)- <i>O</i> -Tosyllactate	1g	25g
H0958	(<i>S</i>)-(+)- γ -Hydroxymethyl- γ -butyrolactone	1g	5g
L0115	L-(-)-Lactide	25g	250g
A1383	Methyl (<i>R</i>)-(+)-3-(Acetylthio)-2-methylpropionate		5mL
B2139	Methyl (<i>R</i>)-(+)-3-Bromoisobutyrate	1g	5g
B2140	Methyl (<i>S</i>)-(-)-3-Bromoisobutyrate	1g	5g
C1633	Methyl (<i>R</i>)-(+)-2-Chloropropionate		5g
C1634	Methyl (<i>S</i>)-(-)-2-Chloropropionate		5g
D2562	Methyl (<i>R</i>)-(+)-2,2-Dimethyl-1,3-dioxolane-4-carboxylate	5g	25g
H0703	Methyl (<i>R</i>)-(-)-3-Hydroxyisobutyrate	5g	25g
H0956	Methyl (<i>R</i>)-(+)-2-(4-Hydroxyphenoxy)propionate		25g
L0136	Methyl D-(+)-Lactate	5g	25g
L0163	Methyl L-(-)-Lactate	25g	500g
M1349	Methyl D-(-)-Mandelate	1g	5g
M1350	Methyl L-(+)-Mandelate	1g	5g
M2350	Methyl D-3-Phenyllactate	1g	5g
M2198	Methyl L-Pyroglutamate	25g	100g
P0011	D-(-)-Pantolactone	25g	500g
R0063	D-(+)-Ribono-1,4-lactone	1g	5g
T2902	(2 <i>R</i> ,5 <i>S</i>)-2-Trichloromethyl-3-oxa-1-azabicyclo[3.3.0]octan-4-one		1g

Amides		A1169 	A1170 	A1124 
A2252 	B3756 	B3410 	B1776 	B4026 
C2678 	C2699 	D1539 	D3676 	D4347 
E0468 	E0452 	H1241 	H0867 	L0167 

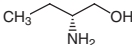
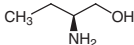
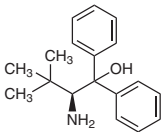
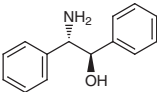
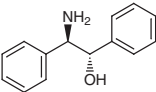
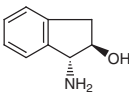
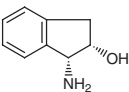
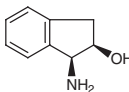
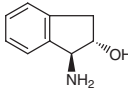
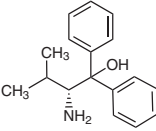
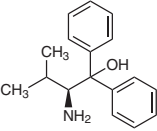
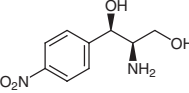
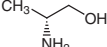
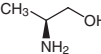
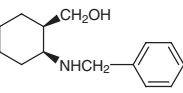
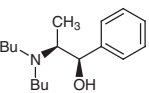
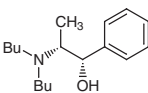
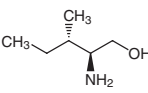
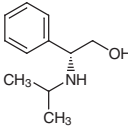
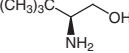
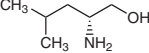
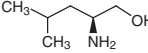
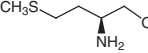
M2198	P2083	P1382	T1702	T1369
				
T1366				
				

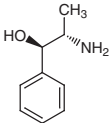
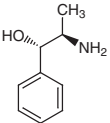
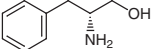
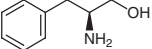
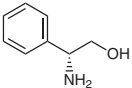
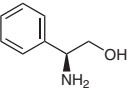
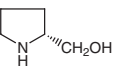
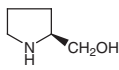
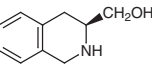
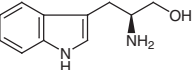
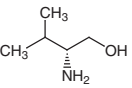
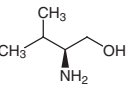
Product No.	Product Name	Unit Size	
A1169	(3R)-(+)-3-Acetamidopyrrolidine	5g	
A1170	(3S)-(-)-3-Acetamidopyrrolidine	5g	
A1124	(3R,4R)-4-Acetoxy-3-[(R)-(tert-butyl)dimethylsilyloxy]ethyl]-2-azetidinone	5g	25g
A2252	(S)-2-Aminobutyramide Hydrochloride	5g	25g
B3756	N-(tert-Butoxycarbonyl)-L-prolinamide	1g	5g
B3410	(S)-N-tert-Butyldecahydroisoquinoline-3-carboxamide	5g	25g
B1776	(3S,4S)-3-[(R)-1-(tert-Butyldimethylsilyloxy)ethyl]-4-[(R)-1-carboxyethyl]-2-azetidinone	1g	
B4026	tert-Butyl L-Pyrroglutamate	1g	5g
C2678	(R)-β-(Carbobenzoxyamino)-γ-butyrolactone		1g
C2699	N-Carbobenzoxy-L-homoserine Lactone	1g	5g
D1539	(+)-N,N'-Diallyl-L-tartardiamide		25g
D3676	(S)-(+)-2,2-Dimethylcyclopropanecarboxamide	5g	25g
D4347	(S)-N-(2,6-Dimethylphenyl)piperidine-2-carboxamide		5g
E0468	(R)-(+)-1-Ethyl-2-pyrrolidinecarboxamide	1g	5g
E0452	(S)-(-)-1-Ethyl-2-pyrrolidinecarboxamide	1g	5g
H1241	(R)-5-(Hydroxymethyl)-2-pyrrolidinone	1g	5g
H0867	(S)-5-(Hydroxymethyl)-2-pyrrolidinone	1g	5g
L0167	(R)-(+)-Lactamide	5g	25g
M2198	Methyl L-Pyroglutamate	25g	100g
P2083	D-Prolinamide	1g	5g
P1382	L-Prolinamide	5g	25g
T1702	(2R,3R)-Tartaric Acid	1g	5g
T1369	(3R)-(+)-3-(Trifluoroacetamido)pyrrolidine Hydrochloride	1g	25g
T1366	(3S)-(-)-3-(Trifluoroacetamido)pyrrolidine Hydrochloride	1g	25g

Isocyanates		I0468	I0334	I0335
				
I0473	I0466	I0471	I0467	I0472
				

I0465	I0336	I0398
		

Product No.	Product Name	Unit Size	
I0468	Diethyl (S)-(-)-2-Isocyanatoglutarate	1g	5g
I0334	(R)-(+)- α -Methylbenzyl Isocyanate	1g	5g
I0335	(S)-(-)- α -Methylbenzyl Isocyanate	1g	5g
I0473	Methyl (S)-(+)-2-Isocyanato-3- <i>tert</i> -butoxypropionate	1g	
I0466	Methyl (S)-(-)-2-Isocyanato-3-methylbutyrate	1g	5g
I0471	Methyl (2S,3S)-2-Isocyanato-3-methylvalerate	1g	5g
I0467	Methyl (S)-(-)-2-Isocyanato-4-methylvalerate	5g	25g
I0472	Methyl (S)-2-Isocyanato-3-phenylpropionate	1g	5g
I0465	Methyl (S)-(-)-2-Isocyanatopropionate	1g	5g
I0336	(R)-(-)-1-(1-Naphthyl)ethyl Isocyanate	1g	5g
I0398	(S)-(+)-1-(1-Naphthyl)ethyl Isocyanate	1g	5g

Amino Alcohols		A0972	A0973	A2503
				
A1230	A1231	A2306	A1623	A1624
				
A2307	A2533	A2504	A1017	A2002
				
A1085	B1119	D2128	D2129	I0462
				
I0476	L0160	L0236	L0137	M0929
				

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P1294 	P1274 	P1087 	T1755 	T1537 
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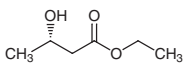
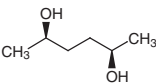
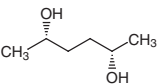
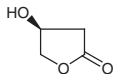
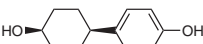
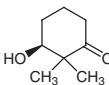
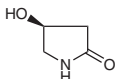
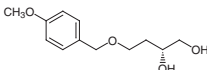
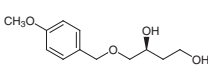
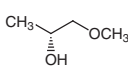
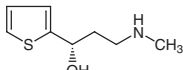
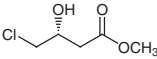
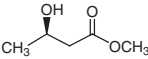
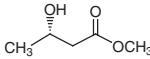
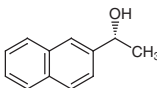
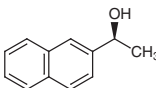
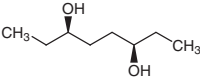
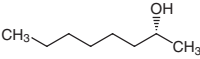
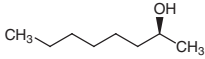
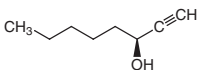
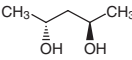
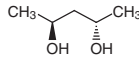
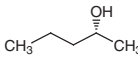
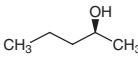
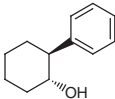
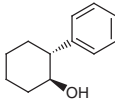
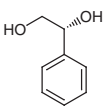
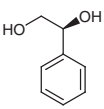
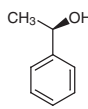
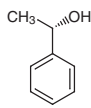
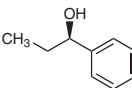
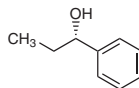
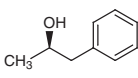
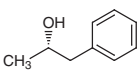
Product No.	Product Name	Unit Size	
A0972	(R)-(-)-2-Amino-1-butanol	5mL	
A0973	(S)-(+)-2-Amino-1-butanol	1mL	5mL
A2503	(S)-(-)-2-Amino-3,3-dimethyl-1,1-diphenyl-1-butanol	1g	5g
A1230	(1R,2S)-(-)-2-Amino-1,2-diphenylethanol	1g	5g
A1231	(1S,2R)-(+)-2-Amino-1,2-diphenylethanol	1g	5g
A2306	(1R,2R)-(-)-1-Amino-2-indanol	1g	5g
A1623	(1R,2S)-(+)-1-Amino-2-indanol	1g	5g
A1624	(1S,2R)-(-)-1-Amino-2-indanol	1g	5g
A2307	(1S,2S)-(+)-1-Amino-2-indanol	1g	5g
A2533	(R)-(+)-2-Amino-3-methyl-1,1-diphenyl-1-butanol		1g
A2504	(S)-(-)-2-Amino-3-methyl-1,1-diphenyl-1-butanol	1g	5g
A1017	D-(-)-threo-2-Amino-1-(4-nitrophenyl)-1,3-propanediol	25g	500g
A2002	(R)-(-)-2-Amino-1-propanol	5mL	25mL
A1085	(S)-(+)-2-Amino-1-propanol	1mL	5mL 25mL
B1119	(+)-cis-2-Benzylaminocyclohexanemethanol	1g	5g
D2128	(1R,2S)-2-(Dibutylamino)-1-phenyl-1-propanol	1g	5g
D2129	(1S,2R)-2-(Dibutylamino)-1-phenyl-1-propanol	1g	5g
I0462	L-Isoleucinol	1g	5g
I0476	(R)-2-Isopropylamino-2-phenylethanol	5g	25g
L0160	L-tert-Leucinol	1g	5g
L0236	D-(-)-Leucinol	1g	5g
L0137	L-(+)-Leucinol	5mL	25mL
M0929	L-(-)-Methioninol	100mg	1g
N0608	(1R,2S)-(-)-Norephedrine		25g
N0631	(1S,2R)-(+)-Norephedrine		25g
P1289	D-Phenylalaninol	5g	25g
P1028	L-Phenylalaninol	5g	25g
P1201	(R)-(-)-2-Phenylglycinol	5g	25g
P1294	(S)-(+)-2-Phenylglycinol	5g	25g
P1274	D-Prolinol	1g	5g 25g
P1087	L-Prolinol	5g	25g
T1755	(S)-1,2,3,4-Tetrahydroisoquinoline-3-methanol		1g
T1537	L-(-)-Tryptophanol		1g
V0077	D-Valinol	1g	5g
V0058	L-Valinol	5g	25g

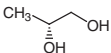
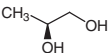
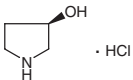
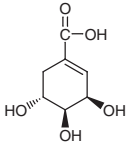
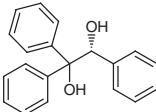
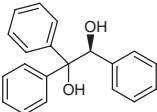
N-Protected Amino Alcohols		B1953	B2174	B2123
B3662	B4283	B1966	B2604	B3270
B3272	B3076	B3077	C2629	C1609
C1610				

Product No.	Product Name	Unit Size	
B1953	<i>N</i> -(<i>tert</i> -Butoxycarbonyl)-L-alaninol	1g	5g
B2174	(<i>R</i>)-1-(<i>tert</i> -Butoxycarbonyl)-2-azetidinemethanol	100mg	1g
B2123	(<i>S</i>)-1-(<i>tert</i> -Butoxycarbonyl)-2-azetidinemethanol	100mg	1g
B3662	(2 <i>S</i> ,4 <i>R</i>)-1-(<i>tert</i> -Butoxycarbonyl)-4-hydroxy-2-((hydroxymethyl)pyrrolidine	1g	5g
B4283	<i>N</i> -(<i>tert</i> -Butoxycarbonyl)-L-methioninol	1g	5g
B1966	<i>N</i> -(<i>tert</i> -Butoxycarbonyl)-D-phenylalaninol	1g	5g
B2604	<i>N</i> -(<i>tert</i> -Butoxycarbonyl)-L-phenylalaninol		5g
B3270	<i>N</i> -(<i>tert</i> -Butoxycarbonyl)-D-2-phenylglycinol	1g	5g
B3272	<i>N</i> -(<i>tert</i> -Butoxycarbonyl)-L-2-phenylglycinol	1g	5g
B3076	<i>N</i> -(<i>tert</i> -Butoxycarbonyl)-D-prolinol	1g	5g
B3077	<i>N</i> -(<i>tert</i> -Butoxycarbonyl)-L-prolinol	5g	25g
C2629	<i>N</i> -Carbobenzoxy-L-alaninol	1g	5g
C1609	<i>N</i> -Carbobenzoxy-D-phenylalaninol	1g	5g
C1610	<i>N</i> -Carbobenzoxy-L-phenylalaninol	1g	5g

Simple Alcohols		A2049	A1979	A1980
A0974	A0975	A1839	A2635	H1200

B2899	B2900	B2901	B2902	B2141
B2142	B4117	B1532	B1533	B4131
B4118	B4119	B1159	B1160	B1161
B1343	B3137	B2404	B0926	B0925
B3054	B3055	B1987	B2909	B2910
C2585	C2453	C2763	C2423	C2424
M0967	D2239	D2240	D4010	D1589
E0455	C1733	C1717	C1474	H1029

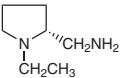
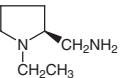
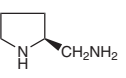
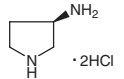
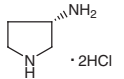
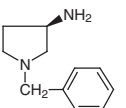
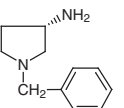
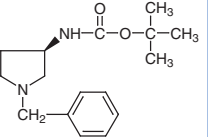
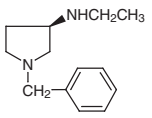
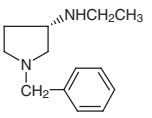
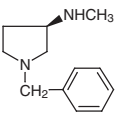
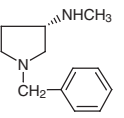
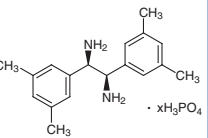
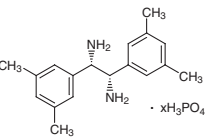
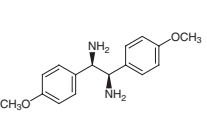
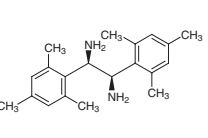
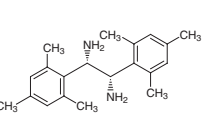
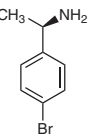
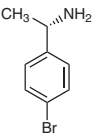
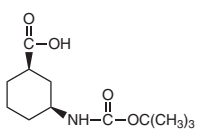
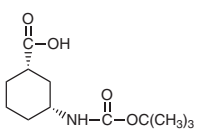
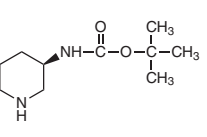
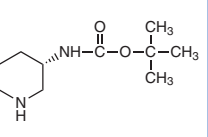
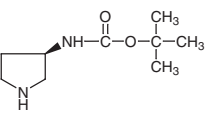
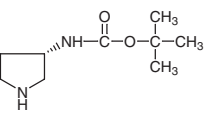
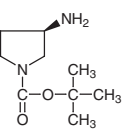
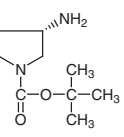
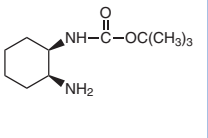
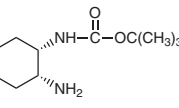
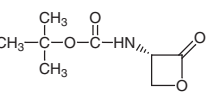
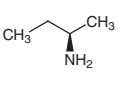
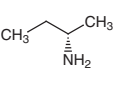
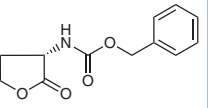
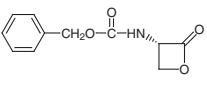
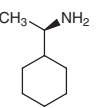
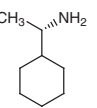
H0975 	H1032 	H0969 	H0950 	H0951 
H0939 	H1384 	H0887 	H1368 	H1332 
T1716 	M1788 	M1790 	M2166 	M2157 
M1483 	H0705 	H0704 	M1937 	M1938 
N0784 	N0785 	O0293 	O0145 	O0144 
O0235 	P1411 	P1412 	P0744 	P0743 
T1490 	T1491 	P1150 	P1151 	P0795 
P0796 	P1930 	P1931 	P1417 	P1780 

P1152	P1129	P1608	P1667	P1140
				
S0038	T2359	T2360	T1499	T1482
				

Product No.	Product Name	Unit Size	
A2049	(R)-1-Acetyl-3-pyrrolidinol	1g	
A1979	(R)-3-Amino-1,2-propanediol	1g	5g
A1980	(S)-3-Amino-1,2-propanediol	1g	5g
A0974	(R)-(-)-1-Amino-2-propanol	1g	5g 25g
A0975	(S)-(+)-1-Amino-2-propanol	1g	5g
A1839	1,4-Anhydroerythritol		5g
A2635	1,4-Anhydro-D-xylitol	20mg	100mg
H1200	(3R,4R)-1-Benzyl-4-hydroxy-3-pyrrolidinemethanol		200mg
B2899	(R)-4-Benzoyloxy-1,2-butanediol	200mg	1g
B2900	(S)-4-Benzoyloxy-1,2-butanediol	200mg	1g
B2901	(R)-4-Benzoyloxy-1,3-butanediol		1g
B2902	(S)-4-Benzoyloxy-1,3-butanediol		1g
B2141	(R)-(+)-3-Benzoyloxy-1,2-propanediol	100mg	1g
B2142	(S)-(-)-3-Benzoyloxy-1,2-propanediol	100mg	1g
B4117	(S)-(+)-1-Benzoyloxy-2-propanol	1g	5g
B1532	(R)-1-Benzyl-3-pyrrolidinol	1g	5g
B1533	(S)-1-Benzyl-3-pyrrolidinol	5g	25g
B4131	(R)-1-[3,5-Bis(trifluoromethyl)phenyl]ethanol	5g	25g
B4118	(R)-1,2-Butanediol	1g	5g
B4119	(S)-1,2-Butanediol	1g	5g
B1159	(R)-(-)-1,3-Butanediol	1g	5g
B1160	(S)-(+)-1,3-Butanediol	1g	5g
B1161	(R,R)-(-)-2,3-Butanediol	1g	5g
B1343	(S,S)-(+)-2,3-Butanediol	100mg	1g
B3137	(R)-1,2,4-Butanetriol	1g	5g
B2404	(S)-1,2,4-Butanetriol	5g	25g
B0926	(R)-(-)-2-Butanol	1mL	5mL
B0925	(S)-(+)-2-Butanol	1mL	5mL
B3054	(R)-1-(tert-Butoxycarbonyl)-3-pyrrolidinol	1g	5g
B3055	(S)-1-(tert-Butoxycarbonyl)-3-pyrrolidinol	1g	5g
B1987	(S)-(-)-3-tert-Butylamino-1,2-propanediol		5g
B2909	(R)-(+)-3-Butyn-2-ol	1g	5g
B2910	(S)-(-)-3-Butyn-2-ol		1g
C2585	(R)-1-Carbobenzoxy-3-pyrrolidinol	1g	5g
C2453	(S)-1-Carbobenzoxy-3-pyrrolidinol	1g	5g
C2763	(R)-(+)-4-Chloro-3-hydroxybutyronitrile	1g	5g
C2423	(R)-(+)-3-Chloro-1-phenyl-1-propanol		1g
C2424	(S)-(-)-3-Chloro-1-phenyl-1-propanol		1g
M0967	(R)-(-)-3-Chloro-1,2-propanediol	10g	25g
D2239	(+)-1,4-Di-O-benzyl-D-threitol		1g
D2240	(-)-1,4-Di-O-benzyl-L-threitol		1g
D4010	(S)-3-(Dimethylamino)-1-(2-thienyl)-1-propanol	1g	5g
D1589	L-Dithiothreitol	1g	5g
E0455	D-Erythroneolactone	1g	5g 25g
C1733	Ethyl (R)-4-Chloro-3-hydroxybutyrate		5g 25g
C1717	Ethyl (S)-4-Chloro-3-hydroxybutyrate		5g 25g
C1474	Ethyl (R)-(-)-4-Cyano-3-hydroxybutyrate	1g	5g 25g
H1029	Ethyl (R)-(-)-3-Hydroxybutyrate	1g	5g
H0975	Ethyl (S)-(+)-3-Hydroxybutyrate	5g	25g
H1032	(2R,5R)-2,5-Hexanediol		1g

Product No.	Product Name	Unit Size	
H0969	(2S,5S)-2,5-Hexanediol	1g	5g
H0950	(R)-(+)- α -Hydroxy- γ -butyrolactone	100mg	1g
H0951	(S)-(-)- α -Hydroxy- γ -butyrolactone		100mg
H0939	(S)-3-Hydroxy- γ -butyrolactone	1g	5g
H1384	4-(<i>cis</i> -4-Hydroxycyclohexyl)phenol		1g
H0887	(S)-(+)-3-Hydroxy-2,2-dimethylcyclohexanone		100mg
H1368	(S)-(-)-4-Hydroxy-2-pyrrolidone		1g
H1332	(R)-3-Hydroxytetrahydrofuran	1g	5g
T1716	(S)-3-Hydroxytetrahydrofuran	1g	5g
M1788	(R)-4-(4-Methoxybenzyloxy)-1,2-butanediol		500mg
M1790	(S)-4-(4-Methoxybenzyloxy)-1,3-butanediol		500mg
M2166	(R)-(-)-1-Methoxy-2-propanol	5g	25g
M2157	(S)-3-(Methylamino)-1-(2-thienyl)-1-propanol	5g	25g
M1483	Methyl (R)-4-Chloro-3-hydroxybutyrate		5g
H0705	Methyl (R)-(-)-3-Hydroxybutyrate	10mL	25mL
H0704	Methyl (S)-(+)-3-Hydroxybutyrate	5mL	25mL
M1937	(R)-1-Methyl-3-pyrrolidinol	1g	5g
M1938	(S)-1-Methyl-3-pyrrolidinol	1g	5g
N0784	(R)-(+)-1-(2-Naphthyl)ethanol		1g
N0785	(S)-(-)-1-(2-Naphthyl)ethanol		1g
O0293	(3R,6R)-3,6-Octanediol		500mg
O0145	(R)-(-)-2-Octanol	5mL	25mL
O0144	(S)-(+)-2-Octanol	5mL	25mL
O0235	(S)-1-Octyn-3-ol	1g	5g
P1411	(2R,4R)-(-)-2,4-Pentanediol		1g
P1412	(2S,4S)-(+)-2,4-Pentanediol		1g
P0744	(R)-(-)-2-Pentanol	1mL	5mL
P0743	(S)-(+)-2-Pentanol	1mL	5mL
T1490	(1R,2S)-(-)- <i>trans</i> -2-Phenyl-1-cyclohexanol	100mg	1g
T1491	(1S,2R)-(+)- <i>trans</i> -2-Phenyl-1-cyclohexanol	100mg	1g
P1150	(R)-(-)-1-Phenylethane-1,2-diol	1g	5g 25g
P1151	(S)-(+)-1-Phenylethane-1,2-diol		1g 5g
P0795	(R)-(+)-1-Phenylethyl Alcohol	1g	5g 25g
P0796	(S)-(-)-1-Phenylethyl Alcohol	1g	5g 25g
P1930	(R)-(+)-1-Phenyl-1-propanol		1g
P1931	(S)-(-)-1-Phenyl-1-propanol		1g
P1417	(R)-1-Phenyl-2-propanol		1mL
P1780	(S)-1-Phenyl-2-propanol		1mL
P1152	(R)-(-)-1,2-Propanediol	5g	25g
P1129	(S)-(+)-1,2-Propanediol		5g
P1608	(R)-3-Pyrrolidinol	1g	5g
P1667	(S)-3-Pyrrolidinol	1g	5g 25g
P1140	(R)-(-)-3-Pyrrolidinol Hydrochloride	5g	25g
S0038	Shikimic Acid	100mg	1g 5g
T2359	(R)-(-)-1,2,3,4-Tetrahydro-1-naphthol		100mg 1g
T2360	(S)-(+)-1,2,3,4-Tetrahydro-1-naphthol	100mg	1g
T1499	(R)-(+)-1,1,2-Triphenyl-1,2-ethanediol	1g	5g
T1482	(S)-(-)-1,1,2-Triphenyl-1,2-ethanediol		1g

Amines		A2335	A2512	A1445
A2323	A2324	A2286	A2473	A2533

A1342 	A1301 	A2206 	A1167 	A1168 
A1053 	A1054 	A1173 	A1174 	B1932 
B1580 	B1581 	B1582 	B1583 	B2775 
B2776 	B3225 	B2316 	B2317 	B3672 
B3674 	B3538 	B3539 	B3591 	B3660 
A1171 	A1172 	B2920 	B2921 	B3478 
B3483 	B1995 	B2917 	B2918 	C2699 
C1575 	C1447 	C1448 	C1541 	C1531 

C1189	D4035	D4036	D2827	D2828
D4258	D2149	D2193	D2459	D2460
D2176	D2175	E0433	E0434	I0480
M1511	M1512	M1107	M1108	M1746
M1747	N0482	N0481	N0724	N0726
P0794	P0793	P1118	T2926	T2878
T1380	T1381			

Product No.	Product Name	Unit Size
A2335	(S)-3-Amino-1- <i>tert</i> -butoxycarbonylpiperidine	1g
A2512	(R)-(+)- α -Amino- γ -butyrolactone Hydrochloride	1g 5g
A1445	(S)-(-)- α -Amino- γ -butyrolactone Hydrochloride	1g
A2323	(R)-3-Amino-1-carbobenzoxypyrrolidine Hydrochloride	1g 5g
A2324	(S)-3-Amino-1-carbobenzoxypyrrolidine Hydrochloride	1g 5g
A2286	(1S,3R)-3-Aminocyclohexanecarboxylic Acid	200mg

Product No.	Product Name	Unit Size		
A2473	(S)-2-(Aminomethyl)-1-(<i>tert</i> -butoxycarbonyl)pyrrolidine		1g	
A2533	(R)-(+)-2-Amino-3-methyl-1,1-diphenyl-1-butanol		1g	
A1342	(R)-(+)-2-Aminomethyl-1-ethylpyrrolidine		1g	
A1301	(S)-(-)-2-Aminomethyl-1-ethylpyrrolidine	1g	5g	
A2206	(S)-2-(Aminomethyl)pyrrolidine	200mg	1g	
A1167	(3R)-(+)-3-Aminopyrrolidine	5g	25g	
A1168	(3S)-(-)-3-Aminopyrrolidine	5g	25g	
A1053	(3R)-(-)-3-Aminopyrrolidine Dihydrochloride	5g	25g	
A1054	(3S)-(+)-3-Aminopyrrolidine Dihydrochloride	5g	25g	
A1173	(3R)-(-)-1-Benzyl-3-aminopyrrolidine	10g	25g	
A1174	(3S)-(+)-1-Benzyl-3-aminopyrrolidine	10g	25g	
B1932	(3R)-(+)-1-Benzyl-3-(<i>tert</i> -butoxycarbonylamino)pyrrolidine		5g	
B1580	(3R)-(-)-1-Benzyl-3-(ethylamino)pyrrolidine		5g	
B1581	(3S)-(+)-1-Benzyl-3-(ethylamino)pyrrolidine		5g	
B1582	(3R)-(-)-1-Benzyl-3-(methylamino)pyrrolidine	5g	25g	
B1583	(3S)-(+)-1-Benzyl-3-(methylamino)pyrrolidine	5g	25g	
B2775	(1R,2R)-1,2-Bis(3,5-dimethylphenyl)-1,2-ethylenediamine Phosphate		100mg	
B2776	(1S,2S)-1,2-Bis(3,5-dimethylphenyl)-1,2-ethylenediamine Phosphate		100mg	
B3225	(1R,2R)-1,2-Bis(4-methoxyphenyl)ethylenediamine		Price on request	
B2316	(1R,2R)-1,2-Bis(2,4,6-trimethylphenyl)ethylenediamine	100mg	500mg	
B2317	(1S,2S)-1,2-Bis(2,4,6-trimethylphenyl)ethylenediamine	100mg	500mg	
B3672	(R)-(+)-1-(4-Bromophenyl)ethylamine	1g	5g	
B3674	(S)-(-)-1-(4-Bromophenyl)ethylamine	5g	25g	
B3538	(1R,3S)-3-(<i>tert</i> -Butoxycarbonylamino)cyclohexanecarboxylic Acid		1g	
B3539	(1S,3R)-3-(<i>tert</i> -Butoxycarbonylamino)cyclohexanecarboxylic Acid		1g	
B3591	(R)-3-(<i>tert</i> -Butoxycarbonylamino)piperidine	1g	5g	
B3660	(S)-3-(<i>tert</i> -Butoxycarbonylamino)piperidine	1g	5g	
A1171	(3R)-(+)-3-(<i>tert</i> -Butoxycarbonylamino)pyrrolidine	5g	25g	
A1172	(3S)-(-)-3-(<i>tert</i> -Butoxycarbonylamino)pyrrolidine	5g	25g	
B2920	(3R)-(+)-1-(<i>tert</i> -Butoxycarbonyl)-3-aminopyrrolidine	1g	5g	
B2921	(3S)-(-)-1-(<i>tert</i> -Butoxycarbonyl)-3-aminopyrrolidine	1g	5g	
B3478	(1R,2S)-N'-1-(<i>tert</i> -Butoxycarbonyl)-1,2-cyclohexanediamine	1g	5g	
B3483	(1S,2R)-N'-1-(<i>tert</i> -Butoxycarbonyl)-1,2-cyclohexanediamine	1g	5g	
B1995	N-(<i>tert</i> -Butoxycarbonyl)-L-serine β -Lactone	1g	5g	
B2917	(R)-(-)- <i>sec</i> -Butylamine	100mg	1g	
B2918	(S)-(+)- <i>sec</i> -Butylamine		1g	
C2699	N-Carbobenzoxy-L-homoserine Lactone	1g	5g	
C1575	N-Carbobenzoxy-L-serine β -Lactone		1g	
C1447	(1R,2R)-(-)-1,2-Cyclohexanediamine	5g	25g	
C1448	(1S,2S)-(+)-1,2-Cyclohexanediamine	5g	25g	
C1541	(R)-(-)-1-Cyclohexylethylamine	5g	25g	
C1531	(S)-(+)-1-Cyclohexylethylamine	5g	25g	
C1189	D-(+)-Cycloserine	1g	5g	
D4035	(3R,4R)-(-)-3,4-Diamino-1-benzylpyrrolidine		50mg	
D4036	(3S,4S)-(+)-3,4-Diamino-1-benzylpyrrolidine		50mg	
D2827	(R)-1,2-Diaminopropane Dihydrochloride		1g	
D2828	(S)-1,2-Diaminopropane Dihydrochloride		1g	
D4258	(S)-3-[1-(Dimethylamino)ethyl]phenol	1g	5g	
D2149	(3R)-(+)-3-(Dimethylamino)pyrrolidine	1g	5g	
D2193	(3S)-(-)-3-(Dimethylamino)pyrrolidine	1g	5g	
D2459	(1R,2R)-(-)-N,N'-Dimethylcyclohexane-1,2-diamine	100mg	1g	
D2460	(1S,2S)-(+)-N,N'-Dimethylcyclohexane-1,2-diamine	100mg	1g	5g
D2176	(1R,2R)-(+)-1,2-Diphenylethylenediamine	1g	5g	
D2175	(1S,2S)-(-)-1,2-Diphenylethylenediamine	1g	5g	
E0433	(3R)-(+)-3-(Ethylamino)pyrrolidine		1g	
E0434	(3S)-(-)-3-(Ethylamino)pyrrolidine		1g	
I0480	(S)-2-Isopropylamino-3-methyl-1-butanol		5g	
M1511	(R)-(+)-1-(4-Methoxyphenyl)ethylamine	5g	25g	
M1512	(S)-(-)-1-(4-Methoxyphenyl)ethylamine	5g	25g	
M1107	(3R)-(+)-3-(Methylamino)pyrrolidine	1g	5g	
M1108	(3S)-(-)-3-(Methylamino)pyrrolidine	1g	5g	
M1746	(R)-(+)- β -Methylphenethylamine	5g	25g	
M1747	(S)-(-)- β -Methylphenethylamine	5g	25g	
N0482	(R)-(+)-1-(1-Naphthyl)ethylamine	1g	5g	
N0481	(S)-(-)-1-(1-Naphthyl)ethylamine	1g	5g	
N0724	(R)-1-(2-Naphthyl)ethylamine	1g	5g	
N0726	(S)-1-(2-Naphthyl)ethylamine	1g	5g	
P0794	(R)-(+)-1-Phenylethylamine	25mL	100mL	500mL

Product No.	Product Name	Unit Size		
P0793	(S)-(-)-1-Phenylethylamine	25mL	100mL	500mL
P1118	(S)-1-Phenyl-2-(<i>p</i> -tolyl)ethylamine		5g	25g
T2926	(<i>R</i>)-(-)-1,2,3,4-Tetrahydro-1-naphthylamine		5g	25g
T2878	(S)-(+)-1,2,3,4-Tetrahydro-1-naphthylamine		5g	25g
T1380	(<i>R</i>)-(+)-1-(<i>p</i> -Tolyl)ethylamine			1mL
T1381	(S)-(-)-1-(<i>p</i> -Tolyl)ethylamine		1mL	5mL

Isopropylidene Sugars		D2265	D3758	D2555
D1949	D2191	D2024	D2447	D2616
I0507	I0454	I0400	I0688	I0489
I0376	I0375	I0721	T2755	

Product No.	Product Name	Unit Size	
D2265	1,2:5,6-Di- <i>O</i> -isopropylidene- α -D-allofuranose	1g	5g
D3758	2,3:4,5-Di- <i>O</i> -isopropylidene- β -D-fructopyranose	5g	25g
D2555	1,2:3,4-Di- <i>O</i> -isopropylidene- α -D-galactopyranose	5g	25g
D1949	1,2:5,6-Di- <i>O</i> -isopropylidene- α -D-glucopyranose	10g	25g
D2191	(-)-2,3,4,6-Di- <i>O</i> -isopropylidene-2-keto-L-gulonic Acid Monohydrate		5g
D2024	1,2:5,6-Di- <i>O</i> -isopropylidene-D-mannitol	5g	25g
D2447	2,3:5,6-Di- <i>O</i> -isopropylidene-D-mannofuranose		5g
D2616	1,2:3,5-Di- <i>O</i> -isopropylidene- α -D-xylofuranose		5g
I0507	(+)-5,6- <i>O</i> -Isopropylidene-L-ascorbic Acid	5g	25g
I0454	2,3- <i>O</i> -Isopropylidene-D-erythrone		1g
I0400	1,2- <i>O</i> -Isopropylidene- α -D-glucopyranose		25g
I0688	1,2- <i>O</i> -Isopropylidene- α -D-glucurono-6,3-lactone		1g
I0489	3,4- <i>O</i> -Isopropylidene-D-mannitol	1g	5g
I0376	(+)-2,3- <i>O</i> -Isopropylidene-L-threitol	1g	5g
I0375	(-)-2,3- <i>O</i> -Isopropylidene-D-threitol	1g	5g
I0721	1,2- <i>O</i> -Isopropylidene- α -D-xylofuranose	5g	25g
T2755	Topiramate	1g	5g

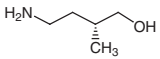
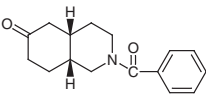
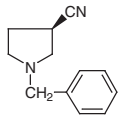
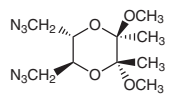
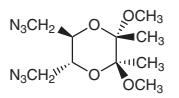
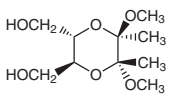
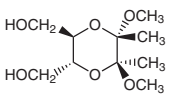
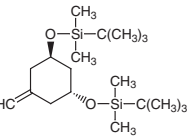
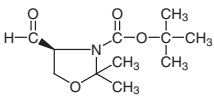
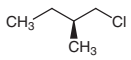
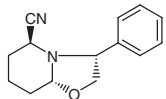
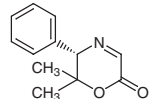
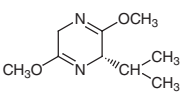
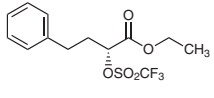
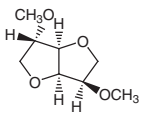
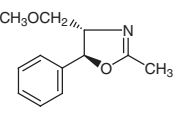
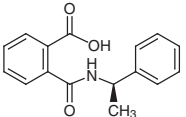
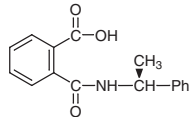
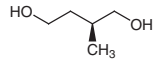
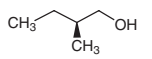
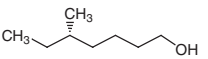
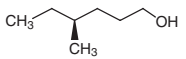
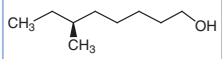
Protected 1,2/1,3-Diols		B2136	B2137	B3702
B3642	B3690	B4214	C2265	C1796
D1705	D1691	D2549	D2550	D4076
D4077	H1188	H1189	M1451	M1456
P1485	P1486			

Product No.	Product Name	Unit Size	
B2136	(R)-4-Benzyloxymethyl-2,2-dimethyl-1,3-dioxolane	1g	
B2137	(S)-4-Benzyloxymethyl-2,2-dimethyl-1,3-dioxolane	1g	
B3702	tert-Butyl 2-[(4R,6R)-6-(2-Aminoethyl)-2,2-dimethyl-1,3-dioxan-4-yl]acetate	1g	5g
B3642	tert-Butyl (4R,6R)-6-Cyanomethyl-2,2-dimethyl-1,3-dioxane-4-acetate	5g	
B3690	tert-Butyl (4R,6R)-2-[6-[2-[2-(4-Fluorophenyl)-5-isopropyl-3-phenyl-4-(phenylcarbamoyl)pyrrol-1-yl]ethyl]-2,2-dimethyl-1,3-dioxan-4-yl]acetate	1g	5g
B4214	tert-Butyl (4R,6S)-6-(Hydroxymethyl)-2,2-dimethyl-1,3-dioxane-4-acetate	5g	25g
C2265	(R)-4-Chloromethyl-2,2-dimethyl-1,3-dioxolane	5g	25g
C1796	(S)-4-Chloromethyl-2,2-dimethyl-1,3-dioxolane	1g	5g
D1705	(R)-(-)-2,2-Dimethyl-1,3-dioxolane-4-methanol	1g	5g 25g
D1691	(S)-(+)-2,2-Dimethyl-1,3-dioxolane-4-methanol	1g	5g 25g
D2549	(R)-(-)-2,2-Dimethyl-1,3-dioxolan-4-ylmethyl p-Toluenesulfonate	1g	
D2550	(S)-(+)-2,2-Dimethyl-1,3-dioxolan-4-ylmethyl p-Toluenesulfonate	1g	5g
D4076	(R)-4-(2-Hydroxyethyl)-2,2-diisopropyl-1,3-dioxolane	1g	
D4077	(S)-4-(2-Hydroxyethyl)-2,2-diisopropyl-1,3-dioxolane	1g	
H1188	(R)-4-(2-Hydroxyethyl)-2,2-dimethyl-1,3-dioxolane	1g	
H1189	(S)-4-(2-Hydroxyethyl)-2,2-dimethyl-1,3-dioxolane	1g	
M1451	(R)-(+)-4-(Methoxymethyl)-1,3-dioxolan-2-one	5g	25g
M1456	(S)-(-)-4-(Methoxymethyl)-1,3-dioxolan-2-one	5g	25g
P1485	(R)-Propylene Carbonate	5g	25g
P1486	(S)-Propylene Carbonate	5g	25g

Glycidyl Compounds		B2238	B2239	E0893
B4111	B3832	B3833	E0581	E0533
G0363	G0364	G0282	G0283	G0280
G0281	G0286	G0287	G0411	G0409
G0410	G0327	G0328	T1611	T1612
G0284	G0285	P1396	P0951	I0580
I0581				

Product No.	Product Name	Unit Size	
B2238	Benzyl (<i>R</i>)-(-)-Glycidyl Ether	1g	25g
B2239	Benzyl (<i>S</i>)-(+)-Glycidyl Ether	1g	25g
E0893	(2 <i>S</i> ,3 <i>S</i>)-3-(<i>tert</i> -Butoxycarbonylamino)-1,2-epoxy-4-phenylbutane	5g	25g
B4111	<i>tert</i> -Butyldimethylsilyl (<i>S</i>)-Glycidyl Ether		5mL
B3832	(<i>R</i>)-(+)-Butylene Oxide	5mL	25mL
B3833	(<i>S</i>)-(-)-Butylene Oxide	5mL	25mL

Product No.	Product Name	Unit Size		
E0581	(<i>R</i>)-Epichlorohydrin	5g	25g	
E0533	(<i>S</i>)-Epichlorohydrin	5g	25g	
G0363	(<i>R</i>)-(+)-Glycidol	5g	25g	
G0364	(<i>S</i>)-(-)-Glycidol	5g	25g	
G0282	(<i>R</i>)-Glycidyl Butyrate	5g	25g	
G0283	(<i>S</i>)-Glycidyl Butyrate	5g	25g	
G0280	(<i>R</i>)-Glycidyl Methyl Ether	5g	25g	
G0281	(<i>S</i>)-Glycidyl Methyl Ether	5g	25g	
G0286	(<i>R</i>)-Glycidyl 3-Nitrobenzenesulfonate	5g	25g	
G0287	(<i>S</i>)-Glycidyl 3-Nitrobenzenesulfonate	5g	25g	
G0411	(<i>S</i>)-Glycidyl 4-Nitrobenzenesulfonate	5g		
G0409	(<i>R</i>)-Glycidyl Phenyl Ether		1g	
G0410	(<i>S</i>)-Glycidyl Phenyl Ether	1g	5g	
G0327	(<i>R</i>)- <i>N</i> -Glycidylphthalimide	5g	25g	
G0328	(<i>S</i>)- <i>N</i> -Glycidylphthalimide	5g	25g	
T1611	(2 <i>R</i>)-(-)-Glycidyl <i>p</i> -Toluenesulfonate	5g	25g	
T1612	(2 <i>S</i>)-(+)-Glycidyl <i>p</i> -Toluenesulfonate	5g	25g	
G0284	(<i>R</i>)-Glycidyl Trityl Ether	5g	25g	
G0285	(<i>S</i>)-Glycidyl Trityl Ether	5g	25g	
P1396	(<i>R</i>)-(+)-Propylene Oxide	5mL	25mL	
P0951	(<i>S</i>)-(-)-Propylene Oxide	1mL	5mL	25mL
I0580	(<i>R,R,R</i>)-Triglycidyl Isocyanurate			1g
I0581	(<i>S,S,S</i>)-Triglycidyl Isocyanurate			1g

Others		A1576 	B2420 	B3299 
B3693 	B3694 	B3695 	B3696 	B2779 
B1759 	C1188 	C1363 	D3259 	D3257 
E0879 	I0390 	M0803 	M1622 	M0824 
M1234 	M0170 	M0965 	M0964 	M0966 

M0963	M2091	M1424	P1499	P1500
P1504	P1509	T2551	T2552	T2636
V0117				

Product No.	Product Name	Unit Size	
A1576	(<i>R</i>)-4-Amino-2-methyl-1-butanol	1g	5g
B2420	(4 <i>aS</i> ,8 <i>aR</i>)-2-Benzoyloctahydro-6(2 <i>H</i>)-isoquinolinone		50mg
B3299	(<i>R</i>)-1-Benzyl-3-pyrrolidinecarbonitrile	1g	5g
B3693	(2 <i>R</i> ,3 <i>R</i> ,5 <i>S</i> ,6 <i>S</i>)-5,6-Bis(azidomethyl)-2,3-dimethoxy-2,3-dimethyl-1,4-dioxane		100mg
B3694	(2 <i>S</i> ,3 <i>S</i> ,5 <i>R</i> ,6 <i>R</i>)-5,6-Bis(azidomethyl)-2,3-dimethoxy-2,3-dimethyl-1,4-dioxane		100mg
B3695	(2 <i>R</i> ,3 <i>R</i> ,5 <i>S</i> ,6 <i>S</i>)-5,6-Bis(hydroxymethyl)-2,3-dimethoxy-2,3-dimethyl-1,4-dioxane		200mg
B3696	(2 <i>S</i> ,3 <i>S</i> ,5 <i>R</i> ,6 <i>R</i>)-5,6-Bis(hydroxymethyl)-2,3-dimethoxy-2,3-dimethyl-1,4-dioxane		200mg
B2779	(1 <i>R</i> ,3 <i>R</i>)-5-(Bromomethylene)-1,3-bis(<i>tert</i> -butyldimethylsilyloxy)cyclohexane		100mg
B1759	(<i>S</i>)-(-)-3-(<i>tert</i> -Butoxycarbonyl)-4-formyl-2,2-dimethyl-1,3-oxazolidine	1g	5g
C1188	(<i>S</i>)-(+)-1-Chloro-2-methylbutane	10mL	25mL
C1363	(-)-2-Cyano-6-phenyloxazolopiperidine		1g
D3259	(5 <i>S</i>)-5,6-Dihydro-6,6-dimethyl-5-phenyl-2 <i>H</i> -1,4-oxazin-2-one		1g
D3257	(2 <i>S</i>)-2,5-Dihydro-2-isopropyl-3,6-dimethoxypyrazine		1g
E0879	Ethyl (<i>R</i>)-4-Phenyl-2-(trifluoromethanesulfonyloxy)butyrate		1g
I0390	Isosorbide Dimethyl Ether		25g
M0803	(4 <i>S</i> ,5 <i>S</i>)-(-)-4-Methoxymethyl-2-methyl-5-phenyl-2-oxazoline		1g
M1622	(<i>R</i>)-(+)- <i>N</i> -(α -Methylbenzyl)phthalamic Acid	1g	5g
M0824	(<i>S</i>)-(-)- <i>N</i> -(α -Methylbenzyl)phthalamic Acid		1g
M1234	(<i>S</i>)-(-)-2-Methyl-1,4-butanediol		5g
M0170	(<i>S</i>)-(-)-2-Methyl-1-butanol		25mL
M0965	(<i>S</i>)-(+)-5-Methyl-1-heptanol		1mL
M0964	(<i>S</i>)-(+)-4-Methyl-1-hexanol	1mL	5mL
M0966	(<i>S</i>)-(+)-6-Methyl-1-octanol	1mL	5mL
M0963	(<i>S</i>)-(+)-3-Methyl-1-pentanol	1mL	5mL
M2091	(<i>R</i>)-(-)-2-Methylpiperazine	5g	25g
M1424	(<i>S</i>)-(+)-2-Methylpiperazine	1g	5g
P1499	(<i>R</i>)-3-Phenylcyclohexanone	100mg	1g
P1500	(<i>S</i>)-3-Phenylcyclohexanone	100mg	1g
P1504	(<i>R</i>)-3-Phenylcyclopentanone	100mg	1g
P1509	(<i>S</i>)-3-Phenylcyclopentanone	100mg	1g
T2551	(<i>R</i>)-(-)-Tetrahydrofurfurylamine	200mg	1g 5g
T2552	(<i>S</i>)-(+)-Tetrahydrofurfurylamine	200mg	1g
T2636	(<i>R</i>)-(-)-2,3,7,7a-Tetrahydro-7a-methyl-1 <i>H</i> -indene-1,5(6 <i>H</i>)-dione		1g
V0117	Valencene		5g

Terminal Acetylenes

Hydrocarbons		B3242	C1195	C1493
		$\text{HC}\equiv\text{C}-\text{CH}_2\text{CH}_2\text{Br}$	$\text{CH}_3-\overset{\text{Cl}}{\underset{ }{\text{CH}}}-\text{C}\equiv\text{CH}$	$\text{HC}\equiv\text{C}-(\text{CH}_2)_4\text{Cl}$
C1522	C1984	D1724	D1326	D0037
$\text{HC}\equiv\text{C}-\text{CH}_2\text{CH}_2\text{CH}_2\text{Cl}$		$\text{CH}_3(\text{CH}_2)_3-\text{C}\equiv\text{C}-\text{CH}_2\text{CH}_2-\text{C}\equiv\text{CH}$	$\text{HC}\equiv\text{C}-(\text{CH}_2)_6-\text{C}\equiv\text{CH}$	$\text{CH}_3(\text{CH}_2)_7-\text{C}\equiv\text{CH}$
B1114	D0997	H0440	H0483	H0048
$\text{CH}_3-\overset{\text{CH}_3}{\underset{\text{CH}_3}{\text{C}}}-\text{C}\equiv\text{CH}$	$\text{CH}_3(\text{CH}_2)_9-\text{C}\equiv\text{CH}$	$\text{CH}_3(\text{CH}_2)_{14}-\text{C}\equiv\text{CH}$	$\text{HC}\equiv\text{C}-(\text{CH}_2)_3-\text{C}\equiv\text{CH}$	$\text{CH}_3(\text{CH}_2)_4-\text{C}\equiv\text{CH}$
H0433	H0140	M0271	M0269	N0406
$\text{CH}_3(\text{CH}_2)_{13}-\text{C}\equiv\text{CH}$	$\text{CH}_3(\text{CH}_2)_3-\text{C}\equiv\text{CH}$	$\text{CH}_3-\overset{\text{CH}_3}{\underset{ }{\text{CH}}}-\text{CH}_2\text{CH}_2-\text{C}\equiv\text{CH}$	$\text{CH}_3-\overset{\text{CH}_3}{\underset{ }{\text{CH}}}-\text{CH}_2-\text{C}\equiv\text{CH}$	$\text{HC}\equiv\text{C}-(\text{CH}_2)_5-\text{C}\equiv\text{CH}$
N0301	O0128	O0147	O0050	P0356
$\text{CH}_3(\text{CH}_2)_6-\text{C}\equiv\text{CH}$	$\text{CH}_3(\text{CH}_2)_{15}-\text{C}\equiv\text{CH}$	$\text{HC}\equiv\text{C}-(\text{CH}_2)_4-\text{C}\equiv\text{CH}$	$\text{CH}_3(\text{CH}_2)_5-\text{C}\equiv\text{CH}$	$\text{CH}_3(\text{CH}_2)_{12}-\text{C}\equiv\text{CH}$
P0068	P1272 P0484	P1273 P0810	P1881	T0761
$\text{CH}_3\text{CH}_2\text{CH}_2-\text{C}\equiv\text{CH}$	$\text{HC}\equiv\text{C}-\text{CH}_2\text{Br}$	$\text{HC}\equiv\text{C}-\text{CH}_2\text{Cl}$	$\text{CH}_3-\text{C}\equiv\text{CH}$	$\text{CH}_3(\text{CH}_2)_{11}-\text{C}\equiv\text{CH}$
U0033				
$\text{CH}_3(\text{CH}_2)_8-\text{C}\equiv\text{CH}$				

Product No.	Product Name	Unit Size	
B3242	4-Bromo-1-butyne	5g	5g
C1195	3-Chloro-1-butyne	1g	5g
C1493	6-Chloro-1-hexyne	5mL	25mL
C1522	5-Chloro-1-pentyne	5mL	25mL
C1984	Cyclopropylacetylene	5g	25g
D1724	1,5-Decadiyne	1mL	5mL
D1326	1,9-Decadiyne	5mL	5mL
D0037	1-Decyne	5mL	25mL
B1114	3,3-Dimethyl-1-butyne	10mL	100mL
D0997	1-Dodecyne	5mL	25mL
H0440	1-Heptadecyne	1g	
H0483	1,6-Heptadiyne	5mL	
H0048	1-Heptyne	25mL	
H0433	1-Hexadecyne	5mL	
H0140	1-Hexyne	25mL	250mL
M0271	5-Methyl-1-hexyne	5mL	
M0269	4-Methyl-1-pentyne	5mL	
N0406	1,8-Nonadiyne	5mL	
N0301	1-Nonyne	5mL	
O0128	1-Octadecyne	5mL	
O0147	1,7-Octadiyne	5mL	25mL
O0050	1-Octyne	25mL	250mL
P0356	1-Pentadecyne	5mL	
P0068	1-Pentyne	25mL	
P1272	Propargyl Bromide (80% in Toluene, ca. 9.2mol/L) (stabilized with MgO)	25g	100g 500g
P0484	Propargyl Bromide (stabilized with MgO)	25g	100g 500g
P1273	Propargyl Chloride (70% in Toluene, ca. 9.2mol/L)	25g	250g
P0810	Propargyl Chloride	25mL	
P1881	Propyne (ca. 3-4% in Heptane)	200g	
T0761	1-Tetradecyne	5mL	25mL
U0033	1-Undecyne	5mL	

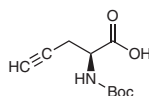
Hydrocarbons having Benzene Ring		B4521	B3701	B2301
C2670	D2496	D2151	D4233	E0749
E0603	E0196	E0654	F0470	E0564
E0933	E0563	E0967	E0750	E0939

E0665	E0655	E0626	P0358	P1956
P2226	P2227	P2190	T3151	T2760
T3135				

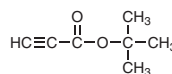
Product No.	Product Name	Unit Size		
B4521	1,3-Bis(2-propynyloxy)benzene	200mg	1g	
B3701	1-Bromo-4-ethynylbenzene	1g	5g	
B2301	1-Butyl-4-ethynylbenzene	5g	25g	
C2670	1-Chloro-4-ethynylbenzene	1g	5g	
D2496	1,3-Diethynylbenzene	1g	5g	
D2151	1,4-Diethynylbenzene	1g	5g	
D4233	4,4'-Diethynylbiphenyl	200mg	1g	
E0749	1-Ethyl-4-ethynylbenzene	5g	25g	
E0603	4-Ethynylanisole	1g	5g	
E0196	Ethynylbenzene	25mL	100mL	500mL
E0654	1-Ethynyl-2-fluorobenzene			5g
F0470	1-Ethynyl-4-fluorobenzene	1g	5g	
E0564	1-Ethynyl-4-hexylbenzene	5g	25g	
E0933	2-Ethynynaphthalene			100mg
E0563	1-Ethynyl-4-pentylbenzene	5g	25g	
E0967	1-Ethynyl-4-(phenylethynyl)benzene	200mg	1g	
E0750	1-Ethynyl-4-propylbenzene	5g	25g	
E0939	1-Ethynylpyrene	200mg	1g	
E0665	3-Ethynyltoluene	1g	5g	25g
E0655	4-Ethynyltoluene		5g	25g
E0626	1-Ethynyl-4-(trifluoromethyl)benzene		1g	5g
P0358	4-Phenyl-1-butyne			5mL
P1956	3-Phenyl-1-propyne (stabilized with BHT)	1g	5g	
P2226	1-[(2-Propynyloxy)methyl]pyrene	200mg	1g	
P2227	1-(2-Propynyloxy)naphthalene		1g	5g
P2190	2-(2-Propynyloxy)naphthalene	200mg	1g	
T3151	Tetrakis(4-ethynylphenyl)methane	100mg	1g	
T2760	1,3,5-Triethynylbenzene		1g	5g
T3135	1,3,5-Tris(2-propynyloxy)benzene	200mg	1g	

Carboxylic Acids & Their Derivatives

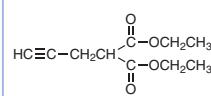
B4007



P1038



D4616



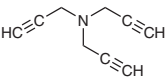
H0823	P0529	H0964	H0882	H0905
P0528	P0497	U0054		

Product No.	Product Name	Unit Size	
B4007	<i>N</i> -(<i>tert</i> -Butoxycarbonyl)-L-propargylglycine	1g	
P1038	<i>tert</i> -Butyl Propiolate	5g	25g
D4616	Diethyl 2-Propynylmalonate	1g	5g
H0823	Ethyl 2-Hydroxy-3-butynoate		1g
P0529	Ethyl Propiolate	5mL	25mL
H0964	2-Hexyl-4-pentynoic Acid	5g	25g
H0882	5-Hexynoic Acid	5g	25g
H0905	2-Hydroxy-3-butynoic Acid	100mg	1g
P0528	Methyl Propiolate	5mL	25mL
P0497	Propiolic Acid	5g	25g
U0054	10-Undecynoic Acid	1g	5g

Alcohols		B0799	B2909	B2910
B0750 B1001	D3710	D1266	D0737	D1276
D2495	E0272	H0823	E0270	E0273
E0297	E0548	H0455	H0141	H0687

H0462	H0905	M0180	M0961	M1312
$\text{HC}\equiv\text{C}-\text{CH}_2-\underset{\text{OH}}{\text{CH}}-\text{CH}_2\text{CH}_3$	$\text{HC}\equiv\text{C}-\underset{\text{OH}}{\text{CH}}-\overset{\text{O}}{\underset{\text{ }}{\text{C}}}-\text{OH}$	$\text{HC}\equiv\text{C}-\underset{\text{OH}}{\overset{\text{CH}_3}{\text{C}}}-\text{CH}_3$	$\text{CH}_3-\overset{\text{CH}_3}{\underset{\text{OH}}{\text{CH}}}-\text{CH}_2-\underset{\text{OH}}{\text{CH}}-\text{C}\equiv\text{CH}$	$\text{HC}\equiv\text{C}-\underset{\text{OH}}{\overset{\text{CH}_3}{\text{C}}}-\text{CH}=\text{CH}_2$
M0396	M0860	O0235	O0196	P0069
$\text{CH}_3\text{CH}_2-\underset{\text{OH}}{\overset{\text{CH}_3}{\text{C}}}-\text{C}\equiv\text{CH}$	$\text{CH}_3\text{OCH}_2-\text{C}\equiv\text{CH}$	$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{C}\equiv\text{CH}$	$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{C}\equiv\text{CH}$	$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{C}\equiv\text{CH}$
P0817	P0818	P0220	P0536	U0055
$\text{HC}\equiv\text{C}-\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$	$\text{HC}\equiv\text{C}-\text{CH}_2-\underset{\text{OH}}{\text{CH}}-\text{CH}_3$	$\text{HC}\equiv\text{C}-\underset{\text{OH}}{\text{CH}}-\text{C}_6\text{H}_5$	$\text{HC}\equiv\text{C}-\text{CH}_2\text{OH}$	$\text{HC}\equiv\text{C}-(\text{CH}_2)_9\text{OH}$

Product No.	Product Name	Unit Size	
B0799	3-Butyn-1-ol	5mL	25mL
B2909	(<i>R</i>)-(+)-3-Butyn-2-ol	1g	5g
B2910	(<i>S</i>)-(-)-3-Butyn-2-ol		1g
B0750	3-Butyn-2-ol (55% in Water, ca. 7.5mol/L)	25mL	500mL
B1001	3-Butyn-2-ol	5mL	25mL
D3710	9-Decyn-1-ol		5g
D1266	3,6-Dimethyl-1-heptyn-3-ol		5mL
D0737	3,5-Dimethyl-1-hexyn-3-ol	25mL	500mL
D1276	3,4-Dimethyl-1-pentyn-3-ol		10mL
D2495	1,1-Diphenyl-2-propyn-1-ol	5g	25g
E0272	3-Ethyl-1-heptyn-3-ol		5mL
H0823	Ethyl 2-Hydroxy-3-butyrate		1g
E0270	4-Ethyl-1-octyn-3-ol	25mL	500mL
E0273	3-Ethyl-1-pentyn-3-ol	5mL	25mL
E0297	1-Ethynyl-1-cyclohexanol	25g	500g
E0548	9-Ethynyl-9-fluorenone		5g
H0455	1-Heptyn-3-ol	1mL	5mL
H0141	1-Hexyn-3-ol	5mL	25mL
H0687	5-Hexyn-1-ol	5mL	25mL
H0462	5-Hexyn-3-ol		5mL
H0905	2-Hydroxy-3-butyric Acid	100mg	1g
M0180	2-Methyl-3-butyn-2-ol	25mL	500mL
M0961	5-Methyl-1-hexyn-3-ol		5mL
M1312	3-Methyl-1-penten-4-yn-3-ol	5mL	25mL
M0396	3-Methyl-1-pentyn-3-ol		25mL
M0860	Methyl Propargyl Ether	5mL	25mL
O0235	(<i>S</i>)-1-Octyn-3-ol	1g	5g
O0196	1-Octyn-3-ol	25mL	250mL
P0069	1-Pentyn-3-ol		10g
P0817	4-Pentyn-1-ol	5mL	25mL
P0818	4-Pentyn-2-ol		5mL
P0220	1-Phenyl-2-propyn-1-ol	5g	25g
P0536	2-Propyn-1-ol	25mL	100mL
U0055	10-Undecyn-1-ol		5g

Others		B4472 	B2393 	T2046
T1224 	D4275 	E1130 	E1093 	E1074
E0466 	G0445 	P1173 	T1455 	P2258
P2171 	T1750 	T2387 	T1683 	T1239
P1438 	T2992 			

Product No.	Product Name	Unit Size	
B4472	N-(tert-Butoxycarbonyl)propargylamine	1g	5g
B2393	3-Butyn-2-one		5g
T2046	3-Butynyl p-Toluenesulfonate		5g
T1224	1-Butyn-3-yl p-Toluenesulfonate		5g
D4275	3,6-Diethynylcarbazole	200mg	1g
E1130	4-Ethynylbenzenesulfonamide	200mg	1g
E1093	5-Ethynyl-2'-deoxycytidine	50mg	200mg
E1074	2-Ethynyl-4,4,5,5-tetramethyl-1,3,2-dioxaborolane	200mg	1g
E0466	Ethynyl p-Tolyl Sulfone	1g	5g
G0445	Glycidyl Propargyl Ether	1g	5g
P1173	Propargylaldehyde Diethyl Acetal	5mL	25mL
T1455	Propargyl p-Toluenesulfonate		5g
P2258	2-Propynyl [3-(Triethoxysilyl)propyl]carbamate	1g	5g
P2171	2-Propynylurea	200mg	1g
T1750	Tributylethynyltin	1g	5g
T2387	Triethylsilylacetylene	1g	5g
T1683	Triisopropylsilylacetylene	5mL	25mL
T1239	Trimethylsilylacetylene	5mL	25mL 250mL
P1438	Triphenylpropargylphosphonium Bromide	5g	25g
T2992	Tripropargylamine	1g	5g

Azide Compounds

Organic Azides		A1786	A0930	A2474
A0971	A2758	A2052	A1341	A2738
A2524	A2290	A2674	A2729	B1110
B1111	B3693	B3694	B3790	D1606
S0860	S0952	T1184		

Product No.	Product Name	Unit Size	
A1786	4-Acetamidobenzenesulfonyl Azide	5g	25g
A0930	4-Azidobenzoic Acid	5g	25g
A2474	2-Azido-1,3-bis[(2,2-dimethyl-1,3-dioxan-5-yl)oxy]propane		100mg
A0971	4-Azidocinnamaldehyde		5g
A2758	4-Azidocoumarin		200mg
A2052	3'-Azido-3'-deoxythymidine	1g	5g
A1341	Azidomethyl Phenyl Sulfide		5g
A2738	3-Azidopropylamine		100mg
A2524	N-(3-Azidopropyl)biotinamide		100mg
A2290	4-Azidosalicylic Acid	100mg	1g
A2674	4-Azido-2,3,5,6-tetrafluorobenzoic Acid		1g
A2729	5-Azidovaleric Acid		200mg
B1110	2,6-Bis(4-azidobenzylidene)cyclohexanone (wetted with ca. 30% Water, containing 25g on a dry weight basis)		25g
B1111	2,6-Bis(4-azidobenzylidene)-4-methylcyclohexanone (wetted with ca. 30% Water, containing 25g on a dry weight basis)	Price on request	

Product No.	Product Name	Unit Size
B3693	(2 <i>R</i> ,3 <i>R</i> ,5 <i>S</i> ,6 <i>S</i>)-5,6-Bis(azidomethyl)-2,3-dimethoxy-2,3-dimethyl-1,4-dioxane	100mg
B3694	(2 <i>S</i> ,3 <i>S</i> ,5 <i>R</i> ,6 <i>R</i>)-5,6-Bis(azidomethyl)-2,3-dimethoxy-2,3-dimethyl-1,4-dioxane	100mg
B3790	Bis[2-(4-azidosalicylamido)ethyl] Disulfide	10mg
D1606	Disodium 4,4'-Diazidostilbene-2,2'-disulfonate Tetrahydrate	25g
D2580	Dodecylbenzenesulfonyl Azide (soft type) (mixture)	25g
S0860	<i>N</i> -Succinimidyl 5-Azido-2-nitrobenzoate	10mg
S0952	<i>N</i> -Succinimidyl 4-Azido-2,3,5,6-tetrafluorobenzoate	200mg 1g
T1184	Trimethylsilylmethyl Azide	1g 5g

PEG Azides		A2523 	A2727 	A2388
A2500 	A2728 	A2363 	A2293 	A2294

Product No.	Product Name	Unit Size
A2523	<i>N</i> -[2-[2-[2-(2-Azidoethoxy)ethoxy]ethoxy]ethyl]biotinamide	100mg
A2727	25-Azido-2,5,8,11,14,17,20,23-octaopentacosane	25mg 100mg
A2388	Azido-PEG ₄ -NHS Ester	25mg
A2500	14-Azido-3,6,9,12-tetraoxatetradecanol	100mg
A2728	13-Azido-2,5,8,11-tetraoxatridecane	25mg 100mg
A2363	11-Azido-3,6,9-trioxaundecan-1-amine	1g 5g
A2293	11-Azido-3,6,9-trioxaundecanoic Acid	1g
A2294	11-Azido-3,6,9-trioxaundecanol	Price on request

Sugar Azides		A1812 	A1813 	A1811
A1616 	A1678 	A1833 	A1832 	G0257

A2627	A2172	A2267	A2377	G0330
D4217	G0309	G0373	G0403	
G0372	G0337	H1333	L0237	
M1643	M1638	M1637	M1617	T1731
T2196	T1733			

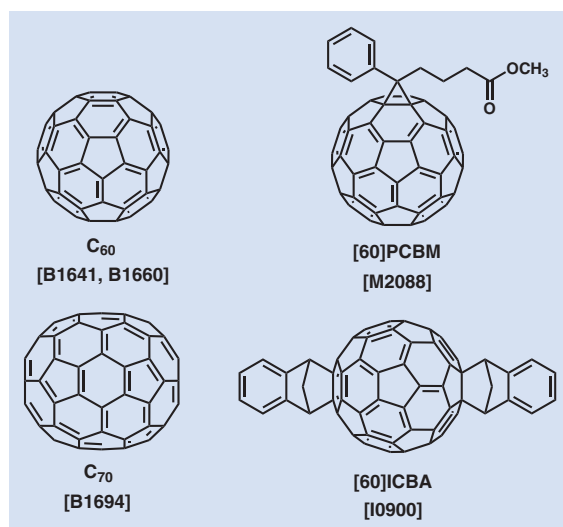
Product No.	Product Name	Unit Size
A1812	2-Acetamido-3-O-allyl-4,6-O-benzylidene-2-deoxy-beta-D-glucopyranosyl Azide	1g
A1813	2-Acetamido-3-O-benzyl-4,6-O-benzylidene-2-deoxy-beta-D-glucopyranosyl Azide	1g
A1811	2-Acetamido-4,6-O-benzylidene-2-deoxy-beta-D-glucopyranosyl Azide	1g 5g
A1616	2-Acetamido-3,4,6-tri-O-acetyl-2-deoxy-beta-D-glucopyranosyl Azide	1g 5g
A1678	2-Acetamido-3,4,6-tri-O-benzyl-2-deoxy-beta-D-glucopyranosyl Azide	1g 5g
A1833	O-(2-Azido-4,6-O-benzylidene-2-deoxy-alpha-D-galactopyranosyl)-N-[(9H-fluoren-9-ylmethoxy)carbonyl]-L-serine <i>tert</i> -Butyl Ester	100mg
A1832	O-(2-Azido-4,6-O-benzylidene-2-deoxy-alpha-D-galactopyranosyl)-N-[(9H-fluoren-9-ylmethoxy)carbonyl]-L-threonine <i>tert</i> -Butyl Ester	100mg
G0257	2-[2-(2-Azidoethoxy)ethoxy]ethyl 2,3,4,6-Tetra-O-acetyl-D-galactopyranoside	1g 5g
A2627	2-Azidoethyl 2-Acetamido-2-deoxy-beta-D-galactopyranoside	Price on request
A2172	2-Azidoethyl 2-Acetamido-2-deoxy-beta-D-glucopyranoside	500mg
A2267	2-Azidoethyl beta-D-Glucopyranoside	1g
A2377	2-Azidoethyl 2,3,4,6-Tetra-O-acetyl-beta-D-glucopyranoside	1g 5g
D4217	Disialylnonasaccharide beta-Ethylazide	Price on request
G0330	Gal[2346Ac]beta(1-3)GalN3[46Bzd]-beta-MP	1g 5g
G0309	Gal[2346Ac]beta(1-3)GlcN3[46Bzd]-beta-MP	1g 5g
G0373	GalNAc beta(1-3)GlcNAc beta-Ethylazide	Price on request
G0403	Gb3-beta-ethylazide	Price on request
G0372	GlcA[3S]beta(1-3)Gal beta(1-4)GlcNAc beta(1-2)Man alpha-Ethylazide	Price on request
G0337	GlcNAc beta(1-2)Man alpha-1-Ethylazide	100mg
H1333	HNK-1 Ethylazide	Price on request
L0237	LacDiNAc Dimer Ethylazide	Price on request
M1643	4-Methoxyphenyl 3-O-Allyl-2-azido-4,6-O-benzylidene-2-deoxy-beta-D-galactopyranoside	1g

Product No.	Product Name	Unit Size
M1638	4-Methoxyphenyl 3- <i>O</i> -Allyl-2-azido-4,6- <i>O</i> -benzylidene-2-deoxy- β -D-glucopyranoside	1g
M1637	4-Methoxyphenyl 2-Azido-4,6- <i>O</i> -benzylidene-2-deoxy- β -D-glucopyranoside	1g 5g
M1617	4-Methoxyphenyl 2-Azido-3,6-di- <i>O</i> -benzyl-2-deoxy- β -D-glucopyranoside	1g
T1731	1,3,4,6-Tetra- <i>O</i> -acetyl-2-azido-2-deoxy- α -D-galactopyranose	100mg
T2196	1,3,4,6-Tetra- <i>O</i> -acetyl-2-azido-2-deoxy- β -D-glucopyranose	200mg 1g
T1733	1,3,4,6-Tetra- <i>O</i> -acetyl-2-azido-2-deoxy- α -D-mannopyranose	100mg

Fullerenes

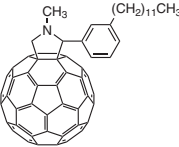
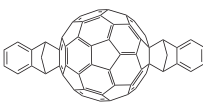
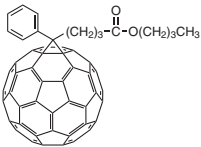
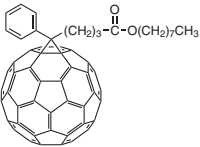
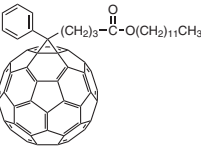
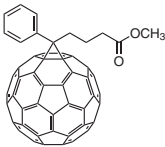
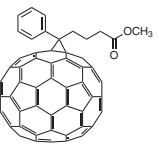
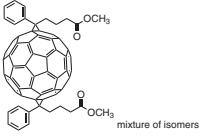
Fullerene is a spherical carbon compound and is an allotrope of carbon such as diamond, graphite and carbon nanotubes. Fullerenes of C_{60} , C_{70} and C_{84} are well known. They are isolable carbon compounds in a sole molecular species. Among them, the C_{60} is a representative species. Kroto, Smalley and Curl *et al.* first observed the C_{60} in which the 60 carbon atoms consist of 12 five-membered rings and 20 six-membered rings.¹⁾ Kroto, Smalley and Curl won their joint Nobel prizes in chemistry in 1996 for their contributions. Osawa predicted existence of fullerene in 1970, earlier than the first observation of fullerene.²⁾

The most specific feature of fullerene is that it is an excellent electron acceptor. Any fullerenes are n-type semiconductors, which are suitable for organic electronic materials with electron carriers. Rubidium- and cesium-doped fullerenes can be superconductors with electron carriers. These superconducting transitions occur at more than 30 K.^{3,4)}



Addition reactions and other chemical modifications of fullerenes easily produce fullerene derivatives. Precise structure analyses of these derivatives are possible because they are molecular species. Non-derivatized fullerenes are poorly soluble in similarity to the other nanocarbon materials. However, we can introduce soluble functional groups to form solution-processible electronic materials. Phenyl- C_{61} -butyric acid methyl ester ([60]PCBM) and indene- C_{60} bisadduct (ICBA) are useful organic semiconductors for fabricating a solution-processible electronic device.^{5,6)} These fullerene derivatives are n-type organic semiconductors for organic photovoltaics (OPV) by mixing with a p-type conjugated polymer.⁷⁾ An application of a fullerene derivative for organic transistors was also reported.⁸⁾ A complexation of C_{60} with tetrakis(dimethylamino)ethylene (TDAE) gives a charge transfer complex (TDAE- C_{60}), which is an organic magnet at low temperature.⁹⁾

Although a chemical modification of the outer surface of fullerene provides PCBM or ICBA, we can introduce a small component to the inner side of fullerene. For instance, fullerenes can encapsulate a metal atom on the inner side, when the fullerenes are produced in the presence of the metal. This is the so-called metal-encapsulated fullerene described as $M@C_{60}$. The encapsulation modifies the electronic state¹⁰⁾ and chemical reactivity of fullerene.¹¹⁾ On the other hand, water-encapsulated fullerene ($H_2O@C_{60}$) was also reported. A publication described that an organic synthetic procedure gave open-caged C_{60} which could then encapsulate one water molecule. A following chemical modification could close the cage to form water-encapsulated fullerene $H_2O@C_{60}$.¹²⁾

B1641 B1660 	B1642 	B1694 	C2415 	I0900 
P2013 	P2014 	P2015 	M2088 	M2550 
B4576  mixture of isomers				

Product No.	Product Name	Unit Size	
B1641	Fullerene C ₆₀ (pure)	100mg	1g
B1660	Fullerene C ₆₀	100mg	1g
B1642	Fullerene Extract, C ₆₀ (contains ca. 20% C ₇₀)	100mg	1g
B1694	Fullerene C ₇₀		100mg
C2415	C ₆₀ MC ₁₂		100mg
I0900	ICBA		50mg
P2013	[60]PCB-C ₄ ([6,6]-Phenyl-C ₆₁ -butyric Acid Butyl Ester)		100mg
P2014	[60]PCB-C ₈ ([6,6]-Phenyl-C ₆₁ -butyric Acid n-Octyl Ester)		100mg
P2015	[60]PCB-C ₁₂ ([6,6]-Phenyl-C ₆₁ -butyric Acid Dodecyl Ester)		100mg
M2088	[60]PCBM (Methyl [6,6]-Phenyl-C ₆₁ -butyrate)		100mg
M2550	[70]PCBM (Methyl [6,6]-Phenyl-C ₇₁ -butyrate) (mixture of isomers)		50mg
B4576	Bis-PCBM (mixture of isomers)		50mg

References

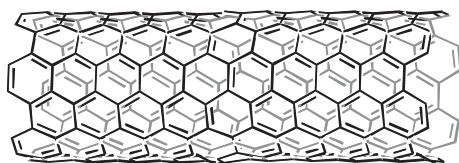
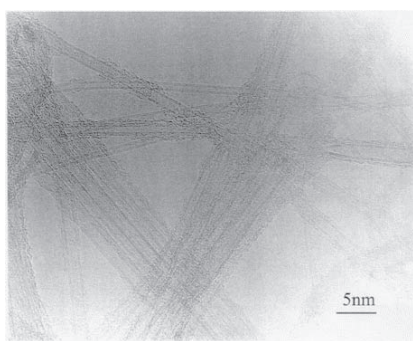
- 1) H. W. Kroto, J. R. Heath, S. C. O' Brien, R. F. Curl, R. E. Smalley, *Nature* **1985**, 318, 162.
- 2) E. Osawa, *Kagaku* **1970**, 25, 854.
- 3) K. Tanigaki, T. W. Ebbesen, S. Saito, J. Mizuki, J. S. Tsai, Y. Kubo, S. Kuroshima, *Nature* **1991**, 352, 222.
- 4) A. Y. Ganin, Y. Takabayashi, Y. Z. Khimyak, S. Margadonna, A. Tamai, M. J. Rosseinsky, K. Prassides, *Nat. Mater.* **2008**, 7, 367.
- 5) J. C. Hummelen, B. W. Knight, F. LePeq, F. Wudl, J. Yao, C. L. Wilkins, *J. Org. Chem.* **1995**, 60, 532.
- 6) Y. He, H.-Y. Chen, J. Hou, Y. Li, *J. Am. Chem. Soc.* **2010**, 132, 1377.
- 7) Review: S. Günes, H. Neugebauer, N. S. Sariciftci, *Chem. Rev.* **2007**, 107, 1324.
- 8) T.-W. Lee, Y. Byun, B.-W. Koo, I.-N. Kang, Y.-Y. Lyu, C. H. Lee, L. Pu, S. Y. Lee, *Adv. Mater.* **2005**, 17, 2180.
- 9) B. Narymbetov, A. Omerzu, V. V. Kabanov, M. Tokumoto, H. Kobayashi, D. Mihailovic, *Nature* **2000**, 407, 883.
- 10) Y. Matsuo, H. Okada, M. Maruyama, H. Sato, H. Tobita, Y. Ono, K. Omote, K. Kawachi, Y. Kasama, *Org. Lett.* **2012**, 14, 3784.
- 11) H. Kawakami, H. Okada, Y. Matsuo, *Org. Lett.* **2013**, 15, 4466.
- 12) K. Kurotobi, Y. Murata, *Science* **2011**, 333, 613.

