

R. Smith

Reagents for Organic Synthesis

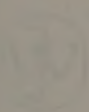
Fieser and Fieser's

Reagents for
Organic Synthesis

COLLECTIVE INDEX FOR VOLUMES 1-12

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PREFACE

This index was prepared in response to suggestions from various chemists for an easier access to the information in the published volumes of Reagents. It covers the material in Volumes 1-12. We have made an attempt to systematize the nomenclature, particularly of the organometallic compounds. Several new sections have been added. Surprisingly, this includes a comprehensive list of reagents, both those singled out as reagents previously, as well as those only cited in the text. For example, the carbenes are now indexed separately as individual reagents. The original "Index According to Type" has now been subdivided and expanded into three separate indices. There is a "Type of Compound" Index in which we have grouped together similar kinds of reagents, for example, Diels-Alder Dienes, Dienophiles, Ylides, and most especially, many of the organometallic compounds whose complex names often make them difficult to locate. Secondly, there is an Index by reaction type. Whereas in the original indices for volumes 1-12 all oxidizing agents were grouped together, they are now divided on the basis of the substrate oxidized as well as the product obtained. Finally, we have included an expanded Synthesis Index, based on both the product and starting material.

We are deeply indebted to Dr. Daniel C. Smith who singlehandedly indexed the over 50,000 author citations in this index. We realize that a cumulative listing of references of chemists with large research groups will be of only limited value. However, reference to a co-worker will provide easy access to specific papers. We have followed Chemical Abstracts' lead in deleting foreign accents, and in indexing the German ä, ö, and ü, as ae, oe, and ue respectively. In both the Type of Reaction and Synthesis Indices, the page numbers refer either to the page on which the citation for a "boldface" reagent begins, or to a page on which a reagent in the text is actually cited.

We want to extend thanks to Jerry Lotto, a member of E. J. Corey's computer group. His expertise was invaluable in both the purchase of our computer hardware and in the execution of the project. We also wish to thank Mr. Bill Farrington and the Department of Electronic Services at Mount Holyoke who were instrumental in maintaining the computer equipment needed to complete this index.

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SeR]**

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 Organocopper reagents, **10**, 282
 Oxalic acid, **1**, 764

Phenyl trimethylsilyl selenide, **9**, 373
 Phosphorus(V) sulfide, **9**, 374
 Piperidine, **1**, 886
 Potassium hydride, **12**, 407
 Sodium acetate, **1**, 1024
 Sodium benzeneselenoate, **9**, 432; **10**, 368
 Sodium thiophenoxide, **6**, 552
 Tetrabutylammonium fluoride, **7**, 353
 Tetrachlorosilane, **12**, 463
 Tetraethylammonium iodide, **12**, 465
 Thiolacetic acid, **1**, 1154
 Tributyltinlithium, **8**, 495; **12**, 523
 Triethyl orthoformate, **6**, 610
 Trimethylsilyllithium, **7**, 400
 Vinyltriphenylphosphonium bromide, **1**,
 1274

HYDROCYANATION
 Acetone cyanohydrin, **1**, **5**; **8**, 409
t-Butyl isocyanide, **11**, 99
 Crown ethers, **6**, 133
 Cyanotrimethylsilane–
 Triethylaluminum, **10**, 113
 Diethylaluminum cyanide–
 Chlorotrimethylsilane, **8**, 130
 Hydrogen cyanide, **1**, 1197, 1198; **5**, 689
 N-Methyl-2-pyrrolidone, **2**, 281
 Organoaluminum cyanides, **1**, 244; **2**,
 127; **4**, 146; **6**, 180; **9**, 158, 328
 Potassium cyanide–Acetone
 cyanohydrin, **8**, 409
 Triethylaluminum, **2**, 427; **4**, 526; **5**, 688

INTRAMOLECULAR REACTIONS
 Alkylaluminum halides, **12**, **5**
 Allyltrimethylsilane, **12**, 23
 Butyllithium, **12**, 96
 Cryptates, **12**, 404
 Dimethyl 1,3-acetonedicarboxylate, **9**,
 176
 Disodium tetracarbonylferrate, **8**, 216
 Ethyl vinyl ether, **11**, 235
 4-Iodobutyltrimethyltin, **10**, 219
 Iodotrimethylsilane, **11**, 271
 Mercury(II) acetate, **11**, 315
 Phenyl vinyl sulfone, **10**, 315
 Potassium carbonate, **8**, 408
 Sodium hydride, **12**, 447
 Tetrabutylammonium fluoride, **10**, 378
 Titanium(IV) chloride, **12**, 494

MICHAEL REACTIONS
 Allylidenetriphenylphosphorane, **6**, 14
 Aniline, **6**, 21

CONJUGATE ADDITION (*Continued*)

- Benzyltrimethylammonium hydroxide, 1, 1252
 Bis(methylthio)(trimethylsilyl)-methyl lithium, 6, 53
t-Butyl cyanoacetate, 1, 87
t-Butyllithium, 8, 70
 1-*t*-Butylthio-1-trimethylsilyloxy-ethylene, 9, 92
 Cesium fluoride, 10, 81; 11, 117; 12, 108
 Chromium carbonyl, 7, 71
 Crown ethers, 8, 128
 1-Cyclopropyl-1-trimethylsilyloxy-ethylene, 8, 140
 1,4-Diazabicyclo[2.2.2]octane, 11, 153
 1,5-Diazabicyclo[5.4.0]undecene-5, 11, 155
 Diethyl acetylmethylmalonate, 7, 102
 Diethyl lithiomorpholinomethylphosphonate, 7, 105
 Dimethyl 1,3-acetonedicarboxylate, 9, 176
 2-(2,6-Dimethylpiperidino)acetonitrile, 11, 212
 Dimethyl sulfoxide, 1, 296
 Dimethylsulfoxonium methylide, 4, 197
 Dimethyl(tetrahydro-2-oxo-3-furanyl)sulfonium tetrafluoroborate, 5, 262
o-Ethoxycarbonylbenzyl phenyl sulfoxide, 8, 75
 2-Ethoxycarbonyl-1,3-dithiolane, 5, 304
 Ethyl acrylate, 6, 251
 Ethyl diethoxyacetate, 6, 253
 Ethyl ethylthiomethyl sulfoxide, 5, 299
 Ethyl 2-methylsulfinylacetate, 6, 255
 Ethyl phenyl sulfoxide, 6, 257
 1-Ethylsulfinyl-3-pentanone, 9, 221
 Grignard reagents, 11, 245
 Hexamethylphosphoric triamide, 8, 240; 9, 235; 10, 196; 12, 239
 Ion-exchange resins, 1, 511
 Ketene alkyl trialkylsilyl acetals or ketals, 10, 261; 11, 279
 Ketene dimethyl thioacetal monoxide, 6, 311; 8, 268; 9, 261
 3-Lithiobenzothiazole, 8, 274
 Lithium 1,3-butadien-1-olate, 8, 291
 Lithium *N*-isopropylcyclohexylamide, 5, 411
 Lithium naphthalenide, 10, 247
 Lithium 2,2,6,6-tetramethylpiperidide, 9, 285
 Magnesium ethyl malonate, 8, 311
 Magnesium methoxide, 3, 189
 2-(2-Methoxy)allylidene-1,3-dithiane, 7, 226
 5-Methoxycarbonyl-1-penten-3-one, 1, 1271
 Methyl bis(ethylthio)acetate, 5, 444
 Methyl 2-bromocrotonate, 7, 235
 3-Methyl-1,3-butadienyl phenyl sulfoxide, 8, 333
 Methyl lithiodithioacetate, 11, 340
 Methyl α -(methyl diphenylsilyl)acetate, 12, 325
 Methyl 2-methylthioacrylate, 5, 455
 Methyl 4-methylthiocrotonate, 6, 389
 Methyl methylthiomethyl sulfoxide, 8, 344
 Methyl 3-oxo-4-pentenoate, 1, 1272
 Methyl phenylsulfinylacetate, 8, 347; 11, 343
 Methyl vinyl ketone, 1, 697; 5, 464; 7, 247; 12, 329
 Nickel(II) acetylacetonate, 10, 42
 1-Nitro-1-(phenylthio)propene, 10, 279
 2-Nitro-3-pivaloyloxypropene, 11, 360
 2-Nitropropene, 7, 253
 (2-Oxo-2-phenylethylidene)-dimethylselenonium ylide, 5, 257
 Ozone, 8, 374
 Phase-transfer catalysts, 9, 356
 3-Phenylsulfonyl-1(3H)-isobenzofuranone, 9, 368
 Phenylthiotrimethylsilylmethane, 11, 423
 Phenyl 2-(trimethylsilyl)ethynyl sulfone, 11, 426
 Phenyl vinyl sulfone(or sulfoxide), 6, 468; 10, 315
 Phthalide, 8, 402
 Piperidine, 1, 886; 7, 293
 Potassium fluoride, 1, 933; 6, 481; 12, 406
 Potassium permanganate, 11, 440
 β -Propiolactone, 1, 957
 Sodium cyanide, 4, 446; 5, 606; 6, 535
 Sodium dicarbonyl(cyclopentadienyl)ferrate, 6, 538
 Sodium ethoxide, 1, 1065
 (+)-(R)-*trans*- β -Styryl *p*-tolyl sulfoxide, 4, 466
 Tetra butylammonium fluoride, 9, 446; 11, 499

