

Reagents for C–C Bond Formation

Vol. 4 No. 2

Buchwald
Phosphine Ligands
for C–C, C–N, and C–O
Bond Formation

Additional Phosphines

Palladium Catalysts

Reagents for the
Mitsunobu Reaction

Verkade's SuperBases

Ruthenium-Based
Metathesis Catalysts

Heterocyclic
Boric Acids & Esters

Boronic Acids

Boronic Acid Esters

Diboron Esters

Potassium
Trifluoroborates

New Biaryl
Building Blocks

NEW! Buchwald Phosphine Ligands for C-C, C-N, and C-O Bond Formation

Sigma-Aldrich is pleased to offer an array of phosphines for C-C, C-N, and C-O bond formation.

The impact of cross-coupling methodologies to form C-C bonds is paramount in organic synthesis.¹ Of these, Suzuki-Miyaura coupling is among the most powerful transformations available as it enjoys broad scope and wide functional group tolerance.² To this end, notable advances have been made in the laboratories of Prof. Stephen Buchwald at MIT. Sigma-Aldrich is proud to offer a series of Buchwald Ligands successfully utilized in processes including Suzuki-Miyaura coupling, amination, amidation, enolate arylation, Sonogashira coupling and C-O bond formation (Table 1) While each ligand has documented utility, recent work has shown that application of dimethoxy-substituted ligand 1, S-Phos, leads to a Pd-catalyst system with unprecedented scope, reactivity,

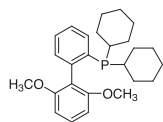
and stability for Suzuki-Miyaura coupling processes.³ Selected examples shown in Table 2 illustrate the success of this system with respect to aryl chloride substrates, the generation of truly hindered biaryls, and heteroaryl cross-couplings.

Recently, triisopropyl-substituted ligand 2, X-Phos, has emerged with key applications to Pd-catalyzed C-N bond formation.⁴ Table 3 gives examples which typify the expanded scope of this process utilizing X-Phos. X-Phos has also been successfully applied to Suzuki-Miyaura couplings with arene and vinyl sulfonates⁵ (Table 2), as well as Sonogashira coupling of alkynes⁶ (Table 4). 2-Di-*t*-butylphosphino-2',4',6'-triisopropyl ligand has been found to be a superior ligand for Pd-catalyzed coupling of phenols with aryl bromides and chlorides.⁷

Buchwald Phosphine Ligands (Table 1)

2-Dicyclohexylphosphino-2',6'-dimethoxybiphenyl (S-Phos)

63,807-2
C₂₆H₃₅O₂P
NEW

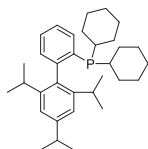


1g
5g
25g

- Highly universal ligand for Suzuki-Miyaura coupling; aryl chlorides, hindered biaryls, generation of heterobiaryls.¹
- Utilized in synthesis of key intermediate enroute to catalytic asymmetric total synthesis of quinine and quinidine.¹¹

2-Dicyclohexylphosphino-2',4',6'-triisopropylbiphenyl, 97% (X-Phos)

63,806-4
C₃₃H₄₉P
NEW

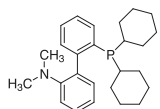


1g
5g
25g

- Increased scope of Pd-catalyzed amination and amidation via arene sulfonates, aryl halides.⁴
- Suzuki-Miyaura coupling of arene, vinyl sulfonates.⁵
- Enolate arylation.⁵
- Sonogashira coupling of alkynes.⁶

2-Dicyclohexylphosphino-2'-(*N,N*-dimethylamino)biphenyl, 97% (DavePhos)

63,802-1
C₂₆H₃₆NP
NEW

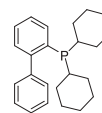


1g
5g
25g

- Amination of aryl halides containing hydroxyl, amide, or enolizable ketone groups.⁸

2-(Dicyclohexylphosphino)biphenyl, 97% (Cyclohexyl JohnPhos)

63,809-9
C₂₄H₃₁P
NEW

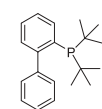


1g
5g
25g

- Amination of aryl halides and triflates.⁹
- Amination of aryl halides containing hydroxyl, amide, or enolizable ketone groups.⁸

2-(Di-*tert*-butylphosphino)biphenyl, 97% (JohnPhos)

63,843-9
C₂₀H₂₇P
NEW

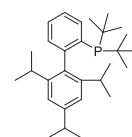


1g
5g
25g

- Amination of aryl halides and triflates.⁹
- Intramolecular C-O bond formation.¹⁰

2-Di-*tert*-butylphosphino-2',4',6'-triisopropylbiphenyl, 97% (*tert*-Butyl X-Phos)

63,808-0
C₂₉H₄₅P
NEW



1g
5g
25g

- Superior ligand for Pd-catalyzed coupling of phenols with aryl chlorides and bromides.⁷
- C-O bond formation; o-glycosylation using glycols.¹²

Table 2

Ligand 1 = 63,807-2, S-Phos **Ligand 2 = 63,806-4, X-Phos**

$$\text{R}^1\text{-C}_6\text{H}_4\text{-X} + \text{R}^2\text{-C}_6\text{H}_4\text{-B(OH)}_2 \xrightarrow[\text{K}_3\text{PO}_4 \text{ or } \text{K}_3\text{PO}_4 \cdot \text{H}_2\text{O}]{\text{Pd(OAc)}_2, \text{Ligand}} \text{R}^1\text{-C}_6\text{H}_4\text{-C}_6\text{H}_4\text{-R}^2$$

X = halide, OTs

Halide, OTs	Boronic Acid	Product	Yield	Ligand	Conditions
			99	1	1 mol % Pd 100 °C, 20h toluene, K ₃ PO ₄
			97-98	1	0.2 mol% Pd 90°C, 12min; 0.02 mol% Pd 100°C, 20h toluene, K ₃ PO ₄
			97	1	2 mol % Pd rt, 2h THF, K ₃ PO ₄ ·H ₂ O
			90	2	3 mol % Pd 80 °C, 6h <i>t</i> -BuOH K ₃ PO ₄ ·H ₂ O
			96	1	0.1 mol % Pd 100 °C, 15h toluene, K ₃ PO ₄
			97	1	0.1 mol % Pd 100 °C, 20h toluene, K ₃ PO ₄ ·H ₂ O

Table 4

$$\text{R}^1\text{-C}_6\text{H}_4\text{-Cl} + \text{H-C}\equiv\text{C-R}^2 \xrightarrow[\text{70-90 °C, 1.5-4h}]{\text{1% PdCl}_2(\text{MeCN})_2, \text{3 mol \% Ligand 2, Cs}_2\text{CO}_3, \text{MeCN}} \text{R}^1\text{-C}_6\text{H}_4\text{-C}\equiv\text{C-R}^2$$

79-95%

Ligand 2 = 63,806-4, X-Phos

		94%
		93%
		89%
0.1 mol% Pd, 9h		
		85%

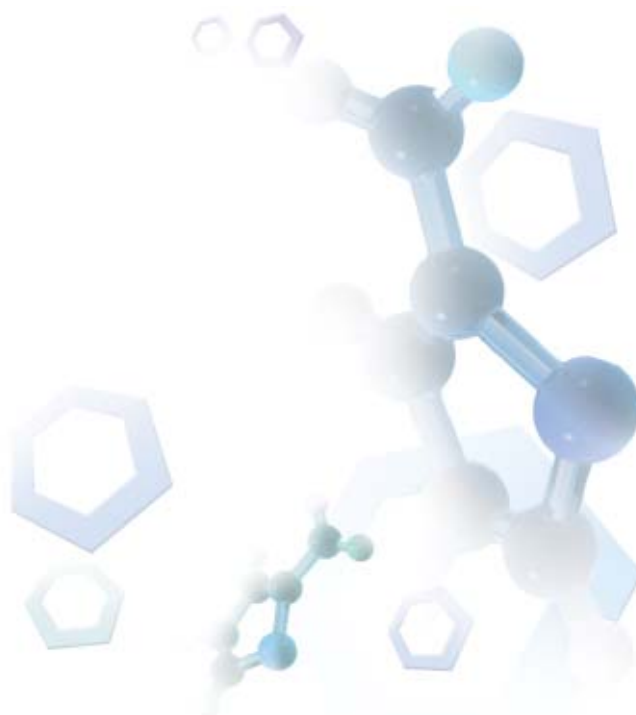
Table 3

Ligand 2 = 63,806-4, X-Phos

$$\text{R}^1\text{-C}_6\text{H}_4\text{-X} + \text{NHR}^2\text{R}^3 \xrightarrow[\text{K}_2\text{CO}_3, \text{t-BuOH or toluene, 80-110 °C, 11-24h}]{\text{Pd(OAc)}_2 \text{ or } \text{Pd}_2(\text{dba})_3, \text{Ligand}} \text{R}^1\text{-C}_6\text{H}_4\text{-NR}^2\text{R}^3$$

X = Br, Cl, OSO₂Ar

Halide	NHR ² R ³	Product	Yield	Catalyst
			99	Pd ₂ (dba) ₃
			78	Pd ₂ (dba) ₃
			88	Pd(OAc) ₂
			95	Pd(OAc) ₂
			88	Pd ₂ (dba) ₃



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Additional Phosphines from Sigma-Aldrich

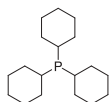
Sigma-Aldrich offers an extended variety of phosphines utilized in C-C bond forming processes. Recent work reported by Prof. Gregory Fu and coworkers has expanded the utility of trialkylphosphines and

has demonstrated the interchangeability of the corresponding air-stable tetrafluoroborate salts with the parent phosphines in a broad spectrum of C-C coupling processes.¹³

Tricyclohexylphosphine

26,197-1

C₁₈H₃₃P



5g

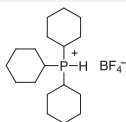
25g

- Useful ligand for Suzuki-Miyaura coupling of simple alkyl chlorides¹⁴ and alkyl bromides possessing beta-hydrogens.¹⁵

Tricyclohexylphosphine tetrafluoroborate, 95%

63,149-3

C₁₈H₃₄BF₄P



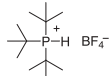
1g

5g

Tri-tert-butylphosphine tetrafluoroborate

57,894-0

C₁₂H₂₈BF₄P



1g

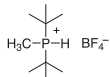
5g

- Air-stable, less odoriferous direct replacement for parent tri-*t*-butylphosphine in a variety of C-C bond forming processes including Suzuki-Miyaura, Heck, Stille, and Sonagashira coupling.¹³

Di-tert-butylmethyl phosphine tetrafluoroborate salt

64,377-7

C₉H₁₉BF₄P



Available

Soon!

- Air-stable ligand for Suzuki-Miyaura coupling of Boronic acids with alkyl bromides.¹⁶
- Room temperature Hiyama cross-couplings of aryl silanes with alkyl bromides and iodides.¹⁷

Di-tert-butylmethylphosphine

64,262-9

C₉H₂₁P



5g

Triisopropylphosphine, tech., 90%

37,730-9

C₉H₂₁P



1g

tert-Butyldiisopropylphosphine, 97%

63,934-6

C₁₀H₂₃P



1g

5g

Tri-tert-butylphosphine, 98%

57,095-8

C₁₂H₂₇P



1g

5g

10g

Tri-tert-butylphosphine, tech., 90%

33,695-5

C₁₂H₂₇P



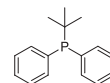
1g

5g

tert-Butyldiphenylphosphine, 97%

59,168-8

C₁₆H₁₉P



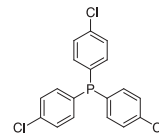
1g

5g

Tris(4-chlorophenyl)phosphine, 95%

24,949-1

C₁₈H₁₂Cl₃P



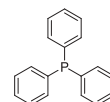
1g

5g

Triphenylphosphine, 99%

T8,440-9

C₁₈H₁₅P



25g

100g

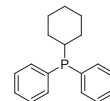
500g

1kg

Cycloxyldiphenylphosphine

51,074-2

C₁₈H₂₁P



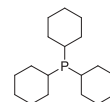
1g

5g

Tricyclohexylphosphine, 1M in tetrahydrofuran

59,239-0

C₁₈H₃₃P

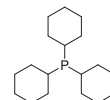


100mL

Tricyclohexylphosphine, 20 wt. % solution in toluene

45,516-4

C₁₈H₃₃P



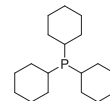
100g

500g

Tricyclohexylphosphine, 1M in toluene

59,228-5

C₁₈H₃₃P

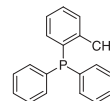


100mL

Diphenyl(o-tolyl)phosphine, 98%

28,7938

C₁₉H₁₇P



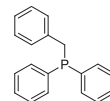
1g

5g

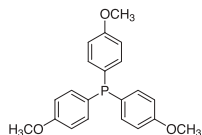
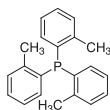
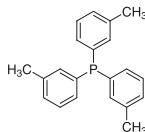
Benzoyldiphenylphosphine

48,7546

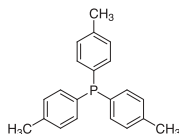
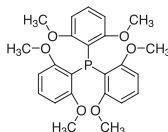
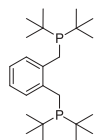
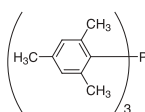
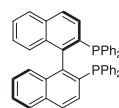
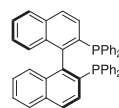
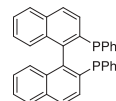
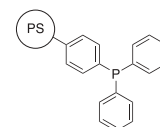
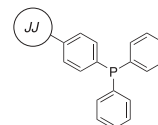
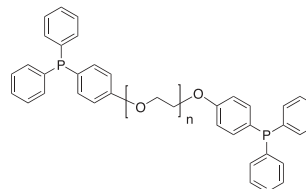
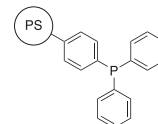
C₁₉H₁₇P