Carbon Nanotubes

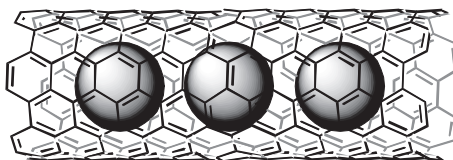
A carbon nanotube (CNT) has a cylindrical structure with a nanoscale diameter that is like a rolled graphene sheet. Iijima first observed a CNT in 1991.¹⁾ A CNT consists of only sp^2 carbons similar to fullerenes. There are diverse CNTs on the basis of their length, diameter of the nanotube, state of chirality, and number of the layer. The variety of these structures provides various band structures and metallic and semiconducting properties.^{2,3)} A normal synthetic procedure gives a mixture of semiconducting CNTs in 2/3 and metallic CNTs in 1/3, because rolling a carbon sheet occurs randomly. Since we need to obtain the semiconducting CNT in pure form in order to utilize the semiconductivity, improved synthetic procedure and efficient purification of CNT are further required.⁴⁻⁷⁾

Moreover, CNTs have high physical durability, high electrical and thermal conductivity, and are light and flexible. On the basis of such excellent characteristics, CNTs are expected to be field-effect transistor (FET) materials, nanoscale wire materials, electron emission sources, optical communication switches, chemical sensors, high strength composites, and thermal devices.⁸⁻¹⁰⁾

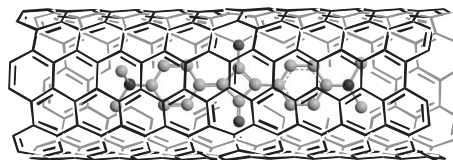
CNTs can enclose nanoscale molecules and atoms in the internal space, because of the cylindrical structure. For instance, there is a fullerene-enclosed CNT, the so-called 'peapod'.¹¹⁾ In addition, CNTs can enclose metal, water, and molecular oxygen. Properties of the enclosed water in the CNT are different from those of bulk water.^{12,13)} An organic dye (eg. squarylium) can be easily enclosed within the internal space of CNTs in solution. In this case, the enclosed squarylium dye absorbs light and then an energy transfer (sensitization) to the outer CNT occurs.¹⁴⁾ Hydrogen storage using CNTs is expected to be used in the development of a fuel cell.¹⁵⁾



Single-Walled Carbon Nanotube (SWCNT)



C₆₀ Peapod



Squarylium@CNT

Product No.	Product Name	Unit Size
C3133	Carbon Nanotube Single-walled (>85%) below 3nm(Average diam.), over 5 μ m(Average length)	200mg
C2143	Carbon Nanotube Double-walled (>50%) below 5nm(diam.), 5-15 μ m(length)	200mg
C2149	Carbon Nanotube Multi-walled below 10nm(diam.), 1-2 μ m(length)	Price on request
C2148	Carbon Nanotube Multi-walled below 10nm(diam.), 5-15 μ m(length)	1g
C2150	Carbon Nanotube Multi-walled 10-20nm(diam.), 5-15 μ m(length)	1g 5g
C2153	Carbon Nanotube Multi-walled 10-30nm(diam.), 1-2 μ m(length)	1g
C2152	Carbon Nanotube Multi-walled 10-30nm(diam.), 5-15 μ m(length)	1g
C2155	Carbon Nanotube Multi-walled 20-40nm(diam.), 1-2 μ m(length)	1g
C2154	Carbon Nanotube Multi-walled 20-40nm(diam.), 5-15 μ m(length)	1g 5g
C2157	Carbon Nanotube Multi-walled 40-60nm(diam.), 1-2 μ m(length)	1g
C2156	Carbon Nanotube Multi-walled 40-60nm(diam.), 5-15 μ m(length)	1g 5g
C2159	Carbon Nanotube Multi-walled 60-100nm(diam.), 1-2 μ m(length)	1g
C2158	Carbon Nanotube Multi-walled 60-100nm(diam.), 5-15 μ m(length)	1g 5g
C2151	Carbon Nanotube Aligned Multi-walled 10-20nm(diam.), 5-15 μ m(length)	1g
C2147	Carbon Nanotube Bundled Multi-walled below 10nm(diam.), 5-15 μ m(length) (allowable temperature limit : 620°C)	200mg
C2146	Carbon Nanotube Herringbone 10-20nm(diam.), 5-15 μ m(length)	200mg

References

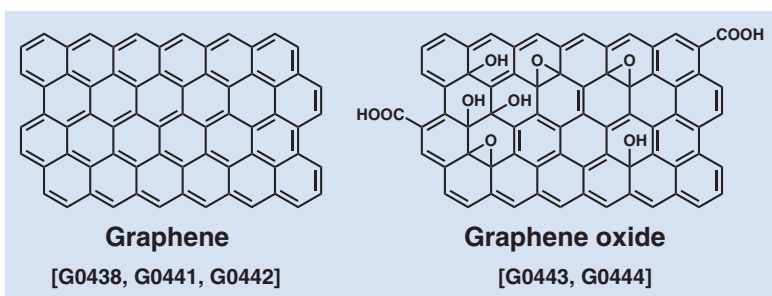
- 1) S. Iijima, *Nature* **1991**, 354, 56.
- 2) J. Kim, A. J. Page, S. Irle, K. Morokuma, *J. Am. Chem. Soc.* **2012**, 134, 9311.
- 3) Review: Y. Miyato, *J. MMIJ* **2011**, 127, 61.
- 4) M. Kawai, H. Kyakuno, T. Suzuki, T. Igarashi, H. Suzuki, T. Okazaki, H. Kataura, Y. Maniwa, K. Yanagi, *J. Am. Chem. Soc.* **2012**, 134, 9545.
- 5) I. Ibrahim, A. Bachmatiuk, J. H. Warner, B. Büchner, G. Cuniberti, M. H. Rummeli, *Small* **2012**, 8, 1973.
- 6) B. Liu, W. Ren, S. Li, C. Liu, H.-M. Cheng, *Chem. Commun.* **2012**, 48, 2409.
- 7) H. Liu, D. Nishide, T. Tanaka, H. Kataura, *Nat. Commun.* **2011**, 2, 1313/1.
- 8) Review: K. Balasubramanian, E. J. H. Lee, R. T. Weitz, M. Burghard, K. Kern, *Phys. Status Solidi A* **2008**, 205, 633.
- 9) J. Park, Y. Kim, G.-T. Kim, J. S. Ha, *Adv. Funct. Mater.* **2011**, 21, 4159.
- 10) N. J. Kybert, M. B. Lerner, J. S. Yodh, G. Preti, A. T. C. Johnson, *ACS Nano* **2013**, 7, 2800.
- 11) J. H. Warner, A. A. R. Watt, L. Ge, K. Porfyakis, T. Akachi, H. Okimoto, Y. Ito, A. Ardavan, B. Montanari, J. H. Jefferson, N. M. Harrison, H. Shinohara, G. A. D. Briggs, *Nano Lett.* **2008**, 8, 1005.
- 12) H. Kyakuno, K. Matsuda, H. Yahiro, Y. Inami, T. Fukuoka, Y. Miyata, K. Yanagi, Y. Maniwa, H. Kataura, T. Saito, M. Yumura, S. Iijima, *J. Chem. Phys.* **2011**, 134, 244501.
- 13) J. M. H. Kroes, F. Pietrucci, A. Curioni, R. Jaafar, O. Gröning, W. Andreoni, *J. Phys. Chem. C* **2013**, 117, 1948.
- 14) K. Yanagi, K. Iakoubovskii, H. Matsui, H. Matsuzaki, H. Okamoto, Y. Miyata, Y. Maniwa, S. Kazaoui, N. Minami, H. Kataura *J. Am. Chem. Soc.* **2007**, 129, 4992.
- 15) E. Tylianakis, G. K. Dimitrakakis, F. J. Martin-Martinez, S. Melchor, J. A. Dobado, E. Klontzas, G. E. Froudakis, *Int. J. Hydrogen Energy* **2014**, 39, 9825.

Graphene & Graphene Oxide

Graphene, which is one of the nanocarbon materials, consists of all six-membered rings with sp^2 carbons having a two-dimensional sheet structure. Graphene has been known for long time, since graphite is formed by combination of graphenes with van der Waals force. However, details of the properties were unclear until late years, because an isolation procedure of graphene from graphite was not well developed for long time. Geim and Novoselov *et al.* in 2004 successfully isolated a thin-flake graphene by a simple procedure. They used a tape to peel off a graphene layer from highly oriented pyrolytic graphite (HOPG) and then the peeled graphene layer is stuck on a substrate. After this observation,¹⁾ studies of graphene have proved the particular characteristics of electronic, mechanical, and chemical properties. Geim and Novoselov won their joint Nobel prizes in physics in 2010 for their contributions.

The most characteristic feature of graphene is its electrical property. The electron mobility in the graphene layer is 100 times greater than that of silicon.²⁾ Accordingly, we can expect to develop a transistor with high-mobility and low-power consumption. Graphene may be promising for a next generation channel material that is useful for LSI (large-scale integration). In addition, the physical strength of graphene is 100 times greater than that of iron. The current density tolerance is much better than that of copper, thus it is expected to be an electrical wire transporting large currents.³⁾

Electrons in the graphene behave as massless Dirac fermions as similar to neutrinos,⁴⁾ and demonstrate a quantum Hall effect at room temperature.⁵⁾ Graphene is an ideal material for spintronics, since there are small spin orbit interactions and the negligible nuclear magnetic moment of carbon. Hybridization of graphene and a ferromagnetic material is developed for the application of an information processor using the electron spin (spintronics device).⁶⁾



The fabrication procedure for graphene is peeling off the layer from HOPG, a chemical vapor deposition (CVD)⁷⁾ as well as reduction of a graphene oxide (GO).⁸⁾ There are various synthetic methods of making GO, and the properties and applications depend on the degree of oxidation. GO disperses in water and several polar solvents, because the structure of GO normally includes hydroxyl, epoxy, and carboxyl groups on the graphene sheet. Accordingly, a GO thin film can be fabricated on a substrate by a solution-process. The reduction of GO provides a reduced graphene oxide (rGO), but it is not a perfect graphene. The rGO contains a few oxygen components and defects on the graphene structure. Although GO is an insulator because there are sp^3 carbon atoms, rGO is conductive. Therefore the rGO is expected to be an electrode material. A water dispersion of GO is used as a lubricant to reduce friction on metal surfaces.⁹⁾ GO-supported metal catalysts were developed for a cross-coupling reaction and hydrogenation.^{10,11)} We can introduce several functional groups on GO because there are oxygen-based groups. These GO derivatives may be useful for luminescent materials and biosensors.^{12,13)}

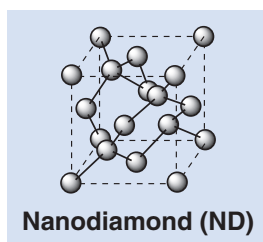
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G0441	Graphene Nanoplatelets 6-8nm(thick), 5μm(wide)	5g	25g
G0442	Graphene Nanoplatelets 6-8nm(thick), 15μm(wide)	5g	25g
G0438	Graphene Nanoplatelets 6-8nm(thick), 25μm(wide)	5g	25g
G0443	Graphene Oxide		100mg
G0444	Graphene Oxide (10mg/mL, Dispersion in Water)	5mL	25mL

References

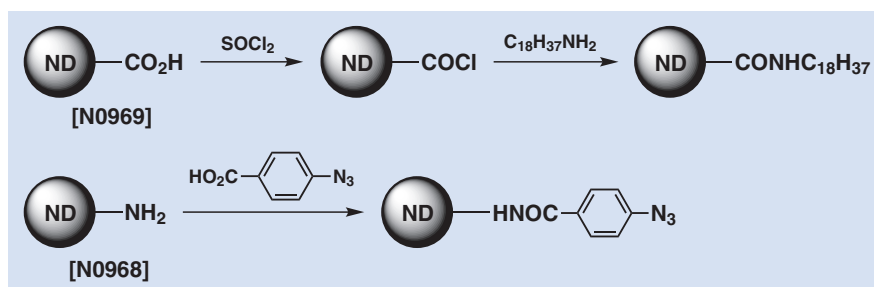
- 1) K. S. Novoselov, A. K. Geim, S. V. Morozov, D. Jiang, Y. Zhang, S. V. Dubonos, I. V. Grigorieva, A. A. Firsov, *Science* **2004**, 306, 666.
- 2) K. I. Bolotin, K. J. Sikes, Z. Jiang, M. Klima, G. Fudenberg, J. Hone, P. Kim, H. L. Stormer, *Solid State Commun.* **2008**, 146, 351.
- 3) A. K. Geim, *Science* **2009**, 324, 1530.
- 4) K. S. Novoselov, A. K. Geim, S. V. Morozov, D. Jiang, M. I. Katsnelson, I. V. Grigorieva, S. V. Dubonos, A. A. Firsov, *Nature* **2005**, 438, 197.
- 5) Y. Zhang, Y.-W. Tan, H. L. Stormer, P. Kim, *Nature* **2005**, 438, 201.
- 6) D. Pesin, A. H. MacDonald, *Nat. Mater.* **2012**, 11, 409.
- 7) X. Zhang, L. Wang, J. Xin, B. I. Yakobson, F. Ding, *J. Am. Chem. Soc.* **2014**, 136, 3040.
- 8) C. K. Chua, M. Pumera, *Chem. Soc. Rev.* **2014**, 43, 291.
- 9) H. Kinoshita, Y. Nishina, A. A. Alias, M. Fujii, *Carbon* **2014**, 66, 720.
- 10) S. Yamamoto, H. Kinoshita, H. Hashimoto, Y. Nishina, *Nanoscale* **2014**, 6, 6501.
- 11) N. Morimoto, S. Yamamoto, Y. Takeuchi, Y. Nishina, *RSC Adv.* **2013**, 3, 15608.
- 12) K. Furukawa, Y. Ueno, E. Tamechika, H. Hibino, *J. Mater. Chem. B* **2013**, 1, 1119.
- 13) G. Gou, R. Ren, S. Li, S. Guo, Z. Dong, M. Xie, J. Ma, *New J. Chem.* **2013**, 37, 3861.

Nanodiamonds

Diamond, an allotrope of carbon, has excellent hardness, coefficient of friction, thermal conductivity, insulation characteristics, and refractive index. Large and highly pure diamond is good for use as jewelry. Furthermore, the major industrial application of diamond is for cutting and polishing tools, because it is the hardest of natural products. However, diamond is not workable enough because of its hardness so there is a limitation for industrial use of a large diamond. Nanodiamond (ND) is a nanoparticle having the crystal structure of diamond, and it has excellent properties of normal diamond. ND is artificially synthesized and is useful for polishing tools and additives of engine oil.



We can modify the surface of ND by introducing carboxyl and amino groups. These groups are further converted by a chemical modification to functionalize the ND particle.¹⁻³⁾ Non-modified ND can be dispersed in water, but coheres in organic solvents. On the other hand, a functionalized ND particle with alkyl groups can be dispersed in organic solvents. We can modify a glass surface with ND that is functionalized with a silane coupling reagent.⁴⁾



An application of ND is extended for biology and medical use^{5,6)} because it is a harmless nanoparticle in-vivo. Since a diamond with a complex defect (NV) containing nitrogen (N) and vacancy (V) shows fluorescence,⁷⁾ we can monitor movements and structural changes of a biological molecule on a microscope using the NV diamond as a fluorescent labeling reagent.⁸⁻¹⁰⁾ We can easily detect fluorescent behavior in a complex atmosphere in-vivo, because ND is chemically stable. A publication described that functionalization of ND also showed fluorescent behavior without NV defects.¹¹⁾ Protein- and biotin-supported ND were reported in order to enhance affinity toward a biological molecule.^{12,13)} These modified NDs are expected to be used for a drug delivery system.

Product No.	Product Name	Unit Size	
N0962	Nanodiamond (particle size : <10nm)	1g	5g
N0968	Nanodiamond (particle size : <10nm) (Amine-modified)		1g
N0969	Nanodiamond (particle size : <10nm) (Carboxyl-modified)		1g

References

- 1) B. T. Branson, P. S. Beauchamp, J. C. Beam, C. M. Lukehart, J. L. Davidson, *ACS Nano* **2013**, 7, 3183.
- 2) V. N. Mochalin, Y. Gogotsi, *J. Am. Chem. Soc.* **2009**, 131, 4594.
- 3) A. Barras, S. Szunerits, L. Marcon, N. Monfiliette-Dupont, R. Boukherroub, *Langmuir* **2010**, 26, 13168.
- 4) Y. Liu, V. N. Khabashesku, N. J. Halas, *J. Am. Chem. Soc.* **2005**, 127, 3712.
- 5) Review: V. K. A. Sreenivasan, A. V. Zvyagin, E. M. Goldys, *J. Phys.: Condens. Matter* **2013**, 25, 194101.
- 6) Review: A. Krueger, *Chem. Eur. J.* **2008**, 14, 1382.

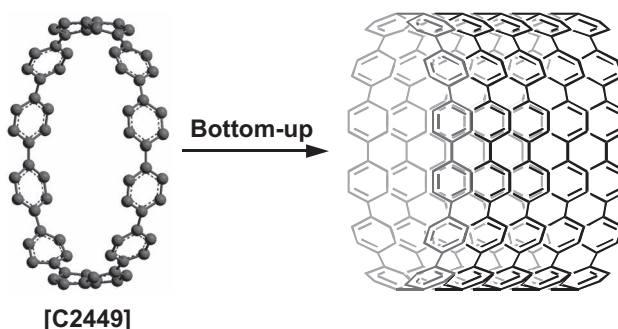
- 7) Review: A. Krueger, *J. Mater. Chem.* **2011**, *21*, 12571.
- 8) S.-J. Yu, M.-W. Kang, H.-C. Chang, K.-M. Chen, Y.-C. Yu, *J. Am. Chem. Soc.* **2005**, *127*, 17604.
- 9) T.-J. Wu, Y.-K. Tzeng, W.-W. Chang, C.-A. Cheng, Y. Kuo, C.-H. Chien, H.-C. Chang, J. Yu, *Nat. Nanotechnol.* **2013**, *8*, 682.
- 10) L. P. McGuinness, Y. Yan, A. Stacey, D. A. Simpson, L. T. Hall, D. Maclaurin, S. Prawer, P. Mulvaney, J. Wrachtrup, F. Caruso, R. E. Scholten, L. C. L. Hollenberg, *Nat. Nanotechnol.* **2011**, *6*, 358.
- 11) V. N. Mochalin, O. Shenderova, D. Ho, Y. Gogotsi, *Nat. Nanotechnol.* **2012**, *7*, 11.
- 12) L.-C. L. Huang, H.-C. Chang, *Langmuir* **2004**, *20*, 5879.
- 13) A. Krueger, J. Stegk, Y. Liang, L. Lu, G. Jarre, *Langmuir* **2008**, *24*, 4200.

Nanocarbon Unit Structures

(1) Cycloparaphenylenes (CPP)

Carbon nanotubes (CNT) have advanced chemistry, material science, life science and other research fields. CNTs can be prepared by physical methods such as arc discharge, laser furnace, and chemical vapor deposition techniques. One disadvantage of these physical methods is forming several kinds of CNTs with various diameters, thus uniform CNTs do not form.

Cycloparaphenylenes (CPP), the so-called carbon nanoring, have a cyclic structure formed by linkages of *para*-substituted benzenes. The CPP attracted researchers in fundamental chemistry and material science, because it is a unit structure of CNT. In fact, Itami *et al.* successfully synthesized uniform CNTs by a bottom-up procedure starting from CPP as a template compound.¹⁾

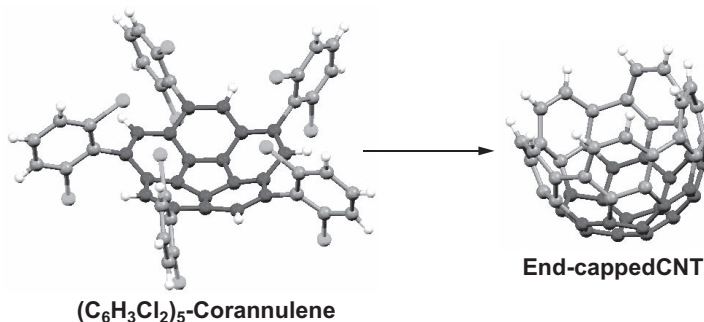


Recently, this research was extended to synthesize a CPP of smaller diameters having a large distortion. Yamago²⁾ and Jasti³⁾ groups independently reported synthesis of the [5]CPP, which has been the smallest CPP so far. We can expect to synthesize the smallest diameter CNTs from [5]CPP. In addition, the electronic and physical properties of [5]CPP may be interesting, because [5]CPP is a unit structure of C₆₀ fullerene, too. CPPs of a specified diameter make an inclusion complex with a fullerene.⁴⁾

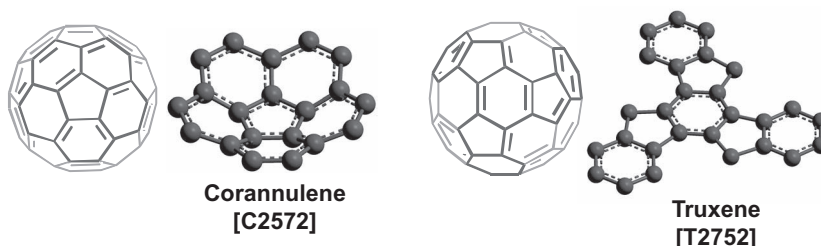
(2) Corannulene and truxene

Corannulene, the so-called [5]circulene, is one of the polycyclic aromatic compounds. It has a condensed structure of five benzene rings. The corannulene was first synthesized in 1960s,⁵⁾ and after that the bowl-type structure was observed.⁶⁾ The corannulene is attractive as a nanocarbon material, because it is a unit structure of C₆₀ fullerene.

Scott *et al.* synthesized a polyarene compound by a flash vacuum pyrolysis (FVP) starting from corannulene. This polyarene compound corresponds to an end-capped CNT. An extension of the end-capped CNT may chemically produce a normal CNT.⁷⁾ Itami and Scott *et al.* synthesized a grossly warped nanographene compound from corannulene.⁸⁾

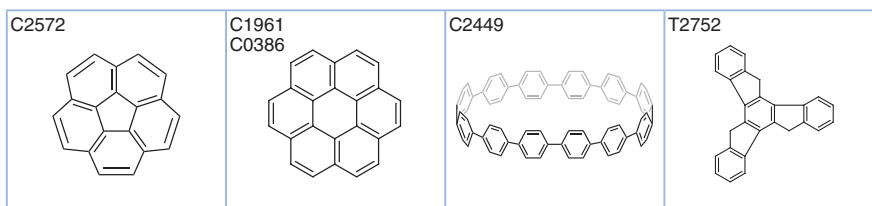
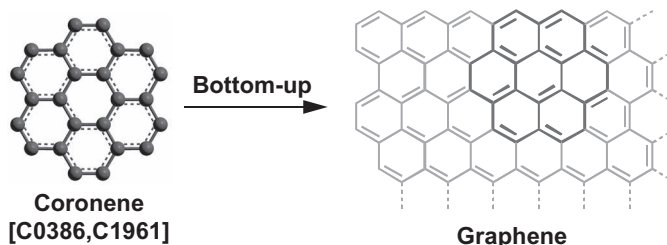


Truxene has star-shaped and rigid planar structures. Truxene is also a unit structure of C₆₀ fullerene. Truxene derivatives are useful for OLED materials because they easily form an amorphous structure.⁹⁾ A chemical synthesis for C₆₀ fullerene was carried out starting from truxene. Otero *et al.* synthesized a polyarene compound formulated as C₆₀H₃₀ by three step reactions, and a thermal treatment of the polyarene on platinum surface gave C₆₀ fullerene all.¹⁰⁾



(3) Coronene

Coronene, the so-called [6]circulene, is another polycyclic aromatic compound. It has a condensed structure of six benzene rings. The coronene is a molecular compound in nanoscale, known as a representative nanographene compound that is smaller than graphene. The coronene can be an organic transistor material¹¹⁾ because it is a nanographene compound with a band gap, which is different from graphene. Furthermore, a bottom-up procedure of coronene fabricated a graphene nanostructure.¹²⁾ After Kubozono *et al.* observed superconductivity from an alkali-doped picene,¹³⁾ studies on organic superconductors of polycyclic aromatic compounds recently received much attention.^{14,15)} An alkali-doped coronene also showed superconductivity.¹⁶⁾



Product No.	Product Name	Unit Size	
C2572	Corannulene	20mg	100mg
C1961	Coronene (purified by sublimation)	100mg	
C0386	Coronene	1g	5g
C2449	[12]Cycloparaphenylene	10mg	
T2752	Truxene	100mg	1g

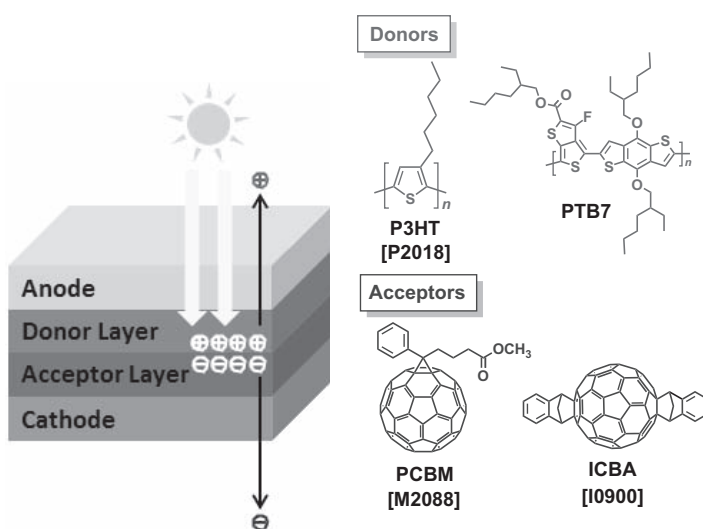
References

- 1) H. Omachi, T. Nakayama, E. Takahashi, Y. Segawa, K. Itami, *Nat. Chem.* **2013**, 5, 572.
- 2) E. Kayahara, V. K. Patel, S. Yamago, *J. Am. Chem. Soc.* **2014**, 136, 2284.
- 3) P. J. Evans, E. R. Darzi, R. Jasti, *Nat. Chem.* **2014**, 6, 404.
- 4) T. Iwamoto, Y. Watanabe, T. Sadahiro, T. Haino, S. Yamago, *Angew. Chem. Int. Ed.* **2011**, 50, 8342.
- 5) W. E. Barth, R. G. Lawton, *J. Am. Chem. Soc.* **1966**, 88, 380.
- 6) J. C. Hanson, C. E. Nordman, *Acta Cryst.* **1976**, B32, 1147.
- 7) L. T. Scott, E. A. Jackson, Q. Zhang, B. D. Steinberg, M. Bancu, B. Li, *J. Am. Chem. Soc.* **2012**, 134, 107.

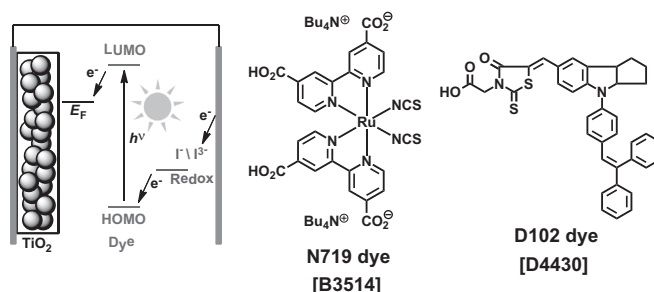
- 8) K. Kawasumi, Q. Zhang, Y. Segawa, L. T. Scott, K. Itami, *Nat. Chem.* **2013**, 5, 739.
- 9) Z. Yang, B. Xu, J. He, L. Xue, Q. Guo, H. Xia, W. Tian, *Org. Electron.* **2009**, 10, 954.
- 10) G. Otero, G. Biddau, C. Sánchez-Sánchez, R. Caillard, M. F. López, C. Rogero, F. J. Palomares, N. Cabello, M. A. Basanta, J. Ortega, J. Méndez, A. M. Echavarren, R. Pérez, B. Gómez-Lor, J. A. Martín-Gago, *Nature* **2008**, 454, 865.
- 11) I. Díez-Pérez, Z. Li, J. Hihath, J. Li, C. Zhang, X. Yang, L. Zang, Y. Dai, X. Feng, K. Muellen, N. Tao, *Nat. Commun.* **2010**, 1, 1.
- 12) X. Wan, K. Chen, D. Liu, J. Chen, Q. Miao, J. Xu, *Chem. Mater.* **2012**, 24, 3906.
- 13) R. Mitsuhashi, Y. Suzuki, Y. Yamanari, H. Mitamura, T. Kambe, N. Ikeda, H. Okamoto, A. Fujiwara, M. Yamaji, N. Kawasaki, Y. Maniwa, Y. Kubozono, *Nature* **2010**, 464, 76.
- 14) X. F. Wang, R. H. Liu, Z. Gui, Y. L. Xie, Y. J. Yan, J. J. Ying, X. G. Luo, X. H. Chen, *Nat. Commun.* **2011**, 2, 1513/1.
- 15) M. Xue, T. Cao, D. Wang, Y. Wu, H. Yang, X. Dong, J. He, F. Li, G. F. Chen, *Sci. Rep.* **2012**, 2, srep00389.
- 16) Y. Kubozono, H. Mitamura, X. Lee, X. He, Y. Yamanari, H. Takahashi, Y. Suzuki, Y. Kaji, R. Eguchi, K. Akaike, T. Kambe, H. Okamoto, A. Fujiwara, T. Kato, T. Kosugi, H. Aoki, *Phys. Chem. Chem. Phys.* **2011**, 13, 16476.

Reagents for Solar Cell Research

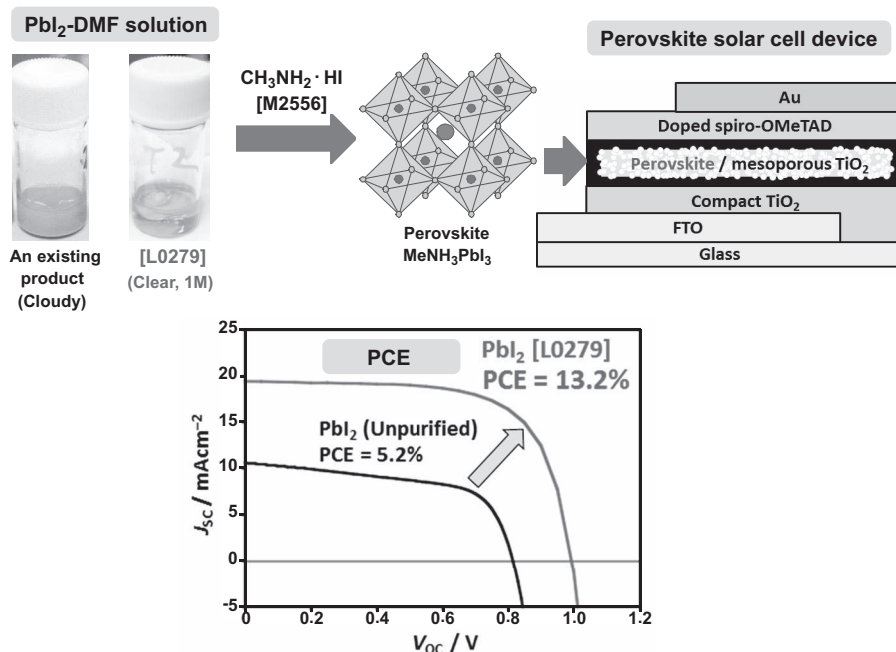
A prototype of organic photovoltaics (OPV) was reported by Tang *et al.* in 1986.¹⁾ In order to fabricate an OPV device, we can use highly productive methods such as printing and roll-to-roll methods. The OPV device usually requires a bulk heterojunction (BHJ) which can be fabricated by mixing an electron-donor (p-type semiconductor) and electron-acceptor (n-type semiconductor).²⁾ The former material involves a π -conjugated polymer and a small molecule semiconductor, and the latter material is normally a fullerene derivative. PCBM, that is a solubility-enhanced fullerene, efficiently provides a bulk heterojunction.³⁾ ICBM gives a high open-circuit voltage because it has a higher energy LUMO than that of PCBM.⁴⁾ A C₇₀ derivative usually gives higher cell efficiency compared with that of the corresponding C₆₀ one, because the C₇₀ derivative absorbs light better than the C₆₀.⁵⁾ We can introduce an acceptor component into the structure of a p-type semiconducting polymer to form a donor-acceptor (DA-type) polymer, that shows light absorption in the long wavelength area based on a charge transfer.⁶⁾ Raw materials for π -conjugated polymers are listed in the section of 'Building Blocks for Semiconducting Polymer'.

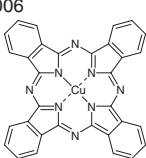
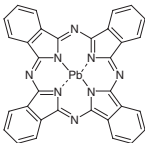
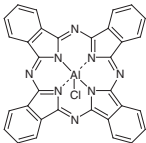
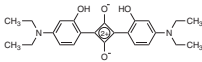
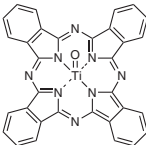
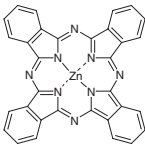
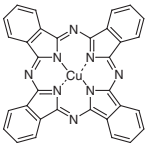
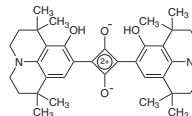
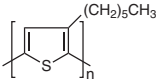


Grätzel *et al.* first developed a dye-sensitized solar cell (DSSC) in 1991.⁷⁾ The DSSC is a liquid-type device that involves nanoporous titanium oxide (TiO₂) as a semiconducting electrode, organic dye-sensitizer and electrolyte solution containing a redox component. This is expected to be a low cost solar cell, because there is a simpler device structure compared with the other solar cells.⁸⁾ The DSSC is usable under conditions with weak light. Thus, it is expected that the DSSC may be installed in a room. A ruthenium complex with a bipyridine ligand is one of popular organic dyes for the solar cell.⁹⁾ In the polypyridine ligand of the ruthenium complex, we can introduce some carboxyl or phosphonic acid groups forming a linkage with TiO₂. In addition, metal-free organic dyes (eg. D-102, D-131 and D-358) were also developed, because they do not contain any expensive ruthenium atoms.^{10,11)} Several examples of DSSC with all solid systems are reported as well.¹²⁾



A perovskite solar cell, that was first reported by Miyasaka *et al.* in 2009, has recently received much attention.¹³⁾ The organic-inorganic perovskite, RNH_3PbX_3 ($\text{X} = \text{Cl}, \text{Br}, \text{I}$), can function as a light absorption layer. Power conversion efficiency (PCE) of the perovskite solar cell is getting >15%, better than those of OPV and DSSC.^{14,15)} A device of the perovskite solar cell is solution-processible enabling fabrication at low cost. The organic-inorganic perovskites RNH_3PbX_3 are easily prepared from HX salts of organic amines and lead halides. A modification of the halide X in the $(\text{MeNH}_3)\text{PbX}_3$ can control the range of absorption wavelength. The perovskite compound with $\text{X} = \text{Br}$ is useful for light absorption in shorter wavelengths and the compound with $\text{X} = \text{I}$ is relatively useful for that in longer wavelengths. Wakamiya *et al.* reported that use of highly dried lead(II) iodide is a key to fabricate efficient perovskite solar cell devices (PCE > 10%) with high reproducibility.^{16,17)}



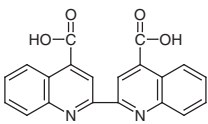
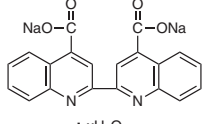
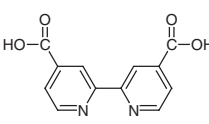
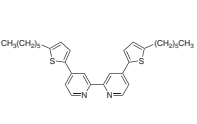
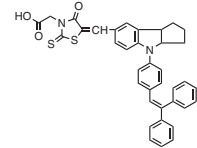
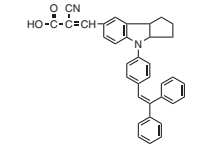
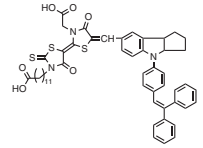
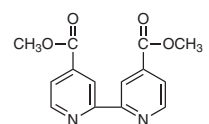
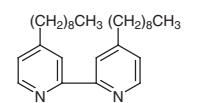
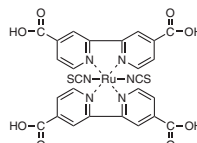
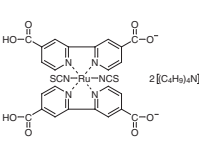
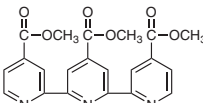
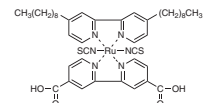
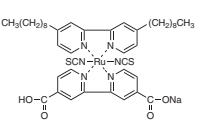
Organic Photovoltaics (OPV)		p-Type Semiconductors	
P1005 P1006 	P0766 	C1167 	B4342 
T2272 	P0767 	P1628 	B4649 
			P2018 

Product No.	Product Name	Unit Size	
B4342	2,4-Bis[4-(diethylamino)-2-hydroxyphenyl]squaraine	1g	5g
B4649	2,4-Bis[8-hydroxy-1,1,7,7-tetramethyljulolidin-9-yl]squaraine	1g	5g
P1005	Copper(II) Phthalocyanine (α -form)	25g	250g
P1006	Copper(II) Phthalocyanine (β -form)	25g	500g
P0766	Lead(II) Phthalocyanine	1g	25g
C1167	Phthalocyanine Chloroaluminum		1g
P1628	Pigment Blue 15 (purified by sublimation)		1g
P2018	Poly(3-hexylthiophene-2,5-diyl) (regioregular)	200mg	1g
T2272	Titanyl Phthalocyanine (purified by sublimation)	200mg	1g
P0767	Zinc Phthalocyanine	1g	10g
		10g	25g

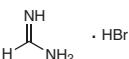
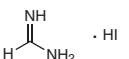
n-Type Semiconductors	B4268	B4343	B4576	C2415
	D4175	B1641	B1694	H1194
	I0900			
P2013	P2014	P2015	M2088	M2550
P0972	P0984	P2119	T2206	T3061

Product No.	Product Name	Unit Size	
B4268	<i>N,N'</i> -Bis(2,6-diisopropylphenyl)-3,4,9,10-perylenetetracarboxylic Diimide	1g	5g
B4343	<i>N,N'</i> -Bis(2-ethylhexyl)-3,4,9,10-perylenetetracarboxylic Diimide		200mg
B4576	Bis-PCBM (mixture of isomers)		50mg
C2415	C ₆₀ MC ₁₂		100mg
D4175	<i>N,N'</i> -Di- <i>n</i> -octyl-3,4,9,10-perylenetetracarboxylic Diimide		1g
B1641	Fullerene C ₆₀ (pure)	100mg	1g
B1694	Fullerene C ₇₀		100mg
H1194	1,2,3,4,8,9,10,11,15,16,17,18,22,23,24,25-Hexadecafluorophthalocyanine Copper(II) (purified by sublimation)	100mg	1g
I0900	ICBA		50mg
P2013	[60]PCB-C ₄ ([6,6]-Phenyl-C ₆₁ -butyric Acid Butyl Ester)		100mg
P2014	[60]PCB-C ₈ ([6,6]-Phenyl-C ₆₁ -butyric Acid <i>n</i> -Octyl Ester)		100mg
P2015	[60]PCB-C ₁₂ ([6,6]-Phenyl-C ₆₁ -butyric Acid Dodecyl Ester)		100mg
M2088	[60]PCBM (Methyl [6,6]-Phenyl-C ₆₁ -butyrate)		100mg
M2550	[70]PCBM (Methyl [6,6]-Phenyl-C ₇₁ -butyrate) (mixture of isomers)		50mg

Product No.	Product Name	Unit Size		
P0972	3,4,9,10-Perylenetetracarboxylic Dianhydride	25g	100g	500g
P0984	3,4,9,10-Perylenetetracarboxylic Diimide			25g
P2119	PTCBI (<i>cis</i> - and <i>trans</i> - mixture)			200mg
T2206	Tetradecafluoro- α -sexithiophene (purified by sublimation)			50mg
T3061	1,6,7,12-Tetrakis(4- <i>tert</i> -butylphenoxy)- <i>N,N'</i> -bis(2,6-diisopropylphenyl)-3,4,9,10-perylenetetracarboxylic Diimide			200mg

Dye-Sensitized Solar Cell (DSSC)		B3509 	B4509 	B1876 
B4420 	D4430 	D4431 	D4432 	D4635 
D3917 	B4372 	B3514 	T2959 	B4373 
B4432 				

Product No.	Product Name	Unit Size	
B3509	2,2'-Bicinchoninic Acid	1g	5g
B4509	Bicinchoninic Acid Disodium Salt Hydrate	1g	5g
B1876	2,2'-Bipyridine-4,4'-dicarboxylic Acid	100mg	1g
B4420	4,4'-Bis(5-hexyl-2-thienyl)-2,2'-bipyridyl		200mg
D4430	D 102		50mg
D4431	D 131		50mg
D4432	D 358		50mg
D4635	Dimethyl 2,2'-Bipyridine-4,4'-dicarboxylate	1g	5g
D3917	4,4'-Dinonyl-2,2'-bipyridyl	1g	5g
B4372	N3 Dye		200mg
B3514	N719 Dye		100mg
T2959	Trimethyl 2,2':6',2''-Terpyridine-4,4',4''-tricarboxylate		200mg
B4373	Z907 Dye		200mg
B4432	Z907 Dye Sodium Salt		200mg

Perovskite Solar Cell		F0973	F0974	L0279
				PbI ₂
M2589	M2556			
CH ₃ NH ₂ · HBr	CH ₃ NH ₂ · HI			

Product No.	Product Name	Unit Size	
F0973	Formamidine Hydrobromide	1g	5g
F0974	Formamidine Hydroiodide	1g	5g
L0279	Lead(II) Iodide [for Perovskite precursor]	1g	5g
M2589	Methylamine Hydrobromide	1g	5g
M2556	Methylamine Hydroiodide	1g	5g 25g

References

- 1) C. W. Tang, *Appl. Phys. Lett.* **1986**, *48*, 183.
- 2) C. J. Brabec, G. Zerza, G. Cerullo, S. De Silvestri, S. Luzzatti, J. C. Hummelen, N. S. Sariciftci, *Chem. Phys. Lett.* **2001**, *340*, 232.
- 3) J. C. Hummelen, B. W. Knight, F. LePeq, F. Wudl, J. Yao, C. L. Wilkins, *J. Org. Chem.* **1995**, *60*, 532.
- 4) Y. He, H.-Y. Chen, J. Hou, Y. Li, *J. Am. Chem. Soc.* **2010**, *132*, 1377.
- 5) M. M. Wienk, J. M. Kroon, W. J. H. Verhees, J. Knol, J. C. Hummelen, P. A. van Hal, R. A. J. Janssen, *Angew. Chem., Int. Ed.* **2003**, *42*, 3371.
- 6) S. H. Park, A. Roy, S. Beaupré, S. Cho, N. Coates, J. S. Moon, D. Moses, M. Leclerc, K. Lee, A. J. Heeger, *Nat. Photonics* **2009**, *3*, 297.
- 7) B. O'Regan, M. Grätzel, *Nature* **1991**, *353*, 737.
- 8) M. K. Nazeeruddin, P. Pechy, M. Grätzel, *Chem. Commun.* **1997**, 1705.
- 9) Review: M. Grätzel, *Inorg. Chem.* **2005**, *44*, 6841.
- 10) W. H. Howie, F. Claeysens, H. Miura, L. M. Peter, *J. Am. Chem. Soc.* **2008**, *130*, 1367.
- 11) R. Yoneya Ogura, S. Nakane, M. Morooka, M. Orihashi, Y. Suzuki, K. Noda, *Appl. Phys. Lett.* **2009**, *94*, 073308/1.
- 12) L. Schmidt-Mende, U. Bach, R. Humphry-Baker, T. Horiuchi, H. Miura, S. Ito, S. Uchida, M. Grätzel, *Adv. Mater.* **2005**, *17*, 813.
- 13) A. Kojima, K. Teshima, Y. Shirai, T. Miyasaka, *J. Am. Chem. Soc.* **2009**, *131*, 6050.
- 14) J. Burschka, N. Pellet, S.-J. Moon, R. Humphry-Baker, P. Gao, M. K. Nazeeruddin, M. Grätzel, *Nature* **2013**, *499*, 316.
- 15) M. Liu, M. B. Johnston, H. J. Snaith, *Nature* **2013**, *501*, 395.
- 16) A. Wakamiya, M. Endo, T. Sasamori, N. Tokito, Y. Ogomi, S. Hayase, Y. Murata, *Chem. Lett.* **2014**, *43*, 711.
- 17) Y. Yamada, T. Nakamura, M. Endo, A. Wakamiya, Y. Kanemitsu, *J. Am. Chem. Soc.* **2014**, *136*, 11610.

Reagents for Secondary Battery

Secondary batteries are rechargeable. There are small types of secondary batteries obtained from nickel-cadmium, nickel-hydrogen, and lithium ion sources. It is known that lead-acid batteries are relatively large. Secondary batteries are useful for automobiles, airplanes, agricultural equipment, electric vehicles, computers, mobile phones and so on. Among them, the lithium ion batteries are mainly used for various applications, and they are manufactured by lithium cobalt oxide (anode), graphite (cathode), and a liquid electrolyte with organic components.¹⁾ The lithium ion batteries provide high voltage and energy density, because the lithium ion supplied from the lithium cobalt oxide is a carrier doing the charge/discharge of the battery. A memory effect hardly occurs. A package of the lithium ion batteries can be compact. A further development of a better secondary battery is also in progress toward a low-carbon society as well as energy security.

In order to improve security of the lithium ion batteries, it is expected to use an ionic liquid electrolyte,²⁾ phosphate-based organic solvent,³⁾ organic solid electrolyte, and inorganic solid electrolyte, since an organic electrolyte solution is more or less flammable. An electrolyte solution requires a fluorine-containing flame retardant as an additive.⁴⁾ A selection of electrolyte is important for input-output characteristics, lifetime, security and voltage of a secondary battery. It is also expected that the electrolyte shows high lithium ion conductivity, electrical and chemical stabilities, and a low environmental load.

A next generation secondary battery with high energy density must be developed well. Among them, we may expect practical use of a secondary battery based on a multivalent ion carrier that can transport multi-electrons. A magnesium-based secondary battery has a theoretically high energy density. Furthermore, it is expected that we can use abundant magnesium for the battery and it is secure to use.⁵⁾

Solvents for Battery		Boric Acid Esters	
		B0518 $\text{CH}_3(\text{CH}_2)_5\text{O}-\text{B}(\text{O}(\text{CH}_2)_3\text{CH}_3)_2$	B0520 $\text{CH}_3\text{CH}_2\text{O}-\text{B}(\text{OCH}_2\text{CH}_3)_2$
B2094 $\text{CH}_3(\text{CH}_2)_5\text{O}-\text{B}(\text{O}(\text{CH}_2)_5\text{CH}_3)_2$	T1581 $\begin{array}{c} \text{OCH}_3 \\ \\ \text{O}-\text{B}-\text{O} \\ / \quad \backslash \\ \text{CH}_3\text{O}-\text{B}-\text{O}-\text{B}-\text{OCH}_3 \\ \quad \\ \text{OCH}_3 \quad \text{OCH}_3 \end{array}$	B0522 $\text{CH}_3\text{O}-\text{B}(\text{OCH}_3)_2$	B0134 $\text{CH}_3\text{CH}_2\text{CH}_2\text{O}-\text{B}(\text{OCH}_2\text{CH}_2\text{CH}_3)_2$

Product No.	Product Name	Unit Size		
B0518	Tributyl Borate	25mL	100mL	500mL
B0520	Triethyl Borate	25mL	100mL	500mL
B2094	Trihexyl Borate			25g
T1581	2,4,6-Trimethoxyboroxin		25g	100g
B0522	Trimethyl Borate	25mL	100mL	500mL
B0134	Tripropyl Borate		25mL	500mL

Carbonates	B4703	B3321	C1858	C0041
	C0053	E0076	C1342	F0731
	G0279			
P0525	V0114	V0015		

Product No.	Product Name	Unit Size	
B4703	Bis(2,2,2-trifluoroethyl) Carbonate	5g	25g
B3321	1,2-Butylene Carbonate	25g	500g
C1858	4-Chloro-1,3-dioxolan-2-one	5g	25g
C0041	Diethyl Carbonate	25g	500g
C0053	Dimethyl Carbonate	25mL	100mL 500mL
E0076	Ethylene Carbonate	25g	500g
C1342	Ethyl Methyl Carbonate	10mL	25mL
F0731	4-Fluoro-1,3-dioxolan-2-one	5g	25g
G0279	Glycerol 1,2-Carbonate	25g	500g
P0525	Propylene Carbonate	25g	500g
V0114	4-Vinyl-1,3-dioxolan-2-one		25g
V0015	Vinylene Carbonate (stabilized with BHT)	5g	25g

Sulfonyls & Related Compounds	B0136	D1172	D0264	M1239
	D2830	D2977	D1171	I0484
	M2471			
M0436	P0324	T0115		

Product No.	Product Name	Unit Size	
B0136	1,4-Butanesultone	25g	250g
D1172	Dibutyl Sulfone		25g
D0264	Dimethyl Sulfite	25g	500g
M1239	Dimethyl Sulfone	25g	500g
D2830	1,3,2-Dioxathiolane 2,2-Dioxide	5g	25g
D2977	1,3,2-Dioxathiolane 2-Oxide	5g	25g
D1171	Dipropyl Sulfone		25g
I0484	Isopropyl Methyl Sulfone	5g	25g
M2471	4-Methyl-1,3,2-dioxathiolane 2-Oxide (mixture of isomers)	5g	25g
M0436	3-Methylsulfolane	25g	250g
P0324	1,3-Propanesultone	25g	100g 500g
T0115	Tetrahydrothiophene 1,1-Dioxide	25g	500g

Nitriles	A0168	B0959	E0299	C0450
	<chem>NC-CH2-CH2-CH2-CN</chem>	<chem>CH3-CH2-CH2-O-CH2-CN</chem>	<chem>CH3-CH2-O-CH2-CN</chem>	<chem>HO-CH2-CH2-CN</chem>
E0108	F0072	G0072	M0033	M0103
<chem>NC-CH2-CH2-O-CH2-CH2-O-CH2-CH2-CN</chem>	<chem>NC-CH=CH-CN</chem>	<chem>NC-CH2-CH2-CH2-CN</chem>	<chem>NC-CH2-CN</chem>	<chem>CH3O-CH2-CN</chem>
M0653	B0475	P1751	S0109	T0077
<chem>CH3O-CH2-CH2-CN</chem>	<chem>NC-CH2-CH2-O-CH2-CH2-CN</chem>	<chem>NC-CH2-C(CN)(CN)-CH2-CN</chem>	<chem>NC-CH2-CH2-CN</chem>	<chem>NC-C(CN)=C(CN)-CN</chem>

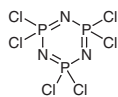
Product No.	Product Name	Unit Size	
A0168	Adiponitrile	25mL	500mL
B0959	3-Butoxypropionitrile		25mL
E0299	3-Ethoxypropionitrile	25mL	500mL
C0450	Ethylene Cyanohydrin	25mL	500mL
E0108	Ethylene Glycol Bis(propionitrile) Ether	25g	100g
F0072	Fumaronitrile	5g	25g
G0072	Glutaronitrile	25g	250g
M0033	Malononitrile	25g	100g 500g
M0103	Methoxyacetoneitrile	5mL	25mL
M0653	3-Methoxypropionitrile	25mL	500mL
B0475	3,3'-Oxydipropionitrile	25mL	500mL
P1751	1,2,2,3-Propanetetracarboxitrile	1g	5g
S0109	Succinonitrile	25g	500g
T0077	Tetracyanoethylene	5g	25g

Additives for Battery		Phosphates		P1021	P0264
P0265	P0266	P0273	P1331	P1472	
T2209	P0270	P0271	P0272	P0683	
P0268	P0269	P1022	T3041	P1134	
T3203					

Product No.	Product Name	Unit Size	
P0259	Cresyl Diphenyl Phosphate (so called) (mixture of analogue)	25mL	500mL
P1021	2-Ethylhexyl Diphenyl Phosphate	25g	500g
P0264	Triallyl Phosphate		25mL
P0265	Triamyl Phosphate		25mL
P0266	Tributyl Phosphate	25g	500g
P0273	Tricresyl Phosphate (mixture of isomers)	25g	500g
P1331	Tri- <i>o</i> -cresyl Phosphate	5g	25g
P1472	Tri- <i>m</i> -cresyl Phosphate		5g
T2209	Tri- <i>p</i> -cresyl Phosphate	5g	25g
P0270	Triethyl Phosphate	25g	500g
P0271	Trimethyl Phosphate	25g	500g
P0272	Triphenyl Phosphate	25g	500g
P0683	Tris(2-butoxyethyl) Phosphate	25g	500g
P0268	Tris(2-chloroethyl) Phosphate		25g
P0269	Tris(1,3-dichloro-2-propyl) Phosphate	25g	500g
P1022	Tris(2-ethylhexyl) Phosphate	25mL	500mL
T3041	Tris(1,1,1,3,3,3-hexafluoro-2-propyl) Phosphate	1g	5g
P1134	Tris(1 <i>H</i> ,1 <i>H</i> ,5 <i>H</i> -octafluoropentyl) Phosphate		10g
T3203	Tris(2,2,2-trifluoroethyl) Phosphate	5g	25g

Phosphazenes	E1140	H1429	H1356	P2286

C0584



Product No.	Product Name	Unit Size	
E1140	Ethoxy(pentafluoro)cyclotriphosphazene	1g	5g
H1429	Hexafluorocyclotriphosphazene	5g	25g
H1356	Hexaphenoxycyclotriphosphazene	5g	25g
P2286	Pentafluoro(phenoxy)cyclotriphosphazene	1g	5g
C0584	Phosphonitrilic Chloride Trimer	25g	250g

Lithium Electrolytes		L0267	B2542	L0224
		$\text{Li}^+ (\text{CF}_3\text{CF}_2\text{SO}_2)_2\text{N}^-$	$\text{Li}^+ (\text{CF}_3\text{SO}_2)_2\text{N}^-$	
L0146	N0710	P0659	S0237	L0133
LiPF_6				LiBF_4
T1548				

Product No.	Product Name	Unit Size	
L0267	Lithium Bis(pentafluoroethanesulfonyl)imide	1g	
B2542	Lithium Bis(trifluoromethanesulfonyl)imide	25g	250g
L0224	Lithium Carbonate	25g	500g
L0146	Lithium Hexafluorophosphate	25g	100g
N0710	Lithium Nonafluoro-1-butan-1-ylsulfonate	25g	
P0659	Lithium Pyruvate Monohydrate	25g	
S0237	Lithium Stearate	25g	500g
L0133	Lithium Tetrafluoroborate	25g	
T1548	Lithium Trifluoromethanesulfonate	25g	

Other Solid Electrolytes		C1966	E0190	E0549
E0191	F0167	H0735	H0734	I0552
M1660	M0253	T1011	T1279	T0057
T0836	T0914 T2648	T1568	T0097	T0839
T0983	T0937	T1745	T1396	T1010
T1296	T0139	T0841	T0842	T0843
T1450	T0172	M1455	T1564	T2198
P0242	P0246	T1056		

Product No.	Product Name	Unit Size	
C1966	Cyclohexyltrimethylammonium Bis(trifluoromethanesulfonyl)imide	5g	
E0190	Ethyltrimethylammonium Iodide	25g	
E0549	Ethyltriphenylphosphonium Iodide	25g	250g
E0191	Ethyltripropylammonium Iodide	25g	
F0167	(Ferrocenylmethyl)trimethylammonium Iodide	5g	
H0735	Hexadecyltrimethylammonium Perchlorate	1g	5g
H0734	Hexadecyltrimethylammonium Tetrafluoroborate	1g	5g
I0552	Isopropyltriphenylphosphonium Iodide	5g	25g
M1660	Methyltri- <i>n</i> -octylammonium Bis(trifluoromethanesulfonyl)imide	5g	
M0253	Methyltriphenylphosphonium Iodide	25g	100g 500g
T1011	Tetraamylammonium Iodide	5g	25g
T1279	Tetrabutylammonium Hexafluorophosphate	25g	25g 250g
T0057	Tetrabutylammonium Iodide	25g	100g 500g
T0836	Tetrabutylammonium Perchlorate	25g	100g 500g
T0914	Tetrabutylammonium Tetrafluoroborate	25g	100g 500g
T2648	Tetrabutylammonium Tetrafluoroborate	25g	
T1568	Tetrabutylammonium Trifluoromethanesulfonate	10g	25g
T0097	Tetraethylammonium Iodide	25g	500g
T0839	Tetraethylammonium Perchlorate	25g	
T0983	Tetraethylammonium Tetrafluoroborate	25g	
T0937	Tetraethylammonium <i>p</i> -Toluenesulfonate	25g	500g
T1745	Tetraethylammonium Trifluoromethanesulfonate	5g	25g
T1396	Tetraheptylammonium Iodide	25g	
T1010	Tetrahexylammonium Iodide	5g	25g
T1296	Tetramethylammonium Hexafluorophosphate	25g	
T0139	Tetramethylammonium Iodide	25g	100g 500g
T0841	Tetramethylammonium Perchlorate	25g	
T0842	Tetramethylammonium Tetrafluoroborate	25g	500g
T0843	Tetramethylammonium <i>p</i> -Toluenesulfonate	25g	
T1450	Tetraphenylphosphonium Iodide	10g	25g
T0172	Tetrapropylammonium Iodide	25g	500g
M1455	Tributylmethylphosphonium Iodide	25g	
T1564	Tributylsulfonium Iodide	1g	
T2198	Triethylmethylammonium Tetrafluoroborate	25g	
P0242	Triethylphenylammonium Iodide	25g	
P0246	Trimethylphenylammonium Iodide	25g	500g
T1056	Trimethylsulfonium Iodide	25g	500g

Ionic Liquids (see p.130)

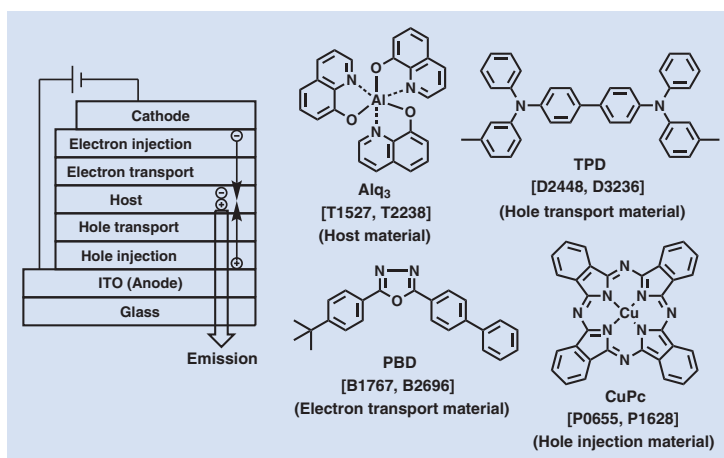
References

- 1) Review: M. V. Reddy, G. V. Subba Rao, B. V. R. Chowdari, *Chem. Rev.* **2013**, *113*, 5364.
- 2) M. Montanino, M. Moreno, M. Carewska, G. Maresca, E. Simonetti, R. Lo Presti, F. Alessandrini, G. B. Appetecchi, *J. Power Sources* **2014**, *269*, 608.
- 3) H. Jia, J. Wang, F. Lin, C. W. Monroe, J. Yang, Y. NuLi, *Chem. Commun.* **2014**, *50*, 7011.
- 4) Z. Zeng, X. Jiang, B. Wu, L. Xiao, X. Ai, H. Yang, Y. Cao, *Electrochim. Acta* **2014**, *129*, 300.
- 5) Y. Orikasa, T. Masese, Y. Koyama, T. Mori, M. Hattori, K. Yamamoto, T. Okado, Z.-D. Huang, T. Minato, C. Tassel, J. Kim, Y. Kobayashi, T. Abe, H. Kageyama, Y. Uchimoto, *Sci. Rep.* **2014**, *4*, 5622.

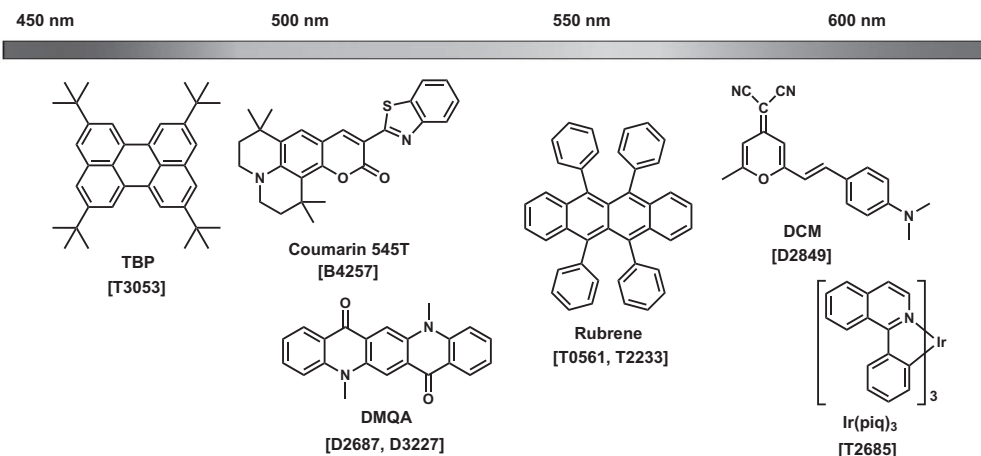
Organic Light-Emitting Diode Materials

Organic light-emitting diode (OLED) devices have received much attention, because they are expected to be a next generation display and light source, thanks to lightweight and flexible organic materials. The OLED was focused on practical use, after Tang *et al.* first observed the OLED device by use of a two layered organic thin film.¹⁾ Adachi *et al.* further reported a three layered device, in which a host layer is sandwiched by hole transport and electron transport layers. In addition, they reported a two layered system, in which one layer has roles of host and electron transport properties.^{2,3)} A five layered system including electron injection and hole injection layers has been also studied in order to improve the efficiency of carrier injection. One can control RGB colors of emission by selection of a dopant into a host layer. A suitable combination of the dopant can give a white colored device.^{4,5)} An application using the white organic light-emitting device (WOLED) is an OLED light panel.⁶⁾

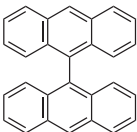
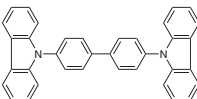
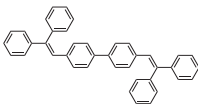
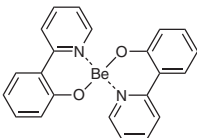
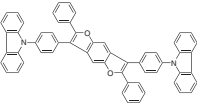
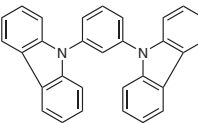
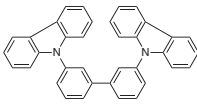
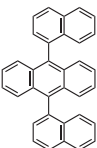
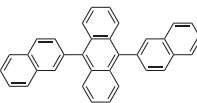
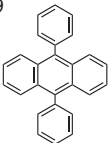
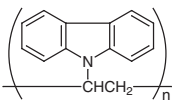
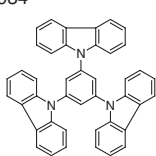
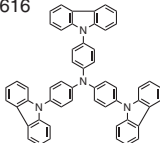
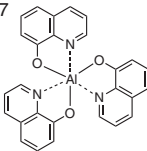
An amorphous material is useful for an OLED device, because it is transparent, homogeneous, isotropic and easily processible. A practical OLED device further requires excellent heat-resistance and durability. Many hole transport materials based on triphenylamine derivatives (TPD) are widely usable, because they are heat-resistant and amorphous.^{7,8)} In addition to the TPDs, oxadiazole derivatives (PBD) having an electron transport property,⁹⁾ Alq₃ as a host material,¹⁾ and blue emissive distyryl derivatives¹⁰⁾ are fundamental materials for amorphous OLED devices.