- 2,4,4,6-Tetramethyl-5,6-dihydro-1,3-(4H)-oxazine, **4**, 481
- 1,1,3,3-Tetramethylguanidine, **1**, 1145; **4**, 489; **12**, 477
- Titanium(IV) chloride, **6**, 590; **7**, 370; **10**, 401; **12**, 494
- Tributylphosphine, **5**, 685
- Tributyltin hydride, **11**, 545
- Trichloroisocyanuric acid, **6**, 605
- Triethylamine, **1**, 1198
- Triphenylphosphine, **12**, 550
- Tris(dimethylamino)sulfonium difluorotrimethylsilicate, **12**, 558
- Tris(methyl- or phenylthio)-methyl lithium, **6**, 650; **7**, 412; **9**, 511
- β -Vinylbutenolide, **6**, 661; **9**, 515; **11**, 594
- Zirconium(IV) propoxide, **11**, 605
- WITH ORGANOALUMINUM REAGENTS**
- Alkylaluminum halides, **4**, 144
- Diisobutylaluminum hydride, **5**, 224
- Nickel(II) acetylacetonate—
Diisobutylaluminum hydride, **8**, 42
- μ -Oxybis(chlorotriphenylbismuth), **11**, 381
- Trialkylaluminums, **5**, 734; **6**, 622
- WITH ORGANOBORON REAGENTS**
- Acrolein, **2**, 15; **3**, 5
- Acrylonitrile, **7**, 4
- B-1-Alkynyl-9-borabicyclo[3.3.1]-nonanes, **8**, 6
- 9-Borabicyclo[3.3.1]nonane, **7**, 29
- Bromine, **5**, 55
- 3-Butyn-2-one, **3**, 38
- Dimethyl(methylene)ammonium halides, **4**, 186
- Diphenylborane, **9**, 198
- Methyl vinyl ketone, **2**, 283
- Titanium(IV) chloride, **10**, 401
- WITH ORGANO COPPER REAGENTS**
- Benzeneselenenyl halides, **6**, 459
- trans*-1,2-Bis(tributylstannyl)ethylene, **5**, 43
- Boron trifluoride etherate, **10**, 52
- 2-(2-Bromoethyl)-1,3-dioxane, **11**, 78
- 2-(2-Bromoethyl)-1,3-dioxolane, **9**, 70
- 3-Bromopropyl 1-ethoxyethyl ether, **4**, 226
- 2-Bromo-3-trimethylsilyl-1-propene, **11**, 80
- 1-Butanethiol, **4**, 64
- 4-Chloro-1-butenyl-2-lithium, **12**, 113
- Copper(II) acetate, **1**, 159
- Copper(I) bromide, **1**, 165; **4**, 108; **8**, 116, 117
- Copper(I) chloride, **1**, 166; **2**, 91
- Copper(I) iodide, **2**, 92; **3**, 278; **4**, 516
- Copper(I) phenoxides, **5**, 148
- Dichlorobis(cyclopentadienyl)titanium, **6**, 48
- N,N-Dimethylformamide, **8**, 189
- N,N-Dimethylhydrazine, **7**, 126; **9**, 184
- 1-Ethoxy-1-trimethylsilyloxy-cyclopropane, **12**, 221
- (Z)-2-Ethoxyvinyl lithium, **8**, 221
- Formaldehyde, **6**, 264
- Grignard reagents, **8**, 235
- Hydrogen peroxide, **12**, 242
- Ketene dimethyl thioacetal monoxide, **9**, 261
- Lithium alkyl(*t*-butoxy)cuprates, **5**, 395
- Lithium alkyl(phenylthio)cuprates, **5**, 414; **7**, 212
- Lithium—Ammonia, **10**, 234
- Lithium bis(2-vinylcyclopropyl)cuprate, **7**, 199
- Lithium diallylcuprate, **5**, 175; **7**, 86
- Lithium dibutylcuprate, **6**, 163
- Lithium (1,1-diethoxy-2-propenyl)-(3,3-dimethyl-1-butyne)cuprate, **8**, 300
- Lithium di(α -methoxyvinyl)cuprate, **6**, 204
- Lithium dimethylcuprate, **2**, 151; **3**, 106; **4**, 177; **5**, 234; **6**, 209; **8**, 301
- Lithium di[(E)-1-propenyl]cuprate, **8**, 302
- Lithium dipropylcuprate, **5**, 283
- Lithium divinylcuprate, **4**, 219, 221
- Lithium methyl(vinyl)cuprate, **6**, 342
- Lithium α -ethoxycarbonylvinyl (1-hexynyl)cuprate, **6**, 329
- Lithium 2,2,6,6-tetramethylpiperidide, **6**, 345
- 3-Methoxy-3-methylbutynylcopper, **8**, 324
- Methylcopper, **2**, 282, 441; **6**, 377
- Organocopper reagents, **9**, 328; **10**, 282; **11**, 365; **12**, 345
- Organolithium reagents, **12**, 350
- Phenylthiocopper, **6**, 465
- 3-Tetrahydropyranyloxy-1-

CONJUGATE ADDITION (*Continued*)

- tributylstannyl-1-propene, **6**, 602
- Titanium(IV) chloride, **12**, 494
- 2,4,6-Triisopropylbenzene-sulfonylhydrazide, **10**, 422
- 3-Trimethylsilyl-3-buten-2-one, **5**, 461
- α -Trimethylsilyl-2-methylbenzothiazole, **8**, 511
- 1-Trimethylsilylpropynylcopper, **6**, 638
- Vinylcopper, **5**, 747

WITH ORGANOLITHIUM**REAGENTS**

- 2-Lithiobenzothiazole, **8**, 274
- 3-Lithio-1-triisopropylsilyl-1-propyne, **11**, 566
- 2-Lithio-2-trimethylsilyl-1,3-dithiane, **4**, 284

- Lithium acetylides, **11**, 288
- Methylolithium, **9**, 310; **12**, 324
- Methyl 2-trimethylsilylacrylate, **11**, 346
- Organolithium reagents, **9**, 5

WITH ORGANOMAGNESIUM**REAGENTS**

- Grignard reagents, **1**, 415; **9**, 229; **10**, 189
- Hexamethylphosphoric triamide, **5**, 323

WITH ORGANOSILANES

- Alkylaluminum halides, **12**, 5
- Allyltrimethylsilane, **12**, 23
- Cesium fluoride, **11**, 115
- 2-Hydroxymethyl-3-trimethylsilyl-1-propene, **11**, 258
- Organocopper reagents, **12**, 345
- Titanium(IV) chloride, **7**, 370; **11**, 529; **12**, 494
- Trimethylsilyllallene, **10**, 428
- 3-Trimethylsilyl-1-cyclopentene, **8**, 509

WITH ORGANOTIN REAGENTS

- Allyltrimethyltin, **11**, 20
- Bis(diethylaluminum) sulfate, **9**, 46

WITH YLIDES

- Allylidenetriphenylphosphorane, **5**, 7
- 2-Butenyldenetriphenylphosphorane, **5**, 69
- Isopropylidenetriphenylphosphorane, **5**, 361

CONJUGATE REDUCTION (*see* REDUCTION REACTIONS)**COPE ELIMINATION** (*see* ELIMINATION REACTIONS)**COPE REARRANGEMENT** (*see* SIGMATROPIC**REARRANGEMENTS)****COREY-KIM OXIDATION**

- N-Chlorosuccinimide-Dimethyl sulfide, **4**, 87
- Dimethyl sulfoxide-Oxalyl chloride, **8**, 200
- Formaldehyde, **7**, 158
- Phenylselenoacetaldehyde, **9**, 365
- Thioanisole, **6**, 582

COREY-WINTER REACTION (*see* ELIMINATION REACTIONS)**COUPLING REACTIONS** (*see also* ASYMMETRIC REACTIONS, OXIDATIVE AND REDUCTIVE COUPLING)**HOMOCOUPLING, ALKYL GROUPS**

- Chromium(II) chloride, **11**, 132
- Chromium(III) chloride-Lithium aluminum hydride, **8**, 110
- Chromium(II) sulfate, **1**, 150
- Copper, **12**, 140
- Copper(II) acetylacetonate, **2**, 81
- Copper(I) iodide-Tributylphosphine, **2**, 400
- Copper(0)-Isonitrile complexes, **9**, 122
- Dicyclopentadienyltitanium methylene-Zinc iodide, **12**, 506
- Diffuoramine, **1**, 253
- Dilithium tetrachlorocuprate, **4**, 163
- N,N-Dimethylformamide, **1**, 278
- Ferric chloride, **9**, 222
- Hydrogen peroxide-Salt and oxide catalysts, **1**, 472
- Lead, **2**, 233
- Lithium aluminum hydride, **9**, 274
- Lithium dibutylcuprate, **3**, 79
- Magnesium, **4**, 315
- Samarium(II) iodide, **10**, 344
- Silver(I) nitrate, **2**, 366; **4**, 429
- Sodium naphthalenide, **1**, 711
- Tetraphenylethylene, **2**, 404
- Thallium(I) bromide, **2**, 405
- Titanium(III) chloride, **2**, 415
- Titanium(IV) chloride, **1**, 1169
- Titanium(III) chloride-Lithium aluminum hydride, **6**, 588; **7**, 369; **10**, 401
- Tungsten carbonyl, **8**, 525
- Vanadium(II) chloride tetrapyridine complex, **5**, 744

HOMOCOUPPLING, ALKYNYL GROUPS

- n*-Butylamine, 1, 84
- Copper(II) acetate, 1, 159; 4, 105; 6, 138
- Copper(I) chloride, 1, 166; 4, 109
- Copper(I) chloride + co-reagent, 1, 165; 5, 165
- Copper(I) cyanide, 6, 146
- Hydroxylamine, 1, 478
- Thionyl chloride, 5, 663

HOMOCOUPPLING, ALLYL GROUPS

- Allylmagnesium chloride, 1, 420
- Chlorotris(triphenylphosphine)cobalt, 12, 128
- Chromium(II) chloride, 11, 132
- Chromium(III) chloride-Lithium aluminum hydride, 8, 110
- Copper(0)-Isonitrile complexes, 9, 122
- Crotyl chloride, 2, 290
- Iron, 3, 167
- Lithium bis(alkylamino)cuprates, 6, 327
- Magnesium, 4, 315
- Nickel carbonyl, 1, 720; 2, 290; 3, 210
- Palladium(II) chloride, 10, 300; 12, 371
- Samarium(II) iodide, 10, 344
- Titanium(III) chloride, 2, 415
- Titanium(III) chloride-Lithium aluminum hydride, 6, 588; 7, 369; 10, 401
- Tris(triphenylphosphine)nickel(0), 6, 653

HOMOCOUPPLING, ARYL GROUPS

- Antimony(III) chloride, 8, 19
- Bis(1,5-cyclooctadiene)nickel(0), 4, 33; 11, 51
- trans*-Bromobis(triethylphosphine)-*o*-tolynickel(II), 10, 58
- Cerium(IV) trifluoroacetate, 5, 102
- Chromium(VI) oxide, 2, 72
- Copper, 1, 157; 5, 146; 7, 73; 9, 122
- Copper(II)-Amine complexes, 8, 114
- Copper bronze, 1, 155; 4, 100
- Copper(II) chloride, 2, 84
- Copper(I) iodide-Triethyl phosphite, 8, 122
- Copper(I) trifluoromethanesulfonate, 6, 130
- 1,4-Dichloro-2-butene, 10, 134
- Diethyltrimethylsilylamine, 6, 184
- N,N-Dimethylformamide, 1, 278
- Ferric chloride, 10, 185
- Magnesium, 7, 218