5g

Tris(4-methoxyphenyl)phosphine, 95%**39,510-2**
C₂₁H₂₁O₃P1g
5g**Tri-o-tolylphosphine, 97%****28,782-2**
C₂₁H₂₁P1g
10g**Tri-m-tolylphosphine, 98%****28,784-9**
C₂₁H₂₁P

5g

Tri-p-tolylphosphine, 98%**28,783-0**
C₂₁H₂₁P1g
5g**Tris(2,6-dimethoxyphenyl)phosphine, 98%****39,343-6**
C₂₄H₂₇O₆P5g
25g**1,2-Bis(di-tert-butylphosphinomethyl)benzene****63,192-2**
C₂₄H₄₄P₂1g
5g**Tris(2,4,6-trimethylphenyl)phosphine, 97%****39,508-0**
C₂₇H₃₃P1g
5g**(R)-(+)-2,2'-Bis(diphenylphosphino)-1,1'-binaphthyl, 97% (99% ee/HPLC)****29,581-7**
C₄₄H₃₂P₂25mg
100mg
1g
5g**(S)-(-)-2,2'-Bis(diphenylphosphino)-1,1'-binaphthyl, 97% (99% ee/HPLC)****29,582-5**
C₄₄H₃₂P₂25mg
100mg
1g
5g**rac-2,2'-Bis(diphenylphosphino)-1,1'-binaphthyl, 97%****48,108-4**
C₄₄H₃₂P₂5g
25g**Triphenylphosphine, polymer-supported****36,645-5**
200–400 mesh
~3 mmol/g
2% DVB1g
5g
25g
100g**JandaJel™ Triphenylphosphine****53,341-6**
50–100 mesh
2–3 mmol P/g
2% DVB1g
5g**Poly(ethylene glycol)triphenylphosphine****53,264-9**1g
5g**Triphenylphosphine, polymer supported****93094**
100–200 mesh
~1.6 mmol/g
1% DVB1g
5g

References: (1) *Metal-Catalyzed Cross-Coupling Reactions*; Diedrich, F., Stang, P. J., Eds.; Wiley-VCH: Weinheim, 1998. (2) Recent reviews: (a) Miyaura, N. *Topics in Current Chem.* **2002**, 219, 11. (b) Hassan, J.; Seignion, M.; Gozzi, C.; Schulz, E.; Lemaire, M. *Chem Rev.* **2002**, 102, 1359. (c) Kotha, S.; Lahiri, K.; Kashinath, D. *Tetrahedron* **2002**, 9633. (3) Walker, S. R.; Barder, T. E.; Martinelli, J. R.; Buchwald, S. L. *Angew. Chem. Intl. Ed.* **2004**, in press. (4) (a) Huang, X.; Anderson, K. W.; Zim, D.; Jiang, L.; Klappers, A.; Buchwald, S. L. *J. Am. Chem. Soc.* **2003**, 125, 6653. (b) For a review on catalysts for C-C, C-N bond formation: Muci, A. R.; Buchwald, S. L. *Topics in Current Chem.*, **2001**, 219, 131. (5) Nguyen, H.; Huang, X.; Buchwald, S. L.; . *J. Am. Chem. Soc.* **2003**, 125, 11818. (6) Gelman, D.; Buchwald, S. L. *Angew. Chem. Intl. Ed.* **2003**, 42, 5993. (7) Burgos, C.; Buchwald, S. L., manuscript in preparation. (8) Harris, M. C.; Huang, X.; Buchwald, S. L. *Org. Lett.* **2002**, 4, 17, 2885. (9) (a) Ali, M. H.; Buchwald, S. L. *J. Org. Chem.* **2001**, 66, 2560. (b) Wolfe, J. P.; Tomori, H.; Sadighi, J. P.; Yin, J.; Buchwald, S. L. *J. Org. Chem.* **2000**, 65, 1158. (10) (a) Kuwabe, S.; Torraca, K. E.; Buchwald, S. L. *J. Am. Chem. Soc.* **2001**, 123, 12202. (b) For intermolecular synthesis of aryl ethers: Torraca, K. E.; Huang, H.; Parrish, C. A.; Buchwald, S. L. *J. Am. Chem. Soc.* **2001**, 123, 10770. (11) Raheem, I. T.; Goodman, S. N.; Jacobsen, E. N. *J. Am. Chem. Soc.* **2004**, 126, 706. (12) Kim, H.; Men, H.; Lee, C. *J. Am. Chem. Soc.* **2004**, 126, 1336. (13) Netherton, M. R.; Fu, G. C. *Org. Lett.*, **2001**, 3, 26, 4295. (14) Kirchoff, J. H.; Dai, C.; Fu, G. C. *Angew. Chem. Intl. Ed.* **2002**, 12, 1945. (15) Netherton, M.; Dai, D.; Neuschütz, K.; Fu, G. C. *J. Am. Chem. Soc.* **2001**, 123, 10099. (16) Kirchoff, J. H.; Netherton, M.; Hills, I. D.; Fu, G. C. *J. Am. Chem. Soc.* **2002**, 123. (17) Lee, J.-Y.; Fu, G. C. *J. Am. Chem. Soc.* **2003**, 125, 5616.



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Palladium Catalysts for C-C, C-N, and C-O Bond Formation

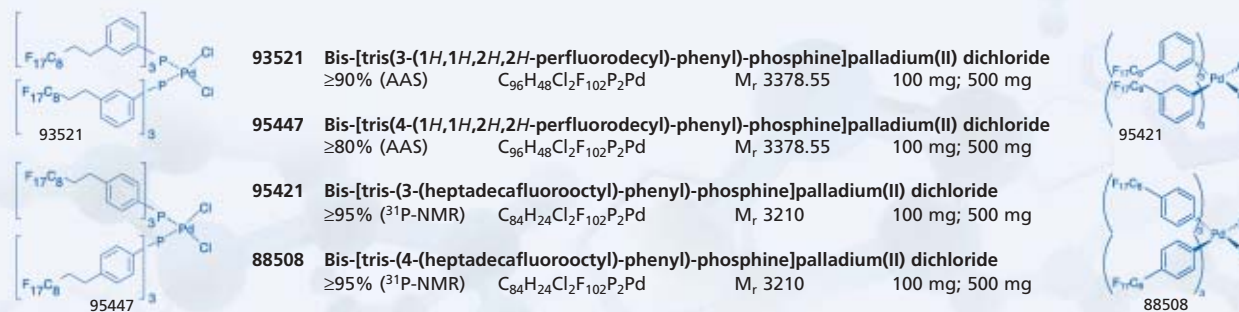
Cat. No	MF	MF Alternate	Name	Unit	Price
20,586-9	Pd(OAc) ₂	C ₄ H ₆ O ₄ Pd	Palladium(II) acetate, 98%	1G	
				2G	
				10G	
				250G	
				1KG	
37,987-5	Pd(OAc) ₂	C ₄ H ₆ O ₄ Pd	Palladium(II) acetate, 99.98%	1G	88.00
				5G	349.90
52,076-4	Pd(OAc) ₂	C ₄ H ₆ O ₄ Pd	Palladium(II) acetate, 99.9+%, Engelhard code S3107	1G	
				5G	
				25G	
32,877-4	Pd ₂ (dba) ₃	C ₅₁ H ₄₂ O ₃ Pd ₂	Tris(dibenzylideneacetone)dipalladium(0)	500MG	37.50
				5G	179.20
				50G	1380.00
				100G	2205.00
36,631-5	Pd ₂ (dba) ₃ ·CHCl ₃	C ₅₂ H ₄₃ Cl ₃ O ₃ Pd ₂	Tris(dibenzylideneacetone)dipalladium(0)-chloroform adduct	250MG	
				1G	
22,799-4	Pd(dba) ₂	C ₃₄ H ₂₈ O ₂ Pd	Palladium(0) bis(dibenzylideneacetone)	500MG	16.10
				5G	89.40
21,666-6	Pd(PPh ₃) ₄	C ₇₂ H ₆₀ P ₄ Pd	Tetrakis(triphenylphosphine)palladium(0), 99%	1G	
				5G	
				25G	
				100G	
				500G	
37,967-0	PdCl ₂ (dppf)	C ₃₅ H ₃₀ Cl ₄ FeP ₂ Pd	(1,1'-Bis(diphenylphosphino)ferrocene)dichloropalladium(II), complex w/CH ₂ Cl ₂	1G	38.50
				5G	120.00
22,565-7	Pd(MeCN) ₂ Cl ₂	C ₄ H ₆ Cl ₂ N ₂ Pd	Bis(acetonitrile)dichloropalladium(II), 99%	500MG	
				5G	
20,588-5	PdCl ₂	Cl ₂ Pd	Palladium(II) chloride, 99%	1G	56.80
				5G	257.80
				25G	725.00
				150G	3,402.80
				1KG	22,220.00
28,360-6	PdCl ₂	Cl ₂ Pd	Palladium(II) chloride, 5 wt. % solution in 10 wt. % HCl	10ML	
				50ML	
32,337-3	PdCl ₂	Cl ₂ Pd	Palladium(II) chloride, 99.999%	1G	74.60
				5G	278.10
52,065-9	PdCl ₂	Cl ₂ Pd	Palladium(II) chloride, 99.9+%, Engelhard code S3120	1G	
				5G	
				25G	
20,867-1	PdCl ₂ (PPh ₃) ₂	C ₃₆ H ₃₀ Cl ₂ P ₂ Pd	Dichlorobis(triphenylphosphine)palladium(II), 98%	1G	27.40
				5G	95.30
				25G	410.00
				100G	1,489.00
				500G	4,963.20
41,274-0	PdCl ₂ (PPh ₃) ₂	C ₃₆ H ₃₀ Cl ₂ P ₂ Pd	Dichlorobis(triphenylphosphine)palladium(II), 99.99%	250MG	
				1G	
				5G	
40,323-7	PdCl ₂ (PCy ₃) ₂	C ₃₆ H ₆₆ Cl ₂ P ₂ Pd	Dichlorobis(tricyclohexylphosphine)palladium(II), 95%	250MG	18.00
				1G	66.00
22,545-2	Pd(OAc) ₂ (PPh ₃) ₂	C ₄₀ H ₃₆ O ₄ P ₂ Pd	Bis(acetato)bis(triphenylphosphine)palladium(II), 98%	1G	
				10G	
22,238-0	[PdCl(CH ₂ CHCH ₂) ₂] ₂	C ₆ H ₁₀ Cl ₂ Pd ₂	Allylpalladium chloride dimer	100MG	15.20
				500MG	30.00
				5G	220.00

TO ORDER: Contact your local Sigma-Aldrich office (see back cover), call 1-800-558-9160 (USA), or visit sigma-aldrich.com.

Pd-Catalysts with Perfluoroalkyl Ponytails: Suzuki couplings under fluoruous biphasic conditions

The new *Fluka Fluorous Biphasic Catalysis, Kit I: C-C-Coupling* contains perfluorotagged Pd-catalysts and solvents for up to 10 different catalytic reactions under fluoruous biphasic conditions. To get acquainted with this innovative FBS-technology our kit provides detailed descriptions of procedures for two C-C-coupling reactions (Suzuki and Stille coupling), all substrates and reagents necessary for these two model reactions, and 8 additional preparations. Analytical methods and spectra are also given as references. FBS technology allows the catalyst to be easily recovered and to be used for further syntheses.

67456 Fluorous Biphasic Catalysis, Kit I: C-C-Coupling



Lit.: [1] Schneider, S. and Bannwarth, W. *Helv. Chem. Acta* **2001**, *84*, 1. [2] Schneider, S. and Bannwarth, W. *Angew. Chem., Int. Ed. Engl.* **2000**, *39*, 4142. For an introduction to fluoruous chemistry please refer to: Gladysz, J.A. and Curran, D.P. *Tetrahedron* **2002**, *58*, 3823.

Reagents for the Mitsunobu Reaction

One of the most powerful and widely used carbon-carbon bond forming reactions in organic synthesis is the Mitsunobu reaction.¹ The Mitsunobu reaction is also useful in the preparation of other moieties, such as

N-alkylamides or imides.² Sigma-Aldrich offers a series of dialkyl azodicarboxylates useful in this well-known reaction.

Diethyl azodicarboxylate, 40 wt.% solution in toluene

56,311-0
C₆H₁₀N₂O₄ 50g
250g
Available Soon!

Di-tert-butyl azodicarboxylate, 98%

13,599-2
C₁₀H₁₈N₂O₄ 5g

Diisopropyl azodicarboxylate, 95%

22,554-1
C₈H₁₄N₂O₄ 5g
100g

1,1'-(Azodicarbonyl)dipiperidine, 99%

25,592-0
C₁₂H₂₀N₄O₂ 1g
5g
25g

Diethyl azodicarboxylate, polymer-bound, 1% DVB, 100-200 mesh

56,185-1
100-200 mesh
1.0-1.5 mmol/g
1% DVB 5g
25g

References: (1) (a) For a recent mechanistic study of the Mitsunobu reaction and leading references: Ahn, C.; Correia, R.; DeShong, P. J. *Org. Chem.* **2002**, *67*, 1751. (b) For a review: Hughes, D. L. *Org. Prep. Proced. Int.* **1996**, *28*, 127-164. (2) (a) Booker-Milburn, K. L.; Dudin, L. F.; Anson, C. E.; Guile, S. D. *Org. Lett.* **2001**, *3*, 3005. (b) Walker, M. J. *Org. Chem.* **1995**, *60*, 5352.