OLED Dopants

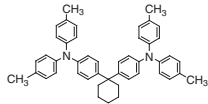
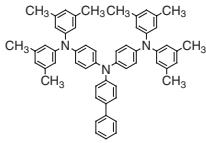
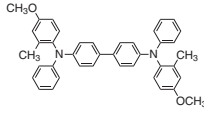
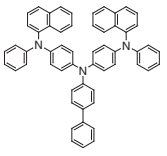
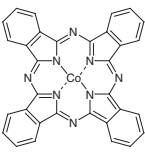
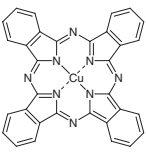
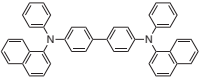
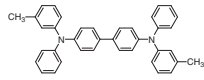
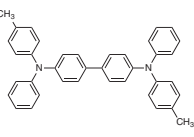
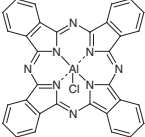
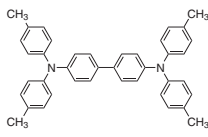
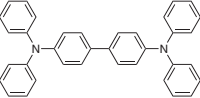
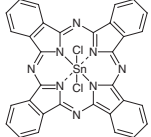
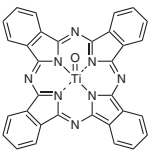
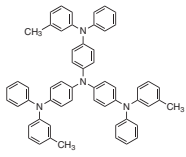


A conventional fluorescent material provides only 25% of a singlet exciton but loses 75% of the triplet one by a nonradiative deactivation, although it has a high current density. On the other hand, a phosphorescent material may provide 100% EL quantum efficiency through an intersystem crossing from singlet to triplet excited states. The phosphorescent Ir(ppy)₃ and its analogues have been reported so far.¹¹⁾ Recently, metal-free materials exhibiting thermally activated delayed fluorescence (TADF) were investigated as well. Adachi *et al.* reported more than 25% quantum efficiency by use of fluorescent materials having a low energy gap between singlet and triplet excited states, because an inverted energy transfer occurs from the triplet to the singlet state.^{12,13)}

Host Materials		B4095 	B4219 B2713 	B2737 
B4720 	C2780 	D4087 	D4772 	D3975 
D4127 	D4401 D1689 	P0656 	T1934 	T2274 T2616 
T2238 T1527 				

Product No.	Product Name	Unit Size	
B4095	9,9'-Bianthracene	1g	5g
B4219	4,4'-Bis(9H-carbazol-9-yl)biphenyl (purified by sublimation)		1g
B2713	4,4'-Bis(9H-carbazol-9-yl)biphenyl	1g	5g
B2737	4,4'-Bis(2,2-diphenylvinyl)biphenyl	5g	25g
B4720	Bis[2-(2-pyridinyl)phenolato]beryllium(II)		200mg
C2780	CZBDF		200mg
D4087	1,3-Di-9-carbazolylbenzene (purified by sublimation)		1g
D4772	3,3'-Di(9H-carbazol-9-yl)-1,1'-biphenyl		200mg
D3975	9,10-Di(1-naphthyl)anthracene	1g	5g
D4127	9,10-Di(2-naphthyl)anthracene	1g	5g
D4401	9,10-Diphenylanthracene (purified by sublimation)		1g
D1689	9,10-Diphenylanthracene	1g	25g
P0656	Poly(N-vinylcarbazole)	5g	25g
T1934	1,3,5-Tri(9H-carbazol-9-yl)benzene (purified by sublimation)	1g	5g

Product No.	Product Name	Unit Size	
T2274	4,4',4"-Tri-9-carbazolyltriphenylamine (purified by sublimation)	200mg	1g
T2616	4,4',4"-Tri-9-carbazolyltriphenylamine	1g	5g
T2238	Tris(8-quinolinolato)aluminum (purified by sublimation)		5g
T1527	Tris(8-quinolinolato)aluminum	25g	250g

Hole Transport Materials		B3146 B2079 	B2269 	B4470 
B2305 	P0887 	P1005 P1006 	D3970 	D3236 D2448 
D4834 	C1167 	T2269 	T1812 	P0997 
T2272 	T2251 			

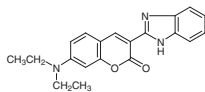
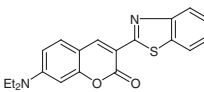
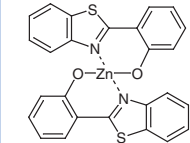
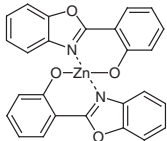
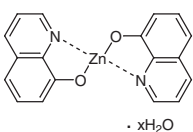
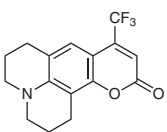
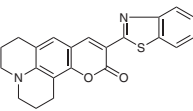
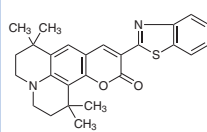
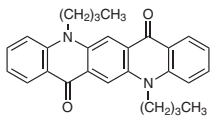
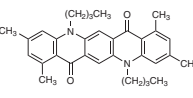
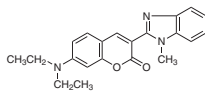
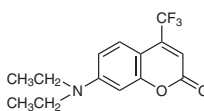
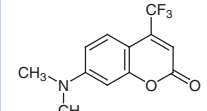
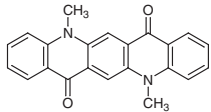
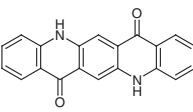
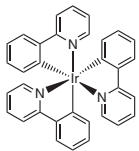
Product No.	Product Name	Unit Size	
B3146	1,1-Bis[4-[N,N-di(p-tolyl)amino]phenyl]cyclohexane (purified by sublimation)		1g
B2079	1,1-Bis[4-[N,N-di(p-tolyl)amino]phenyl]cyclohexane	1g	5g
B2269	4,4'-Bis[di(3,5-xylol)amino]-4''-phenyltriphenylamine	100mg	1g
B4470	N,N'-Bis(4-methoxy-2-methylphenyl)-N,N'-diphenylbenzidine	5g	25g
B2305	4,4'-Bis[di(1-naphthyl)-N-phenylamino]-4''-phenyltriphenylamine		100mg
P0887	Cobalt(II) Phthalocyanine		25g
P1005	Copper(II) Phthalocyanine (α-form)	25g	250g
P1006	Copper(II) Phthalocyanine (β-form)	25g	500g
D3970	N,N'-Di-1-naphthyl-N,N'-diphenylbenzidine (purified by sublimation)	1g	5g
D3236	N,N'-Diphenyl-N,N'-di(m-tolyl)benzidine (purified by sublimation)	1g	5g
D2448	N,N'-Diphenyl-N,N'-di(m-tolyl)benzidine	1g	5g
D4834	N,N'-Diphenyl-N,N'-di(p-tolyl)benzidine	200mg	1g
C1167	Phthalocyanine Chloroaluminum		1g
T2269	N,N,N',N'-Tetrakis(p-tolyl)benzidine		5g
T1812	N,N,N',N'-Tetraphenylbenzidine	5g	25g
P0997	Tin(IV) Phthalocyanine Dichloride		1g
T2272	Titanyl Phthalocyanine (purified by sublimation)	200mg	1g
T2251	4,4',4''-Tris[phenyl(m-tolyl)amino]triphenylamine		100mg

Electron Transport Materials		B2694 D0711	B2695 D0905	B4221 B1554
B2696 B1767	D2757	D1429	P1633	T1333
T2700	T3268 T2785			

Product No.	Product Name	Unit Size	
B2694	Bathocuproine (purified by sublimation)	1g	5g
D0711	Bathocuproine	1g	5g
B2695	Bathophenanthroline (purified by sublimation)		1g
D0905	Bathophenanthroline	1g	5g
B4221	2,5-Bis(5- <i>tert</i> -butyl-2-benzoxazolyl)thiophene (purified by sublimation)	1g	5g
B1554	2,5-Bis(5- <i>tert</i> -butyl-2-benzoxazolyl)thiophene	5g	25g
B2696	2-(4- <i>tert</i> -Butylphenyl)-5-(4-biphenyl)-1,3,4-oxadiazole (purified by sublimation)	1g	5g
B1767	2-(4- <i>tert</i> -Butylphenyl)-5-(4-biphenyl)-1,3,4-oxadiazole	5g	25g
D2757	2,5-Di(1-naphthyl)-1,3,4-oxadiazole		5g
D1429	2,5-Diphenyl-1,3,4-oxadiazole		10g
P1633	1,2,3,4,5-Pentaphenyl-1,3-cyclopentadiene	100mg	1g
T1333	1,2,3,4-Tetraphenyl-1,3-cyclopentadiene	1g	5g
T2700	2,4,6-Tri(9 <i>H</i> -carbazol-9-yl)-1,3,5-triazine (purified by sublimation)	1g	5g
T3268	2,4,6-Triphenyl-1,3,5-triazine (purified by sublimation)		1g
T2785	2,4,6-Triphenyl-1,3,5-triazine	1g	5g

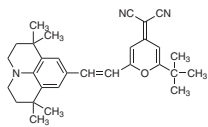
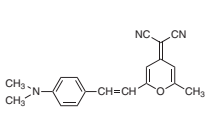
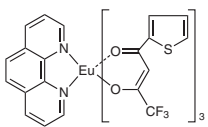
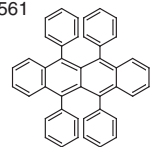
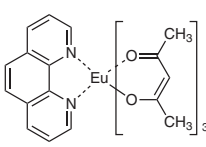
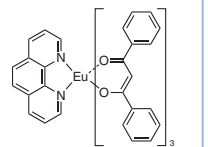
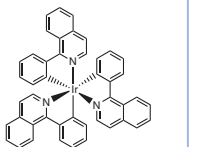
Blue Dopants		B2080	B4682	B4792
P1629 P0078	T3053	T3042		

Product No.	Product Name	Unit Size
B2080	1,4-Bis[4-(di- <i>p</i> -tolylamino)styryl]benzene	1g
B4682	4,4'-Bis[4-(di- <i>p</i> -tolylamino)styryl]biphenyl	200mg
B4792	1,4-Bis[2-(9-ethylcarbazol-3-yl)vinyl]benzene	200mg
P1629	Perylene (purified by sublimation)	1g
P0078	Perylene	5g 25g
T3053	2,5,8,11-Tetra- <i>tert</i> -butylperylene	100mg
T3042	1,3,6,8-Tetraphenylpyrene	50mg 200mg

Green Dopants		B2111 	B2088 	B2077 
B2078 	B1678 	C2858 	C2900 	B4257 
D4780 	D4697 	C2837 	D4466 	D3356 
D3227 D2687 	Q0083 Q0057 	T1946 		

Product No.	Product Name	Unit Size
B2111	3-(2-Benzimidazolyl)-7-(diethylamino)coumarin	100mg 1g
B2088	3-(2-Benzothiazolyl)-7-(diethylamino)coumarin	1g 5g
B2077	Bis[2-(2-benzothiazolyl)phenolato]zinc(II)	1g 5g
B2078	Bis[2-(2-benzoxazolyl)phenolato]zinc(II)	5g
B1678	Bis(8-quinolinolato)zinc(II) Hydrate	5g 25g
C2858	Coumarin 153	200mg 1g
C2900	Coumarin 545	200mg
B4257	Coumarin 545T	200mg
D4780	<i>N,N'</i> -Dibutylquinacridone	200mg 1g
D4697	5,12-Dibutyl-1,3,8,10-tetramethylquinacridone (This product is only available in Japan.)	200mg 1g
C2837	7-(Diethylamino)-3-(1-methyl-2-benzimidazolyl)coumarin	200mg 1g
D4466	7-(Diethylamino)-4-(trifluoromethyl)coumarin	200mg
D3356	7-(Dimethylamino)-4-(trifluoromethyl)coumarin	5g 25g
D3227	<i>N,N'</i> -Dimethylquinacridone (purified by sublimation)	1g

Product No.	Product Name	Unit Size	
D2687	<i>N,N'</i> -Dimethylquinacridone	1g	5g
Q0083	Quinacridone (purified by sublimation)		1g
Q0057	Quinacridone		25g
T1946	Tris(2-phenylpyridinato)iridium(III) (purified by sublimation)		200mg

Red Dopants		D4700	D2849	P1766
				
T2233 T0561	T3206	T1735	T2685	
				

Product No.	Product Name	Unit Size	
D4700	DCJTb		200mg
D2849	4-(Dicyanomethylene)-2-methyl-6-(4-dimethylaminostyryl)-4 <i>H</i> -pyran		500mg
P1766	(1,10-Phenanthroline)tris[4,4,4-trifluoro-1-(2-thienyl)-1,3-butanedionato]europium(III)		1g
T2233	5,6,11,12-Tetraphenylnaphthalene (purified by sublimation)	250mg	1g
T0561	5,6,11,12-Tetraphenylnaphthalene	100mg	1g
T3206	Tris(acetylacetonato)(1,10-phenanthroline)europium(III)		200mg
T1735	Tris(1,3-diphenyl-1,3-propanedionato)(1,10-phenanthroline)europium(III)	1g	5g
T2685	Tris[1-phenylisoquinoline- <i>C</i> ² , <i>N</i>]iridium(III) (purified by sublimation)		100mg

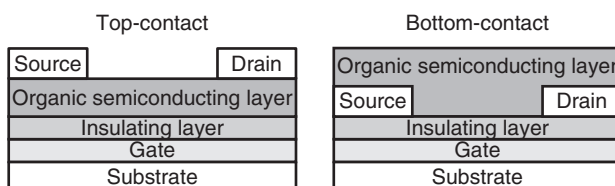
References

- 1) C. W. Tang, S. A. VanSlyke, *Appl. Phys. Lett.* **1987**, 51, 913.
- 2) C. Adachi, S. Tokito, T. Tsutsui, S. Saito, *Jpn. J. Appl. Phys.* **1988**, 27, L269.
- 3) C. Adachi, S. Tokito, T. Tsutsui, S. Saito, *Jpn. J. Appl. Phys.* **1988**, 27, L713.
- 4) Review: B. Luessem, M. Riede, K. Leo, *Phys. Org. Semicon. (2nd Edition)* **2012**, 427.
- 5) Review: C. Adachi, T. Oyamada, T. Matsushima, *Mol. Electron. Bioelectron.* **2007**, 18, 25.
- 6) Review: H. Sasabe, J. Kido, *J. Mater. Chem. C* **2013**, 1, 1699.
- 7) Y. Shirota, K. Okumoto, H. Inada, *Synth. Met.* **2000**, 111-112, 387.
- 8) X. Zhou, J. Blochwitz, M. Pfeiffer, A. Nollau, T. Fritz, K. Leo, *Adv. Funct. Mater.* **2001**, 11, 310.
- 9) M. Era, C. Adachi, T. Tsutsui, S. Saito, *Chem. Phys. Lett.* **1991**, 178, 488.
- 10) C. Hosokawa, H. Higashi, H. Nakamura, T. Kusumoto, *Appl. Phys. Lett.* **1995**, 67, 3853.
- 11) C. Adachi, M. A. Baldo, S. R. Forrest, M. E. Thompson, *Appl. Phys. Lett.* **2000**, 77, 904.
- 12) H. Uoyama, K. Goushi, K. Shizu, H. Nomura, C. Adachi, *Nature* **2012**, 492, 234.
- 13) Q. Zhang, B. Li, S. Huang, H. Nomura, H. Tanaka, C. Adachi, *Nat. Photonics* **2014**, 8, 326.

Organic Transistor Materials

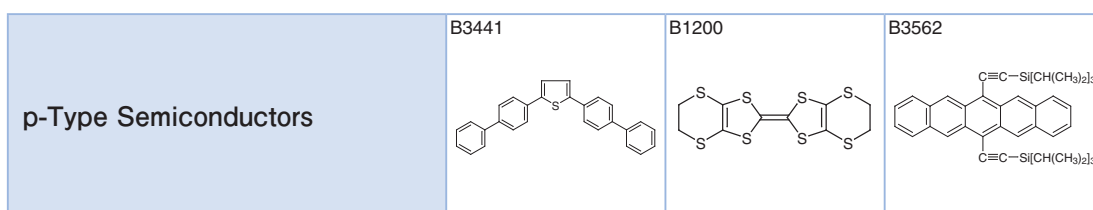
Light and flexible organic semiconductor materials are promising for foldable electronic circuits¹⁾ and implantable biometric sensors,²⁾ although such electronic devices are hardly obtained from silicon-based semiconductors. We have developed a printed electronics giving large scale and highly precise devices on flexible substrates (eg. paper and film) by a printing method thanks to solubility of organic materials. The printing method is an efficient technology for mass production and low cost production of a semiconducting device.³⁾ Further advantage using an organic material is that one can precisely control electrical properties and processing characteristics by chemical modification of the material, because organic materials are structurally diverse.

One functional parameter for evaluation of an organic semiconductor is mobility (μ) that shows how fast holes or electrons move in the semiconducting layer. We need an organic material with high mobility for highly drivable electronic circuits. The mobility can be measured from an organic field-effect transistor (OFET). There are TOF and TRMC methods for the measurement. The OFET can be fabricated by an organic semiconductor layer, insulating layer, source, drain and gate electrodes. In addition to the mobility value, we can determine fundamental OFET characteristics such as minimum drive voltage and drive stability. There are several types of OFET device structures with top-contact and bottom-contact systems. Furthermore, there is also a vertical transistor in which a carrier is movable vertically.



There are p-type organic semiconductors with hole carriers, n-type organic semiconductors with electron carriers and ambipolar organic semiconductors with both hole and electron carriers. Among them, there are small molecule p-type organic semiconductors; rubrene and pentacene as acene series, dinaphthothienothiophene (DNTT) and benzothenobenzothiophene (BTBT) as heteroacene series, oligothiophene series and porphyrin series. A category of n-type small molecule semiconductor involves perylene tetracarboxydiimide (PTCDI) and tetracyanoquinodimethane (TCNQ), and fullerenes. A polymer-based organic transistor also has been developed by using polythiophene, polyfluorene, and a donor-acceptor type polymer. A mobility value obtained from a solution-processed OFET has been normally lower than that obtained from a vapor deposited one, thus solubility is incompatible with mobility so far. However, an excellent solution-processible device was recently developed by soluble organic materials with high mobility.⁴⁻⁷⁾ Further synthetic and process developments of organic materials may provide an efficient solution-processible device.

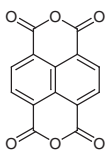
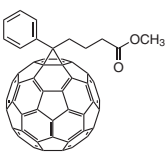
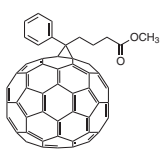
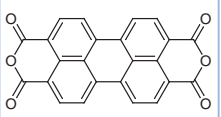
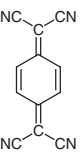
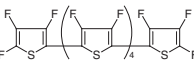
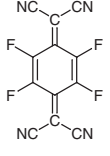
One characteristic of organic semiconductors is flexibility. Liquid crystal organic semiconductors also receive attention, because they are more flexible than the usual crystalline and amorphous organic semiconductors.^{8,9)} The liquid crystal organic semiconductor shows carrier mobility and self-assembly, in which the liquid crystal molecule spontaneously undergoes an orientation. Moreover, one can control the molecular orientation by applying an electrical field, thanks to flexibility of the liquid crystal molecule.



B3612	D3526	D4487	H1448	N0951 N0001
P0030	P1795	P2207 P1893	P1628	P2018
Q0078	S0220	S0504	T1196	T2233

Product No.	Product Name	Unit Size	
B3441	2,5-Bis(4-biphenyl)thiophene	1g	5g
B1200	Bis(ethylenedithio)tetrathiafulvalene	100mg	1g
B3562	6,13-Bis(triisopropylsilyl)ethynyl)pentacene (This product is unavailable in the U.S.)		100mg
B3612	BTQBT (purified by sublimation)		100mg
D3526	2,7-Diphenyl[1]benzothieno[3,2-b][1]benzothiophene		100mg
D4487	4,7-Di(2-thienyl)-2,1,3-benzothiadiazole	200mg	1g
H1448	4'-Hexyl-1,4-bis(5-phenyl-2-thienyl)benzene (purified by sublimation)		50mg
N0951	Naphthalene (purified by sublimation)	200mg	1g
N0001	Naphthalene	100mg	1g
P0030	Pentacene (purified by sublimation)		1g
P1795	Phthalocyanine (purified by sublimation)		1g
P2207	Picene (purified by sublimation) (>99.9%)		100mg
P1893	Picene (purified by sublimation)	100mg	1g
P1628	Pigment Blue 15 (purified by sublimation)		1g
P2018	Poly(3-hexylthiophene-2,5-diyl) (regioregular)	200mg	1g
Q0078	α -Quaterthiophene		100mg
S0220	p -Sexiphenyl	100mg	1g
S0504	α -Sexithiophene (purified by sublimation)	100mg	1g
T1196	2,2':5',2''-Terthiophene (purified by sublimation)		1g
T2233	5,6,11,12-Tetraphenylnaphthalene (purified by sublimation)	250mg	1g

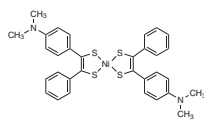
n-Type Semiconductors		B4268	B4343	D4175
D3947	B1641	B1694	H1194	I0900

N0755 N0369 	M2088 	M2550 	P0972 	T0078 
T2206 	T1131 			

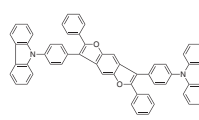
Product No.	Product Name	Unit Size	
B4268	<i>N,N'</i> -Bis(2,6-diisopropylphenyl)-3,4,9,10-perylenetetracarboxylic Diimide	1g	5g
B4343	<i>N,N'</i> -Bis(2-ethylhexyl)-3,4,9,10-perylenetetracarboxylic Diimide	200mg	
D4175	<i>N,N'</i> -Di- <i>n</i> -octyl-3,4,9,10-perylenetetracarboxylic Diimide	1g	
D3947	<i>N,N'</i> -Ditridecyl-3,4,9,10-perylenetetracarboxylic Diimide	200mg	1g
B1641	Fullerene C ₆₀ (pure)	100mg	1g
B1694	Fullerene C ₇₀	100mg	
H1194	1,2,3,4,8,9,10,11,15,16,17,18,22,23,24,25-Hexadecafluorophthalocyanine Copper(II) (purified by sublimation)	100mg	1g
I0900	ICBA	50mg	
N0755	Naphthalene-1,4,5,8-tetracarboxylic Dianhydride (purified by sublimation)	1g	5g
N0369	Naphthalene-1,4,5,8-tetracarboxylic Dianhydride	10g	25g 250g
M2088	[60]PCBM (Methyl [6,6]-Phenyl-C ₆₁ -butyrate)	100mg	
M2550	[70]PCBM (Methyl [6,6]-Phenyl-C ₇₁ -butyrate) (mixture of isomers)	50mg	
P0972	3,4,9,10-Perylenetetracarboxylic Dianhydride	25g	100g 500g
T0078	7,7,8,8-Tetracyanoquinodimethane	5g 25g	
T2206	Tetradecafluoro- α -sexithiophene (purified by sublimation)	50mg	
T1131	Tetrafluorotetracyanoquinodimethane (purified by sublimation)	100mg	1g

Ambipolar Semiconductors

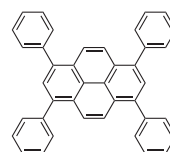
B4361



C2780



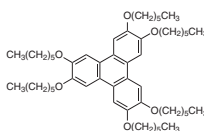
T3042



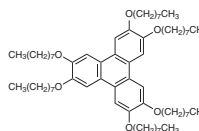
Product No.	Product Name	Unit Size	
B4361	Bis(4-dimethylaminodithiobenzil)nickel(II)	1g	
C2780	CZBDF	200mg	
T3042	1,3,6,8-Tetraphenylpyrene	50mg	200mg

Liquid Crystal Semiconductors

H1449



H1450



Product No.	Product Name	Unit Size	
H1449	2,3,6,7,10,11-Hexakis(hexyloxy)triphenylene	200mg	1g
H1450	2,3,6,7,10,11-Hexakis(<i>n</i> -octyloxy)triphenylene	200mg	1g

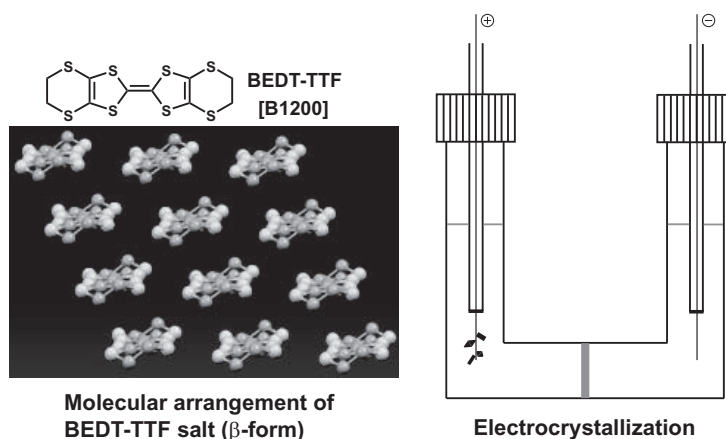
References

- 1) M. Kaltenbrunner, T. Sekitani, J. Reeder, T. Yokota, K. Kuribara, T. Tokuhara, M. Drack, R. Schwödiauer, I. Graz, S. Bauer-Gogonea, S. Bauer, T. Someya, *Nature* **2013**, 499, 458.
- 2) K. Kuribara, H. Wang, N. Uchiyama, K. Fukuda, T. Yokota, U. Zschieschang, C. Jaye, D. Fischer, H. Klauk, T. Yamamoto, K. Takimiya, M. Ikeda, H. Kuwabara, T. Sekitani, Y.-L. Loo, T. Someya, *Nat. Commun.* **2012**, 3, 723.
- 3) K. Suganuma, in *Introduction to Printed Electronics*, Springer, New York, **2014**, 124, 148.
- 4) T. Okamoto, C. Mitsui, M. Yamagishi, K. Nakahara, J. Soeda, Y. Hirose, K. Miwa, H. Sato, A. Yamano, T. Matsushita, T. Uemura, J. Takeya, *Adv. Mater.* **2013**, 25, 6392.
- 5) H. Ebata, T. Izawa, E. Miyazaki, K. Takimiya, M. Ikeda, H. Kuwabara, T. Yui, *J. Am. Chem. Soc.* **2007**, 129, 15732.
- 6) G. Kim, S.-J. Kang, G. K. Dutta, Y.-K. Han, T. J. Shin, Y.-Y. Noh, C. Yang, *J. Am. Chem. Soc.* **2014**, 136, 9477.
- 7) H. Minemawari, T. Yamada, H. Matsui, J. Tsutsumi, S. Haas, R. Chiba, R. Kumai, T. Hasegawa, *Nature* **2011**, 475, 364.
- 8) Review: E.-K. Fleischmann, R. Zentel, *Angew. Chem. Int. Ed.* **2013**, 52, 8810.
- 9) M. A. Alam, J. Motoyanagi, Y. Yamamoto, T. Fukushima, J. Kim, K. Kato, M. Takata, A. Saeki, S. Seki, S. Tagawa, T. Aida, *J. Am. Chem. Soc.* **2009**, 131, 17722.

Molecular Conductors

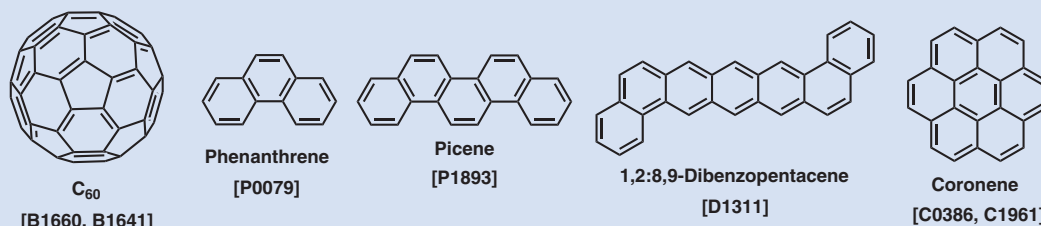
A molecular conductor is an electrical conductor based on a molecular component. A chemical modification of the molecule can control the electronic structure and physical properties. We can synthesize an opened-shell molecular conductor by chemical or electrochemical doping of a carrier, although an organic molecule is usually an insulator with a closed-shell structure. The first example of an organic conductor was observed from a bromine-doped perylene.¹⁾ After this observation, a molecular conductor based on tetrathiafulvalene (TTF) was reported in the 1970s,²⁾ and the first case of an organic molecular superconductor was observed from the organic salt of tetraselenafulvalene, (TMTSF)₂X in the 1980s.³⁾ These TTF and TMTSF salts form a one-dimensional or pseudo one-dimensional molecular arrangement. On the other hand, bis(ethylenedithio)tetrathiafulvalene (BEDT-TTF) favors forming a two-dimensional molecular arrangement, which is a relatively stable molecular metal toward temperature.⁴⁻⁶⁾

Conducting salts of TTF derivatives can be normally obtained by an electrochemical oxidation (electrocrystallization).⁷⁾ These TTF derivatives can function as donor molecules with a hole carrier. Metal dithiolene complexes (M(dmit)₂), 7,7,8,8-Tetracyanoquinodimethane (TCNQ) and fullerene (C₆₀) are acceptor molecules with an electron carrier. An M(dmit)₂ salt produced the first example of an acceptor-based organic superconductor.⁸⁾ Chemical modifications of the M(dmit)₂ salt produced plenty of those organic superconductors by changing the central metal atom and counter cation.⁹⁾



Several alkali-doped nanocarbon and nanographene compounds have shown superconductivity. It has well known that rubidium- and cesium-doped fullerenes have demonstrated superconductivity at more than 30 K.¹⁰⁾ Recently, superconductivity of Cs₃C₆₀ at 38 K was reported.¹¹⁾ Although the molecular conductors synthesized from TTF and M(dmit)₂ exhibit low-dimensional molecular arrangements, these fullerene salts can form three-dimensionality.¹²⁾ Kubozono *et al.* reported that an alkali-doped picene demonstrated superconductivity at 18 K.¹³⁾ This result indicates that one can observe superconductivity from a planar nanocarbon material as well. In addition to the picene-based superconductor, an alkali-doped phenanthrene ($T_c = 5$ K),¹⁴⁾ alkali-doped coronene ($T_c = 15$ K),¹⁵⁾ and alkali-doped 1,2:8,9-dibenzopentacene ($T_c = 33$ K)¹⁶⁾ have also shown superconductivity.

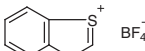
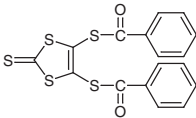
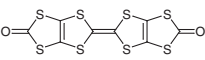
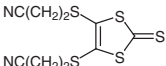
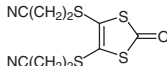
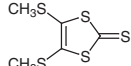
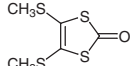
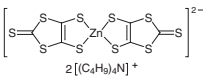
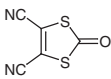
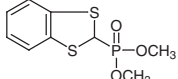
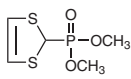
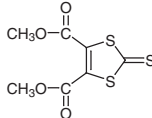
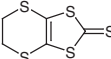
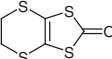
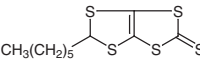
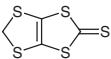
Superconducting materials by alkali metal doping



Donor Molecules		B1200	B1299	B1218
B1244	P0887	P1005 P1006	T1256	P1049
D2067	P0973	F0285	I0783 P0774	P0766
P1018	P1629 P0078	P1795 P0355	P0996	P1628 P0655
P0660	S0363	T2806	T1221	T1571
T1119	T1205	T0980	T1377	T2468
P1024	P0997	T2272	T1282	P0767

Product No.	Product Name	Unit Size		
B1200	Bis(ethylenedithio)tetrathiafulvalene	100mg	1g	5g
B1299	Bis(ethylenedithio)tetrathiafulvalene-d ₈			100mg
B1218	Bis(methylenedithio)tetrathiafulvalene			100mg
B1244	Bis(trimethylenedithio)tetrathiafulvalene			100mg
P0887	Cobalt(II) Phthalocyanine			25g
P1005	Copper(II) Phthalocyanine (α-form)		25g	250g

Product No.	Product Name	Unit Size	
P1006	Copper(II) Phthalocyanine (β -form)	25g	500g
T1256	Copper(II) 2,9,16,23-Tetra- <i>tert</i> -butylphthalocyanine	100mg	
P1049	Dilithium Phthalocyanine	1g	
D2067	Dimethyltetraethiafulvalene	100mg	1g
P0973	Disodium Phthalocyanine	1g	5g
F0285	Formyltetraethiafulvalene	1g	
I0783	Iron(II) Phthalocyanine (purified by sublimation)	200mg	1g
P0774	Iron(II) Phthalocyanine	25g	
P0766	Lead(II) Phthalocyanine	1g	25g
P1018	Magnesium(II) Phthalocyanine	1g	
P1629	Perylene (purified by sublimation)	1g	
P0078	Perylene	5g	25g
P1795	Phthalocyanine (purified by sublimation)	1g	
P0355	Phthalocyanine	25g	
P0996	Phthalocyanine Silicon Dichloride	Price on request	
P1628	Pigment Blue 15 (purified by sublimation)	1g	
P0655	Pigment Blue 15	25g	
P0660	Pigment Green 7	25g	
S0363	Silver(I) Phthalocyanine	Price on request	
T2806	2,3,6,7-Tetrakis(2-cyanoethylthio)tetrathiafulvalene	100mg	1g
T1221	Tetrakis(dimethylamino)ethylene	5g	25g
T1571	Tetrakis(ethylthio)tetrathiafulvalene	100mg	
T1119	Tetrakis(methylthio)tetrathiafulvalene	100mg	
T1205	Tetrakis(pentylthio)tetrathiafulvalene	100mg	
T0980	Tetrathiafulvalene	1g	5g 25g
T1377	Tetrathiafulvalene- d_4	100mg	
T2468	Tetrathiafulvalene - 7,7,8,8-Tetracyanoquinodimethane Complex	1g	
P1024	Tin(II) Phthalocyanine	1g	5g
P0997	Tin(IV) Phthalocyanine Dichloride	1g	
T2272	Titanyl Phthalocyanine (purified by sublimation)	200mg	
T1282	Tris(tetrathiafulvalene) Bis(tetrafluoroborate) Complex	1g	
P0767	Zinc Phthalocyanine	1g	10g 25g

TTF Precursors		B1322	B1151	B1199
				
B1272	B2228	B2233	B1778	B1777
				
B1221	D3252	D3992	D3981	D2127
				
D2133	E0429	E0460	H1163	M1112
				

M1154	P1635	T1132	T0266	T0279

Product No.	Product Name	Unit Size	
B1322	1,2-Benzenedithiol	1g	5g
B1151	1,3-Benzodithiolylum Tetrafluoroborate		5g
B1199	4,5-Bis(benzoylthio)-1,3-dithiole-2-thione	1g	5g
B1272	Bis(carbonyldithio)tetrathiafulvalene		1g
B2228	4,5-Bis(2-cyanoethylthio)-1,3-dithiole-2-thione		1g
B2233	4,5-Bis(2-cyanoethylthio)-1,3-dithiol-2-one		1g
B1778	4,5-Bis(methylthio)-1,3-dithiole-2-thione		1g
B1777	4,5-Bis(methylthio)-1,3-dithiol-2-one		1g
B1221	Bis(tetrabutylammonium) Bis(1,3-dithiole-2-thione-4,5-dithiolato)zinc Complex	5g	25g
D3252	4,5-Dicyano-1,3-dithiol-2-one		1g
D3992	Dimethyl 1,3-Benzodithiol-2-ylphosphonate		1g
D3981	Dimethyl 2-(1,3-Dithiole)phosphonate	1g	5g
D2127	Dimethyl 1,3-Dithiole-2-thione-4,5-dicarboxylate		10g
D2133	1,3-Dithiole-2-thione		5g
E0429	4,5-Ethylenedithio-1,3-dithiole-2-thione	5g	25g
E0460	4,5-Ethylenedithio-1,3-dithiol-2-one	1g	5g
H1163	5-Hexyl-1,3-dithiol[4,5-d][1,3]dithiole-2-thione		1g
M1112	4,5-Methylenedithio-1,3-dithiole-2-thione		1g
M1154	4,5-Methylenedithio-1,3-dithiol-2-one		100mg
P1635	5-Propyl-1,3-dithiol[4,5-d][1,3]dithiole-2-thione	250mg	1g
T1132	1,3,4,6-Tetrathiapentalene-2,5-dione	1g	5g 25g
T0266	Toluene-3,4-dithiol	1g	5g 25g
T0279	(Toluene-3,4-dithiolato)zinc(II)	1g	5g

Acceptor Molecules		B0089	B1416	B2309
B1437	B1438	B1371	B1466	T0617
B1601	B1595	T0061	C1336	C1961 C0386
D2152	D1311	D2249	D4407	D0343

D1070	D3200	D2250	D1956	D2234
D2021	D2134	F0509	B1641 B1660	B1694
M1045	P0331 P0079	P2207 P1893	T1272	T1415
T1503	T1416	T0077	T1246	T3034 T0078
T0790	T1131	T2468	T0875	

Product No.	Product Name	Unit Size		
B0089	1,4-Benzoquinone	25g	100g	500g
B1416	1,3-Bis(dicyanomethylidene)indan			5g
B2309	2,5-Bis(2-hydroxyethoxy)-7,7,8,8-tetracyanoquinodimethane		Price on request	
B1437	Bis(tetrabutylammonium) Bis(1,3-dithiole-2-thione-4,5-dithiolato)palladium(II)	100mg		1g
B1438	Bis(tetrabutylammonium) Bis(1,3-dithiole-2-thione-4,5-dithiolato)platinum(II)		100mg	
B1371	Bis(tetrabutylammonium) Bis(maleonitriledithiolato)nickel(II) Complex			1g
B1466	Bis(tetrabutylammonium) Tetracyanodiphenylquinodimethanide		100mg	
T0617	Bromanil	5g	25g	
B1601	2-Bromo-1,4-benzoquinone	1g	5g	
B1595	2-Bromo-5-methyl-1,4-benzoquinone		5g	
T0061	Chloranil	25g	500g	
C1336	2-Chloro-5-methyl-1,4-benzoquinone		5g	
C1961	Coronene (purified by sublimation)		100mg	
C0386	Coronene	1g	5g	
D2152	2,5-Di- <i>tert</i> -amylbenzoquinone		5g	
D1311	1,2:8,9-Dibenzopentacene		100mg	
D2249	2,5-Dibromo-1,4-benzoquinone	1g	5g	
D4407	3,3'-Di- <i>tert</i> -butyl-5,5'-dimethyldiphenylquinone		1g	
D0343	2,5-Dichloro-1,4-benzoquinone	1g	5g	
D1070	2,3-Dichloro-5,6-dicyano-1,4-benzoquinone	25g	250g	
D3200	2,5-Difluoro-7,7,8,8-tetracyanoquinodimethane		100mg	
D2250	2,5-Dimethoxy-1,4-benzoquinone	5g	25g	
D1956	2,3-Dimethoxy-5-methyl-1,4-benzoquinone		1g	5g
D2234	2,6-Dimethyl-1,4-benzoquinone	1g	5g	25g

Product No.	Product Name	Unit Size	
D2021	2,5-Dimethyl-7,7,8,8-tetracyanoquinodimethane	100mg	500mg
D2134	Diocetadecyldimethylammonium Bis(1,3-dithiole-2-thione-4,5-dithiolato)aurate(III)		100mg
F0509	2-Fluoro-7,7,8,8-tetracyanoquinodimethane		100mg
B1641	Fullerene C ₆₀ (pure)	100mg	1g
B1660	Fullerene C ₆₀	100mg	1g
B1694	Fullerene C ₇₀		100mg
M1045	Methoxybenzoquinone	1g	5g
P0331	Phenanthrene Zone Refined (number of passes:30)		1sample
P0079	Phenanthrene	25g	500g
P2207	Picene (purified by sublimation) (>99.9%)		100mg
P1893	Picene (purified by sublimation)	100mg	1g
T1272	Tetrabutylammonium Bis(1,3-dithiole-2-thione-4,5-dithiolato)nickel(III) Complex		100mg
T1415	Tetrabutylammonium Bis(maleonitriledithiolato)nickel(III) Complex		1g
T1503	3,3',5,5'-Tetra- <i>tert</i> -butyl-4,4'-diphenylquinone		1g
T1416	Tetrabutylphosphonium Bis(1,3-dithiole-2-thione-4,5-dithiolato)nickel(III) Complex		1g
T0077	Tetracyanoethylene	5g	25g
T1246	11,11,12,12-Tetracyanonaphtho-2,6-quinodimethane		100mg
T3034	7,7,8,8-Tetracyanoquinodimethane (purified by sublimation)	1g	5g
T0078	7,7,8,8-Tetracyanoquinodimethane	5g	25g
T0790	Tetrafluoro-1,4-benzoquinone	1g	5g
T1131	Tetrafluorotetracyanoquinodimethane (purified by sublimation)	100mg	1g
T2468	Tetrathiafulvalene - 7,7,8,8-Tetracyanoquinodimethane Complex		1g
T0875	2,4,7-Trinitro-9-fluorenylidene malononitrile	1g	5g

Supporting Electrolytes for Electrocrystallization		S0838	T1270	T1261
		$\begin{array}{c} \text{NC} \\ \\ \text{N}^- \\ \\ \text{NC} \end{array} \text{Na}^+$	$\begin{array}{c} (\text{CH}_2)_3\text{CH}_3 \\ \\ \text{CH}_3(\text{CH}_2)_3-\text{N}^+-\text{C}(\text{CH}_2)_3\text{CH}_3 \\ \\ (\text{CH}_2)_3\text{CH}_3 \end{array} \text{BrI}_2^-$	$\begin{array}{c} (\text{CH}_2)_3\text{CH}_3 \\ \\ \text{CH}_3(\text{CH}_2)_3-\text{N}^+-\text{C}(\text{CH}_2)_3\text{CH}_3 \\ \\ (\text{CH}_2)_3\text{CH}_3 \end{array} \text{AuBr}_2^-$
T1269	T1273	T1186	T1357	T1279
$\begin{array}{c} (\text{CH}_2)_3\text{CH}_3 \\ \\ \text{CH}_3(\text{CH}_2)_3-\text{N}^+-\text{C}(\text{CH}_2)_3\text{CH}_3 \\ \\ (\text{CH}_2)_3\text{CH}_3 \end{array} \text{IBr}_2^-$	$\begin{array}{c} (\text{CH}_2)_3\text{CH}_3 \\ \\ \text{CH}_3(\text{CH}_2)_3-\text{N}^+-\text{C}(\text{CH}_2)_3\text{CH}_3 \\ \\ (\text{CH}_2)_3\text{CH}_3 \end{array} \text{AuCl}_2^-$	$\begin{array}{c} (\text{CH}_2)_3\text{CH}_3 \\ \\ \text{CH}_3(\text{CH}_2)_3-\text{N}^+-\text{C}(\text{CH}_2)_3\text{CH}_3 \\ \\ (\text{CH}_2)_3\text{CH}_3 \end{array} \text{Cl}_2\text{Br}^-$	$\begin{array}{c} (\text{CH}_2)_3\text{CH}_3 \\ \\ \text{CH}_3(\text{CH}_2)_3-\text{N}^+-\text{C}(\text{CH}_2)_3\text{CH}_3 \\ \\ (\text{CH}_2)_3\text{CH}_3 \end{array} \text{AuI}_2^-$	$\begin{array}{c} (\text{CH}_2)_3\text{CH}_3 \\ \\ \text{CH}_3(\text{CH}_2)_3-\text{N}^+-\text{C}(\text{CH}_2)_3\text{CH}_3 \\ \\ (\text{CH}_2)_3\text{CH}_3 \end{array} \text{PF}_6^-$
T0836	T1803	T2648 T0914	T1278	T1284
$\begin{array}{c} (\text{CH}_2)_3\text{CH}_3 \\ \\ \text{CH}_3(\text{CH}_2)_3-\text{N}^+-\text{C}(\text{CH}_2)_3\text{CH}_3 \\ \\ (\text{CH}_2)_3\text{CH}_3 \end{array} \text{ClO}_4^-$	$\begin{array}{c} (\text{CH}_2)_3\text{CH}_3 \\ \\ \text{CH}_3(\text{CH}_2)_3-\text{N}^+-\text{C}(\text{CH}_2)_3\text{CH}_3 \\ \\ (\text{CH}_2)_3\text{CH}_3 \end{array} \text{ReO}_4^-$	$\begin{array}{c} (\text{CH}_2)_3\text{CH}_3 \\ \\ \text{CH}_3(\text{CH}_2)_3-\text{N}^+-\text{C}(\text{CH}_2)_3\text{CH}_3 \\ \\ (\text{CH}_2)_3\text{CH}_3 \end{array} \text{BF}_4^-$	$\begin{array}{c} (\text{CH}_2)_3\text{CH}_3 \\ \\ \text{CH}_3(\text{CH}_2)_3-\text{N}^+-\text{C}(\text{CH}_2)_3\text{CH}_3 \\ \\ (\text{CH}_2)_3\text{CH}_3 \end{array} \text{SCN}^-$	$\begin{array}{c} (\text{CH}_2)_3\text{CH}_3 \\ \\ \text{CH}_3(\text{CH}_2)_3-\text{N}^+-\text{C}(\text{CH}_2)_3\text{CH}_3 \\ \\ (\text{CH}_2)_3\text{CH}_3 \end{array} \text{BrI}_3^-$
T1271	T0839	T0983		
$\begin{array}{c} (\text{CH}_2)_3\text{CH}_3 \\ \\ \text{CH}_3(\text{CH}_2)_3-\text{N}^+-\text{C}(\text{CH}_2)_3\text{CH}_3 \\ \\ (\text{CH}_2)_3\text{CH}_3 \end{array} \text{I}_3^-$	$\begin{array}{c} \text{CH}_2\text{CH}_3 \\ \\ \text{CH}_3\text{CH}_2-\text{N}^+-\text{C}(\text{CH}_2)_3\text{CH}_3 \\ \\ \text{CH}_2\text{CH}_3 \end{array} \text{ClO}_4^-$	$\begin{array}{c} \text{CH}_2\text{CH}_3 \\ \\ \text{CH}_3\text{CH}_2-\text{N}^+-\text{C}(\text{CH}_2)_3\text{CH}_3 \\ \\ \text{CH}_2\text{CH}_3 \end{array} \text{BF}_4^-$		

Product No.	Product Name	Unit Size	
S0838	Sodium Dicyanamide	25g	100g
T1270	Tetrabutylammonium Bromodiodide		1g
T1261	Tetrabutylammonium Dibromoaurate		1g
T1269	Tetrabutylammonium Dibromiodide	1g	10g
T1273	Tetrabutylammonium Dichloroaurate		100mg
T1186	Tetrabutylammonium Dichlorobromide		25g

Product No.	Product Name	Unit Size	
T1357	Tetrabutylammonium Diiodaurate	100mg	1g
T1279	Tetrabutylammonium Hexafluorophosphate	25g	250g
T0836	Tetrabutylammonium Perchlorate	25g	100g 500g
T1803	Tetrabutylammonium Perrhenate	1g	5g
T2648	Tetrabutylammonium Tetrafluoroborate		25g
T0914	Tetrabutylammonium Tetrafluoroborate	25g	100g 500g
T1278	Tetrabutylammonium Thiocyanate	25g	250g
T1284	Tetrabutylammonium Tribromide	25g	100g 500g
T1271	Tetrabutylammonium Triiodide		5g 25g
T0839	Tetraethylammonium Perchlorate		25g
T0983	Tetraethylammonium Tetrafluoroborate		25g

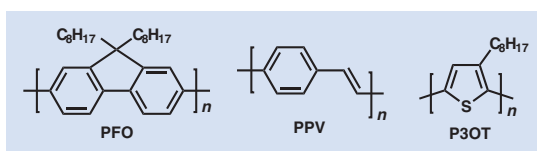
References

- 1) H. Akamatu, H. Inokuchi, Y. Matsunaga, *Nature* **1954**, 173, 168.
- 2) F. Wudl, D. Wobschall, E. J. Hufnagel, *J. Am. Chem. Soc.* **1972**, 94, 670.
- 3) D. Jérôme, A. Mazaud, M. Ribault, K. Bechgaard, *J. Phys. Lett.* **1980**, 41, 95.
- 4) T. Mori, *Chem. Rev.* **2004**, 104, 4947.
- 5) R. P. Shibaeva, E. B. Yagubskii, *Chem. Rev.* **2004**, 104, 5347.
- 6) H. Mori, *Int. J. Mod. Phys. B* **1994**, 8, 1.
- 7) P. Batail, K. Boubekeur, M. Fourmigué, J.-C. P. Gabriel, *Chem. Mater.* **1998**, 10, 3005.
- 8) L. Brossard, M. Ribault, M. Bousseau, L. Valade, P. Cassoux, *C. R. Acad. Sci., Ser. II* **1986**, 302, 205.
- 9) R. Kato, *Chem. Rev.* **2004**, 104, 5319.
- 10) K. Tanigaki, T. W. Ebbesen, S. Saito, J. Mizuki, J. S. Tsai, Y. Kubo, S. Kuroshima, *Nature* **1991**, 352, 222.
- 11) A. Y. Ganin, Y. Takabayashi, Y. Z. Khimyak, S. Margadonna, A. Tamai, M. J. Rosseinsky, K. Prassides, *Nat. Mater.* **2008**, 7, 367.
- 12) Y. Takabayashi, A. Y. Ganin, P. Jeglič, D. Arčon, T. Takano, Y. Iwasa, Y. Ohishi, M. Takata, N. Takeshita, K. Prassides, M. J. Rosseinsky, *Science* **2009**, 323, 1585.
- 13) R. Mitsuhashi, Y. Suzuki, Y. Yamanari, H. Mitamura, T. Kambe, N. Ikeda, H. Okamoto, A. Fujiwara, M. Yamaji, N. Kawasaki, Y. Maniwa, Y. Kubozono, *Nature* **2010**, 464, 76.
- 14) X. F. Wang, R. H. Liu, Z. Gui, Y. L. Xie, Y. J. Yan, J. J. Ying, X. G. Luo, X. H. Chen, *Nat. Commun.* **2011**, 2, 1513.
- 15) Y. Kubozono, H. Mitamura, X. Lee, X. He, Y. Yamanari, Y. Takahashi, Y. Suzuki, Y. Kaji, R. Eguchi, K. Akaike, T. Kambe, H. Okamoto, A. Fujiwara, T. Kato, T. Kosugi, H. Aoki, *Phys. Chem. Chem. Phys.* **2011**, 13, 16476.
- 16) M. Xue, T. Cao, D. Wang, Y. Wu, H. Yang, X. Dong, J. He, F. Li, G. F. Chen, *Sci. Rep.* **2012**, 2, srep00389.

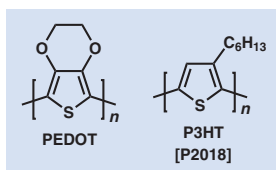
Building Blocks for Semiconducting Polymer

Polyacetylenes exhibit semiconducting-insulating properties by a lack of free electrons (carriers), although there are conducting pathways through π -conjugations. Shirakawa, MacDiarmid and Heeger *et al.* in 1977 observed that polyacetylenes show high electrical conduction comparable with a metal when the insulating polyacetylenes obtain carriers by a bromine doping.¹⁾ After their observation, studies of conducting polymers were dramatically enhanced, and some of the representative polymers were practical for electronic equipment.

In 1990s, an organic light-emitting diode (OLED) of polyphenylene vinylene (PPV) was reported and then semiconducting polymers attracted us in this research area.²⁾ The PPV is one of the light-emitting polymers (LEP) and the functionality is due to the semiconducting property of a π -conjugated polymer without a chemical doping. A chemical modification of a π -conjugated polymer can create various colored emissions. For instance, polyfluorenes (PFO),³⁾ PPVs⁴⁾ and regiorandom poly(3-octylthiophene) (P3OT)⁵⁾ exhibit blue, green and red emissions, respectively.

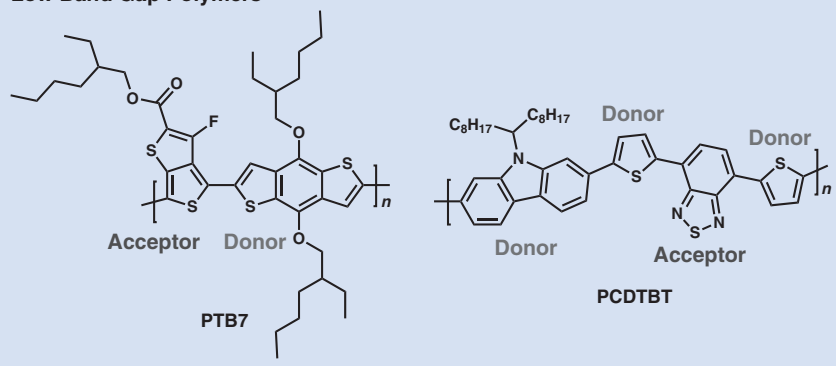


Recent research on organic electronics developed sulfur-containing polymers such as polythiophene. Poly(3,4-ethylenedioxythiophene) (PEDOT) is useful for a capacitor, organic transistor, hole transport material for an OLED device, and secondary battery as well as for an actuator, sensor and thermoelectric conversion element.^{6,7)} PEDOT/PSS that is mixture of PEDOT and polystyrene sulfonate (PSS), is widely used as a hole transport material for organic photovoltaics (OPV).⁸⁾ Poly(3-hexyl)thiophene (P3HT) can be blended with fullerene derivatives (eg. PCBM) to form an efficient bulk heterojunction. The polymer for the OPV device works as a p-type semiconductor with light absorption.⁹⁾

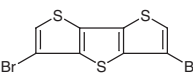
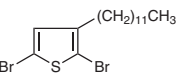
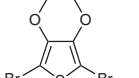
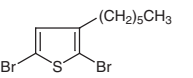
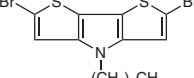
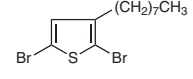
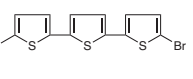
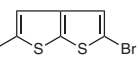
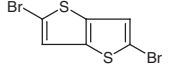
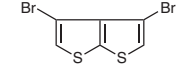
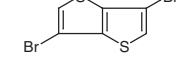
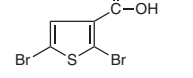
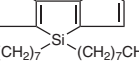
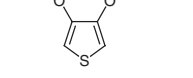
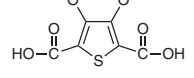


On the other hand, some thiophene-based polymers exhibit a high energy level of the highest occupied molecular orbital (HOMO), because they are electron-rich. One problem of the thiophene-based polymers is their sensitivity for electrochemical oxidation. In order to solve the problem, one can combine an electron-rich monomer (donor) and an electron-deficient monomer (acceptor) to decrease the HOMO energy level and then stable donor-acceptor (DA type) polymers can be produced.¹⁰⁻¹²⁾ The DA type polymer usually shows a low band gap state which can absorb light of long wavelength. Furthermore, several DA type polymers are ambipolar enabling both p- and n-dopes.^{13,14)}

Low Band Gap Polymers



Donor Raw Materials		Thiophenes		
			B4685	B4102
B4437	B4378	B3363	B4536	B4586
B4585	B3865	B4584	D3954	D4568
D4621	D3941	D3798	D2755	D4572
D2245	D4274	D4183	D4184	D3799

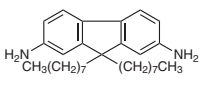
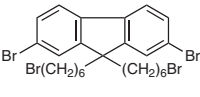
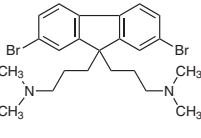
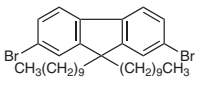
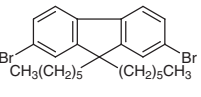
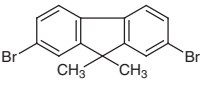
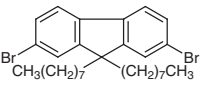
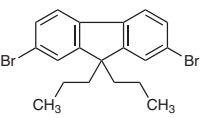
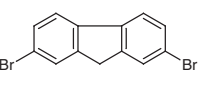
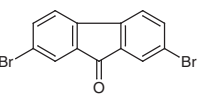
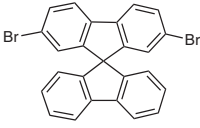
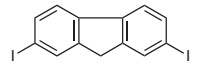
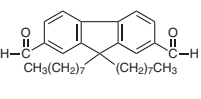
D3800	D4031	D4056	D3896	D4714
				
D4053	D4050	D4032	D3678	D4033
				
D3679	D4582	D4564	E0741	E0743
				

Product No.	Product Name	Unit Size	
B4685	4,8-Bis(2-butyl- <i>n</i> -octyloxy)-2,6-bis(trimethylstannyl)benzo[1,2- <i>b</i> :4,5- <i>b'</i>]dithiophene	200mg	
B4102	4,4-Bis(2-ethylhexyl)-4 <i>H</i> -cyclopenta[2,1- <i>b</i> :3,4- <i>b'</i>]dithiophene	1g	5g
B4437	4,8-Bis[5-(2-ethylhexyl)thiophen-2-yl]-2,6-bis(trimethylstannyl)benzo[1,2- <i>b</i> :4,5- <i>b'</i>]dithiophene	200mg	
B4378	4,8-Bis(<i>n</i> -octyloxy)-2,6-bis(trimethylstannyl)benzo[1,2- <i>b</i> :4,5- <i>b'</i>]dithiophene	200mg	
B3363	5,5'-Bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)-2,2'-bithiophene		5g
B4536	2,5-Bis(trimethylstannyl)thieno[3,2- <i>b</i>]thiophene	200mg	1g
B4586	2-Bromo-3-dodecyl-5-iodothiophene (stabilized with Copper chip)		1g
B4585	2-Bromo-3-(2-ethylhexyl)-5-iodothiophene (stabilized with Copper chip)	1g	5g
B3865	2-Bromo-3-hexyl-5-iodothiophene (stabilized with Copper chip)	1g	5g
B4584	2-Bromo-5-iodo-3- <i>n</i> -octylthiophene (stabilized with Copper chip)		1g
D3954	2,6-Dibromobenzo[1,2- <i>b</i> :4,5- <i>b'</i>]dithiophene	1g	5g
D4568	2,6-Dibromo-4,4-bis(2-ethylhexyl)-4 <i>H</i> -cyclopenta[2,1- <i>b</i> :3,4- <i>b'</i>]dithiophene	200mg	
D4621	2,6-Dibromo-4,8-bis(<i>n</i> -octyloxy)benzo[1,2- <i>b</i> :4,5- <i>b'</i>]dithiophene	200mg	
D3941	3,3'-Dibromo-5,5'-bis(trimethylsilyl)-2,2'-bithiophene	1g	5g
D3798	3,3'-Dibromo-2,2'-bithiophene	1g	5g 25g
D2755	5,5'-Dibromo-2,2'-bithiophene		1g 5g
D4572	2,5-Dibromo-3-decylthiophene		5g 25g
D2245	2,8-Dibromodibenzothiophene	1g	5g 25g
D4274	3,7-Dibromodibenzo[<i>b</i> , <i>d</i>]thiophene		200mg
D4183	5,5'-Dibromo-3,3'-dihexyl-2,2'-bithiophene	1g	5g
D4184	5,5'-Dibromo-4,4'-dihexyl-2,2'-bithiophene	200mg	1g
D3799	2,6-Dibromodithieno[3,2- <i>b</i> :2',3'- <i>d'</i>]thiophene	200mg	1g
D3800	3,5-Dibromodithieno[3,2- <i>b</i> :2',3'- <i>d'</i>]thiophene	200mg	1g
D4031	2,5-Dibromo-3-dodecylthiophene		5g
D4056	2,5-Dibromo-3,4-ethylenedioxythiophene	1g	5g
D3896	2,5-Dibromo-3-hexylthiophene	5g	25g
D4714	2,6-Dibromo-4- <i>n</i> -octyldithieno[3,2- <i>b</i> :2',3'- <i>d'</i>]pyrrole		200mg
D4053	2,5-Dibromo-3- <i>n</i> -octylthiophene		5g
D4050	5,5'-Dibromo-2,2':5',2''-terthiophene	1g	5g
D4032	2,5-Dibromothieno[2,3- <i>b</i>]thiophene		1g
D3678	2,5-Dibromothieno[3,2- <i>b</i>]thiophene	200mg	1g 5g
D4033	3,4-Dibromothieno[2,3- <i>b</i>]thiophene		1g
D3679	3,6-Dibromothieno[3,2- <i>b</i>]thiophene	200mg	1g
D4582	2,5-Dibromothiophene-3-carboxylic Acid	1g	5g
D4564	4,4-Di- <i>n</i> -octyldithieno[3,2- <i>b</i> :2',3'- <i>d'</i>]silole		200mg
E0741	3,4-Ethylenedioxythiophene	5g	25g
E0743	3,4-Ethylenedioxythiophene-2,5-dicarboxylic Acid	1g	5g

Carbazoles	A2051	B2805	B4348	D4563
	D3932	D2983	D2982	D4735
	D4490	D3935	D4482	D2981
	D4548	D4543	O0428	O0439

Product No.	Product Name	Unit Size	
A2051	9-Acetyl-3,6-diiodocarbazole	1g	5g
B2805	9-Benzylcarbazole-3,6-dicarboxaldehyde		100mg
B4348	9-Benzyl-3,6-dibromocarbazole		1g
D4563	3,6-Dibromo-9-(4-bromophenyl)carbazole	200mg	1g
D3932	2,7-Dibromocarbazole		1g 5g
D2983	3,6-Dibromocarbazole	1g	5g 25g
D2982	3,6-Dibromo-9-ethylcarbazole		1g 5g
D4735	2,7-Dibromo-9-(2-ethylhexyl)carbazole		200mg
D4490	2,7-Dibromo-9-(9-heptadecyl)carbazole	200mg	1g
D3935	2,7-Dibromo-9-n-octylcarbazole		200mg
D4482	3,6-Dibromo-9-n-octylcarbazole	200mg	1g
D2981	3,6-Dibromo-9-phenylcarbazole		1g 5g
D4548	3,6-Diiodocarbazole		5g 25g
D4543	3,6-Diiodo-9-phenylcarbazole		1g 5g
O0428	9-(9-Heptadecanyl)-2,7-bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)carbazole	200mg	1g
O0439	9-n-Octyl-2,7-bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)carbazole		200mg

Fluorenes	B4588	B4624	B4029	B3582

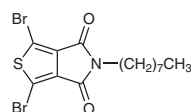
D4719 	B3552 	D4550 	D4561 	D3933 
D3859 	D3934 	D4569 	D3556 	D3557 
D3781 	D4504 	D4671 		

Product No.	Product Name	Unit Size		
B4588	2,7-Bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)-9,9-didecylfluorene		1g	
B4624	2,7-Bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)-9,9-didodecylfluorene		1g	
B4029	2,7-Bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)-9,9-dihexylfluorene		1g	
B3582	2,7-Bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)-9,9-di-n-octylfluorene		1g	
D4719	2,7-Diamino-9,9-di-n-octylfluorene	200mg	1g	
B3552	2,7-Dibromo-9,9-bis(6-bromohexyl)fluorene	1g	5g	
D4550	2,7-Dibromo-9,9-bis[3-(dimethylamino)propyl]fluorene	200mg	1g	
D4561	2,7-Dibromo-9,9-didecylfluorene	5g	25g	
D3933	2,7-Dibromo-9,9-dihexylfluorene	5g	25g	
D3859	2,7-Dibromo-9,9-dimethylfluorene	5g	25g	
D3934	2,7-Dibromo-9,9-di-n-octylfluorene	5g	25g	
D4569	2,7-Dibromo-9,9-dipropylfluorene	1g	5g	
D3556	2,7-Dibromofluorene	5g	25g	100g
D3557	2,7-Dibromo-9-fluorenone	5g	25g	
D3781	2,7-Dibromo-9,9'-spirobi[9H-fluorene]		1g	
D4504	2,7-Diiodofluorene	1g	5g	
D4671	9,9-Di-n-octylfluorene-2,7-dicarboxaldehyde		1g	

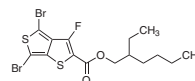
Acceptor Raw Materials

Thiophenes

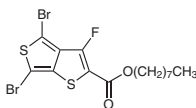
D4219



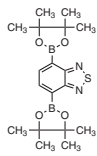
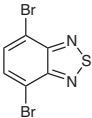
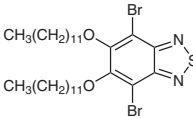
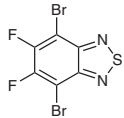
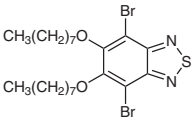
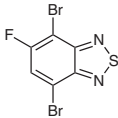
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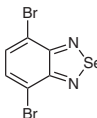
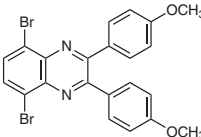
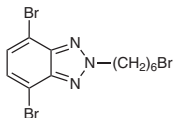
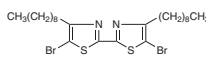
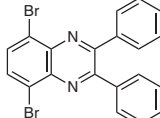
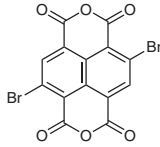
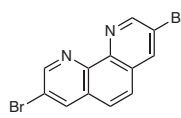
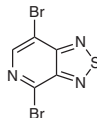
O0436



Product No.	Product Name	Unit Size
D4219	2,5-Dibromo- <i>N</i> - <i>n</i> -octyl-3,4-thiophenedicarboximide	200mg
E1040	2-Ethylhexyl 4,6-Dibromo-3-fluorothieno[3,4- <i>b</i>]thiophene-2-carboxylate	100mg
O0436	<i>n</i> -Octyl 4,6-Dibromo-3-fluorothieno[3,4- <i>b</i>]thiophene-2-carboxylate	100mg

Benzothiadiazoles	B3573		D3842		D4622		D4734	
	D4529		D4750					

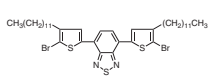
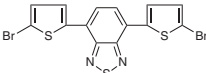
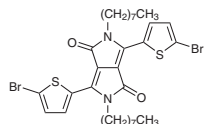
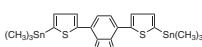
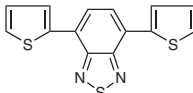
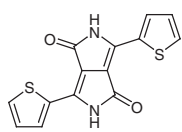
Product No.	Product Name	Unit Size
B3573	4,7-Bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)-2,1,3-benzothiadiazole	1g
D3842	4,7-Dibromo-2,1,3-benzothiadiazole	1g 5g 25g
D4622	4,7-Dibromo-5,6-bis(dodecyloxy)-2,1,3-benzothiadiazole	200mg
D4734	4,7-Dibromo-5,6-difluoro-2,1,3-benzothiadiazole	200mg
D4529	4,7-Dibromo-5,6-di- <i>n</i> -octyloxy-2,1,3-benzothiadiazole	200mg
D4750	4,7-Dibromo-5-fluoro-2,1,3-benzothiadiazole	200mg 1g

Others	D3944		D4653		D4514		D4558	
	D4461		D4339		D3209		D4442	

Product No.	Product Name	Unit Size
D3944	4,7-Dibromo-2,1,3-benzoselenadiazole	1g
D4653	5,8-Dibromo-2,3-bis(4-methoxyphenyl)quinoxaline	200mg
D4514	4,7-Dibromo-2-(6-bromohexyl)benzotriazole	200mg
D4558	5,5'-Dibromo-4,4'-dinonyl-2,2'-bithiazole	200mg
D4461	5,8-Dibromo-2,3-diphenylquinoxaline	200mg
D4339	2,6-Dibromonaphthalene-1,4,5,8-tetracarboxylic Dianhydride	1g 5g

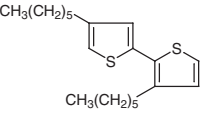
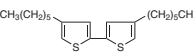
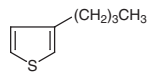
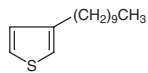
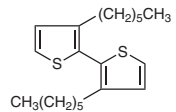
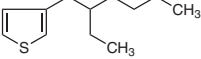
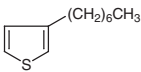
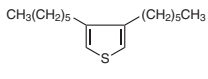
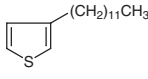
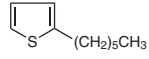
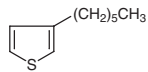
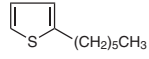
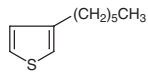
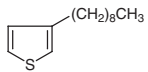
Product No.	Product Name	Unit Size	
D3209	3,8-Dibromo-1,10-phenanthroline	200mg	1g
D4442	4,7-Dibromo[1,2,5]thiadiazolo[3,4- <i>c</i>]pyridine	200mg	1g

DA-Type Monomers

DA-Type Monomers	B4719	B3886	B4419
			
B4453	D4487	D3969	
			

Product No.	Product Name	Unit Size	
B4719	4,7-Bis(5-bromo-4-dodecyl-2-thienyl)-2,1,3-benzothiadiazole	200mg	
B3886	4,7-Bis(5-bromo-2-thienyl)-2,1,3-benzothiadiazole	100mg	1g
B4419	3,6-Bis(5-bromo-2-thienyl)-2,5-di- <i>n</i> -octylpyrrolo[3,4- <i>c</i>]pyrrole-1,4-dione	200mg	
B4453	4,7-Bis(5-trimethylstannyl-2-thienyl)-2,1,3-benzothiadiazole		200mg
D4487	4,7-Di(2-thienyl)-2,1,3-benzothiadiazole	200mg	1g
D3969	3,6-Di(2-thienyl)-2,5-dihydropyrrolo[3,4- <i>c</i>]pyrrole-1,4-dione	1g	5g

Raw Materials for Oxidative Polymerization, Thiophenes

		B1458	D2098	D4180
				
		D4202	D2016	E0741
				
		H1350	H0756	N0533
				

O0245	O0383	O0376	O0213	P1835
P1127	U0056			

Product No.	Product Name	Unit Size	
B1458	3-Butylthiophene	1g	5g
D2098	3-Decylthiophene	1g	5g
D4180	3,3'-Dihexyl-2,2'-bithiophene	1g	5g
D3928	3,4'-Dihexyl-2,2'-bithiophene	1g	5g
D4182	4,4'-Dihexyl-2,2'-bithiophene	200mg	1g
D4202	3,4-Dihexylthiophene	1g	5g
D2016	3-Dodecylthiophene	1g	5g 25g
E0741	3,4-Ethylenedioxythiophene	5g	25g
E0973	3-(2-Ethylhexyl)thiophene	200mg	1g
H0722	3-Heptylthiophene	1g	5g
H1350	2-Hexylthiophene	5g	25g
H0756	3-Hexylthiophene	1g	5g 25g
N0533	3-Nonylthiophene	1g	5g
O0245	3-Octadecylthiophene	1g	5g
O0383	5-n-Octyl-2,2'-bithiophene		1g
O0376	2-n-Octylthiophene		5g
O0213	3-n-Octylthiophene	1g	5g 25g
P1835	2-Pentylthiophene		5g
P1127	3-Pentylthiophene	1g	5g
U0056	3-Undecylthiophene	1g	5g

References

- 1) H. Shirakawa, E. J. Louis, A. G. MacDiarmid, C. K. Chiang, A. J. Heeger, *J. Chem. Soc., Chem. Comm.* **1977**, 578.
- 2) J. H. Burroughes, D. D. C. Bradley, A. R. Brown, R. N. Marks, K. Mackay, R. H. Friend, P. L. Burns, A. B. Holmes, *Nature* **1990**, 347, 539.
- 3) A. W. Grice, D. D. C. Bradley, M. T. Bernius, M. Inbasekaran, W. W. Wu, E. P. Woo, *Appl. Phys. Lett.* **1998**, 73, 629.
- 4) Review: A. B. Holmes, D. D. C. Bradley, A. R. Brown, P. L. Burn, J. H. Burroughes, R. H. Friend, N. C. Greenham, R. W. Gymer, D. A. Halliday, R. W. Jackson, A. Kraft, J. H. F. Martens, K. Pichler, I. D. W. Samuel, *Synth. Met.* **1993**, 57, 4031.
- 5) D. Braun, G. Gustafsson, D. McBranch, A. J. Heeger, *J. Appl. Phys.* **1992**, 72, 564.
- 6) Review: L. Groenendaal, F. Jonas, D. Freitag, H. Pielartzik, J. R. Reynolds, *Adv. Mater.* **2000**, 12, 481.
- 7) A. Elschner, S. Kirchmeyer, W. Lovenich, U. Merker, K. Reuter, in *PEDOT: Principles and Applications of an Intrinsically Conductive Polymer*, CRC Press, **2010**.
- 8) Review: C. Winder, N. S. Sariciftci, *J. Mater. Chem.* **2004**, 14, 1077.
- 9) Review: M. T. Dang, L. Hirsch, G. Wantz, *Adv. Mater.* **2011**, 23, 3597.
- 10) Y. Liang, Z. Xu, J. Xia, S.-T. Tsai, Y. Wu, G. Li, C. Ray, L. Yu, *Adv. Mater.* **2010**, 22, E135.
- 11) N. Blouin, A. Michaud, M. Leclerc, *Adv. Mater.* **2007**, 19, 2295.
- 12) P. M. Beaujuge, W. Pisula, H. N. Tsao, S. Ellinger, K. Müllen, J. R. Reynolds, *J. Am. Chem. Soc.* **2009**, 131, 7514.
- 13) H. Ito, T. Iwata, S. Watanabe, S. Kuroda, *Appl. Phys. Express* **2013**, 6, 051601.
- 14) S. Cho, J. H. Seo, G.-H. Kim, J. Y. Kim, H. Y. Woo, *J. Mater. Chem.* **2012**, 22, 21238.

Building Blocks for Small Molecule Semiconductor

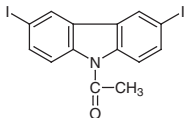
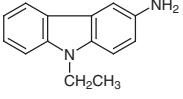
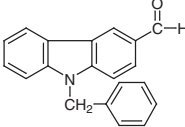
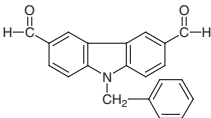
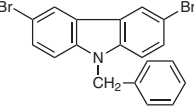
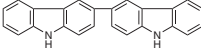
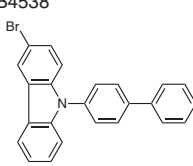
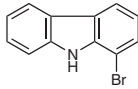
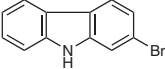
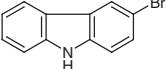
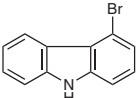
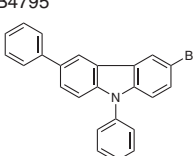
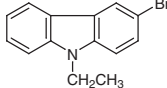
Several features of small molecule organic semiconductors are that they are isolable in a chemically pure form, it is possible to determine structures by a single crystal structure analysis, it is possible to fabricate a thin-layer and to purify it by vacuum deposition. In comparison with inorganic materials, organic materials are structurally diverse based on the carbon-centered geometry. Therefore, we can precisely control physical properties such as photo absorption, emission properties, energy level and solubility by applying organic synthesis. Several conventional coupling reactions can enable expansion of π -conjugated structures. In particular, palladium- and copper-catalyzed cross-coupling reactions can systematically and rapidly produce various organic compounds to develop new materials. The following lists plenty of 'Building Blocks for Small Molecule Semiconductors' bearing halogen, boronic acid (ester), a stannyl group, amino group, or formyl group.