Nickel, 12, 335

Nickel(II) bromide-Zinc, 9, 322

Nickel catalysts, 1, 723

Palladium(II) acetate, 6, 442; 10, 297

Periodic acid, 2, 313

Potassium-Graphite, 7, 296

Pyridine-Aluminum chloride, 2, 351

Tellurium(IV) chloride, 5, 643

Tetracarbonyldi- μ -chlorodirhodium, 8, 469

Tetramethylurea, 1, 1146

Thallium(I) bromide, 2, 405; 3, 286; 5, 655; 7, 361

Thallium(III) trifluoroacetate, 8, 478; 10, 397

Thallium(III) trifluoroacetate-

Palladium(II) acetate, 11, 516; 12, 484

Tris(*p*-bromophenyl)ammoniumyl hexachloroantimonate, 5, 735

Tris(triphenylphosphine)nickel(0), 6, 653; 8, 523

Vanadium(IV) chloride, 3, 332

Vanadyl trifluoride, 8, 528

HOMOCOUPPLING, PROPARGYL GROUPS

Copper(I) chloride, 6, 145

HOMOCOUPPLING, VINYL GROUPS

Bis(1,5-cyclooctadiene)nickel(0), 4, 33

Chlorobis(cyclopentadienyl)-hydridozeirconium(IV), 8, 84

Copper, 4, 102

Copper(I) bromide-Dimethyl sulfide, 10, 104

Copper(I) chloride, 2, 91

Copper(I) trifluoromethanesulfonate, 6, 130

Diisobutylaluminum hydride, 4, 158

Manganese(II) chloride, 7, 222

Methylcopper, 6, 377

(*R*)-4-Methylcyclohexylidene-methylcopper, 7, 238

Monochloroborane diethyl etherate, 5, 465

Nickel(II) chloride, 12, 336

Organopentafluorosilicates, 11, 373

Palladium(II) acetate, 2, 303

Palladium(II) chloride, 8, 384

Tetracarbonyldi- μ -chlorodirhodium, 8, 469

Tetrakis(triphenylphosphine)-palladium(0), 6, 571

COUPLING REACTIONS (*Continued*)

Thionyl chloride, 5, 663

Tris(triphenylphosphine)nickel(0), 6, 653

Vinylcopper reagents, 6, 662

CROSS-COUPLING, TWO ALKYL GROUPS

Butyllithium, 6, 85

N-Chlorosuccinimide-Triethylamine, 6, 120

Copper(I) methyltrialkylborates, 7, 75

Dichlorodimethyltitanium, 10, 138

Diethyl sulfate, 1, 253

Dilithium tetrachlorocuprate(II), 4, 163; 5, 226; 6, 203; 7, 114

1,1-Diphenylhexyllithium, 5, 277

Grignard reagents, 1, 415

2,3-O-Isopropylidene-2,3-dihydroxy-1,4-bis(diphenylphosphine)butane, 5, 360

Lithium alkyl(*t*-butoxy)cuprates, 5, 395

Lithium alkyl(phenylthio)cuprates, 5, 414

Lithium dibutylcuprate, 7, 92; 8, 291

Lithium diisopropylamide, 3, 184

Lithium dimethylcuprate, 2, 151; 3, 106; 4, 177; 5, 234; 8, 301

Lithium trimethylferrate and related reagents, 3, 112, 312

3-Methoxy-3-methylbutynylcopper, 8, 324

Methyl fluoride-Antimony(V) fluoride, 3, 201

Methylolithium, 5, 448

Organocopper reagents, 11, 365; 12, 345

Sodium bis(2-methoxyethoxy)aluminum hydride, 4, 441; 6, 528

Sodium methoxide, 1, 1091

N,N,N',N'-Tetramethylethylenediamine, 5, 652

Trimethylaluminum, 5, 707; 6, 622

CROSS-COUPLING, TWO ALKYNYL GROUPS

Copper(I) chloride-Ammonium chloride, 1, 165

Dicyclohexylmethylthioborane, 7, 101

3,3-Diethoxy-1-propyne, 2, 126

Iodine, 7, 179

Lithium aluminum hydride, 5, 382

Palladium catalysts, 7, 275

CROSS-COUPLING, TWO ALLYL GROUPS

Allyl phenyl ether, 11, 14

Allyltrimethylsilane, 11, 16

Benzylchlorobis(triphenylphosphine)-palladium(II), 10, 26

1-Bromo-3-methyl-2-butene, 5, 84

B-Butyl-9-borabicyclo[3.3.1]nonane, 9, 76

Copper, 9, 122

Copper(I) bromide-Dimethyl sulfide, 10, 104

Copper(I) iodide, 8, 121

1-Cyclobutenylmethylolithium, 6, 151

Hexamethylphosphoric triamide, 3, 149

Lithium-Alkylamines, 5, 377

Nickel(II) acetylacetonate-

Trimethylaluminum, 9, 52

Palladium(II) chloride, 12, 371

Tetrakis(triphenylphosphine)-palladium(0), 10, 384

N,N,N',N'-Tetramethylethylenediamine, 4, 485

p-Toluenesulfonyl chloride-Lithium chloride, 3, 293

Zinc chloride, 12, 574

CROSS-COUPLING, TWO ARYL GROUPS(1*S*,2*S*)-2-Amino-3-methoxy-1-phenyl-1-propanol, 12, 310, 381

Bis(1,5-cyclooctadiene)nickel(0), 11, 51

Bis-3,4-dichlorobenzoyl peroxide, 3, 21

[1,3-Bis(diphenylphosphine)propane]-(dichloro)nickel(II), 11, 167

t-Butyl thionitrate, 9, 91

Cobalt(II) chloride, 1, 155

Copper, 8, 113

Copper(I) alkoxides, 9, 122

Copper(I) iodide-Triethyl phosphite, 8, 122

Crown ethers, 8, 128

Dichlorobis(triphenylphosphine)-nickel(II), 6, 59; 9, 147

1,3-Dichloro-2-butene, 10, 134

Diethyltrimethylsilylamine, 6, 184

Dinitrogen trioxide-Boron trifluoride, 1, 329

Diphenyl selenoxide, 9, 201

Grignard reagents-Nickel(II) reagents, 7, 250

Isoamyl nitrite, 1, 40

Methanesulfonyl chloride, 6, 362

2-(*o*-Methoxyphenyl)-4,4-dimethyl-2-oxazoline, 6, 368

- Nickel(II) acetylacetonate, **11**, 58
 Pentafluorophenylcopper, **5**, 504
 Phase-transfer catalysts, **9**, 356; **12**, 379
 Phenylsodium, **1**, 848
 Potassium *t*-butoxide, **5**, 544
 Tetrakis(triphenylphosphine)nickel(0), **9**, 450
 Tetrakis(triphenylphosphine)-palladium(0), **8**, 472; **11**, 503
 Tetraphenylbismuth trifluoroacetate, **11**, 515
 Thallium(III) trifluoroacetate, **3**, 286; **12**, 481
p-Toluenesulfonic acid, **1**, 1172
 Vanadyl trifluoride, **6**, 660; **7**, 418; **9**, 513
- CROSS-COUPLING, TWO VINYL GROUPS**
 B-1-Alkenyl-9-borabicyclo[3.3.1]-nonanes, **12**, 5
 Benzylchlorobis(triphenylphosphine)-palladium(II), **12**, 44
 Bis(acetonitrile)dichloropalladium(II), **11**, 46
 Chlorobis(cyclopentadienyl)-hydrido­zirconium(IV), **8**, 84
 Copper(I) iodide-Tributylphosphine, **2**, 400
 Diacetatobis(triphenylphosphine)-palladium(II), **6**, 156
 Dichlorobis(triphenylphosphine)-palladium(II)-Diisobutylaluminum hydride, **7**, 95
 1,2-Dichloroethylene, **12**, 175
 Dihalobis(triphenylphosphine)-palladium(II), **6**, 60
 Grignard reagents, **10**, 189
 Nickel(II) acetylacetonate-Trimethylaluminum, **9**, 52
 Organocopper reagents, **10**, 282
 Palladium(II) acetate, **12**, 367
 Palladium catalysts, **10**, 297; **11**, 392
 Palladium(II) chloride, **8**, 384
 Tetrakis(triphenylphosphine)-palladium(0), **8**, 472; **9**, 451; **12**, 468
 Thexylborane, **5**, 232
 Trimethylaluminum, **8**, 506
 Zinc chloride, **12**, 574
- CROSS-COUPLING, ALKYL + ALKYNYL GROUPS**
 Acetylene, **1**, 11
 2-Chloro-1,1-diethoxyethane, **5**, 107
 Diiodo(methyl)bis(triphenylphosphine)-rhodium, **10**, 149
 Hexamethylphosphoric triamide, **2**, 208; **4**, 244
 Iodine, **5**, 346; **6**, 293; **8**, 256
 Lithium acetylde-Ethylenediamine, **1**, 574; **5**, 382
 Lithium amide, **9**, 278
 Methanesulfinyl chloride, **5**, 434
 Organocopper reagents, **9**, 328
 Organolithium reagents, **9**, 5
 Sodium amide, **1**, 1034; **5**, 591
 Sodium methylsulfinylmethyllide, **2**, 166
 Trialkynylalanes, **6**, 600
- CROSS-COUPLING, ALKYL + ALLYL GROUPS (see also SYNTHESIS INDEX-ALKENES)**
 Alkylcopper + co-reagent, **8**, 334; **9**, 333; **10**, 282, 286
 Allyl phenyl ether, **11**, 14
 Allyltributyltin, **11**, 15
 Allyltrimethylsilane, **11**, 16
 [1,2-Bis(diphenylphosphine)ethane]-(dichloro)nickel(II), **10**, 36
 [1,1'-Bis(diphenylphosphine)ferrocene]-(dichloro)palladium(II), **12**, 171
 Boron trifluoride etherate, **12**, 66
 Butyllithium-Tetramethylethylenediamine, **5**, 80
 α -Chloroallyllithium, **10**, 87
 1-Chloro-2-methyl-N,N-tetramethylenepropenylamine, **12**, 124
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Formaldehyde, 9, 224

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Sodium amide, 8, 446

Triethyloxonium tetrafluoroborate, 1,
1210**DEACYLOXYLATION (see REDUCTION****REACTIONS)****DEALKOXYCARBONYLATION**

Alumina, 7, 5

Birch reduction, 4, 31

Boric acid, 5, 48; 9, 59

t-Butyl acetoacetate, 1, 83

Chlorosulfuric acid, 2, 70

Chlorotrimethylsilane, 4, 537

Crown ethers, 8, 128

1,5-Diazabicyclo[4.3.0]nonene-5, 4, 116

1,4-Diazabicyclo[2.2.2]octane, 5, 176; 7,
861,8-Diazabicyclo[5.4.0]undecene-7, 4,
119