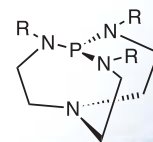


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Proazaphosphatranes: Verkade's Superbases

Sigma-Aldrich is pleased to offer Verkade's Superbases. For a recent survey of the applications of proazaphosphatranes in organic synthesis, see *Aldrichimica Acta*, 2004, 37(1).

Catalog No.	Product Name	Unit	Price
56,588-1	2,8,9-Triisobutyl-2,5,8,9-tetraaza-1-phosphabicyclo[3.3.3]undecane [Triisobutyl-Verkade's Superbase]	1g 5g	
55,695-5	2,8,9-Triisopropyl-2,5,8,9-tetraaza-1-phosphabicyclo[3.3.3]undecane [Triisopropyl-Verkade's Superbase]	1g 5g	
46,355-8	2,8,9-Trimethyl-2,5,8,9-tetraaza-1-phosphabicyclo[3.3.3]undecane [Trimethyl-Verkade's Superbase]	1g 5g	



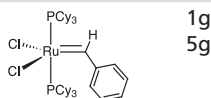
R = *i*-Bu, *i*-Pr, Me

Ruthenium-Based Metathesis Catalysts

Sigma-Aldrich is pleased to announce an agreement with Materia, Inc. to exclusively distribute research quantities of Grubbs catalysts and Hoveyda-Grubbs catalysts. For a recent review on cross-metathesis of nitrogen-containing systems and for pertinent references to other systems, see *Aldrichimica Acta*, 2003, 36(3), 93.

Grubbs Catalyst 1st Generation

57,972-6

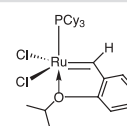


1g
5g

The first metathesis catalyst to be widely utilized in organic synthesis, Grubbs First Generation Catalyst effects ring-closing metathesis, olefin cross-metathesis, and ROMP with high activities and tolerance for functional groups and protic media.^{1,2}

Hoveyda-Grubbs Catalyst 1st Generation

57,794-4

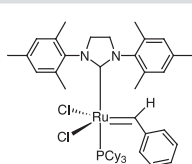


100mg
500mg
2g

An efficient, recyclable catalyst for RCM of terminal olefins.^{6,7}

Grubbs Catalyst 2nd Generation

56,974-7

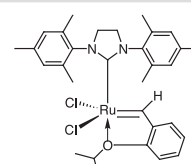


100mg
500mg
2g

Grubbs Second Generation Catalyst is a more active analog of the first-generation Grubbs catalyst for ring-closing metathesis, cross metathesis, and ROMP,³ and can lead to trisubstituted olefins via cross metathesis,⁴ it ring-closes olefins with excellent functional-group tolerance and selectivity.⁵

Hoveyda-Grubbs Catalyst 2nd Generation

56,975-5

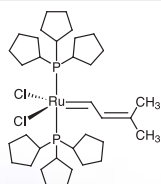


100mg
500mg
2g

The Hoveyda-Grubbs Second Generation catalyst shows efficiencies similar to those of second-generation Grubbs catalyst, but with different substrate specificities. The catalyst is unique in catalyzing the ring-closing, ring-opening, and cross-metathesis reactions of highly electron-deficient substrates.^{7,8}

Dichloro(3-methyl-2-butenylidene)bis(tricyclopentylphosphine)ruthenium(II)

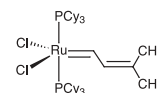
57,870-3



1g
5g

Dichloro(3-methyl-2-butenylidene)bis(tricyclohexylphosphine)ruthenium(II)

57,868-1



1g
5g

References: (1) Schwab, P. et al. *J. Am. Chem. Soc.* **1996**, 118, 100. (2) Miller, S. J. et al. *ibid.* **1996**, 118, 9606. (3) Trnka, T. M.; Grubbs, R. H. *Acc. Chem. Res.* **2001**, 34, 18. (4) Chatterjee, A. K.; Grubbs, R. H. *Org. Lett.* **1999**, 1, 1751. (5) (a) Scholl, M. et al. *ibid.* **1999**, 1, 953. (b) Saito, N. et al. *ibid.* **2002**, 4, 803. (6) Kingsbury, J. S. et al. *J. Am. Chem. Soc.* **1999**, 121, 791. (7) Garber, S. B. et al. *ibid.* **2000**, 122, 8168. (8) Randl, S. et al. *Synlett* **2001**, 430.

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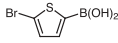
Suzuki-Miyaura Coupling Reagents

This brochure contains a comprehensive selection of boronic acids, boronic acid esters, diboron esters, and transition-metal catalysts useful for the Suzuki-Miyaura coupling reaction. New offerings are

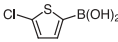
added monthly; if you don't see the material you need for your research, please call us at 1-800-231-8327 (USA) or your local office. Your new product suggestions, as always, are welcome and appreciated.

Heterocyclic Boronic Acids & Esters


5-Bromothiophene-2-boronic acid

55,768-4
C₄H₄BBrO₂S  5g


5-Chloro-2-thiopheneboronic acid

49,993-5
C₄H₄BClO₂S  5g

2-Thiopheneboronic acid

43,683-6
C₄H₅BO₂S  1g
5g

3-Thiopheneboronic acid

43,684-4
C₄H₅BO₂S  1g
5g

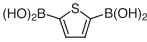
2-Furanboronic acid

46,491-0
C₄H₅BO₃  1g
10g

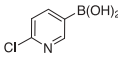
3-Furanboronic acid

51,216-8
C₄H₅BO₃  1g

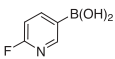
2,5-Thiophenediboronic acid

47,031-7
C₄H₆B₂O₄S  5g


(2-Chloro-5-pyridyl)boronic acid

63,738-6
C₅H₅BClNO₂  1g
5g

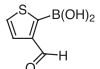
2-Fluoro-5-pyridylboronic acid

63,918-4
C₅H₅BFNO₂  1g
5g

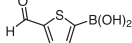
2-Formyl-3-thiopheneboronic acid

49,990-0
C₅H₅BO₃S  1g
5g


3-Formyl-2-thiopheneboronic acid

49,991-9
C₅H₅BO₃S  1g
5g


5-Formyl-2-thiopheneboronic acid

51,405-5
C₅H₅BO₃S  1g
5g

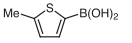
3-Pyridineboronic acid

51,212-5
C₅H₆BNO₂  1g
5g

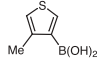
4-Pyridineboronic acid

63,449-2
C₅H₆BNO₂  1g
5g

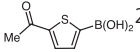
5-Methyl-2-thiopheneboronic acid

51,219-2
C₅H₇BO₂S  1g
5g

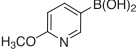
4-Methyl-3-thiopheneboronic acid

54,239-3
C₅H₇BO₂S  1g

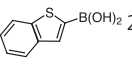
5-Acetyl-2-thiopheneboronic acid

49,992-7
C₆H₇BO₃S  5g
25g

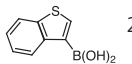
2-Methoxy-5-pyridineboronic acid

63,761-0
C₆H₈BNO₃  1g
5g

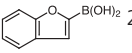
Thianaphthene-2-boronic acid

49,997-8
C₈H₇BO₂S  5g
25g

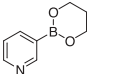
Thianaphthene-3-boronic acid

51,211-7
C₈H₇BO₂S  5g
25g

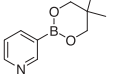
2-Benzofuranboronic acid

49,994-3
C₈H₇BO₃  5g
25g

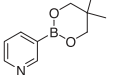
3-(1,3,2)Dioxaborolan-2-yl-pyridine, 97%

63,156-6
C₈H₁₀BNO₂  1g
5g


Pyridine-3-boronic acid neopentylglycol ester, 97%

64,262-2
C₁₀H₁₄BNO₂  1g
5g

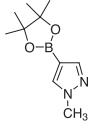
Pyridine-3-boronic acid neopentylglycol ester, 97%

64,262-2
C₁₀H₁₄BNO₂  1g
5g

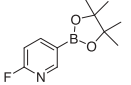
3-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)furan, 98%

57,505-4
C₁₀H₁₅BO₃  1g
5g

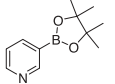
1-Methyl-4-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)-1H-pyrazole, 95%

59,531-4
C₁₀H₁₇BN₂O₂  1g
5g

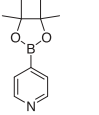
2-Fluoro-5-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)pyridine, 97%

59,254-4
C₁₁H₁₅BFNO₂  1g
5g

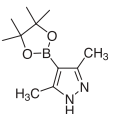
3-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)pyridine, 97%

57,656-5
C₁₁H₁₆BNO₂  1g
5g

4-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)pyridine, 97%

57,877-0
C₁₁H₁₆BNO₂  1g
5g

3,5-Dimethyl-4-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)-1H-pyrazole, 97%

63,601-0
C₁₁H₁₉BN₂O₂  1g
5g



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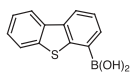
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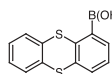
ALDRICH®

4-Dibenzothiopheneboronic acid

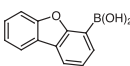
49,998-6
C₁₂H₉BO₂S 1g
5g

**Thianthrene-1-boronic acid**

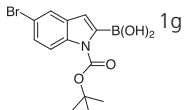
51,221-4
C₁₂H₉BO₂S₂ 5g

**4-Dibenzofuranboronic acid**

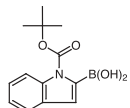
49,995-1
C₁₂H₉BO₃ 5g

**1-(tert-Butoxycarbonyl-5-bromo-1H-indol-2-yl)boronic acid**

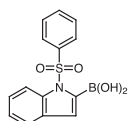
63,739-4
C₁₃H₁₅BBrNO₄ 1g
(NEW)

**1-(tert-Butoxycarbonyl)indole-2-boronic acid**

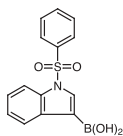
56,233-5
C₁₃H₁₆BN₂O₄ 1g

**1-(Phenylsulfonyl)-2-indoleboronic acid**

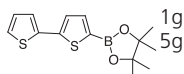
56,386-2
C₁₄H₁₂BN₂O₄S 1g

**1-(Phenylsulfonyl)-3-indoleboronic acid, 97%**

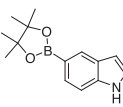
56,387-0
C₁₄H₁₂BN₂O₄S 1g
5g

**5-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)-2,2'-bithiophene**

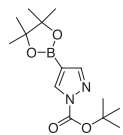
57,887-8
C₁₄H₁₇BO₂S₂ 1g
5g

**5-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)-1H-indole, 97%**

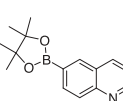
57,883-5
C₁₄H₁₈BN₂O₄ 1g
5g
(NEW)

**4-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)pyrazole-1-carboxylic acid tert-butyl ester**

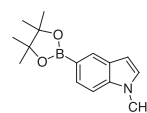
63,273-2
C₁₄H₂₃BN₂O₄ 1g
5g
(NEW)

**6-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)quinoline**

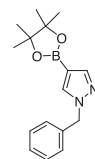
64,161-8
C₁₅H₁₈BN₂O₄ 1g
5g
(NEW)

**1-Methyl-5-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)-1H-indole**

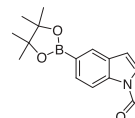
64,039-5
C₁₆H₂₀BN₂O₄ 1g
5g
(NEW)

**1-Benzyl-4-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)-1H-pyrazole, 95%**

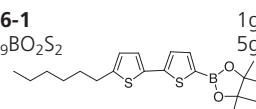
63,600-2
C₁₆H₂₁BN₂O₄ 1g
5g
(NEW)

**5-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)-1-BOC-indole, 97%**

64,038-7
C₁₉H₂₆BN₂O₄ 1g
5g
(NEW)

**5-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)-5'-N-hexyl-2,2'-bithiophene, 97%**

63,296-1
C₂₀H₂₉BO₂S₂ 1g
5g
(NEW)

**Boronic Acids**

Most boronic acids readily undergo dehydration reactions to give a cyclic (trimer) anhydride. Our selection of boronic acids may contain varying amounts of this cyclic anhydride. Fortunately, the acid and

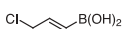
the anhydride work equally well in the Suzuki coupling reactions; thus, the two forms are generally regarded as equivalent.