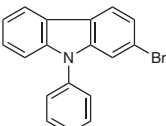
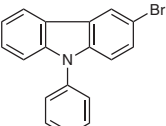
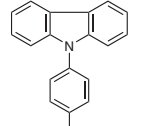
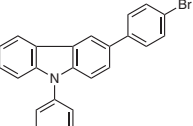
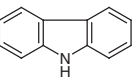
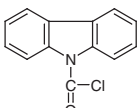
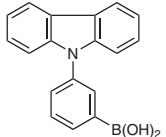
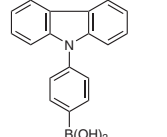
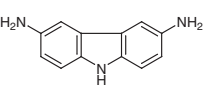
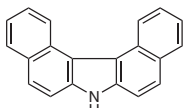
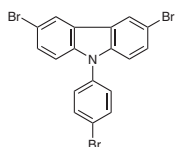
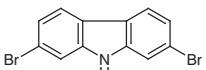
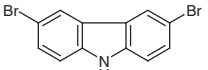
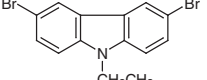
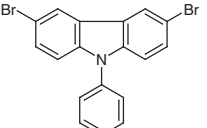
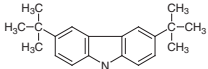
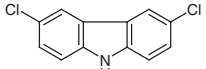
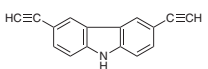
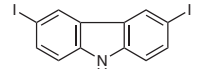
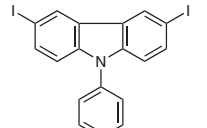
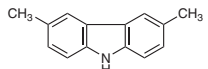
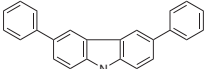
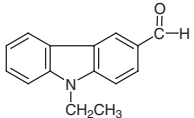
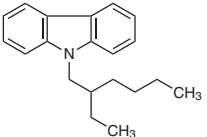
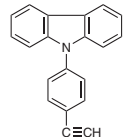
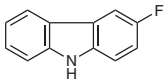
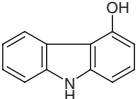
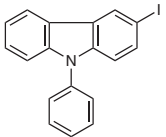
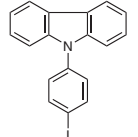
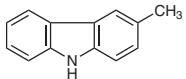
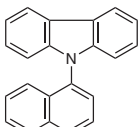
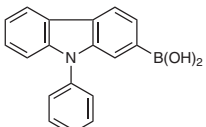
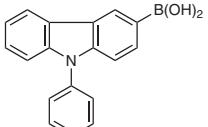
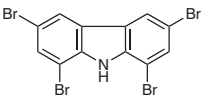
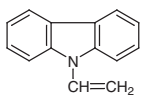
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B4086 	B2033 	B2893 	B1838 	B3762
B1874 	B4511 	B3525 	B4449 	B3691
B4783 	B3507 	B3985 	B3812 	B3733
B3738 	B3663 	B4050 	B2058 	B3200
B3692 	B3226 	B4126 	C2613 	C2457

C3021	C2715	D4373	D4057	D4777
D4767	D4822	D3823	D4290	D4291
F0548	H1298	H1294	H1503	I0947
O0410	O0411	O0394	T1805	T2699
T2772	T2518	T3236	T2621	T3221
T3156	T2897			

Product No.	Product Name	Unit Size	
B3793	Benzo[1,2- <i>b</i> :4,5- <i>b'</i>]dithiophene-4,8-dione	1g	5g
B4774	Benzo[<i>b</i>]thiophene-3-boronic Acid (contains varying amounts of Anhydride)	1g	5g
B3777	Benzo[<i>b</i>]thiophene-2-carboxaldehyde		5g
B4086	Benzo[<i>b</i>]thiophene-3-carboxaldehyde	1g	5g
B2033	Benzo[<i>b</i>]thiophene-2-carboxylic Acid		1g
B2893	Benzo[<i>b</i>]thiophene-2-ylboronic Acid (contains varying amounts of Anhydride)	1g	5g 25g
B1838	2,2'-Bithiophene-5-carboxaldehyde	1g	5g 25g
B3762	5-Bromobenzo[<i>b</i>]thiophene		1g 5g
B1874	5-Bromo-2,2'-bithiophene-5'-carboxaldehyde	1g	5g
B4511	2-Bromo-3-butylthiophene	5g	25g
B3525	2-Bromodibenzothiophene	5g	25g
B4449	4-Bromodibenzothiophene	1g	5g
B3691	2-Bromo-3-dodecylthiophene		5g
B4783	2-Bromo-3-(2-ethylhexyl)thiophene	1g	5g

Product No.	Product Name	Unit Size	
B3507	2-Bromo-3-hexylthiophene	5g	25g
B3985	2-Bromo-4-hexylthiophene		1g
B3812	2-Bromo-5-hexylthiophene		5g
B3733	2-Bromo-3- <i>n</i> -octylthiophene		5g
B3738	2-Bromo-5- <i>n</i> -octylthiophene	5g	25g
B3663	2-Bromo-5-phenylthiophene	1g	5g
B4050	3'-Bromo-2,2':5,2"-terthiophene	1g	5g
B2058	5'-Bromo-2,2':5,2'-terthiophene-5-carboxaldehyde	100mg	1g
B3200	5-Bromo-5'-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)-2,2'-bithiophene		1g
B3692	2-Bromothiopheno[2,3- <i>b</i>]thiophene		1g
B3226	3-Bromothiopheno[3,2- <i>b</i>]thiophene	200mg	1g
B4126	4-Bromothiophene-3-carboxaldehyde	200mg	1g
C2613	2-Chloro-3-hexylthiophene		5g
C2457	5-Chloro-3-methylbenzo[<i>b</i>]thiophene	5g	25g
C3021	4 <i>H</i> -Cyclopenta[2,1- <i>b</i> :3,4- <i>b'</i>]dithiophene	200mg	1g
C2715	4 <i>H</i> -Cyclopenta[1,2- <i>b</i> :5,4- <i>b'</i>]dithiophene-4-one		200mg
D4373	Dibenzothiophene-2-boronic Acid (contains varying amounts of Anhydride)	1g	5g
D4057	Dibenzothiophene-4-boronic Acid (contains varying amounts of Anhydride)	1g	5g
D4777	Dibenzothiophene-2-carboxaldehyde	1g	5g
D4767	Dibenzothiophene-4-carboxaldehyde	1g	5g
D4822	4,6-Dibromodibenzothiophene	200mg	1g
D3823	Dithieno[3,2- <i>b</i> :2',3'- <i>d'</i>]thiophene-2-boronic Acid (contains varying amounts of Anhydride)	200mg	1g
D4290	3-Dodecyl-2-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)thiophene	1g	5g
D4291	4-Dodecyl-2-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)thiophene	1g	5g
F0548	5'-Formyl-2,2'-bithiophene-5-boronic Acid (contains varying amounts of Anhydride)		1g
H1298	3-Hexyl-2-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)thiophene	1g	5g
H1294	4-Hexyl-2-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)thiophene		5g
H1503	4-Hexylthiophene-2-carbonitrile		200mg
I0947	4-Iododibenzothiophene	1g	5g
O0410	3- <i>n</i> -Octyl-2-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)thiophene	1g	5g
O0411	4- <i>n</i> -Octyl-2-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)thiophene	1g	5g
O0394	<i>N</i> - <i>n</i> -Octyl-3,4-thiophenedicarboximide	200mg	1g
T1805	2,2':5,2'-Terthiophene-5-carboxaldehyde		1g
T2699	3,3',5,5'-Tetrabromo-2,2'-bithiophene	1g	5g
T2772	2,3,5,6-Tetrabromothiopheno[3,2- <i>b</i>]thiophene		1g
T2518	5-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)-2,2'-bithiophene	1g	5g
T3236	4-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)dibenzothiophene	1g	5g
T2621	Thieno[3,2- <i>b</i>]thiophene-2-boronic Acid (contains varying amounts of Anhydride)		1g
T3221	Thieno[3,2- <i>b</i>]thiophene-2-carbonitrile	200mg	1g
T3156	Thieno[3,2- <i>b</i>]thiophene-2-carboxylic Acid	200mg	1g
T2897	3,4-Thiophenedicarboxylic Anhydride		1g

Carbazoles		A2051	A1508	B2804
				
B2805	B4348	B4646	B4538	B4816
				
B4381	B3458	B4752	B4795	B3459
				

B4439 	B3908 	B3554 	B4452 	C0032 
C1031 	C2967 	C2926 	D2116 	D4473 
D4563 	D3932 	D2983 	D2982 	D2981 
D3952 	D3751 	D4275 	D4548 	D4543 
D4512 	D4433 	E0359 	E0972 	E1055 
F0965 	H1014 	I0913 	I0961 	M2561 
N1012 	P2169 	P2001 	T2932 	V0021 

Product No.	Product Name	Unit Size	
A2051	9-Acetyl-3,6-diiodocarbazole	1g	5g
A1508	3-Amino-9-ethylcarbazole		5g
B2804	9-Benzylcarbazole-3-carboxaldehyde	1g	5g
B2805	9-Benzylcarbazole-3,6-dicarboxaldehyde		100mg
B4348	9-Benzyl-3,6-dibromocarbazole		1g
B4646	3,3'-Bicarbazole	200mg	1g

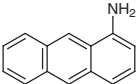
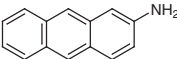
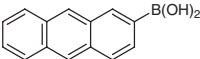
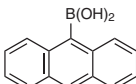
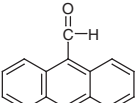
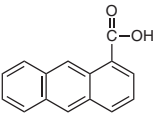
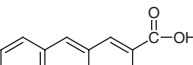
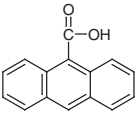
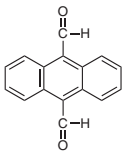
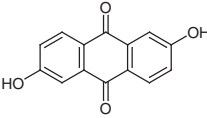
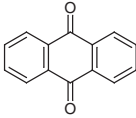
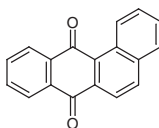
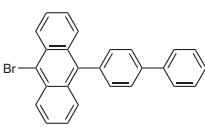
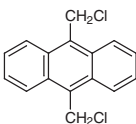
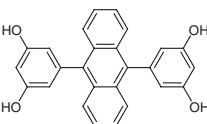
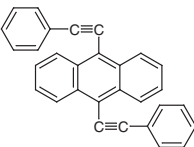
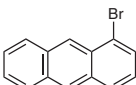
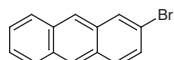
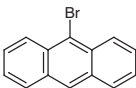
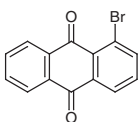
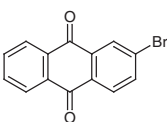
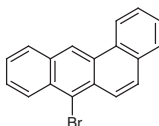
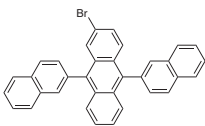
Product No.	Product Name	Unit Size	
B4538	9-(4-Biphenyl)-3-bromocarbazole	5g	25g
B4816	1-Bromocarbazole	200mg	1g
B4381	2-Bromocarbazole		5g
B3458	3-Bromocarbazole		5g
B4752	4-Bromocarbazole	200mg	1g
B4795	3-Bromo-6,9-diphenylcarbazole	1g	5g
B3459	3-Bromo-9-ethylcarbazole	1g	5g
B4439	2-Bromo-9-phenylcarbazole	1g	5g
B3908	3-Bromo-9-phenylcarbazole	1g	5g
B3554	9-(4-Bromophenyl)carbazole	1g	5g
B4452	3-(4-Bromophenyl)-9-phenylcarbazole	1g	5g
C0032	Carbazole	25g	100g 500g
C1031	Carbazole-9-carbonyl Chloride	1g	5g 25g
C2967	3-(9 <i>H</i> -Carbazol-9-yl)phenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
C2926	4-(9 <i>H</i> -Carbazol-9-yl)phenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
D2116	3,6-Diaminocarbazole	1g	5g
D4473	7 <i>H</i> -Dibenzo[<i>c,g</i>]carbazole		200mg
D4563	3,6-Dibromo-9-(4-bromophenyl)carbazole	200mg	1g
D3932	2,7-Dibromocarbazole		1g 5g
D2983	3,6-Dibromocarbazole	1g	5g 25g
D2982	3,6-Dibromo-9-ethylcarbazole		1g 5g
D2981	3,6-Dibromo-9-phenylcarbazole		1g 5g
D3952	3,6-Di- <i>tert</i> -butylcarbazole		1g 5g
D3751	3,6-Dichlorocarbazole		1g 5g
D4275	3,6-Diethynylcarbazole	200mg	1g
D4548	3,6-Diiodocarbazole	5g	25g
D4543	3,6-Diiodo-9-phenylcarbazole	1g	5g
D4512	3,6-Dimethylcarbazole		1g
D4433	3,6-Diphenylcarbazole	1g	5g
E0359	<i>N</i> -Ethylcarbazole-3-carboxaldehyde		25g
E0972	9-(2-Ethylhexyl)carbazole	1g	5g
E1055	9-(4-Ethynylphenyl)carbazole	1g	5g
F0965	3-Fluorocarbazole		1g
H1014	4-Hydroxycarbazole	1g	5g 25g
I0913	3-Iodo-9-phenylcarbazole		1g 5g
I0961	9-(4-Iodophenyl)carbazole		1g 5g
M2561	3-Methyl-9 <i>H</i> -carbazole		1g
N1012	9-(1-Naphthyl)carbazole		1g 5g
P2169	9-Phenylcarbazole-2-boronic Acid (contains varying amounts of Anhydride)	200mg	1g
P2001	9-Phenylcarbazole-3-boronic Acid (contains varying amounts of Anhydride)	5g	25g
T2932	1,3,6,8-Tetrabromocarbazole	200mg	1g
V0021	9-Vinylcarbazole		25g

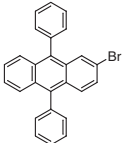
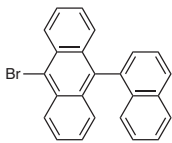
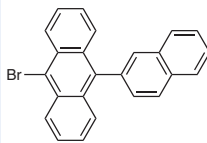
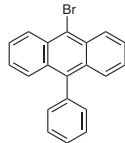
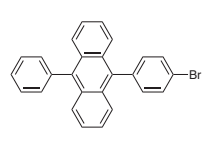
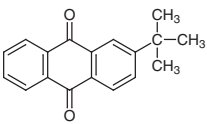
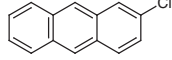
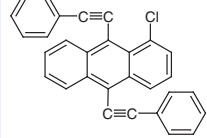
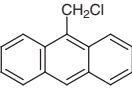
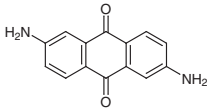
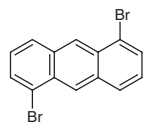
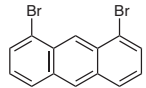
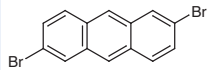
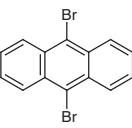
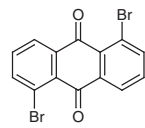
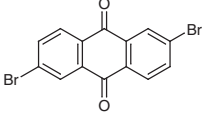
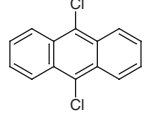
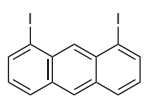
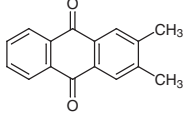
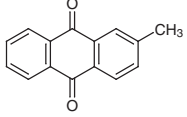
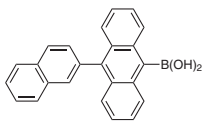
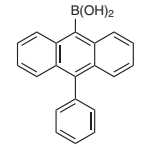
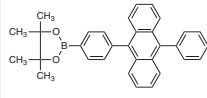
Fluorenes & Fluorenones		A2634	A2779	A0621
A1040	B3931	B0059	B3933	B3932

B4441 	B3894 	B4661 	B4668 	B4366
B4450 	B4776 	B3069 	B3109 	B4431
B1702 	B3560 	D3557 	D4573 	D3872
D4084 	D4327 	D3974 	D3235 	D3586
F0017 	F0021 	F0228 	H0329 	I0875
I0793 	S0800 	S0831 		

Product No.	Product Name	Unit Size	
A2634	2-Amino-9,9-dimethylfluorene	200mg	1g
A2779	2-Amino-9,9-diphenylfluorene	1g	5g
A0621	2-Aminofluorene	5g	25g
A1040	2-Amino-9-fluorenone	1g	5g
B3931	1,2-Benzofluorene	200mg	1g
B0059	2,3-Benzofluorene	100mg	1g
B3933	11 <i>H</i> -Benzo[<i>a</i>]fluoren-11-one		1g
B3932	11 <i>H</i> -Benzo[<i>b</i>]fluoren-11-one		5g
B4441	2-Bromo-9,9-bis(2-ethylhexyl)fluorene		1g
B3894	2-Bromo-9,9-dimethylfluorene	5g	25g
B4661	4-Bromo-9,9-dimethylfluorene	200mg	1g
B4668	2-Bromo-13,13-dimethyl-6 <i>H</i> -indeno[1,2- <i>b</i>]anthracene-6,11(13 <i>H</i>)-dione		1g
B4366	2-Bromo-9,9-di- <i>n</i> -octylfluorene		1g
B4450	2-Bromo-9,9-diphenylfluorene	1g	5g

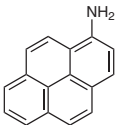
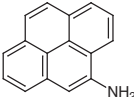
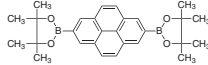
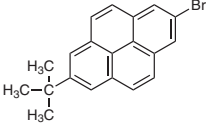
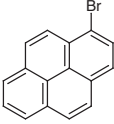
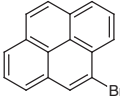
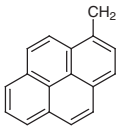
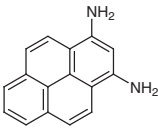
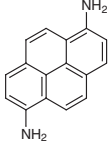
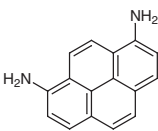
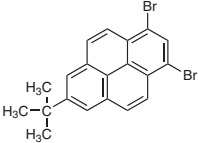
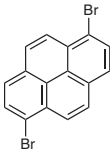
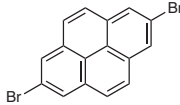
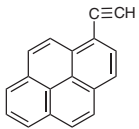
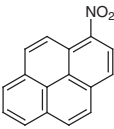
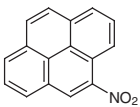
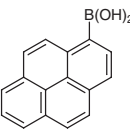
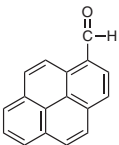
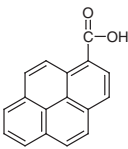
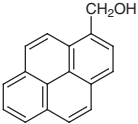
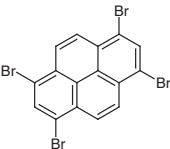
Product No.	Product Name	Unit Size	
B4776	4-Bromo-9,9-diphenylfluorene	1g	5g
B3069	2-Bromofluorene	5g	25g 100g
B3109	2-Bromo-9-fluorenone	5g	25g
B4431	2-Bromo-7-iodofluorene	5g	25g
B1702	9-Bromo-9-phenylfluorene	5g	25g
B3560	2-Bromo-9,9'-spirobi[9H-fluorene]		5g
D3557	2,7-Dibromo-9-fluorenone	5g	25g
D4573	2,8-Dibromoindeno[1,2-b]fluorene-6,12-dione		1g
D3872	2,2'-Dibromo-9,9'-spirobi[9H-fluorene]		1g
D4084	2,7-Di- <i>tert</i> -butylfluorene	5g	25g
D4327	9,9-Dihexylfluorene	1g	5g
D3974	9,9-Dimethylfluorene-2-boronic Acid (contains varying amounts of Anhydride)	1g	5g
D3235	9,9-Dimethylfluorene		5g
D3586	9,9-Diphenylfluorene	5g	25g
F0017	Fluorene	25g	500g
F0021	9-Fluorenone	25g	500g
F0228	2-Fluorofluorene	5g	25g
H0329	2-Hydroxy-9-fluorenone		1g
I0875	2-Iodo-9,9-dimethylfluorene	5g	25g
I0793	2-Iodofluorene	5g	25g
S0800	9,9'-Spirobi[9H-fluorene]	1g	5g
S0831	9,9'-Spirobi[9H-fluorene]-2-boronic Acid	1g	5g

Anthracenes & Anthraquinones		A1709	A1687	A1843
				
A2328	A0779	A1220	A1150	A0690
				
A2664	A1894	A0502	B0018	B4569
				
B1327	B2109	P1137	B3475 B2615	B2616
				
B2871 B0872	B2688	B2689	B1603	B4321
				

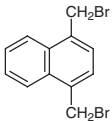
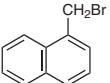
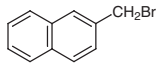
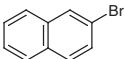
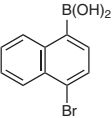
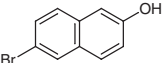
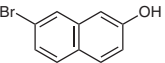
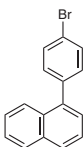
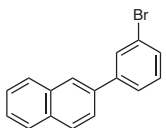
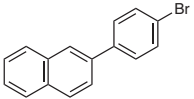
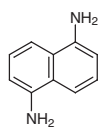
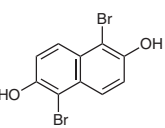
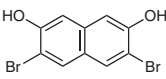
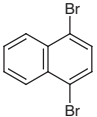
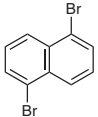
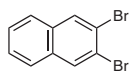
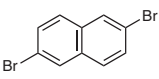
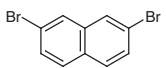
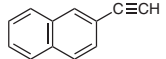
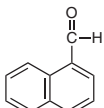
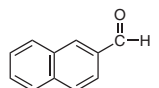
B3442 	B4451 	B4426 	B3977 	B4475 
B0816 	C1962 	C1289 	C1046 	D3180 
D3183 	D4230 	D3171 	D0166 	D3181 
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N0929 	P1984 	T3276 		

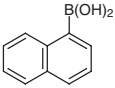
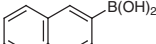
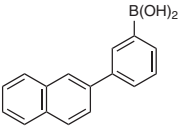
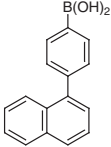
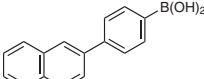
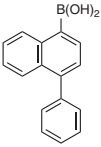
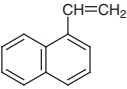
Product No.	Product Name	Unit Size
A1709	1-Aminoanthracene	1g
A1687	2-Aminoanthracene	1g
A1843	2-Anthraceneboronic Acid (contains varying amounts of Anhydride)	250mg 1g
A2328	9-Anthraceneboronic Acid (contains varying amounts of Anhydride)	1g 5g
A0779	9-Anthracenecarboxaldehyde	25g 100g
A1220	1-Anthracenecarboxylic Acid	1g
A1150	2-Anthracenecarboxylic Acid	1g 5g
A0690	9-Anthracenecarboxylic Acid	5g 25g
A2664	Anthracene-9,10-dicarboxaldehyde	1g 5g
A1894	Anthraflavic Acid	1g 5g
A0502	Anthraquinone	25g 500g
B0018	1,2-Benzanthraquinone	5g 25g
B4569	9-(4-Biphenyl)-10-bromoanthracene	1g 5g
B1327	9,10-Bis(chloromethyl)anthracene	5g 25g
B2109	9,10-Bis(3,5-dihydroxyphenyl)anthracene	100mg 1g
P1137	9,10-Bis(phenylethynyl)anthracene	1g 5g
B3475	1-Bromoanthracene (purified by sublimation)	1g
B2615	1-Bromoanthracene	100mg 500mg
B2616	2-Bromoanthracene	1g 5g
B2871	9-Bromoanthracene	5g 25g 100g
B0872	9-Bromoanthracene	5g 25g
B2688	1-Bromoanthraquinone	1g 5g
B2689	2-Bromoanthraquinone	1g 5g 25g
B1603	7-Bromobenz[a]anthracene	1g 5g

Product No.	Product Name	Unit Size	
B4321	2-Bromo-9,10-di(2-naphthyl)anthracene	1g	5g
B3442	2-Bromo-9,10-diphenylanthracene		1g
B4451	9-Bromo-10-(1-naphthyl)anthracene	1g	5g
B4426	9-Bromo-10-(2-naphthyl)anthracene	1g	5g
B3977	9-Bromo-10-phenylanthracene	1g	5g
B4475	9-(4-Bromophenyl)-10-phenylanthracene	200mg	1g
B0816	2- <i>tert</i> -Butylanthraquinone	25g	500g
C1962	2-Chloroanthracene		1g
C1289	1-Chloro-9,10-bis(phenylethynyl)anthracene	1g	10g
C1046	9-Chloromethylanthracene	1g	5g 25g
D3180	2,6-Diaminoanthraquinone	25g	250g
D3183	1,5-Dibromoanthracene		1g
D4230	1,8-Dibromoanthracene	1g	5g
D3171	2,6-Dibromoanthracene	1g	5g
D0166	9,10-Dibromoanthracene	25g	100g 500g
D3181	1,5-Dibromoanthraquinone		1g
D3182	2,6-Dibromoanthraquinone	1g	5g
D0327	9,10-Dichloroanthracene	1g	10g
D4151	1,8-Diiodoanthracene	1g	5g
D2980	2,3-Dimethylanthraquinone	1g	5g
M0156	2-Methylanthraquinone	25g	500g
N0929	10-(2-Naphthyl)anthracene-9-boronic Acid (contains varying amounts of Anhydride)		1g
P1984	10-Phenyl-9-anthraceneboronic Acid (contains varying amounts of Anhydride)		1g
T3276	4,4,5,5-Tetramethyl-2-[4-(10-phenylanthracen-9-yl)phenyl]-1,3,2-dioxaborolane	200mg	1g

Pyrenes		A0632 	A2180 	B3956 
B3957 	B1495 	B2807 	C1637 	D2167 
D2160 	D2168 	D4187 	D3167 	D3169 
E0939 	N0419 	N0838 	P1625 	P1448 
P1687 	P1221 	T2716 		

Product No.	Product Name	Unit Size		
A0632	1-Aminopyrene	1g	5g	25g
A2180	4-Aminopyrene			1g
B3956	2,7-Bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)pyrene		1g	5g
B3957	2-Bromo-7- <i>tert</i> -butylpyrene		1g	5g
B1495	1-Bromopyrene		5g	25g
B2807	4-Bromopyrene		1g	5g
C1637	1-Chloromethylpyrene			1g
D2167	1,3-Diaminopyrene			100mg
D2160	1,6-Diaminopyrene			100mg
D2168	1,8-Diaminopyrene			100mg
D4187	1,3-Dibromo-7- <i>tert</i> -butylpyrene		1g	5g
D3167	1,6-Dibromopyrene		1g	5g
D3169	2,7-Dibromopyrene			1g
E0939	1-Ethynylpyrene		200mg	1g
N0419	1-Nitropyrene		5g	25g
N0838	4-Nitropyrene			1g
P1625	1-Pyreneboronic Acid (contains varying amounts of Anhydride)	1g	5g	25g
P1448	1-Pyrenecarboxaldehyde		1g	5g
P1687	1-Pyrenecarboxylic Acid		1g	5g
P1221	1-Pyrenemethanol		1g	5g
T2716	1,3,6,8-Tetrabromopyrene			5g

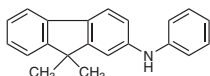
Naphthalenes		B1919	B4563	B1524
				
B0618	B0619	B4463	B0621	B4580
				
B3978	B4568	B4159	D0101	D4668
				
D4669	D2359	D4660	D4597	D4154
				
D3624	E0933	I0266	N0002	N0003
				

N0630 	N0649 	N0052 	N1009 	N0798 
N0946 	N0212 	P2290 	V0040 	

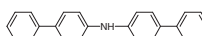
Product No.	Product Name	Unit Size	
B1919	1,4-Bis(bromomethyl)naphthalene (contains ca. 23% isomer)	1g	5g
B4563	1-(Bromomethyl)naphthalene	5g	25g
B1524	2-(Bromomethyl)naphthalene	5g	25g
B0618	1-Bromonaphthalene	25g	100g 500g
B0619	2-Bromonaphthalene	5g	25g
B4463	4-Bromo-1-naphthaleneboronic Acid (contains varying amounts of Anhydride)		1g
B0621	6-Bromo-2-naphthol	25g	100g
B4580	7-Bromo-2-naphthol	1g	5g
B3978	1-(4-Bromophenyl)naphthalene	1g	5g
B4568	2-(3-Bromophenyl)naphthalene	1g	5g
B4159	2-(4-Bromophenyl)naphthalene		1g
D0101	1,5-Diaminonaphthalene	25g	100g 500g
D4668	1,5-Dibromo-2,6-dihydroxynaphthalene	5g	25g
D4669	3,6-Dibromo-2,7-dihydroxynaphthalene	1g	5g
D2359	1,4-Dibromonaphthalene	5g	25g
D4660	1,5-Dibromonaphthalene		1g
D4597	2,3-Dibromonaphthalene	200mg	1g
D4154	2,6-Dibromonaphthalene		1g
D3624	2,7-Dibromonaphthalene	5g	25g
E0933	2-Ethynyl naphthalene		100mg
I0266	1-Iodonaphthalene		25g
N0002	1-Naphthaldehyde	25mL	500mL
N0003	2-Naphthaldehyde	5g	25g
N0630	1-Naphthaleneboronic Acid (contains varying amounts of Anhydride)	1g	5g 25g
N0649	2-Naphthaleneboronic Acid (contains varying amounts of Anhydride)	1g	5g 25g
N0052	1-Naphthylamine	25g	100g
N1009	3-(2-Naphthyl)phenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
N0798	4-(1-Naphthyl)phenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
N0946	4-(2-Naphthyl)phenylboronic Acid (contains varying amounts of Anhydride)	200mg	1g
N0212	1-Nitronaphthalene	25g	500g
P2290	4-Phenylnaphthalene-1-boronic Acid (contains varying amounts of Anhydride)	1g	5g
V0040	1-Vinylnaphthalene (stabilized with TBC)		5g

Secondary Arylamines

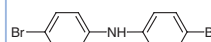
A2741

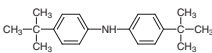
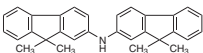
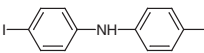
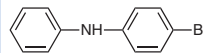
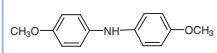
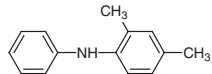
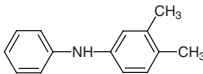
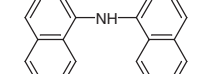
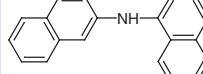
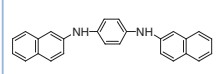
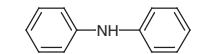
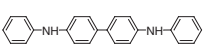
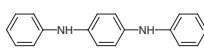
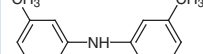
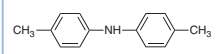
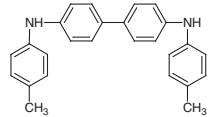
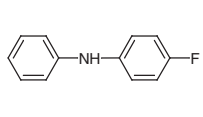
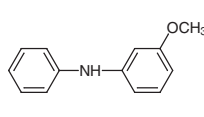
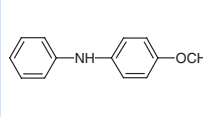
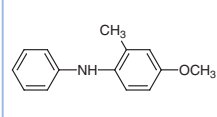
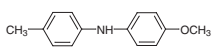
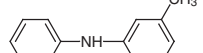
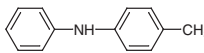
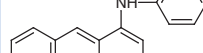
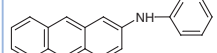
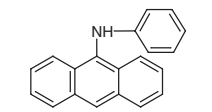
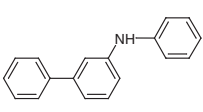
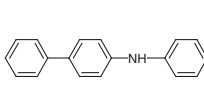
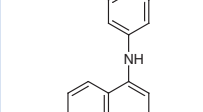
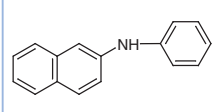
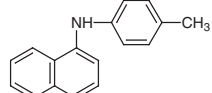
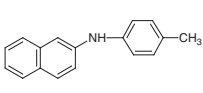
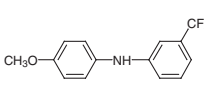
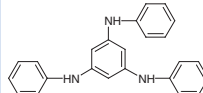
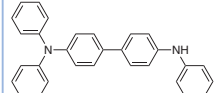


B2429



B2684

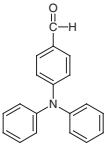
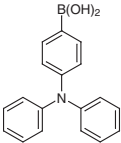
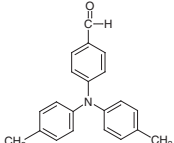
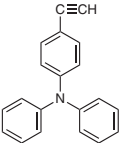
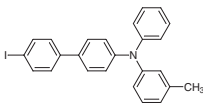
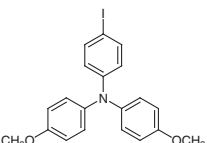
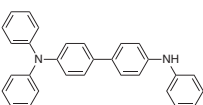
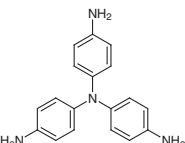
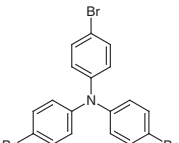
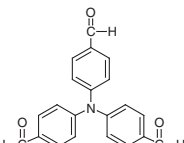
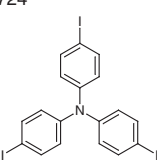
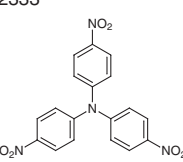


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D3398	D3845	D2986	D2988	D0812
				
D0872	D0878	D0609	D1512	D0950
				
D3567	F0630	M1135	M2069	M1286
				
M2070	M1258	M1173	P1494	P1495
				
P1496	P1497	P1498	P0197	P0198
				
T2201	T2065	T1326	T1831	T2891
				

Product No.	Product Name	Unit Size	
A2741	2-Anilino-9,9-dimethylfluorene	1g	5g
B2429	Bis(4-biphenyl)amine	1g	5g
B2684	Bis(4-bromophenyl)amine	1g	5g
B2803	Bis(4- <i>tert</i> -butylphenyl)amine	25g	500g
B4664	Bis(9,9-dimethyl-9H-fluoren-2-yl)amine	1g	5g
B2685	Bis(4-iodophenyl)amine	1g	5g

Product No.	Product Name	Unit Size	
B3949	4-Bromodiphenylamine	5g	25g
D0632	4,4'-Dimethoxydiphenylamine	1g	5g
D3398	2,4-Dimethyldiphenylamine		25g
D3845	3,4-Dimethyldiphenylamine		25g
D2986	1,1'-Dinaphthylamine		1g
D2988	1,2'-Dinaphthylamine (purified by sublimation)		5g
D0812	<i>N,N'</i> -Di-2-naphthyl-1,4-phenylenediamine	25g	500g
D0872	Diphenylamine	25g	500g
D0878	<i>N,N'</i> -Diphenylbenzidine	5g	25g
D0609	<i>N,N'</i> -Diphenyl-1,4-phenylenediamine	25g	500g
D1512	<i>m,m'</i> -Ditolylamine	5g	25g
D0950	<i>p,p'</i> -Ditolylamine	5g	25g
D3567	<i>N,N'</i> -Di- <i>p</i> -tolylbenzidine	1g	5g
F0630	4-Fluorodiphenylamine	1g	5g
M1135	3-Methoxydiphenylamine	25g	500g
M2069	4-Methoxydiphenylamine	5g	25g
M1286	4-Methoxy-2-methyldiphenylamine	25g	500g
M2070	4-Methoxy-4'-methyldiphenylamine	5g	25g
M1258	3-Methyldiphenylamine		25g
M1173	4-Methyldiphenylamine	1g	5g
P1494	<i>N</i> -Phenyl-1-anthramine		500mg
P1495	<i>N</i> -Phenyl-2-anthramine		1g
P1496	<i>N</i> -Phenyl-9-anthramine	1g	5g
P1497	<i>N</i> -Phenyl-3-biphenylamine		500mg
P1498	<i>N</i> -Phenyl-4-biphenylamine		500mg
P0197	<i>N</i> -Phenyl-1-naphthylamine	25g	500g
P0198	<i>N</i> -Phenyl-2-naphthylamine	25g	500g
T2201	<i>N</i> -(<i>p</i> -Tolyl)-1-naphthylamine		500mg
T2065	<i>N</i> -(<i>p</i> -Tolyl)-2-naphthylamine		500mg
T1326	3-Trifluoromethyl-4'-methoxydiphenylamine	1g	5g
T1831	<i>N,N',N''</i> -Triphenyl-1,3,5-benzenetriamine	5g	25g
T2891	<i>N,N,N'</i> -Triphenylbenzidine	1g	5g

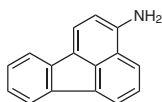
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B3089	B2844	B4299	B4008	B4036
B2633	D3302	D3303	D1910	D4755

D2172 	D3537 	D2737 	E0894 	I0490 
I0776 	T2891 	T2332 	T1361 	T2310 
T1724 	T2333 			

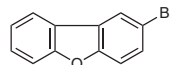
Product No.	Product Name	Unit Size	
A2858	2-Amino-N-[(1,1'-biphenyl)-4-yl]-N-(4-bromophenyl)-9,9-dimethylfluorene	1g	5g
A2624	4-Aminotriphenylamine		200mg
B4550	N,N-Bis(4-biphenyl)-N-(4-bromophenyl)amine	5g	25g
B3991	4-[N,N-Bis(4-bromophenyl)amino]benzaldehyde		200mg
B1336	N,N'-Bis(4-chlorophenyl)-N,N'-diphenyl-1,4-phenylenediamine		1g
B4793	N,N'-Bis(4-formylphenyl)-N,N'-diphenylbenzidine	200mg	1g
B2843	Bis(4-formylphenyl)phenylamine (purified by sublimation)		1g
B4667	4-Bromo-4',4''-dimethoxytriphenylamine	1g	5g
B3089	4-Bromo-4',4''-dimethyltriphenylamine	1g	5g
B2844	4-Bromo-4'-(diphenylamino)biphenyl	250mg	1g
B4299	N-(4-Bromophenyl)-N-phenyl-1-naphthylamine	200mg	1g
B4008	2-Bromotriphenylamine		5g
B4036	3-Bromotriphenylamine	1g	5g
B2633	4-Bromotriphenylamine	5g	25g
D3302	4,4'-Dibromo-4''-cyclohexyltriphenylamine		1g
D3303	4,4'-Dibromo-4''-phenyltriphenylamine		1g
D1910	4,4'-Dibromotriphenylamine	1g	5g
D4755	3,3'-Dimethyltriphenylamine	1g	5g
D2172	4-(N,N-Diphenylamino)benzaldehyde	5g	25g
D3537	4-(Diphenylamino)phenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
D2737	4-(Di-p-tolylamino)benzaldehyde	1g	5g
E0894	4-Ethynyltriphenylamine		1g
I0490	N-(4'-Iodobiphenyl-4-yl)-N-(m-tolyl)aniline		1g
I0776	4-Iodo-4',4''-dimethoxytriphenylamine	1g	5g
T2891	N,N,N'-Triphenylbenzidine	1g	5g
T2332	Tris(4-aminophenyl)amine	1g	5g
T1361	Tris(4-bromophenyl)amine		25g
T2310	Tris(4-formylphenyl)amine		500mg
T1724	Tris(4-iodophenyl)amine	5g	25g
T2333	Tris(4-nitrophenyl)amine	1g	25g

Others

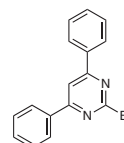
A2789

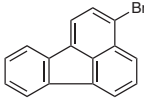
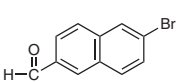
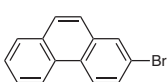
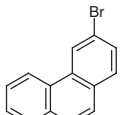
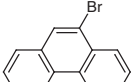
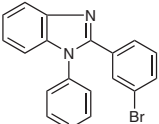
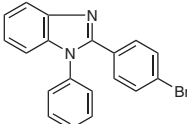
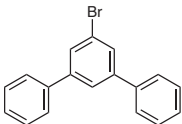
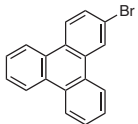
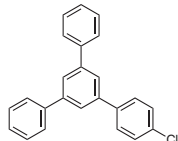
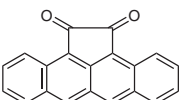
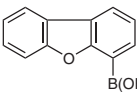
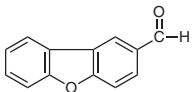
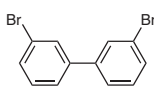
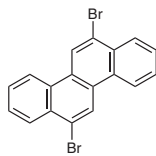
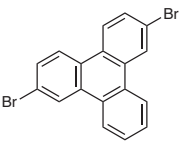
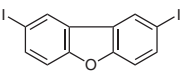
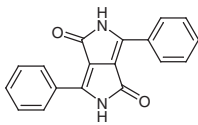
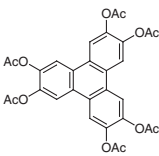
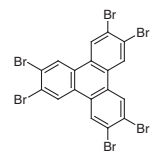
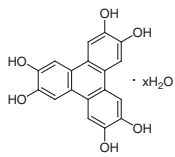
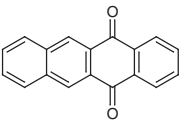
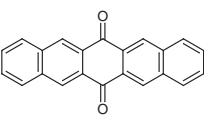
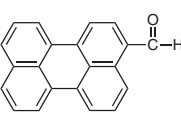
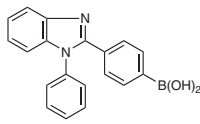
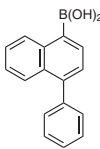
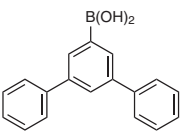
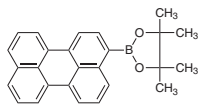
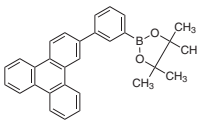
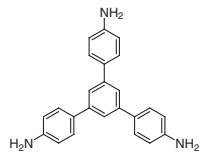
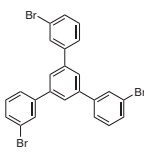
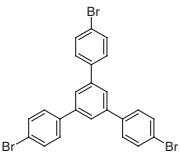
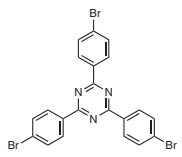
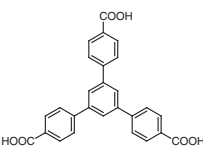
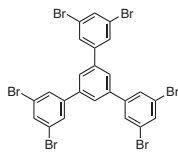
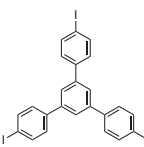


B4459



B4662



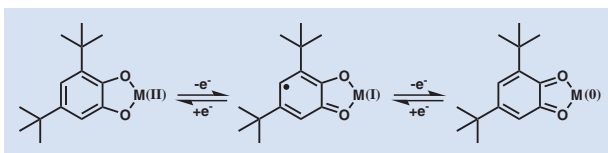
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B4794	B4479	B4308	B4442	C3008
				
C2669	D4567	D4759	D3166	D4236
				
D4801	D4835	D3743	H0923	H1201
				
H0907	N0603	P1685	P2110	P2158
				
P2290	T2792	T3089	T3261	T2728
				
T3073	T2644	T3178	T2647	T3213
				
T3084				
				

Product No.	Product Name	Unit Size	
A2789	3-Aminofluoranthene	1g	5g
B4459	2-Bromodibenzofuran	1g	5g
B4662	2-Bromo-4,6-diphenylpyrimidine	200mg	1g
B4599	3-Bromofluoranthene	1g	5g
B4686	6-Bromo-2-naphthaldehyde		1g
B4671	2-Bromophenanthrene	200mg	1g
B2387	3-Bromophenanthrene		100mg
B0838	9-Bromophenanthrene	25g	250g
B4794	2-(3-Bromophenyl)-1-phenylbenzimidazole	1g	5g
B4479	2-(4-Bromophenyl)-1-phenylbenzimidazole	1g	5g
B4308	5'-Bromo- <i>m</i> -terphenyl	5g	25g
B4442	2-Bromotriphenylene	1g	5g
C3008	4-Chloro-5'-phenyl-1,1':3',1"-terphenyl	200mg	1g
C2669	Cyclopenta[<i>fg</i>]tetracene-1,2-dione	200mg	1g
D4567	Dibenzofuran-4-boronic Acid (contains varying amounts of Anhydride)	1g	5g
D4759	Dibenzofuran-2-carboxaldehyde	1g	5g
D3166	3,3'-Dibromobiphenyl	5g	25g
D4236	6,12-Dibromochrysene	200mg	1g
D4801	2,7-Dibromotriphenylene	200mg	1g
D4835	2,8-Diododibenzofuran	200mg	1g
D3743	3,6-Diphenyl-2,5-dihydropyrrolo[3,4- <i>c</i>]pyrrole-1,4-dione	5g	25g
H0923	2,3,6,7,10,11-Hexaacetoxyltriphenylene		100mg
H1201	2,3,6,7,10,11-Hexabromotriphenylene	100mg	1g
H0907	2,3,6,7,10,11-Hexahydroxytriphenylene Hydrate	1g	5g
N0603	5,12-Naphthacenequinone	10g	25g
P1685	6,13-Pentacenedione	5g	25g
P2110	3-Perylenecarboxaldehyde	1g	5g
P2158	4-(1-Phenyl-1 <i>H</i> -benzimidazol-2-yl)phenylboronic Acid (contains varying amounts of Anhydride)	1g	5g
P2290	4-Phenylanthracene-1-boronic Acid (contains varying amounts of Anhydride)	1g	5g
T2792	5'- <i>m</i> -Terphenylboronic Acid (contains varying amounts of Anhydride)		1g
T3089	4,4,5,5-Tetramethyl-2-(3-perylenyl)-1,3,2-dioxaborolane	200mg	1g
T3261	4,4,5,5-Tetramethyl-2-[3-(triphenyl-2-yl)phenyl]-1,3,2-dioxaborolane	200mg	1g
T2728	1,3,5-Tris(4-aminophenyl)benzene		5g
T3073	1,3,5-Tris(3-bromophenyl)benzene	1g	5g
T2644	1,3,5-Tris(4-bromophenyl)benzene	1g	5g
T3178	2,4,6-Tris(4-bromophenyl)-1,3,5-triazine		200mg
T2647	1,3,5-Tris(4-carboxyphenyl)benzene	1g	5g
T3213	1,3,5-Tris(3,5-dibromophenyl)benzene	200mg	1g
T3084	1,3,5-Tris(4-iodophenyl)benzene	1g	5g

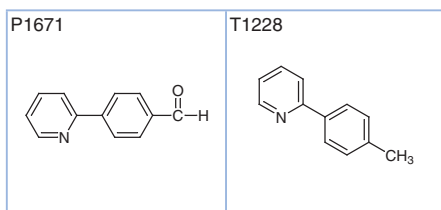
Ligands for Functional Metal Complex

Optically and electronically functional metal complexes exhibiting light absorption, emission, and magnetism have been well known. Such functional metal complexes show absorption (emission) by a charge transfer, electrical conduction, and magnetic properties based on d- or f-electrons of the metal center. Coordination modes of metal complexes are diverse from two-coordinate to eight-coordinate, and thus many coordination geometries are known. Here we list ligands to synthesize the functional metal complexes that are useful for electronics and dye-sensitizers. In particular, these ligands undergo more than bidentate chelation with a metal center forming a rigid structure.

Many transition metals can be redox centers in the metal complex, because they can have several oxidation states. On the other hand, there are 'redox active ligands' that can function as redox centers. One can observe a variety of oxidation states in the transition metal complexes bearing a redox active ligand, because the redox center involves both of the metal and the coordinating ligand. In addition, a redox active ligand may interexchange electrons with a metal center. A typical example is valence tautomerism.^{1,2)} The water oxidation catalyst developed by Tanaka *et al.* also requires a redox active ligand.^{3,4)} Physical properties of a metal complex involving a redox active ligand are sometimes due to the π -electrons of the ligand. The metal complexes with a redox active dithiolenelike ligand have been studied on conductivity and magnetism based on the π -conjugated structure.⁵⁾



Phenylpyridines		B0088	B3509	B4509
B0841	B0470	B4092	B3314	D3413
D1922	H1265	M2101	M2001	M0932
P1731	P1039	P2057	P1301	P1889

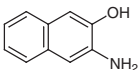
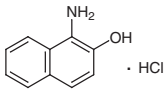
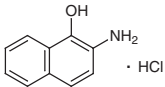
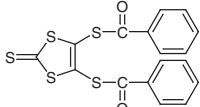
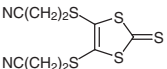
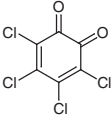
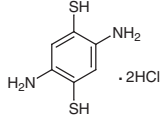
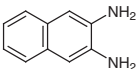
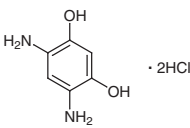
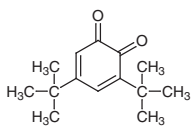
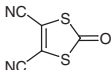
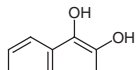
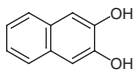
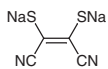
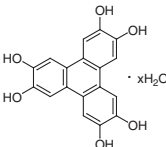
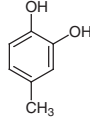
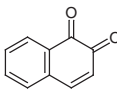
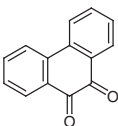
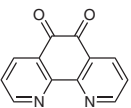
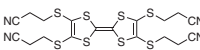
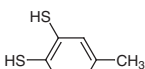


Product No.	Product Name	Unit Size	
B0088	Benzo[h]quinoline	5g	25g
B3509	2,2'-Bicinchoninic Acid	1g	5g
B4509	Bicinchoninic Acid Disodium Salt Hydrate	1g	5g
B0841	2,2'-Bi-4-lepidine	100mg	
B0470	2,2'-Biquinoline	1g	5g
B4092	2-(4- <i>tert</i> -Butylphenyl)pyridine	200mg	1g
B3314	2-Butyl-6-phenylpyridine	1g	
D3413	2-(2,4-Difluorophenyl)pyridine	1g	5g
D1922	2,6-Diphenylpyridine	5g	25g
H1265	2-Hexyl-6-phenylpyridine	1g	
M2101	2-(4-Methoxyphenyl)pyridine	1g	5g 25g
M2001	2-Methyl-6-phenylpyridine	1g	5g
M0932	3-Methyl-2-phenylpyridine	5g	25g
P1731	1-Phenylisoquinoline	1g	5g
P1039	2-Phenylpyridine	5g	25g
P2057	2-Phenylquinoline	1g	5g
P1301	2-Phenylquinoline-4-carboxylic Acid	25g	
P1889	3-(2-Pyridyl)benzaldehyde	1g	
P1671	4-(2-Pyridyl)benzaldehyde	1g	5g
T1228	2-(<i>p</i> -Tolyl)pyridine	5g	25g

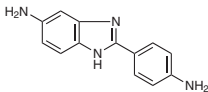
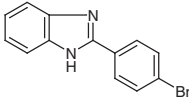
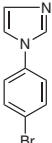
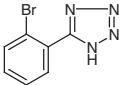
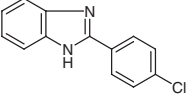
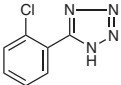
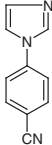
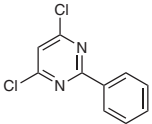
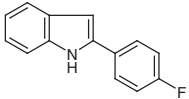
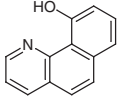
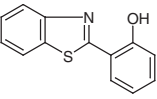
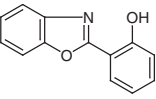
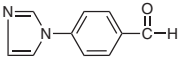
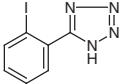
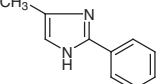
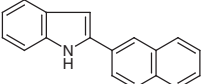
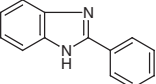
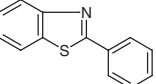
Quinolinols		A1005	B3324	C0645
D0208	D0412	D3819	D1736	F0038
H1272	M0420	N0270	H0305	Q0017

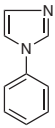
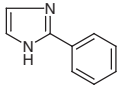
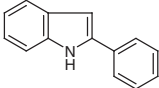
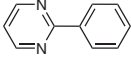
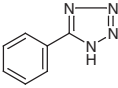
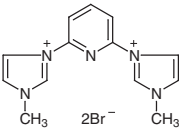
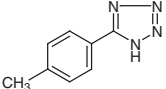
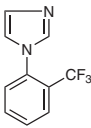
Product No.	Product Name	Unit Size	
A1005	5-Amino-8-hydroxyquinoline Dihydrochloride	5g	25g
B3324	5-Bromo-8-hydroxyquinoline	5g	25g
C0645	5-Chloro-8-hydroxyquinoline	25g	250g
D0208	5,7-Dibromo-8-hydroxyquinoline	25g	
D0412	5,7-Dichloro-8-hydroxyquinoline	5g	25g
D3819	2,8-Dihydroxyquinoline	5g	25g

Product No.	Product Name	Unit Size		
D1736	5,7-Diiodo-8-hydroxyquinoline			25g
F0038	5-Fluoro-8-quinolinol		1g	5g
H1272	8-Hydroxyquinoline <i>N</i> -Oxide		5g	25g
M0420	2-Methyl-8-quinolinol	25g	100g	500g
N0270	5-Nitroso-8-hydroxyquinoline			25g
H0305	8-Quinolinol		25g	500g
Q0017	8-Quinolinol Sulfate Monohydrate		25g	500g

Redox Active Ligands		A0267	A1593	A0364
				
A0365	A0335	B1322	B1199	B2228
				
P0317	T0970	D2022	D1335	D1045
				
D1888	D2430	D3252	D2299	D0593
				
D1930	H0907	H1177	M0413	N0041
				
P0080	P1973	P0168	T2806	T0266
				

Product No.	Product Name	Unit Size		
		25mL	100mL	500mL
A0267	2-Aminobenzenethiol			5g
A1593	3-Amino-2-naphthol			25g
A0364	1-Amino-2-naphthol Hydrochloride			5g
A0365	2-Amino-1-naphthol Hydrochloride		1g	5g
A0335	2-Aminophenol	25g	100g	500g
B1322	1,2-Benzenedithiol		1g	5g
B1199	4,5-Bis(benzoylthio)-1,3-dithiole-2-thione		1g	5g
B2228	4,5-Bis(2-cyanoethylthio)-1,3-dithiole-2-thione			1g
P0317	Catechol		25g	100g
T0970	<i>o</i> -Chloranil		5g	25g
D2022	2,5-Diamino-1,4-benzenedithiol Dihydrochloride		5g	25g
D1335	Diaminomaleonitrile	25g	100g	500g
D1045	2,3-Diaminonaphthalene		1g	5g
D1888	4,6-Diaminoresorcinol Dihydrochloride		5g	25g
D2430	3,5-Di- <i>tert</i> -butyl-1,2-benzoquinone		5g	25g
D3252	4,5-Dicyano-1,3-dithiol-2-one			1g
D2299	1,2-Dihydroxynaphthalene		1g	5g
D0593	2,3-Dihydroxynaphthalene		25g	250g
D1930	Disodium Dimercaptomaleonitrile		1g	5g
H0907	2,3,6,7,10,11-Hexahydroxytriphenylene Hydrate		1g	5g
H1177	2-Hydroxybenzenethiol		5g	25g
M0413	4-Methylcatechol		25g	500g
N0041	1,2-Naphthoquinone		5g	25g
P0080	9,10-Phenanthrenequinone		5g	25g
P1973	1,10-Phenanthroline-5,6-dione		1g	5g
P0168	1,2-Phenylenediamine	25g	100g	500g
T2806	2,3,6,7-Tetrakis(2-cyanoethylthio)tetrathiafulvalene		100mg	1g
T0266	Toluene-3,4-dithiol	1g	5g	25g

Other Ligands		A2759	B2812	B4101
				
B2577	C2027	C2811	C2045	F0851
				
F0427	H0738	H0973	H0291	I0818
				
I0735	M0669	N0859	P1105	P1130
				

P2030 	P0684 	P0188 	P1945 	P1109 
P1816 	T2486 	T2982 		

Product No.	Product Name	Unit Size	
A2759	5-Amino-2-(4-aminophenyl)benzimidazole	1g	5g
B2812	2-(4-Bromophenyl)benzimidazole	1g	5g
B4101	1-(4-Bromophenyl)imidazole	1g	5g
B2577	5-(2-Bromophenyl)-1H-tetrazole	5g	25g
C2027	2-(4-Chlorophenyl)benzimidazole	1g	5g
C2811	5-(2-Chlorophenyl)-1H-tetrazole	1g	5g
C2045	1-(4-Cyanophenyl)imidazole		5g
F0851	Fenclozim	1g	5g
F0427	2-(4-Fluorophenyl)indole		25g
H0738	10-Hydroxybenzo[h]quinoline	1g	5g
H0973	2-(2-Hydroxyphenyl)benzothiazole	5g	25g
H0291	2-(2-Hydroxyphenyl)benzoxazole	1g	25g
I0818	4-(1-Imidazolyl)benzaldehyde	1g	5g
I0735	5-(2-Iodophenyl)-1H-tetrazole		5g
M0669	4-Methyl-2-phenylimidazole	25g	500g
N0859	2-(2-Naphthyl)indole	1g	5g
P1105	2-Phenylbenzimidazole		25g
P1130	2-Phenylbenzothiazole		5g
P2030	1-Phenylimidazole	1g	5g
P0684	2-Phenylimidazole		100g
P0188	2-Phenylindole	25g	250g
P1945	2-Phenylpyrimidine	200mg	1g
P1109	5-Phenyltetrazole	25g	100g 500g
P1816	1,1'-(2,6-Pyridinediyl)bis(3-methylimidazolium) Dibromide	1g	5g
T2486	5-(p-Tolyl)-1H-tetrazole	5g	25g
T2982	1-[2-(Trifluoromethyl)phenyl]imidazole		1g

Bipyridine & Terpyridine (see also p.98)

Phenanthroline (see also p.100)

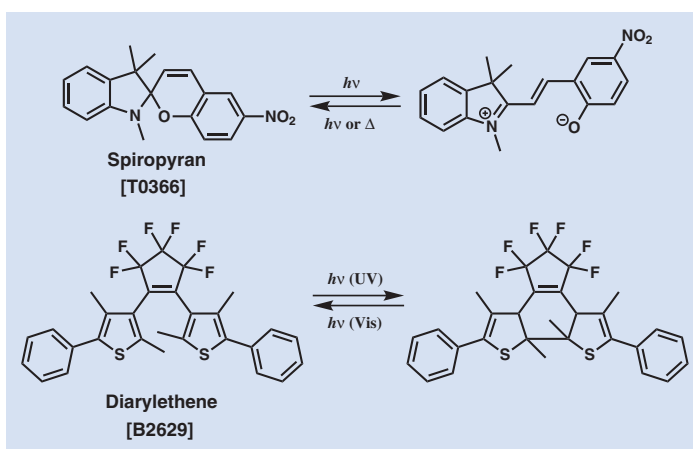
References

- 1) Review: T. Tezgerevska, K. G. Alley, C. Boskovic, *Coord. Chem. Rev.* **2014**, 268, 23.
- 2) C. G. Pierpont, O.-S. Jung, *Inorg. Chem.* **1995**, 34, 4281.
- 3) T. Wada, K. Tsuge, K. Tanaka, *Angew. Chem. Int. Ed.* **2000**, 39, 1479.
- 4) T. Wada, K. Tsuge, K. Tanaka, *Inorg. Chem.* **2001**, 40, 329.
- 5) Review: R. Kato, *Chem. Rev.* **2004**, 104, 5319.

Photochromic Compounds

Chromism is a phenomenon that reversibly changes optical properties (eg. photo absorption and emission) by an external stimulus. A molecular structure changes in many cases while chromism occurs, and then refractive index, dielectricity, redox potentials, and melting point also change. Photochromism is a photo-induced chromism. Photochromic materials are further developed for a light-modulating materials, optical recording media, optical switches, and functional inks.

A structural isomerization during photochromism involves photo-induced geometrical isomerizations (eg. *cis-trans* isomerization) and photo-induced ring-opening and -closure reactions. Fischer *et al.* first reported the photochromic behavior of spiropyrans.¹⁾ UV irradiation to a spiropyran undertakes a ring-opening of the spiro carbon. The structural change leads to a blue shift of photo absorption up to the visible region. Irie *et al.* first observed photochromism of diarylethenes.²⁾ The diarylethene also shows photo-induced ring-opening and -closure reactions. UV irradiation to the diarylethene undertakes a ring-closure (with coloration) whereas a spiropyran does a ring-opening (with coloration) by UV irradiation. The ring-opened spiropyran thermally closes the ring (T-type). On the other hand, the ring-closed diarylethene is thermally stable but opens to form the original compound by visible light irradiation (P-type). It is well known that diarylethene is a photochromic compound with high photo sensitivity and repetition durability.³⁾ A fulgide is also a P-type photochromic compound exhibiting a ring-closure by a photo irradiation.⁴⁾



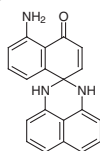
Hayashi and Maeda observed photochromism of an imidazole dimer, hexaarylbiimidazole (HABI).⁵⁾ A light irradiation to HABI undertakes dissociation of the dimer. The photochromic mechanism is different from those of the others doing photo isomerizations. A triphenylimidazolyl radical formed by the dissociation thermally recombines to reform the original HABI, thus this is a T-type photochromism. The triphenylimidazolyl radical is also useful as a photopolymerization initiator.⁶⁾

Spiropyrans		H1042	T0344	T0370
T0416	T0423	T1259	T0366	

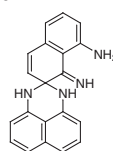
Product No.	Product Name	Unit Size	
H1042	1-(2-Hydroxyethyl)-3,3-dimethylindolino-6'-nitrobenzopyrrolospiran	1g	5g
T0344	1,3,3-Trimethylindolinobenzopyrrolospiran	1g	5g
T0370	1,3,3-Trimethylindolino-6'-bromobenzopyrrolospiran		1g
T0416	1,3,3-Trimethylindolino-8'-methoxybenzopyrrolospiran	1g	25g
T0423	1,3,3-Trimethylindolino- β -naphthopyrrolospiran	1g	5g
T1259	1,3,3-Trimethylindolinonaphthospirooxazine		1g
T0366	1,3,3-Trimethylindolino-6'-nitrobenzopyrrolospiran	1g	25g

Spiroperimidines

D3618



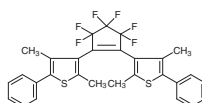
D3619



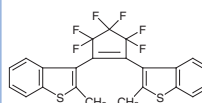
Product No.	Product Name	Unit Size	
D3618	2,3-Dihydro-2-spiro-4'-[8'-aminonaphthalen-1'(4H)-one]perimidine (contains α -form)	100mg	
D3619	2,3-Dihydro-2-spiro-7'-[8'-imino-7,8'-dihydronaphthalen-1'-amine]perimidine	100mg	

Diarylethenes

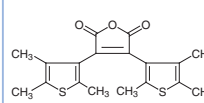
B2629



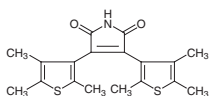
B2287



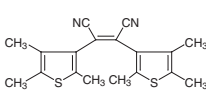
B1534



B1535



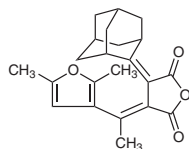
B1536



Product No.	Product Name	Unit Size	
B2629	1,2-Bis(2,4-dimethyl-5-phenyl-3-thienyl)-3,3,4,4,5,5-hexafluoro-1-cyclopentene	100mg	1g
B2287	1,2-Bis[2-methylbenzo(b)thiophen-3-yl]-3,3,4,4,5,5-hexafluoro-1-cyclopentene	100mg	1g
B1534	2,3-Bis(2,4,5-trimethyl-3-thienyl)maleic Anhydride	100mg	1g
B1535	2,3-Bis(2,4,5-trimethyl-3-thienyl)maleimide	100mg	1g
B1536	<i>cis</i> -1,2-Dicyano-1,2-bis(2,4,5-trimethyl-3-thienyl)ethene	1g	5g

Fulgide

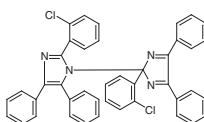
A2869



Product No.	Product Name	Unit Size
A2869	Aberchrome 670	200mg 1g

Hexaarylbiimidazole

B1225



Product No.	Product Name	Unit Size
B1225	2,2'-Bis(2-chlorophenyl)-4,4',5,5'-tetraphenyl-1,2'-biimidazole	25g

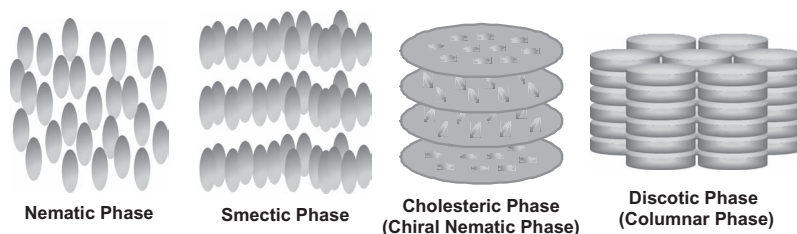
References

- 1) E. Fischer, Y. Hirshberg, *J. Chem. Soc.* **1952**, 4522.
- 2) Review: M. Irie, *Chem. Rev.* **2000**, 100, 1685.
- 3) K. Matsuda, M. Irie, *TCIMAIL* **2003**, number 120, 2.
- 4) J. Harada, R. Nakajima, K. Ogawa, *J. Am. Chem. Soc.* **2008**, 130, 7085.
- 5) K. Maeda, T. Hayashi, *Bull. Chem. Soc. Jpn.* **1969**, 42, 3509.
- 6) Review: B. M. Monroe, G. C. Weed, *Chem. Rev.* **1993**, 93, 435.

Liquid Crystal Materials

Liquid crystals have properties between those of conventional liquid and those of solid crystal. For instance, a liquid crystal shows fluidity like a liquid, but it also demonstrates optical anisotropy like a crystal. Liquid crystal molecules are directionally oriented, but positionally not oriented. Small molecule-based and polymer-based liquid crystals are known. The structure of a liquid crystal involves rigid π -electron systems bearing flexible long alkyl chains. Many liquid crystal molecules are calamitic shaped with a group for polarization, but planar molecules are also known. We can control the temperature which shows a liquid crystal phase by modifying the length of alkyl chain. A practical liquid crystal has a mesophase around room temperature. In addition to an application for a liquid crystal display, liquid crystal materials are expected to be organic semiconductors. A semiconductor having a liquid crystal phase, the so-called liquid crystal semiconductor, spontaneously undergoes a molecular orientation and self-assembly.^{1,2)}

The various liquid-crystal phases can be characterized by the type of ordering. Among them, there are mainly nematic, smectic, cholesteric, and discotic phases. We can introduce chirality into a liquid crystal molecule giving chiral nematic and chiral smectic phases.



(1) Nematic phase

Calamitic shaped molecules are oriented one-dimensionally. The individual molecule can be relatively movable along the long axis direction. This phase belongs to the most flexible liquid crystal with large fluidity and small viscosity. Calamitic shaped cyanobiphenyls with large dielectric anisotropy ($\Delta\epsilon$) enable control of the molecular orientation by applying an electrical field. A liquid crystal display of a twisted nematic (TN) system³⁾ is fabricated from a nematic liquid crystal.

(2) Smectic phase

There is a two-dimensional layered structure caused by more positional limitations compared with that of a nematic phase. A smectic phase is harder than a nematic phase, because the movable range of the unit molecules is relatively narrow. A nematic phase sometimes changes to a smectic phase by decreasing the temperature. Diversity of the layered structures demonstrates many kinds of smectic phases.

(3) Cholesteric phase (Chiral nematic phase)

This phase is usually observed from cholesterol derivatives. The unit molecules are oriented one-dimensionally similar to a normal nematic phase, but the molecular orientation shows a twisted helical arrangement between layers. This is due to an asymmetric carbon (chiral center) in the cholesterol molecule. Accordingly, a cholesteric phase is called a chiral nematic phase. This chiral phase exhibits optical rotation, selective optical scattering, circular polarization, and dichroism. Recently, a research development on a 'blue phase' received much attention.⁴⁾ This phase is observed between temperatures of the cholesteric phase and an isotropic liquid. One difficulty is that we can find the blue phase in a narrow temperature range of 1-2 degrees. However, one can widen the temperature range more than several dozens of degrees, when a polymer slightly forms in the blue phase (polymer-stabilized blue phase).⁵⁾

(4) Discotic phase

Formation of a discotic phase requires a discotic aromatic molecule such as phthalocyanine,⁶⁾ triphenylene,⁷⁾ hexabenzocoronene⁸⁾ and so on, although nematic and smectic phases require calamitic molecules. A discotic molecule usually forms a one-dimensional columnar structure (columnar phase) by stacking the molecules. A research area on organic electronics focuses on the discotic phase, because electrical conduction may occur along the molecular stacking direction. On the other hand, a rare example was reported that a chemical modification of a discotic molecule provided a three-dimensionally stacked cubic phase,⁹⁾ whereas discotic molecules normally stack one-dimensionally.

Nematic & Smectic Liquid Crystals		Cyanobiphenyls & Analogs		
		A1828	A2568	
H0812	C1606	C2618	C1550	C1551
C2910	C2911	D4534	D4535	P2150

Product No.	Product Name	Unit Size	
A1828	4-(<i>trans</i> -4-Amylcyclohexyl)benzonitrile	5g	25g
A2568	4'-(<i>trans</i> -4-Amylcyclohexyl)biphenyl-4-carbonitrile	1g	5g
H0812	4-Cyano-4'-heptylbiphenyl	1g	5g
C1606	4-Cyano-4'-heptyloxybiphenyl		1g
C2618	4-Cyano-4'- <i>n</i> -octyloxybiphenyl	5g	25g
C1550	4-Cyano-4'-pentylbiphenyl	1g	5g
C1551	4-Cyano-4'-pentyloxybiphenyl	1g	5g
C2910	4-Cyano-4'-pentyl- <i>p</i> -terphenyl	1g	5g
C2911	4-Cyano-4'-propoxy-1,1'-biphenyl	1g	5g
D4534	3,4-Difluoro-4'-(<i>trans</i> -4-pentylcyclohexyl)biphenyl	5g	25g
D4535	3,4-Difluoro-4'-(<i>trans</i> -4-propylcyclohexyl)biphenyl	5g	25g
P2150	(<i>R</i>)-1-Phenyl-1,2-ethanediyl Bis[4-(<i>trans</i> -4-pentylcyclohexyl)benzoate]	200mg	1g

Carbonates		A0608	E0257

Product No.	Product Name	Unit Size
A0608	Amyl 4-(4-Ethoxyphenoxycarbonyl)phenyl Carbonate	1g
E0257	4-(4-Ethoxyphenoxycarbonyl)phenyl Ethyl Carbonate	1g

Phenyl Esters	P0896	B1586	H0810
	B0375	P0897	M2106
	B1091		
B1092	P0898	S0016	

Product No.	Product Name	Unit Size
P0896	4-Butoxyphenyl 4-Pentylbenzoate	1g
B1586	4-Cyanophenyl 4-(3-Butenyloxy)benzoate	1g
H0810	4-Cyanophenyl 4-Heptylbenzoate	1g 5g
B0375	4-Ethoxyphenyl 4-Butylbenzoate	1g
B1091	4-(Hexyloxy)phenyl 4-Butylbenzoate	1g
P0897	4-Hexyloxyphenyl 4-Pentylbenzoate	1g
M2106	4-Methoxyphenyl 4-(3-Butenyloxy)benzoate	1g 5g
B1092	4- <i>n</i> -Octyloxyphenyl 4-Butylbenzoate	1g
P0898	4- <i>n</i> -Octyloxyphenyl 4-Pentylbenzoate	5g
S0016	4-Octylphenyl Salicylate	25g

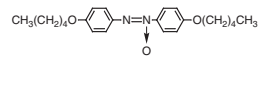
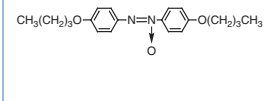
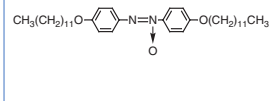
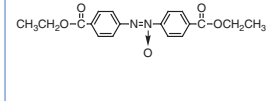
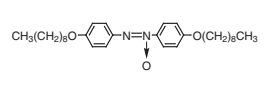
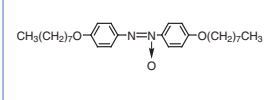
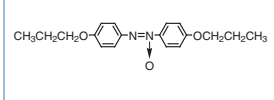
Schiff Bases	B0253	B0372	B0252
B0255	C0743	C0744	C0742

E0254 	E0262 	E0240 	M0602
H0419 	M0581 	M0583 	M0604
M0603 	M0582 	M0275 	B0250
B0871 			

Product No.	Product Name	Unit Size	
B0253	4'-(Amyloxy)benzylidene-4-cyanoaniline	1g	
B0372	N-(4-Butoxybenzylidene)-4-acetylaniline	1g	
B0252	4'-Butoxybenzylidene-4-cyanoaniline	1g	
B0255	Butyl 4-[(4-Methoxybenzylidene)amino]cinnamate	1g	
C0743	4'-Cyanobenzylidene-4-butoxyaniline	1g	
C0744	4'-Cyanobenzylidene-4-ethoxyaniline	1g	
C0742	4'-Cyanobenzylidene-4-hexyloxyaniline	Price on request	
E0254	N-(4-Ethoxybenzylidene)-4-acetylaniline	1g	
E0262	4'-Ethoxybenzylidene-4-butylaniline	25g	500g
E0240	4'-Ethoxybenzylidene-4-cyanoaniline	1g	
M0602	Ethyl 4-[(4-Methoxybenzylidene)amino]cinnamate	1g	
H0419	4'-Hexyloxybenzylidene-4-cyanoaniline	1g	
M0581	N-(4-Methoxybenzylidene)-4-acetoxylaniline	25g	
M0583	4-[(4-Methoxybenzylidene)amino]azobenzene	Price on request	
M0604	4-[(4-Methoxybenzylidene)amino]benzonitrile	1g	
M0603	4-[(4-Methoxybenzylidene)amino]stilbene	1g	
M0582	N-(4-Methoxybenzylidene)aniline	5g	25g
M0275	N-(4-Methoxybenzylidene)-4-butylaniline	25g	
B0250	N-(4-Methoxy-2-hydroxybenzylidene)-4-butylaniline	1g	
B0871	Terephthalbis(p-phenetidine)	5g	25g

Azoxybenzenes

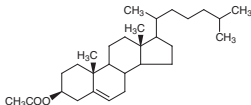
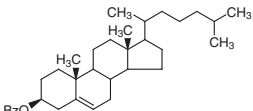
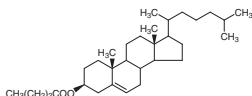
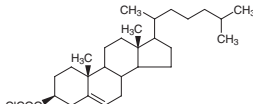
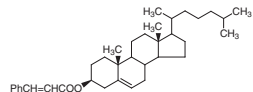
A0554 	A0683 	D1092
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D1093 	D1096 	D0553 	A1065 
D1518 	D1123 	D1094 	

Product No.	Product Name	Unit Size	
A0554	4,4'-Azoxydianisole	5g	25g
A0683	4,4'-Azoxydiphenetole	1g	5g
D1092	4,4'-Bis(hexyloxy)azoxybenzene		1g
D1093	4,4'-Diamyloxyazoxybenzene		1g
D1096	4,4'-Dibutoxyazoxybenzene		1g
D0553	4,4'-Didodecyloxyazoxybenzene		5g
A1065	Diethyl Azoxybenzene-4,4'-dicarboxylate		1g
D1518	4,4'-Dinonyloxyazoxybenzene		100mg
D1123	4,4'-Di- <i>n</i> -octyloxyazoxybenzene	1g	5g
D1094	4,4'-Dipropoxyazoxybenzene		5g

Others	T0697 	T0699 
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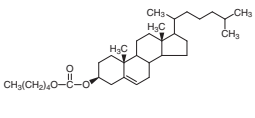
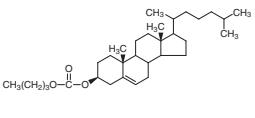
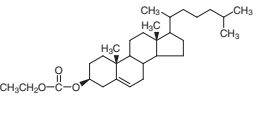
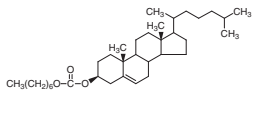
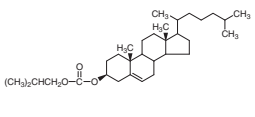
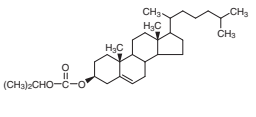
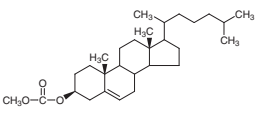
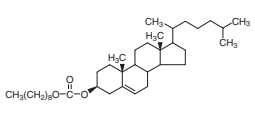
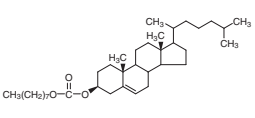
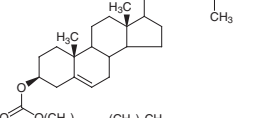
Product No.	Product Name	Unit Size
T0697	Liquid Crystal, TK-LQ 2040 Electric effect type, Mesomorphic range:20-40°C [Nematic Liquid Crystal]	1g
T0699	Liquid Crystal, TK-LQ 3858 Electric effect type, Mesomorphic range:38-58°C [Nematic Liquid Crystal]	1g

Cholesteric Liquid Crystals		Cholesteryl Compounds	C0319 
C0320 	C0668 	C0694 	C0617 

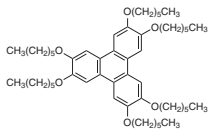
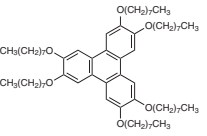
C0618 	C1260 	C0671 	C0672
C0673 	C0619 	C0692 	C0674
C0620 	C0321 	C0675 	C0334
C0559 	C0322 	N0347 	C0693
C0676 	C0323 	C0677 	C0695
C0610 			

Product No.	Product Name	Unit Size	
C0319	Cholesterol Acetate	25g	500g
C0320	Cholesterol Benzoate		25g
C0668	Cholesterol Butyrate	25g	500g
C0694	Cholesterol Chloroformate		25g
C0617	Cholesterol <i>trans</i> -Cinnamate		25g
C0618	Cholesterol Decanoate		25g
C1260	Cholesterol 2,4-Dichlorobenzoate		25g
C0671	Cholesterol Formate		10g
C0672	Cholesterol Heptanoate		25g
C0673	Cholesterol Hexanoate		25g
C0619	Cholesterol Hydrocinnamate		10g
C0692	Cholesterol Hydrogen Phthalate		10g
C0674	Cholesterol Hydrogen Succinate		10g
C0620	Cholesterol Laurate		25g

Product No.	Product Name	Unit Size		
C0321	Cholesterol Linoleate		25g	
C0675	Cholesterol Myristate	10g	25g	
C0334	Cholesterol <i>n</i> -Octanoate	5g	25g	
C0559	Cholesterol Oleate	25g	100g	500g
C0322	Cholesterol Palmitate		25g	
N0347	Cholesterol Pelargonate	25g	500g	
C0693	Cholesterol Phenylacetate		10g	
C0676	Cholesterol Propionate	10g	25g	
C0323	Cholesterol Stearate	25g	500g	
C0677	Cholesterol Valerate		10g	
C0695	Cholesteryl Bromide from Beef Fat		10g	
C0610	Cholesteryl Chloride from Beef Fat		25g	

Cholesteryl Carbonates	C0720	C0718	C0716
			
	B0264	C0719	C0717
	C0725		
C0715	B0256	C0721	C0691
			

Product No.	Product Name	Unit Size	
C0720	Cholesterol Amyl Carbonate	1g	10g
C0718	Cholesterol Butyl Carbonate		10g
C0716	Cholesterol Ethyl Carbonate		10g
B0264	Cholesterol Heptyl Carbonate		10g
C0725	Cholesterol Hexyl Carbonate		10g
C0719	Cholesterol Isobutyl Carbonate		10g
C0717	Cholesterol Isopropyl Carbonate		10g
C0715	Cholesterol Methyl Carbonate		10g
B0256	Cholesterol Nonyl Carbonate	1g	10g
C0721	Cholesterol <i>n</i> -Octyl Carbonate		10g
C0691	Cholesterol Oleyl Carbonate	10g	25g

Discotic Liquid Crystals	H1449	H1450
		

Product No.	Product Name	Unit Size	
H1449	2,3,6,7,10,11-Hexakis(hexyloxy)triphenylene	200mg	1g
H1450	2,3,6,7,10,11-Hexakis(<i>n</i> -octyloxy)triphenylene	200mg	1g

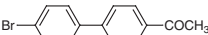
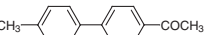
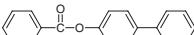
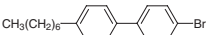
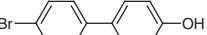
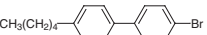
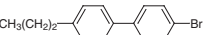
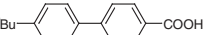
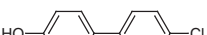
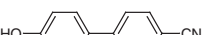
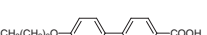
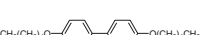
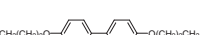
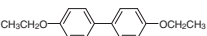
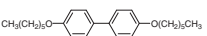
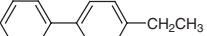
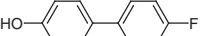
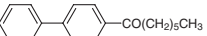
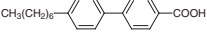
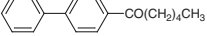
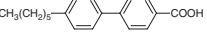
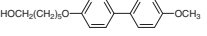
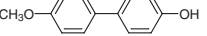
References

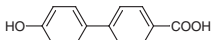
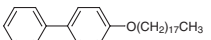
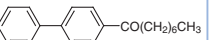
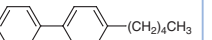
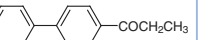
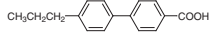
- 1) M. Funahashi, J. Hanna, *Mol. Cryst. Liq. Cryst.* **1997**, *304*, 429.
- 2) T. Yasuda, T. Shimizu, F. Liu, G. Ungar, T. Kato, *J. Am. Chem. Soc.* **2011**, *133*, 13437.
- 3) M. Schadt, W. Helfrich, *Appl. Phys. Lett.* **1971**, *18*, 127.
- 4) D. Coates, G. W. Gray, *Phys. Lett. A* **1973**, *45*, 115.
- 5) H. Kikuchi, M. Yokota, Y. Hisakado, H. Yang, T. Kajiyama, *Nat. Mater.* **2002**, *1*, 64.
- 6) E. Venuti, R. G. D. Valle, I. Bilotti, A. Brillante, M. Cavallini, A. Calo', Y. H. Geerts, *J. Phys. Chem. C* **2011**, *115*, 12150.
- 7) S. K. Pal, S. Setia, B. S. Avinash, S. Kumar, *Liq. Cryst.* **2013**, *40*, 1769.
- 8) L. Piot, C. Marie, X. Feng, K. Müllen, D. Fichou, *Adv. Mater.* **2008**, *20*, 3854.
- 9) M. A. Alam, J. Motoyanagi, Y. Yamamoto, T. Fukushima, J. Kim, K. Kato, M. Takata, A. Saeki, S. Seki, S. Tagawa, T. Aida, *J. Am. Chem. Soc.* **2009**, *131*, 17722.