Dibenzyl malonate, 1, 198

Di-*t*-butyl malonate, 1, 210

Dimethyl sulfoxide, 5, 263

Hexamethylphosphoric triamide, 5, 323

Hydrochloric acid, 6, 283

Iodotrimethylsilane, 8, 261; 9, 251

Ion-exchange resins, 1, 511

Isobutene, 1, 522

Lithium halides, 1, 617; 7, 200; 9, 283;
10, 240; 11, 300; 12, 282

Magnesium, 1, 627

Magnesium chloride, 10, 251

Palladium(II) acetate-1,2-Bis(diphenyl-
phosphine)ethane, 11, 391

Palladium(II) chloride, 6, 447

Piperidine, 6, 472

Propionic acid, 12, 415

Quinoline-Acetic acid, 6, 501

Sodium chloride, 4, 445; 9, 422

Sodium cyanide, 2, 381; 4, 447; 6, 536

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Dichlorobis(cyclopentadienyl)titanium,
6, 179

Iodotrimethylsilane, 9, 251

Lithium-Alkylamines, 1, 574

Lithium aluminum hydride, 5, 382

Lithium aluminum hydride-Aluminum
chloride, 4, 293

Lithium triethylborohydride, 11, 304

Sodium-Potassium alloy, 1, 1102

Titanium(III) chloride, 10, 400

Titanium(IV) chloride-Lithium
aluminum hydride, 7, 372

Zinc, 4, 574

DEALKYLATION (*see also*
DEMETHYLATION)

ArR, R-R' $\rightarrow$ ArH, RH

Nickel-Alumina, 9, 321

Trifluoroacetic acid, 5, 695

ArOR $\rightarrow$ ArOH

Aluminum bromide, 1, 22

Aluminum iodide, 12, 30

Borane-Tetrahydrofuran, 1, 199

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Boron trifluoride-Ethanethiol, 9, 63

5-Chloro-1-phenyltetrazole, 7, 64

(Diphenylphosphine)lithium, 1, 345

Hexamethylphosphoric triamide, 7, 168

Iodotrimethylsilane, 8, 261

Lead tetraacetate, 9, 265

Lithium-Ethylenediamine, 2, 250

Lithium iodide, 4, 304

Phase-transfer catalysts, 9, 356

Phosphorus(V) chloride, 1, 866

Selenium(IV) oxide, 3, 245

Sodium bis(2-methoxyethoxy)aluminum
hydride, 7, 327

Sodium-Potassium alloy, 1, 1102

Triethyloxonium tetrafluoroborate, 7,
386

ROR' $\rightarrow$ ROH

Acetic anhydride-Ferric chloride, 6, 260

Borane-Tetrahydrofuran, 1, 199

Boron tribromide, 1, 66

Boron trifluoride-Ethanethiol, 9, 63

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Diethyl azodicarboxylate, 5, 212

Hydrogen bromide, 1, 453

Iodotrimethylsilane, 8, 261

Lithium bromide-Boron trifluoride
etherate, 1, 604

Phenylthiotrimethylsilane, 10, 426

Selenium(IV) oxide, 3, 245

Sodium borohydride, 2, 377

Sodium thiophenoxide, 3, 268

Trichloro(methyl)silane, 11, 553

Trimethylammonium formate, 1, 1231

Uranium(VI) fluoride, 7, 417

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trifluoromethanesulfonate, 12, 86

α -Chloroethyl chloroformate, 12, 112

1,4-Diazabicyclo[2.2.2]octane, 4, 119

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Manganese(III) acetate, 6, 355

2-Nitroprop-2-yl hydroperoxide, 3, 213

Phenyl chloroformate, 2, 318

Pyridinium chloride, 1, 964; 3, 239

Triphenylphosphine, 6, 643

Vinyl chloroformate, 8, 530

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DEDIAZOTIZATION,

ELIMINATION REACTIONS,

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Amyl nitrite, 5, 18

Arenediazonium salts, 1, 42, 43

Diffluoramine, 1, 253

Hexamethylphosphoric triamide, 5, 323

Hydroquinone, 5, 341

Hydroxylamine-O-sulfonic acid, 1, 481

Hypophosphorous acid, 1, 489; 8, 255

Nickel-Alumina, 9, 321

Nitrogen dioxide, 8, 361

Sodium borohydride, 6, 530, 531

Sodium cyanoborohydride, 9, 424

Sodium nitrite, 11, 491

Tetramethylurea, 1, 1146

2,4,6-Triphenylpyrylium perchlorate, 7,
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Triphenyltin hydride, 1, 1250

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REACTIONS-BENZYL ETHERS)

Aluminum chloride, 4, 10

Lithium 1-propanethiolate, 6, 496

Oxygen, 12, 362

Phosphoric acid, 7, 255

Sodium thiophenoxide, 3, 268

Sulfuryl chloride, 1, 1128

2,2-Trichloroethyl chloroformate, 5,
686

DEBROMINATION (*see* **ELIMINATION**
REACTIONS, REDUCTION
REACTIONS)

DECARBOALKOXYLATION (*see*
DEALKOXYCARBONYLATION)

DECARBONYLATION (*see also*
ELIMINATION REACTIONS)

OF RCOCl $\rightarrow$ RCl

Carbonylchlorobis(triphenylphosphine)-
rhodium(I), 2, 67

Chlorotris(triphenylphosphine)-
rhodium(I), 1, 140; 2, 448

Palladium catalysts, 11, 392

3-Pyridinethiol-1-oxide, 12, 417

DECARBONYLATION (*Continued*)**OF RCHO $\rightarrow$ RH**

Bis[1,3-bis(diphenylphosphine)propane]-chlororhodium(I), 12, 111

Chlorotris(methyldiphenylphosphine)-rhodium(I), 7, 67

Chlorotris(triphenylphosphine)-rhodium(I), 1, 140, 1252; 2, 448; 3, 325; 4, 559; 8, 109

Lithium dimethylcuprate, 6, 209

Nickel-Alumina, 9, 321

Palladium catalysts, 1, 778

OF RCOOH $\rightarrow$ ROH*m*-Chloroperbenzoic acid, 1, 135**DECARBOXYLATION**

Alumina, 7, 5

Aniline, 6, 21

Benzoic anhydride, 1, 49

Bis[1,3-bis(diphenylphosphine)propane]-chlororhodium(I), 12, 111

N-Bromosuccinimide, 1, 78*t*-Butyl hydroperoxide, 1, 88; 2, 49; 6, 81

Copper, 1, 157; 2, 82; 3, 63; 5, 146

Copper carbonate, basic, 1, 163

Copper chromite, 1, 156

Copper salts, 1, 158

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Dibenzo-18-crown-6, 6, 159

Dicyclohexylcarbodiimide, 3, 91

Dimethylacetamide, 1, 270

N,N-Dimethylaniline, 1, 274

2,4-Dimethylpyridine, 6, 224

Dimethyl sulfoxide, 2, 157

Ferrous perchlorate, 6, 260

Iodosylbenzene, 10, 213

Lithium nitride, 1, 618

Lithium phenylethynolate, 6, 343

Mercury(II) oxide, 7, 224

Morpholine, 11, 352

Nitric acid, 1, 733; 4, 356

Osmium tetroxide-*t*-Butyl hydroperoxide, 1, 88

3,3,6,9,9-Pentamethyl-2,10-diazabicyclo-[4.4.0]decene, 9, 354

Phosphoryl chloride, 5, 535; 7, 292; 9, 374

Potassium fluoride, 1, 933

Potassium permanganate, 1, 942

Potassium persulfate, 3, 238

2-Pyridinethiol-1-oxide, 12, 417

Quinoline, 1, 975

Sodium chloride, 6, 534

Tributyltin hydride, 10, 411

DECARBOXYLATIVE BROMINATION

(see HUNSDIECKER REACTION)

DECARBOXYLATIVE DEHYDRATION

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DECARBOXYLATIVE DIMERIZATION

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DECHLOROCARBONYLATION*m*-Chloroperbenzoic acid, 5, 120

Zinc chloride, 3, 338

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DECYANATION α -Chloro-*N*-cyclohexylpropanal-donitrone, 4, 80

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Iron(III) acetylacetonate, 4, 268

Nickel-Alumina, 9, 321

Potassium, 4, 245; 5, 543; 10, 322

Sodium-Ammonia, 7, 324

Sodium hydroxide, 5, 616

Sodium naphthalenide, 4, 349

Zinc, 4, 574

DEDIAZOTIZATION

Amyl nitrite, 5, 18

Arenediazonium salts, 1, 42, 43

Chlorotris(triphenylphosphine)-rhodium(I), 4, 559

Hexamethylphosphoric triamide, 5, 323

Hypophosphorous acid, 1, 489; 8, 255

Sodium borohydride, 1, 1049

Tetramethylurea, 1, 1146

Thiophenol, 9, 465

Tributyltin hydride, 3, 294

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DEFORMYLATION (see

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DEHALOGENATION (see ELIMINATION

REACTIONS, REDUCTION

REACTIONS)

DEHYDRATION, DEHYDRATIVE

DECARBOXYLATION,

DEHYDROAMINATION,

DEHYDROCYANATION (see

ELIMINATION REACTIONS)

DEHYDROGENATION (*see also*

AROMATIZATION,
CYCLODEHYDROGENATION)

OF ALKANES → ALKENES

Benzeneseleninic anhydride, 11, 37

1,4-Benzoquinone, 1, 49

Bis(benzonitrile)dichloropalladium(II),
11, 48

t-Butyl hypochlorite, 6, 82

Butyllithium–Tetramethylethy-
lenediamine, 5, 80; 8, 67

Chloranil, 1, 125; 2, 66

Copper(II) acetate, 12, 140

Diborane–Lithium borohydride, 2, 108

2,3-Dichloro-5,6-dicyano-1,4-
benzoquinone, 2, 112; 3, 83; 4, 130; 6,
168; 7, 96; 8, 153

N,N-Dichlorourethane, 8, 161

Diphenylpicrylhydrazyl, 1, 347

Mercury(II) acetate, 1, 644

Phenyl iodine(III) dichloride, 4, 264; 5,
352; 6, 298; 10, 215

Potassium superoxide, 11, 442

Selenium(IV) oxide, 1, 992

Sulfur, 6, 556

Thionyl chloride, 1, 1158

Triphenylcarbenium tetrafluoroborate,
2, 454; 6, 657

OF KETONES, ENONES, ETC. →

ENONES, DIENONES, ETC.