Methylboronic acid, 97%

16,533-6
CH₃BO₂ 1g
5g

**trans-2-Chloromethylvinylboronic acid**

55,659-9
C₃H₆BClO₂ 1g
5g

**cis-Propenylboronic acid**

57,217-9
C₃H₇BO₂ 1g
5g

**trans-Propenylboronic acid**

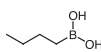
57,663-8
C₃H₇BO₂ 1g
5g

**Cyclopropylboronic acid**

59,798-8
C₃H₇BO₂ 1g
5g
(NEW)

**Butylboronic acid, 97%**

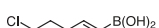
16,324-4
C₄H₁₁BO₂ 1g
5g
25g

**(2-Methylpropyl)boronic acid**

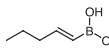
34,622-5
C₄H₁₁BO₂ 1g
5g

**(E)-5-Chloro-1-penteneboronic acid**

56,279-3
C₅H₁₀BClO₂ 1g
10g

**1-Pentenylboronic acid**

57,845-2
C₅H₁₁BO₂ 1g
5g

**Cyclopentylboronic acid**

58,841-5
C₅H₁₁BO₂ 1g
10g
(NEW)

**3-Methyl-2-buten-2-ylboronic acid**

63,907-9
C₅H₁₁BO₂ 1g
5g
(NEW)

**4-Bromo-2,3,5,6-tetrafluorophenylboronic acid**

59,396-6
C₆H₂BBrF₄O₂ 1g
10g
(NEW)

**Pentafluorophenylboronic acid**

46,509-7
C₆H₂BF₅O₂ 5g
25g

**4-Bromo-2,6-difluorophenylboronic acid**

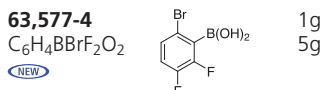
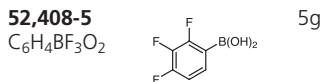
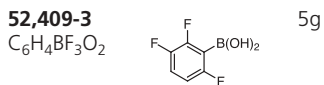
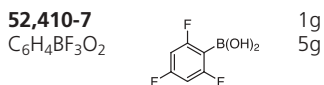
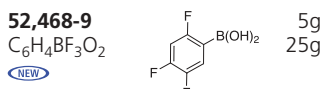
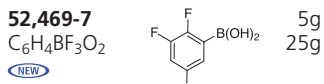
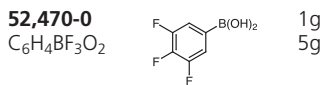
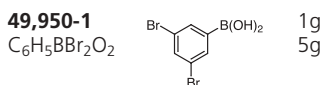
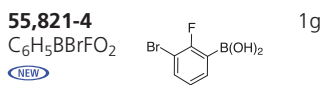
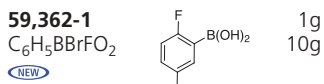
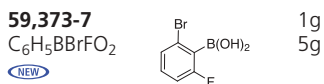
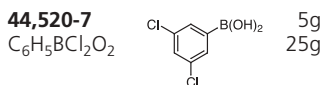
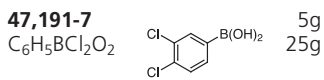
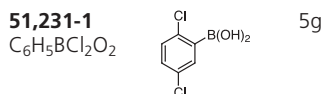
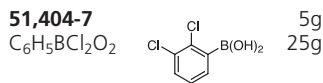
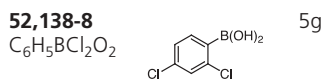
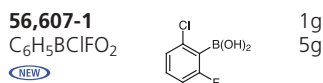
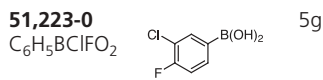
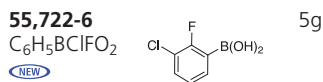
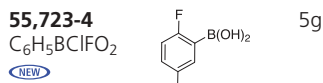
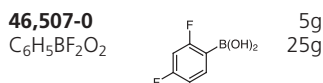
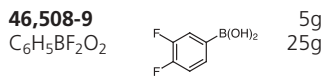
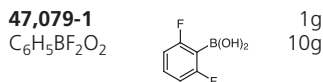
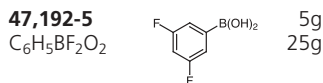
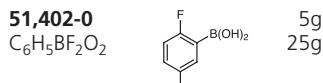
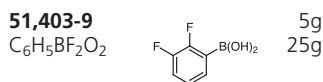
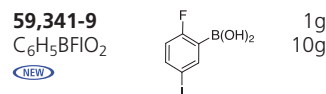
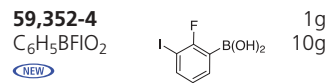
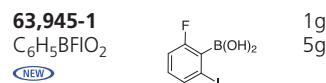
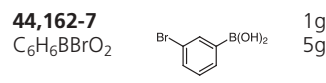
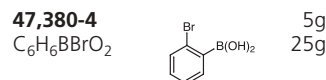
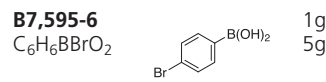
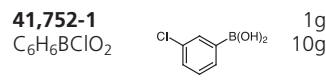
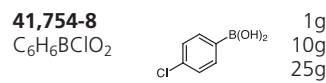
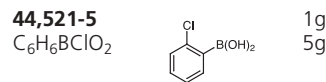
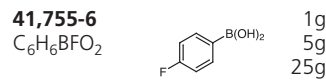
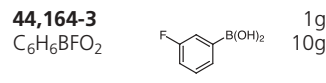
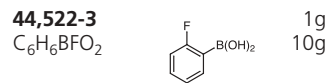
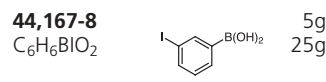
55,721-8
C₆H₄BBrF₂O₂ 1g
(NEW)

**3-Bromo-2,6-difluorophenylboronic acid**

55,724-2
C₆H₄BBrF₂O₂ 5g
(NEW)

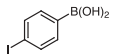


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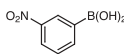
2-Bromo-5,6-difluorophenylboronic acid**2,3,4-Trifluorophenylboronic acid****2,3,6-Trifluorophenylboronic acid****2,4,6-Trifluorophenylboronic acid****2,4,5-Trifluorophenylboronic acid****2,3,5-Trifluorophenylboronic acid****3,4,5-Trifluorophenylboronic acid****3,5-Dibromophenylboronic acid****3-Bromo-2-fluorophenylboronic acid****5-Bromo-2-fluorophenylboronic acid****2-Bromo-6-fluorophenylboronic acid****3,5-Dichlorophenylboronic acid****3,4-Dichlorophenylboronic acid****2,5-Dichlorophenylboronic acid****2,3-Dichlorophenylboronic acid****2,4-Dichlorophenylboronic acid****2-Chloro-6-fluorophenylboronic acid****3-Chloro-4-fluorophenylboronic acid****3-Chloro-2-fluorophenylboronic acid****5-Chloro-2-fluorophenylboronic acid****2,4-Difluorophenylboronic acid****3,4-Difluorophenylboronic acid****2,6-Difluorophenylboronic acid, 98%****3,5-Difluorophenylboronic acid****2,5-Difluorophenylboronic acid****2,3-Difluorophenylboronic acid****2-Fluoro-5-iodophenylboronic acid****2-Fluoro-3-iodophenylboronic acid****2-Fluoro-6-iodophenylboronic acid****3-Bromophenylboronic acid****2-Bromophenylboronic acid****4-Bromophenylboronic acid****3-Chlorophenylboronic acid****4-Chlorophenylboronic acid, 95%****2-Chlorophenylboronic acid****4-Fluorophenylboronic acid****3-Fluorophenylboronic acid****2-Fluorophenylboronic acid****3-Iodophenylboronic acid**

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
4-Iodophenylboronic acid

47,193-3
C₆H₆BO₂  5g
25g

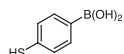
3-Nitrophenylboronic acid

32,510-4
C₆H₆BNO₄  1g
5g

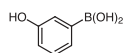
Phenylboronic acid, 97%

P2,000-9
C₆H₇BO₂  10g
50g
250g

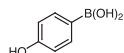
4-Mercaptophenylboronic acid, 90%

52,401-8
C₆H₇BO₂S  1g
5g

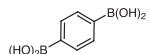
3-Hydroxyphenylboronic acid

52,396-8
C₆H₇BO₃  1g
10g

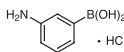
4-Hydroxyphenylboronic acid

52,397-6
C₆H₇BO₃  1g
5g

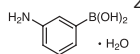
1,4-Phenylenebisboronic acid

41,713-0
C₆H₈B₂O₄  5g
25g

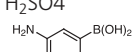
3-Aminophenylboronic acid
hydrochloride, 98%

41,070-5
C₆H₉BClNO₂  1g
5g

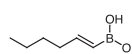
3-Aminophenylboronic acid
monohydrate, 98%

28,751-2
C₆H₁₀BNO₃  250mg
1g
5g

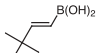
3-Aminophenylboronic acid
hemisulfate

A7,175-1
C₆H₈BNO₂•½ H₂SO₄  1g
5g
25g
• ½ H₂SO₄


trans-1-Hexen-1-ylboronic acid

52,101-9
C₆H₁₃BO₂  1g

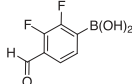
trans-2-tert-Butylvinylboronic acid

55,655-6
C₆H₁₃BO₂  1g
5g

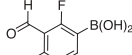
Cyclohexyl boronic acid

55,658-0
C₆H₁₃BO₂  5g
10g


2,3-Difluoro-4-formylphenylboronic acid

57,137-7
C₇H₅BF₂O₃  1g
5g

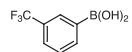
2,4-Difluoro-3-formylphenylboronic acid

59,740-6
C₇H₅BF₂O₃  1g
10g

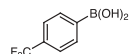
2-Fluoro-5-(trifluoromethyl)-
phenylboronic acid

55,818-4
C₇H₅BF₄O₂  1g

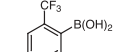
3-(Trifluoromethyl)phenylboronic acid

43,203-2
C₇H₆BF₃O₂  1g
5g

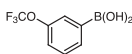
4-(Trifluoromethyl)phenylboronic acid

43,932-0
C₇H₆BF₃O₂  1g
5g

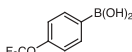
2-(Trifluoromethyl)phenylboronic acid

44,519-3
C₇H₆BF₃O₂  1g
10g

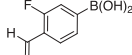
3-(Trifluoromethoxy)phenylboronic acid

51,012-2
C₇H₆BF₃O₃  5g

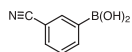
4-(Trifluoromethoxy)phenylboronic acid

51,013-0
C₇H₆BF₃O₃  5g


3-Fluoro-4-formylphenylboronic acid

54,229-6
C₇H₆BF₃O₃  1g

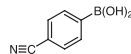
3-Cyanophenylboronic acid

51,301-6
C₇H₆BNO₂  1g
5g

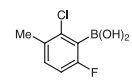
2-Cyanophenylboronic acid

52,139-6
C₇H₆BNO₂  1g
5g

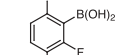
4-Cyanophenylboronic acid

52,141-8
C₇H₆BNO₂  1g
10g

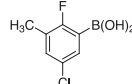
2-Chloro-6-fluoro-3-
methylphenylboronic acid

55,725-0
C₇H₇BClFO₂  5g

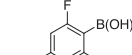
2-Chloro-6-fluoro-5-
methylphenylboronic acid

55,726-9
C₇H₇BClFO₂  5g

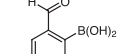
5-Chloro-2-fluoro-3-
methylphenylboronic acid

55,727-7
C₇H₇BClFO₂  5g

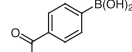
2,6-Difluoro-4-methoxyphenylboronic acid

59,306-0
C₇H₇BF₂O₃  1g
5g

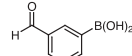
2-Formylphenylboronic acid

43,195-8
C₇H₇BO₃  1g
5g

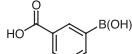
4-Formylphenylboronic acid

43,196-6
C₇H₇BO₃  1g
5g
25g

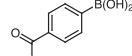
3-Formylphenylboronic acid

44,165-1
C₇H₇BO₃  1g
5g
25g

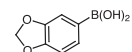
3-Carboxyphenylboronic acid

45,676-4
C₇H₇BO₄  1g
10g

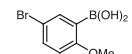
4-Carboxyphenylboronic acid

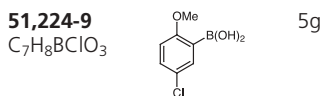
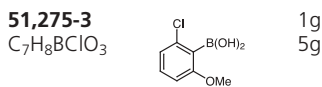
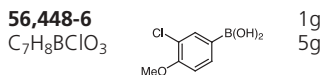
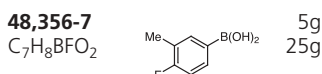
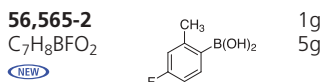
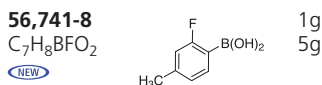
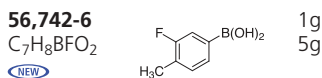
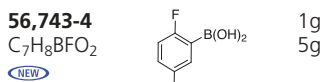
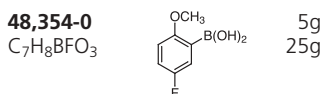
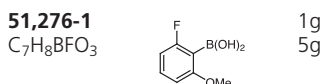
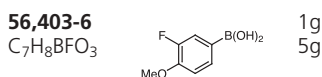
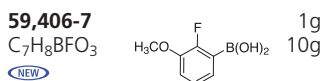
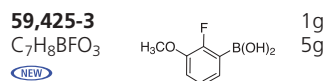
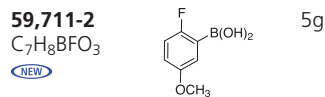
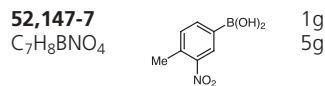
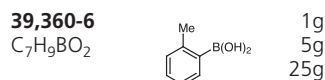
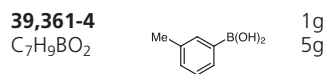
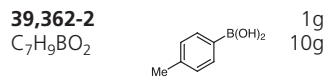
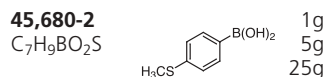
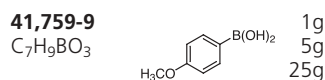
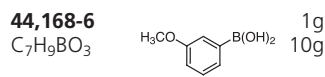
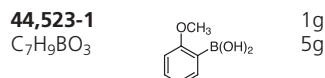
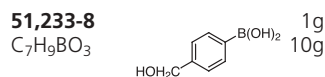
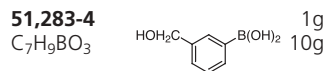
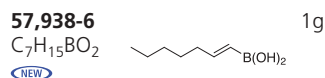
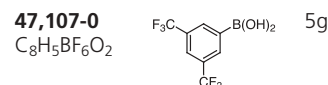
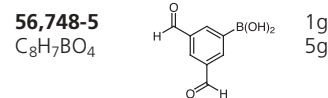
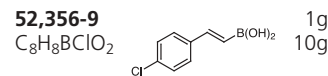
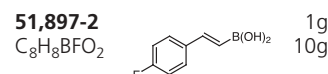
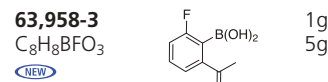
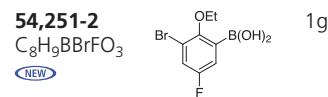
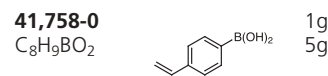
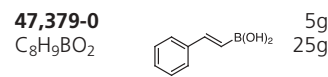
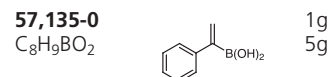
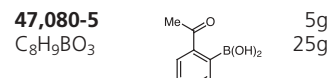
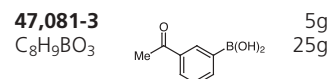
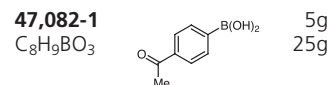
45,677-2
C₇H₇BO₄  1g
10g