Building Blocks for Liquid Crystals

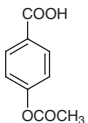
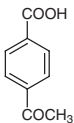
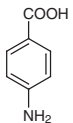
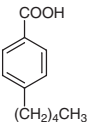
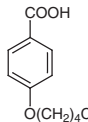
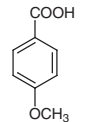
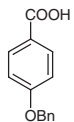
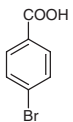
The first nematic liquid crystal materials, the Schiff base types, were sensitive to moisture, while the azoxybenzene types were sensitive to light. Therefore, research to improve the stability of liquid crystals to moisture and light had been undertaken. The chemically stable biphenylcarboxylates and cyanobiphenyls were developed one after another. The cyanobiphenyls were found to be exceptional in possessing the necessary properties of display material. They exhibited low viscosity and low voltage operation, leading to many reports on the cyanobiphenyls. The phenylcyclohexane-based liquid crystals also have low viscosity and high response speeds, thus drawing to attention their use as display material. Furthermore, these bicyclic liquid crystals were modified by the addition of benzene and cyclohexane rings to produce tricyclic and tetracyclic liquid crystals. As a result, the upper range of temperature was increased. Further improvements in the various physical properties were made by introduction of fluorine and other functional groups to the liquid crystals. The optically active compounds are important components of chiral nematic liquid crystals, chiral smectic liquid crystals, and blue phase. Antiferroelectric liquid crystals of the chiral smectic liquid crystal type are undergoing vigorous synthetic studies to develop novel liquid crystal compounds. Larger high-resolution displays are the target for the next generation of liquid crystal materials.

Following are listed building blocks for liquid crystals. These products enable you to develop new liquid crystal materials.

Biphenyls		A1410	A1322	B1866
				
B1304	H0690	B1305	B1306	B1986
				
C1239	H0523	D2041	D1090	D1082
				
D1127	D1089	E0463	F0704	H0708
				
H0709	H0710	H0711	H0767	H0819
				

H0695	B1924	O0214	P1133	P1212
				
P1037				
				

Product No.	Product Name	Unit	Size
A1410	4-Acetyl-4'-bromobiphenyl		25g
A1322	4-Acetyl-4'-methylbiphenyl		5g
B1866	4-Biphenyl Benzoate	5g	25g
B1304	4-Bromo-4'-heptylbiphenyl		5g
H0690	4-Bromo-4'-hydroxybiphenyl	5g	25g
B1305	4-Bromo-4'-pentylbiphenyl		5g
B1306	4-Bromo-4'-propylbiphenyl	5g	25g
B1986	4-(4- <i>tert</i> -Butylphenyl)benzoic Acid	1g	5g
C1239	4-Chloro-4'-hydroxybiphenyl	1g	5g
H0523	4-Cyano-4'-hydroxybiphenyl	5g	25g
D2041	4'-Decyloxybiphenyl-4-carboxylic Acid		1g
D1090	4,4'-Diamyloxybiphenyl		5g
D1082	4,4'-Dibutoxybiphenyl		25g
D1127	4,4'-Diethoxybiphenyl		5g
D1089	4,4'-Dihexyloxybiphenyl		5g
E0463	4-Ethylbiphenyl		25g
F0704	4-Fluoro-4'-hydroxybiphenyl	5g	25g
H0708	4-Heptanoylbiphenyl		25g
H0709	4-(4-Heptylphenyl)benzoic Acid		5g
H0710	4-Hexanoylbiphenyl		10g
H0711	4-(4-Hexylphenyl)benzoic Acid		5g
H0767	4-(6-Hydroxyhexyloxy)-4'-methoxybiphenyl		1g
H0819	4-Hydroxy-4'-methoxybiphenyl	1g	5g
H0695	4-(4-Hydroxyphenyl)benzoic Acid	5g	25g
B1924	4-Octadecyloxybiphenyl		25g
O0214	4- <i>n</i> -Octanoylbiphenyl		10g
P1133	4-Pentylbiphenyl	5mL	25mL
P1212	4-Propionylbiphenyl	5g	25g
P1037	4-(4-Propylphenyl)benzoic Acid		10g

Benzoic Acids		A0885	A1024	A0269
				
A0741	A0708	A0482	B1665	B0553
				

B1950 	B1585 	B0896 	B0241 	D4176
D2859 	E0045 	E0379 	F0337 	H0774
H0792 	H0248 	H0829 	H0247 	H0207
H0642 	H0695 	O0137 	O0117 	P0206
P0945 	T0293 	U0072 		

Product No.	Product Name	Unit Size	
A0885	4-Acetoxybenzoic Acid	25g	500g
A1024	4-Acetylbenzoic Acid	1g	5g
A0269	4-Aminobenzoic Acid	25g	100g 500g
A0741	4-Amylbenzoic Acid	5g	25g 250g
A0708	4-Amyloxybenzoic Acid		25g
A0482	<i>p</i> -Anisic Acid	25g	500g
B1665	4-Benzyloxybenzoic Acid	5g	25g
B0553	4-Bromobenzoic Acid	25g	100g 500g
B1950	4-Bromo-2-fluorobenzoic Acid	5g	25g
B1585	4-(3-Butenyloxy)benzoic Acid		5g
B0896	4-Butoxybenzoic Acid		25g
B0241	4-Butylbenzoic Acid	5g	25g
D4176	4-(Decyloxy)benzoic Acid	5g	25g
D2859	4-(Dodecyloxy)benzoic Acid	5g	25g
E0045	4-Ethoxybenzoic Acid		25g
E0379	4-Ethylbenzoic Acid		25g
F0337	3-Fluoro-4- <i>n</i> -octyloxybenzoic Acid	1g	5g
H0774	4-Heptylbenzoic Acid		10g
H0792	4-Heptylbenzoyl Chloride	5g	25g
H0248	4-(Heptyloxy)benzoic Acid	25g	500g
H0829	4-Hexylbenzoic Acid		5g
H0247	4-(Hexyloxy)benzoic Acid		25g 500g
H0207	4-Hydroxybenzoic Acid	25g	100g 500g
H0642	4-(4-Hydroxyphenoxy)benzoic Acid	1g	5g

Product No.	Product Name	Unit Size	
H0695	4-(4-Hydroxyphenyl)benzoic Acid	5g	25g
O0137	4- <i>n</i> -Octylbenzoic Acid	1g	5g
O0117	4- <i>n</i> -Octyloxybenzoic Acid		25g
P0206	4-Propoxybenzoic Acid		25g
P0945	4-Propylbenzoic Acid	25g	500g
T0293	<i>p</i> -Toluic Acid	25g	500g
U0072	4-Undecyloxybenzoic Acid		5g

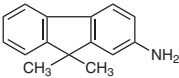
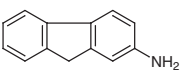
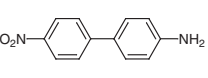
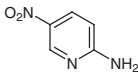
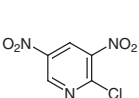
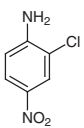
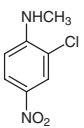
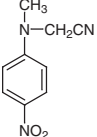
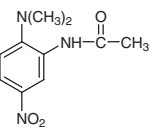
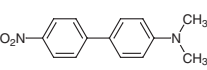
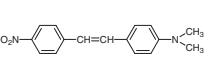
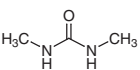
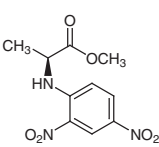
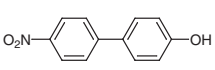
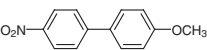
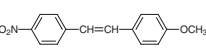
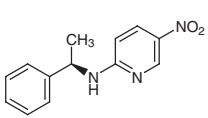
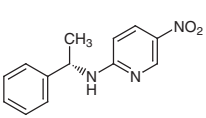
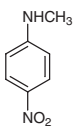
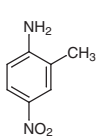
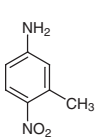
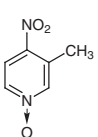
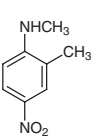
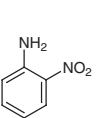
For others: See our website

References

- 1) T. Kitamura, *Zairyo Kagaku* **1992**, 29, 72.
- 2) H. Numata, *Kogyo Zairyo* **1998**, 46, 40.
- 3) Y. Suzuki, *Kino Zairyo* **1995**, 15, 8.
- 4) T. Inukai, K. Miyazawa, *Ekisho* **1997**, 1, 9.
- 5) G. W. Gray, G. R. Luckhurst, in *The Molecular Physics of Liquid Crystal*, Academic Press, **1979**, pp.1-29, pp.263-284.
- 6) P. G. Gennes, J. Prost, in *The Physics of Liquid Crystals, Second Edition*, Oxford University Press, **1993**.

Organic Nonlinear Optical Materials

Advancements of lasers and optical fibers contributed to optical communications and optical disks for practical use. Further development of optical materials is urgently required. Nonlinear optical materials efficiently exhibit nonlinear optical phenomena, which are conversion of light wavelength, amplification of light, and conversion of the refractive index depending on optical intensity. Since a laser oscillation was reported from an inorganic compound in the 1960s, inorganic nonlinear optical materials have been well developed. In addition to these inorganic materials, organic nonlinear optical materials have also been studied. This is because organic materials show efficient nonlinear optical properties and rapid responsiveness based on highly movable π -electrons, thanks to delocalized electrons in organic materials. Nonlinear optical materials may be important for large-capacity communications, because further application of this material may provide a device in an all optical system. As one of the basic technologies of photonics, lightwave technology using organic nonlinear optical effects are important to develop. Further research on organic materials with excellent nonlinear optical properties and vigorous applied studies has been carried out.

A2634 	A0621 	A1251 	A0838 	A0794 
C0943 	C0214 	C1209 	C1349 	D2020 
D2263 	D2505 	D0289 	D2135 	H0747 
M0997 	M0999 	M0909 	M0985 	M1011 
N0529 	M1677 	N0527 	M0953 	N0118 

N0117 	N0119 	N0400 	N0547 	N0546
N0540 	N0281 			

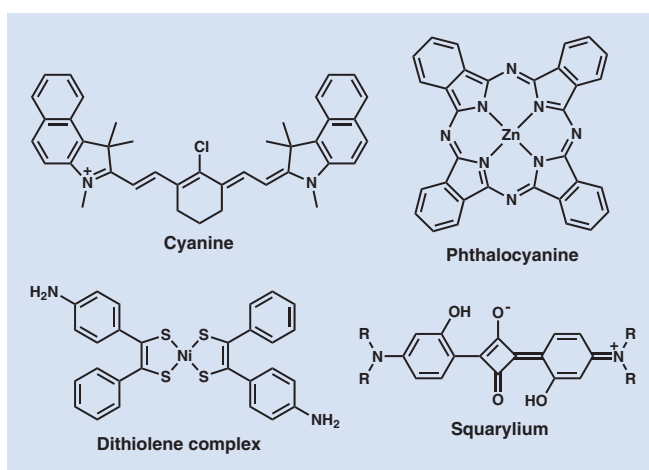
Product No.	Product Name	Unit Size	
A2634	2-Amino-9,9-dimethylfluorene	200mg	1g
A0621	2-Aminofluorene	5g	25g
A1251	4-Amino-4'-nitrobiphenyl	1g	5g
A0838	2-Amino-3-nitropyridine		5g
A0794	2-Amino-5-nitropyridine	25g	250g
C0943	2-Chloro-3,5-dinitropyridine	1g	5g
C0214	2-Chloro-4-nitroaniline		25g
C1209	2-Chloro-4-nitro-N-methylaniline	Price on request	
C1349	N-Cyanomethyl-N-methyl-4-nitroaniline		5g
D2020	2'-(N,N-Dimethylamino)-5'-nitroacetanilide		1g
D2263	4-Dimethylamino-4'-nitrobiphenyl	1g	5g
D2505	4-Dimethylamino-4'-nitrostilbene		5g
D0289	1,3-Dimethylurea	25g	500g
D2135	N-(2,4-Dinitrophenyl)-L-alanine Methyl Ester		1g
H0747	4-Hydroxy-4'-nitrobiphenyl	1g	5g 25g
M0997	4-Methoxy-4'-nitrobiphenyl	100mg	1g
M0999	4-Methoxy-4'-nitrostilbene		5g
M0909	(R)-(+)-2-(α -Methylbenzylamino)-5-nitropyridine		5g
M0985	(S)-(-)-2-(α -Methylbenzylamino)-5-nitropyridine	1g	5g
M1011	N-Methyl-4-nitroaniline	25g	500g
N0529	2-Methyl-4-nitroaniline		25g
M1677	3-Methyl-4-nitroaniline	5g	25g
N0527	3-Methyl-4-nitropyridine N-Oxide	5g	25g
M0953	N-Methyl-4-nitro- α -toluidine		5g
N0118	2-Nitroaniline	25g	500g
N0117	3-Nitroaniline	25g	500g
N0119	4-Nitroaniline	25g	500g
N0400	5-Nitroindole	5g	25g
N0547	(S)-(-)-N-(5-Nitro-2-pyridyl)alaninol		100mg
N0546	(S)-N-(5-Nitro-2-pyridyl)phenylalaninol		1g
N0540	(S)-(-)-N-(5-Nitro-2-pyridyl)prolinol	1g	5g
N0281	5-Nitouracil	5g	25g

References

- 1) S. Miyata, *et al.*, Preprints of IUPAC 32nd International Symposium on Macromolecules, Kyoto, **1988**, p.582.
- 2) D. S. Chemla, J. Zyss, in *Nonlinear Optical Properties of Organic Molecules and Crystals*, Academic Press, New York, **1987**.
- 3) L. M. Hayden, S. T. Kowel, M. P. Srinivasan, *Opt. Commun.* **1987**, 61, 351.
- 4) C. Flytzanis, J. L. Oudar, in *Nonlinear Optics: Materials and Devices*, Springer, Berlin, **1986**.
- 5) P. N. Prasad, D. R. Ulrich, in *Nonlinear Optical and Electroactive Polymers*, Plenum, New York, **1988**.
- 6) D. R. Ulrich, J. Orenstein, A. J. Heeger, in *Nonlinear Optical Properties, of Polymers*, Material Research Society, Pittsburgh, **1988**.

Materials for Near Infrared Absorption

Near infrared dyes show light absorption in the near infrared area of 700-2000 nm. Their intense absorption normally originates from a charge transfer of an organic dye or metal complex. Materials of near infrared absorption involve cyanine dyes having an extended polymethine, phthalocyanine dyes with a metal center of aluminum or zinc, naphthalocyanine dyes, nickel dithiolenes complexes with a square-planar geometry, squarylium dyes, quinone analogues, diimonium compounds and azo derivatives. Applications using these organic dyes include security markings, lithography, optical recording media and optical filters. A laser-induced process requires near infrared dyes having a sensitive absorption of longer than 700 nm, high solubility for appropriate organic solvents, and excellent heat-resistivity. In order to increase power conversion efficiency of an organic solar cell, efficient near infrared dyes are required, because sunlight includes near infrared light. Furthermore, near infrared dyes are expected to be biomaterials for chemotherapy and imaging deep-tissue in-vivo by using luminescent phenomena in the near infrared region.



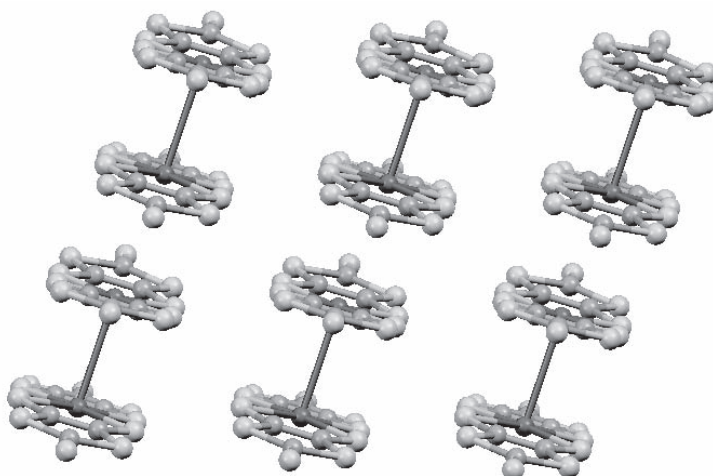
B4360 	B4361 	C3051 	D4773 	C2886
T3204 	T3205 			

Product No.	Product Name	Unit Size
B4360	Bis[4,4'-dimethoxy(dithiobenzil)]nickel(II)	1g
B4361	Bis(4-dimethylaminodithiobenzil)nickel(II)	1g
C3051	Copper(II) 5,9,14,18,23,27,32,36-Octabutoxy-2,3-naphthalocyanine	200mg 1g
D4773	3,3'-Diethylthiatricarbocyanine iodide	1g 5g
C2886	IR-813 <i>p</i> -Toluenesulfonate	1g 5g
T3204	Tetrabutylammonium Bis(3,6-dichloro-1,2-benzenedithiolato)nickelate	200mg
T3205	Tetrabutylammonium Bis(3,4,6-trichloro-1,2-benzenedithiolato)nickelate	200mg

Magnetic Metal Complexes

Magnetism is mainly classified into five categories: paramagnetism in which unpaired electrons are randomly oriented, ferromagnetism in which unpaired electrons are oriented in the same direction, antiferromagnetism in which unpaired electrons are oriented in antiparallel direction, ferrimagnetism in which unpaired electrons with different magnetic moments are oriented in antiparallel direction, and diamagnetism without unpaired electrons. An application of ferromagnet for electronics is a magnetic disk that is further developed to enhance memory capacity. Many Prussian blue analogues formulated as $M_4[M(CN)_6]_3$ are ferromagnets and ferrimagnets.^{1,2)}

Although neodymium magnets and ferrite magnets are magnetic materials based on inorganic solids, magnetic materials using molecular metal complexes have been also developed. Since a molecular magnetic material has a molecular unit, one advantage is that a chemical modification of the unit molecule controls physical properties. Furthermore, a molecular material can fabricate a device at low cost. Miller *et al.* observed a ferromagnet of the charge transfer complex derived from metallocene and tetracyanoethylene (TCNE) or tetracyanoquinodimethane (TCNQ).^{3,4)} Single molecule magnets (SMM) in which a single molecule behaves as a magnet, were intensively investigated from 1993.^{5,6)} The SMM is a specified material obtained from a molecular compound, and the application may be high-density information media. Single-chain magnets (SCM) are obtained from a one-dimensional assembly of magnetic complexes.⁷⁾ Kato *et al.* reported that physical properties of the metal complex salt of the 1,2-dithiolene ligand formulated as (Cation)[Pd(dmit)₂]₂ in which the anion radical of the dimer [Pd(dmit)₂]₂ shows paramagnetism, antiferromagnetism, superconductivity and spin liquid state.⁸⁾



Triangular Lattice of Dimer [Pd(dmit)₂]₂

β -Diketonato Complexes		H0553	H0554	H0557
C0373 B2681	C0384	M0042	V0016	T0746

T0752	T0685	T1686	H0555	C0336
M0043	T0932	T0750		

Product No.	Product Name	Unit Size	
H0553	Bis(hexafluoroacetylacetonato)cobalt(II) Hydrate	5g	
H0554	Bis(hexafluoroacetylacetonato)copper(II) Hydrate	1g	5g
H0557	Bis(hexafluoroacetylacetonato)manganese(II) Hydrate	1g	5g
C0373	Bis(2,4-pentanedionato)cobalt(II) Dihydrate	25g	500g
B2681	Bis(2,4-pentanedionato)cobalt(II)	25g	
C0384	Bis(2,4-pentanedionato)copper(II)	25g	250g
M0042	Bis(2,4-pentanedionato)manganese(II) Dihydrate	25g	500g
V0016	Bis(2,4-pentanedionato)vanadium(IV) Oxide	25g	
T0746	Bis(trifluoro-2,4-pentanedionato)cobalt(II) Hydrate	5g	
T0752	Bis(trifluoro-2,4-pentanedionato)copper(II)	5g	
T0685	Bis(trifluoro-2,4-pentanedionato)manganese(II)	5g	
T1686	Tris(dibenzoylmethanato) Iron	5g	25g
H0555	Tris(hexafluoroacetylacetonato)iron(III)	1g	
C0336	Tris(2,4-pentanedionato)chromium(III)	25g	500g
M0043	Tris(2,4-pentanedionato)manganese(III)	25g	100g 500g
T0932	Tris(trifluoro-2,4-pentanedionato)chromium(III)	1g	
T0750	Tris(trifluoro-2,4-pentanedionato)iron(III)	5g	

Porphyrin & Phthalocyanine Complexes

	P0887	C2986	P1005 P1006
T1256	P1628	T1861	

Product No.	Product Name	Unit Size	
P0887	Cobalt(II) Phthalocyanine	25g	
C2986	Cobalt(II) Tetraphenylporphyrin	1g	5g
P1005	Copper(II) Phthalocyanine (α-form)	25g	250g
P1006	Copper(II) Phthalocyanine (β-form)	25g	500g
T1256	Copper(II) 2,9,16,23-Tetra- <i>tert</i> -butylphthalocyanine	100mg	
P1628	Pigment Blue 15 (purified by sublimation)	1g	

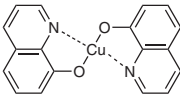
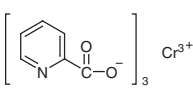
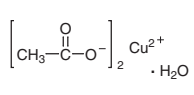
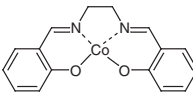
Product No.	Product Name	Unit Size	
T1861	[5,10,15,20-Tetrakis(4-methoxyphenyl)porphyrinato]cobalt(III)	1g	5g

Dithiolene Complexes		B4360	B4361	B1350
B1437	B1438	B1371	D2134	T3204
T1272	T1415	T3205	T1416	

Product No.	Product Name	Unit Size
B4360	Bis[4,4'-dimethoxy(dithiobenzil)]nickel(II)	1g
B4361	Bis(4-dimethylaminodithiobenzil)nickel(II)	1g
B1350	Bis(dithiobenzil)nickel(II)	1g
B1437	Bis(tetrabutylammonium) Bis(1,3-dithiole-2-thione-4,5-dithiolato)palladium(II)	100mg 1g
B1438	Bis(tetrabutylammonium) Bis(1,3-dithiole-2-thione-4,5-dithiolato)platinum(II)	100mg
B1371	Bis(tetrabutylammonium) Bis(maleonitriledithiolato)nickel(II) Complex	1g
D2134	Diocadecyldimethylammonium Bis(1,3-dithiole-2-thione-4,5-dithiolato)aurate(III)	100mg
T3204	Tetrabutylammonium Bis(3,6-dichloro-1,2-benzenedithiolato)nickelate	200mg
T1272	Tetrabutylammonium Bis(1,3-dithiole-2-thione-4,5-dithiolato)nickel(III) Complex	100mg
T1415	Tetrabutylammonium Bis(maleonitriledithiolato)nickel(III) Complex	1g
T3205	Tetrabutylammonium Bis(3,4,6-trichloro-1,2-benzenedithiolato)nickelate	200mg
T1416	Tetrabutylphosphonium Bis(1,3-dithiole-2-thione-4,5-dithiolato)nickel(III) Complex	1g

Dithiocarbamato Complexes		B0491	D0487	D1022
D0489	D1267			

Product No.	Product Name	Unit Size
B0491	Copper(II) Bis(2-hydroxyethyl)dithiocarbamate	25g
D0487	Copper Diethyldithiocarbamate	25g
D1022	Copper(II) Dimethyldithiocarbamate	25g
D0489	Iron(III) Diethyldithiocarbamate	25g
D1267	Iron(III) Dimethyldithiocarbamate	25g 500g

Other Complexes		B3834 B1677 	P1347  Cr^{3+}	C2346  $\text{Cu}^{2+} \cdot \text{H}_2\text{O}$
		I0849 $\text{Fe}_4[\text{Fe}(\text{CN})_6]_3$	S0318 	

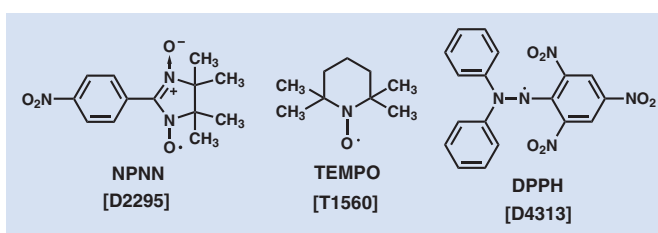
Product No.	Product Name	Unit Size
B3834	Bis(8-quinolinolato)copper(II) (purified by sublimation)	1g
B1677	Bis(8-quinolinolato)copper(II)	25g
P1347	Chromium(III) Pyridine-2-carboxylate	25g
C2346	Copper(II) Acetate Monohydrate	25g 500g
I0849	Iron(III) Hexacyanoferrate(II)	25g
S0318	Salcomine [=N,N'-Bis(salicylidene)ethylenediiminocobalt(II)]	25g 100g 500g

References

- 1) S. Ohkoshi, H. Tokoro, T. Matsuda, H. Takahashi, H. Irie, K. Hashimoto, *Angew. Chem. Int. Ed.* **2007**, *46*, 3238.
- 2) W. Kosaka, K. Nomura, K. Hashimoto, S. Ohkoshi, *J. Am. Chem. Soc.* **2005**, *127*, 8590.
- 3) J. S. Miller, A. J. Epstein, *Angew. Chem. Int. Ed.* **1994**, *33*, 385.
- 4) J. S. Miller, D. A. Dixon, R. S. McLean, D. M. Groski, R. B. Flippen, J. M. Manriquez, G. T. Yee, K. S. Narayan, A. J. Epstein, *Adv. Mater.* **1991**, *3*, 309.
- 5) R. Sessoli, D. Gatteschi, A. Caneschi, M. A. Novak, *Nature* **1993**, *365*, 141.
- 6) T. Komeda, H. Isshiki, J. Liu, Y.-F. Zhang, N. Lorente, K. Katoh, B. K. Breedlove, M. Yamashita, *Nat. Commun.* **2011**, *2*, 1210.
- 7) R. Clérac, H. Miyasaka, M. Yamashita, C. Coulon, *J. Am. Chem. Soc.* **2002**, *124*, 12837.
- 8) Review: R. Kato, *Bull. Chem. Soc. Jpn.* **2014**, *87*, 355.

Organic Radicals

Ferromagnetic and ferrimagnetic properties of metal compounds are based on contributions of unpaired d- or f-electrons of transition or lanthanoid metals. On the other hand, magnetic properties of metal-free organic compounds are due to unpaired π -electrons. Normally, π -electrons are favorable to electrical conduction in material science, because they are movable by the π -conjugation effect, but they have received less attention for magnetic materials. However, diverse chemical modifications of an organic molecule have produced organic radical-based ferromagnets.^{1,2)} It is known that the charge transfer complex obtained from fullerene with tetrakis(dimethylamino)ethylene (TDAE) becomes an organic magnet.³⁾ In addition to using a π -conjugated organic radical, localized free radical species also provide organic magnets. 4-Nitrophenylnitronyl nitroxide (NPNN) was the first organic ferromagnet in a pure organic radical.⁴⁾ Nogami *et al.* reported that 2,2,6,6-tetramethylpiperidine 1-oxyl (TEMPO) and its analogues became ferromagnets or antiferromagnets.^{5,6)} Furthermore, 1,1-diphenyl-2-picrylhydrazyl (DPPH) is an antiferromagnet at extremely low temperature.



A1348 	A1343 	C1428 	C1406 	C1432
C1782 	D4313 	D2399 	G0020 	H0865
H0878 	I0487 	I0908 	I0486 	M1531
M1197 	D2295 	O0266 	A5440 	T1560

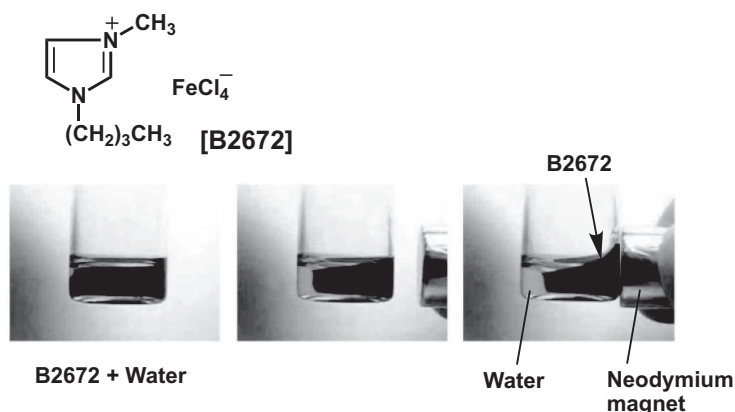
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A1343	4-Amino-2,2,6,6-tetramethylpiperidine 1-Oxyl Free Radical	1g	5g
C1428	4-Carboxy-2,2,6,6-tetramethylpiperidine 1-Oxyl Free Radical	100mg	1g
C1406	3-Carboxy-2,2,5,5-tetramethylpyrrolidine 1-Oxyl Free Radical		1g
C1432	4-(2-Chloroacetamido)-2,2,6,6-tetramethylpiperidine 1-Oxyl Free Radical	100mg	1g
C1782	4-Cyano-2,2,6,6-tetramethylpiperidine 1-Oxyl Free Radical		1g
D4313	1,1-Diphenyl-2-picrylhydrazyl Free Radical	1g	5g
D2399	16-DOXYL-stearic Acid Free Radical	25mg	100mg
G0020	Galvinoxyl Free Radical	1g	5g
H0865	4-Hydroxy-2,2,6,6-tetramethylpiperidine 1-Oxyl Free Radical	5g	25g
H0878	4-Hydroxy-2,2,6,6-tetramethylpiperidine 1-Oxyl Benzoate Free Radical	1g	5g
I0487	4-(2-Iodoacetamido)-2,2,6,6-tetramethylpiperidine 1-Oxyl Free Radical		100mg
I0908	4-[2-[2-(4-Iodophenoxy)ethoxy]carbonyl]benzoxy-2,2,6,6-tetramethylpiperidin-1-oxyl		100mg
I0486	4-Isothiocyanato-2,2,6,6-tetramethylpiperidine 1-Oxyl Free Radical	100mg	1g
M1531	4-Methacryloyloxy-2,2,6,6-tetramethylpiperidine 1-Oxyl Free Radical	1g	5g
M1197	4-Methoxy-2,2,6,6-tetramethylpiperidine 1-Oxyl Free Radical	1g	5g
D2295	2-(4-Nitrophenyl)-4,4,5,5-tetramethylimidazoline-3-oxide-1-oxyl Free Radical		100mg
O0266	4-Oxo-2,2,6,6-tetramethylpiperidine 1-Oxyl Free Radical	5g	25g
A5440	PTIO (=2-Phenyl-4,4,5,5-tetramethylimidazoline-3-oxide-1-oxyl)	1g	5g
T1560	2,2,6,6-Tetramethylpiperidine 1-Oxyl Free Radical	5g	25g

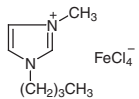
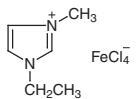
References

- 1) W. Fujita, K. Awaga, *J. Am. Chem. Soc.* **2001**, *123*, 3601.
- 2) W. Fujita, K. Awaga, *Chem. Phys. Lett.* **2002**, *357*, 385.
- 3) P. W. Stephens, D. Cox, J. W. Lauher, L. Mihalý, J. B. Wiley, P.-M. Allemand, A. Hirsch, K. Holczer, Q. Li, J. D. Thompson, F. Wudl, *Nature* **1992**, *355*, 331.
- 4) M. Kinoshita, P. Turek, M. Tamura, K. Nozawa, D. Shiomi, Y. Nakazawa, M. Ishikawa, M. Takahashi, K. Awaga, T. Inabe, Y. Maruyama, *Chem. Lett.* **1991**, *20*, 1225.
- 5) T. Nogami, K. Tomioka, T. Ishida, H. Yoshikawa, M. Yasui, F. Iwasaki, H. Iwamura, N. Takeda, M. Ishikawa, *Chem. Lett.* **1994**, *23*, 29.
- 6) T. Nogami, T. Ishida, M. Yasui, F. Iwasaki, N. Takeda, M. Ishikawa, T. Kawakami, K. Yamaguchi, *Bull. Chem. Soc. Jpn.* **1996**, *69*, 1841.

Magnetic Ionic Liquids

Ionic liquids consist of only ionic components, having high ionic conductivity suitable for a liquid electrolyte. An electrolyte for a secondary battery requires not only high ionic conductivity but also non-volatility, heat-resistivity, non-inflammability, and non-corrosiveness. Ionic liquids cover these conditions. The cationic component of ionic liquid involves alkyl-substituted imidazolium, pyrrolidinium, piperidinium, ammonium, phosphonium, sulfonium and the anionic component involves halide, BF_4 , PF_6 , thiocyanate, and di(sulfonyl)imide. Chemical modifications of the cation and anion control melting point, viscosity and ionic conductivity. Hamaguchi *et al.* observed magnetic ionic liquids by introducing FeCl_4 to the anion part to form 1-butyl-3-methylimidazolium tetrachloroferrate, $(\text{Bmim})\text{FeCl}_4$.^{1,2)} A magnetic fluid is a liquid with magnetic properties. However, a conventional magnetic fluid contains volatile solvents. It causes a change of viscosity and phase separation by cohesion/precipitation. On the other hand, the magnetic ionic liquid is a highly stable and non-volatile liquid. Moreover, this magnetic ionic liquid responds to a magnetic field by a permanent magnet, because it shows large magnetic susceptibility at room temperature.



B2672	E0706
	

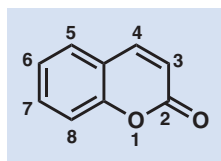
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B2672	1-Butyl-3-methylimidazolium Tetrachloroferrate	5g	25g
E0706	1-Ethyl-3-methylimidazolium Tetrachloroferrate		5g

References

- 1) S. Hayashi, H. Hamaguchi, *Chem. Lett.* **2004**, 33, 1590.
- 2) K. Iwata, H. Okajima, S. Saha, H. Hamaguchi, *Acc. Chem. Res.* **2007**, 40, 1174.

Coumarin Dyes

Coumarins are aromatic lactone compounds and many of them exist in natural plants. A coumarin compound with an electron-donating group on the 7-position shows strong light absorption and luminescence, whereas unsubstituted coumarin compounds are hardly luminescent. This is because intramolecular charge transfer occurs when electron-donating and -withdrawing groups coexist in the coumarin molecule. An introduction of a group on the 3- or 4-position largely controls the wavelength of light absorption and luminescence. Furthermore, an introduction of an electron-withdrawing group on these positions can enhance the intensity of luminescence. Such coumarin dyes are useful for laser dyes emitting blue-green light.

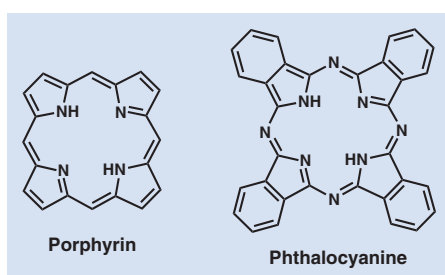


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C3044 	C3072 	C3047 	C2836 	C3045
C3046 	B4257 	D3354 	D4462 	D4238
C2837 	M0631 	D4466 	D3355 	D3356
E1132 	E1129 	E0642 	H1145 	

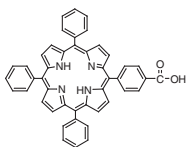
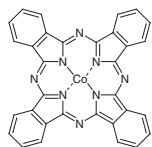
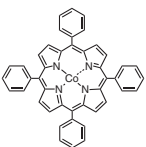
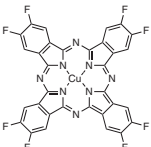
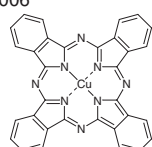
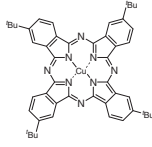
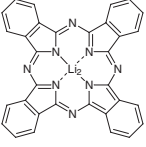
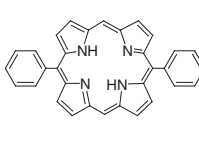
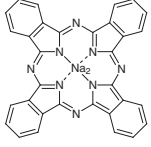
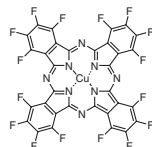
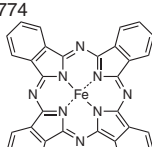
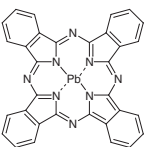
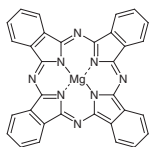
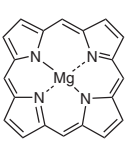
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B2111	3-(2-Benzimidazolyl)-7-(diethylamino)coumarin	100mg	1g
B2088	3-(2-Benzothiazolyl)-7-(diethylamino)coumarin	1g	5g
C2267	Coumarin 102		1g
C2858	Coumarin 153	200mg	1g
C2268	Coumarin 314		1g
C3044	Coumarin 498		200mg
C3072	Coumarin 510	200mg	1g
C3047	Coumarin 525		200mg
C2836	Coumarin 6H	200mg	1g
C3045	Coumarin 504T	200mg	1g
C3046	Coumarin 521T		200mg
B4257	Coumarin 545T		200mg
D3354	7-(Diethylamino)coumarin	200mg	1g
D4462	7-(Diethylamino)coumarin-3-carbonitrile	1g	5g
D4238	7-(Diethylamino)coumarin-3-carboxylic Acid		100mg
C2837	7-(Diethylamino)-3-(1-methyl-2-benzimidazolyl)coumarin	200mg	1g
M0631	7-Diethylamino-4-methylcoumarin	25g	500g
D4466	7-(Diethylamino)-4-(trifluoromethyl)coumarin		200mg
D3355	7-(Dimethylamino)-4-methylcoumarin	5g	25g
D3356	7-(Dimethylamino)-4-(trifluoromethyl)coumarin	5g	25g
E1132	7-(Ethylamino)-4,6-dimethylcoumarin	200mg	1g
E1129	7-(Ethylamino)-4-methylcoumarin		200mg
E0642	Ethyl 7-(Diethylamino)coumarin-3-carboxylate	1g	5g
H1145	Hexyl 7-(Diethylamino)coumarin-3-carboxylate	1g	5g

Porphyrin & Phthalocyanine Dyes

Porphyrin has a cyclic structure with four condensed pyrroles. The corresponding porphyrin metal complexes are important in-vivo, because they are included in chlorophyll functioning photo absorption and photo electron transfer for photosynthesis, and also included in heme (hemoglobin) transporting oxygen in blood. In addition, porphyrinato metal complexes are useful for photoelectron functional materials, metal complex catalysts and molecular electrical conductors. Chemical modifications of substituted groups, metal centers, and axial ligands on the porphyrinato metal complexes show various functionalities. Normal porphyrin complexes have sharp absorptions, the so-called Soret band, around 400-500 nm, and the Q band around 500-700 nm that is a relatively weak absorption. Molar absorption coefficients of the Soret band are up to order of 10^5 M/cm. The chlorophyll and porphyrinato zinc complexes hardly show energy relaxation of absorbed light, but easily show photoelectron transfer. Therefore, studies on porphyrinato metal complexes are performed for artificial photosynthesis (eg. reduction of carbon dioxide) and solar cell materials.



Phthalocyanine compounds do not exist in nature, although they have an analogue structure to porphyrin compounds. The phthalocyanato metal complexes are artificial dyes for painting of railway trains, and for organic photoconductors of electrophotography. There are applications of organic semiconductors as organic transistors and hole injection materials for organic light-emitting diodes (OLED). The phthalocyanato metal complexes show a more intense Q band absorption than that of the Soret band. Their absorption wavelengths are shifted to longer wavelengths than those of porphyrin compounds. Absorption wavelength is further shifted to the near infrared area by modification of the central metal and expansion of the π -conjugates. Introduction of an alkyl group provides soluble phthalocyanine and porphyrin compounds, although they are poorly soluble due to the large π -conjugated cycle.

C1630 	P0887 	C2986 	C3051 	C2427 
P1005 P1006 	T1256 	P1049 	D2860 	P0973 
H1194 	I0783 P0774 	P0766 	P1018 	M2209 

M1338 	O0234 	O0319 	P1795 P0355 	C1167
P0996 	P1628 P0655 	P0660 	S0363 	T1494
T1495 	T1438 	T1815 	T1832 	T1497
T1360 	T1861 	T1730 	T1729 	T1358
T1359 	T2222 	T2940 	P1024 	P0997
T2272 	P0767 	Z0036 		

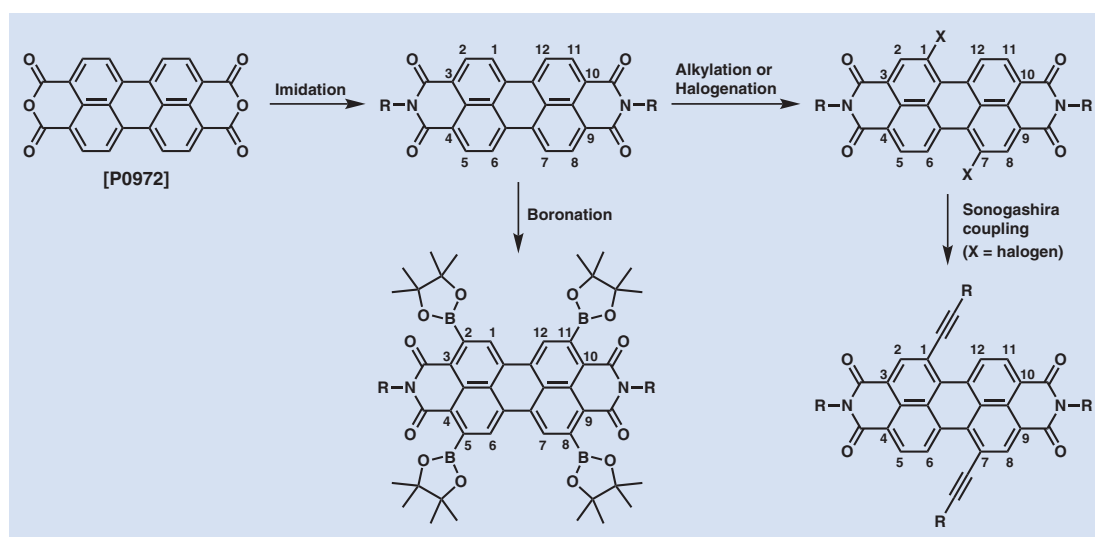
Product No.	Product Name	Unit Size	
C1630	5-(4-Carboxyphenyl)-10,15,20-triphenylporphyrin	100mg	
P0887	Cobalt(II) Phthalocyanine	25g	
C2986	Cobalt(II) Tetraphenylporphyrin	1g	5g
C3051	Copper(II) 5,9,14,18,23,27,32,36-Octabutoxy-2,3-naphthalocyanine	200mg	1g
C2427	Copper(II) 2,3,9,10,16,17,23,24-Octafluorophthalocyanine (purified by sublimation)	100mg	1g
P1005	Copper(II) Phthalocyanine (α -form)	25g	250g
P1006	Copper(II) Phthalocyanine (β -form)	25g	500g
T1256	Copper(II) 2,9,16,23-Tetra- <i>tert</i> -butylphthalocyanine	100mg	
P1049	Dilithium Phthalocyanine	1g	
D2860	5,15-Diphenylporphyrin	100mg	
P0973	Disodium Phthalocyanine	1g	5g
H1194	1,2,3,4,8,9,10,11,15,16,17,18,22,23,24,25-Hexadecafluorophthalocyanine Copper(II) (purified by sublimation)	100mg	1g
I0783	Iron(II) Phthalocyanine (purified by sublimation)	200mg	1g
P0774	Iron(II) Phthalocyanine	25g	

Product No.	Product Name	Unit Size	
P0766	Lead(II) Phthalocyanine	1g	25g
P1018	Magnesium(II) Phthalocyanine		1g
M2209	Magnesium Porphyrin		100mg
M1338	5-(4-Methoxycarbonylphenyl)-10,15,20-triphenylporphyrin	100mg	1g
O0234	2,3,7,8,12,13,17,18-Octaethylporphyrin	100mg	1g
O0319	2,3,7,8,12,13,17,18-Octafluoro-5,10,15,20-tetrakis(pentafluorophenyl)porphyrin		100mg
P1795	Phthalocyanine (purified by sublimation)		1g
P0355	Phthalocyanine		25g
C1167	Phthalocyanine Chloroaluminum		1g
P0996	Phthalocyanine Silicon Dichloride	Price on request	
P1628	Pigment Blue 15 (purified by sublimation)		1g
P0655	Pigment Blue 15		25g
P0660	Pigment Green 7		25g
S0363	Silver(I) Phthalocyanine	Price on request	
T1494	5,10,15,20-Tetrakis(4-aminophenyl)porphyrin		100mg
T1495	5,10,15,20-Tetrakis(4-carboxymethoxyphenyl)porphyrin		100mg
T1438	5,10,15,20-Tetrakis(2,6-dichlorophenyl)porphyrin		100mg
T1815	5,10,15,20-Tetrakis(3,5-dihydroxyphenyl)porphyrin	100mg	1g
T1832	5,10,15,20-Tetrakis(3,5-dimethoxyphenyl)porphyrin		100mg
T1497	5,10,15,20-Tetrakis(4-hydroxyphenyl)porphyrin		100mg
T1360	5,10,15,20-Tetrakis(4-methoxyphenyl)porphyrin	100mg	1g
T1861	[5,10,15,20-Tetrakis(4-methoxyphenyl)porphyrinato]cobalt(II)	1g	5g
T1730	5,10,15,20-Tetrakis(pentafluorophenyl)porphyrin		100mg
T1729	5,10,15,20-Tetrakis(2,4,6-trimethylphenyl)porphyrin	100mg	1g
T1358	<i>meso</i> -Tetraphenylchlorin		100mg
T1359	Tetraphenylporphyrin (Chlorin free)		1g
T2222	5,10,15,20-Tetra(4-pyridyl)porphyrin		1g
T2940	Tin(IV) 2,3-Naphthalocyanine Dichloride	200mg	1g
P1024	Tin(II) Phthalocyanine	1g	5g
P0997	Tin(IV) Phthalocyanine Dichloride		1g
T2272	Titanyl Phthalocyanine (purified by sublimation)	200mg	1g
P0767	Zinc Phthalocyanine	1g	10g 25g
Z0036	Zinc(II) Tetraphenylporphyrin		1g 5g

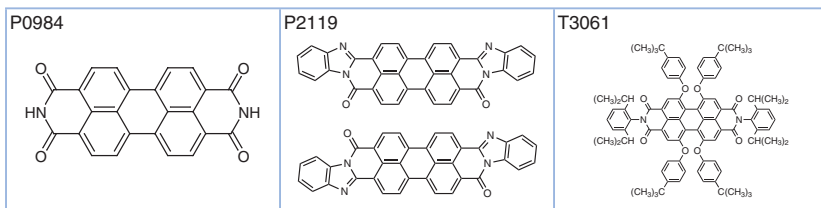
Perylene Dyes

Perylene was a p-type organic semiconductor and it was known in the 1950s that the bromine-doped material showed electrical conductivity¹⁾. In contrast to that, perylenetetracarboxylic dianhydride and perylenetetracarboxylic diimide derivatives are n-type organic semiconductors. The latter perylenetetracarboxylic derivatives (PDI or PBI) are important semiconducting materials, because n-type ones are relatively less known than p-type ones. In fact, PTCBI (3,4,9,10-perylenetetracarboxylic bisbenzimidazole) was an n-type organic semiconductor for a prototype of organic photovoltaics.²⁾

Applications in organic electronics using PDI derivatives are organic light-emitting diode (OLED) materials³⁾ and laser dyes⁴⁾ thanks to their high fluorescent quantum efficiency and photochemical stability. PDIs with electron mobility larger than 0.1 cm²/Vs are also reported.^{5,6)} An introduction of an alkyl group on the imido moiety (NR) produces soluble PDI derivatives, although they are poorly soluble in general.⁷⁾ Recent research has proved direct alkylations at the meta positions (1,6,7,12-positions),^{8,9)} and direct boronations at the ortho positions (2,5,8,11-positions)¹⁰⁾ for PDIs. Halogenations at the meta positions are available, followed by various cross-coupling reactions¹¹⁾ and polymerizations¹²⁾ providing PDI derivatives with diverse molecular structures and molecular weights.



B4268 	B4394 	B4231 	B4343
B2892 	D4175 	D3947 	P0972



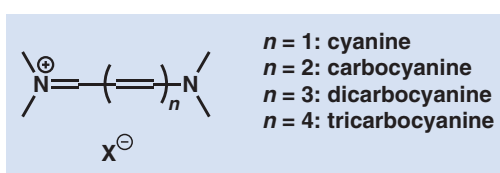
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B4394	<i>N,N'</i> -Bis(2,6-diisopropylphenyl)-1,6,7,12-tetraphenoxy-3,4,9,10-perylenetetracarboxylic Diimide	1g	5g
B4231	<i>N,N'</i> -Bis(3,5-dimethylphenyl)-3,4,9,10-perylenetetracarboxylic Diimide	1g	5g
B4343	<i>N,N'</i> -Bis(2-ethylhexyl)-3,4,9,10-perylenetetracarboxylic Diimide		200mg
B2892	<i>N,N'</i> -Bis(4-methoxyphenyl)-3,4,9,10-perylenetetracarboxylic Diimide	1g	5g
D4175	<i>N,N'</i> -Di- <i>n</i> -octyl-3,4,9,10-perylenetetracarboxylic Diimide		1g
D3947	<i>N,N'</i> -Ditridecyl-3,4,9,10-perylenetetracarboxylic Diimide	200mg	1g
P0972	3,4,9,10-Perylenetetracarboxylic Dianhydride	25g	100g 500g
P0984	3,4,9,10-Perylenetetracarboxylic Diimide		25g
P2119	PTCBI (<i>cis</i> - and <i>trans</i> - mixture)		200mg
T3061	1,6,7,12-Tetrakis(4- <i>tert</i> -butylphenoxy)- <i>N,N'</i> -bis(2,6-diisopropylphenyl)-3,4,9,10-perylenetetracarboxylic Diimide		200mg

References

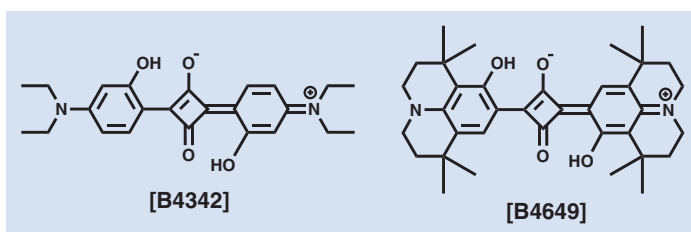
- 1) H. Akamasu, H. Inokuchi, Y. Matsunaga, *Nature* **1954**, 173, 168.
- 2) C. W. Tang, *Appl. Phys. Lett.* **1986**, 48, 183.
- 3) P. Ranke, I. Bleyl, J. Simmerer, D. Haarer, A. Bacher, H. W. Schmidt, *Appl. Phys. Lett.* **1997**, 71, 1332.
- 4) M. G. Ramirez, M. Morales-Vidal, V. Navarro-Fuster, P. G. Boj, J. A. Quintana, J. M. Villalvilla, A. Retolaza, S. Merino, M. A. Diaz-Garcia, *J. Mater. Chem. C* **2013**, 1, 1182.
- 5) P. R. L. Malenfant, C. D. Dimitrakopoulos, J. D. Gelorme, L. L. Kosbar, T. O. Graham, A. Curioni, W. Andreoni, *Appl. Phys. Lett.* **2002**, 80, 2517.
- 6) R. J. Chesterfield, J. C. McKeen, C. R. Newman, P. C. Ewbank, D. A. da Silva Filho, J.-L. Brédas, L. L. Miller, K. R. Mann, C. D. Frisbie, *J. Phys. Chem. B* **2004**, 108, 19281.
- 7) R. Narayan, P. Kumar, K. S. Narayan, S. K. Asha, *Adv. Funct. Mater.* **2013**, 23, 2033.
- 8) W. Yue, Y. Li, W. Jiang, Y. Zhen, Z. Wang, *Org. Lett.* **2009**, 11, 5430.
- 9) Y. Li, C. Li, W. Yue, W. Jiang, R. Kopecek, J. Qu, Z. Wang, *Org. Lett.* **2010**, 12, 2374.
- 10) G. Battagliarin, C. Li, V. Enkelmann, K. Müllen, *Org. Lett.* **2011**, 13, 3012.
- 11) J. Sun, F. Zhong, J. Zhao, *Dalton Trans.* **2013**, 42, 9595.
- 12) X. Hu, L. Zuo, H. Pan, F. Hao, J. Pan, L. Fu, M. Shi, H. Chen, *Sol. Energy Mater. Sol. Cells* **2012**, 103, 157.

Cyanine & Squarylium Dyes

Cyanine dyes contain some *N*-heterocycles on both sides of the polymethine structure. The *N*-heterocycle on the one side is a cationic ammonium with an electron-withdrawing effect, and the other *N*-heterocycle is a tertiary amine with an electron-donating effect. Accordingly, cyanine dyes show the light absorption of a charge transfer through the central polymethine structure. An extension of the polymethine structure exhibits a red shift of absorption. The absorption of cyanine dyes shifts to longer wavelengths with every extension by the addition of two methine moieties (or by the addition of one *n* moiety).¹⁾ There are cyanine dyes exhibiting near infrared absorption. The *N*-heterocycles contained in the cyanine dyes consist of indole, benzoxazole, benzothiazole, naphthothiazole, quinoline and so on. Proper selection of these *N*-heterocycles controls absorption wavelength. Increasing the number of aromatic rings shifts absorption to longer wavelengths. Counter anions consist of halides, sulfonate, perchlorate, tetrafluoroborate, hexafluoroantimonate and so on. Proper selection of these anions enhances solubility and durability.^{2,3)} Cyanine dyes are useful for silver photography, and optical recording media by laser sensitivity.⁴⁾ Water-soluble cyanine dyes are usable as fluorescent probes in biochemical research.⁵⁾



Squarylium dye (SQ), which is an analogue of cyanine dye, has a squaraine moiety in the center of the π -conjugate. The SQ dye has a zwitterion structure in which the cation and anion coexist in the molecule, although the cyanine dye has a separated cation component. The SQ was conventionally used as a charge generation material for an organic photo conductors.^{6,7)} Recently, SQ provided a sensitizer for organic solar cells originating from a strong absorption in near infrared area.^{8,9)} In addition, the SQ dye was applied to an organic light-emitting diode because it shows efficient red luminescence.¹⁰⁾



B4342 	B4649 	C0426 	C0436
D4453 	D4457 	A2684 	D4454

D4773 	D4456 	I0535 	P0156
P0436 	D4463 	D4464 	

Product No.	Product Name	Unit Size	
B4342	2,4-Bis[4-(diethylamino)-2-hydroxyphenyl]squaraine	1g	5g
B4649	2,4-Bis[8-hydroxy-1,1',7,7'-tetramethyljulolidin-9-yl]squaraine	1g	5g
C0426	Cryptocyanine	200mg	1g
C0436	Cyanine	1g	5g
D4453	3,3'-Diethyloxacarbocyanine iodide	1g	5g
D4457	3,3'-Diethyloxadibenzocyanine iodide		200mg
A2684	1,1'-Diethyl-3,3,3',3'-tetramethylindocarbocyanine iodide	1g	5g
D4454	3,3'-Diethylthiacarbocyanine iodide	1g	5g
D4773	3,3'-Diethylthiatriacarbocyanine iodide	1g	5g
D4456	3,3'-Dipropylthiadibenzocyanine iodide	200mg	1g
I0535	Indocyanine Green	100mg	1g
P0156	Pinacyanol Chloride	100mg	1g
P0436	Pinacyanol iodide	1g	5g
D4463	3,3,3',3'-Tetramethyl-1,1'-bis(4-sulfobutyl)benzoindocarbocyanine Sodium Salt	1g	5g
D4464	3,3,3',3'-Tetramethyl-1,1'-bis(4-sulfobutyl)indocarbocyanine Sodium Salt	1g	5g

References

- 1) Y. Y. Davidson, B. M. Gunn, S. A. Soper, *Appl. Spectrosc.* **1996**, 50, 211.
- 2) A. Mishra, R. K. Behera, P. K. Behera, B. K. Mishra, G. B. Behera, *Chem. Rev.* **2000**, 100, 1973.
- 3) Review: Z. Zhu, *Dyes Pigments* **1995**, 27, 77.
- 4) H. Oba, M. Abe, M. Umehara, T. Sato, Y. Ueda, M. Kunikane, *Appl. Opt.* **1986**, 25, 4023.
- 5) X. H. Zhang, Q. Liu, H. J. Shi, L. Y. Wang, Y. L. Fu, X. C. Wei, L. F. Yang, *Dyes Pigments* **2014**, 100, 232.
- 6) K.-Y. Law, F. C. Bailey, L. J. Bluet, *Can. J. Chem.* **1986**, 64, 1607.
- 7) K.-Y. Law, F. C. Bailey, *Dyes Pigments* **1993**, 21, 1.
- 8) A. Burke, L. Schmidt-Mende, S. Ito, M. Grätzel, *Chem. Commun.* **2007**, 234.
- 9) T. Maeda, Y. Hamamura, K. Miyanaga, N. Shima, S. Yagi, H. Nakazumi, *Org. Lett.* **2011**, 13, 5994.
- 10) B. Zhang, W. Zhao, Y. Cao, X. Wang, Z. Zhang, X. Jiang, S. Xu, *Synth. Met.* **1997**, 91, 237.

Dipyrrromethene Dyes

Dipyrrromethene is a unit structure of porphyrin and can coordinate to main group elements and transition metals as a monoanionic bidentate ligand to form complexes. Among them, a dipyrrromethene-coordinated boron complex (boron dipyrrromethene) shows a very small Stokes shift, high fluorescent quantum efficiency that is independent of solvent polarity, large molar absorption coefficient, and sharp excitation and emission spectra. It is expected that dipyrrromethene dyes are alternative fluorescent dyes to fluorescein and rhodamine dyes. Applications of dipyrrromethene dyes are fluorescent labeling reagents, laser dyes, and electronic materials. A chemical modification of boron dipyrrromethene controls optical properties more easily than other fluorescent dyes.

B4400	B4489	D4341	D4593	E1065

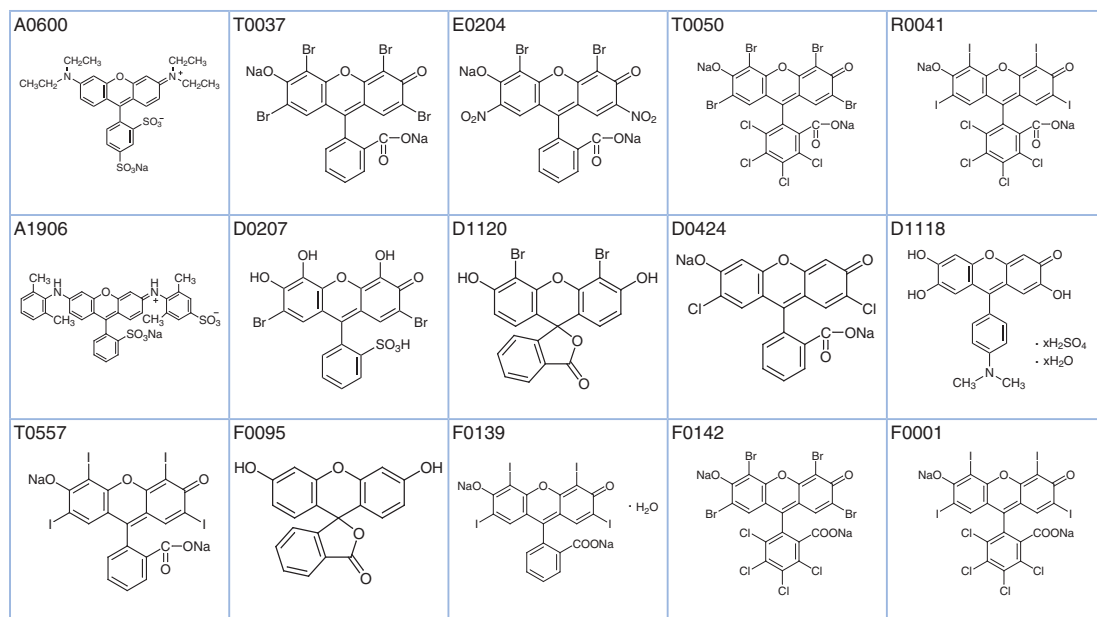
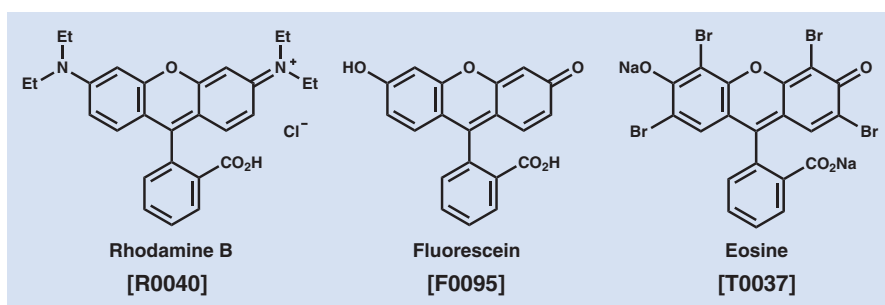
Product No.	Product Name	Unit Size
B4400	[[[(4- <i>tert</i> -Butyl-3,5-dimethyl-1 <i>H</i> -pyrrol-2-yl)(4- <i>tert</i> -butyl-3,5-dimethyl-2 <i>H</i> -pyrrol-2-ylidene)methyl]-methane](difluoroborane)	200mg
B4489	[[[(4-Butyl-3,5-dimethyl-1 <i>H</i> -pyrrol-2-yl)(4-butyl-3,5-dimethyl-2 <i>H</i> -pyrrol-2-ylidene)methyl]-methane](difluoroborane)	200mg
D4341	[[[(3,5-Dimethyl-1 <i>H</i> -pyrrol-2-yl)(3,5-dimethyl-2 <i>H</i> -pyrrol-2-ylidene)methyl]-methane](difluoroborane)	1g
D4593	[[[(3,5-Dimethyl-4-sulfo-1 <i>H</i> -pyrrol-2-yl)(3,5-dimethyl-4-sulfo-2 <i>H</i> -pyrrol-2-ylidene)methyl]-methane](difluoroborane) Disodium Salt	200mg
E1065	[[[(4-Ethyl-3,5-dimethyl-1 <i>H</i> -pyrrol-2-yl)(4-ethyl-3,5-dimethyl-2 <i>H</i> -pyrrol-2-ylidene)methyl]-methane](difluoroborane)	200mg

Xanthene Dyes

Both cationic and anionic xanthene dyes are known to be efficient fluorescent dyes. Functional groups on the xanthene moiety control their fluorescent colors. For instance, there are the cationic dyes of rhodamine B with a dialkylamino group as a red fluorescent dye, fluorescein as a green fluorescent dye, and the anionic dye of eosin (brominated fluorescein) as a red fluorescent dye. Applications of xanthene dyes involve optical materials and organic dyes for medical diagnosis research. Several characteristic features of xanthene dyes are large absorption and luminescence, excellent light resistance, low toxicity in-vivo, and relatively high solubility in water.

Since xanthene dyes have a sensitizing effect, their applications for dye sensitized solar cells (DSSC) have been reported.¹⁾ We can expect that the xanthene dyes fabricate DSSC devices at low cost, because they are metal-free, although the power conversion efficiency of xanthene dyes are lower than those of ruthenium-based dyes. Further research has been in progress with a combination of several xanthene dyes to increase power conversion efficiency.²⁾

There is an application of xanthene derivatives for a laser dye. A dye laser requires coumarin and rhodamine dyes as an organic medium. They all oscillate in the visible area. Among these xanthene dyes, the rhodamine 6G is mainly used for a laser dye.³⁾



F0143 	A0601 	T0450 	P0572 	R0040
R0039 	S0132 	T0036 	T0049 	T0066
T0124 	F0096 	F0027 		

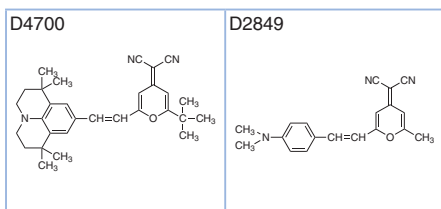
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T0037	Acid Red 87			25g
E0204	Acid Red 91			25g
T0050	Acid Red 92			25g
R0041	Acid Red 94			25g
A1906	Acid Red 289			25g
D0207	Bromopyrogallol Red	1g		5g
D1120	Dibromofluorescein (contains Mono-, Tri- and Tetra-)			5g
D0424	2',7'-Dichlorofluorescein Sodium Salt	1g		25g
D1118	9-(4'-Dimethylaminophenyl)-2,6,7-trihydroxyfluorone Sulfate Hydrate			1g
T0557	Erythrosine B			25g
F0095	Fluorescein	25g	100g	500g
F0139	Food Red No. 3			25g
F0142	Food Red No. 104			25g
F0001	Food Red No. 105			25g
F0143	Food Red No. 106			25g
A0601	Gallein	1g		25g
T0450	Phenylfluorone			1g
P0572	Pyrogallol Red			1g
R0040	Rhodamine B	25g		250g
R0039	Rhodamine 6G			25g
S0132	Sulfonfluorescein	1g		5g
T0036	Tetrabromofluorescein Potassium Salt			25g
T0049	2',4',5',7'-Tetrabromo-3,4,5,6-tetrachlorofluorescein			25g
T0066	3,4,5,6-Tetrachlorofluorescein			1g
T0124	Tetraiodofluorescein			25g
F0096	Uranine	25g		500g
F0027	Uranine K			25g

References

- 1) H. Tsubomura, M. Matsumura, Y. Nomura, T. Amamiya, *Nature* **1976**, 261, 402.
- 2) S. Rani, P. K. Shishodia, R. M. Mehra, *J. Renew. Sust. Energ.* **2010**, 2, 043103.
- 3) J. Loerke, F. Marlow, *Adv. Mater.* **2002**, 14, 1745.

DCM Dyes

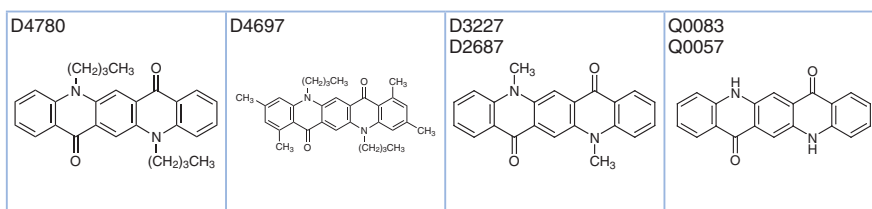
DCM dye consists of a pyranilidene malononitrile as an electron acceptor and a 4-aminostyryl group as an electron donor. Chemical modifications of the substituent on the pyran ring and amino group control the wavelengths of absorption and luminescence. The DCM dyes are useful for laser oscillation and a red dopant for an organic light-emitting diode device. This dye is a low band gap material with good efficiency and long lifetime.



Product No.	Product Name	Unit Size
D4700	DCJTB	200mg
D2849	4-(Dicyanomethylene)-2-methyl-6-(4-dimethylaminostyryl)-4 <i>H</i> -pyran	500mg

Quinacridone Dyes

Quinacridone dyes were originally used as red pigments having clear color and durability. They are useful for painting of automobiles, printing ink and coloring of plastics. In the research field of organic electronics, quinacridone dyes are applied to solar cells and organic light-emitting diodes (OLED). Quinacridones easily show intermolecular stacks in face-to-face mode and form strong intermolecular hydrogen bondings (NH...O). Thus, these facts indicate that quenching of emission occurs under a concentrated condition. On the other hand, quinacridone dyes are strongly luminescent in solution, and are useful for luminescent dopant materials even if they are used in the solid state. In fact, they are green luminescent dopants for an OLED device. In order to decrease intermolecular hydrogen bonding, we can introduce a group on the nitrogen to avoid intermolecular quenching. Introduction of alkyl groups enhances solubility, because quinacridones usually are poorly soluble.



Product No.	Product Name	Unit Size	
D4780	<i>N,N'</i> -Dibutylquinacridone	200mg	1g
D4697	5,12-Dibutyl-1,3,8,10-tetramethylquinacridone (This product is only available in Japan.)	200mg	1g
D3227	<i>N,N'</i> -Dimethylquinacridone (purified by sublimation)		1g
D2687	<i>N,N'</i> -Dimethylquinacridone	1g	5g
Q0083	Quinacridone (purified by sublimation)		1g
Q0057	Quinacridone		25g

Metal-Organic Frameworks (MOFs / PCPs) & Related Ligands

Porous metal-organic frameworks (MOFs) (other name: porous coordination polymers (PCPs)) have attracted wide scientific attention for the potential application to gas storage, gas separation, catalysis and nanospace engineering.¹⁾ MOFs (PCPs) are constructed mainly by coordination bonds between metal cations and multidentate ligands. Their specificities depend on the pore shape, size, and chemical environments of the voids or channels. Kitagawa *et al.* have reported the first utilization of a MOF as an electrocatalyst for oxidation of ethanol to aldehyde, for which the potential was comparable with Pt-based catalysts.²⁾

Recently, Kaneko, Kanoh, Kondo, Kajiro, *et al.* have developed a quite unique Cu complex MOF $[\text{Cu}(\text{bpy})(\text{BF}_4)_2(\text{H}_2\text{O})_2]\text{bpy}$ (bpy = 4,4'-bipyridine),³⁾ named as *pre*-ELM-11 (ELM stands for Elastic Layer-Structured MOF). Upon heating and dehydration, *pre*-ELM-11 converts to an innovative and stable gas absorbent ELM-11 $[\text{Cu}(\text{bpy})_2(\text{BF}_4)_2]$ (Figure 1). ELM-11 has structural flexibility, and its structural transformation occurs easier than traditional rigid MOFs. And the gate type adsorption isotherm on ELM-11, which has a predominantly rectangular shaped hysteresis, is quite unique (Figure 2).