Acetic anhydride, 5, 3

Allyl chloroformate, 12, 15

Benzeneselenenyl halides, 11, 34

Benzeneseleninic anhydride, 8, 29; 11, 37

Bis(acetonitrile)dichloropalladium(II),
12, 50

Chloranil, 1, 125

2,3-Dichloro-5,6-dicyano-1,4-
benzoquinone, 1, 215; 2, 112; 3, 83; 4,
130; 5, 193; 8, 153; 10, 135

Dichloroketene, 12, 176

Dimethyl sulfoxide–Iodine, 9, 190

Iodine–Potassium *t*-butoxide, 5, 349

Iodylbenzene, 11, 275

Lithium tri-*sec*-butylborohydride, 10,
248

Methyl vinyl ketone, 7, 247

Palladium(II) acetate, 11, 391; 12, 367

Palladium(II) chloride, 5, 500; 8, 384

Potassium nitrosodisulfonate, 3, 238

Pyridine, 2, 349

Pyridine N-oxide, 9, 396

Pyridinium bromide perbromide, 1, 967

Selenium(IV) oxide, 1, 992

Sulfur, 3, 273; 5, 632

Thallium(III) acetate, 7, 360

p-Toluenesulfinyl chloride, 12, 507

DEHYDROHALOGENATION,

DEHYDROMETALLATION

DEHYDROSULFONYLATION (*see*
ELIMINATION REACTIONS)

DEHYDROXYLATION (*see*

DEOXYGENATION)

DEIODINATION (*see* ELIMINATION

REACTIONS, REDUCTION
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Hexamethylenetetramine, 1, 427

DEMETHYLATION (*see also*

DEALKYLATION)

ROCH₃ → ROH

Acetic anhydride–Boron trifluoride
etherate, 1, 72

Aluminum chloride–Sodium iodide, 12,
29

Boron tribromide, 11, 71

Boron trichloride, 1, 67

Boron trifluoride–Ethanethiol, 7, 33; 9,
63

Boron trifluoride etherate, 11, 72

Bromodimethylborane, 12, 199

Chlorotrimethylsilane–Sodium iodide,
10, 97

Chromium(VI) oxide, 2, 72

Phenylthiotrimethylsilane, 10, 426

Pyridinium chloride, 4, 415

Quinuclidine, 4, 417

2,4,4,6-Tetrabromo-2,5-
cyclohexadienone, 11, 498

Trichloro(methyl)silane, 11, 553

ArOCH₃ → ArOH

Aluminum bromide, 1, 22

Aluminum chloride, 1, 24; 3, 7; 4, 10

Boron tribromide, 1, 66; 2, 33; 3, 30; 10,
50

Boron trichloride, 2, 34; 4, 42; 12, 65

Boron trifluoride etherate, 7, 33; 12, 66

Boron triiodide, 9, 65

Bromodimethylborane, 12, 199

Chlorotrimethylsilane–Acetic anhydride,
12, 126

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- Copper(II) chloride, 6, 139
- Diisobutylaluminum hydride, 6, 198
- (Diphenylphosphine)lithium, 1, 345; 5, 408; 8, 302
- Hydriodic acid, 1, 449
- Hydriodic acid–Red phosphorus, 1, 864
- Hydrobromic acid, 1, 450; 4, 249
- Hydrochloric acid, 4, 250
- Iodotrimethylsilane, 9, 251
- Lithium iodide, 11, 300
- Lithium methanethiolate, 8, 303
- Lithium 2-methylpropane-2-thiolate, 7, 210
- Magnesium iodide etherate, 12, 290
- Methylmagnesium iodide, 1, 689; 2, 278; 3, 204
- Pyridinium chloride, 1, 964; 2, 352; 6, 497
- Sodium–Ammonia, 2, 27
- Sodium cyanide, 9, 423
- Sodium ethanethiolate, 3, 115; 4, 465
- Sodium iodide, 1, 1087; 2, 384
- Sodium methaneselenoate, 12, 450
- Sodium N-methylanilide, 10, 367
- Sodium nitrite, 7, 169
- Sodium 2-propanethiolate, 11, 473
- Sodium *p*-thiocresolate, 7, 342
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N COMPOUNDS

- Alkyl chloroformates, 5, 117
- N,N-Dimethylformamide, 4, 184; 7, 124
- Lithium alkanethiolates, 5, 412, 415
- Lithium tri-*sec*-butylborohydride, 10, 248
- Lithium triethylborohydride, 6, 348
- Phenylcarbonimidic dichloride, 6, 458
- Potassium ferricyanide, 1, 929
- Silver nitrite, 6, 515
- Sodium thiophenoxide, 1, 1106
- 2,2,2-Trichloroethyl chloroformate, 5, 686; 7, 383

DENITRATION (*see also* REDUCTION REACTIONS)

- 1-Benzyl-1,4-dihydronicotinamide, 12, 47
- Lithium aluminum hydride, 12, 272
- Sodium borohydride, 5, 597
- Tributyltin hydride, 10, 411; 11, 545; 12, 516

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- Lithium diisopropylamide, 7, 204

- Molybdenum carbonyl, 3, 206
- Raney nickel, 7, 312
- Tin(II) chloride, 1, 1113
- Titanium(IV) chloride–Sodium borohydride, 10, 404

DEOXIMATION (*see* HYDROLYSIS)**DEOXYGENATION****OF ROH → RH**

- Bis(dimethylamino) phosphorochloridate, 4, 480
 - Borane–Pyridine, 9, 59
 - Chlorotrimethylsilane–Sodium iodide, 10, 97; 11, 127
 - Dicyclohexylcarbodiimide, 5, 206
 - Diiododimethylsilane, 9, 170
 - N,N-Dimethylsulfamoyl chloride, 9, 187
 - N,N-Dimethylthiocarbamoyl chloride, 3, 127
 - Formic acid, 1, 404
 - Hydrazine, 1, 434
 - Hydriodic acid–Red phosphorus, 1, 865
 - Iodine, 1, 495
 - Iodotrimethylsilane, 12, 259
 - Iron carbonyl, 10, 221
 - Lithium aluminum hydride, 4, 473; 5, 326
 - Lithium aluminum hydride–Aluminum chloride, 1, 595
 - Lithium triethylborohydride, 9, 297
 - Nickel catalysts, 1, 718; 9, 321; 11, 355
 - Palladium catalysts, 1, 778; 2, 303
 - Phenyl chlorothionocarbonate, 10, 306
 - Potassium, 9, 377; 10, 322
 - Sodium borohydride, 12, 441
 - Sodium borohydride + co-reagent, 8, 451; 11, 479
 - Sodium–Hexamethylphosphoric triamide, 9, 416
 - Sulfur trioxide–Pyridine, 3, 275
 - Titanium(IV) chloride–Lithium aluminum hydride, 7, 372
 - Tributyltin hydride, 10, 411; 11, 545; 12, 516
 - Triethylsilane–Boron trifluoride, 7, 387; 8, 501
 - Trifluoroacetic acid–Alkylsilanes, 6, 616
 - Zinc, 4, 574
 - Zinc amalgam, 8, 534
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- Clemmensen reduction

- Zinc, 2, 459; 3, 334; 5, 753
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 Tin(II) chloride, 1, 1113
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 Potassium iodide–Zinc–Phosphorus(V) oxide, **10**, 329
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- Dimethyl diazomalonate, **12**, 203
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 Iron carbonyl, **8**, 265
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 Triphenylphosphine, **1**, 1238
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- OF ArOH $\rightarrow$ ArH
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 Diethyl phosphite, **1**, 251; **2**, 132
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- OF RSeR $\rightarrow$ RH
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Nickel catalysts, 12, 335

Triphenyltin hydride, 8, 521; 10, 451

Tris(phenylseleno)borane, 9, 511

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Boron trifluoride etherate, 12, 66

Butadiynyl(trimethyl)silane, 5, 68

Cesium fluoride, 9, 100

Chlorotrimethylsilane, 5, 709

Dicarbonylcyclopentadienylcobalt, 6, 153

Hydrogen chloride, 9, 239

Hydrogen fluoride, 9, 240

Methoxy(trimethylsilyl)methyl lithium, 9, 284

Methyl lithium-Lithium bromide, 9, 311

Potassium *t*-butoxide, 11, 432

Potassium fluoride, 10, 325

Sodium methoxide, 5, 617

Tetraalkylammonium fluoride, 7, 356; 10, 378

Tributyltin fluoride, 12, 515

1-Trimethylsilyl-1,3-butadiene, 7, 395

3-Trimethylsilyl-3-buten-2-one, 5, 461

β -Trimethylsilylethylidenetriphenylphosphorane, 9, 492

2-Trimethylsilylmethyl-1,3-butadiene, 10, 432

Trimethylsilylmethyl lithium, 9, 495

Trimethylsilylmethylmagnesium chloride, 5, 724

Trimethylsilylmethyl trifluoromethanesulfonate, 10, 434

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Aluminum amalgam, 5, 9

Chlorotris(triphenylphosphine)-rhodium(I), 4, 559

Diethyl phosphite, 2, 132

Dimethyl sulfone, 2, 157

Hexamethylphosphoric triamide, 6, 273

Hydrogen bromide-Acetic acid, 7, 171

Lithium dimethylcuprate, 4, 177

Lithium-Ethylamine, 5, 377; 11, 287

Lithium triethylborohydride, 11, 304

Nickel catalysts, 1, 723

Organolithium reagents, 10, 3

Potassium *t*-butoxide, 1, 911

Potassium-Crown ether, 11, 431

Potassium-Graphite, 10, 326

Sodium amalgam, 1, 1030; 7, 326; 11, 473

Sodium benzylate, 1, 1045

Sodium bis(2-methoxyethoxy)aluminum hydride, 4, 441

Sodium-Ethanol, 11, 472

Sodium naphthalenide, 1, 711

Sulfuric acid, 5, 633

Tetrakis(triphenylphosphine)-palladium(0), 11, 503

Tributyltin hydride, 9, 476

Zinc, 2, 459

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OF CYCLIC SULFIDES $\rightarrow C=C$