3,4-(Methylenedioxy)phenylboronic acid

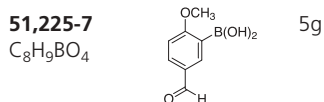
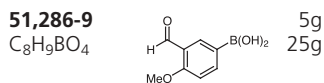
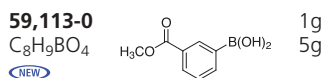
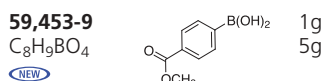
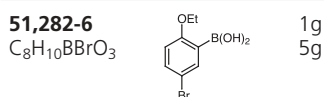
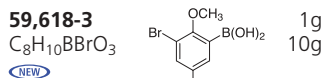
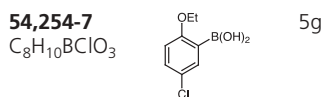
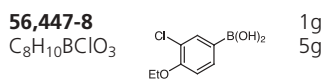
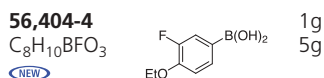
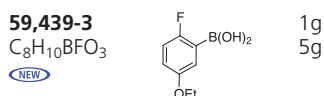
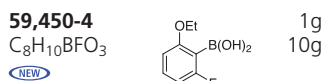
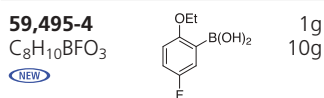
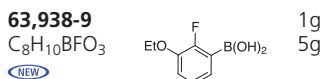
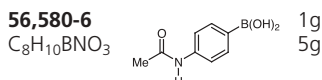
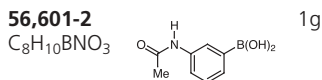
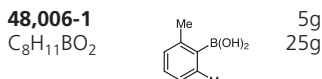
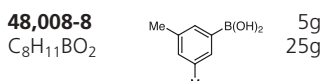
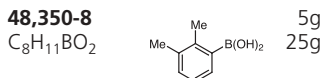
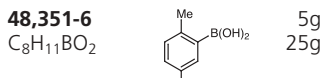
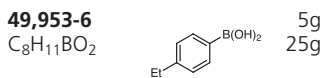
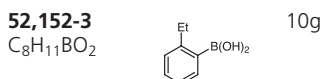
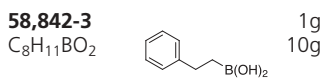
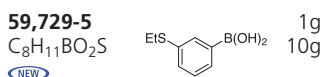
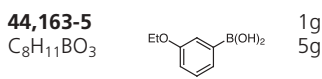
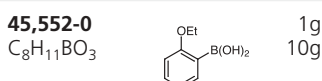
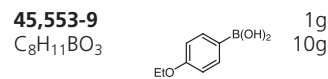
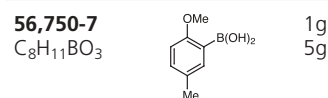
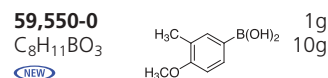
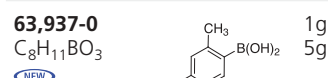
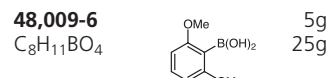
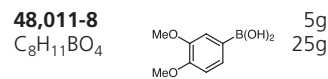
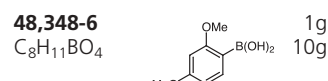
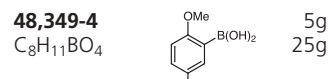
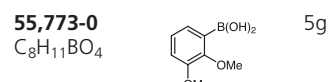
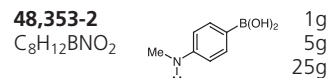
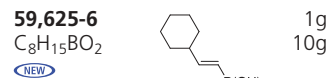
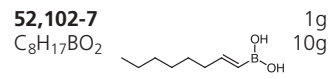
49,999-4
C₇H₇BO₄  1g
5g

5-Bromo-2-methoxyphenylboronic acid

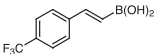
51,270-2
C₇H₈BBrO₃  5g

5-Chloro-2-methoxyphenylboronic acid**2-Chloro-6-methoxyphenylboronic acid****3-Chloro-4-methoxyphenylboronic acid****4-Fluoro-3-methylphenylboronic acid****4-Fluoro-2-methylphenylboronic acid****2-Fluoro-4-methylphenylboronic acid****3-Fluoro-4-methylphenylboronic acid****2-Fluoro-5-methylphenylboronic acid****5-Fluoro-2-methoxyphenylboronic acid****2-Fluoro-6-methoxyphenylboronic acid****3-Fluoro-4-methoxyphenylboronic acid****2-Fluoro-3-methoxyphenylboronic acid****2-Fluoro-3-methoxyphenylboronic acid****2-Fluoro-5-methoxyphenylboronic acid****4-Methyl-3-nitrophenylboronic acid****o-Tolylboronic acid****m-Tolylboronic acid, 97%****p-Tolylboronic acid, 97%****4-(Methylthio)phenylboronic acid****4-Methoxyphenylboronic acid****3-Methoxyphenylboronic acid****2-Methoxyphenylboronic acid, 95%****4-(Hydroxymethyl)phenylboronic acid****3-(Hydroxymethyl)phenylboronic acid****trans-1-Heptynylboronic acid****3,5-Bis(trifluoromethyl)phenylboronic acid****3,5-Diformylphenylboronic acid****trans-2-(4-Chlorophenyl)vinylboronic acid****trans-2-(4-Fluorophenyl)vinylboronic acid****2-Fluoro-5-acetylphenylboronic acid****3-Bromo-2-ethoxy-5-fluorophenylboronic acid****4-Vinylphenylboronic acid****trans-2-Phenylvinylboronic acid, 97%****α-Phenylvinylboronic acid****2-Acetylphenylboronic acid****3-Acetylphenylboronic acid****4-Acetylphenylboronic acid**

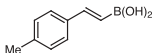
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5-Formyl-2-methoxyphenylboronic acid**3-Formyl-4-methoxyphenylboronic acid****3-Methoxycarbonylphenylboronic acid****4-Methoxycarbonylphenylboronic acid****5-Bromo-2-ethoxyphenylboronic acid****3-Bromo-5-methyl-2-methoxyphenylboronic acid****5-Chloro-2-ethoxyphenylboronic acid****3-Chloro-4-ethoxyphenylboronic acid****4-Ethoxy-3-fluorophenylboronic acid****5-Ethoxy-2-fluorophenylboronic acid****2-Ethoxy-6-fluorophenylboronic acid****2-Ethoxy-5-fluorophenylboronic acid****3-Ethoxy-2-fluorophenylboronic acid****4-Acetamidophenylboronic acid****3-Acetamidophenylboronic acid****2,6-Dimethylphenylboronic acid****3,5-Dimethylphenylboronic acid****2,3-Dimethylphenylboronic acid****2,5-Dimethylphenylboronic acid****4-Ethylphenylboronic acid****2-Ethylphenylboronic acid****Phenethylboronic acid****3-(Ethylthio)phenylboronic acid****3-Ethoxyphenylboronic acid****2-Ethoxyphenylboronic acid****4-Ethoxyphenylboronic acid****2-Methoxy-5-methylphenylboronic acid****4-Methoxy-3-methylphenylboronic acid****4-Methoxy-2-methylphenylboronic acid****2,6-Dimethoxyphenylboronic acid****3,4-Dimethoxyphenylboronic acid****2,4-Dimethoxyphenylboronic acid, 95%****2,5-Dimethoxyphenylboronic acid****2,3-Dimethoxyphenylboronic acid, 97%****4-(Dimethylamino)phenylboronic acid****2-Cyclohexylvinylboronic acid****trans-1-Octen-1-ylboronic acid**

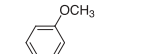
trans-2-(4-(Trifluoromethyl)phenyl)-vinylboronic acid

51,902-2
C₉H₈BF₃O₂  1g
5g

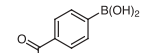
trans-2-(4-Methylphenyl)vinylboronic acid, 97%

56,813-9
C₉H₁₁BO₂  1g
5g

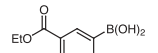
trans-2-(3-Methoxyphenyl)vinylboronic acid

52,786-6
C₉H₁₁BO₃  1g
10g

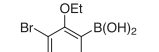
4-Ethoxycarbonylphenylboronic acid

57,464-3
C₉H₁₁BO₄  1g
5g

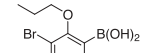
3-Ethoxycarbonylphenylboronic acid

57,465-1
C₉H₁₁BO₄  1g
5g

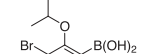
3-Bromo-2-ethoxy-5-methylphenylboronic acid

59,629-9
C₉H₁₂BBrO₃  1g
10g

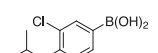
3-Bromo-2-propoxyphenylboronic acid

59,707-4
C₉H₁₂BBrO₃  1g
10g

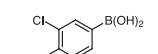
3-Bromo-2-isopropoxyphenylboronic acid

59,717-1
C₉H₁₂BBrO₃  1g
10g

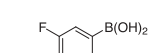
3-Chloro-4-isopropoxyphenylboronic acid

56,444-3
C₉H₁₂BClO₃  1g
5g

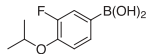
3-Chloro-4-propoxyphenylboronic acid

56,445-1
C₉H₁₂BClO₃  1g
5g

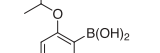
3-Fluoro-4-propoxyphenylboronic acid

56,405-2
C₉H₁₂BFO₃  1g
5g


3-Fluoro-4-isopropoxyphenylboronic acid

56,406-0
C₉H₁₂BFO₃  1g
5g

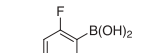
5-Fluoro-2-isopropoxyphenylboronic acid

56,455-9
C₉H₁₂BFO₃  1g
5g

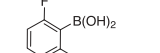
5-Fluoro-2-propoxyphenylboronic acid

56,577-6
C₉H₁₂BFO₃  1g
5g

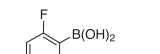
2-Fluoro-5-propoxyphenylboronic acid

59,428-8
C₉H₁₂BFO₃  1g
10g

2-Fluoro-6-isopropoxyphenylboronic acid

63,939-7
C₉H₁₂BFO₃  1g
5g

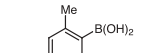
2-Fluoro-6-propoxyphenylboronic acid

63,941-9
C₉H₁₂BFO₃  1g
5g

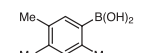
4-Propylphenylboronic acid

52,150-7
C₉H₁₃BO₂  10g

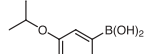
2,4,6-Trimethylphenylboronic acid

54,231-8
C₉H₁₃BO₂  5g

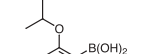
2,4,5-Trimethylphenylboronic acid

54,232-6
C₉H₁₃BO₂  5g

3-Isopropoxyphenylboronic acid

54,245-8
C₉H₁₃BO₃  1g
10g

2-Isopropoxyphenylboronic acid

54,246-6
C₉H₁₃BO₃  1g
10g

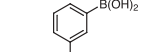
4-Isopropoxyphenylboronic acid

54,247-4
C₉H₁₃BO₃  1g
10g

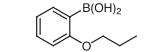
4-Propoxyphenylboronic acid

55,770-6
C₉H₁₃BO₃  5g

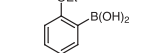
3-Propoxyphenylboronic acid

55,771-4
C₉H₁₃BO₃  5g

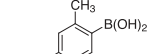
2-Propoxyphenylboronic acid

55,772-2
C₉H₁₃BO₃  5g

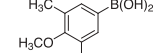
2-Ethoxy-5-methylphenylboronic acid

56,749-3
C₉H₁₃BO₃  1g
5g

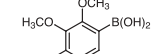
4-Ethoxy-2-methylphenylboronic acid

59,483-0
C₉H₁₃BO₃  1g
5g

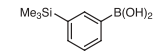
3,5-Dimethyl-4-methoxyphenylboronic acid