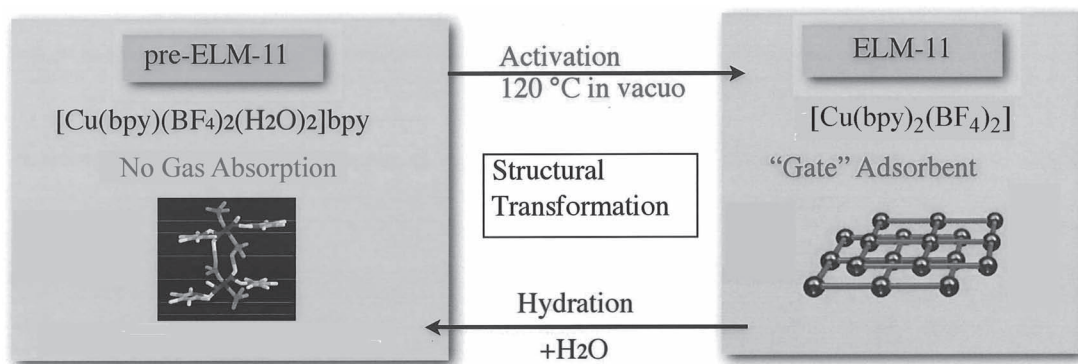


Figure 1. Structure Transformation between *pre*-ELM-11 and ELM-11

Pre-ELM-11 is easily converted to ELM-11 by an activation process (dehydration). Recommended conditions are 120°C for 3 h in vacuo. ELM-11 is stable on drying at rt. ELM-11 rapidly absorbs moisture in atmospheric conditions and changes its structure to *pre*-ELM-11, but can be re-transformed.

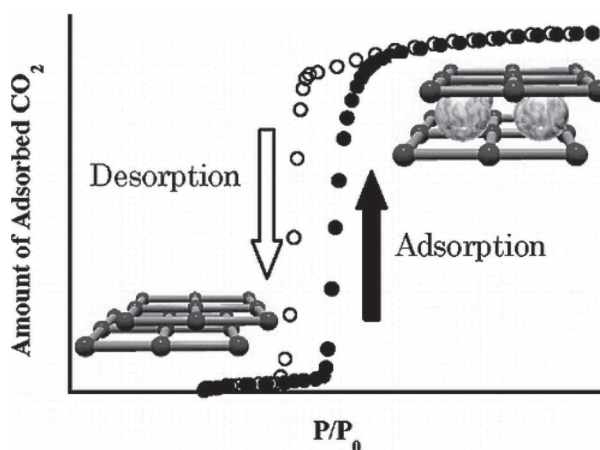
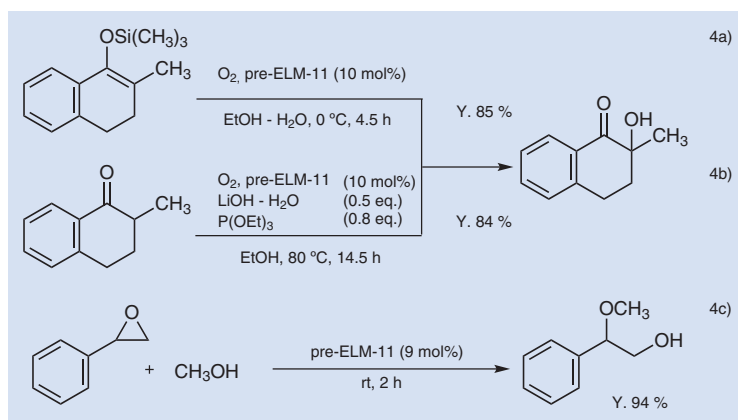


Figure 2. Schematic representation of the gate adsorption of CO_2 ^{3a)}

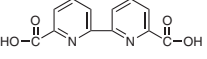
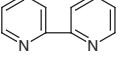
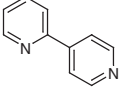
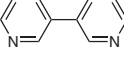
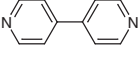
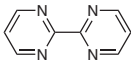
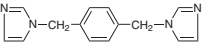
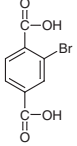
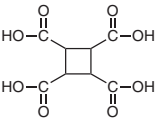
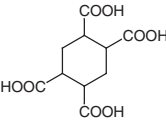
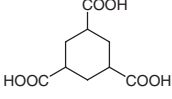
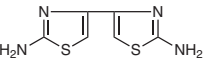
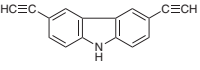
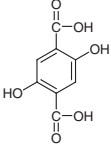
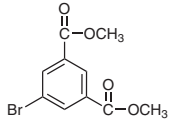
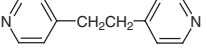
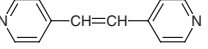
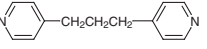
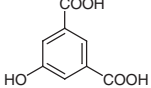
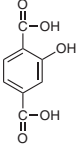
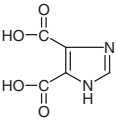
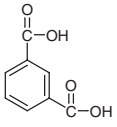
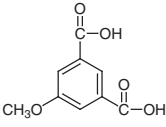
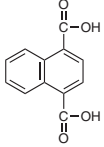
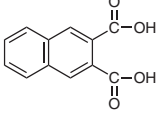
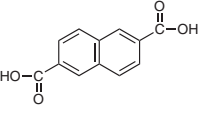
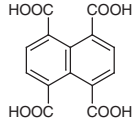
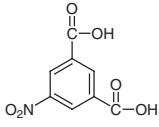
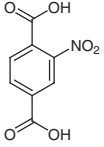
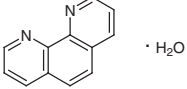
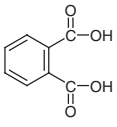
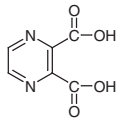
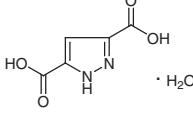
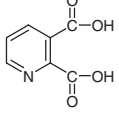
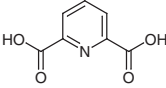
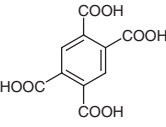
Pre-ELM-11 is also utilized as a catalyst in organic synthesis for molecular oxygen-derived oxidation and epoxide alcoholysis (Scheme).⁴⁾

Scheme. Molecular oxygen-derived oxidation and epoxide alcoholysis using *pre*-ELM-11

MOF/PCP	C2409
	[Cu(bpy)(BF ₄) ₂ (H ₂ O) ₂]bpy

Product No.	Product Name	Unit Size
C2409	<i>pre</i> -ELM-11	5g

Ligands for MOF/PCP		A0088	A1358	A1290
		<chem>OC(=O)C#CC(=O)O</chem>	<chem>OC(=O)C12CC3CC4C(C1)C(C2)C(C3)C4</chem>	<chem>OC(=O)c1ccc(N)cc1C(=O)O</chem> · xH ₂ O
A1291	B4294	B0043	D0864	B1191
<chem>OC(=O)c1ccc(N)cc1C(=O)O</chem>	<chem>N#Cc1cc(C#N)cc(C#N)c1</chem>	<chem>OC(=O)c1cc(C(=O)O)cc(C(=O)O)c1</chem>	<chem>OC(=O)c1ccccc1C(=O)O</chem>	<chem>OC(=O)c1ccc(cc1)-c2ccc(cc2)C(=O)O</chem>
B3792	B4297	B3622	B1876	B3502
<chem>OC(=O)c1cc(C(=O)O)cc(C(=O)O)c1</chem>	<chem>c1ccc2nc3ccncc3cc2n1</chem>	<chem>OC(=O)c1ccc2c(c1)c(cn2)C(=O)O</chem>	<chem>OC(=O)c1ccc2c(c1)c(cn2)C(=O)O</chem>	<chem>OC(=O)c1ccc2c(c1)c(cn2)C(=O)O</chem>

B3533	B0468	B0863	B3984	B0469
				
B2496	B4023	B1321	C2502	C2198
				
C2029	D4273	D0134	D4275	D3899
				
D4068	D3752	D0276	D0938	H0794
				
H1385	I0001	I0003	I0155	M1835
				
M0345	N0606	N0526	N0377	N0770
				
N0520	N0272	P0221	P0287	P0544
				
P0545	P1048	P0550	P0554	B0039
				

S0850	T0166	T0975	T2760	B0042
T1937	T2647			

Product No.	Product Name	Unit Size	
A0088	Acetylenedicarboxylic Acid	5g	25g
A1358	1,3-Adamantanedicarboxylic Acid	5g	25g
A1290	5-Aminoisophthalic Acid Hydrate	25g	500g
A1291	2-Aminoterephthalic Acid		25g
B4294	1,3,5-Benzenetricarbonitrile	1g	5g
B0043	1,3,5-Benzenetricarboxylic Acid	25g	100g 500g
D0864	2,2'-Biphenyldicarboxylic Acid	25g	100g
B1191	4,4'-Biphenyldicarboxylic Acid	5g	25g
B3792	Biphenyl-3,3',5,5'-tetracarboxylic Acid		200mg
B4297	2,2'-Bipyrazine		100mg
B3622	2,2'-Bipyridine-3,3'-dicarboxylic Acid	1g	5g
B1876	2,2'-Bipyridine-4,4'-dicarboxylic Acid	100mg	1g
B3502	2,2'-Bipyridine-5,5'-dicarboxylic Acid		1g
B3533	2,2'-Bipyridine-6,6'-dicarboxylic Acid	1g	5g
B0468	2,2'-Bipyridyl	25g	100g 500g
B0863	2,4'-Bipyridyl	1g	5g
B3984	3,3'-Bipyridyl	1g	5g
B0469	4,4'-Bipyridyl	25g	100g
B2496	2,2'-Bipyrimidyl	200mg	1g
B4023	1,4-Bis[(1 <i>H</i> -imidazol-1-yl)methyl]benzene		5g
B1321	Bromoterephthalic Acid	5g	25g
C2502	1,2,3,4-Cyclobutanetetracarboxylic Acid		1g
C2198	1,2,4,5-Cyclohexanetetracarboxylic Acid	5g	25g
C2029	1,3,5-Cyclohexanetricarboxylic Acid (<i>cis</i> - and <i>trans</i> - mixture)	5g	25g
D4273	2,2'-Diamino-4,4'-bithiazole	200mg	1g
D0134	1,4-Diazabicyclo[2.2.2]octane	25g	100g 500g
D4275	3,6-Diethynylcarbazole	200mg	1g
D3899	2,5-Dihydroxyterephthalic Acid	5g	25g
D4068	Dimethyl 5-Bromoisophthalate	1g	5g
D3752	1,2-Di(4-pyridyl)ethane	1g	5g
D0276	1,2-Di(4-pyridyl)ethylene	10g	25g
D0938	1,3-Di(4-pyridyl)propane	25g	500g
H0794	5-Hydroxyisophthalic Acid	25g	500g
H1385	2-Hydroxyterephthalic Acid	1g	5g
I0001	Imidazole	25g	100g 500g
I0003	1 <i>H</i> -Imidazole-4,5-dicarboxylic Acid	5g	25g
I0155	Isophthalic Acid	25g	500g
M1835	5-Methoxyisophthalic Acid		5g
M0345	2-Methylimidazole	25g	100g 500g
N0606	1,4-Naphthalenedicarboxylic Acid		25g
N0526	2,3-Naphthalenedicarboxylic Acid	5g	25g
N0377	2,6-Naphthalenedicarboxylic Acid	25g	100g
N0770	1,4,5,8-Naphthalenetetracarboxylic Acid (contains Monoanhydride)	25g	250g
N0520	5-Nitroisophthalic Acid	25g	500g
N0272	Nitroterephthalic Acid		25g
P0221	1,10-Phenanthroline Monohydrate	1g	25g
P0287	Phthalic Acid	25g	500g
P0544	Pyrazine	25g	500g
P0545	2,3-Pyrazinedicarboxylic Acid		25g
P1048	3,5-Pyrazoledicarboxylic Acid Monohydrate	5g	25g

Product No.	Product Name	Unit Size	
P0550	2,3-Pyridinedicarboxylic Acid	25g	500g
P0554	2,6-Pyridinedicarboxylic Acid	25g	500g
B0039	Pyromellitic Acid	25g	500g
S0850	Salicylaldehyde Azine	5g	25g
T0166	Terephthalic Acid	25g	500g
T0975	Tetrahydrofuran-2,3,4,5-tetracarboxylic Acid	25g	500g
T2760	1,3,5-Triethynylbenzene	1g	5g
B0042	Trimellitic Acid	25g	100g
T1937	2,4,6-Tri(4-pyridyl)-1,3,5-triazine (purified by sublimation)	1g	5g
T2647	1,3,5-Tris(4-carboxyphenyl)benzene	1g	5g

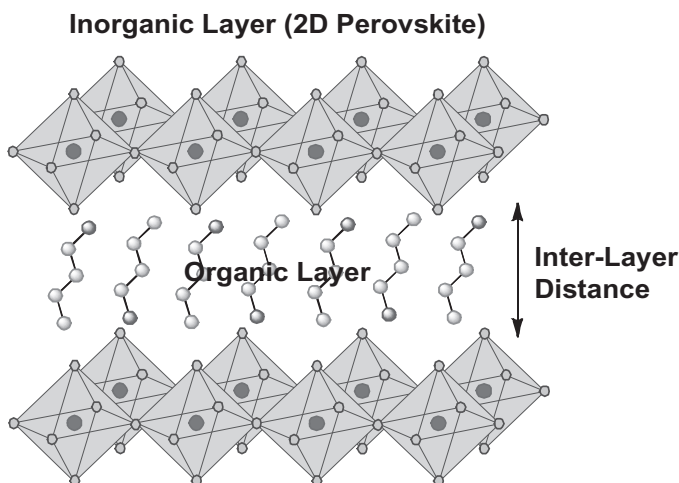
References

- Reviews of metal-organic frameworks (MOFs / PCPs)
 - "Chemistry of Coordination Space", ed. by H. Nishihara, *Coord. Chem. Rev.* **2007**, *251*, 2489-2766.
 - M. P. Suh, Y. E. Cheon, E. Y. Lee, *Coord. Chem. Rev.* **2008**, *250*, 1007.
 - A. Corma, H. García, F. X. L. Xamena, *Chem. Rev.* **2010**, *110*, 4606.
- Electrocatalyst for ethanol oxidation
 - Yang, S. Kinoshita, T. Yamada, S. Kanda, H. Kitagawa, M. Tokunaga, T. Ishimoto, T. Ogura, R. Nagumo, A. Miyamoto, M. Koyama, *Angew. Chem. Int. Ed.* **2010**, *49*, 5348.
- For gas storage and gas separation research of pre-ELM-11
 - D. Li, K. Kaneko, *Chem. Phys. Lett.* **2001**, *335*, 50.
 - A. Kondo, H. Noguchi, S. Ohnishi, H. Kajiro, A. Tohdoh, Y. Hattori, W.-C. Xu, H. Tanaka, H. Kanoh, K. Kaneko, *Nano Lett.* **2006**, *6*, 2581.
 - H. Noguchi, A. Kondo, Y. Hattori, H. Kajiro, H. Kanoh, K. Kaneko, *J. Phys. Chem. C* **2007**, *111*, 248.
 - H. Kanoh, A. Kondo, H. Noguchi, H. Kajiro, A. Tohdoh, Y. Hattori, W.-C. Xu, M. Inoue, T. Sugiura, K. Morita, H. Tanaka, T. Ohba, K. Kaneko, *J. Colloid Interface Sci.* **2009**, *334*, 1.
 - H. Kajiro, A. Kondo, K. Kaneko, H. Kanoh, *Int. J. Mol. Sci.* **2010**, *11*, 3803.
 - Nippon Steel Corporation, Nippon Steel Chemical Co., Ltd., Institute of Research and Innovation, Jpn. Kokai Tokkyo Koho 2005 162624; Nippon Steel Corporation, Nippon Steel Chemical Co., Ltd., Institute of Research and Innovation, Jpn. Kokai Tokkyo Koho 2005 162625; Nippon Steel Corporation, Institute of Research and Innovation, Jpn. Kokai Tokkyo Koho 2005 336129; Nippon Steel Corporation, Jpn. Kokai Tokkyo Koho 2005 232031.
- For catalysis research of pre-ELM-11
 - T. Arai, H. Takasugi, T. Sato, H. Noguchi, H. Kanoh, K. Kaneko, A. Yanagisawa, *Chem. Lett.* **2005**, *34*, 1590.
 - T. Arai, T. Sato, H. Noguchi, H. Kanoh, K. Kaneko, A. Yanagisawa, *Chem. Lett.* **2006**, *35*, 1094.
 - D. Jiang, T. Mallat, F. Krumeich, A. Baiker, *J. Catal.* **2008**, *257*, 390.

Organic-Inorganic Perovskite Precursors

'Perovskite' originates from the mineral name of calcium titanate (CaTiO_3) and the compounds with formula of ABO_3 generally belong to a perovskite-type compound, where the A is a divalent and B is a tetravalent metal ion. A perovskite with cubic or orthorhombic phases shows ferroelectricity, for instance, barium titanate (BaTiO_3) is a ferroelectric or piezoelectric material.¹⁾ High temperature superconductive oxides with unit of a copper oxide are obtained from all perovskite compounds.²⁾ These perovskite compounds consist of metal ions and oxygen atoms, and are manufactured by a physical procedure (eg. sintering method).³⁾ Modification of the metal ion and a changing ratio of the metal ion components can drastically control physical properties of the perovskite. In addition to the oxide perovskites, halide-based perovskites are also well known.

On the other hand, one can replace the cationic component with an organic ammonium. In this case, a chemical method can provide a perovskite compound. This perovskite compound is called an 'organic-inorganic perovskite compound', because it contains an organic component. A metal ion component usually involves tin or lead.^{4,5)} This perovskite compound has the general formula $[(\text{RNH}_3)_m\text{MX}_n]$, in which modifications of metal (M), halide (X) and organic groups (R) precisely control physical properties. Among them, the tin perovskite is relatively better for electrical conduction,⁶⁾ and the lead one is better for optical properties.⁷⁾ A chemical modification of the halide controls band gap.⁸⁾ Selection of organic ammonium halide, metal halide and their mixing ratio changes the component ratio of the halide. The organic groups are selected from methyl, long alkyls, phenyl, benzyl, phenethyl and so on. Diversity of these organic groups allows controlling the structure of a perovskite compound. For instance, a perovskite compound with $\text{R} = \text{methyl}$ provides $[(\text{MeNH}_3)\text{MX}_3]$ having a three-dimensional cubic perovskite structure.⁹⁾ A perovskite compound with $\text{R} = \text{C}_n\text{H}_{2n+1}$ ($n \geq 2$) provides a two-dimensional perovskite layer and the length of alkyl group can control the inter-layer distance.¹⁰⁾



An application of organic-inorganic perovskite is a perovskite solar cell.¹¹⁾ This solar cell can be usually fabricated by the three-dimensional cubic perovskite $[(\text{MeNH}_3)\text{MX}_3]$. Research on the perovskite solar cell recently received much attention. Power conversion efficiency of this solar cell is more than those of organic photovoltaics (OPV) and dye-sensitized solar cells (DSSC), and the device can be fabricated by solution-process at low cost.

A2778	B4566	B4434	B4433	D4667

D4643	D4555	E1045	F0973	F0974
G0449	G0450	I0935	I0934	M2556
P2213	P2212			

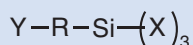
Product No.	Product Name	Unit Size	
A2778	Aniline Hydroiodide	1g	5g
B4566	Benzylamine Hydroiodide	1g	5g
B4434	<i>tert</i> -Butylamine Hydroiodide	1g	5g
B4433	Butylamine Hydroiodide	1g	5g
D4667	Diethylamine Hydrobromide	1g	5g
D4643	Diethylamine Hydroiodide	1g	5g
D4555	Dimethylamine Hydroiodide	1g	5g
E1045	Ethylamine Hydroiodide	1g	5g
F0973	Formamidinium Hydrobromide	1g	5g
F0974	Formamidinium Hydroiodide	1g	5g
G0449	Guanidine Hydrobromide	1g	5g
G0450	Guanidine Hydroiodide	1g	5g
I0935	Isobutylamine Hydroiodide	1g	5g
I0934	Isopropylamine Hydroiodide	1g	5g
M2556	Methylamine Hydroiodide	1g	5g 25g
P2213	2-Phenylethylamine Hydroiodide	1g	5g
P2212	Propylamine Hydroiodide	1g	5g

References

- 1) E. Sawaguchi, Y. Akishige, M. Kobayashi, *J. Phys. Soc. Jpn.* **1985**, *54*, 480.
- 2) Y. Tokura, H. Takagi, S. Uchida, *Nature* **1989**, *337*, 345.
- 3) F. S. Galasso, M. Kestigan, *Inorg. Synth.* **1973**, *14*, 142.
- 4) D. B. Mitzi, C. A. Feild, W. T. A. Harrison, A. M. Guloy, *Nature* **1994**, *369*, 467.
- 5) K. Liang, D. B. Mitzi, M. T. Prikas, *Chem. Mater.* **1998**, *10*, 403.
- 6) Y. Takahashi, R. Obara, Z.-Z. Lin, Y. Takahashi, T. Naito, T. Inabe, S. Ishibashi, K. Terakura, *Dalton Trans.* **2011**, *40*, 5563.
- 7) N. Pellet, P. Gao, G. Gregori, T.-Y. Yang, M. K. Nazeeruddin, J. Maier, M. Grätzel, *Angew. Chem. Int. Ed.* **2014**, *53*, 3151.
- 8) S. A. Kulkarni, T. Baikie, P. P. Boix, N. Yantara, N. Mathews, S. Mhaisalkar, *J. Mater. Chem. A* **2014**, *2*, 9221.
- 9) Y. Kawamura, H. Mashiyama, K. Hasebe, *J. Phys. Soc. Jpn.* **2002**, *71*, 1694.
- 10) T. Ishihara, J. Takahashi, T. Goto, *Phys. Rev. B* **1990**, *42*, 11099.
- 11) A. Kojima, K. Teshima, Y. Shirai, T. Miyasaka, *J. Am. Chem. Soc.* **2009**, *131*, 6050.

Silane Coupling Agents

Silane coupling agents are organosilicon compounds having two functional groups with different reactivity. One of the two functional groups reacts with organic materials and the other reacts with inorganic materials. Their general structure is as follows:



Where Y denotes a functional group that links with organic materials, e.g. vinyl, epoxy, amino group and so on. X is a functional group that undergoes hydrolysis by water or moisture to form silanol. This silanol links with inorganic materials. Representative examples of X include chlorine, alkoxy, and acetoxy group.

Silane coupling agents are effective for the improved adhesion at the interface between the organic and inorganic materials and have been frequently utilized to enhance the strength and improve the performance of glass-fiber reinforced plastics. Recently, they have been used in the manufacture of inorganic-organic hybrid materials such as the laminating board for printed circuit boards, artificial marble, plastic magnets, and silica-immobilized bioactive compounds.

In addition to the original purpose of improving the adhesiveness of an interface, different applications are being explored. Examples include synthesis of moisture crosslinkable polymers using the reactivity of hydrolytic functional group, to give antistatic and antibacterial properties from surface treatment using silane coupling agents. It is expected that silane coupling agents will be applied in many fields.

Olefinyl Silanes		A1275	A1538	A0785
		$CH_2=CHCH_2-Si(CH_3)_2Cl$	$CH_2=CHCH_2-Si(CH_3)_2Cl$	$CH_2=CHCH_2-Si(CH_3)_2(OCH_2CH_3)_2$
A1504	B3214	C1208	D2318	D3386
$CH_2=CHCH_2-Si(CH_3)_2OCH_3$	 -Si(OCH ₂ CH ₃) ₃	$CH_2=CH-Si(CH_3)_2Cl$	$CH_2=CH-Si(CH_3)_2OCH_2CH_3$	$CH_2=CH-Si(CH_3)_2OCH_3$
V0046	T0407	V0044	V0042	V0048
$CH_2=CH-Si(CH_3)_2OCH_2CH_3$	$CH_2=CH-Si(CH_3)_2Cl$	$CH_2=CH-Si(CH_3)_2OCH_2CH_3$	$CH_2=CH-Si(CH_3)_2OCH_3$	$CH_2=CH-Si(CH_3)_2OCH_2CH_2OCH_3$

Product No.	Product Name	Unit Size	
A1275	Allylchlorodimethylsilane	10mL	25mL
A1538	Allyltrichlorosilane	5g	25g
A0785	Allyltriethoxysilane	10mL	
A1504	Allyltrimethoxysilane	5mL	25mL
B3214	[Bicyclo[2.2.1]hept-5-en-2-yl]triethoxysilane (mixture of isomers)	1g	5g
C1208	Chlorodimethylvinylsilane	25mL	100mL

Product No.	Product Name	Unit Size		
D2318	Diethoxymethylvinylsilane			25mL
D3386	Dimethoxymethylvinylsilane	25g		250g
V0046	Dimethylethoxyvinylsilane			25mL
T0407	Trichlorovinylsilane	25g	100g	500g
V0044	Triethoxyvinylsilane	25mL	100mL	500mL
V0042	Vinyltrimethoxysilane	25mL	100mL	500mL
V0048	Vinyltris(2-methoxyethoxy)silane		25mL	500mL

Acryloyloxyalkyl Silanes		D4679	M1530	M2525
		$\text{CH}_2=\text{C}(\text{CH}_3)-\text{C}(=\text{O})-\text{O}(\text{CH}_2)_3-\text{Si}(\text{CH}_3)(\text{OCH}_2\text{CH}_3)_2$	$\text{CH}_2=\text{C}(\text{CH}_3)-\text{C}(=\text{O})-\text{O}(\text{CH}_2)_3-\text{Si}(\text{CH}_3)(\text{OCH}_3)_2$	$\text{CH}_2=\text{C}(\text{CH}_3)-\text{C}(=\text{O})-\text{O}(\text{CH}_2)_3-\text{Si}(\text{CH}_3)(\text{OCH}_3)_2$
T2676	A1597	M0725	M1324	
$\text{CH}_2=\text{C}(\text{CH}_3)-\text{C}(=\text{O})-\text{O}(\text{CH}_2)_3-\text{Si}(\text{CH}_3)(\text{OCH}_2\text{CH}_3)_2$	$\text{CH}_2=\text{CH}-\text{C}(=\text{O})-\text{O}(\text{CH}_2)_3-\text{Si}(\text{CH}_3)(\text{OCH}_3)_2$	$\text{CH}_2=\text{C}(\text{CH}_3)-\text{C}(=\text{O})-\text{O}(\text{CH}_2)_3-\text{Si}(\text{CH}_3)(\text{OCH}_3)_2$	$\text{CH}_2=\text{C}(\text{CH}_3)-\text{C}(=\text{O})-\text{O}(\text{CH}_2)_3-\text{Si}(\text{CH}_3)(\text{OSi}(\text{CH}_3)_3)_2$	

Product No.	Product Name	Unit Size		
D4679	3-[Diethoxy(methyl)silyl]propyl Methacrylate	25mL		
M1530	3-[Dimethoxy(methyl)silyl]propyl Methacrylate	25mL		
M2525	3-(Methoxydimethylsilyl)propyl Acrylate (stabilized with MEHQ)	5g		
T2676	3-(Triethoxysilyl)propyl Methacrylate (stabilized with HQ)	25g		
A1597	3-(Trimethoxysilyl)propyl Acrylate (stabilized with BHT)	25g		
M0725	3-(Trimethoxysilyl)propyl Methacrylate (stabilized with BHT)	25mL	100mL	500mL
M1324	3-[Tris(trimethylsilyloxy)silyl]propyl Methacrylate (stabilized with MEHQ)	25mL	100mL	

Glycidyoxyalkyl Silanes		D2632	G0261	G0210
		$\text{CH}_2\text{O}(\text{CH}_2)_3-\text{Si}(\text{CH}_3)(\text{OCH}_2\text{CH}_3)_2$	$\text{CH}_2\text{O}(\text{CH}_2)_3-\text{Si}(\text{CH}_3)(\text{OCH}_3)_2$	$\text{CH}_2\text{O}(\text{CH}_2)_3-\text{Si}(\text{CH}_3)(\text{OCH}_3)_2$
T2675				
$\text{CH}_2\text{O}(\text{CH}_2)_3-\text{Si}(\text{CH}_3)(\text{OCH}_2\text{CH}_3)_2$				

Product No.	Product Name	Unit Size		
D2632	Diethoxy(3-glycidyloxypropyl)methylsilane	25mL		
G0261	3-Glycidyloxypropyl(dimethoxy)methylsilane	25g	500g	
G0210	3-Glycidyloxypropyltrimethoxysilane	25g	100g	500g
T2675	Triethoxy(3-glycidyloxypropyl)silane	25g		

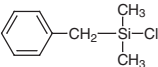
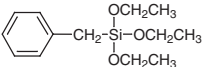
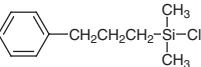
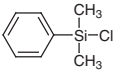
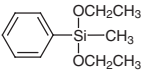
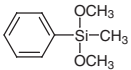
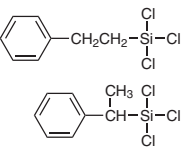
Aminoalkyl Silanes		A0876	A1923	A0774
		$\text{H}_2\text{NCH}_2\text{CH}_2\text{NH}(\text{CH}_2)_3\text{Si}(\text{OCH}_3)_2\text{CH}_3$	$\text{H}_2\text{NCH}_2\text{CH}_2\text{NH}(\text{CH}_2)_3\text{Si}(\text{OCH}_2\text{CH}_3)_2\text{CH}_3$	$\text{H}_2\text{NCH}_2\text{CH}_2\text{NH}(\text{CH}_2)_3\text{Si}(\text{OCH}_3)_2\text{CH}_3$
D1980	A2628	A0439	T1255	B2548
$\text{H}_2\text{N}(\text{CH}_2)_3\text{Si}(\text{OCH}_2\text{CH}_3)_2\text{CH}_3$	$\text{H}_2\text{N}(\text{CH}_2)_3\text{Si}(\text{OCH}_3)_2\text{CH}_3$	$\text{H}_2\text{N}(\text{CH}_2)_3\text{Si}(\text{OCH}_2\text{CH}_3)_2\text{CH}_3$	$\text{H}_2\text{NCH}_2\text{CH}_2\text{CH}_2\text{Si}(\text{OCH}_3)_2\text{CH}_3$	$\text{CH}_3\text{O}-\text{Si}(\text{OCH}_3)_2-(\text{CH}_2)_3\text{NH}(\text{CH}_2)_3\text{Si}(\text{OCH}_3)_2\text{CH}_3$
D4328	T2868	P1458	T2246	T2796
$\text{CH}_3\text{N}(\text{CH}_3)_2\text{Si}(\text{OCH}_3)_2\text{CH}_3$	$\text{CH}_3\text{NH}(\text{CH}_2)_3\text{Si}(\text{OCH}_3)_2\text{CH}_3$	$\text{C}_6\text{H}_5\text{NH}(\text{CH}_2)_3\text{Si}(\text{OCH}_3)_2\text{CH}_3$	$(\text{CH}_3\text{CH}_2\text{O})_3\text{Si}(\text{CH}_2)_3\text{N}^+\text{CH}_3\text{CH}_3\text{Cl}^-$	$(\text{CH}_3\text{O})_3\text{Si}(\text{CH}_2)_3\text{N}^+\text{CH}_3\text{CH}_3\text{Cl}^-$

Product No.	Product Name	Unit Size		
A0876	3-(2-Aminoethylamino)propyldimethoxymethylsilane	25mL	500mL	
A1923	3-(2-Aminoethylamino)propyltriethoxysilane	25g		
A0774	3-(2-Aminoethylamino)propyltrimethoxysilane	25g	100g	500g
D1980	3-Aminopropyldiethoxymethylsilane	25mL	100mL	500mL
A2628	3-Aminopropyldimethoxymethylsilane	25mL		
A0439	3-Aminopropyltriethoxysilane	25g	100g	500g
T1255	3-Aminopropyltrimethoxysilane	25mL	100mL	500mL
B2548	Bis[3-(trimethoxysilyl)propyl]amine	25g	500g	
D4328	[3-(<i>N,N</i> -Dimethylamino)propyl]trimethoxysilane	5mL	25mL	
T2868	Trimethoxy[3-(methylamino)propyl]silane	25g	100g	
P1458	Trimethoxy[3-(phenylamino)propyl]silane	25g	250g	
T2246	Trimethyl[3-(triethoxysilyl)propyl]ammonium Chloride	5g	25g	
T2796	Trimethyl[3-(trimethoxysilyl)propyl]ammonium Chloride (ca. 50% in Methanol)	10g	25g	

Alkyl Silanes		B4123	B2927	B2010
		$\text{CH}_3\text{CH}_2\text{O}-\text{Si}(\text{OCH}_2\text{CH}_3)_2-\text{CH}_2\text{CH}_2-\text{Si}(\text{OCH}_2\text{CH}_3)_2\text{CH}_3$	$\text{CH}_3\text{O}-\text{Si}(\text{OCH}_3)_2-\text{CH}_2\text{CH}_2-\text{Si}(\text{OCH}_3)_2\text{CH}_3$	$\text{CH}_3(\text{CH}_2)_3\text{Si}(\text{CH}_3)_2\text{Cl}$
B0995	B0393	C1468	D2262	D1590
$\text{CH}_3\text{C}(\text{CH}_3)_2\text{Si}(\text{CH}_3)_2\text{Cl}$	$\text{CH}_3(\text{CH}_2)_3\text{Si}(\text{Cl})_2\text{Cl}$	$\text{CH}_3(\text{CH}_2)_9\text{Si}(\text{CH}_3)_2\text{Cl}$	$\text{CH}_3\text{CH}(\text{CH}_3)\text{CH}_2\text{CH}_2\text{Si}(\text{CH}_3)_2\text{Cl}$	$\text{CH}_3\text{CH}_2\text{CH}_2\text{Si}(\text{CH}_3)_2\text{Cl}$

T2116 $\begin{array}{c} \text{CH}_3 \quad \text{CH}_3 \text{ CH}_3 \\ \diagdown \quad \quad / \\ \text{CH}_3 - \text{CH} - \text{C} - \text{Si} - \text{Cl} \\ \quad \quad \quad \quad \\ \quad \quad \text{CH}_3 \text{ CH}_3 \end{array}$	C1469 $\begin{array}{c} \text{CH}_3 \\ \\ \text{CH}_3(\text{CH}_2)_{11} - \text{Si} - \text{Cl} \\ \\ \text{CH}_3 \end{array}$	T0589 $\begin{array}{c} \text{CH}_2\text{CH}_3 \\ \\ \text{CH}_3\text{CH}_2 - \text{Si} - \text{Cl} \\ \\ \text{CH}_2\text{CH}_3 \end{array}$	C0306 $\begin{array}{c} \text{CH}_3 \\ \\ \text{CH}_3 - \text{Si} - \text{Cl} \\ \\ \text{CH}_3 \end{array}$	C0892 $\begin{array}{c} \text{SiCl}_3 \\ \\ \text{C}_6\text{H}_{11} \end{array}$
C2280 $\begin{array}{c} \text{OCH}_3 \\ \\ \text{C}_6\text{H}_{11} - \text{Si} - \text{OCH}_3 \\ \\ \text{OCH}_3 \end{array}$	D1486 $\begin{array}{c} \text{Cl} \\ \\ \text{CH}_3(\text{CH}_2)_9 - \text{Si} - \text{Cl} \\ \\ \text{Cl} \end{array}$	D0135 $\begin{array}{c} \text{CH}_3 \\ \\ \text{Cl} - \text{Si} - \text{CH}_2\text{CH}_3 \\ \\ \text{CH}_3 \end{array}$	D1594 $\begin{array}{c} \text{CH}_3 \quad \text{CH}_3 \\ \diagdown \quad \quad / \\ \text{CH}_3 - \text{Si} - \text{Cl} \\ \quad \quad \\ \quad \quad \text{CH}_3 \end{array}$	D1560 $\begin{array}{c} \text{CH}_3 \\ \\ \text{CH}_3(\text{CH}_2)_{17} - \text{Si} - \text{Cl} \\ \\ \text{CH}_3 \end{array}$
D1827 $\begin{array}{c} \text{CH}_3 \\ \\ \text{CH}_3(\text{CH}_2)_7 - \text{Si} - \text{Cl} \\ \\ \text{CH}_3 \end{array}$	D1509 $\begin{array}{c} \text{Cl} \\ \\ \text{CH}_3(\text{CH}_2)_{11} - \text{Si} - \text{Cl} \\ \\ \text{Cl} \end{array}$	D1510 $\begin{array}{c} \text{OCH}_2\text{CH}_3 \\ \\ \text{CH}_3(\text{CH}_2)_{11} - \text{Si} - \text{OCH}_2\text{CH}_3 \\ \\ \text{OCH}_2\text{CH}_3 \end{array}$	D3383 $\begin{array}{c} \text{OCH}_3 \\ \\ \text{CH}_3(\text{CH}_2)_{11} - \text{Si} - \text{OCH}_3 \\ \\ \text{OCH}_3 \end{array}$	E0188 $\begin{array}{c} \text{Cl} \\ \\ \text{CH}_3\text{CH}_2 - \text{Si} - \text{Cl} \\ \\ \text{Cl} \end{array}$
E0789 $\begin{array}{c} \text{OCH}_3 \\ \\ \text{CH}_3\text{CH}_2 - \text{Si} - \text{OCH}_3 \\ \\ \text{OCH}_3 \end{array}$	H1376 $\begin{array}{c} \text{OCH}_3 \\ \\ \text{CH}_3(\text{CH}_2)_{15} - \text{Si} - \text{OCH}_3 \\ \\ \text{OCH}_3 \end{array}$	H1158 $\begin{array}{c} \text{OCH}_2\text{CH}_3 \\ \\ \text{CH}_3(\text{CH}_2)_5 - \text{Si} - \text{OCH}_2\text{CH}_3 \\ \\ \text{OCH}_2\text{CH}_3 \end{array}$	H0879 $\begin{array}{c} \text{OCH}_3 \\ \\ \text{CH}_3(\text{CH}_2)_5 - \text{Si} - \text{OCH}_3 \\ \\ \text{OCH}_3 \end{array}$	I0452 $\begin{array}{c} \text{CH}_3 \quad \text{Cl} \\ \quad \\ \text{CH}_3 - \text{CH} - \text{CH}_2 - \text{Si} - \text{Cl} \\ \quad \quad \\ \quad \quad \text{Cl} \end{array}$
O0165 $\begin{array}{c} \text{OCH}_2\text{CH}_3 \\ \\ \text{CH}_3(\text{CH}_2)_{17} - \text{Si} - \text{OCH}_2\text{CH}_3 \\ \\ \text{OCH}_2\text{CH}_3 \end{array}$	O0256 $\begin{array}{c} \text{OCH}_3 \\ \\ \text{CH}_3(\text{CH}_2)_{17} - \text{Si} - \text{OCH}_3 \\ \\ \text{OCH}_3 \end{array}$	O0168 $\begin{array}{c} \text{Cl} \\ \\ \text{CH}_3(\text{CH}_2)_7 - \text{Si} - \text{Cl} \\ \\ \text{Cl} \end{array}$	T2517 $\begin{array}{c} \text{Cl} \quad \text{CH}_3 \\ \quad \\ \text{Cl} - \text{Si} - \text{C} - \text{CH} \\ \quad \quad \\ \text{Cl} \quad \text{CH}_3 \quad \text{CH}_3 \end{array}$	H0547 $\begin{array}{c} \text{Cl} \\ \\ \text{CH}_3(\text{CH}_2)_5 - \text{Si} - \text{Cl} \\ \\ \text{Cl} \end{array}$
M0450 $\begin{array}{c} \text{Cl} \\ \\ \text{CH}_3 - \text{Si} - \text{Cl} \\ \\ \text{Cl} \end{array}$	O0079 $\begin{array}{c} \text{Cl} \\ \\ \text{CH}_3(\text{CH}_2)_{17} - \text{Si} - \text{Cl} \\ \\ \text{Cl} \end{array}$	P0371 $\begin{array}{c} \text{Cl} \\ \\ \text{CH}_3(\text{CH}_2)_2 - \text{Si} - \text{Cl} \\ \\ \text{Cl} \end{array}$	T0924 $\begin{array}{c} \text{Cl} \\ \\ \text{CH}_3(\text{CH}_2)_{13} - \text{Si} - \text{Cl} \\ \\ \text{Cl} \end{array}$	E0189 $\begin{array}{c} \text{OCH}_2\text{CH}_3 \\ \\ \text{CH}_3\text{CH}_2 - \text{Si} - \text{OCH}_2\text{CH}_3 \\ \\ \text{OCH}_2\text{CH}_3 \end{array}$
M0451 $\begin{array}{c} \text{OCH}_2\text{CH}_3 \\ \\ \text{CH}_3 - \text{Si} - \text{OCH}_2\text{CH}_3 \\ \\ \text{OCH}_2\text{CH}_3 \end{array}$	O0171 $\begin{array}{c} \text{OCH}_2\text{CH}_3 \\ \\ \text{CH}_3(\text{CH}_2)_7 - \text{Si} - \text{OCH}_2\text{CH}_3 \\ \\ \text{OCH}_2\text{CH}_3 \end{array}$	T2867 $\begin{array}{c} \text{OCH}_2\text{CH}_3 \\ \\ \text{CH}_3\text{CH}_2\text{CH}_2 - \text{Si} - \text{OCH}_2\text{CH}_3 \\ \\ \text{OCH}_2\text{CH}_3 \end{array}$	T1078 $\begin{array}{c} \text{Pr} \\ \\ \text{Pr} - \text{Si} - \text{Cl} \\ \\ \text{Pr} \end{array}$	M0660 $\begin{array}{c} \text{OCH}_3 \\ \\ \text{CH}_3 - \text{Si} - \text{OCH}_3 \\ \\ \text{OCH}_3 \end{array}$
T2875 $\begin{array}{c} \text{OCH}_3 \\ \\ \text{CH}_3(\text{CH}_2)_7 - \text{Si} - \text{OCH}_3 \\ \\ \text{OCH}_3 \end{array}$	T1801 $\begin{array}{c} \text{OCH}_3 \\ \\ \text{CH}_3(\text{CH}_2)_2 - \text{Si} - \text{OCH}_3 \\ \\ \text{OCH}_3 \end{array}$			

Product No.	Product Name	Unit Size		
B4123	1,2-Bis(triethoxysilyl)ethane			5mL
B2927	1,2-Bis(trimethoxysilyl)ethane		5g	25g
B2010	Butylchlorodimethylsilane			25mL
B0995	<i>tert</i> -Butyldimethylchlorosilane	5g	25g	100g
B0393	Butyltrichlorosilane			25g
C1468	Chloro(decyl)dimethylsilane			25mL
D2262	Chlorodiethylisopropylsilane		1g	5g
D1590	Chlorodimethylpropylsilane		5mL	25mL
T2116	Chloro(dimethyl)thexylsilane		5g	25g
C1469	Chloro(dodecyl)dimethylsilane			25mL
T0589	Chlorotriethylsilane	5g	25g	100g
C0306	Chlorotrimethylsilane	25mL	100mL	500mL
C0892	Cyclohexyltrichlorosilane		5g	25g
C2280	Cyclohexyltrimethoxysilane		5g	25g
D1486	Decyltrichlorosilane			25mL
D0135	Dimethylethylchlorosilane		5g	25g
D1594	Dimethylisopropylchlorosilane		5mL	25mL
D1560	Dimethyloctadecylchlorosilane			25mL
D1827	Dimethyl- <i>n</i> -octylchlorosilane		25mL	100mL
D1509	Dodecyltrichlorosilane			25mL
D1510	Dodecyltriethoxysilane			10mL
D3383	Dodecyltrimethoxysilane		25g	250g
E0188	Ethyltrichlorosilane		25g	500g
E0789	Ethyltrimethoxysilane			25g
H1376	Hexadecyltrimethoxysilane			25g
H1158	Hexyltriethoxysilane		25mL	500mL
H0879	Hexyltrimethoxysilane		25mL	500mL
I0452	Isobutyltrichlorosilane		25g	500g
O0165	Octadecyltriethoxysilane			25g
O0256	Octadecyltrimethoxysilane			25mL
O0168	<i>n</i> -Octyltrichlorosilane		25g	250g
T2517	Thexyltrichlorosilane		5g	25g
H0547	Trichlorohexylsilane			25mL
M0450	Trichloro(methyl)silane	25g	100g	500g
O0079	Trichlorooctadecylsilane			25g
P0371	Trichloro(propyl)silane			25g
T0924	Trichlorotetradecylsilane			10mL
E0189	Triethoxyethylsilane			25mL
M0451	Triethoxymethylsilane		25mL	500mL
O0171	Triethoxy- <i>n</i> -octylsilane		25mL	500mL
T2867	Triethoxy(propyl)silane		25g	100g
T1078	Triisopropylsilyl Chloride	5mL	25mL	250mL
M0660	Trimethoxy(methyl)silane		25mL	500mL
T2875	Trimethoxy- <i>n</i> -octylsilane			25mL
T1801	Trimethoxy(propyl)silane		25mL	500mL

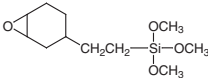
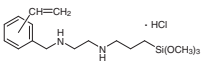
Aryl Silanes, Arylalkyl Silanes		B2334	B3282	C1488
				
D1147	D3760	D2319	P0240	T2852
				

T2854 	T2853 	P0735 	T2869 	P0857
T2560 	T3185 			

Product No.	Product Name	Unit Size		
B2334	Benzylchlorodimethylsilane		5g	
B3282	Benzyltriethoxysilane	1g	5g	25g
C1488	Chlorodimethyl(3-phenylpropyl)silane	5mL	25mL	
D1147	Chlorodimethylphenylsilane		25mL	
D3760	Diethoxy(methyl)phenylsilane		25g	
D2319	Dimethoxymethylphenylsilane	25mL	100mL	
P0240	Phenyltrichlorosilane	25g	500g	
T2852	Trichloro(phenylethyl)silane (mixture of isomers)		25g	
T2854	Trichloro(6-phenylhexyl)silane		5g	25g
T2853	Trichloro(3-phenylpropyl)silane		5g	25g
P0735	Triethoxyphenylsilane	25mL	500mL	
T2869	Trimethoxy(2-phenylethyl)silane [contains ca. 25% Trimethoxy(1-phenylethyl)silane]	25g	100g	
P0857	Trimethoxyphenylsilane	25mL	100mL	500mL
T2560	Trimethoxy(<i>p</i> -tolyl)silane			5g
T3185	Trimethoxy(4-vinylphenyl)silane		5g	25g

Fluoroalkyl Silanes, Fluoroaryl Silanes		C2700 	P0854 	P1242
T2705 	T3030 	T2577 	T2876 	T2860
T1770 	T2917 	T2918 	T3158 	T2720

Product No.	Product Name	Unit Size	
C2700	Chlorodimethyl[3-(2,3,4,5,6-pentafluorophenyl)propyl]silane	5g	25g
P0854	Pentafluorophenyldimethylchlorosilane	1mL	5mL
P1242	Pentafluorophenylethoxydimethylsilane		1g
T2705	Trichloro(1 <i>H</i> ,1 <i>H</i> ,2 <i>H</i> ,2 <i>H</i> -heptadecafluorodecyl)silane	5g	25g
T3030	Trichloro[3-(pentafluorophenyl)propyl]silane	1g	5g
T2577	Trichloro(1 <i>H</i> ,1 <i>H</i> ,2 <i>H</i> ,2 <i>H</i> -tridecafluoro- <i>n</i> -octyl)silane		5g
T2876	Triethoxy-1 <i>H</i> ,1 <i>H</i> ,2 <i>H</i> ,2 <i>H</i> -heptadecafluorodecylsilane		5g
T2860	Triethoxy(1 <i>H</i> ,1 <i>H</i> ,2 <i>H</i> ,2 <i>H</i> -nonafluorohexyl)silane	5g	25g
T1770	Triethoxy-1 <i>H</i> ,1 <i>H</i> ,2 <i>H</i> ,2 <i>H</i> -tridecafluoro- <i>n</i> -octylsilane	5g	25g
T2917	Trimethoxy(1 <i>H</i> ,1 <i>H</i> ,2 <i>H</i> ,2 <i>H</i> -heptadecafluorodecyl)silane	5g	25g
T2918	Trimethoxy(1 <i>H</i> ,1 <i>H</i> ,2 <i>H</i> ,2 <i>H</i> -nonafluorohexyl)silane	5g	25g
T3158	Trimethoxy(11-pentafluorophenoxyundecyl)silane (This product is only available in Japan.)		100mg
T2720	Trimethoxy(3,3,3-trifluoropropyl)silane	5g	25g

Other Silane Coupling Agents		A2783	B0847	C0605
		$\text{N}_3(\text{CH}_2)_{11}-\text{Si}(\text{OCH}_3)_3$	$\text{BrCH}_2-\text{Si}(\text{CH}_3)_2-\text{Cl}$	$\text{ClCH}_2-\text{Si}(\text{CH}_3)_2-\text{Cl}$
C1402	C3073	C1168	C0844	T1253
$\text{ClCH}_2-\text{Si}(\text{OCH}_2\text{CH}_3)_3$	$\text{ClCH}_2-\text{Si}(\text{OCH}_3)_3$	$\text{Cl}(\text{CH}_2)_3-\text{Si}(\text{OCH}_3)_3$	$\text{Cl}(\text{CH}_2)_3-\text{Si}(\text{Cl})_2-\text{Cl}$	$\text{Cl}(\text{CH}_2)_3-\text{Si}(\text{OCH}_2\text{CH}_3)_3$
C1259	C1207	E0327	M1323	M1505
$\text{NCCH}_2\text{CH}_2-\text{Si}(\text{OCH}_2\text{CH}_3)_3$	$\text{NC}-\text{CH}_2\text{CH}_2\text{CH}_2-\text{Si}(\text{CH}_3)_2-\text{Cl}$		$\text{CH}_3-\text{Si}(\text{OCH}_3)_2-(\text{CH}_2)_3\text{SH}$	$\text{HS}(\text{CH}_2)_3-\text{Si}(\text{OCH}_2\text{CH}_3)_3$
M0928	P2258	I0556	U0048	C0840
$\text{HS}(\text{CH}_2)_3-\text{Si}(\text{OCH}_3)_3$	$\text{HC}\equiv\text{C}-\text{CH}_2\text{O}-\text{C}(=\text{O})-\text{NH}(\text{CH}_2)_3-\text{Si}(\text{OCH}_2\text{CH}_3)_3$	$\text{OCN}(\text{CH}_2)_3-\text{Si}(\text{OCH}_2\text{CH}_3)_3$	$\text{H}_2\text{N}-\text{C}(=\text{O})-\text{NH}(\text{CH}_2)_3-\text{Si}(\text{OCH}_2\text{CH}_3)_3$	$\text{ClCH}_2\text{CH}_2\text{CH}_2-\text{Si}(\text{OCH}_3)_3$
T1915	V0050			
$\text{H}_2\text{N}-\text{C}(=\text{O})-\text{NH}(\text{CH}_2)_3-\text{Si}(\text{OCH}_3)_3$				

Product No.	Product Name	Unit Size
A2783	(11-Azidoundecyl)trimethoxysilane	100mg
B0847	(Bromomethyl)chlorodimethylsilane	25g
C0605	Chloro(chloromethyl)dimethylsilane	25g 250g
C1402	(Chloromethyl)triethoxysilane	10g
C3073	(Chloromethyl)trimethoxysilane	5g 25g
C1168	3-Chloropropyltrimethoxymethylsilane	5g 25g

Product No.	Product Name	Unit Size	
C0844	3-Chloropropyltrichlorosilane	25g	
T1253	3-Chloropropyltriethoxysilane	25mL	500mL
C1259	2-Cyanoethyltriethoxysilane	25mL	250mL
C1207	(3-Cyanopropyl)dimethylchlorosilane	5mL	25mL
E0327	2-(3,4-Epoxy cyclohexyl)ethyltrimethoxysilane	25mL	500mL
M1323	3-Mercaptopropyl(dimethoxy)methylsilane	25mL	
M1505	(3-Mercaptopropyl)triethoxysilane	25g	100g 500g
M0928	(3-Mercaptopropyl)trimethoxysilane	25mL	100mL 500mL
P2258	2-Propynyl [3-(Triethoxysilyl)propyl]carbamate	1g	5g
I0556	3-(Triethoxysilyl)propyl Isocyanate	25g	100g
U0048	1-[3-(Triethoxysilyl)propyl]urea (40-52% in Methanol)	25mL	500mL
C0840	3-Trimethoxysilylpropyl Chloride	25mL	500mL
T1915	1-[3-(Trimethoxysilyl)propyl]urea	25g	250g
V0050	N-[2-(N-Vinylbenzylamino)ethyl]-3-aminopropyltrimethoxysilane Hydrochloride (30-40% in Methanol)	25mL	

References

- 1) E. P. Plueddemann, in *Silane Coupling Agents*, 2nd ed., Springer US, New York, **1991**.
- 2) K. L. Mittal, in *Silanes and Other Coupling Agents*, CRC Press, New York, **2009**, Vol. 5.

Self-Assembled Monolayer (SAM) Forming Agents

Self-assembly is the spontaneous gathering and regular arrangement of atoms, molecules and particles and is observed in various natural environments. There are many reports describing basic and applied research into artificial self-assembly, in particular "self-assembled monolayers (SAMs)" formed by the aggregation of organic molecules on a solid surface.

A family of organic silicon compounds, silane coupling agents, can form SAMs on glass, alumina and other inorganic oxide surfaces. Thiols (R-SH) are used to form SAMs on the surface of metal nanoparticles and metal substrates because of their high affinity for gold, silver and other transition metals. Phosphonic acids (R-PO₃H₂) combine with the surfaces of many inorganic oxides to form stable SAMs.

Reference

J. C. Love, L. A. Estroff, J. K. Kriebel, R. G. Nuzzo, G. M. Whitesides, *Chem. Rev.* **2005**, *105*, 1103.

Silane Coupling Agents (see p.305)

Thiols		A0623	B0041	B2888
B0685	B0686	C0727	C0810	D0016
D4047	D4286	D0970	E0672	M1067
M1038	H0029	H0068	H0103	I0149
M0404	M1294	M2266	M2433	M0061

M1323	M0928	M1802	M0682	M1041
O0005	O0026	O0025	P0836	P0861
P0053	P1715	P0488	T0082	T2972
U0066				

Product No.	Product Name	Unit Size	
A0623	4-Aminobenzenethiol	25g	25g
B0041	Benzenethiol	25mL	500mL
B2888	2,3-Butanedithiol	5g	25g
B0685	1-Butanethiol	25mL	500mL
B0686	sec-Butyl Mercaptan	25mL	500mL
C0727	Cyclohexanethiol	25mL	500mL
C0810	Cyclopentanethiol	5mL	25mL
D0016	1-Decanethiol	25mL	500mL
D4047	4-(Dimethylamino)benzenethiol		1g
D4286	3,5-Dimethylbenzenethiol		5g
D0970	1-Dodecanethiol	25mL	500mL
E0672	4-Ethylbenzenethiol	5g	25g
M1067	2-Ethylhexyl 3-Mercaptopropionate	25mL	500mL
M1038	Ethyl 3-Mercaptopropionate	25g	500g
H0029	1-Heptanethiol	10g	25g
H0068	1-Hexadecanethiol	25mL	500mL
H0103	Hexyl Mercaptan	25mL	500mL
I0149	Isoamyl Mercaptan	25mL	250mL
M0404	Isobutyl Mercaptan	25mL	500mL
M1294	4-Mercaptobenzoic Acid	5g	25g
M2266	6-Mercapto-1-hexanol	5g	25g
M2433	3-Mercapto-3-methyl-1-butanol	5g	25g
M0061	3-Mercaptopropionic Acid	25g	100g
M1323	3-Mercaptopropyl(dimethoxy)methylsilane		25mL
M0928	(3-Mercaptopropyl)trimethoxysilane	25mL	100mL
M1802	3-Methoxybutyl 3-Mercaptopropionate	25g	500g
M0682	4-Methylbenzyl Mercaptan	10mL	25mL
M1041	2-Methyl-1-butanethiol	5g	25g
O0005	1-Octadecanethiol	25g	400g
O0026	tert-Octanethiol		5mL
O0025	1-Octanethiol	25mL	500mL
P0836	1-Pentadecanethiol		10mL

Product No.	Product Name	Unit Size	
P0861	Pentafluorobenzenethiol	5g	25g
P0053	1-Pentanethiol	25mL	500mL
P1715	2-Phenylethanethiol	5g	25g
P0488	1-Propanethiol	25mL	500mL
T0082	1-Tetradecanethiol		25mL
T2972	4-(Trifluoromethyl)benzenethiol	1g	5g
U0066	1-Undecanethiol		5mL

Phosphonic Acids		B1591	B4848	D3884
H1459	H1535	H1536	M1155	N1025
O0371	O0380	P2300	P2303	U0088
X0074				

Product No.	Product Name	Unit Size	
B1591	(3-Bromopropyl)phosphonic Acid	1g	5g
B4848	1,4-Butylenediphosphonic Acid		1g
D3884	Decylphosphonic Acid	1g	5g
H1459	(1 <i>H</i> ,1 <i>H</i> ,2 <i>H</i> ,2 <i>H</i> -Heptadecafluorodecyl)phosphonic Acid		200mg
H1535	Heptylphosphonic Acid	1g	5g
H1536	1,6-Hexylenediphosphonic Acid		1g
M1155	4-Methoxyphenylphosphonic Acid		1g
N1025	Nonylphosphonic Acid		1g
O0371	Octadecylphosphonic Acid	1g	5g
O0380	<i>n</i> -Octylphosphonic Acid	1g	5g
P2300	1,5-Pentylenediphosphonic Acid		1g
P2303	1,4-Phenylenediphosphonic Acid	200mg	1g
U0088	Undecylphosphonic Acid	1g	5g
X0074	<i>p</i> -Xylylenediphosphonic Acid	1g	5g

Polymers

Polyvinyl chloride and polyethylene polymers have long been the mainstay of industrial polymers but are now making way for new high performance polymers. Engineering plastics are polymers engineered to have various specific properties.

For example, some polymers are designed for thermal resistance, such as polyamide and polycarbonate, and are widely used. The thermal resistance of a polymer is determined by the softening point: an increase in the softening point increases the material strength. Engineering plastics such as polysulfone, polyether sulfone, polyarylate and polyimide have been developed to improve the softening point and material strength. The softening points of these polymers are all above 150 °C, and these polymers are incorporated into, for example, firefighter uniforms and bulletproof vests. R&D into engineering plastics continues to further improve their performance.

There has also been extensive research into adding new functions to polymers, such as electrical, optical, medical and biological properties. For example, copolymers obtained by the polymerization of fluorine-containing monomers and a variety of other monomers are used to make photoresists, optical fiber dressings, oxygen enrichment membranes, and membrane oxygenators. The maximum absorbance of polysilane is in the ultraviolet region, and it is photosensitive; therefore, polysilane can be used as a positive-type resist with excellent oxygen plasma resistance. Another polymer, polylactic acid (PLA), has been commercialized as an environmentally-friendly polymer that reduces the consumption of fossil fuel resources because it is made from biomass raw materials.

There are many broad applications of polymer materials, making R&D in this field highly promising. The page below describes natural polymers, semisynthetic polymers and synthetic polymers.

Natural Polymers

Product No.	Product Name	Unit Size	
A0733	Alginate Acid	25g	500g
A0456	Amylopectin Hydrate (Amylose free), from Waxy Corn	25g	500g
A0847	Amylose (<i>Mw.</i> =ca. 15,000)		1g
A1328	(+)-Arabinogalactan from Larch Wood		25g
A0738	Calcium Alginate	25g	500g
C1805	<i>ι</i> -Carrageenan	25g	500g
C1804	<i>κ</i> -Carrageenan	25g	500g
C2871	<i>λ</i> -Carrageenan	1g	5g
C0072	Chitin	25g	250g
C2395	Chitosan (5-20mPa·s, 0.5% in 0.5% Acetic Acid at 20°C)	25g	500g
C2396	Chitosan (50-100mPa·s, 0.5% in 0.5% Acetic Acid at 20°C)	25g	100g
C0831	Chitosan (200-600mPa·s, 0.5% in 0.5% Acetic Acid at 20°C)	25g	500g
C0335	Chondroitin Sulfate Sodium Salt	25g	100g
D3672	Dermatan Sulfate Sodium Salt	20mg	100mg
D1448	Dextran 40 (<i>Mw.</i> =ca. 40,000)	25g	500g
D1449	Dextran 70 (<i>Mw.</i> =ca. 70,000)	25g	100g
G0331	Glucan from Black Yeast	1g	5g
H0393	Heparin Sodium Salt from Hog intestine	100mg	1g
H0595	Hyaluronic Acid from Cockscomb		1g
I0041	Inulin	5g	25g
L0082	Lignin (Alkaline)	25g	500g
L0045	Lignin (Dealkaline)	25g	500g
P0024	Pectin from Citrus	25g	500g
H0652	Potassium Hyaluronate from Cockscomb		1g
H0603	Sodium Hyaluronate from Cockscomb	100mg	1g
L0098	Sodium Ligninsulfonate	25g	500g
X0048	Xanthan Gum	25g	500g
Z0008	Zymosan	100mg	1g

Semisynthetic Polymers

Product No.	Product Name	Unit Size	
C0045	Carboxymethyl Cellulose Sodium $n \approx 500$	25g	500g
C0603	Carboxymethyl Cellulose Sodium $n \approx 1050$	25g	500g
E0265	Ethyl Cellulose [9-11mPa·s, 5% in Toluene + Ethanol (80:20) at 25°C]	25g	500g
E0072	Ethyl Cellulose [18-22mPa·s, 5% in Toluene + Ethanol (80:20) at 25°C]	25g	500g
E0266	Ethyl Cellulose [45-55mPa·s, 5% in Toluene + Ethanol (80:20) at 25°C]	25g	500g
E0290	Ethyl Cellulose [90-110mPa·s, 5% in Toluene + Ethanol (80:20) at 25°C]	25g	500g
H0242	Hydroxyethyl Cellulose (200-300mPa·s, 2% in Water at 20°C)	25g	500g
H0418	Hydroxyethyl Cellulose (800-1,500mPa·s, 2% in Water at 20°C)	25g	500g
H0392	Hydroxyethyl Cellulose (4,500-6,500mPa·s, 2% in Water at 25°C)	25g	500g
H0473	Hydroxypropyl Cellulose (3-6mPa·s, 2% in Water at 20°C)	25g	500g
H0474	Hydroxypropyl Cellulose (6-10mPa·s, 2% in Water at 20°C)	25g	500g
H0386	Hydroxypropyl Cellulose (150-400mPa·s, 2% in Water at 20°C)	25g	500g
H0475	Hydroxypropyl Cellulose (1,000-4,000mPa·s, 2% in Water at 20°C)	25g	500g
M0290	Methyl Cellulose (13-18mPa·s, 2% in Water at 20°C)	25g	500g
M0291	Methyl Cellulose (20-30mPa·s, 2% in Water at 20°C)	25g	500g
M0292	Methyl Cellulose (80-120mPa·s, 2% in Water at 20°C)	25g	500g
M0293	Methyl Cellulose (350-550mPa·s, 2% in Water at 20°C)	25g	500g
M0294	Methyl Cellulose (1,000-1,800mPa·s, 2% in Water at 20°C)	25g	500g
M0185	Methyl Cellulose (3,500-5,600mPa·s, 2% in Water at 20°C)	25g	500g
M0295	Methyl Cellulose (7,000-10,000mPa·s, 2% in Water at 20°C)	25g	500g

Synthetic Polymers

Product No.	Product Name	Unit Size	
A0140	Acrylamide Polymer ($M_w = 400,000-800,000$) (containing small amounts of formalin as fungicide) (10% in Water)		500g
A0259	3-Aminobenzaldehyde Polymer		25g
A0260	4-Aminobenzaldehyde Polymer		25g
G0264	Ethyl Glyoxylate Polymer form (47% in Toluene)	25g	100g 500g
M0086	Isobutyl Methacrylate Polymer		25g 500g
M0088	Methyl Methacrylate Polymer		25g 500g
S0098	Poly(diethylene Glycol Succinate)		25g
P0840	Polyethylene Glycol 200		25g 500g
H0543	Polyethylene Glycol 300		25g 500g
N0443	Polyethylene Glycol 400		25g 500g
P1187	Polyethylene Glycol 600		25g 500g
P2034	Polyethylene Glycol 2,000		25g 500g
P0885	Polyethylene Glycol 4,000		25g 500g
P0903	Polyethylene Glycol 6,000		25g 500g
P2241	Polyethylene Glycol Dimethyl Ether ($M_w = ca. 240$)		25g 500g
P0872	Polyethylene Glycol Monolaurate $n \approx 10$		25g 500g
P2183	Polyethylene Glycol Monomethyl Ether 400	100g	500g
P2184	Polyethylene Glycol Monomethyl Ether 550	100g	500g
P2185	Polyethylene Glycol Monomethyl Ether 1000	100g	500g
P2186	Polyethylene Glycol Monomethyl Ether 2000	100g	500g
P2187	Polyethylene Glycol Monomethyl Ether 4000	100g	500g
P0704	Polyethylene Glycol Mono-4-nonylphenyl Ether $n \approx 2$		25g
P0707	Polyethylene Glycol Mono-4-nonylphenyl Ether $n \approx 10$		25g
P0708	Polyethylene Glycol Mono-4-nonylphenyl Ether $n \approx 15$		25g
P0709	Polyethylene Glycol Mono-4-nonylphenyl Ether $n \approx 18$		25g
P0710	Polyethylene Glycol Mono-4-nonylphenyl Ether $n \approx 20$		25g
P0467	Poly(ethylene Glycol Succinate)		25g
P0381	Polyethyleneimine (<i>ca.</i> 30% in Water)	25g	500g
P2018	Poly(3-hexylthiophene-2,5-diyl) (regioregular)	200mg	1g
P0384	Poly(methyl Vinyl Ether) (30% in Water)	25g	500g
S0099	Poly(neopentyl Glycol Succinate)	5g	25g
P0966	Poly(perfluoropropylene Oxide)		10g
P0469	Poly(vinyl Alcohol) $n = 1750 \pm 50$	25g	500g
P0804	Poly(vinyl Alcohol) $n \approx 2,000$ (degree's of saponification <i>ca.</i> 80mol%)	25g	500g
P0656	Poly(<i>N</i> -vinylcarbazole)	5g	25g
P0641	Polyvinylformal	25g	500g
P1007	Poly(vinyl Methyl Ether) (50% in Methanol)		500g
P0691	Polyvinylpyrrolidone (insoluble)		100g

Product No.	Product Name	Unit Size		
P0471	Polyvinylpyrrolidone K 15 Viscosity Average Molecular Wt. 10,000	25g	100g	500g
P0472	Polyvinylpyrrolidone K 30 Viscosity Average Molecular Wt. 40,000	25g	500g	
P0696	Polyvinylpyrrolidone K 60 Viscosity Average Molecular Wt. 160,000 (ca. 35% in Water)	25g	500g	
P0473	Polyvinylpyrrolidone K 90 Viscosity Average Molecular Wt. 360,000	25g	500g	
P0385	Poly(1-vinylpyrrolidone-co-Vinyl Acetate) (Copolymer, 3:7) (50% in Ethanol)	25g	500g	
P0382	Poly(1-vinylpyrrolidone-co-Vinyl Acetate) (Copolymer, 7:3) (50% in Ethanol)	25g	500g	

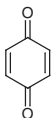
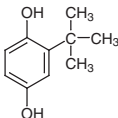
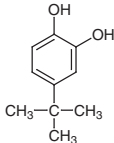
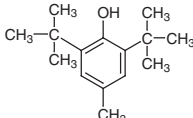
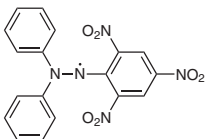
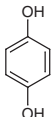
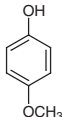
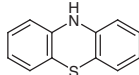
Monomers

Monomers are the building blocks of polymers and are categorized below. Lists of categorized monomers also appear on our website.

Ethylene Monomers
Styrene Monomers
Acrylate Monomers
Methacrylate Monomers
Acrylamide Monomers
Methacrylamide Monomers
Divinyl Monomers, Diallyl Monomers
Cyclic Olefin Monomers
Epoxide Monomers
Diol Monomers
Diamine Monomers
Tetracarboxylic Dianhydride Monomers
Dicarboxylic Acid Monomers
Diacid Chloride Monomers
Bismaleimide Monomers
Isocyanate Monomers
Thiol Monomers
Lactone, Lactide Monomers
etc.

Polymerization Inhibitors

Monomers are often stabilized by the addition of inhibitors to prevent polymerization initiation by light, heat and air. For example, stable radical compounds which can trap free radicals are used to inhibit radical polymerization.

B0887 	B0833 	B0739 	D0228 	D4313 
H0186 	M0123 	P0106 		

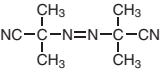
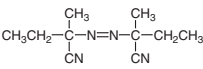
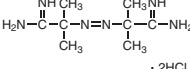
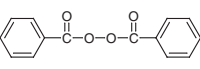
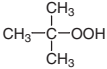
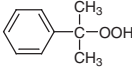
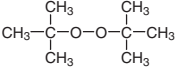
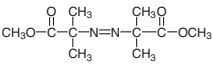
Product No.	Product Name	Unit Size	
B0887	1,4-Benzoquinone	25g	500g
B0833	<i>tert</i> -Butylhydroquinone	25g	500g
B0739	4- <i>tert</i> -Butylpyrocatechol	25g	500g
D0228	2,6-Di- <i>tert</i> -butyl- <i>p</i> -cresol	25g	500g
D4313	1,1-Diphenyl-2-picrylhydrazyl Free Radical	1g	5g
H0186	Hydroquinone	25g	500g
M0123	4-Methoxyphenol	25g	100g 500g
P0106	Phenothiazine	25g	500g

Polymerization Initiators

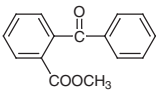
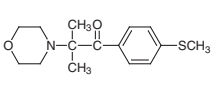
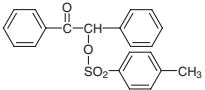
Initiators are often used in chain-growth polymerization such as radical polymerization to regulate initiation by heat or light.

Thermal polymerization initiators are compounds that generate radicals or cations upon exposure to heat. For example, azo compounds such as 2,2'-azobis(isobutyronitrile) (AIBN) and organic peroxides such as benzoyl peroxide (BPO) are well-known thermal radical initiators, and benzenesulfonic acid esters and alkylsulfonium salts have been developed as thermal cation initiators.

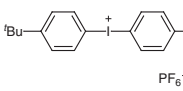
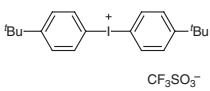
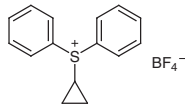
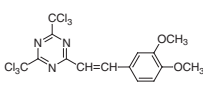
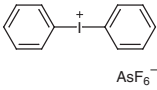
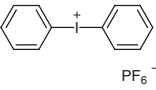
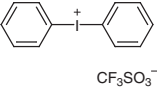
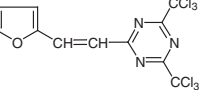
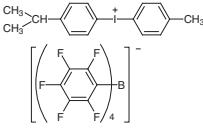
Photopolymerization initiators are roughly categorized into three groups depending on the generated active species (radicals, cations, anions). Conventional photopolymerization initiators such as benzoin derivatives generate free radicals upon light irradiation. Photo-acid generators which produce cations (acid) upon light irradiation found practical use in the late 1990s. Photo-base generators, which produce anions (base) upon light irradiation, are of current research interest.