Lithium-Ethylamine; Raney nickel, 5, 381

Raney nickel, 5, 263

OF $R_2C(SR)_2 \rightarrow R_2CH_2$

Copper(II) chloride-Zinc chloride-Lithium aluminum hydride, 5, 161

1,2-Ethanedithiol, 1, 356

Hydrazine, 1, 434

Lithium-Ethylamine, 1, 574

Nickel catalysts, 1, 720, 723; 5, 471

Titanium(IV) chloride-Lithium aluminum hydride, 8, 486

Tributyltin hydride, 10, 411

OF RSOR $\rightarrow$ RH

Nickel catalysts, 1, 723

Organolithium reagents, 10, 3

OF $R_2C=S \rightarrow R_2CH_2$

Iron carbonyl, 8, 265

Potassium tetracarbonylhydridoferrate, 6, 483; 8, 266

OF RSH, RSR, RSSR $\rightarrow$ RH

Aluminum amalgam, 1, 20

Bis(3-dimethylaminopropyl)phenylphosphine, 5, 36

Chlorotrimethylsilane-Zinc, 8, 532

Lithium-Alkylamines, 1, 574

Lithium aluminum hydride, 5, 382

Lithium naphthalenide, 8, 305

Lithium triethylborohydride, 11, 304

Molybdenum carbonyl, 10, 273

Nickel catalysts, 1, 723; 2, 289

Potassium thiocyanate, 1, 954

Sodium triethylborohydride-Ferrous chloride, 10, 369

DESULFURIZATION (*Continued*)Triethyl phosphite, **1**, 1212; **6**, 612**DETHIOACETALIZATION** (*see* HYDROLYSIS)**DIALKYLATION** (*see* ALKYLATION REACTIONS)**DIAMINATION** (*see* ADDITION REACTIONS)**DIAZO TRANSFER REACTIONS**Arenesulfonyl azides, **2**, 62; **10**, 422Benzyltriethylammonium chloride, **7**, 18Dimethyl diazomalonate, **5**, 244Sodium azide, **1**, 1041*p*-Toluenesulfonyl azide, **1**, 1178; **2**, 415; **3**, 291; **4**, 510; **5**, 675; **6**, 597; **7**, 19; **11**, 535Tricaprylmethylammonium chloride, **5**, 460**DIAZONIATION**Dinitrogen trioxide–Boron trifluoride, **1**, 329**DIAZONIUM COUPLING** (*see* AZO COUPLING)**DIAZOTIZATION***p*-Aminoacetophenone, **4**, 18Amyl nitrite, **5**, 18Arenediazonium hexafluorophosphates, **1**, 42Butyl nitrite, **1**, 97*t*-Butyl nitrite, **1**, 97Copper(I) chloride, **1**, 166Hypophosphorous acid, **1**, 489Isoamyl nitrite, **1**, 520; **5**, 358Nitrosylsulfuric acid, **1**, 755Sodium nitrite, **1**, 1097Tetrafluoroboric acid, **1**, 394Tetrahydrofuran, **1**, 1140Trichloroacetic acid, **1**, 1194Urea, **1**, 1262**DIECKMANN REACTION**Dichlorobis(trifluoromethanesulfonato)-titanium(IV), **12**, 173Dimethyl sulfoxide, **2**, 157Ethyl acetate, **1**, 1075Hydrogen fluoride, **6**, 285Magnesium methoxide, **3**, 189Organocopper reagents, **12**, 345Potassium, **12**, 400Potassium *t*-butoxide, **1**, 911; **2**, 336Potassium ethoxide, **1**, 928Potassium hydride, **6**, 482Sodium hydride, **1**, 1075; **9**, 427Sodium methylsulfinylmethylide, **1**, 310Triphenylmethylpotassium, **9**, 502**DIELS–ALDER REACTION,****INTRAMOLECULAR** (*see also* TYPE OF COMPOUND INDEX—DIENES, DIENOPHILES; SYNTHESIS INDEX—ARENES, SIX-MEMBERED RINGS)Alkylaluminum halides, **10**, 177; **12**, 5Aluminum chloride, **11**, 25Benzyl *trans*-1,3-butadiene 1-carbamate, **11**, 43*O*-*t*-Butyldimethylsilylhydroxylamine, **12**, 85Cesium carbonate, **11**, 114Cesium fluoride, **11**, 115; **12**, 108Chlorotrimethylsilane, **11**, 125Cyclodextrins, **11**, 150Dichlorobis(cyclopentadienyl)titanium, **12**, 1681,3-Dihydrobenzo[*c*]thiophene 2,2-dioxide, **9**, 168Dimethyl 1,2,4,5-tetrazine-3,6-dicarboxylate, **12**, 214Florisil, **9**, 223Methyl 4-diethoxyphosphinylcrotonate, **8**, 336Molybdenum carbonyl, **12**, 3302-Oxazolidones, chiral, **12**, 359Potassium hydride, **11**, 435Tetraethylammonium periodate, **9**, 4483-Triethylsilyloxypentadienyllithium, **11**, 556Trifluoromethanesulfonic acid, **12**, 5311-Trimethylsilyl(pentadienyl)lithium, **10**, 436**DIENONE–PHENOL****REARRANGEMENT**Cyanotrimethylsilane, **5**, 720Trifluoroacetic acid, **5**, 695; **11**, 557Trifluoroacetic anhydride, **1**, 1221**DIHYDROXYLATION** (*see* ADDITION REACTIONS)**DIMERIZATION** (*see* COUPLING REACTIONS)**DISSOLVING-METAL REDUCTION** (*see* BIRCH REDUCTION, REDUCTION OF SPECIFIC FUNCTIONAL GROUPS)**DOEBNER–MILLER REACTION**Dimethyl 2-oxoglutaconate, **11**, 206

DUFF REACTION

Hexamethylenetetramine, 1, 427; 4, 243

ELBS OXIDATION

Potassium persulfate, 1, 952; 8, 417

ELECTROCYCLIC REARRANGEMENTS

Chlorotrimethylsilane, 3, 310

Dimethyl acetylenedicarboxylate, 4, 168

Silver tetrafluoroborate, 3, 250

ELIMINATION REACTIONS TO FORM C=C, C $\equiv$ C (see also AROMATIZATION, DEHYDROGENATION, DEOXYGENATION, EXTRUSION REACTIONS)**BAMFORD-STEVENS REACTION**

Sodium hydroxide, 8, 460

p-Toluenesulfonylhydrazide, 1, 1185; 2, 417

2,4,6-Triisopropylbenzenesulfonylhydrazide, 11, 563

CHUGAEV AND RELATED REACTIONS

N,N-Dimethylthiocarbamoyl chloride, 3, 127

Sodium methylsulfinylmethylide, 3, 123; 4, 195

p-Tolylthionochlorocarbonate, 4, 342; 5, 457; 9, 474

CLEAVAGE OF BISHYDRAZONES TO C $\equiv$ C

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Copper(I) chloride-Oxygen, 5, 165

Hydrazine, 1, 434

Mercury(II) oxide, 1, 655

Oxygen, 6, 426

Silver(I) oxide, 3, 252

Silver(II) oxide, 4, 431

Silver(I) trifluoroacetate, 1, 1018

CLEAVAGE OF ETHERS (-H, OR)

Alumina, 6, 16

Iodotrimethylsilane, 11, 271

Molecular sieves, 6, 411

Palladium(II) acetate, 8, 378; 9, 349

Pentacarbonyl(trimethylsilyl)manganese, 11, 401

Potassium *t*-butoxide, 5, 544

Sodium amide, 1, 1034; 2, 373; 5, 591

Sodium hydride-Dimethyl sulfoxide, 10, 364

COPE ELIMINATION

Dimethyl(methylene)ammonium salts, 8,

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Dimethyl sulfoxide, 1, 296

Hydrogen peroxide, 1, 471

COREY-WINTER REACTION

Bis(1,5-cyclooctadiene)nickel(0), 5, 34

Dichloromethylenedimethylammonium chloride, 5, 195

1,3-Dimethyl-2-phenyl-1,3,2-diazaphospholidine, 11, 208

Iron carbonyl, 4, 268

Methyl iodide, 6, 384

N,N'-Thiocarbonyldiimidazole, 5, 661; 6, 583

Trimethyl phosphite, 1, 1233; 2, 439; 3, 315; 4, 541; 7, 393

DEAMINATION OF AZIRIDINES

Difluoramine, 1, 253

3-Nitro-N-nitrosocarbazole, 1, 741

Nitrosyl chloride, 1, 748

DECARBONYLATION OF RCOCI (-H,COCI)

Chlorotris(triphenylphosphine)-rhodium(I), 2, 448

DECARBOXYLATIVE

DEHYDRATION (-OH,COOH)

Benzenesulfonyl chloride, 5, 22

Copper, 1, 157

Dimethylformamide dialkyl acetals, 6, 221, 222; 11, 198; 12, 204

Sodium methylsulfinylmethylide, 2, 166

Tetrakis(triphenylphosphine)-palladium(0), 10, 384; 11, 503

Triphenylphosphine-Diethyl azodicarboxylate, 8, 517; 9, 504; 12, 552

DEHALOGENATION (-X,X)

Aluminum, 4, 9

Benzyltrimethylammonium mesitoate, 1, 54

1,8-Bis(dimethylamino)naphthalene, 6, 50

Bis(trimethylsilyl)mercury, 9, 55

Chromium(II)-Amine complexes, 3, 57

Chromium(II) chloride, 1, 149; 12, 136

Chromium(II) sulfate, 1, 150

(Diphenylphosphine)lithium, 6, 340

Diphenyltelluride, 1, 348

Disodium phenanthrene, 1, 350; 2, 182

Disodium tetracarbonylferrate, 6, 550

Hexamethylphosphoric triamide, 6, 273

Iron-Graphite, 11, 276

ELIMINATION REACTIONS TO FORM**C = C, C $\equiv$ C** (*Continued*)

Lithium amalgam, 3, 177; 4, 287

Magnesium–Iodine–Ether, 1, 630

Potassium *t*-butoxide, 8, 407

Potassium hydroxide, 1, 938

Sodium + solvent, 5, 589; 6, 523; 7, 325

Sodium dithionite, 7, 336

Sodium hydrogen telluride, 8, 459

Sodium iodide, 1, 1087; 6, 543; 7, 338

Sodium methaneselenoate, 10, 368

Sodium methylsulfinylmethylide, 1, 310

Sodium naphthalenide, 2, 289

Sodium phenanthrenide, 4, 375

Sodium sulfide, 11, 492; 12, 453

Sodium thiosulfate, 4, 466

Tetracarbonyl(cyclopentadienyl)-
vanadium, 8, 468

Thiourea, 1, 1164

Titanium(III) chloride–Lithium

aluminum hydride, 7, 369

Trialkyl phosphites, 1, 1212, 1229, 1233;
4, 529

Tributyltin hydride, 5, 685

Trichloroethylene, 10, 414

Trimethyltinsodium, 9, 500

Triphenylphosphine, 1, 1238; 2, 443

Vanadium(II) chloride tetrapyridine
complex, 5, 744Zinc, 1, 1276, 1286; 2, 459; 3, 334; 7, 426;
11, 598

Zinc–copper couple, 12, 569

Zinc–Dimethylformamide, 3, 338

Zinc–Silver couple, 5, 760; 12, 571

Zinc–Titanium(IV) chloride, 11, 599

DEHYDRATION (–H₂O)

Alumina, 1, 19, 958; 2, 17

Bis(benzonitrile)dichloropalladium(II),
11, 48

Boric acid, 1, 63

Boron trifluoride etherate, 1, 70

N-Bromoacetamide–Pyridine–Sulfur
dioxide, 1, 752-Chloro-3-ethylbenzoxazolium
tetrafluoroborate, 9, 105

Chloromethyl methyl ether, 1, 132

Copper(II) sulfate, 2, 89; 10, 107

Dicyclohexylcarbodiimide, 2, 126; 4,
141; 11, 173

Diethoxyaluminum chloride, 6, 180

(Diethylamino)sulfur trifluoride, 8, 166

Diketene, 1, 264

Dimethylformamide dialkyl acetals, 7,
125; 9, 183Dimethylformamide–Sodium acetate, 1,
285