59,806-2
C₉H₁₃BO₃  1g
10g

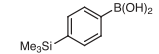
2,3,4-Trimethoxyphenylboronic acid

51,228-1
C₉H₁₃BO₅  5g

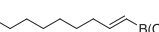
3-(Trimethylsilyl)phenylboronic acid

52,366-6
C₉H₁₅BO₂Si  1g
5g

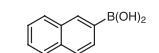
4-(Trimethylsilyl)phenylboronic acid

52,367-4
C₉H₁₅BO₂Si  1g
5g

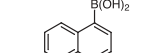
trans-1-Nonenylboronic acid

57,939-4
C₉H₁₉BO₂  1g

2-Naphthaleneboronic acid

48,013-4
C₁₀H₉BO₂  5g
25g

1-Naphthaleneboronic acid

N,25-7
C₁₀H₉BO₂  5g
25g

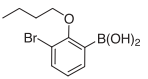
1,1'-Ferrocenediboronic acid, 97%

45,555-5
C₁₀H₁₂B₂FeO₄  5g

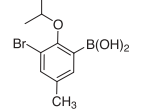


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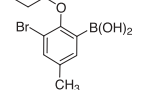
3-Bromo-2-butoxyphenylboronic acid

59,212-9
 $C_{10}H_{14}BBrO_3$  1g
 10g
 (NEW)

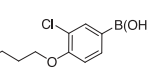
3-Bromo-2-isopropoxy-5-methylphenylboronic acid

59,662-0
 $C_{10}H_{14}BBrO_3$  1g
 10g
 (NEW)

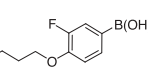
3-Bromo-5-methyl-2-propoxyphenylboronic acid

59,674-4
 $C_{10}H_{14}BBrO_3$  1g
 10g
 (NEW)

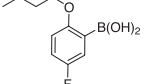
4-Butoxy-3-chlorophenylboronic acid

56,443-5
 $C_{10}H_{14}BClO_3$  1g
 5g
 (NEW)

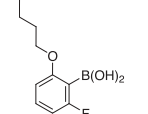
4-Butoxy-3-fluorophenylboronic acid

56,407-9
 $C_{10}H_{14}BFO_3$  1g
 5g
 (NEW)

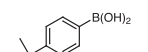
2-Butoxy-5-fluorophenylboronic acid

56,454-0
 $C_{10}H_{14}BFO_3$  1g
 5g
 (NEW)

2-Butoxy-6-fluorophenylboronic acid

63,942-7
 $C_{10}H_{14}BFO_3$  1g
 5g
 (NEW)

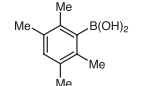
4-tert-Butylphenylboronic acid

48,005-3
 $C_{10}H_{15}BO_2$  5g
 25g

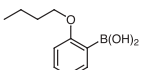
4-Butylphenylboronic acid

52,149-3
 $C_{10}H_{15}BO_2$  1g
 5g

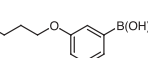
2,3,5,6-Tetramethylphenylboronic acid

52,151-5
 $C_{10}H_{15}BO_2$  5g
 25g

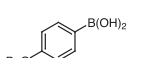
2-Butoxyphenylboronic acid

54,248-2
 $C_{10}H_{15}BO_3$  1g
 10g

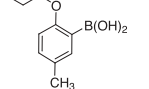
3-Butoxyphenylboronic acid

54,249-0
 $C_{10}H_{15}BO_3$  1g
 10g

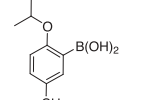
4-Butoxyphenylboronic acid

54,250-4
 $C_{10}H_{15}BO_3$  1g
 10g

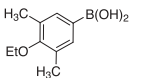
5-Methyl-2-propoxyphenylboronic acid

56,564-4
 $C_{10}H_{15}BO_3$  1g
 5g
 (NEW)

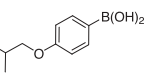
2-Isopropoxy-5-methylphenylboronic acid

56,566-0
 $C_{10}H_{15}BO_3$  1g
 5g
 (NEW)

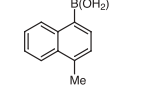
3,5-Dimethyl-4-ethoxyphenylboronic acid

59,794-5
 $C_{10}H_{15}BO_3$  1g
 10g
 (NEW)

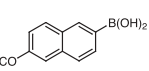
4-Isobutoxyphenylboronic acid

63,960-5
 $C_{10}H_{15}BO_3$  1g
 5g
 (NEW)

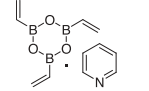
4-Methyl-1-naphthaleneboronic acid

52,145-0
 $C_{11}H_{11}BO_2$  10g

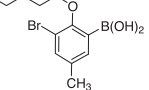
6-Methoxy-2-naphthaleneboronic acid

52,189-2
 $C_{11}H_{11}BO_3$  5g

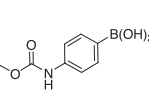
Vinylboronic anhydride pyridine complex, 97%

63,799-8
 $C_{11}H_{14}B_3NO_3$  1g
 5g
 (NEW)

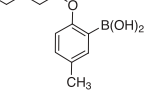
3-Bromo-2-butoxy-5-methylphenylboronic acid

59,684-1
 $C_{11}H_{16}BBrO_3$  1g
 10g
 (NEW)

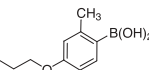
4-(N-Boc-amino)phenylboronic acid

56,581-4
 $C_{11}H_{16}BNO_4$  1g
 5g
 (NEW)

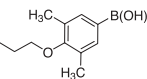
2-Butoxy-5-methylphenylboronic acid

56,567-9
 $C_{11}H_{17}BO_3$  1g
 5g
 (NEW)

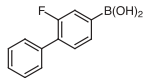
4-Butoxy-2-methylphenylboronic acid

59,462-8
 $C_{11}H_{17}BO_3$  1g
 5g
 (NEW)

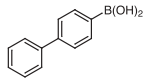
3,5-Dimethyl-4-propoxyphenylboronic acid

59,784-8
 $C_{11}H_{17}BO_3$  1g
 10g
 (NEW)

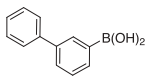
2-Fluoro-4-biphenylboronic acid

51,210-9
 $C_{12}H_{10}BFO_2$  5g

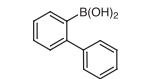
4-Biphenylboronic acid

48,345-1
 $C_{12}H_{11}BO_2$  5g
 25g

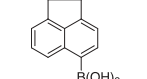
3-Biphenylboronic acid

54,219-9
 $C_{12}H_{11}BO_2$  5g
 (NEW)

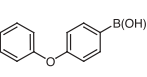
2-Biphenylboronic acid

54,220-2
 $C_{12}H_{11}BO_2$  5g

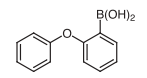
Acenaphthene-5-boronic acid

56,747-7
 $C_{12}H_{11}BO_2$  1g
 5g
 (NEW)

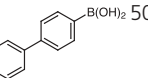
4-Phenoxyphenylboronic acid

48,014-2
 $C_{12}H_{11}BO_3$  5g
 25g

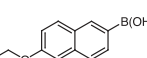
2-Phenoxyphenylboronic acid

52,148-5
 $C_{12}H_{11}BO_3$  10g

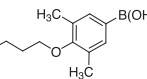
4,4'-Biphenyldiboronic acid

45,679-9
 $C_{12}H_{12}B_2O_4$  500mg
 (HO)₂B

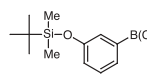
6-Ethoxy-2-naphthaleneboronic acid

52,190-6
 $C_{12}H_{13}BO_3$  5g

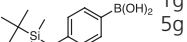
4-Butoxy-3,5-dimethylphenylboronic acid

59,751-1
 $C_{12}H_{19}BO_3$  1g
 10g
 (NEW)

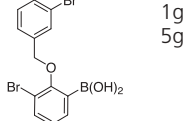
3-(tert-Butyldimethylsilyloxy)phenylboronic acid, tech. grade

52,403-4
 $C_{12}H_{21}BO_3Si$  5g

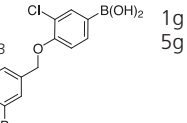
4-(*tert*-Butyldimethylsilyloxy)phenylboronic acid

52,404-2
 $C_{12}H_{21}BO_3Si$  1g
 5g

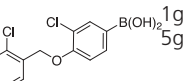
3-Bromo-2-(3'-bromobenzoyloxy)phenylboronic acid

63,956-7
 $C_{13}H_{11}BBR_2O_3$  1g
 5g

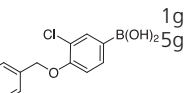
3-Chloro-4-(3'-bromobenzoyloxy)phenylboronic acid

63,952-4
 $C_{13}H_{11}BBRClO_3$  1g
 5g

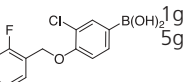
3-Chloro-4-(2'-chlorobenzoyloxy)phenylboronic acid

63,953-2
 $C_{13}H_{11}BCl_2O_3$  1g
 5g

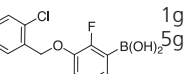
3-Chloro-4-(3'-chlorobenzoyloxy)phenylboronic acid

63,954-0
 $C_{13}H_{11}BCl_2O_3$  1g
 5g

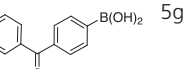
3-Chloro-4-(2'-fluorobenzoyloxy)phenylboronic acid

63,957-5
 $C_{13}H_{11}BClFO_3$  1g
 5g

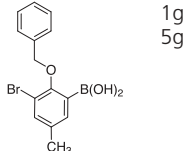
3-Benzyloxy-2,6-difluorophenylboronic acid

63,570-7
 $C_{13}H_{11}BF_2O_3$  1g
 5g

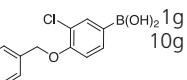
4-Benzoylphenylboronic acid

52,601-0
 $C_{13}H_{11}BO_3$  5g

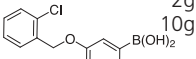
2-Benzyloxy-3-bromo-5-methylphenylboronic acid

63,943-5
 $C_{13}H_{12}BBRO_3$  1g
 5g

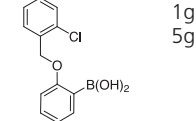
4-Benzyloxy-3-chlorophenylboronic acid

59,561-6
 $C_{13}H_{12}BClO_3$  1g
 10g

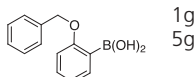
3-(2'-Chlorobenzoyloxy)phenylboronic acid

63,573-1
 $C_{13}H_{12}BClO_3$  2g
 10g

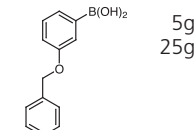
2-(2'-Chlorobenzoyloxy)phenylboronic acid

63,944-3
 $C_{13}H_{12}BClO_3$  1g
 5g

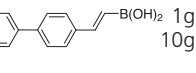
2-Benzyloxyphenylboronic acid

52,133-7
 $C_{13}H_{13}BO_3$  1g
 5g

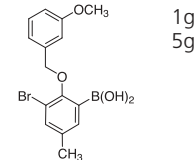
3-Benzyloxyphenylboronic acid

52,633-9
 $C_{13}H_{13}BO_3$  5g
 25g

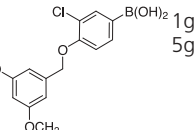
***trans*-2-(4-Biphenyl)vinylboronic acid**

52,604-5
 $C_{14}H_{13}BO_2$  1g
 10g

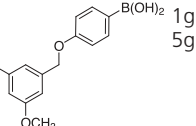
3-Bromo-5-methyl-2-(3'-methoxybenzyloxy)phenylboronic acid

63,947-8
 $C_{15}H_{16}BBRO_4$  1g
 5g

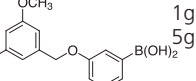
3-Chloro-4-(3',5'-dimethoxybenzyloxy)phenylboronic acid

63,951-6
 $C_{15}H_{16}BClO_5$  1g
 5g

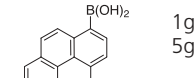
4-(3',5'-Dimethoxybenzyloxy)phenylboronic acid

63,575-8
 $C_{15}H_{17}BO_5$  1g
 5g

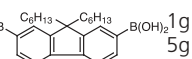
3-(3',5'-Dimethoxybenzyloxy)phenylboronic acid

63,576-6
 $C_{15}H_{17}BO_5$  1g
 5g

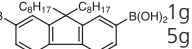
Pyrene-1-boronic acid

54,287-3
 $C_{16}H_{11}BO_2$  1g
 5g

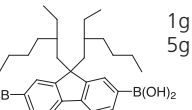
9,9-Dihexylfluorene-2,7-diboronic acid, 97%

56,633-0  1g
 $C_{25}H_{36}B_2O_4$ 5g

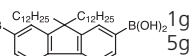
9,9-Dioctylfluorene-2,7-diboronic acid, 96%

56,936-4  1g
 $C_{29}H_{44}B_2O_4$ 5g

9,9-Di(2'-ethylhexyl)fluorene-2,7-diboronic acid

57,153-9  1g
 $C_{29}H_{44}B_2O_4$ 5g

9,9-Didodecylfluorene-2,7-diboronic acid

57,149-0  1g
 $C_{37}H_{60}B_2O_4$ 5g



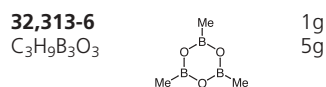
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Boronic Acid Esters

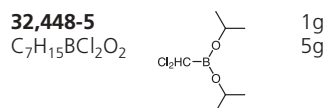
The synthesis of biaryl compounds via the Suzuki–Miyaura coupling reaction has become more commonplace now that many arylboronic acids are readily available. Several years ago, Miyaura et al. demonstrated the utility of cyclic pinacol esters of arylboronic acids

in Suzuki–Miyaura coupling reactions. Aldrich is pleased to offer the following boronic acid esters as part of a growing line of reagents used in the Suzuki–Miyaura coupling reaction.