Thermal Polymerization Initiators		Thermal Radical Initiators	A1671	A0680
A0566	A1670	A2735	B3152	B3153
				
C2223	D3411	D3797		
				

Product No.	Product Name	Unit Size	
A1671	4,4'-Azobis(4-cyanovaleric Acid) (contains ca. 20% Water)	25g	250g
A0680	2,2'-Azobis(2,4-dimethylvaleronitrile)	25g	500g
A0566	2,2'-Azobis(isobutyronitrile)	25g	500g
A1670	2,2'-Azobis(2-methylbutyronitrile)	25g	500g
A2735	2,2'-Azobis(2-methylpropionamide) Dihydrochloride		25g
B3152	Benzoyl Peroxide (wetted with ca. 25% Water)		25g
B3153	tert-Butyl Hydroperoxide (70% in Water)		100g
C2223	Cumene Hydroperoxide (contains ca. 20% Aromatic Hydrocarbon)		100g
D3411	Di-tert-butyl Peroxide		100mL
D3797	Dimethyl 2,2'-Azobis(2-methylpropionate)		25g

B1231	M2028	P1410
		

Product No.	Product Name	Unit Size	
A0061	Acetophenone	25g	500g
A1028	<i>p</i> -Anisil		25g
B0221	Benzil Zone Refined (number of passes:22)		1sample
B0050	Benzil	25g	500g
B3633	2-(1,3-Benzodioxol-5-yl)-4,6-bis(trichloromethyl)-1,3,5-triazine		5g
B0222	Benzoin Zone Refined (number of passes:40)		1sample
B0079	Benzoin	25g	500g
B1019	Benzoin Ethyl Ether	25g	100g 500g
B1015	Benzoin Isobutyl Ether		25g 500g
B0942	Benzoin Isopropyl Ether		25g 500g
B0869	Benzoin Methyl Ether		25g 500g
B0083	Benzophenone		25g 500g
B0103	2-Benzoylbenzoic Acid		25g 500g
B1164	4-Benzoylbenzoic Acid		5g 25g
B3914	2-Benzyl-2-(dimethylamino)-4'-morpholinobutyrophenone		25g 100g
B1225	2,2'-Bis(2-chlorophenyl)-4,4',5,5'-tetraphenyl-1,2'-biimidazole		25g
B0139	4,4'-Bis(diethylamino)benzophenone		25g 500g
B0481	4,4'-Bis(dimethylamino)benzophenone		25g 500g
D4196	1,4-Dibenzoylbenzene		5g
D1621	4,4'-Dichlorobenzophenone		25g 500g
D1640	2,2-Diethoxyacetophenone		25g 500g
D2375	2,4-Diethylthioxanthene-9-one		25g 250g
D1702	2,2-Dimethoxy-2-phenylacetophenone	25g	100g 500g
D3358	Diphenyl(2,4,6-trimethylbenzoyl)phosphine Oxide		25g
E0063	2-Ethylantraquinone		25g 500g
H0617	1-Hydroxycyclohexyl Phenyl Ketone		25g 500g
H1361	2-Hydroxy-4'-(2-hydroxyethoxy)-2-methylpropiophenone	5g	25g 100g
H0991	2-Hydroxy-2-methylpropiophenone	25g	100g 500g
P0211	2-Isonitrosopropiophenone		25g
B1231	Methyl 2-Benzoylbenzoate		25g 500g
M2028	2-Methyl-4'-(methylthio)-2-morpholinopropiophenone		25g 500g
P1410	2-Phenyl-2-(<i>p</i> -toluenesulfonyloxy)acetophenone		1g

Photo-Cationic Initiators	B2380	B2381	C1390	D2963
				
D2248	D2238	D2253	F0362	I0591
				

M1245 	M1209 	N0137 	T1609 	T1608
T2041 	T2042 			

Product No.	Product Name	Unit Size	
B2380	Bis(4- <i>tert</i> -butylphenyl)iodonium Hexafluorophosphate	1g	5g
B2381	Bis(4- <i>tert</i> -butylphenyl)iodonium Trifluoromethanesulfonate		1g
C1390	Cyclopropyldiphenylsulfonium Tetrafluoroborate		1g
D2963	2-(3,4-Dimethoxystyryl)-4,6-bis(trichloromethyl)-1,3,5-triazine		5g
D2248	Diphenyliodonium Hexafluoroarsenate		1g
D2238	Diphenyliodonium Hexafluorophosphate	1g	5g
D2253	Diphenyliodonium Trifluoromethanesulfonate		5g
F0362	2-[2-(Furan-2-yl)vinyl]-4,6-bis(trichloromethyl)-1,3,5-triazine		5g
I0591	4-Isopropyl-4'-methyl-diphenyliodonium Tetrakis(pentafluorophenyl)borate	5g	25g
M1245	2-(4-Methoxyphenyl)-4,6-bis(trichloromethyl)-1,3,5-triazine	5g	25g
M1209	2-[2-(5-Methylfuran-2-yl)vinyl]-4,6-bis(trichloromethyl)-1,3,5-triazine		5g
N0137	4-Nitrobenzenediazonium Tetrafluoroborate		25g
T1609	Triphenylsulfonium Bromide	100mg	1g
T1608	Triphenylsulfonium Tetrafluoroborate		5g
T2041	Tri- <i>p</i> -tolylsulfonium Hexafluorophosphate		1g
T2042	Tri- <i>p</i> -tolylsulfonium Trifluoromethanesulfonate		5g

Photo-Anionic Initiators

A2502 	N0528 	O0396
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Product No.	Product Name	Unit Size	
A2502	Acetophenone <i>O</i> -Benzoyloxime	1g	5g
N0528	Nifedipine	10g	25g
O0396	2-(9-Oxoxanthene-2-yl)propionic Acid 1,5,7-Triazabicyclo[4.4.0]dec-5-ene Salt		1g

Polymerization Catalysts

The Ziegler-Natta catalyst discovered in 1953 made possible the synthesis of high-density polyethylene. Later, transition metal catalysts such as metallocene were developed for polyolefin synthesis. Transition metal carbene complexes were used as catalysts for ring-opening metathesis polymerization in Nobel Prize-winning work in 2005.

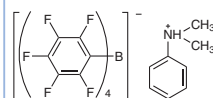
This section also includes catalysts for Kumada-Tamao-Corriu cross coupling for polymer synthesis.

Olefin Polymerization Catalysts		Metallocene Catalysts		
			C1994 	C1995
D3307 	D3321 	D4100 	D3286 	H0914
I0646 	I0645 	P1651 	C1411 	T0616
V0090 	Z0010 	Z0007 		

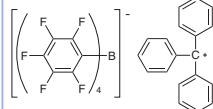
Product No.	Product Name	Unit Size	
C1994	Cyclopentadienyltitanium(IV) Trichloride	1g	5g
C1995	Cyclopentadienylzirconium(IV) Trichloride	1g	5g
D3307	Decamethylzirconocene Dichloride		1g
D3321	1,1'-Dibutylzirconocene Dichloride	1g	5g
D4100	Dimethyltitanocene (5% in Tetrahydrofuran/Toluene)		100g
D3286	1,1'-Dipropylhafnocene Dichloride		1g
H0914	Hafnocene Dichloride	1g	5g 25g
I0646	(Indenyl)titanium(IV) Trichloride		1g
I0645	1,1'-Isopropylidenezirconocene Dichloride		100mg
P1651	(Pentamethylcyclopentadienyl)titanium(IV) Trichloride		1g
C1411	Tebbe Reagent (ca. 0.5mol/L in Toluene)		25mL
T0616	Titanocene Dichloride	5g	25g
V0090	Vanadocene Dichloride		1g
Z0010	Zirconocene Chloride Hydride	1g	5g 25g
Z0007	Zirconocene Dichloride		5g 25g

Olefin
Polymerization
Co-catalysts

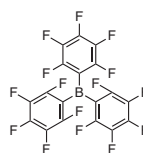
D4404



T2863



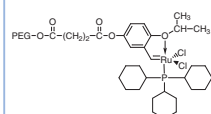
T2313



Product No.	Product Name	Unit Size	
D4404	<i>N,N</i> -Dimethylanilinium Tetrakis(pentafluorophenyl)borate	200mg	1g
T2863	Triphenylmethylium Tetrakis(pentafluorophenyl)borate	1g	5g
T2313	Tris(pentafluorophenyl)borane	1g	5g

Olefin
Metathesis
Catalysts

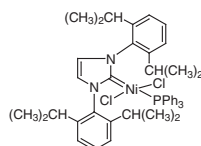
P1427



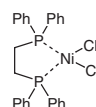
Product No.	Product Name	Unit Size	
P1427	Polyethylene Glycol-bound Ruthenium Carbene Complex	100mg	

Cross-coupling Polymerization
Catalysts

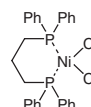
B3235



B2225



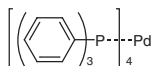
B1313



B3161



T1350



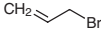
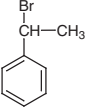
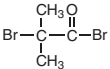
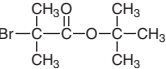
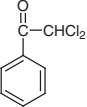
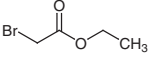
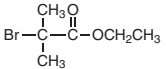
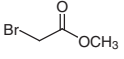
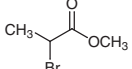
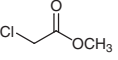
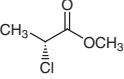
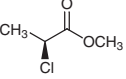
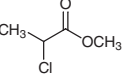
Product No.	Product Name	Unit Size	
B3235	[1,3-Bis(2,6-diisopropylphenyl)imidazol-2-ylidene]triphenylphosphine Nickel(II) Dichloride	200mg	1g
B2225	[1,2-Bis(diphenylphosphino)ethane]nickel(II) Dichloride	1g	5g 25g
B1313	[1,3-Bis(diphenylphosphino)propane]nickel(II) Dichloride	5g	25g
B3161	Bis(tri- <i>tert</i> -butylphosphine)palladium(0)	250mg	1g
T1350	Tetrakis(triphenylphosphine)palladium(0)	1g	5g 25g

Polyurethane Catalysts		B1291	B1784	D1313
D0134	D0302	D0303	D0649	D1756
D0688	D0705	P0881	Z0006	T1289
T0537	T1598	T1618		

Product No.	Product Name	Unit Size	
B1291	Bis(2-dimethylaminoethyl) Ether	25mL	500mL
B1784	Bis(2-morpholinoethyl) Ether	25g	500g
D1313	1,5-Diazabicyclo[4.3.0]-5-nonene	10mL	25mL 250mL
D0134	1,4-Diazabicyclo[2.2.2]octane	25g	100g 500g
D0302	Dibutyltin Diacetate	25g	100g 500g
D0303	Dibutyltin Dilaurate	25g	100g 500g
D0649	2-(Dimethylamino)ethanol	25mL	500mL
D1756	2-[2-(Dimethylamino)ethoxy]ethanol	25mL	500mL
D0688	<i>N,N</i> -Dimethylbenzylamine	25mL	500mL
D0705	<i>N,N</i> -Dimethylcyclohexylamine	25mL	500mL
P0881	<i>N,N,N',N'</i> -Pentamethyldiethylenetriamine	25mL	500mL
Z0006	Tetrakis(2,4-pentanedionato)zirconium(IV)	25g	500g
T1289	<i>N,N,N',N'</i> -Tetramethyl-1,4-diaminobutane	25mL	500mL
T0537	<i>N,N,N',N'</i> -Tetramethyl-1,6-diaminohexane	25mL	500mL
T1598	<i>N,N,N'</i> -Trimethyl- <i>N''</i> -(2-hydroxyethyl)bis(2-aminoethyl) Ether	25mL	500mL
T1618	2,6,10-Trimethyl-2,6,10-triazaundecane	25mL	500mL

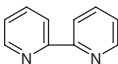
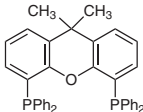
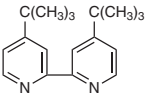
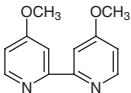
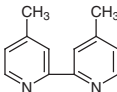
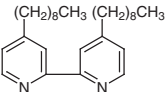
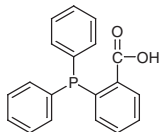
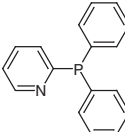
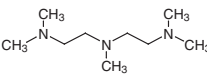
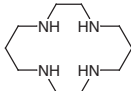
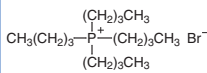
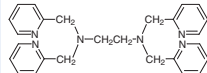
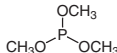
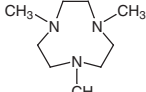
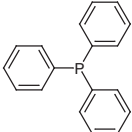
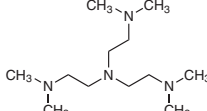
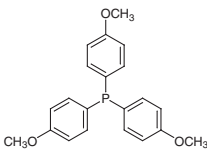
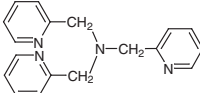
Precise Polymerization Reagents

In the radical, cationic or anionic polymerization of vinyl monomers, the chain propagation is often compromised by termination reaction, chain-transfer reaction, and other side reactions. There has been much research on living polymerization, which decreases termination reaction and maintains actively growing polymer chains, allowing control of the average molecular weight and thus synthesis of polymers with a narrow molecular weight distribution.

Atom Transfer Radical Polymerization (ATRP) Reagents		Initiators		
			B0643 	B1058 
B0592 	B0607 	B3500 	C0094 	C0166 
D1122 	B0532 	B0606 	B0533 	B1460 
C0093 	C1633 	C1634 	C0970 	

Product No.	Product Name	Unit Size	
B0643	Allyl Bromide	25g	500g
B1058	Bromoacetonitrile	25g	100g 500g
B0592	(1-Bromoethyl)benzene	25g	100g
B0607	2-Bromoisobutyl Bromide	25g	500g
B3500	tert-Butyl 2-Bromoisobutyrate	25g	500g
C0094	Chloroacetonitrile	25g	100g 500g
C0166	(1-Chloroethyl)benzene	25mL	500mL
D1122	2,2-Dichloroacetophenone	25g	
B0532	Ethyl Bromoacetate	25g	500g
B0606	Ethyl 2-Bromoisobutyrate	25g	100g 500g
B0533	Methyl Bromoacetate	25g	100g 500g
B1460	Methyl 2-Bromopropionate	25g	500g
C0093	Methyl Chloroacetate	25mL	500mL
C1633	Methyl (R)-(+)-2-Chloropropionate		5g

Product No.	Product Name	Unit Size
C1634	Methyl (S)-(-)-2-Chloropropionate	5g
C0970	Methyl 2-Chloropropionate	25mL 500mL

Ligands	B0468 	B2709 	D3134 	D3886 
B0852 	D3917 	D3242 	D2471 	P0881 
T1597 	T1124 	T1487 	T1878 	T0361 
T0488 	T1879 	T0519 	T2898 	T0861 
T2671 				

Product No.	Product Name	Unit Size
B0468	2,2'-Bipyridyl	25g 100g 500g
B2709	4,5-Bis(diphenylphosphino)-9,9-dimethylxanthene	1g 5g
D3134	4,4'-Di- <i>tert</i> -butyl-2,2'-bipyridyl	1g 5g
D3886	4,4'-Dimethoxy-2,2'-bipyridyl	1g 5g
B0852	4,4'-Dimethyl-2,2'-bipyridyl	1g 5g 25g
D3917	4,4'-Dinonyl-2,2'-bipyridyl	1g 5g
D3242	2-(Diphenylphosphino)benzoic Acid	1g
D2471	Diphenyl-2-pyridylphosphine	1g 5g
P0881	<i>N,N,N',N'</i> -Pentamethyldiethylenetriamine	25mL 500mL
T1597	1,4,8,11-Tetraazacyclotetradecane	1g 5g
T1124	Tetrabutylphosphonium Bromide	25g 100g 500g
T1487	<i>N,N,N',N'</i> -Tetrakis(2-pyridylmethyl)ethylenediamine	1g 5g
T1878	1,4,7-Triazacyclononane	200mg 1g 5g
T0361	Tributylphosphine	25mL 100mL 500mL

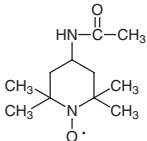
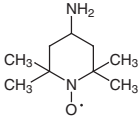
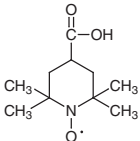
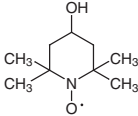
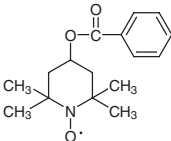
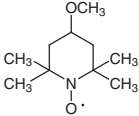
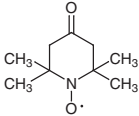
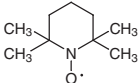
Product No.	Product Name	Unit Size	
T0488	Trimethyl Phosphite	25mL	
T1879	1,4,7-Trimethyl-1,4,7-triazacyclononane (stabilized with NaHCO ₃)	1g	5g
T0519	Triphenylphosphine	25g	500g
T2898	Tris[2-(dimethylamino)ethyl]amine	1g	5g
T0861	Tris(4-methoxyphenyl)phosphine	5g	25g
T2671	Tris(2-pyridylmethyl)amine	1g	5g

Transition Metal Complexes	B1571	C2201	C1592	D1997

Product No.	Product Name	Unit Size	
B1571	Bis(triphenylphosphine)nickel(II) Dichloride	10g	100g
C2201	Cyclopentadienylbis(triphenylphosphine)ruthenium(II) Chloride	1g	5g
C1592	Cyclopentadienyliron Dicarbonyl Dimer		5g
D1997	Tris(triphenylphosphine)ruthenium(II) Dichloride	1g	5g

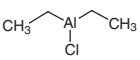
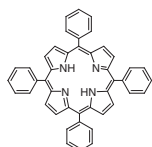
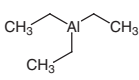
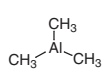
Reversible Addition Fragmentation Chain Transfer (RAFT) Polymerization Reagents	B0479	B0486	T2401

Product No.	Product Name	Unit Size	
B0479	Tetraethylthiuram Disulfide	25g	500g
B0486	Tetramethylthiuram Disulfide	25g	500g
T2401	S-(Thiobenzoyl)thioglycolic Acid	5g	25g

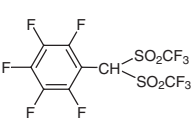
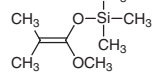
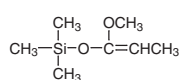
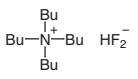
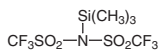
Nitroxide-Mediated Radical Polymerization (NMP) Reagents	A1348	A1343	C1428	
				
H0865	H0878	M1197	O0266	T1560
				

Product No.	Product Name	Unit Size	
A1348	4-Acetamido-2,2,6,6-tetramethylpiperidine 1-Oxyl Free Radical	5g	25g
A1343	4-Amino-2,2,6,6-tetramethylpiperidine 1-Oxyl Free Radical	1g	5g
C1428	4-Carboxy-2,2,6,6-tetramethylpiperidine 1-Oxyl Free Radical	100mg	1g
H0865	4-Hydroxy-2,2,6,6-tetramethylpiperidine 1-Oxyl Free Radical	5g	25g
H0878	4-Hydroxy-2,2,6,6-tetramethylpiperidine 1-Oxyl Benzoate Free Radical	1g	5g
M1197	4-Methoxy-2,2,6,6-tetramethylpiperidine 1-Oxyl Free Radical	1g	5g

Product No.	Product Name	Unit Size	
O0266	4-Oxo-2,2,6,6-tetramethylpiperidine 1-Oxyl Free Radical	5g	25g
T1560	2,2,6,6-Tetramethylpiperidine 1-Oxyl Free Radical	5g	25g

Immortal Polymerization Reagents		D1340	D3902 D3214	T1359
			$\text{Zn}(\text{CH}_2\text{CH}_3)_2$	
T0783 T0925	T0782 T1575			
				

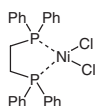
Product No.	Product Name	Unit Size	
D1340	Diethylaluminum Chloride (ca. 15% in Hexane, ca. 0.87mol/L)	100mL	
D3902	Diethylzinc (ca. 15% in Toluene, ca. 1mol/L)	100mL	
D3214	Diethylzinc (ca. 17% in Hexane, ca. 1mol/L)	100mL	500mL
T1359	Tetraphenylporphyrin (Chlorin free)	1g	
T0783	Triethylaluminum (15% in Hexane, ca. 1.0mol/L)	100mL	
T0925	Triethylaluminum (15% in Toluene, ca. 1.1mol/L)	100mL	
T0782	Trimethylaluminum (15% in Hexane, ca. 1.4mol/L)	100mL	
T1575	Trimethylaluminum (15% in Toluene, ca. 1.8mol/L)	100mL	

Group Transfer Polymerization (GTP) Reagents		B2291	D1789	M1199
				
P1888	T1295	T2392		
KHF_2				

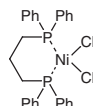
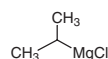
Product No.	Product Name	Unit Size	
B2291	1-[Bis(trifluoromethanesulfonyl)methyl]-2,3,4,5,6-pentafluorobenzene	100mg	1g
D1789	Dimethylketene Methyl Trimethylsilyl Acetal	5mL	25mL
M1199	1-Methoxy-1-trimethylsilyloxypropene	1g	5g
P1888	Potassium Hydrogenfluoride		500g
T1295	Tetrabutylammonium Bifluoride	5g	25g
T2392	N-(Trimethylsilyl)bis(trifluoromethanesulfonyl)imide	1g	5g

Catalyst-transfer
Polycondensation Reagents

B2225



B1313

I0543
I0542

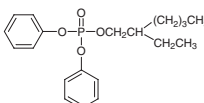
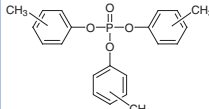
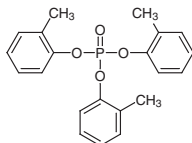
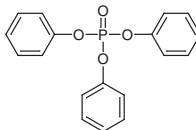
Product No.	Product Name	Unit Size		
B2225	[1,2-Bis(diphenylphosphino)ethane]nickel(II) Dichloride	1g	5g	25g
B1313	[1,3-Bis(diphenylphosphino)propane]nickel(II) Dichloride		5g	25g
I0543	Isopropylmagnesium Chloride (ca. 11% in Tetrahydrofuran, ca. 1mol/L)			250g
I0542	Isopropylmagnesium Chloride (ca. 13% in Ethyl Ether, ca. 1mol/L)			250g

Resin Additives

The addition of additives makes synthetic resin, a polymer material, workable or stable. This section includes plasticizers which improve the workability of resin by increasing flexibility and stabilizers which protect against resin aging caused by radicals.

Plasticizers		Phthalates		
			P0288	B2714
B2715	B4302	P0297	B0737	P0291
P0292	P0293	P0296	P1344	P0298
P0299	P0300	P0301	I0157	P0302
P0303	P0304	P0305	P0306	P0307
D3248	E0164	P0657		

Product No.	Product Name	Unit Size	
P0288	Benzyl Butyl Phthalate	25g	500g
B2714	Benzyl 2-Ethylhexyl Phthalate		25g
B2715	Benzyl Isononyl Phthalate (mixture of branched chain isomers)		25g
B4302	Bis(2-ethylhexyl) Isophthalate	25g	500g
P0297	Bis(2-ethylhexyl) Phthalate	25g	500g
B0737	Butyl Phthalyl Butyl Glycolate	25g	500g
P0291	Diamyl Phthalate	25g	100g 500g
P0292	Dibutyl Phthalate	25mL	500mL
P0293	Dicyclohexyl Phthalate	25g	500g
P0296	Diethyl Phthalate	25mL	500mL
P1344	Dihexyl Phthalate	5g	25g
P0298	Diisobutyl Phthalate	25g	500g
P0299	Diisodecyl Phthalate (mixture of branched chain isomers)	25mL	500mL
P0300	Diisononyl Phthalate (mixture of branched chain isomers)		500g
P0301	Diisopropyl Phthalate	25mL	500mL
I0157	Dimethyl Isophthalate	25g	500g
P0302	Dimethyl Phthalate	25g	500g
P0303	Dinonyl Phthalate (mixture of isomers)	25mL	500mL
P0304	Di- <i>n</i> -octyl Phthalate	25mL	500mL
P0305	Diphenyl Phthalate	25g	500g
P0306	Dipropyl Phthalate	25mL	100mL 500mL
P0307	Ditridecyl Phthalate (mixture of branched chain isomers)	25g	500g
D3248	Diundecyl Phthalate (mixture of branched chain isomers)		500g
E0164	Ethyl Phthalyl Ethyl Glycolate	25g	500g
P0657	Phthalic Acid Bis(2-butoxyethyl) Ester		25g

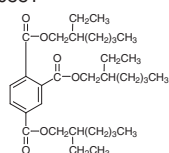
Phosphates	P1021		P0265	$\text{CH}_3(\text{CH}_2)_4\text{O}-\text{P}(\text{O})(\text{O}(\text{CH}_2)_4\text{CH}_3)_2$	P0266	$\text{CH}_3(\text{CH}_2)_3\text{O}-\text{P}(\text{O})(\text{O}(\text{CH}_2)_3\text{CH}_3)_2$	P0273			
	P1331		P0270	$\text{CH}_3\text{CH}_2\text{O}-\text{P}(\text{O})(\text{OCH}_2\text{CH}_3)_2$	P0271	$\text{CH}_3\text{O}-\text{P}(\text{O})(\text{OCH}_3)_2$	P0272		P0683	$\text{CH}_3(\text{CH}_2)_2\text{OCH}_2\text{CH}_2\text{O}-\text{P}(\text{O})(\text{OCH}_2\text{CH}_2\text{O}(\text{CH}_2)_3\text{CH}_3)_2$
	P0268	$\text{ClCH}_2\text{CH}_2\text{O}-\text{P}(\text{O})(\text{OCH}_2\text{CH}_2\text{Cl})_2$	P0269	$(\text{ClCH}_2)_2\text{CHO}-\text{P}(\text{O})(\text{OCH}(\text{CH}_2\text{Cl})_2)_2$	P1022	$\text{CH}_3(\text{CH}_2)_2\text{CH}(\text{CH}_2)_2\text{O}-\text{P}(\text{O})(\text{OCH}_2\text{CH}(\text{CH}_2)_3\text{CH}_3)_2$				

Product No.	Product Name	Unit Size	
P0259	Cresyl Diphenyl Phosphate (so called) (mixture of analogue)	25mL	500mL
P1021	2-Ethylhexyl Diphenyl Phosphate	25g	500g
P0265	Triamyl Phosphate		25mL
P0266	Tributyl Phosphate	25g	500g
P0273	Tricresyl Phosphate (mixture of isomers)	25g	500g
P1331	Tri- <i>o</i> -cresyl Phosphate	5g	25g

Product No.	Product Name	Unit Size	
P0270	Triethyl Phosphate	25g	500g
P0271	Trimethyl Phosphate	25g	500g
P0272	Triphenyl Phosphate	25g	500g
P0683	Tris(2-butoxyethyl) Phosphate	25g	500g
P0268	Tris(2-chloroethyl) Phosphate		25g
P0269	Tris(1,3-dichloro-2-propyl) Phosphate	25g	500g
P1022	Tris(2-ethylhexyl) Phosphate	25mL	500mL

Trimellitate

B0881



Product No.	Product Name	Unit Size	
B0881	Tris(2-ethylhexyl) Trimellitate	25mL	500mL

Fatty Acid Esters

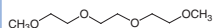
	B2716	A0163	A0653 A1473	F0117
M0011	S0025	A1386	A0655	F0116
M0009	S0023	A0162	M0010	S0024
S0103	A0706	A0164	A1387	A0654

A0166	A1308	M0012	S0027	S0028
A0931	O0143 O0054	A1388	O0055	

Product No.	Product Name	Unit Size	
B2716	Bis(2-butoxyethyl) Adipate	25g	500g
A0163	Bis(2-ethylhexyl) Adipate	25mL	500mL
A0653	Bis(2-ethylhexyl) Azelate	25mL	500mL
A1473	Bis(2-ethylhexyl) Azelate		25mL
F0117	Bis(2-ethylhexyl) Fumarate	25mL	500mL
M0011	Bis(2-ethylhexyl) Maleate	25mL	500mL
S0025	Bis(2-ethylhexyl) Sebacate	25mL	500mL
A1386	Di- <i>n</i> -alkyl Adipate	25mL	500mL
A0655	Dibutyl Adipate	25mL	500mL
F0116	Dibutyl Fumarate	25g	500g
M0009	Dibutyl Maleate	25g	500g
S0023	Dibutyl Sebacate	25mL	500mL
A0162	Diethyl Adipate	25mL	500mL
M0010	Diethyl Maleate	25mL	500mL
S0024	Diethyl Sebacate	25mL	500mL
S0103	Diethyl Succinate	25g	500g
A0706	Diisobutyl Adipate	25mL	500mL
A0164	Diisodecyl Adipate	25mL	500mL
A1387	Diisononyl Adipate (so called)	25mL	500mL
A0654	Diisopropyl Adipate	25mL	500mL
A0166	Dimethyl Adipate	25mL	500mL
A1308	Dimethyl Azelate		25mL
M0012	Dimethyl Maleate	25mL	500mL
S0027	Dimethyl Sebacate	25g	500g
S0028	Di- <i>n</i> -octyl Sebacate		25mL
A0931	Dipropyl Adipate		25mL
O0143	Ethyl Oleate	5mL	25mL
O0054	Ethyl Oleate	25mL	500mL
A1388	Heptylnonyl Adipate (so called)	25mL	500mL
O0055	Methyl Oleate	25mL	500mL

Polyalcohol Ethers, Esters	D1230	D1522	B0828	B0489
B0498	G0082	G0086	T0364	T0923

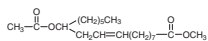
B0496



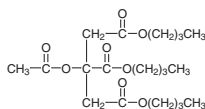
Product No.	Product Name	Unit Size	
D1230	Diethylene Glycol Diacetate	25mL	500mL
D1522	Diethylene Glycol Dibenzoate	25mL	500mL
B0828	Diethylene Glycol Dibutyl Ether	25mL	500mL
B0489	Diethylene Glycol Diethyl Ether	25mL	500mL
B0498	Diethylene Glycol Dimethyl Ether	25mL	500mL
G0082	Monolein	25g	500g
G0086	Triacetin	25g	500g
T0364	Tributyrin	25mL	500mL
T0923	Triethylene Glycol Diacetate	25g	500g
B0496	Triethylene Glycol Dimethyl Ether (stabilized with BHT)	25g	500g

Hydroxycarboxylic Acid Esters

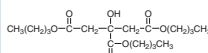
A0879



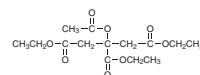
A0822



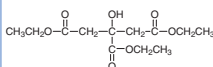
C0366



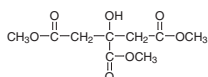
A0086



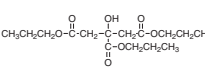
C0367



C0368



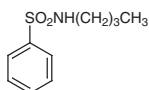
C0601



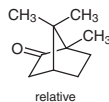
Product No.	Product Name	Unit Size	
A0879	Methyl <i>O</i> -Acetylricinoleate	25mL	500mL
A0822	Tributyl <i>O</i> -Acetylcitrate	25mL	500mL
C0366	Tributyl Citrate	25mL	500mL
A0086	Triethyl <i>O</i> -Acetylcitrate	25g	500g
C0367	Triethyl Citrate	25g	500g
C0368	Trimethyl Citrate	25g	
C0601	Tripropyl Citrate	25g	

Camphor, etc.

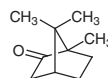
B0716



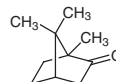
C0011

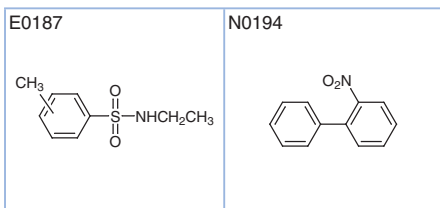


C0010



C1251





Product No.	Product Name	Unit Size	
B0716	<i>N</i> -Butylbenzenesulfonamide	25g	500g
C0011	(±)-Camphor	25g	500g
C0010	(+)-Camphor	25g	500g
C1251	(-)-Camphor		5g
E0187	<i>N</i> -Ethyltoluenesulfonamide (<i>o</i> - and <i>p</i> - mixture)	25g	500g
N0194	2-Nitrobiphenyl	25g	500g

Resin Stabilizers

		B1970 	B0724 	D0299
D0228 	D0940 	D0303 	T0205 	D3331
D0812 	D0609 	E0237 	P0327 	B0055
M0215 	D1781 	P0932 	P0197 	D1644
T0196 	T0420 	T0510 	T0916 	P1421

Product No.	Product Name	Unit Size	
B1970	4,4'-Bis(α,α -dimethylbenzyl)diphenylamine	25g	500g
B0724	4,4'-Butylidenebis(6- <i>tert</i> -butyl- <i>m</i> -cresol)	25g	500g
D0299	2,5-Di- <i>tert</i> -amylhydroquinone	25g	500g
D0228	2,6-Di- <i>tert</i> -butyl- <i>p</i> -cresol	25g	500g
D0940	2,5-Di- <i>tert</i> -butylhydroquinone	25g	500g
D0303	Dibutyltin Dilaurate	25g 100g	500g
D0304	Dibutyltin Maleate (so called)	25g	500g
T0205	Didodecyl 3,3'-Thiodipropionate	25g	500g
D3331	<i>N</i> -(1,3-Dimethylbutyl)- <i>N</i> '-phenyl-1,4-phenylenediamine	25g	500g
D0812	<i>N,N</i> '-Di-2-naphthyl-1,4-phenylenediamine	25g	500g
D0609	<i>N,N</i> '-Diphenyl-1,4-phenylenediamine	25g	500g
E0237	6-Ethoxy-2,2,4-trimethyl-1,2-dihydroquinoline	25g	500g
P0327	4-Isopropylaminodiphenylamine	25g	500g
B0055	2-Mercaptobenzimidazole	25g	500g
M0215	2,2'-Methylenebis(6- <i>tert</i> -butyl-4-ethylphenol)	25g	500g
D1781	Nickel(II) Dibutyldithiocarbamate	25g	500g
P0932	Pentaerythritol Tetrakis[3-(3,5-di- <i>tert</i> -butyl-4-hydroxyphenyl)propionate]	25g	500g
P0197	<i>N</i> -Phenyl-1-naphthylamine	25g	500g
D1644	Stearyl 3-(3,5-Di- <i>tert</i> -butyl-4-hydroxyphenyl)propionate	25g	500g
T0196	4,4'-Thiobis(6- <i>tert</i> -butyl- <i>m</i> -cresol)	25g	500g
T0420	Triisodecyl Phosphite (mixture of isomers)	25mL	500mL
T0510	Triphenyl Phosphite	25g	500g
T0916	2,4,6-Tris(3',5'-di- <i>tert</i> -butyl-4'-hydroxybenzyl)mesitylene	25g	500g
P1421	Tris(2,4-di- <i>tert</i> -butylphenyl) Phosphite	25g 100g	500g

UV Absorbents		Benzotriazoles	
		B3717	B3400
H0719	H0559	H0718	D1529
H0560	M1259		H1261

Product No.	Product Name	Unit Size
B3717	2-(2 <i>H</i> -Benzotriazol-2-yl)-4,6-bis(1-methyl-1-phenylethyl)phenol	25g 250g
B3400	2-(3- <i>sec</i> -Butyl-5- <i>tert</i> -butyl-2-hydroxyphenyl)benzotriazole	Price on request
H0719	2-(5- <i>tert</i> -Butyl-2-hydroxyphenyl)benzotriazole	25g 500g
H0559	2-(5-Chloro-2-benzotriazolyl)-6- <i>tert</i> -butyl- <i>p</i> -cresol	25g 500g
H0718	2-(3,5-Di- <i>tert</i> -amyl-2-hydroxyphenyl)benzotriazole	25g 500g
D1529	2-(3,5-Di- <i>tert</i> -butyl-2-hydroxyphenyl)-5-chlorobenzotriazole	25g

Product No.	Product Name	Unit Size	
H1261	2-[2-Hydroxy-5-[2-(methacryloyloxy)ethyl]phenyl]-2 <i>H</i> -benzotriazole	25g	500g
H0560	2-(2-Hydroxy-5-methylphenyl)benzotriazole	25g	500g
H0716	2-(2-Hydroxy-5- <i>tert</i> -octylphenyl)benzotriazole	25g	500g
M1259	2,2'-Methylenebis[6-(benzotriazol-2-yl)-4- <i>tert</i> -octylphenol]	25g	500g

Benzophenones	D0573	D0575	H0266	H0288
T0118				

Product No.	Product Name	Unit Size	
D0573	2,4-Dihydroxybenzophenone	25g	500g
D0575	2,2'-Dihydroxy-4,4'-dimethoxybenzophenone	25g	
H0266	2-Hydroxy-4-methoxybenzophenone	25g	500g
H0288	2-Hydroxy-4- <i>n</i> -octyloxybenzophenone	25g	500g
T0118	2,2',4,4'-Tetrahydroxybenzophenone	25g	

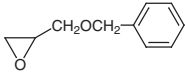
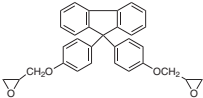
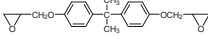
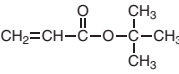
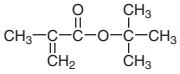
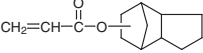
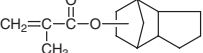
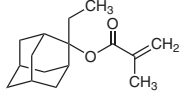
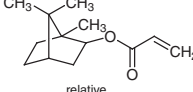
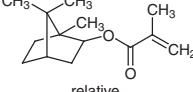
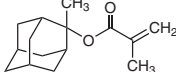
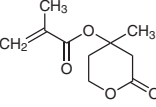
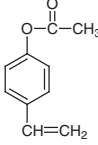
Hindered Amines	B3924	S0448	P1513	T2324

Product No.	Product Name	Unit Size	
B3924	Bis(1,2,2,6,6-pentamethyl-4-piperidyl) Sebacate	5g	25g
S0448	Bis(2,2,6,6-tetramethyl-4-piperidyl) Sebacate	5g	25g
P1513	1,2,2,6,6-Pentamethyl-4-piperidyl Methacrylate (stabilized with MEHQ)	25g	500g
T2324	2,2,6,6-Tetramethyl-4-piperidyl Methacrylate	25g	500g

Photopolymer Research Reagents

A photopolymer is a photosensitive, optically functional polymer material or resin whose properties, such as solubility, are altered by light irradiation. Photopolymers are widely used as photoresist materials during etching in the manufacture of printed circuits and semiconductor integrated circuits. In positive-type photoresist, photoacid generators (PAG) change the solubility of the photopolymer, whereas negative-type photoresist requires photopolymerization initiators for polymerization and curing. This section includes the monomers required to generate photopolymers.

Photopolymerization initiators are described on p. 322.

B2108 	B4269 	B1796 	A1389 	M0326 
D3380 	D3381 	E0909 	I0638 	I0617 
M2260 	M2261 	A1551 		

Product No.	Product Name	Unit Size	
B2108	Benzyl Glycidyl Ether	5g	25g
B4269	9,9-Bis(4-glycidyloxyphenyl)fluorene	5g	25g
B1796	2,2-Bis(4-glycidyloxyphenyl)propane	25g	500g
A1389	<i>tert</i> -Butyl Acrylate (stabilized with MEHQ)	25mL	500mL
M0326	<i>tert</i> -Butyl Methacrylate Monomer (stabilized with MEHQ)	25mL	500mL
D3380	Dicyclopentanyl Acrylate (stabilized with MEHQ)	25g	500g
D3381	Dicyclopentanyl Methacrylate (stabilized with MEHQ)	25g	500g
E0909	2-Ethyl-2-methacryloyloxyadamantane (stabilized with MEHQ)		5g
I0638	Isobornyl Acrylate (stabilized with MEHQ)	25g	500g
I0617	Isobornyl Methacrylate (stabilized with MEHQ)	25g	500g
M2260	2-Methacryloyloxy-2-methyladamantane (stabilized with MEHQ)		5g
M2261	Mevalonic Lactone Methacrylate (stabilized with MEHQ)		1g
A1551	4-Vinylphenyl Acetate (stabilized with TBC)	5g	25g

Macrocycles

for Host-Guest Chemistry

Host-compounds recognize and incorporate specific molecules, atoms or ions (guests) into the molecules to form complexes. In the formation of these complexes, a variety of forces such as electrostatic interaction, hydrophobic interaction, hydrogen bonding, etc. are utilized to create high selectivity. Molecular sensors, synthetic enzymes, separation systems, etc. utilize the high guest selectivity of these host compounds. Synthesis of new host compounds with even higher selectivity are currently being developed.

For example, Shinkai and co-workers have developed exciting purification techniques for fullerene C_{60} employing calixarene. According to these techniques, the stirring of crude fullerene and *tert*-butylcalix[8]arene in toluene causes only C_{60} to be incorporated in the calixarene to form and precipitate a complex. Filtration and subsequent stirring of the complex in chloroform cause it to decompose to yield C_{60} of high purity as a precipitate. This method has been reported to be an efficient purification technique in obtaining C_{60} compared with conventional column purification techniques.

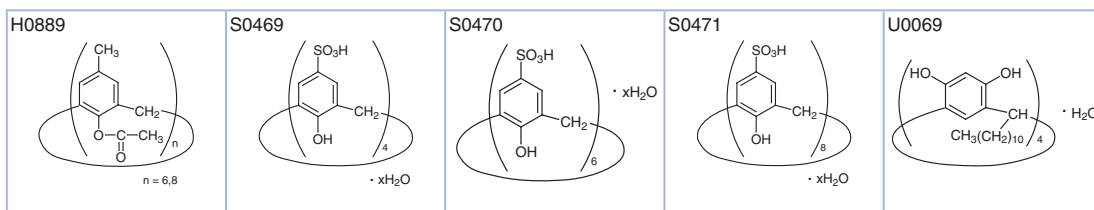
Crown Ethers		A1603	A1604	A1404
A1552	A1323	A1324	B1249	B1154
B1539	B2245	B2189	B2181	C1713
C1714	C1942	C1943	C0858	C0859
C0860	C1736	D2743	D2744	D2323

D2877	D1533	D2878	D1830	D2684
D2321	D1668	F0448	F0451	H1070
H1215	H0932	H0982	H0983	H0990
M1489	N0561	N0562	P1143	T1874
T1875	T1426	T1691	T1597	T2540
T1959	T1876	T1878	T1600	T2642
T2541	T1879	T1972		

Product No.	Product Name	Unit Size
A1603	4'-Acetylbenzo-15-crown 5-Ether	1g
A1604	4'-Acetylbenzo-18-crown 6-Ether	1g
A1404	4'-Aminobenzo-15-crown 5-Ether	1g
A1552	1-Aza-12-crown 4-Ether	250mg 1g
A1323	1-Aza-15-crown 5-Ether	1g 5g
A1324	1-Aza-18-crown 6-Ether	1g 5g

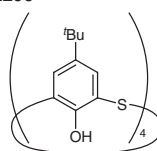
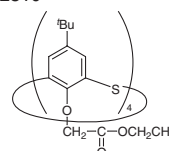
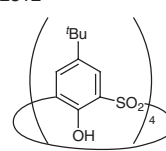
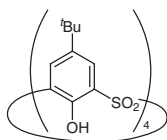
Product No.	Product Name	Unit Size	
B1249	Benzo-12-crown 4-Ether	1g	5g
B1154	Benzo-15-crown 5-Ether	1g	5g
B1539	Benzo-18-crown 6-Ether	1g	5g
B2245	Bis(1,4-phenylene)-34-crown 10-Ether	100mg	
B2189	4'-Bromobenzo-15-crown 5-Ether	1g	5g
B2181	4'-Bromobenzo-18-crown 6-Ether	1g	5g
C1713	4'-Carboxybenzo-15-crown 5-Ether	1g	
C1714	4'-Carboxybenzo-18-crown 6-Ether	100mg	1g
C1942	15-Crown-4 [4-(2,4-Dinitrophenylazo)phenol]	100mg	
C1943	18-Crown-5 [4-(2,4-Dinitrophenylazo)phenol]	100mg	
C0858	12-Crown 4-Ether	1mL	5mL
C0859	15-Crown 5-Ether	5mL	25mL
C0860	18-Crown 6-Ether	5g	25g
C1736	24-Crown 8-Ether	1g	
D2743	4,10-Diaza-12-crown 4-Ether	100mg	
D2744	4,10-Diaza-15-crown 5-Ether	1g	
D2323	4,13-Diaza-18-crown 6-Ether	1g	5g
D2877	Dibenzo-15-crown 5-Ether	1g	
D1533	Dibenzo-18-crown 6-Ether	5g	25g
D2878	Dibenzo-21-crown 7-Ether	1g	
D1830	Dibenzo-24-crown 8-Ether	1g	5g
D2684	Dibenzo-30-crown 10-Ether	1g	
D2321	<i>N,N'</i> -Dibenzyl-4,13-diaza-18-crown 6-Ether	1g	5g
D1668	Dicyclohexano-18-crown 6-Ether	1g	5g
F0448	4'-Formylbenzo-15-crown 5-Ether	100mg	1g
F0451	4'-Formylbenzo-18-crown 6-Ether	500mg	
H1070	1,4,7,10,13,16-Hexaazacyclooctadecane	100mg	
H1215	1,4,7,10,13,16-Hexaazacyclooctadecane Hexahydrochloride	100mg	
H0932	4,7,13,16,21,24-Hexaoxa-1,10-diazabicyclo[8.8.8]hexacosane	1g	5g
H0982	2-(Hydroxymethyl)-12-crown 4-Ether	1g	5g
H0983	2-(Hydroxymethyl)-15-crown 5-Ether	1g	5g
H0990	2-(Hydroxymethyl)-18-crown 6-Ether	200mg	1g
M1489	4'-Methoxycarbonylbenzo-15-crown 5-Ether	1g	
N0561	4'-Nitrobenzo-15-crown 5-Ether	1g	5g
N0562	4'-Nitrobenzo-18-crown 6-Ether	1g	5g
P1143	<i>N</i> -Phenylaza-15-crown 5-Ether	1g	5g
T1874	1,4,7,10-Tetraazacyclododecane	1g	5g
T1875	1,4,7,10-Tetraazacyclododecane-1,4,7,10-tetraacetic Acid	200mg	1g
T1426	1,4,7,10-Tetraazacyclododecane Tetrahydrochloride	1g	5g
T1691	1,4,8,12-Tetraazacyclotetradecane	1g	5g
T1597	1,4,8,11-Tetraazacyclotetradecane	1g	5g
T2540	Tetraethyl 1,4,8,11-Tetraazacyclotetradecane-1,4,8,11-tetraacetate	200mg	
T1959	1,4,8,11-Tetrathiacyclotetradecane	200mg	1g
T1876	1,5,9-Triazacyclododecane	100mg	
T1878	1,4,7-Triazacyclononane	200mg	1g
T1600	1,4,7-Triazacyclononane Trihydrochloride	1g	5g
T2642	Tri- <i>tert</i> -butyl 1,4,7,10-Tetraazacyclododecane-1,4,7,10-tetraacetate	100mg	1g
T2541	Tri- <i>tert</i> -butyl 1,4,7,10-Tetraazacyclododecane-1,4,7-triacetate	200mg	
T1879	1,4,7-Trimethyl-1,4,7-triazacyclononane (stabilized with NaHCO ₃)	1g	5g
T1972	1,4,7-Trithiacyclononane	500mg	

Calixarenes		B1809 	B2221 	H0714
B1750 	T2563 	C1455 	H0713 	C1435



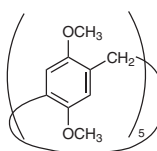
Product No.	Product Name	Unit Size		
B1809	4- <i>tert</i> -Butylcalix[4]arene	1g	5g	25g
B2221	4- <i>tert</i> -Butylcalix[5]arene	100mg		
H0714	4- <i>tert</i> -Butylcalix[6]arene (contains 5-10% Benzene)	5g	25g	25g
B1750	4- <i>tert</i> -Butylcalix[8]arene	5g	25g	
T2563	Tetraethyl 4- <i>tert</i> -Butylcalix[4]arene- <i>O,O',O'',O'''</i> -tetraacetate	200mg	1g	
C1455	Calix[4]arene (contains ca. 8% Chloroform)	100mg	1g	
H0713	Calix[6]arene	1g	5g	
C1435	Calix[8]arene	1g	5g	
H0889	4-Methyl-1-acetoxycalixarene [mixture of [6] and [8]] (contains 5-10% Acetone)	100mg	1g	
S0469	4-Sulfocalix[4]arene Hydrate	1g	5g	
S0470	4-Sulfocalix[6]arene Hydrate	1g	5g	
S0471	4-Sulfocalix[8]arene Hydrate	1g	5g	
U0069	C-Undecylcalix[4]resorcinarene Monohydrate			1g

Thiacalixarenes

B2296

B2310

B2312

S0477


Product No.	Product Name	Unit Size	
B2296	4- <i>tert</i> -Butylthiacalix[4]arene	1g	5g
B2310	4- <i>tert</i> -Butyl-1-(ethoxycarbonylmethoxy)thiacalix[4]arene	1g	5g
B2312	4- <i>tert</i> -Butylsulfonylethylthiacalix[4]arene	1g	5g
S0477	4-Sulfonylethylthiacalix[4]arene Sodium Salt	1g	5g

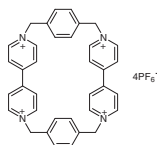
Pillararenes

D4471


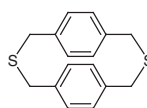
Product No.	Product Name	Unit Size
D4471	Dimethoxypillar[5]arene	100mg

Cyclophanes

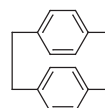
C1749



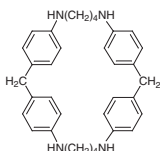
D2210



P1165



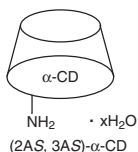
T1378



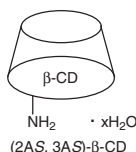
Product No.	Product Name	Unit Size
C1749	Cyclobis(paraquat-1,4-phenylene) Tetrakis(hexafluorophosphate)	100mg
D2210	2,11-Dithia[3.3]paracyclophane	100mg 500mg
P1165	[2.2]Paracyclophane	1g
T1378	1,6,20,25-Tetraaza[6.1.6.1]paracyclophane	100mg

Cyclodextrins

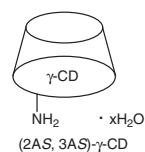
A2122



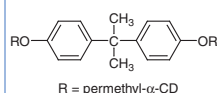
A1916



A2123



B3026

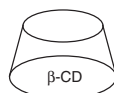


C0776



C0900

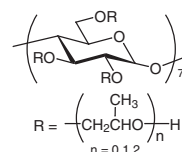
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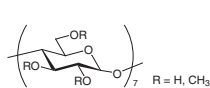
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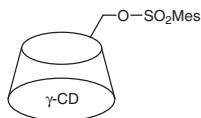
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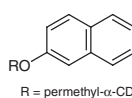
M1356



M1212



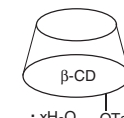
M1876



M1956



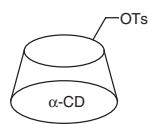
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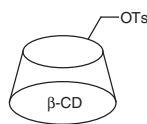
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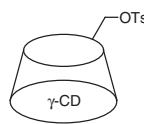
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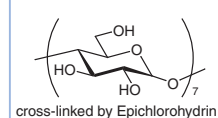
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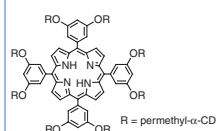
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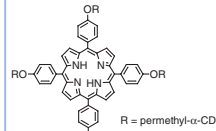
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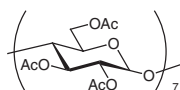
T2452



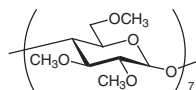
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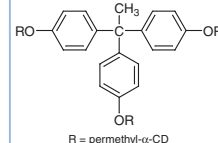
T1844



T1094



T2450



Product No.	Product Name	Unit Size	
A2122	3A-Amino-3A-deoxy-(2AS,3AS)- α -cyclodextrin Hydrate	200mg	1g
A1916	3A-Amino-3A-deoxy-(2AS,3AS)- β -cyclodextrin Hydrate	200mg	1g
A2123	3A-Amino-3A-deoxy-(2AS,3AS)- γ -cyclodextrin Hydrate		1g
B3026	2,2-Bis[4-(per- <i>O</i> -methyl- α -cyclodextrin-6-yloxy)phenyl]propane		10mg
C0776	α -Cyclodextrin	10g	25g
C0900	β -Cyclodextrin	25g	100g
C0777	β -Cyclodextrin		25g
C0869	γ -Cyclodextrin	5g	25g
H0979	Hydroxypropyl- β -cyclodextrin		100g
M1356	Methyl- β -cyclodextrin (mixture of several Methylated)	25g	250g
M1212	Mono-6- <i>O</i> -mesitylenesulfonyl- γ -cyclodextrin		1g
M1876	Mono-6- <i>O</i> -(2-naphthyl)-per- <i>O</i> -methyl- α -cyclodextrin		10mg
M1956	Mono-2- <i>O</i> -(<i>p</i> -toluenesulfonyl)- α -cyclodextrin		1g
M1741	Mono-2- <i>O</i> -(<i>p</i> -toluenesulfonyl)- β -cyclodextrin Hydrate		1g
M1957	Mono-2- <i>O</i> -(<i>p</i> -toluenesulfonyl)- γ -cyclodextrin		1g
M1644	Mono-6- <i>O</i> -(<i>p</i> -toluenesulfonyl)- α -cyclodextrin	200mg	1g
M1381	Mono-6- <i>O</i> -(<i>p</i> -toluenesulfonyl)- β -cyclodextrin		200mg
M1645	Mono-6- <i>O</i> -(<i>p</i> -toluenesulfonyl)- γ -cyclodextrin		200mg
P0977	Poly- β -cyclodextrin (Cross-linked by Epichlorohydrin)		1g
T2452	5,10,15,20-Tetrakis[3,5-bis(per- <i>O</i> -methyl- α -cyclodextrin-6-yloxy)phenyl]-21 <i>H</i> ,23 <i>H</i> -porphine		10mg
T2451	5,10,15,20-Tetrakis[4-(per- <i>O</i> -methyl- α -cyclodextrin-6-yloxy)phenyl]-21 <i>H</i> ,23 <i>H</i> -porphine		10mg
T1844	Triacetyl- β -cyclodextrin		25g
T1094	Trimethyl- β -cyclodextrin		1g
T2450	1,1,1-Tris[4-(per- <i>O</i> -methyl- α -cyclodextrin-6-yloxy)phenyl]ethane		10mg

References

- 1) Calixarene
A. Ikeda, S. Shinkai, *Chem. Rev.* **1997**, 97, 1713; M. Ayabe, S. Shinkai, *TCIMAIL* **2003**, number 118, 2.
- 2) Cyclodextrin
K. Takahashi, *Chem. Rev.* **1998**, 98, 2013.
- 3) Thiacalixarene
N. Morohashi, S. Miyano, *TCIMAIL* **2004**, number 122, 2.

Building Blocks for Dendrimers

Dendrimers are a single dendritic polymer consisting of three layers, its core, dendron regularly branched from the core, and the exterior surface layer. The typical species become globular and their size is in a clear-cut nm scale, having physical properties different from conventional straight polymer. Since their report in 1984 by Tomalia and co-workers, dendrimers have received much attention in many areas.¹⁾ Nowadays, applications of dendrimers are examined in chemical sensors, catalysts, electronics, photonics and medicines.^{2, 3)}

Functional elements and functional groups can be introduced into the core, dendron and surface layer. The synthetic technique is divided mainly into the divergent method, where synthesis proceeds from the center core toward the outside, and the convergent method, where synthesis proceeds from the exterior shell to the core.

For the synthesis of the regularly branched portions, multifunctional compounds have been utilized. The 1,3,5-trisubstituted benzenes, shown below are useful building blocks for dendrimers. Please refer to our website for other building blocks. We provide the structure search on the website and you can search by the substructure.

B3586 	B2081 	B2118 	B2248 	B2865
B2052 	B2246 	B2247 	B2120 	B2866
C1258 	D1978 	D2844 	D2085 	D3184
D2267 	D2651 	B2093 	D2832 	D2353
D2824 	D2724 	I0302 	D1981 	D2875

D0570 D2554		D2656		D1484		D1164		D1558	
D1534		D2609		D2594		D2657		D2950	
H1412		H0794		M1413		B2051		B2092	
M1929		D2215		D1737		D2655		T2760	
T2719		T2647							

Product No.	Product Name	Unit Size	
B3586	1,3,5-Benzenetrimethanol	1g	5g
B2081	3,5-Bis(4-aminophenoxy)benzoic Acid	1g	5g
B2118	3,5-Bis[3,5-bis(benzyloxy)benzyloxy]benzyl Bromide	1g	5g
B2248	3,5-Bis[3,5-bis(3,5-dimethoxybenzyloxy)benzyloxy]benzyl Bromide		1g
B2865	3,5-Bis[3,5-bis(methoxycarbonyl)phenoxy]methylphenol		200mg
B2052	3,5-Bis(<i>tert</i> -butyldiphenylsilyloxy)benzyl Alcohol		1g
B2246	3,5-Bis(3,5-dimethoxybenzyloxy)benzyl Alcohol	1g	5g
B2247	3,5-Bis(3,5-dimethoxybenzyloxy)benzyl Bromide	1g	5g
B2120	3,5-Bis(4-nitrophenoxy)benzoic Acid		5g
B2866	5-(<i>tert</i> -Butyldiphenylsilyloxy)-1,3-benzenedimethanol	1g	5g
C1258	1-Chloro-3,5-dimethoxybenzene	10g	25g
D1978	3',5'-Diacetoxyacetophenone	10g	25g
D2844	3,5-Diacetoxybenzoic Acid	1g	5g
D2085	3',5'-Dibenzyloxyacetophenone		10g
D3184	3,5-Dibenzyloxybenzaldehyde	1g	5g
D2267	3,5-Dibenzyloxybenzoic Acid	5g	25g
D2651	3,5-Dibenzyloxybenzyl Alcohol	5g	25g
B2093	3,5-Dibenzyloxybenzyl Bromide	5g	25g
D2832	3,5-Dibromobenzaldehyde	5g	25g
D2353	3,5-Dibromobenzoic Acid		10g
D2824	3',5'-Dibromo-4'-hydroxyacetophenone	5g	25g
D2724	3,5-Dibromo-1-trimethylsilylbenzene	5g	25g
I0302	3,5-Dichlorophenyl Isocyanate		10g
D1981	3',5'-Dihydroxyacetophenone	10g	25g

Product No.	Product Name	Unit Size	
D2875	3,5-Dihydroxybenzamide		5g
D0570	3,5-Dihydroxybenzoic Acid	25g	500g
D2554	3,5-Dihydroxybenzoic Acid	25g	500g
D2656	3,5-Dihydroxybenzyl Alcohol	5g	25g
D1484	3,5-Dimethoxyaniline	5g	25g
D1164	3,5-Dimethoxybenzaldehyde	5g	25g
D1558	3,5-Dimethoxybenzamide		5g
D1534	3,5-Dimethoxybenzoic Acid	25g	500g
D2609	3,5-Dimethoxybenzoyl Chloride	5g	25g
D2594	3,5-Dimethoxybenzyl Alcohol	5g	25g
D2657	3,5-Dimethoxybenzyl Bromide	5g	25g
D2950	3,5-Dimethoxyphenylacetic Acid	1g	5g
H1412	Hexaphenylbenzene	1g	5g
H0794	5-Hydroxyisophthalic Acid	25g	500g
M1413	5-Methoxyresorcinol		1g
B2051	Methyl 3,5-Bis(<i>tert</i> -butyldiphenylsilyloxy)benzoate (ca. 20% in Toluene, ca. 0.28mol/L)		25g
B2092	Methyl 3,5-Dibenzyloxybenzoate	5g	25g
M1929	Methyl 3,5-Dibromobenzoate	5g	25g
D2215	Methyl 3,5-Dihydroxybenzoate	25g	250g
D1737	Methyl 3,5-Dimethoxybenzoate		25g
D2655	2,2,2-Trichloroethyl 3,5-Dihydroxybenzoate (ca. 20% in Dichloromethane, ca. 1mol/L)	5g	25g
T2760	1,3,5-Triethynylbenzene	1g	5g
T2719	1,3,5-Tris(bromomethyl)benzene	1g	5g
T2647	1,3,5-Tris(4-carboxyphenyl)benzene	1g	5g

References

- 1) D. A. Tomalia, J. R. Dewald, M. R. Hall, S. J. Martin, P. B. Smith, Preprints of the 1st SPSJ International Polymer Conference, Society of Polymer Science Japan, Kyoto, **1984**, p 65; D. A. Tomalia, J. M. J. Fréchet, *J. Polym. Sci. Part A: Polym. Chem.* **2002**, *40*, 2719.
- 2) F. Vögtle, G. Richardt, N. Werner, in *Dendrimer Chemistry: Concepts, Syntheses, Properties, Applications*, Wiley-VCH, Weinheim, **2009**.
- 3) D. Astruc, E. Boisselier, C. Ornelas, *Chem. Rev.* **2010**, *110*, 1857.

Derivatizing Reagents for Solubility Improvement

Alkyl groups do not affect molecular electronic properties, because they do not strongly interact with π -conjugates. However, the effect of alkyl groups is large in the molecule-assembled solid state, modifying solubility and melting point when alkyl groups are introduced. In particular, organic devices require alkyl derivatizations to increase solubility, because solution-processible printing technologies are required for large scale manufacturing. In addition, introduction of a long alkyl chain to an organic molecule produces a liquid crystal material.

C5 Alkyl Groups		A0445	B0628	P0053
		<chem>CCCCCN</chem>	<chem>CCCCCBr</chem>	<chem>CCCCCS</chem>
P0055	P1177	U0081	V0003	
<chem>CCCCCO</chem>	<chem>CCCCC[Mg]Br</chem>	<chem>CF3(CF2)4I</chem>	<chem>CCCCC(=O)O</chem>	

Product No.	Product Name	Unit Size		
A0445	Amylamine	25mL	100mL	500mL
B0628	1-Bromopentane	25mL	500mL	
P0053	1-Pentanethiol	25mL	500mL	
P0055	1-Pentanol	25mL	500mL	
P1177	Pentylmagnesium Bromide (18% in Tetrahydrofuran, ca. 1mol/L)			250g
U0081	Undecafluoropentyl Iodide		5g	25g
V0003	Valeric Acid	25mL	500mL	

C6 Alkyl Groups		B0600	H0105	H0130
		<chem>CCCCCBr</chem>	<chem>CCCCC(=O)O</chem>	<chem>CCCCCO</chem>
H0134	H0842	H0821	H0103	T2479
<chem>CCCCCN</chem>	<chem>CCCCC[Li]</chem>	<chem>CCCCC[Mg]Br</chem>	<chem>CCCCCS</chem>	<chem>CF3(CF2)5Br</chem>

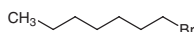
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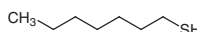
Product No.	Product Name	Unit Size	
B0600	1-Bromohexane	25g	500g
H0105	Hexanoic Acid	25mL	500mL
H0130	1-Hexanol	25mL	500mL
H0134	Hexylamine	25mL	100mL 500mL
H0842	Hexyllithium (30% in Hexane, ca. 2.3mol/L)		100mL
H0821	Hexylmagnesium Bromide (20% in Tetrahydrofuran, ca. 1mol/L)		250g
H0103	Hexyl Mercaptan	25mL	500mL
T2479	Tridecafluorohexyl Bromide	5g	25g
T1098	Tridecafluorohexyl Iodide	5g	25g

C7 Alkyl Groups

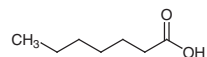
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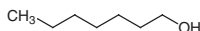
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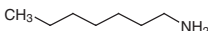
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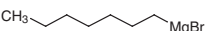
H0033



H0045



H0822



P1753



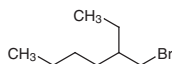
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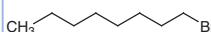
Product No.	Product Name	Unit Size	
B0598	1-Bromoheptane	25g	500g
H0029	1-Heptanethiol	10g	25g
H0030	Heptanoic Acid	25mL	500mL
H0033	1-Heptanol	25mL	500mL
H0045	Heptylamine	25mL	500mL
H0822	Heptylmagnesium Bromide (21% in Tetrahydrofuran, ca. 1mol/L)		250g
P1753	Pentadecafluoroheptyl Bromide		5g
P1839	Pentadecafluoroheptyl Iodide (stabilized with $\text{Na}_2\text{S}_2\text{O}_3$)	5g	25g

C8 Alkyl Groups

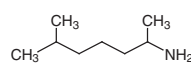
B0596



B0626



D1800

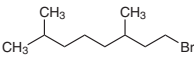
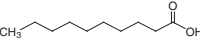
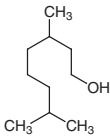


E1031 	E1020 	E1022 	E1026 	E1027
E1028 	H0946 $\text{CF}_3(\text{CF}_2)_7\text{Br}$	P1084 $\text{CF}_3(\text{CF}_2)_7\text{I}$	O0025 	O0027
O0036 	O0045 	O0240 		

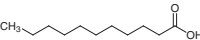
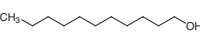
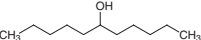
Product No.	Product Name	Unit Size		
B0596	1-Bromo-2-ethylhexane	25mL	100mL	500mL
B0626	1-Bromooctane		25mL	500mL
D1800	1,5-Dimethylhexylamine			25mL
E1031	2-Ethyl-1-hexanethiol		25g	100g
E1020	2-Ethylhexanoic Acid		25mL	500mL
E1022	2-Ethyl-1-hexanol		25mL	500mL
E1026	2-Ethylhexylamine	25mL	100mL	500mL
E1027	2-Ethylhexylamine Hydrobromide			25g
E1028	2-Ethylhexylamine Hydrochloride			25g
H0946	Heptadecafluoro- <i>n</i> -octyl Bromide		5g	25g
P1084	Heptadecafluoro- <i>n</i> -octyl Iodide			25g
O0025	1-Octanethiol		25mL	500mL
O0027	<i>n</i> -Octanoic Acid		25mL	500mL
O0036	1-Octanol		25mL	500mL
O0045	<i>n</i> -Octylamine		25mL	500mL
O0240	<i>n</i> -Octylmagnesium Bromide (ca. 22% in Tetrahydrofuran, ca. 1mol/L)			250g

C9 Alkyl Groups		B0933 	N0808 $\text{CF}_3(\text{CF}_2)_8\text{Br}$	N0288 P0952
		N0292 	N0297 	

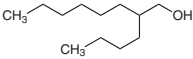
Product No.	Product Name	Unit Size	
B0933	1-Bromononane	25mL	500mL
N0808	Nonadecafluorononyl Bromide		5g
N0288	Nonanoic Acid	25mL	500mL
P0952	Nonanoic Acid	25mL	500mL
N0292	1-Nonanol	25mL	500mL
N0297	Nonylamine		25mL

C10 Alkyl Groups		D0033	B0583	B4401
				
D0016	D0017	D0031	D1442	H0844
				$\text{CF}_3(\text{CF}_2)_9\text{I}$

Product No.	Product Name	Unit Size		
D0033	1-Aminodecane	25mL	100mL	500mL
B0583	1-Bromodecane		25mL	500mL
B4401	1-Bromo-3,7-dimethyloctane		5g	25g
D0016	1-Decanethiol		25mL	500mL
D0017	Decanoic Acid		25g	400g
D0031	1-Decanol		25mL	500mL
D1442	3,7-Dimethyl-1-octanol		25mL	500mL
H0844	Heneicosafuorodecyl iodide			5g

C11 Alkyl Groups		A0761	B0934	U0066
				
U0004	U0005	U0040		
				

Product No.	Product Name	Unit Size	
A0761	1-Aminoundecane		10mL
B0934	1-Bromoundecane	25mL	500mL
U0066	1-Undecanethiol		5mL
U0004	Undecanoic Acid	25g	250g
U0005	1-Undecanol	25mL	500mL
U0040	6-Undecanol		5g

C12 Alkyl Groups		B0587	B3457	D0970
		$\text{CH}_3(\text{CH}_2)_{11}\text{Br}$		$\text{CH}_3(\text{CH}_2)_{11}\text{SH}$
D0980	D1452	L0011		
$\text{CH}_3(\text{CH}_2)_{11}\text{NH}_2$	$\text{CH}_3(\text{CH}_2)_{11}\text{NH}_2 \cdot \text{HCl}$	$\text{CH}_3(\text{CH}_2)_{10}-\overset{\text{O}}{\parallel}\text{C}-\text{OH}$		

Product No.	Product Name	Unit Size	
B0587	1-Bromododecane	25mL	500mL
B3457	2-Butyl-1- <i>n</i> -octanol	25mL	500mL
D0970	1-Dodecanethiol	25mL	500mL
D0980	Dodecylamine	25g	400g
D1452	Dodecylamine Hydrochloride	25g	500g
L0011	Lauric Acid	25g	500g

C13 Alkyl Groups		A0762	B0935	T0412
		$\text{CH}_3(\text{CH}_2)_{12}\text{NH}_2$	$\text{CH}_3(\text{CH}_2)_{12}\text{Br}$	$\text{CH}_3(\text{CH}_2)_{11}-\overset{\text{O}}{\parallel}\text{C}-\text{OH}$
T0803				
$\text{CH}_3(\text{CH}_2)_{12}\text{OH}$				

Product No.	Product Name	Unit Size	
A0762	1-Aminotridecane	10g	25g
B0935	1-Bromotridecane	5mL	25mL
T0412	Tridecanoic Acid	25g	500g
T0803	1-Tridecanol		25g

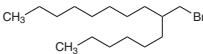
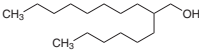
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		$\text{CH}_3(\text{CH}_2)_{13}\text{Br}$	$\text{CH}_3(\text{CH}_2)_{12}-\overset{\text{O}}{\parallel}\text{C}-\text{OH}$	$\text{CH}_3(\text{CH}_2)_{13}\text{SH}$

T0084	T0090
$\text{CH}_3(\text{CH}_2)_{13}\text{OH}$	$\text{CH}_3(\text{CH}_2)_{13}\text{NH}_2$

Product No.	Product Name	Unit Size	
B0233	1-Bromotetradecane	25mL	500mL
M0476	Myristic Acid	25g	500g
T0082	1-Tetradecanethiol		25mL
T0084	1-Tetradecanol	25mL	500mL
T0090	Tetradecylamine	25g	400g

C15 Alkyl Groups		A0763	B0936	P0836
		$\text{CH}_3(\text{CH}_2)_{14}\text{NH}_2$	$\text{CH}_3(\text{CH}_2)_{14}\text{Br}$	$\text{CH}_3(\text{CH}_2)_{14}\text{SH}$
P0035	P0036	P1251		
$\text{CH}_3(\text{CH}_2)_{13}-\text{C}(=\text{O})\text{OH}$	$\text{CH}_3(\text{CH}_2)_{14}\text{OH}$	$\text{CH}_3(\text{CH}_2)_{14}\text{MgBr}$		

Product No.	Product Name	Unit Size		
A0763	1-Aminopentadecane		10g	
B0936	1-Bromopentadecane	25mL	250mL	
P0836	1-Pentadecanethiol		10mL	
P0035	Pentadecanoic Acid	25g	100g	500g
P0036	1-Pentadecanol	25g	100g	500g
P1251	Pentadecylmagnesium Bromide (ca. 15% in Tetrahydrofuran, ca. 0.4mol/L)			250g

C16 Alkyl Groups		B0599	B4544	H0068
		$\text{CH}_3(\text{CH}_2)_{15}\text{Br}$		$\text{CH}_3(\text{CH}_2)_{15}\text{SH}$
H0071	H0074	H1461	P1145 P0002	
$\text{CH}_3(\text{CH}_2)_{15}\text{OH}$	$\text{CH}_3(\text{CH}_2)_{15}\text{NH}_2$		$\text{CH}_3(\text{CH}_2)_{14}-\text{C}(=\text{O})\text{OH}$	

Product No.	Product Name	Unit Size	
B0599	1-Bromohexadecane	25g	500g
B4544	7-(Bromomethyl)pentadecane	5mL	25mL
H0068	1-Hexadecanethiol	25mL	500mL
H0071	1-Hexadecanol	25g	500g
H0074	Hexadecylamine	25g	500g
H1461	2-Hexyl-1-decanol	25mL	500mL
P1145	Palmitic Acid		5g
P0002	Palmitic Acid	25g	500g

C17 Alkyl Groups		A0764	B0937	B1456
		$\text{CH}_3(\text{CH}_2)_{16}\text{NH}_2$	$\text{CH}_3(\text{CH}_2)_{16}\text{Br}$	$\text{CH}_3(\text{CH}_2)_{13}-\overset{\text{CH}_3}{\underset{ }{\text{CH}}}-\text{CH}_2\text{Br}$
H0019	H0018	H1401		
$\text{CH}_3(\text{CH}_2)_{15}-\overset{\text{O}}{\parallel}{\text{C}}-\text{OH}$	$\text{CH}_3(\text{CH}_2)_{16}\text{OH}$	$\text{CH}_3(\text{CH}_2)_7-\overset{\text{OH}}{\underset{ }{\text{CH}}}-\text{(CH}_2)_7\text{CH}_3$		

Product No.	Product Name	Unit Size		
A0764	1-Aminoheptadecane			10g
B0937	1-Bromoheptadecane	5g		25g
B1456	1-Bromo-2-methylhexadecane			1g
H0019	Heptadecanoic Acid	25g	100g	500g
H0018	1-Heptadecanol		5g	25g
H1401	9-Heptadecanol			1g

C18 Alkyl Groups		B0625	O0005	O0006
		$\text{CH}_3(\text{CH}_2)_{17}\text{Br}$	$\text{CH}_3(\text{CH}_2)_{17}\text{SH}$	$\text{CH}_3(\text{CH}_2)_{17}\text{OH}$
O0099	S0163	O0014		
$\text{CH}_3(\text{CH}_2)_{17}\text{NH}_2 \cdot \text{HCl}$	$\text{CH}_3(\text{CH}_2)_{16}-\overset{\text{O}}{\parallel}{\text{C}}-\text{OH}$	$\text{CH}_3(\text{CH}_2)_{17}\text{NH}_2$		

Product No.	Product Name	Unit Size	
B0625	1-Bromooctadecane	25g	500g
O0005	1-Octadecanethiol	25g	400g
O0006	1-Octadecanol	25g	500g
O0099	Octadecylamine Hydrochloride	25g	
S0163	Stearic Acid	25g	500g
O0014	Stearylamine	25g	500g

Dialkyldichlorosilanes		D2704	D2712	D4336
		$\text{CH}_3(\text{CH}_2)_3\text{—}\overset{\text{Cl}}{\underset{\text{Cl}}{\text{Si}}}\text{—}(\text{CH}_2)_3\text{CH}_3$	$\text{CH}_3(\text{CH}_2)_5\text{—}\overset{\text{Cl}}{\underset{\text{Cl}}{\text{Si}}}\text{—}(\text{CH}_2)_5\text{CH}_3$	$\text{CH}_3(\text{CH}_2)_7\text{—}\overset{\text{Cl}}{\underset{\text{Cl}}{\text{Si}}}\text{—}(\text{CH}_2)_7\text{CH}_3$
D2710	$\text{CH}_3(\text{CH}_2)_4\text{—}\overset{\text{Cl}}{\underset{\text{Cl}}{\text{Si}}}\text{—}(\text{CH}_2)_4\text{CH}_3$			

Product No.	Product Name	Unit Size	
D2704	Dibutyldichlorosilane	5g	25g
D2712	Dichlorodihexylsilane	5g	25g
D4336	Dichlorodi- <i>n</i> -octylsilane	1g	
D2710	Dichlorodipentylsilane	5g	

Abbreviations

Descriptors

<i>o</i> -	ortho	τ -	tau(tele)	L-	L form
<i>m</i> -	meta	ω -	omega	DL-	DL form
<i>p</i> -	para	B-	boron position	<i>d</i> - or (+)-	dextro rotation
<i>n</i> -	normal	N-	nitrogen position	<i>l</i> - or (–)-	levo rotation
<i>prim</i> -	primary	O-	oxygen position	<i>dl</i> - or (±)-	racemic mixture
<i>sec</i> -	secondary	P-	phosphorus position	(<i>R</i>)-	R (rectus) form
<i>tert</i> -	tertiary	S-	sulfur position	(<i>S</i>)-	S (sinister) form
α -	alpha	<i>cis</i> -	<i>cis</i> form	<i>meso</i> -	meso form
β -	beta	<i>trans</i> -	<i>trans</i> form	<i>syn</i> -	syn form
γ -	gamma	(<i>Z</i>)-	Z (zusammen) form	<i>anti</i> -	anti form
δ -	delta	(<i>E</i>)-	E (entgegen) form	<i>asym</i> -	asymmetric form
ϵ -	epsilon	<i>threo</i> -	threo form	<i>s</i> - or <i>sym</i> -	symmetric form
η -	eta	<i>erythro</i> -	erythro form	<i>active</i> -	active form
μ -	mu	D-	D form	<i>leuco</i> -	leuco form