1,3-Dimethyl-2-imidazolidinone, 11, 202

N,N-Dimethylphosphoramidic
dichloride, 9, 187Dimethyl sulfoxide, 1, 296; 4, 192; 10,
166N,N-Dimethylthiocarbamoyl chloride, 3,
127Diphenyldi(1,1,1,3,3,3-hexafluoro-2-
phenyl-2-propoxy)sulfurane, 4, 205

N,N'-Disuccinimidyl carbonate, 11, 226

Ethyl(carboxysulfamoyl)triethyl-
ammonium hydroxide inner salt, 4,
227; 5, 442

Ferric chloride, 8, 229

Florisil, 1, 393

Formaldehyde, 5, 312; 6, 264

Girard reagent T, 1, 410

Hexamethylphosphoric triamide, 4, 244

Hydrobromic acid, 1, 450

Iodine, 1, 495; 2, 220; 4, 258

Lithium diisopropylamide, 4, 298

Lithium piperidide, 6, 344

Magnesium methyl carbonate, 5, 420

Methanesulfonyl chloride–Sulfur
dioxide, 1, 664

Methyl chlorosulfinate, 1, 675

Methyl N-sulfonylurethane
triethylamine complex, 4, 343Methyltriphenoxyphosphonium iodide,
4, 557; 6, 649

Methyl vinyl ketone, 1, 697

Naphthalene- β -sulfonic acid, 1, 712

Oxalic acid, 1, 764

Phenylene orthosulfite, 8, 393

Phenyl isocyanate, 1, 842

Phosphorus(V) oxide, 1, 871; 7, 291

Phosphoryl chloride, 1, 876

Phthalic anhydride, 1, 882

Potassium bisulfate, 1, 909

Silver perchlorate, 9, 413

Sulfuryl chloride–Pyridine, 5, 642

N,N'-Sulfuryldiimidazole, 11, 496

Tetrafluoropyrrolidine, 9, 449

Thionyl chloride, 1, 1158

Thorium oxide, 1, 1167; 5, 669

Titanium(IV) chloride, 11, 529

- p*-Toluenesulfonic acid, **1**, 1172
p-Toluenesulfonyl chloride, **1**, 1179
p-Tolylthionochlorocarbonate, **5**, 457
 Triphenylphosphine bis(trifluoromethanesulfonate), **6**, 648
 Triphenylphosphine + co-reagent, **7**, 404; **9**, 504
 Vilsmeier reagent, **7**, 292
- DEHYDROAMINATION + RELATED REACTIONS** [—H, NR₂(NX₂, ETC.)]
- Copper(I) chloride, **6**, 145
 N,N-Dimethylaniline, **1**, 274
 N,N-Dimethylbenzeneselenenamide, **7**, 119
 Dimethyl(methylene)ammonium iodide, **8**, 194
 Formaldehyde, **5**, 312
 Isoamyl nitrite, **5**, 358
 Methyl vinyl ketone, **1**, 697
 Oxalic acid, **1**, 764
 Phenyllithium, **1**, 845
 Potassium amide, **1**, 907
 5,6,8,9-Tetrahydro-7-phenyldibenzo-[c,h]xanthylum tetrafluoroborate, **11**, 502
 Trifluoromethanesulfonic anhydride, **5**, 702
- DEHYDROCYANATION** (—H, CN)
- Ascarite, **4**, 21
 Dimethyl sulfoxide, **1**, 296
 Potassium *t*-butoxide, **9**, 380; **10**, 323
- DEHYDROHALOGENATION** (—H, X)
- Alkylaluminum halides, **12**, 5
 Alumina, **2**, 18; **8**, **9**; **9**, **8**
 Aluminum chloride, **6**, 17
 Benzyltrimethylammonium hydroxide, **5**, 29; **7**, 20
 Bis(dimethylamino)phosphorochloridite, **6**, 575
t-Butylamine, **1**, 84
 Calcium carbonate, **1**, 103; **5**, 89
m-Chloroperbenzoic acid, **8**, 97
 Collidine, **1**, 155
 Crown ethers, **5**, 152, 207; **6**, 133; **10**, 110
 1,5-Diazabicyclo[4.3.0]nonene-5, **1**, 189; **2**, 98; **4**, 16; **5**, 176; **6**, 157
 1,4-Diazabicyclo[2.2.2]octane, **2**, 99
 1,8-Diazabicyclo[5.4.0]undecene-7, **2**, 101; **7**, 87
 1,2-Dibromoethane, **4**, 126
 1,3-Dichloro-2-butene, **2**, 111
- Dichloro(diethoxyphosphinyl)methyl lithium, **6**, 188
 Dichloromethyl lithium, **9**, 154
 Dicyclohexylethylamine, **1**, 370
 Diethylamine, **4**, 148
 Diisopropylethylamine, **1**, 371
 Dimethylaminotrimethyltin, **2**, 147
 N,N-Dimethylaniline, **1**, 274
 Dimethyl bromomalonate, **12**, 200
 N,N-Dimethylformamide, **1**, 278
 N,N-Dimethylhydrazine, **8**, 192
 1,3-Dimethyl-2-imidazolidinone, **11**, 202
 Dimethyl sulfoxide, **1**, 296; **2**, 157; **4**, 192
 2,4-Dinitrophenylhydrazine, **1**, 330
 (Diphenylphosphine)lithium, **6**, 340
 Ethyl carbazate, **1**, 360
 Ethylene glycol, **1**, 375
 Ethylene oxide, **5**, 297
 Hexamethylphosphoric triamide, **2**, 208; **4**, 244; **8**, 240
 Ion-exchange resins, **1**, 511
 Lithium carbonate, **1**, 606; **3**, 183
 Lithium carbonate-Lithium halide, **1**, 606; **2**, 245; **4**, 298; **5**, 395; **7**, 200
 Lithium chloride, **1**, 609; **2**, 246; **12**, 277
 Lithium dicyclohexylamide, **2**, 246
 Magnesium oxide, **2**, 256
 Methyl lithium, **5**, 448
 Penta-isopropylguanidine, **11**, 249
 Phase-transfer catalysts, **9**, 356; **11**, 403
 N-Phenylbenzamidine, **5**, 513
 N-Phenylmorpholine, **1**, 846
 Phosphoryl chloride, **2**, 330
 Potassium amide, **1**, 907
 Potassium *t*-butoxide, **1**, 911; **2**, 336; **3**, 233; **4**, 358, 401; **5**, 544; **6**, 477; **7**, 296, 298; **8**, 407; **9**, 126, 380
 Potassium fluoride, **2**, 346; **5**, 153, 555; **12**, 406
 Potassium hydroxide, **6**, 486
 Potassium superoxide, **6**, 488; **11**, 442
 Potassium triethylmethoxide, **2**, 349
 Pyridine, **1**, 958; **11**, 448
 Quinoline, **1**, 975; **9**, 403
 Silica, **9**, 410
 Silver fluoride, **2**, 364; **10**, 348
 Silver(I) nitrate, **1**, 1008
 Silver(I) oxide, **1**, 1011
 Sodium acetate, **1**, 1024
 Sodium amide, **1**, 1034; **2**, 373; **5**, 591; **6**, 525

ELIMINATION REACTIONS TO FORM**C=C, C $\equiv$ C** (*Continued*)Sodium amide–Sodium *t*-butoxide, 4, 439; 5, 593; 9, 417

Sodium 2-butylcyclohexoxide, 1, 1056

Sodium dicarbonyl(cyclopentadienyl)-ferrate, 9, 426

Sodium hydride, 1, 1075

Sodium iodide, 1, 1087

Sodium isopropoxide, 2, 385

Sodium methoxide, 1, 1091; 6, 545

Sodium methylsulfinylmethylide, 3, 123

Tetrabutylammonium salts, 4, 477; 7, 354

Tetraethylammonium chloride, 1, 1137

Tetramethylammonium dimethyl phosphate, 6, 573

Triethylamine, 1, 1189

Triethylamine, 1, 1198; 2, 427; 4, 527

Trimethyl phosphite, 1, 1233

Triphenylmethylpotassium, 12, 550

DEHYDROMETALLATION (–H,M)*trans*-1,2-Bis(tributylstannyl)ethylene, 5, 43

Nickel(II) chloride–Ethylene, 10, 276

Tributyltinlithium, 11, 551

Triphenylmethylpotassium, 8, 524

DEHYDROSULFONYLATION(–H,OSO₂R)

Alumina, 7, 5; 8, 9

Amidines, bicyclic, 4, 16

Dimethyl sulfoxide, 1, 296

Formaldehyde, 5, 312; 6, 264

Guanidines, 11, 105, 249

o-Nitrobenzenesulfonyl chloride, 6, 419

Potassium acetate, 6, 475

Potassium *t*-butoxide, 1, 911; 2, 336; 3, 233; 4, 399; 5, 544

Potassium iodide–Zinc-copper couple, 4, 411

Potassium trifluoromethanesulfinate, 5, 564

Sodium dicarbonyl(cyclopentadienyl)-ferrate, 9, 426

N,N'-Sulfuryldiimidazole, 11, 496

Tetrabutylammonium formate, 4, 478

Trifluoromethanesulfonic anhydride, 5, 702; 6, 618

DEOXYGENATION OF DIOLS,**EPOXIDES** (*see* DEOXYGENATION)**DESULFURIZATION OF****EPISULFIDES AND RELATED COMPOUNDS**

Butyllithium, 4, 60

Chromium(II)–Amine complexes, 3, 57

Diazomethane, 2, 102

4,4-Dimethyl-2-methylthio-2-oxazoline, 6, 584

Diphosphorus tetraiodide, 12, 218

Methyl iodide, 2, 274

3-Methyl-2-selenoxo-1,3-benzothiazole, 7, 245

Potassium thiocyanate, 1, 954

Triethyl phosphite, 1, 1212

Triphenylphosphine, 1, 1238

ELIMINATION OF ESTERS AND RELATED COMPOUNDS

[–H,OCOR(OCsR)]