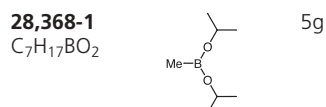
Trimethylboroxine, 99%



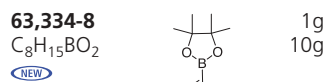
Dichloromethyldiisopropoxyborane



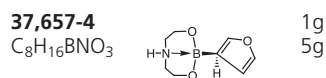
Diisopropoxymethylborane, 97%



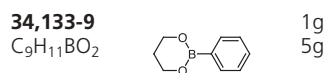
Vinylboronic acid pinacolester, 95%



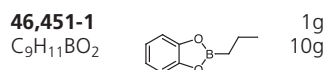
Diethanolamine (3*R*)-(+)-tetrahydrofuranboronate, 98%



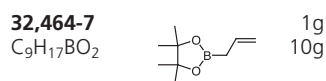
2-Phenyl-1,3,2-dioxaborinane, 99%



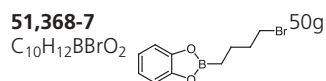
2-Propyl-1,3,2-benzodioxaborole, 97%



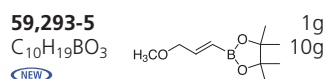
2-Allyl-4,4,5,5-tetramethyl-1,3,2-dioxaborolane



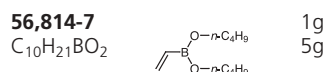
2-(4-Bromobutyl)-1,3,2-benzodioxaborole, 96%



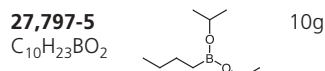
(*E*)-2-(3-Methoxypropenyl)-4,4,5,5-tetramethyl-1,3,2-dioxaborolane, 95%



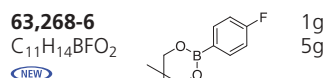
Vinylboronic acid dibutyl ester, 97%



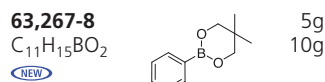
Butyldiisopropoxyborane, 98%



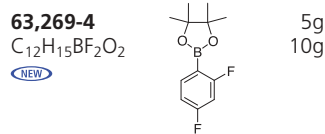
2-(5,5-Dimethyl-1,3,2-dioxaborinan-2-yl)fluorobenzene, 97%



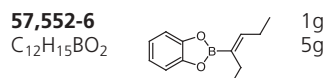
(5,5-Dimethyl-1,3,2-dioxaborinan-2-yl)benzene, 97%



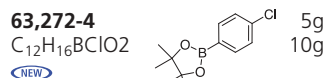
2-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)-1,5-difluorobenzene, 97%



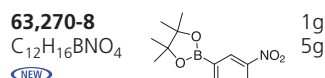
2-(*cis*-1-Ethyl-1-butenyl)benzo-(1,3,2)dioxaborole, 97%



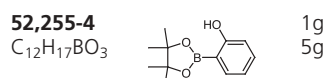
4-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)chlorobenzene, 97%



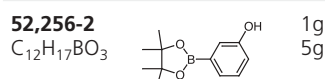
3-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)nitrobenzene, 97%



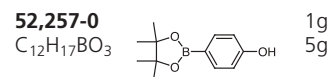
2-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)phenol



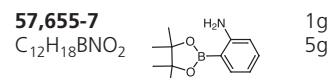
3-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)phenol, 97%



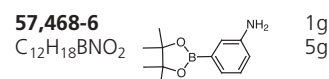
4-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)phenol, 97%



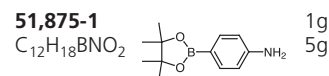
2-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)aniline



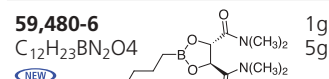
3-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)aniline, 97%



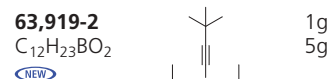
4-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)aniline, 97%



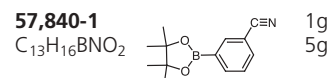
(4*S*,5*S*)-(+)-2-Butyl-*N,N,N',N'*-tetramethyl-1,3,2-dioxaborolane-4,5-dicarboxamide, 97%



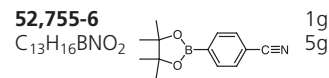
(2-*tert*-Butyl-1-ethynyl)-diisopropoxyborane



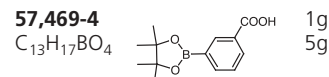
3-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)benzotrile, 97%

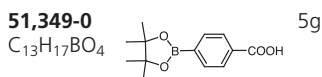
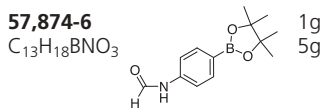
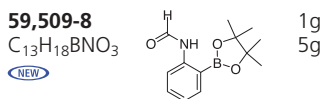
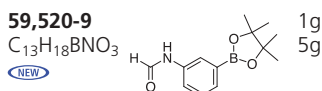
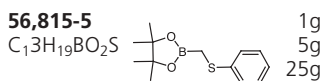
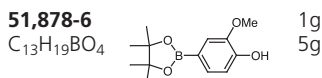
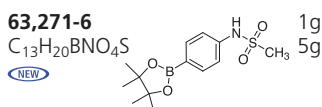
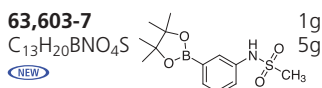
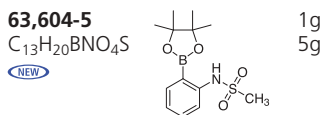
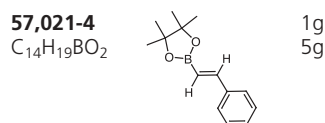
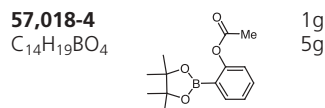
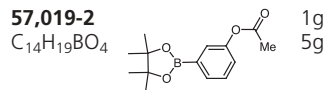
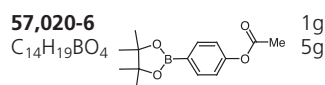
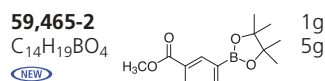
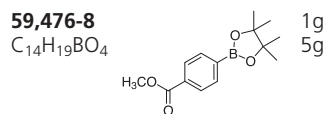
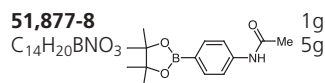
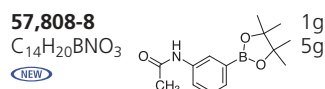
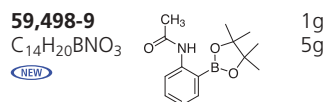
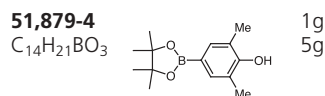
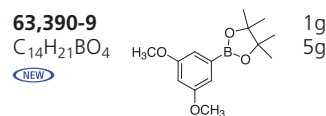
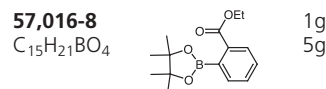
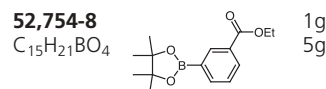
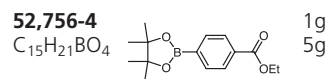
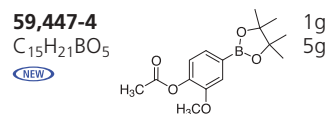
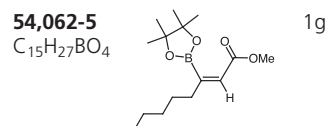
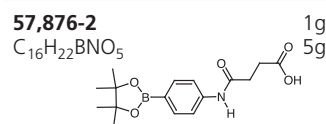
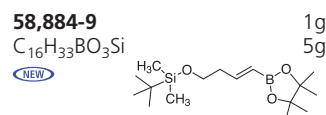
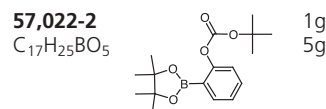


4-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)benzotrile, 97%



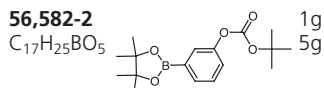
3-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)benzoic acid, 97%



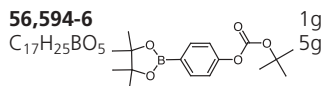
4-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)benzoic acid, 97%**N-(4-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)phenyl)formamide, 97%****N-(2-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)phenyl)formamide, 97%****N-[3-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)phenyl]formamide****4,4,5,5-Tetramethyl-2-phenylsulfanyl-methyl-(1,3,2)dioxaborolane, 97%****2-Methoxy-4-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)phenol, 98%****N-4-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)-phenylmethane-sulfonamide, 97%****N-3-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)phenylmethane-sulfonamide, 97%****N-2-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)phenylmethane-sulfonamide, 97%****trans-2-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)styrene****2-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)phenyl acetate****3-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)phenyl acetate, 97%****4-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)phenyl acetate, 97%****Methyl 3-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)benzoate, 97%****Methyl 4-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)benzoate, 97%****4'-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)acetanilide, 97%****3'-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)acetanilide****2'-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)acetanilide****2,6-Dimethyl-4-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)phenol, 97%****2-(3,5-Dimethoxy)-phenyl-4,4,5,5-tetramethyl-(1,3,2)dioxaborolane, 97%****Ethyl 2-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)benzoate, 97%****Ethyl 3-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)benzoate, 97%****Ethyl 4-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl) benzoate****2-Methoxy-4-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)phenyl acetate, 97%****Methyl 3-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)-2-octenoate****N-(4-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)phenyl)succinamic acid, 97%****trans-1-Buten-1-yl-(4-tert-butyl-di-methylsilyloxy)-4',4',5',5'-tetramethyl-(1',3',2')-dioxaborolane, 95%****tert-Butyl-2-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)-phenylcarbonate, 97%**

Ready to scale up? For competitive quotes on larger quantities or custom synthesis, contact Sigma-Aldrich Fine Chemicals at 1-800-336-9719 (USA), or visit www.sigma-aldrich.com/safc.

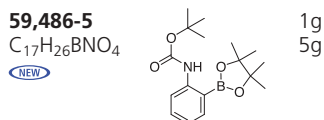
tert-Butyl 3-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)phenyl carbonate, 97%



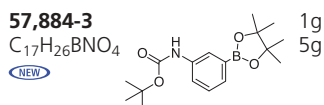
tert-Butyl 4-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)phenyl carbonate, 97%



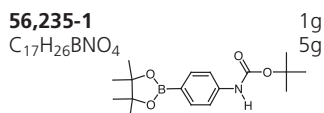
tert-Butyl-*N*-[2-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)phenyl]-carbamate, 97%



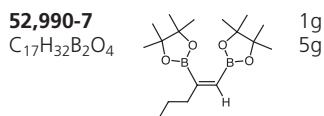
tert-Butyl-*N*-[3-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)phenyl]-carbamate, 97%



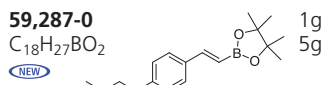
tert-Butyl-*N*-[4-(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)phenyl]-carbamate, 97%



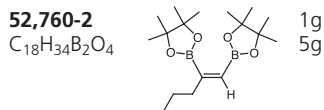
1-(*cis*-1,2-Bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl))pentene



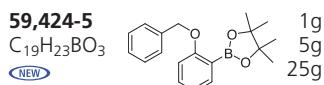
2-[2-(4-Butylphenyl)vinyl]-4,4,5,5-tetramethyl-1,3,2-dioxaborolane, 97%



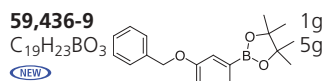
1-(*cis*-1,2-Bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl))hexene



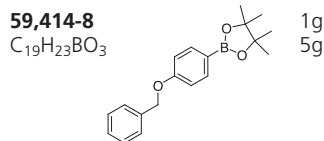
2-(2-Benzyloxyphenyl)-4,4,5,5-tetramethyl-1,3,2-dioxaborolane, 97%



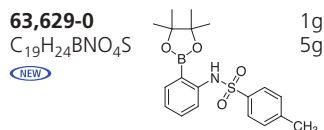
2-(3-Benzyloxyphenyl)-4,4,5,5-tetramethyl-1,3,2-dioxaborolane, 97%



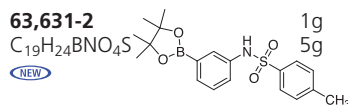
2-(4-Benzyloxyphenyl)-4,4,5,5-tetramethyl-1,3,2-dioxaborolane, 97%



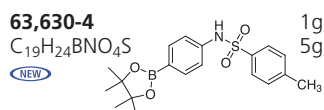
N-2-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)phenyltolylsulfonamide, 97%



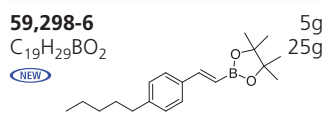
N-3-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)phenyltolylsulfonamide, 97%



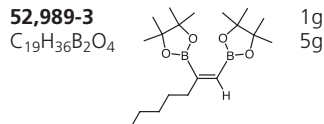
N-4-(4,4,5,5-Tetramethyl-1,3,2-dioxaborolan-2-yl)phenyltolylsulfonamide, 97%