Products / Ligands

acac	Acetylacetone	dppf	1,1'-Bis(diphenylphosphinoferrocene)
ADDP	1,1'-(Azodicarbonyl)dipiperidine	DTBP	Di- <i>tert</i> -butyl Peroxide
AIBN	2,2'-Azobis(isobutyronitrile)	DVB	Divinylbenzene
BINAP	2,2'-Bis(diphenylphosphino)-1,1'-binaphthyl	EDAC	= EDCI
BINOL	Binaphthol	EDC	3-(3-Dimethylaminopropyl)-1-ethylcarbodiimide
bipy	= bpy	EDC	= EDCI
BMS	Borane - Dimethyl Sulfide Complex	EDCI	1-Ethyl-3-(3-dimethylaminopropyl)carbodiimide
bpy	Bipyridine	EDTA	Ethylenediaminetetraacetic Acid
BSA	<i>N,O</i> -Bis(trimethylsilyl)acetamide	FAMSO	Formaldehyde Dimethyl Dithioacetal S-Oxide
CD	Cyclodextrin	Fc	Ferrocene
CDI	<i>N,N'</i> -Carbonyldiimidazole	HMDS	1,1,1,3,3,3-Hexamethyldisilazane
cod	Cyclooctadiene	HMPA	Hexamethylphosphoric Triamide
cot	Cyclooctatetraene	HMPT	Hexamethylphosphorous Triamide
CSA	Camphorsulfonic Acid	HOAt	1-Hydroxy-7-azabenzotriazole
CSI	Chlorosulfonyl Isocyanate	HOBT	1-Hydroxybenzotriazole
DABCO	1,4-Diazabicyclo[2.2.2]octane	HOSu	<i>N</i> -Hydroxysuccinimide
DAST	(Diethylamino)sulfur Trifluoride	IBX	2-Iodoxybenzoic Acid
dba	Dibenzylideneacetone	Im	Imidazole
DBAD	Di- <i>tert</i> -butyl Azodicarboxylate	Imid	= Im
DBN	1,5-Diazabicyclo[4.3.0]non-5-ene	LAH	Lithium Aluminum Hydride
DBU	1,8-Diazabicyclo[5.4.0]-7-undecene	LDA	Lithium Diisopropylamide
DCC	<i>N,N'</i> -Dicyclohexylcarbodiimide	LHMDS	= LiHMDS
DDQ	2,3-Dichloro-5,6-dicyano-1,4-benzoquinone	LiHMDS	Lithium Hexamethyldisilazide
DEAD	Diethyl Azodicarboxylate	LTA	Lead Tetraacetate
DET	Diethyl Tartrate	MCPBA	<i>m</i> -Chloroperoxybenzoic Acid
DHP	3,4-Dihydro-2 <i>H</i> -pyran	MEK	Methyl Ethyl Ketone
DIAD	Diisopropyl Azodicarboxylate	MTBE	Methyl <i>tert</i> -Butyl Ether
DIBAL	= DIBAL-H	MVK	Methyl Vinyl Ketone
DIBAL-H	Diisobutylaluminum Hydride	NaHMDS	Sodium Hexamethyldisilazide
DIEA	= DIPEA	nbd	2,5-Norbornadiene
DIPEA	<i>N,N</i> -Diisopropylethylamine	NBS	<i>N</i> -Bromosuccinimide
DIPT	Diisopropyl Tartrate	NCS	<i>N</i> -Chlorosuccinimide
DMA	<i>N,N</i> -Dimethylacetamide	NHC	<i>N</i> -Heterocyclic Carbene
DMAP	4-Dimethylaminopyridine	NIS	<i>N</i> -Iodosuccinimide
DME	1,2-Dimethoxyethane	NMO	4-Methylmorpholine <i>N</i> -Oxide
DMF	<i>N,N</i> -Dimethylformamide	NMP	<i>N</i> -Methyl-2-pyrrolidone
dmit	4,5-Dimercapto-1,3-dithiole-2-thione	Norphos	2,3-Bis(diphenylphosphino)bicyclo[2.2.1]hept-5-ene
DMP	Dess-Martin Periodinane	Pc	Phthalocyanine
DMPU	<i>N,N'</i> -Dimethylpropyleneurea	PCC	Pyridinium Chlorochromate
DMS	Dimethyl Sulfide	PDC	Pyridinium Dichromate
DMSO	Dimethyl Sulfoxide	PEG	Polyethylene Glycol
DMTSP	Dimethyl(methylthio)sulfonium Tetrafluoroborate	PG	Prostaglandin
DOXYL	4,4-Dimethyloxazolidine-1-oxyl	phen	Phenanthroline
DPPA	Diphenylphosphoryl Azide		

PPTS	Pyridinium <i>p</i> -Toluenesulfonate
PTSA	<i>p</i> -Toluenesulfonic Acid
py	Pyridine
Salen	<i>N,N'</i> -Bis(salicylidene)ethylenediamine
SDS	Sodium Dodecyl Sulfate
TBAB	Tetrabutylammonium Bromide
TBAD	= DBAD
TBAF	Tetrabutylammonium Fluoride
TBHP	<i>tert</i> -Butyl Hydroperoxide
TCNQ	7,7,8,8-Tetracyanoquinodimethane
TEMPO	2,2,6,6,-Tetramethylpiperidine 1-Oxyl

TFA	Trifluoroacetic Acid
TFAA	Trifluoroacetic Anhydride
THF	Tetrahydrofuran
THP	Tetrahydropyran
TMTSF	Tetramethyltetraselenafuvalene
TNBS	2,4,6-Trinitrobenzenesulfonic Acid
TPAP	Tetrapropylammonium Perruthenate
TPD	<i>N,N'</i> -Diphenyl- <i>N,N'</i> -di(<i>m</i> -tolyl)benzidine
TPDS	Tetraphenyldisilane
TPP	Tetraphenylporphyrin
TTF	Tetrathiafulvalene

Protecting Groups / Functional Groups

Ac	Acetyl-
Alloc	Allyloxycarbonyl-
Ar	Aryl-
Bn	Benzyl-
Boc	<i>tert</i> -Butoxycarbonyl-
BOM	Benzyloxycarbonyl-
BPS	= TBDPS
Bz	Benzoyl-
Cbz	Carbobenzyloxy- (=Benzyloxycarbonyl-)
Chx	= Cy
Cp	Cyclopentadienyl-
Cy	Cyclohexyl-
DMTr	4,4'-Dimethoxytrityl-
Dnp	2,4-Dinitrophenyl-
Fmoc	(9 <i>H</i> -Fluoren-9-ylmethoxy)carbonyl-
MEM	(2-Methoxyethoxy)methyl-
Mes	2,4,6-Trimethylphenyl- (=Mesityl-)
MMTr	4-Monomethoxytrityl-
MOM	Methoxymethyl-

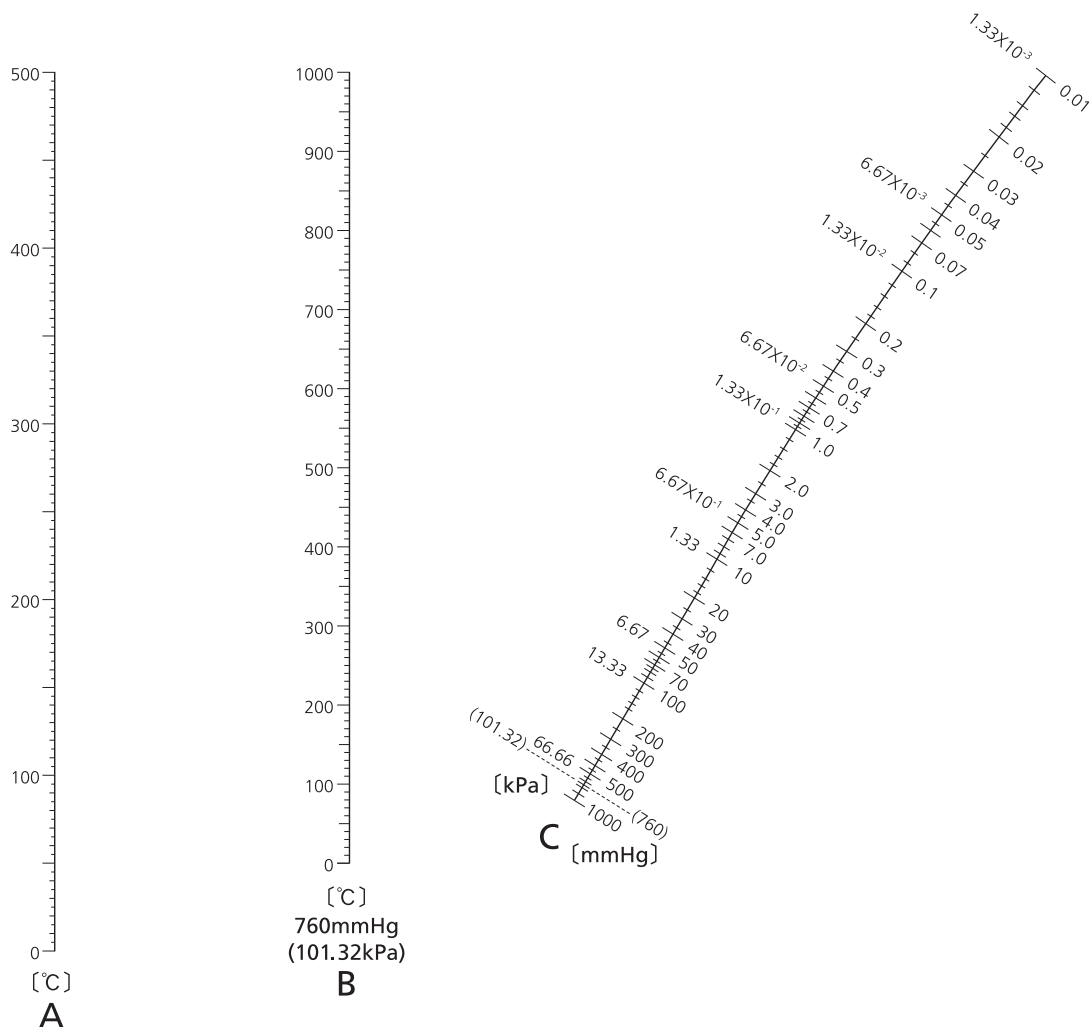
Ms	Methanesulfonyl-
Naph	= Np
Np	Naphthyl-
Nps	2-Nitrophenylsulfonyl-
Ns	Nitrobenzenesulfonyl
Piv	Pivaloyl-
PMB	<i>p</i> -Methoxybenzyl
SEM	2-(Trimethylsilyl)ethoxymethyl-
TBDMS	<i>tert</i> -Butyldimethylsilyl- (=TBS)
TBDPS	<i>tert</i> -Butyldiphenylsilyl-
TES	Triethylsilyl-
Tf	Trifluoromethanesulfonyl-
TIPS	Triisopropylsilyl-
TMS	Trimethylsilyl-
Tol	<i>p</i> -Tolyl-
Tr	Triphenylmethyl- (=Trityl-)
Ts	<i>p</i> -Toluenesulfonyl- (=Tosyl)
Z	=Cbz

Stabilizers

BHT	3,5-Di- <i>tert</i> -butyl-4-hydroxytoluene
HQ	Hydroquinone
MEHQ	Hydroquinone Monomethyl Ether (=4-Methoxyphenol)

ONP	<i>o</i> -Nitrophenol
TBC	4- <i>tert</i> -Butylcatechol
TBBP	3,3',5,5'-Tetra- <i>tert</i> -butyl-4,4'- dihydroxybiphenyl

Pressure-Temperature Nomograph



● How to calculate the bp under atmospheric pressure from bp under reduced pressure

- ① Connect a degree on the line C and its corresponding bp on the line A under reduced pressure using a straight line.
- ② An intersection found by step ① on the line B serves as an approximate bp in atmospheric pressure.

*This nomograph applies to nonassociated solvent.

Since the bp obtained from this nomograph is an approximate value, it is not an exact bp.

Reference : Science of Petroleum, Vol.II, p.1281 (1938).

The physical properties of the typical organic solvents ¹⁾

Organic Solvents	bp (°C)	mp (°C)	d (20/4°C)	Compatibility with Water (°C) (weight % of solvents)	Miscibility with Water ^{a)}
Methanol (MeOH)	64.5	-97.7	0.791	— a)	○
Ethanol (EtOH)	78.3	-114.5	0.789	78.2(96.0)	○
Propanol (<i>n</i> -PrOH)	97.2	-126.2	0.804	87.7(71.7)	○
Isopropyl Alcohol (<i>i</i> -PrOH)	82.2	-88.0	0.785	80.1(88.0)	○
Butanol (BuOH)	117.7	-88.6	0.810	92.7(57.5)	△
Isobutyl Alcohol (<i>i</i> -BuOH)	107.9	-108	0.802	89.8(67)	△
<i>sec</i> -Butyl Alcohol (<i>s</i> -BuOH)	99.5	-114.7	0.807	87.0(73.2)	△
<i>tert</i> -Butyl Alcohol (<i>t</i> -BuOH)	82.3	25.6	0.781	79.7(88.2)	○
Ethylene Glycol	197.5	-12.6	1.114	— a)	○
1,2-Dimethoxyethane (Glyme)	84.5	-69	0.869	77.4(89.9)	○
Diethyl Ether (Et ₂ O)	34.4	-116	0.714	34.2(98.7)	× c)
Diisopropyl Ether (<i>i</i> -Pr ₂ O)	68.5	-85.5	0.724	62.2(95.5)	×
Acetic Acid (AcOH)	117.9	16.7	1.050	— a)	○
Ethyl Acetate (AcOEt)	77.1	-83.6	0.901	70.4(91.5)	× c)
Acetic Anhydride (Ac ₂ O)	140.0	-73.1	1.083		
Tetrahydrofuran (THF)	66.0	-108.4	0.889	63.4(93.3)	○
1,4-Dioxane	101.3	11.8	1.034	87.8(82)	○
Acetone	56.1	-94.7	0.790	— a)	○
Ethyl Methyl Ketone	79.6	-86.7	0.805	73.4(88.7)	△
Carbon Tetrachloride (CCl ₄)	76.6	-22.8	1.594	66(95.9)	×
Chloroform (CHCl ₃)	61.2	-63.5	1.489	56.1(97.8)	×
Dichloromethane (CH ₂ Cl ₂)	39.6	-94.9	1.326	38.1(98.5)	×
1,2-Dichloroethane (ClCH ₂ CH ₂ Cl)	83.5	-35.7	1.252	72(91.8)	×
Benzene (C ₆ H ₆)	80.1	5.5	0.879	69.3(91.2)	×
Toluene	110.6	-95.0	0.867	85(79.8)	×
<i>o</i> -Xylene	144.4	-25.2	0.880	93.5(50.1)	×
Cyclohexane	80.7	6.7	0.779	69.0(91)	×
Pentane	36.1	-129.7	0.626	34.6(98.6)	×
Hexane	68.7	-95.3	0.659	61.6(94.4)	×
Heptane	98.4	-90.6	0.684		×
Acetonitrile (CH ₃ CN)	81.6	-43.8	0.782	76.7(84.2)	○
Nitromethane (CH ₃ NO ₂)	101.2	-28.6	1.138	83.6(76.4)	×
Dimethylformamide (DMF)	153	-60.4	0.949	— a)	○
Hexamethylphosphoric Triamide (HMPA)	233	7.2	1.027		○
Triethylamine (Et ₃ N)	89.6	-114.7	0.728		○
Pyridine (Py)	115.3	-41.6	0.983	93.6(58.7)	○
Dimethyl Sulfoxide (DMSO)	189.0	18.5	1.100	— a)	△
Carbon Disulfide (CS ₂)	46.2	-111.6	1.263	42.6(97.2)	×

a) It doesn't form azeotropic mixture

b) ○ : freely miscible

c) highly soluble in water

△ : partially miscible

× : practically immiscible (solubility : less than 1%)

Example of combination of recrystallization solvents

The crystals are obtained from the solution of single or more than one solvent.

In the two solvent system, solvent A and B should be miscible : when solubility is A > B, it is desirable that the boiling point is A < B and the density is A > B.

Freezing mixtures ²⁾

Freezing mixtures	Temp. (°C)	Freezing mixtures	Temp. (°C)
Ice	0	Chloroform / N ₂	-63
Ethylene Glycol / CO ₂	-15	Chloroform / CO ₂	-63
Ice(100) / NH ₄ Cl (25)	-15	Ethanol / CO ₂	-72
Ice(100) / NaCl(33)	-21	Ether / CO ₂	-77
Carbon Tetrachloride / N ₂	-23	Acetone / CO ₂	-78
Carbon Tetrachloride / CO ₂	-23	Methanol / N ₂	-98
Ice(100) / EtOH (100)	-30	<i>n</i> -Pentane / N ₂	-131
Acetonitrile / N ₂	-41	N ₂	-180
Ice(100) / CaCl ₂ (150)	-49		

References

- 1) "Yuki Kagaku Jikken no Tebiki 1", editors : T. Goto, T. Shiba, T. Matsuura, Kagaku Dojin
- 2) "Shinhan Kiso Yuki Kagaku Jikken", K. Hata, K. Watanabe, Maruzen

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18																																																																																																																																																																																																																																																																																																																																																																																																																																																							
1 H 1.008 v: 1.20 z _p : 2.20	ATOMIC NUMBER SYMBOL ATOMIC WEIGHT i : ionic radius (Å) (coordination no:6) a : atomic radius (Å) v : Van der Waals radius (Å) z_e : electronegativity Atomic Weights : 2011 IUPAC values																2 He 4.002602 v: 1.40																																																																																																																																																																																																																																																																																																																																																																																																																																																							
3 Li 6.94 i: 0.76 (+) a: 1.57 v: 1.82 z _p : 0.98	4 Be 9.012182 a: 1.12 z _p : 1.57																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
11 Na 22.98976928 i: 1.02 (+) a: 1.91 v: 2.27 z _p : 0.93	12 Mg 24.305 i: 0.72 (2+) a: 1.60 v: 1.73 z _p : 1.31	19 K 39.0983 i: 1.38 (+) a: 2.35 v: 2.75 z _p : 0.82	20 Ca 40.078 i: 1.00 (2+) a: 2.15 v: 1.90 z _p : 1.00	21 Sc 44.955912 a: 1.64 z _p : 1.36	22 Ti 47.867 a: 1.47 z _p : 1.54	23 V 50.9415 a: 1.35 z _p : 1.63	24 Cr 51.9961 a: 1.29 z _p : 1.66	25 Mn 54.938045 a: 1.37 z _p : 1.55	26 Fe 55.845 a: 1.26 z _p : 1.83	27 Co 58.933195 a: 1.25 z _p : 1.88	28 Ni 58.6934 a: 1.25 z _p : 1.91	29 Cu 63.546 a: 1.28 v: 1.4 z _p : 1.90	30 Zn 65.38 i: 0.62 (3+) a: 1.53 v: 1.87 z _p : 1.81	31 Ga 69.723 i: 0.62 (3+) a: 1.53 v: 1.87 z _p : 1.81	32 Ge 72.630 a: 1.22 v: 2.10 z _p : 2.01	33 As 74.92160 i: 1.98 (2-) a: 1.17 v: 1.90 z _p : 2.18	34 Se 78.96 i: 1.98 (2-) a: 1.17 v: 1.90 z _p : 2.18	35 Br 79.904 i: 1.96 (-) a: 1.14 v: 1.85 z _p : 2.96	36 Kr 83.798 v: 2.02 z _p : 3.00	54 Xe 131.293 v: 2.16 z _p : 2.60																																																																																																																																																																																																																																																																																																																																																																																																																																																				
55 Cs 132.9054519 i: 1.67 (+) a: 2.72 z _p : 0.79	56 Ba 137.327 i: 1.35 (2+) a: 2.24 z _p : 0.89	57 La 138.90547 a: 1.88 z _p : 1.10	58 Ce 140.116 a: 1.47 z _p : 1.50	59 Pr 140.90765 a: 1.41 z _p : 2.36	60 Nd 144.242 a: 1.37 z _p : 1.90	61 Pm 144.9128 a: 1.35 z _p : 2.20	62 Sm 150.36 a: 1.36 z _p : 2.20	63 Eu 151.964 a: 1.39 z _p : 2.28	64 Gd 157.25 a: 1.44 v: 1.66 z _p : 2.54	65 Tb 158.92535 a: 1.55 v: 1.55 z _p : 2.00	66 Dy 162.500 i: 0.89 (3+) a: 1.71 v: 1.96 z _p : 2.04	67 Ho 164.93032 a: 1.75 v: 2.02 z _p : 2.33	68 Er 167.259 a: 1.82 z _p : 2.02	69 Tm 168.93421 a: 1.82 z _p : 2.00	70 Yb 173.054 a: 1.82 z _p : 2.20	71 Lu 174.9668 a: 1.82 z _p : 2.20	86 Rn (222)	87 Fr (223)	88 Ra (226)	89 Ac (227)	90 Ce (228)	91 Pr (229)	92 Nd (230)	93 Pm (231)	94 Sm (232)	95 Eu (233)	96 Gd (234)	97 Tb (235)	98 Dy (236)	99 Ho (237)	100 Er (238)	101 Tm (239)	102 Yb (240)	103 Lu (241)	104 Be (242)	105 B (243)	106 C (244)	107 N (245)	108 O (246)	109 F (247)	110 Ne (248)	111 Na (249)	112 Mg (250)	113 Al (251)	114 Si (252)	115 P (253)	116 S (254)	117 Cl (255)	118 Ar (256)	119 K (257)	120 Ca (258)	121 Sc (259)	122 Ti (260)	123 V (261)	124 Cr (262)	125 Mn (263)	126 Fe (264)	127 Co (265)	128 Ni (266)	129 Cu (267)	130 Zn (268)	131 Ga (269)	132 Ge (270)	133 As (271)	134 Se (272)	135 Br (273)	136 Kr (274)	137 Rb (275)	138 Sr (276)	139 Y (277)	140 Zr (278)	141 Nb (279)	142 Mo (280)	143 Tc (281)	144 Ru (282)	145 Rh (283)	146 Pd (284)	147 Ag (285)	148 Cd (286)	149 In (287)	150 Sn (288)	151 Sb (289)	152 Te (290)	153 I (291)	154 Xe (292)	155 At (293)	156 B (294)	157 C (295)	158 N (296)	159 O (297)	160 F (298)	161 Ne (299)	162 Na (300)	163 Mg (301)	164 Al (302)	165 Si (303)	166 P (304)	167 S (305)	168 Cl (306)	169 Ar (307)	170 K (308)	171 Ca (309)	172 Sc (310)	173 Ti (311)	174 V (312)	175 Cr (313)	176 Mn (314)	177 Fe (315)	178 Co (316)	179 Ni (317)	180 Cu (318)	181 Zn (319)	182 Ga (320)	183 Ge (321)	184 As (322)	185 Se (323)	186 Br (324)	187 Kr (325)	188 Rb (326)	189 Sr (327)	190 Y (328)	191 Zr (329)	192 Nb (330)	193 Mo (331)	194 Tc (332)	195 Ru (333)	196 Rh (334)	197 Pd (335)	198 Ag (336)	199 Cd (337)	200 In (338)	201 Sn (339)	202 Sb (340)	203 Te (341)	204 I (342)	205 Xe (343)	206 At (344)	207 B (345)	208 C (346)	209 N (347)	210 O (348)	211 F (349)	212 Ne (350)	213 Na (351)	214 Mg (352)	215 Al (353)	216 Si (354)	217 P (355)	218 S (356)	219 Cl (357)	220 Ar (358)	221 K (359)	222 Ca (360)	223 Sc (361)	224 Ti (362)	225 V (363)	226 Cr (364)	227 Mn (365)	228 Fe (366)	229 Co (367)	230 Ni (368)	231 Cu (369)	232 Zn (370)	233 Ga (371)	234 Ge (372)	235 As (373)	236 Se (374)	237 Br (375)	238 Kr (376)	239 Rb (377)	240 Sr (378)	241 Y (379)	242 Zr (380)	243 Nb (381)	244 Mo (382)	245 Tc (383)	246 Ru (384)	247 Rh (385)	248 Pd (386)	249 Ag (387)	250 Cd (388)	251 In (389)	252 Sn (390)	253 Sb (391)	254 Te (392)	255 I (393)	256 Xe (394)	257 At (395)	258 B (396)	259 C (397)	260 N (398)	261 O (399)	262 F (400)	263 Ne (401)	264 Na (402)	265 Mg (403)	266 Al (404)	267 Si (405)	268 P (406)	269 S (407)	270 Cl (408)	271 Ar (409)	272 K (410)	273 Ca (411)	274 Sc (412)	275 Ti (413)	276 V (414)	277 Cr (415)	278 Mn (416)	279 Fe (417)	280 Co (418)	281 Ni (419)	282 Cu (420)	283 Zn (421)	284 Ga (422)	285 Ge (423)	286 As (424)	287 Se (425)	288 Br (426)	289 Kr (427)	290 Rb (428)	291 Sr (429)	292 Y (430)	293 Zr (431)	294 Nb (432)	295 Mo (433)	296 Tc (434)	297 Ru (435)	298 Rh (436)	299 Pd (437)	300 Ag (438)	301 Cd (439)	302 In (440)	303 Sn (441)	304 Sb (442)	305 Te (443)	306 I (444)	307 Xe (445)	308 At (446)	309 B (447)	310 C (448)	311 N (449)	312 O (450)	313 F (451)	314 Ne (452)	315 Na (453)	316 Mg (454)	317 Al (455)	318 Si (456)	319 P (457)	320 S (458)	321 Cl (459)	322 Ar (460)	323 K (461)	324 Ca (462)	325 Sc (463)	326 Ti (464)	327 V (465)	328 Cr (466)	329 Mn (467)	330 Fe (468)	331 Co (469)	332 Ni (470)	333 Cu (471)	334 Zn (472)	335 Ga (473)	336 Ge (474)	337 As (475)	338 Se (476)	339 Br (477)	340 Kr (478)	341 Rb (479)	342 Sr (480)	343 Y (481)	344 Zr (482)	345 Nb (483)	346 Mo (484)	347 Tc (485)	348 Ru (486)	349 Rh (487)	350 Pd (488)	351 Ag (489)	352 Cd (490)	353 In (491)	354 Sn (492)	355 Sb (493)	356 Te (494)	357 I (495)	358 Xe (496)	359 At (497)	360 B (498)	361 C (499)	362 N (500)	363 O (501)	364 F (502)	365 Ne (503)	366 Na (504)	367 Mg (505)	368 Al (506)	369 Si (507)	370 P (508)	371 S (509)	372 Cl (510)	373 Ar (511)	374 K (512)	375 Ca (513)	376 Sc (514)	377 Ti (515)	378 V (516)	379 Cr (517)	380 Mn (518)	381 Fe (519)	382 Co (520)	383 Ni (521)	384 Cu (522)	385 Zn (523)	386 Ga (524)	387 Ge (525)	388 As (526)	389 Se (527)	390 Br (528)	391 Kr (529)	392 Rb (530)	393 Sr (531)	394 Y (532)	395 Zr (533)	396 Nb (534)	397 Mo (535)	398 Tc (536)	399 Ru (537)	400 Rh (538)	401 Pd (539)	402 Ag (540)	403 Cd (541)	404 In (542)	405 Sn (543)	406 Sb (544)	407 Te (545)	408 I (546)	409 Xe (547)	410 At (548)	411 B (549)	412 C (550)	413 N (551)	414 O (552)	415 F (553)	416 Ne (554)	417 Na (555)	418 Mg (556)	419 Al (557)	420 Si (558)	421 P (559)	422 S (560)	423 Cl (561)	424 Ar (562)	425 K (563)	426 Ca (564)	427 Sc (565)	428 Ti (566)	429 V (567)	430 Cr (568)	431 Mn (569)	432 Fe (570)	433 Co (571)	434 Ni (572)	435 Cu (573)	436 Zn (574)	437 Ga (575)	438 Ge (576)	439 As (577)	440 Se (578)	441 Br (579)	442 Kr (580)	443 Rb (581)	444 Sr (582)	445 Y (583)	446 Zr (584)	447 Nb (585)	448 Mo (586)	449 Tc (587)	450 Ru (588)	451 Rh (589)	452 Pd (590)	453 Ag (591)	454 Cd (592)	455 In (593)	456 Sn (594)	457 Sb (595)	458 Te (596)	459 I (597)	460 Xe (598)	461 At (599)	462 B (600)	463 C (601)	464 N (602)	465 O (603)	466 F (604)	467 Ne (605)	468 Na (606)	469 Mg (607)	470 Al (608)	471 Si (609)	472 P (610)	473 S (611)	474 Cl (612)	475 Ar (613)	476 K (614)	477 Ca (615)	478 Sc (616)	479 Ti (617)	480 V (618)	481 Cr (619)	482 Mn (620)	483 Fe (621)	484 Co (622)	485 Ni (623)	486 Cu (624)	487 Zn (625)	488 Ga (626)	489 Ge (627)	490 As (628)	491 Se (629)	492 Br (630)	493 Kr (631)	494 Rb (632)	495 Sr (633)	496 Y (634)	497 Zr (635)	498 Nb (636)	499 Mo (637)	500 Tc (638)	501 Ru (639)	502 Rh (640)	503 Pd (641)	504 Ag (642)	505 Cd (643)	506 In (644)	507 Sn (645)	508 Sb (646)	509 Te (647)	510 I (648)	511 Xe (649)	512 At (650)	513 B (651)	514 C (652)	515 N (653)	516 O (654)	517 F (655)	518 Ne (656)	519 Na (657)	520 Mg (658)	521 Al (659)	522 Si (660)	523 P (661)	524 S (662)	525 Cl

INDEX

S : Reagent Guide Synthetic Organic Chemistry & Materials Chemistry
 B : Reagent Guide Bioscience & Analytical Science
 HP : Please visit our website.

[A]	
Abscisic Acids	B-272
Absolute Configuration Determination	B-304
Ac-Amino Acids	B-28
Acceptor Molecules (Molecular Conductors)	S-226
Acceptor Raw Materials (Building Blocks for Semiconducting Polymers)	S-234
Acetalization	S-123
Acryloyloxyalkyl Silanes (Silane Coupling Agents)	S-306
Activating Agents (Fmoc Solid Phase Peptide Synthesis)	B-56
Acyclic Monoterpenes	B-116
Acylation	S-122
Acylation (GC Derivatizing Reagents)	B-278
Additives for Battery	S-209
Al (Aluminum) Compounds	S-87
Alcohols (Terminal Acetylenes)	S-183
Alcohols (Chiral)	S-167
Alkali Phosphatase Substrates	B-258
Alkaline Phosphatase Inhibitors	B-233
Alkaloids	B-148
<i>n</i> -Alkane (GC Standard)	B-279
1-Alkenes (GC Standard)	B-279
Alkyl & Alkenylboronic Acid Esters	S-151
Alkyl & Alkenylboronic Acids	S-139
Alkyl Metal Reagents	S-77
Alkylating Agents (Antitumors)	B-182
Alkylation (GC Derivatizing Reagents)	B-277
Alkyldimethylsilylation (GC Derivatizing Reagents)	B-277
Alkylsilanes (Silane Coupling Agents)	S-307
Allergy Research	HP
Alloc Protection	S-124
Allose	B-68
Allylation	S-124
Allyloxycarbonylation	S-124
α -Amino Acids	B-17
Aluminum Hydrides (Reduction)	S-10
Ambipolar Semiconductors	S-221
Amides (Chiral)	S-163
Amination	B-161, S-31
Amine Ligands	S-94
Amines (Chiral)	S-171
Amino Acid Benzyl Esters	B-48
Amino Acid <i>tert</i> -Butyl Esters	B-47
Amino Acid Ethyl Esters	B-46
Amino Acid Methyl Esters	B-43
Amino Acid Succinimidyl Esters	B-49
Amino Acids	B-17
Amino Acids (Asymmetric Organocatalysts) ..	S-104
Amino Acids (<i>C</i> -Protected)	B-43
Amino Acids (<i>N</i> -Protected)	B-28
Amino Alcohols (Chiral)	S-165
Amino Group Labeling Reagents for Fluorescence HPLC	B-285
Amino Group Labeling Reagents for HPLC ..	B-282
Aminoalkyl Silanes (Silane Coupling Agents)	S-307
Aminoglycosides (Antibiotic Ingredients)	B-171
Ammonium Salts (Ionic Liquids)	S-133
Amphoteric Surfactants (for Biochemistry) ..	B-264
Androstanes	B-128
Animal Disease Model Preparation	B-217
Anion Detection	B-322
Anionic Surfactants (for Biochemistry)	B-264
Anthelmintic Ingredients	B-179
Anthracenes & Anthraquinones (Building Blocks for Small Molecule Semiconductors)	S-244
Anti-DTBTA-Eu ³⁺ Antibody	B-249
Anti-Glyco Antibodies	B-103
Anti-HRP Antibody	B-252
Anti-inflammatory Ingredients	B-195
Anti-Influenza Virus Monoclonal Antibodies ..	B-247
Anti-allergic Ingredients	B-198
Antibiotics (Antitumors)	B-184
Antibiotics	B-170
Antibodies	B-247
Anticoagulant Agents	B-190
Antidiabetic Ingredients	B-190
Antifungal Ingredients	B-177
Anti-Glyco Monoclonal Antibody	B-103
Anti-Glyco Monoclonal Antibody (Culture Supernatant)	B-105
Antihistamine Agents	B-198
Antihistamine Ingredients	B-198
Anti-hypercholesterolemic Ingredients	B-189
Antihypertensive Ingredients	B-186
Antilipemic Ingredients	B-189
Antimetabolites (Antitumors)	B-182
Antimicrobials	B-174
Anti-osteoporosis Ingredients	B-203
Antioxidants	B-229
Antiplatelet Agents	B-189

Antiprotozoals	B-178
Anti-rheumatoid Arthritis Ingredients	B-201
Antithrombotic Ingredients	B-189
Antitumor Ingredients	B-182
Antiviral Ingredients	B-180
Arabinose	B-69
Aromatic Polyketides	B-143
Arylboronic Acid Esters	S-152
Arylboronic Acids	S-140
Aryne Precursors	HP
Asymmetric Hydrogenation Catalysts	S-14
Asymmetric Organocatalysts	S-102
Activation of Non-active Bonds	S-69
Atom Transfer Radical Polymerization (ATRP)	
Reagents	S-328
Auxins	B-270
Azidation	HP
Azide Compounds	S-186
Azo Compounds	B-325
Azodicarboxylates & Amides	
(Mitsunobu Reaction)	S-35
Azoxybenzenes (Liquid Crystal Materials)	S-265

[B]

Ba (Barium) Compounds	S-86
Bases & Additives (Cross-coupling	
Reaction using Transition Metal Catalysts) ...	S-67
BCl ₃ -Alkanol Solutions	
(GC Derivatizing Reagents)	B-278
Be (Beryllium) Compounds	S-85
Benzoic Acids	
(Building Blocks for Liquid Crystals)	S-271
Benzophenones (UV Absorbents)	S-340
Benzothiadiazoles (Building Blocks for	
Semiconducting Polymers /	
Acceptor Raw Materials)	S-235
Benzotriazoles (UV Absorbents)	S-339
Benzoxadiazole (HPLC Labeling Reagents) ...	B-284
Benzylation	S-124
Benzoyloxycarbonylation	S-124
β-Diketonato Complexes	
(Magnetic Metal Complexes)	S-277
BF ₃ -Alkanol Solutions	
(GC Derivatizing Reagents)	B-278
Bicyclic Monoterpenes	B-119
Bile Acids	B-131
Bioconjugation	B-234
Biologically-modified Amino Acids	B-20
Biotin Conjugated Secondary Antibodies	B-253
Biotins (for Bioconjugation)	B-235
Biotinylated Anti-Glyco Antibody	B-105

Biphenyls	
(Building Blocks for Liquid Crystals)	S-270
Bipyridine Ligands	S-98
Blue Dopants	S-216
Boc-Amino Acids	B-29
Boc Protection	S-126
Bone Metabolism Research	HP
Bone Resorption Inhibitors	B-203
Borane Complex (Reduction)	S-11
Borane-Amine Complex (Reduction)	S-12
Boranes (Reduction)	S-11
Boration	HP
Boric Acid Esters (Solvents for Battery)	S-206
Borohydrides (Reduction)	S-11
Boronic Acids & Boronic Acid Derivatives ...	S-139
Bromination	S-20
Buffers	B-268
Building Blocks for Liquid Crystals	S-270
Building Blocks for	
Semiconducting Polymers	S-230
Building Blocks for Small Molecule	
Semiconductors	S-238
<i>tert</i> -Butoxycarbonylation	S-126

[C]

C-H Bond Activation Reaction	S-69
C-Protected Amino Acids	B-43
Ca (Calcium) Compounds	S-86
Calcium Chelating Reagents	HP
Calcium Signaling Research	HP
Calixarenes	S-344
Calmodulin Antagonists	HP
Carbapenems (Antibiotic Ingredients)	B-171
Carbazoles (Building Blocks for Small	
Molecule Semiconductors)	S-240
Carbazoles Donor (Raw Materials)	S-233
Carbohydrate Polymers	B-95
Carbon Degradation	HP
Carbon Homologation	HP
Carbon Monoxide Surrogates	S-2
Carbon Nanotubes	S-192
Carbonates (Liquid Crystal Materials)	S-263
Carbonates (Solvents for Battery)	S-207
Carbonyl Group Labeling Reagents for	
Fluorescence HPLC	B-287
Carbonyl Group Labeling Reagents for	
HPLC	B-283
Carbonyl Olefination	S-44
Carboxyl Group Labeling Reagents for	
Fluorescence HPLC	B-284

Carboxyl Group Labeling Reagents for HPLC	B-281	Cinnamic Acids & Esters	B-137
Carboxylic Acids & Their Derivatives (Terminal Acetylenes).....	S-182	Cleavage & Work-up Agents (Fmoc Solid Phase Peptide Synthesis)	B-57
Carboxylic Acids (Chiral)	S-156	Click Chemistry	HP
Carcinogenic Model Preparation Reagents ..	B-217	Click Reaction (Copper-free)	S-1
Catalase Inhibitors	B-228	CO Surrogates	S-2
Catalyst-transfer Polycondensation Reagents	S-332	Coenzymes in Nucleic Acids	B-7
Cbz-Amino Acids	B-40	Combinatorial Chemistry	HP
Cbz Protection	S-124	Complexones	B-323
Central Nervous System Disease Model Preparation Reagents	B-217	Condensation & Active Esterification	S-38
Cephems (Antibiotic Ingredients).....	B-170	Condensing Agents (Fmoc Solid Phase Peptide Synthesis)	B-56
Chalconoids	B-144	Condensing Agents (for Nucleic Acid Synthesis)	B-15
Chelating Reagents.....	B-323	Condensing Agents (Peptide Synthesis)	B-57
Chemical Building Blocks for Polyamine Synthesis	B-158	Copper Catalysts (Cross-coupling Reaction using Transition Metal Catalysts)	S-61
Chemical Chaperones	HP	Copper (for Activation Reaction of Unactivated Bonds).....	S-73
Chemical Mediator Release Inhibitors	B-199	Corticosteroids	B-202
Chemical Shift Standards for Multinuclear NMR	B-302	Cosmetic Ingredients	HP
Chemiluminescence Detection (HPLC Labeling Reagents)	B-288	Coumarin Dyes	S-284
Chemiluminescent Method (ROS/RNS Detection Reagents)	B-227	Coumarins	B-141
Chiral Auxiliaries	S-108	Cross-coupling Polymerization Catalysts	S-326
Chiral Building Blocks	S-156	Crown Ethers	S-342
Chiral Diols (Asymmetric Organocatalysts) ..	S-105	Crude Medicine Ingredients	HP
Chiral Oxazolidinones (Chiral Auxiliaries)	S-108	Curcuminoids	B-143
Chiral Phase-transfer Catalysts	S-110	Cyanation	S-29
Chiral Phosphoric Acids (Asymmetric Organocatalysts)	S-105	Cyanine Dyes	S-291
Chiral Separation Columns	B-294	Cyanobiphenyls & Analogs (Liquid Crystal Materials)	S-263
Chlorination	S-19	Cyclodextrins (Drug Delivery Systems)	B-216
Cholanes	B-131	Cyclodextrins (Macrocycles for Host-Guest Chemistry) ..	S-346
Cholestanes	B-132	Cyclophanes.....	S-346
Cholesteric Liquid Crystals	S-266	Cytokinins	B-271
Cholesteryl Carbonates (Liquid Crystal Materials)	S-268	[D]	
Cholesteryl Compounds (Liquid Crystal Materials)	S-266	Dabsyl Amino Acids	B-34
Chromatography Columns for HPLC	B-294	Dansyl Amino Acids	B-34
Chromogenic Method (ROS/RNS Detection Reagents)	B-227	DA-Type Monomers (Building Blocks for Semiconducting Polymers)	S-236
Cinchona Alkaloid Derivatives (Chiral Phase-transfer Catalysts).....	S-111	Dbz-Amino Acids.....	B-34
Cinchona Alkaloids (Asymmetric Organocatalysts)	S-104	DCM Dyes	S-296
Cinnamaldehydes	B-139	DDS	B-212
Cinnamic Acid Derivatives	B-140	2'-Deoxyriboses	B-11
		Deproteinization Agents.....	HP
		Derivatization Reagents.....	S-120
		Derivatization Reagents for Mass Spectrometry	B-311
		Derivatizing Reagents (for GC)	B-276

[E]

Ene Ligands	S-91
Enzyme (Transfers the Intact Oligosaccharides)	B-100
Enzymes	B-62
Enzymes in Nucleic Acids	B-7
Epigenetics	B-220
Erythrose	B-69
ESR Method (ROS/RNS Detection Reagents)	B-227
ESR Spectrometry	B-318
Esterification (GC Derivatizing Reagents)	B-277
Esters (Chiral)	S-160
Estranes	B-127
Estrogenic Hormones	B-204
Estrogens (Pharmaceutical Ingredients)	B-204
Ethynylation	HP
Europium Fluorescent Labeling Reagent	B-241
Exciton Chirality CD Method	B-308

FABMS Matrix Materials	B-317
Fatty Acid Cholesteryl Esters	B-112
Fatty Acid Esters (Plasticizer)	S-335
Fatty Acid Ethyl Esters	B-110
Fatty Acid Methyl Esters (GC Standard)	B-279
Fatty Acid Methyl Esters	B-109
Fatty Acid Sodium Salts	B-110
Ferrocenes	S-79
FITC labeled Secondary Antibodies	B-252
Flavonoids.....	B-145
Fluorenes & Fluorenones (Building Blocks for Small Molecule Semiconductors)	S-242
Fluorenes (Building Blocks for Semiconducting Polymers / Donor Raw Materials)	S-233
9-Fluorenylmethyloxycarbonylation	S-126
Fluorescence Detection (HPLC Labeling Reagents)	B-284
Fluorescence-labeled Antibodies.....	B-246
Fluorescent Labeling Dyes	B-243
Fluorescent Labeling Reagents	B-241
Fluorescent Labeling Reagents for HPLC	B-284
Fluorescent Probes	B-245
Fluorescent Stains	B-245
Fluorimetric Ion-Pair Reagent for HPLC.....	B-292
Fluorinated Building Blocks	HP
Fluorination	S-18
Fluoroalkyl Silanes, Fluoroaryl Silanes (Silane Coupling Agents)	S-310
Fluorous Chemistry	HP
Fluorous Solvents	S-135
Emoc-Amino Acids	B-35

- Fmoc-Amino Acids
 (Side Chain Protected Type) B-56
 Fmoc Protection S-126
 Fmoc-Deprotecting Agents
 (Fmoc Solid Phase Peptide Synthesis) B-56
 Food Color Testing Solutions in Japan B-330
 Food Colors by
 Food Sanitation Law in Japan B-329
 Formylation S-26
 Free Radical Generators B-226
 FRET Donors & Acceptors B-244
 Fructose B-69
 Fucose B-70
 Fulgide (Photochromic Compounds) S-261
 Fullerenes S-190
 Functional Group Blocking Reagents B-234
 Functionality Creating Reagents B-234
- [G]**
- Galactosamine B-72
 Galactose B-70
 β -Galactosidase Substrates B-258
 GC Derivatizing Reagents B-276
 GC Standard Materials B-279
 Generating Insoluble Dyes
 (Peroxidase Substrates) B-257
 Generating Soluble Dyes
 (Peroxidase Substrates) B-257
 Glucocorticoids B-130
 Glucosamine B-78
 Glucose B-73
 Glucuronic Acids B-79
 Glucuronidase Substrates B-259
 Glycerides B-112
 Glycerophospholipids B-112
 Glycidyl Compounds (Chiral) S-177
 Glycidyoxyalkyl Silanes
 (Silane Coupling Agents) S-306
 Glycosylation HP
 Glycosynthase B-97
 Gold (for Activation Reaction of
 Unactivated Bonds) S-73
 Good's Buffers B-268
 Graphene & Graphene Oxide S-194
 Green Chemistry (Ionic Liquids) S-130
 Green Dopants S-217
 Griess Method
 (ROS/RNS Detection Reagents) B-226
 Grignard Reagents S-76
 Group Transfer Polymerization (GTP)
 Reagents S-331
- Guanidinylation HP
 Guard Columns B-298
 Gulose B-80
- [H]**
- Half Metallocenes S-82
 Halogenation S-17
 Halomethylsilylation
 (GC Derivatizing Reagents) B-277
 HCl-Alkanol Solutions
 (GC Derivatizing Reagents) B-278
 HDAC Activators B-220
 HDAC Inhibitors B-220
 Heat Sensitive Recording Materials HP
 Hemiterpenes B-115
 Herbicide Ingredients HP
 Heteroarylboronic Acid Esters S-154
 Heteroarylboronic Acids S-149
 Heteroaryne Precursors HP
 Heterobifunctional Cross-Linkers B-237
 Hexaarylbiimidazole
 (Photochromic Compounds) S-261
 Highly Purified Reagents HP
 Hindered Amines (UV Absorbents) S-340
 Histamine Receptor Antagonists B-198
 Histone Deacetylase Activators B-220
 Histone Deacetylase (HDAC) Inhibitors B-220
 Histone Demethylase Inhibitors B-220
 HNO Donors B-225
 Hole Transport Materials S-215
 Homobifunctional Linkers B-239
 Hormones (Antitumors) B-185
 Horner-Emmons Reaction S-47
 Host-Guest Chemistry S-342
 Host Materials S-214
 HPLC Columns B-294
 HPLC Ion-Pair Reagents B-290
 HPLC Labeling Reagents B-281
 HRP Conjugated Secondary Antibodies B-252
 Hydrazines, Hydrazides (Reduction) S-13
 Hydrocarbons (Terminal Acetylenes) S-180
 Hydrocarbons having Benzene Ring
 (Terminal Acetylenes) S-181
 Hydrogenation Catalysts S-14
 Hydrolase B-62
 Hydroxycarboxylic Acid Esters (Plasticizer) S-337
 Hydroxyl Group Labeling Reagents for
 Fluorescence HPLC B-286
 Hydroxyl Group Labeling Reagents for
 HPLC B-283
 Hypervalent Iodine Compounds (Oxidation) S-5

[I]

Ibuprofen	B-80
Imidazole Alkaloids	B-154
Imidazolium Salts (Ionic Liquids)	S-130
Imine Ligands	S-96
Immortal Polymerization Reagents	S-331
Immune System Research	HP
Immunosuppressant Ingredients	B-200
In (Indium) Compounds	S-87
Indicators (pH)	B-320
Indole Alkaloids	B-153
Infection Research	HP
Inflammation & Immunity Disorder Model	
Preparation Reagents	B-217
Inflammation Research	HP
Inhibitors	B-233
Inositol	B-80
Instant Buffers	B-269
Iodination	S-21
Ion Association	B-322
Ionic Liquids	S-130
Ion-Pair Reagents for HPLC	B-290
Iridium (for Activation Reaction of	
Unactivated Bonds)	S-72
Iron Catalysts (Cross-coupling Reaction using	
Transition Metal Catalysts)	S-59
Isocyanates (Chiral)	S-164
Isoflavonoids	B-147
Isopropylidene Sugars (Chiral)	S-175
Isoquinoline Alkaloids	B-151

[J]

Jasmonates	B-272
------------	-------

[K]

K (Potassium) Compounds	S-84
-------------------------	------

[L]

Labeling Reagents for HPLC	B-281
Laemmli's Method Reagents	
(for Electrophoresis)	B-261
Langmuir-Blodgett Film Forming Agents	HP
LC/MS Ion-Pair Reagents for	
Acidic Samples	B-291
LC/MS Ion-Pair Reagents for	
Basic Samples	B-292
Lead Compounds	S-88
Lectin, Fucose specific	B-96
Leukotriene Receptor Antagonists	B-199
Lewis Acids (Stable in Aqueous Media)	S-89
Li (Lithium) Compounds	S-83

Life-style related Disease Model Preparation

Reagents	B-218
Ligands	S-91
Ligands (Chelating Reagents)	B-323
Ligands for Functional Metal Complexes	S-254
Ligands for MOF/PCP	S-299
Lignins & Lignans	B-143
Lipid Extracts	B-111
Lipid Mediators	HP
Lipid Peroxide Measurement Reagents	B-229
Lipids	B-106
Liquid Crystal Materials	S-262
Liquid Crystal Semiconductors	S-221
Liquid Phase Peptide Synthesis Reagents	B-57
Liquid SIMS Matrix Materials	B-317
Lithium Electrolytes	S-210
Luciferase Substrate	B-260
Lyxose	B-81

[M]

Macrocycles for Host-Guest Chemistry	S-342
Macrolides (Antibiotic Ingredients)	B-172
Magnetic Ionic Liquids	S-283
Magnetic Metal Complexes	S-277
MALDI-TOF-MS Matrix Materials	B-317
Mannosamine	B-83
Mannose	B-81
Mass Marker	B-316
Matrix Materials (for Mass Spectrometry)	B-317
Mercapto Group Labeling Reagents for	
Fluorescence HPLC	B-287
Metal Extractants	HP
Metal Hydrides (Reduction)	S-10
Metal Organic Frameworks	S-298
Metal Oxidants	S-3
Metal Reagents for Organic Synthesis	S-76
Metallocene Catalysts	S-325
Metallocenes	S-79
Methoxymethylation	S-125
Methylated Nucleosides	B-220
Mg (Magnesium) Compounds	S-85
Mitsunobu Reaction	S-34
Mixed-Mode Columns	B-295
MOF/PCP	S-298
Molecular Conductors	S-223
MOM Protection	S-125
Monobactams (Antibiotic Ingredients)	B-171
Monocyclic Monoterpenes	B-117
Monomer Stabilizers	S-320
Monomers	S-319
Monomers for Synthetic Polymers of DDS	B-213

Monoterpenes (Acyclic)	B-116	Non-steroidal Anti-inflammatory Agents	B-202
Monoterpenes (Bicyclic)	B-119	NOS Substrates	B-225
Monoterpenes (Monocyclic)	B-117	NOX Inhibitors	B-228
Multicomponent Reaction (MCR)	HP	N-Protected Amino Alcohols (Chiral)	S-167
[N]			
N-Boc-diaminoalkanes	B-158	N-Protecting Agents for Polyamine Synthesis	B-160
N-Cbz-diaminoalkanes	B-159	Nps-Amino Acids	B-38
N-(o-Ns)-amines	B-159	NSAIDs	B-202
N-(o-Ns)-diaminoalkanes	B-159	N-Ts-amines	B-160
N-Protected Amino Acids	B-28	n-Type Semiconductors	S-220
Na (Sodium) Compounds	S-83	n-Type Semiconductors (Organic Photovoltaics)	S-203
N-Ac-diaminoalkanes	B-159	Nucleic Acid Removing Agents	HP
NADPH Oxidase (NOX) Inhibitors	B-228	Nucleic Acids	B-7
Nanocarbon Unit Structures	S-198	Nucleic Acid Synthetic Agents	B-12
Nanodiamonds	S-196	Nucleobases	B-7
Naphthalenes (Building Blocks for Small Molecule Semiconductors)	S-247	Nucleosides	B-1
Naphthylazo Compounds	B-325	Nucleotides	B-6
Natural Polymers (Drug Delivery Systems) ..	B-213	[O]	
Natural Polymers (Polymer Research Reagents)	S-316	ODS Columns	B-297
Near Infrared Absorption Materials	S-276	ODS+Ion-Exchange Columns	B-295
Nematic Liquid Crystals	S-263	OLED Materials	S-213
Neurotransmission Research	HP	1-Olefins (GC Standard)	B-279
Neurotransmitter Agent Ingredients	B-191	Olefin Polymerization Catalysts	S-325
NHC Ligands	S-66	Olefin Polymerization Co-catalysts	S-326
N-Heterocyclic Carbene Ligands (Cross-coupling Reaction using Transition Metal Catalysts)	S-66	Olefin Ligands	S-91
Nickel Catalysts (Cross-coupling Reaction using Transition Metal Catalysts)	S-58	Olefin Metathesis Catalysts	S-326
Nickel (for Activation Reaction of Unactivated Bonds)	S-72	Olefynyl Silanes (Silane Coupling Agents)	S-305
Nicotinamide Adenine Dinucleotide Phosphate-oxidase Inhibitors	B-228	Oligopeptides	B-52
Nitration	HP	Oligosaccharides	B-93
Nitric Oxide (NO) Donors	B-225	Onium Hydroxides (GC Derivatizing Reagents)	B-278
Nitric Oxide Synthase (NOS) Inhibitors	B-228	Optical Resolving Agents	S-113
Nitric Oxide Synthase (NOS) Substrates	B-225	Optically Active Compounds	S-156
Nitriles (Solvents for Battery)	S-208	OPV	S-202
Nitroxide-Mediated Radical Polymerization (NMP) Reagents	S-330	Organic Azides	S-186
Nitroxyl (HNO) Donors	B-225	Organic Bismuths (Oxidation)	S-6
NMR Spectrometry	B-302	Organic Light-Emitting Diode Materials	S-213
NMR Standards	B-302	Organic Nonlinear Optical Materials	S-274
NO Donors	B-225	Organic Peroxides (Oxidation)	S-4
NO Synthase (NOS) Inhibitors	B-228	Organic Photovoltaics	S-202
Non-detergent Sulfobetaines (NDSB)	B-266	Organic Radicals	S-281
Nonionic Surfactants (for Biochemistry)	B-264	Organic Transistor Materials	S-219
Non-Proteinorganic Amino Acids	B-22	Organic-Inorganic Perovskite Precursors	S-303
		Organotitanium Reagents (Carbonyl Olefination)	S-49
		Oxidation	S-3
		Oxidative/Nitrosative Stress Research	B-225
		N-Oxides (Oxidation)	S-6
		Oxido-Reductase	B-62

Oxidoreductase Coenzymes	HP
[P]	
Pain & Itch Model Preparation Reagents	B-218
Palladium Catalysts (Cross-coupling Reaction using Transition Metal Catalysts)	S-55
Palladium Complexes (for Activation Reaction of Unactivated Bonds)	S-70
<i>n</i> -Paraffins (GC Standard)	B-279
Pb (Lead) Compounds	S-88
PEG	B-215
PEG Azides	S-187
PEGylation Reagents (Drug Delivery Systems)	B-215
PEGylation Reagents & PEG Spacers (Bioconjugation)	B-235
Penicillins (Antibiotic Ingredients)	B-170
Pentafluorophenyl Columns	B-297
Peptides	B-52
Perchlorates (Oxidation)	S-4
Perovskite Solar Cell	S-205
Peroxidase Substrates	B-257
Peroxynitrite (ONOO) Donors	B-226
Perylene Dyes	S-289
Pesticide Ingredients	HP
pH Indicators	B-320
pH Standard Solution	B-269
Pharmaceutical Ingredients	B-170
Phenanthroline Ligands	S-100
Phenanthrolines (Chelating Reagents)	B-326
Phenyl Esters (Liquid Crystal Materials)	S-264
Phenylethylamines	B-150
Phenylpropanoids	B-137
Phenylpropenes	B-140
Phenylpyridines (Ligands for Functional Metal Complexes)	S-254
Phosphates (Additives for Battery)	S-209
Phosphates (Plasticizer)	S-334
Phosphazenes (Additives for Battery)	S-210
Phosphine Ligands (Cross-coupling Reaction using Transition Metal Catalysts)	S-63
Phosphines (Mitsunobu Reaction)	S-36
Phospholipids	B-212
Phosphonic Acids (for Self-Assembled Monolayer (SAM) Forming)	S-315
Phosphonium Salts (Ionic Liquids)	S-133
Phosphorothioating Agents (for Nucleic Acid Synthesis)	B-14
Phosphorylating Agents (for Nucleic Acid Synthesis)	B-14
Phosphorylation	HP

Photo Acid Generators	S-323
Photo-Anionic Initiators	S-324
Photo Base Generators	S-324
Photo-Cationic Initiators	S-323
Photochromic Compounds	S-259
Photometric Reagents (Complexone)	B-323
Photopolymer Reagents	S-341
Photopolymerization Initiators	S-322
Photo-Radical Initiators	S-322
Phthalates (Plasticizer)	S-333
Phthalocyanine Dyes	S-286
Phytochemicals	B-274
Phytosteroids	B-133
Pillararenes	S-345
Piperidine Alkaloids	B-150
Piperidinium Salts (Ionic Liquids)	S-133
Plant Alkaloids and Terpenoids (Antitumors)	B-184
Plant Growth Regulators	B-270
Plant Hormones	B-270
Plasticizers	S-333
Platinum-based Agents (Antitumors)	B-182
Polyalcohol Ethers, Esters (Plasticizer)	S-336
Polyamine Synthesis Reagents	B-160
Polyamines	B-157
Polyethyleneglycols (PEG)	B-215
Polymer-supported Reagents	S-137
Polymerization Catalysts	S-325
Polymerization Inhibitors	S-320
Polymerization Initiators	S-321
Polymers	S-316
Polynucleotides	B-7
Polypeptides (Antibiotic Ingredients)	B-172
Polyphenols	B-143
Polysaccharides	B-95
Polyurethane Catalysts	S-327
Porphines	B-327
Porphyrin & Phthalocyanine Complexes (Magnetic Metal Complexes)	S-278
Porphyrin Dyes	S-286
Porphyrins	B-163
Potassium Compounds	S-84
Precise Polymerization Reagents	S-328
Pregnanes	B-129
Preservatives for Biochemical Research	B-267
Pressure Sensitive Recording Materials	HP
Prodrug Ingredients	B-212
Progestogens	B-129
Prolines and Their Analogs (Asymmetric Organocatalysts)	S-102
Prostaglandins	B-111

- Protease Inhibitors B-233
- Protected 1,2/1,3-Diols (Chiral) S-176
- Protecting Agents S-120
- Protecting Agents for Hydroxyl and
Amino Groups (for Nucleic Acid Synthesis) ... B-12
- Protecting Agents (Peptide Synthesis) B-60
- Protein Denaturation Reagents B-265
- Protein Mass Analysis Reagent B-314
- Psicose B-83
- PTH-Amino Acids B-39
- p-Type Semiconductors S-219
- p-Type Semiconductors
(Organic Photovoltaics) S-202
- Purine Alkaloids B-155
- Purine Nucleobases B-9
- Purine Nucleosides B-3
- Purine Nucleotides B-6
- Pyrenes (Building Blocks for Small Molecule
Semiconductors) S-246
- Pyridine Alkaloids B-153
- Pyridine Ligands S-97
- Pyridinium Salts (Ionic Liquids) S-132
- Pyridylazo Compounds B-325
- Pyrimidine Nucleobases B-7
- Pyrimidine Nucleosides B-1
- Pyrimidine Nucleotides B-6
- Pyrrolidinium Salts (Ionic Liquids) S-134
- [Q]**
- Quinacridone Dyes S-297
- Quinoline Alkaloids B-152
- Quinolins (Ligands for
Functional Metal Complexes) S-255
- Quinolones
(Synthetic Antimicrobial Ingredients) B-174
- [R]**
- Raw Materials for Oxidative Polymerization,
Thiophenes S-236
- Rb (Rubidium) Compounds S-85
- Reactive Nitrogen Species (RNS) Research ... B-225
- Reactive Oxygen Species (ROS) Research ... B-225
- Red Dopants S-218
- Redox Active Ligands S-256
- Reduction S-9
- Reference Materials Certified by
The Japan Petroleum Institute B-332
- Refined Products by Sublimation HP
- Regenerative Medicine Research Reagents ... B-222
- Resin Additives S-333
- Resin Stabilizers S-338
- Reversible Addition Fragmentation Chain
Transfer (RAFT) Polymerization Reagents ... S-330
- Rhamnose B-83
- Rhodium (for Activation Reaction of
Unactivated Bonds) S-71
- Ribose B-84
- Riboses (for Nucleic Acid Synthesis) B-11
- RNA Synthesis B-1
- ROS/RNS Detection Reagents B-226
- ROS/RNS Generators B-225
- ROS/RNS-related Enzyme Inhibitors B-228
- Ruthenium (for Activation Reaction of
Unactivated Bonds) S-70
- [S]**
- Salen Ligands S-93
- Saturated Fatty Acids B-108
- Schiff Bases (Liquid Crystal Materials) S-264
- Secondary Antibodies B-252
- Secondary Arylamines (Building Blocks for
Small Molecule Semiconductors) S-248
- Secondary Battery Research Reagents S-206
- Selective Estrogen Receptor Modulators B-204
- Selenenylation HP
- Self-Assembled Monolayer (SAM)
Forming Agents S-313
- Semisynthetic Polymers S-317
- SERM B-204
- Sesquiterpenes B-121
- Shift Reagents (for NMR) B-303
- Sialic Acids B-85
- Side Chain Protected Amino Acids
(N,C-termini Free) B-49
- Silane Coupling Agents S-305
- Silanes (Reduction) S-12
- Silylation S-120
- Silylation (GC Derivatizing Reagents) B-276
- Smectic Liquid Crystals S-263
- Sn (Tin) Compounds S-87
- Sodium Compounds S-83
- Solar Cell Research Reagents S-201
- Solid Phase Peptide Synthesis Reagents B-56
- Solvents for HPLC & Spectrophotometry B-293
- Solvents for Spectrophotometry B-293
- Solvents for Battery S-206
- Solvents for HPLC B-293
- Solvents for NMR B-302
- Sorbose B-85
- Sphingolipids B-113
- Spin Labels B-319
- Spin Trapping Reagents B-318

Spiroperimidines		
(Photochromic Compounds)	S-260	
Spiropyrans (Photochromic Compounds)	S-259	
Squarylium Dyes	S-291	
Stable Lewis Acids in Aqueous Media	S-89	
Staining	B-254	
Staining Reagents and Others		
(for Electrophoresis)	B-261	
Standard Materials for GC	B-279	
Standard Mixtures for GC	B-280	
Standards for Mass Spectrometry	B-316	
Standards for NMR	B-302	
Steroid Glycosides	B-133	
Steroids	B-126	
Stilbenoids	B-143	
Substrates for Enzymatic Detection	B-257	
Sugar Azides	S-187	
Sugars	B-63	
Sulfenylation	HP	
Sulfonamides		
(Synthetic Antimicrobial Ingredients)	B-175	
Sulfonium Salts (Ionic Liquids)	S-133	
Sulfonyls and Related Compounds		
(Solvents for Battery)	S-207	
Supporting Electrolyte for Electrocrystallization		
(Molecular Conductor)	S-228	
Surfactants	HP	
Surfactants (for Biochemistry)	B-264	
Synthetic Antimicrobials	B-174	
Synthetic Polymers	S-317	
[T]		
Tagatose	B-86	
Talose	B-86	
Tartaric Acid Derivatives		
(Chiral Phase-transfer Catalysts)	S-111	
TBXS Inhibitors	B-200	
TEMPOs (Oxidation)	S-6	
Terminal Acetylenes	S-180	
Terpenes	B-114	
Tertiary Arylamines (Building Blocks for Small		
Molecule Semiconductors)	S-250	
Testing Solutions of Food Colors in Japan	B-330	
Tetrasaccharides	B-92	
Th2 Cytokine Production Inhibitors	B-200	
Thermal Polymerization Initiators	S-321	
Thiacalixarenes	S-345	
Thioacetalization	S-123	
Thiols (for Self-Assembled Monolayer		
(SAM) Forming)	S-313	
Thiophenes (Raw Materials for Oxidative		
Polymerization)	S-236	
Thiophenes (Building Blocks for Small		
Molecule Semiconductors)	S-238	
Thiophenes (Building Blocks for		
Semiconducting Polymers /		
Acceptor Raw Materials)	S-234	
Thiophenes (Building Blocks for		
Semiconducting Polymers /		
Donor Raw Materials)	S-231	
Thromboxane Synthase Inhibitors	B-200	
Tin Compounds	S-87	
Tin Hydrides (Reduction)	S-10	
Tl (Thallium) Compounds	S-87	
TLC Stains	B-301	
TMS Derivatizing Reagents (GC)	B-276	
Transferase	B-62	
Transition Metal Complexes (for ATRP)	S-330	
Treatment Agents (Staining)	B-256	
Triazines (GC Derivatizing Reagents)	B-277	
2,2,2-Trichloroethoxycarbonylation	S-125	
Triflation	HP	
Trifluoromethanesulfonylation	HP	
Trifluoromethylation	S-23	
Trifluoromethylthiolation	S-25	
Trimellitate (Plasticizers)	S-335	
Trimethylsilylation		
(GC Derivatizing Reagents)	B-276	
Trisaccharides	B-90	
Triterpenes	B-123	
Tritylation	S-127	
Troc Protection	S-125	
Tropane Alkaloids	B-149	
Tsunoda Reagent (Mitsunobu Reaction)	S-36	
TTF Precursors (Molecular Conductors)	S-225	
Typical Metal Reagents	S-83	
[U]		
Unsaturated Fatty Acids	B-108	
UV Absorbents	S-339	
UV Detection (HPLC Labeling Reagents)	B-281	
[V]		
Vitamins	B-165	
[W]		
Waxes	B-111	
Wittig Reaction	S-44	
[X]		
Xanthene Dyes	S-294	

Xanthine Oxidase (XO) Inhibitors	B-228
XO Inhibitors	B-228
Xylose	B-86

[Z]

Z-Amino Acids	B-40
Zero-length Crosslinkers	B-237
Zone Refined Products	HP

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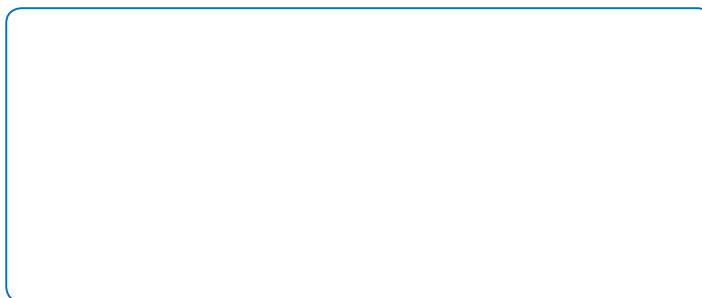
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1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18		
1 H 1.008 v: 1.20 z: 2.20	Periodic Table of the Elements																2 He 4.002602 v: 1.40		
3 Li 6.94 i: 0.76 (+) a: 1.57 v: 1.82 z: 0.98	4 Be 9.012182 i: 0.12 a: 1.57	ATOMIC NUMBER SYMBOL ATOMIC WEIGHT i: ionic radius (Å) a: atomic radius (Å) v: Van der Waals radius (Å) z: electronegativity										Other Non Metals Other Main Group Elements Alkali Metals Alkali Earth Metals Transition Metals	Metalloids Halogens Noble Gases Lanthanoids Actinoids	5 B 10.81 i: 0.88 a: 2.04 z: 1.81	6 C 12.011 i: 0.77 a: 1.70 v: 2.55 z: 2.55	7 N 14.007 i: 0.74 a: 1.55 v: 3.04 z: 3.04	8 O 15.999 i: 1.40 (2-) a: 0.66 v: 1.52 z: 3.44	9 F 18.9984032 i: 1.33 (-) a: 0.64 v: 1.47 z: 3.98	10 Ne 20.1797 v: 1.54
11 Na 22.98976928 i: 1.02 (+) a: 1.91 v: 2.27 z: 0.93	12 Mg 24.305 i: 0.72 (2+) a: 1.60 v: 1.73 z: 1.31	Atomic Weights : 2011 IUPAC values										13 Al 26.9815386 i: 0.54 (3+) a: 1.43 v: 1.61 z: 1.81	14 Si 28.085 i: 1.17 a: 1.50 v: 1.90 z: 1.90	15 P 30.973762 i: 1.10 a: 1.80 v: 2.19 z: 2.19	16 S 32.06 i: 1.84 (2-) a: 1.04 v: 1.80 z: 2.58	17 Cl 35.45 i: 1.81 (-) a: 0.99 v: 1.75 z: 3.16	18 Ar 39.948 v: 1.88		
19 K 39.0983 i: 1.38 (+) a: 2.35 v: 2.75 z: 0.82	20 Ca 40.078 i: 1.00 (2+) a: 1.97 v: 2.27 z: 1.00	21 Sc 44.955912 a: 1.64 z: 1.36	22 Ti 47.867 a: 1.47 z: 1.54	23 V 50.9415 a: 1.35 z: 1.83	24 Cr 51.9961 a: 1.29 z: 1.66	25 Mn 54.938045 a: 1.37 z: 1.55	26 Fe 55.845 a: 1.26 z: 1.83	27 Co 58.933195 a: 1.25 z: 1.83	28 Ni 58.6934 a: 1.25 z: 1.91	29 Cu 63.546 a: 1.28 v: 1.4 z: 1.90	30 Zn 65.38 i: 1.37 v: 1.39 z: 1.85	31 Ga 69.723 i: 0.62 (3+) a: 1.53 v: 1.87 z: 1.81	32 Ge 72.630 i: 1.22 a: 1.53 v: 2.01 z: 2.01	33 As 74.92160 i: 1.21 v: 1.85 z: 2.18	34 Se 78.96 i: 1.98 (2-) a: 1.17 v: 2.06 z: 2.55	35 Br 79.904 i: 1.96 (-) a: 1.14 v: 1.85 z: 2.96	36 Kr 83.798 v: 2.02 z: 3.00		
37 Rb 85.4678 i: 1.52 (+) a: 2.50 z: 0.82	38 Sr 87.62 i: 1.18 (2+) a: 2.15 z: 0.95	39 Y 88.90585 a: 1.82 z: 1.22	40 Zr 91.224 a: 1.60 z: 1.33	41 Nb 92.90638 a: 1.47 z: 1.60	42 Mo 95.96 a: 1.40 z: 2.16	43 Tc (99) a: 1.36 z: 1.90	44 Ru 101.07 a: 1.34 z: 2.20	45 Rh 102.90550 a: 1.34 z: 2.28	46 Pd 106.42 a: 1.37 z: 2.20	47 Ag 107.8682 i: 1.44 v: 1.66 z: 2.54	48 Cd 112.411 i: 1.52 v: 1.58 z: 1.69	49 In 114.818 i: 0.80 (3+) a: 1.67 v: 1.93 z: 1.78	50 Sn 118.710 i: 0.69 (4+) a: 1.58 v: 2.17 z: 1.96	51 Sb 121.760 i: 1.41 v: 2.05 z: 2.05	52 Te 127.60 i: 2.21 (2-) v: 2.06 z: 2.10	53 I 126.90447 i: 2.20 (-) a: 1.33 v: 1.98 z: 2.66	54 Xe 131.293 v: 2.16 z: 2.60		
55 Cs 132.9054519 i: 1.67 (+) a: 2.72 z: 0.79	56 Ba 137.327 i: 1.35 (2+) a: 2.24 z: 0.89	57 La 138.90547 a: 1.88 z: 1.10	72 Hf 178.49 a: 1.59 z: 1.30	73 Ta 180.94788 a: 1.47 z: 1.50	74 W 183.84 a: 1.41 z: 2.36	75 Re 186.207 a: 1.37 z: 1.90	76 Os 190.23 a: 1.35 z: 2.20	77 Ir 192.217 a: 1.39 z: 2.20	78 Pt 195.084 i: 1.44 v: 1.75 z: 2.28	79 Au 196.966569 i: 1.55 v: 1.86 z: 2.00	80 Hg 200.592 i: 1.55 v: 1.96 z: 2.04	81 Tl 204.38 i: 0.89 (3+) a: 1.75 v: 2.02 z: 2.33	82 Pb 207.2 i: 1.75 v: 2.02 z: 2.33	83 Bi 208.98040 i: 1.82 v: 2.02 z: 2.02	84 Po (210) z: 2.00	85 At (210) z: 2.20	86 Rn (222)		
87 Fr (223)	88 Ra (226)	89 Ac (227)	104 Rf (267)	105 Db (268)	106 Sg (271)	107 Bh (272)	108 Hs (277)	109 Mt (276)	110 Ds (281)	111 Rg (280)	112 Cn (285)	113 Uut (284)	114 Fl (289)	115 Uup (288)	116 Lv (293)	117 Uus (293)	118 Uuo (294)		
• Lanthanoids			58 Ce 140.116	59 Pr 140.90765	60 Nd 144.242	61 Pm (145)	62 Sm 150.36	63 Eu 151.964	64 Gd 157.25	65 Tb 158.92535	66 Dy 162.500	67 Ho 164.93032	68 Er 167.259	69 Tm 168.93421	70 Yb 173.054	71 Lu 174.9668			
▲ Actinoids			90 Th 232.03806	91 Pa 231.03688	92 U 238.02891	93 Np (237)	94 Pu (239)	95 Am (243)	96 Cm (247)	97 Bk (247)	98 Cf (252)	99 Es (252)	100 Fm (257)	101 Md (258)	102 No (259)	103 Lr (262)			



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