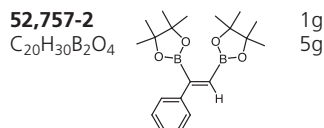
2-[2-(4-Pentylphenyl)vinyl]-4,4,5,5-tetramethyl-1,3,2-dioxaborolane, 95%



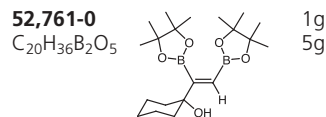
1-(*cis*-1,2-Bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl))heptene, 95%



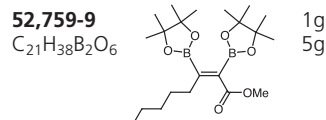
cis-1,2-Bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)styrene, 98%



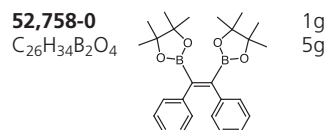
1-(*cis*-1,2-Bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl))vinylcyclohexan-1-ol



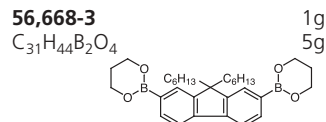
Methyl (*cis*-2,3-bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl))-2-octenoate



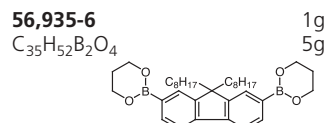
cis-1,2-Bis(4,4,5,5-tetramethyl-1,3,2-dioxaborolan-2-yl)stilbene, 96%



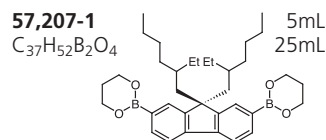
9,9-Dihexylfluorene-2,7-bis(trimethyleneborate), 97%



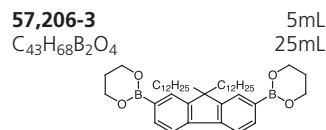
9,9-Dioctylfluorene-2,7-bis(trimethyleneborate), 97%



9,9-Di(2'-ethylhexyl)fluorene-2,7-bis(trimethylene borate) 0.5M solution in toluene



9,9-Didodecylfluorene-2,7-bis(trimethyleneborate) 0.5M solution in toluene

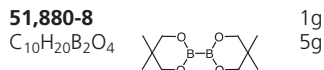


Diboron Esters

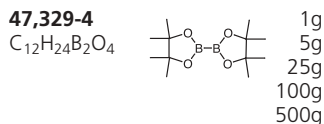
The following diboron esters are versatile reagents that couple with organic triflates and halides to give the corresponding boronic esters, which are used directly or readily converted to arylboronic acids. The subsequent Suzuki–Miyaura coupling reaction can be run under mild

conditions, thus permitting the use of cyano-, ester-, carbonyl-, and nitro-substituted aryl rings. The wide variety of arylboronic acids available via these diboron esters also makes this class of compounds suitable for solid-phase combinatorial studies.

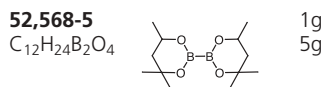
Bis(neopentylglycolato)diboron, 96%



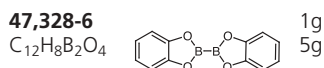
Bis(pinacolato)diboron, 98%



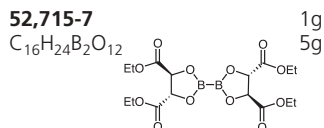
Bis(hexyleneglycolato)diboron, 96%



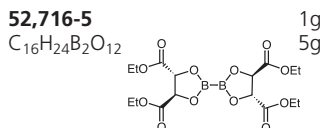
Bis(catecholato)diboron, 97%



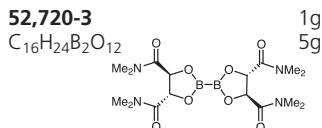
Bis(diethyl-D-tartrate glycolato)-diboron



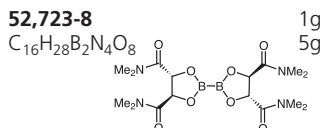
Bis(diethyl-L-tartrate glycolato)diboron, 90%



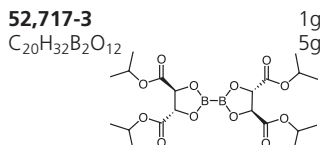
Bis(N,N,N',N'-tetramethyl-D-tartaramide glycolato)diboron



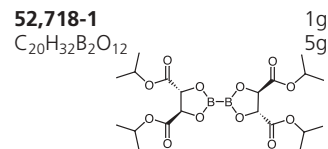
Bis(N,N,N',N'-tetramethyl-L-tartaramide glycolato)diboron



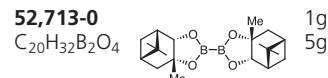
Bis(diisopropyl-D-tartrate glycolato)diboron, 97%



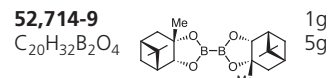
Bis(diisopropyl-L-tartrate glycolato)diboron, 97%



Bis(+)-pinanediolato)diboron, 98%



Bis(-)-pinanediolato)diboron, 98%



PROFESSOR SUZUKI'S contributions to organoborane chemistry involve the discovery and development of new synthetic methodologies using organoboron compounds. The formation of organic radicals from organoboranes in the presence of catalytic amounts of oxygen was first discovered in the course of cooperative work with Professor Brown's research group.



Akira Suzuki

Professor Suzuki was also instrumental in the utilization of organoboron compounds as carbanions in synthesis. Organoboranes are also useful as a source of carbocations under electrochemical conditions, although a limited number of examples have been reported. More recent work by Suzuki and coworkers revolves around palladium catalyzed cross-coupling reactions of various organoboron compounds with a number of organic electrophiles in the presence of bases. This reaction has become known as the Suzuki Coupling and is the focus of this book.

ORGANIC SYNTHESIS VIA BORANES VOLUME 3: SUZUKI COUPLING

Akira Suzuki & Herbert C. Brown
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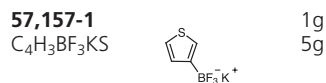
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Potassium Trifluoroborates

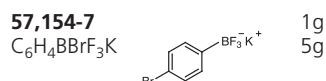
Alkyl, aryl, and alkenyl trifluoroborate salts are compelling alternatives to boronic acids in Suzuki–Miyaura coupling and in rhodium catalyzed carbon-carbon bond forming reactions. These salts are air and water stable, and in many cases eliminate the need to add either additional ligands or base for cross coupling.

Whereas the boronic acids readily form cyclic anhydrides, these new salts do not form unwanted side products. In many cases, the trifluoroborate salt is more efficient and tolerant to functional groups than the corresponding boronic acids.

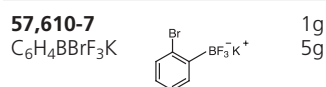
Potassium 3-thiophenetrifluoroborate



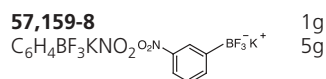
Potassium 4-bromophenyltrifluoroborate



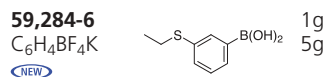
Potassium 2-bromophenyltrifluoroborate, 96%



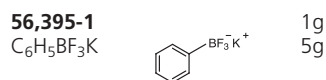
Potassium 3-nitrophenyltrifluoroborate



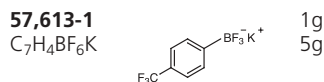
Potassium 4-fluorophenyltrifluoroborate, 95%



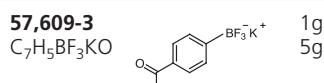
Potassium phenyltrifluoroborate, 95%



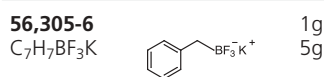
Potassium 4-(trifluoromethyl)phenyltrifluoroborate, 96%



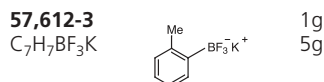
Potassium 4-formylphenyltrifluoroborate



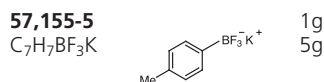
Potassium benzyltrifluoroborate, 95%



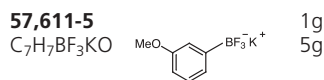
Potassium o-tolyltrifluoroborate



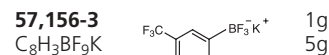
Potassium p-tolyltrifluoroborate



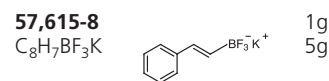
Potassium 3-methoxyphenyltrifluoroborate, 96%



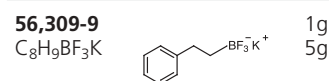
Potassium 3,5-bis(trifluoromethyl)phenyltrifluoroborate



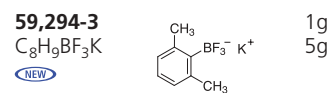
Potassium trans-styryltrifluoroborate



Potassium phenethyltrifluoroborate, 95%

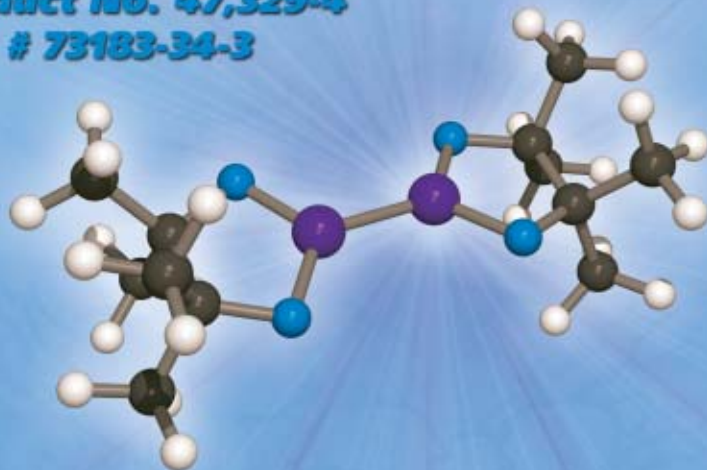


Potassium 2,6-dimethylphenyltrifluoroborate, 95%



Bis(pinacolato)diboron

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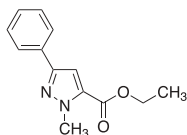
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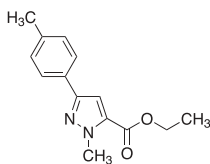
L20,136-7

C₁₃H₁₄N₂O₂
mw 230.27
250mg



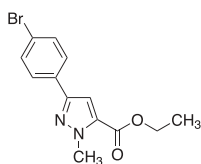
L20,137-5

C₁₄H₁₆N₂O₂
mw 244.30
250mg



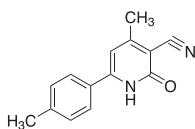
L20,138-3

C₁₃H₁₃BrN₂O₂
mw 309.16
250mg



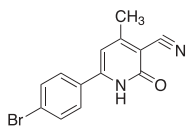
L23,277-7

C₁₄H₁₂N₂O
mw 224.26
250mg



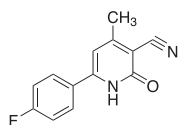
L23,279-3

C₁₃H₉BrN₂O
mw 289.13
250mg



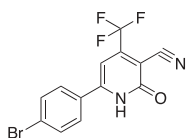
L23,280-7

C₁₃H₉FN₂O
mw 228.23
250mg



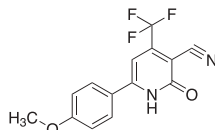
L23,285-8

C₁₃H₆BrF₃N₂O
mw 343.10
250mg



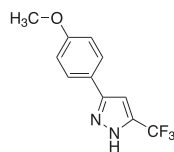
L23,287-4

C₁₄H₉F₃N₂O₂
mw 294.24
250mg



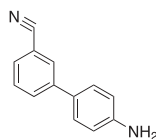
L23,306-4

C₁₁H₉F₃N₂O
mw 242.20
250mg



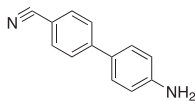
L30,068-3

C₁₃H₁₀N₂
mw 194.24
500mg



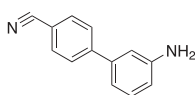
L30,069-1

C₁₃H₁₀N₂
mw 194.24
500mg



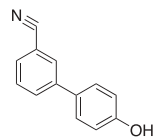
L30,070-5

C₁₃H₁₀N₂
mw 194.24
500mg



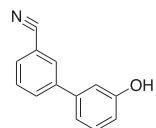
L30,071-3

C₁₃H₉NO
mw 195.22
500mg



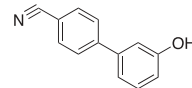
L30,072-1

C₁₃H₉NO
mw 195.22
500mg



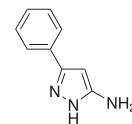
L30,074-8

C₁₃H₉NO
mw 195.22
500mg



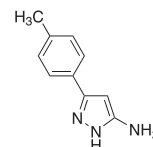
L31,783-7

C₉H₉N₃
mw 159.19
250mg



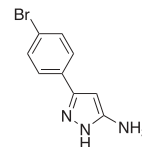
L31,784-5

C₁₀H₁₁N₃
mw 173.22
250mg



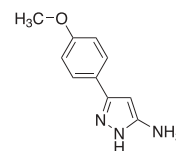
L31,786-1

C₉H₈BrN₃
mw 238.09
250mg



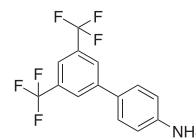
L31,788-8

C₁₀H₁₁N₃O
mw 189.22
250mg



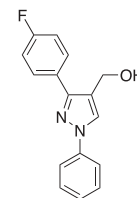
L44,655-6

C₁₄H₉F₆N
mw 305.22
250mg



L45,046-4

C₁₆H₁₃FN₂O
mw 268.29
250mg



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