1,8-Diazabicyclo[5.4.0]undecene-7, 9, 132

Dibenzoyl peroxide, 4, 122

Hexamethylphosphoric triamide, 7, 168

Molybdenum carbonyl, 12, 330

Palladium(II) acetate, 8, 378; 9, 349

Pyridine, 4, 414

Sodium methylsulfinylmethylide, 4, 195

Tetrakis(triphenylphosphine)-palladium(0), 10, 384

Thiobenzoyl chloride, 6, 582

Zinc oxide, 1, 1294

ELIMINATION OF H, SR AND RELATED

Benzyl phenyl sulfoxide, 6, 394

m-Chloroperbenzoic acid, 10, 92

Chloro(phenylsulfinyl)methylolithium, 9, 271

Copper(I) trifluoromethanesulfonate, 6, 130; 8, 125

Dialkoxycarbenium tetrafluoroborates, 4, 114

Dimethyl disulfide, 5, 246; 6, 217

Dimethyl sulfoxide, 1, 296

Diphenyl disulfide, 5, 276; 6, 235

Diphosphorus tetraiodide, 11, 224

2,2'-Dipyridyl disulfide, 8, 214

Ethyl 2-phenylsulfinylacetate, 6, 256

Ethyl α -trifluoromethyl-sulfonyloxyacetate, 7, 149

Iodomethyl methyl sulfide, 5, 353

Lithium diisopropylamide, 9, 280

Methyl phenylsulfinylacetate, 6, 393

Phenylsulfinylacetone, 5, 524

- Potassium *t*-butoxide, 1, 911; 8, 407; 12, 401
Potassium trifluoromethanesulfinate, 5, 564
Sodium methylsulfinylmethylide, 7, 338
Tetrakis(triphenylphosphine)-palladium(0), 9, 451
Thiophenol, 10, 399

ELIMINATION OF H, SeR AND RELATED

- Benzeneselenenic acid, 8, 24
Benzeneselenenyl halides, 5, 518; 6, 459; 7, 286; 8, 25; 10, 16
Benzeneseleninic anhydride, 8, 29
Benzeneselenol, 6, 28
t-Butyl hydroperoxide, 8, 64
4,4'-Dichlorodiphenyl diselenide, 6, 421
Dimethyl disulfide, 5, 246
Diphenyl diselenide, 5, 272; 6, 235; 7, 136
Diphosphorus tetraiodide, 11, 224
Lithium diisopropylamide, 6, 334; 9, 280
Methyl fluorosulfonate, 9, 307
o-Nitrophenyl selenocyanate, 6, 420
Ozone, 10, 295
Potassium 3-aminopropylamide, 8, 406
2-Pyridineselenenyl bromide, 11, 455
Selenium, 11, 465
Sodium benzeneselenoate, 8, 447
Sodium pyridylselenate, 10, 368

ELIMINATION OF H, TeR

- Chloramine-T, 10, 85

ELIMINATION OF OH(OR),X

- Chromium(II)-Amine complexes, 3, 57
Chromium(II) chloride, 1, 149
Dibromomethylithium, 11, 158
Hexamethylphosphorous triamide, 10, 199
Methanesulfonyl chloride, 4, 326
Phosphoryl chloride, 1, 881; 4, 390; 5, 535
Sodium iodide, 1, 1116
Tin(II) chloride, 1, 1113
Titanium(III) chloride-Lithium aluminum hydride, 6, 588
Trimethyltinsodium, 9, 500
Zinc, 1, 1276
Zinc-Silver couple, 5, 760

ELIMINATION OF OH, SiR₃ AND RELATED

- Bis(cyclopentadienyl)(η^3 -1-trimethylsilylallyl)titanium, 11, 174

- α -Bromovinyltriphenylsilane, 5, 68
t-Butyldimethylchlorosilane, 11, 88
t-Butyl lithioacetate, 6, 84
Chloromethyl diphenylsilane, 12, 321
Diisobutylaluminum hydride, 6, 198
Lithium dipropylcuprate, 6, 245
Methoxy(trimethylsilyl)methylithium, 10, 246; 11, 331
Methylithium, 7, 242
Organotitanium reagents, 11, 174
Potassium fluoride, 5, 555
[(Trimethylsilyl)allyl]lithium, 11, 572
Trimethylsilylmethylithium, 6, 635; 11, 581
Trimethylsilylmethylmagnesium chloride, 5, 724

ELIMINATION OF OH, SR AND RELATED

- Diethyl phosphorochloridate, 8, 171
Dimethyl(methylthio)sulfonium tetrafluoroborate, 11, 204
Diphenyl disulfide, 6, 235
Diphosphorus tetraiodide, 9, 203
Lithium diethylamide, 5, 398
N-Methanesulfinyl-*p*-toluidine, 2, 269
Methoxymethyl phenyl sulfide, 12, 316
Phenylthioacetic acid, 6, 463
Sodium amalgam, 9, 416; 11, 473
Sodium methylsulfinylmethylide, 4, 195
Sulfuryl chloride, 6, 561
Titanium(0), 11, 526
Tributyltin hydride, 8, 497

ELIMINATION OF OH, SeR AND RELATED

- Chlorotrimethylsilane-Sodium iodide, 10, 97
Phenylselenoacetaldehyde, 10, 310
Phosphorus(III) iodide, 10, 318
Phosphoryl chloride, 8, 401
Sodium benzeneselenoate, 6, 548
Thionyl chloride-Triethylamine, 7, 367
Zinc chloride, 8, 536

ELIMINATION OF NO₂,NO₂

- Calcium amalgam, 8, 74
Sodium sulfide, 4, 460
Tin(II) chloride, 6, 554
Tributyltin hydride, 11, 545

ELIMINATION OF X, SiR₃ AND RELATED

- Alumina, 8, 9
Bromine, 11, 75

ELIMINATION REACTIONS TO FORM**C = C, C $\equiv$ C** (*Continued*)

- α -Bromovinyltrimethylsilane, 8, 56
- Cesium fluoride, 6, 100; 10, 81; 11, 115
- Chloro[(trimethylsilyl)methyl]ketene, 12, 127
- Iodine monochloride, 8, 261
- (1-Lithiovinyl)triphenylsilane, 5, 375
- Peracetic acid–Sodium acetate, 7, 279
- 1-Phenylsulfonyl-2-trimethylsilylethane, 11, 41
- Potassium fluoride, 5, 555; 6, 481
- Tetrabutylammonium fluoride, 9, 444; 10, 378
- Vinyltrimethylsilane, 10, 444

HOFMANN ELIMINATION

- Hydrogen peroxide, 1, 471
- Methyl 3-(N,N-dimethylamino)-propionate, 9, 306
- Methylenetriphenylphosphorane, 8, 339
- Methyl iodide, 5, 447
- Phenyllithium, 1, 845
- Potassium amide, 1, 907
- Potassium hydroxide, 5, 557
- Potassium 2-methylcyclohexoxide, 5, 560
- Silver(I) oxide, 3, 252; 5, 583

OXIDATIVE DECARBOXYLATION

(see OXIDATIVE ...)

RAMBERG–BACKLUND REACTION

- Bromomethanesulfonyl bromide, 12, 75
- Copper(II) chloride, 5, 158
- Lithium aluminum hydride, 5, 382
- Nickel(II) acetylacetonate, 11, 58
- Organocopper reagents, 11, 365
- Potassium hydroxide–Carbon tetrachloride, 5, 96, 560
- Sodium *t*-amylloxide, 6, 546
- Sulfuryl chloride, 5, 641

SHAPIRO REACTION

- Catecholborane, 9, 443
- Lithium diisopropylamide, 7, 204
- Lithium hydride, 4, 304
- p*-Toluenesulfonyl chloride, 5, 676
- p*-Toluenesulfonylhydrazide, 1, 1185; 2, 417; 4, 511; 5, 678; 6, 598; 7, 375; 8, 460, 489

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- Sodium amalgam, 1, 1030

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- Acetyl hexachloroantimonate, 8, 5

- Alkylaluminum halides, 10, 177; 11, 7; 12, 5
- Aluminum chloride, 5, 10; 7, 7; 8, 13; 9, 11, 13
- Butyllithium–Tetramethylethylenediamine, 8, 67
- Butyl *N*-(*p*-toluenesulfonyl)-iminoacetate, 7, 50
- Chloral, 8, 82
- p*-Chlorobenzoyl nitrite, 4, 79
- Diethyl azodicarboxylate, 11, 177
- Diethyl oxomalonate, 10, 143
- Formaldehyde, 11, 8
- Grignard reagents, 11, 245
- Methyl cyanodithioformate, 7, 237
- Methyl cyclobutenecarboxylate, 10, 263
- Methyl fluoride–Antimony(V) fluoride, 6, 381
- Nitrosocarbonylmethane, 11, 362
- Oxygen, singlet, 6, 431; 7, 261; 9, 338; 11, 385
- Phenyl iodine(III) dichloride, 6, 298
- N*-Phenyl-1,2,4-triazoline-3,5-dione, 4, 381; 5, 528; 6, 467; 7, 287; 9, 372
- Selenium(IV) oxide, 5, 575
- Sodium α -(N,N-dimethylamino)-naphthalenide, 10, 362
- N*-Sulfinylbenzenesulfonamide, 9, 439
- Tetracyanoethylene, 5, 647
- Tin(IV) chloride, 9, 436; 11, 522; 12, 486
- Triphenyl phosphite ozonide, 3, 323
- Vinyltrichlorosilane, 5, 749

ENOL ACYLATION

- 4-Dimethylaminopyridine, 9, 178
- Dimethylformamide diethyl acetal, 9, 182
- Hydrobromic acid, 3, 154
- Isopropenyl acetate, 1, 524
- Ketene, 1, 528
- Lithium dimethylcuprate, 4, 177; 5, 234
- Perchloric acid, 1, 796; 2, 309
- Potassium acetate, 1, 906
- Potassium hydride, 9, 386
- Sodium hexamethyldisilazide, 3, 261
- Sodium hydride, 2, 382
- Sulfoacetic acid, 1, 1117
- Sulfosalicylic acid, 1, 1118
- Thallium(I) ethoxide, 2, 407
- p*-Toluenesulfonic acid, 1, 1172; 4, 508
- Trifluoroacetyl trifluoromethanesulfonate, 9, 485

ENOL ETHERIFICATION

- Chloromethyl methyl ether, **4**, 83
 2,2-Dimethoxypropane, **1**, 268
 Ion-exchange resins, **5**, 355
 Lithium diisopropylamide, **12**, 277
 Methyl fluorosulfonate, **4**, 339; **6**, 381
 Potassium fluoride, **10**, 325
 Thallium(I) ethoxide, **4**, 501
p-Toluenesulfonic acid, **1**, 1172
 Trialkyl orthoformate, **1**, 1204; **5**, 714
 Triethyloxonium tetrafluoroborate, **2**, 430; **6**, 611

ENOL LACTONIZATION

- Acetic anhydride, **8**, 1
 Mercury(II) acetate, **8**, 315
 Mercury(II) oxide, **8**, 316; **12**, 305
 Mercury(II) trifluoroacetate, **11**, 320
 Phosphorus(V) oxide-Methanesulfonic acid, **7**, 291
 Potassium hydride, **12**, 407
 Silver(I) nitrate, **12**, 433
 Thallium(III) trifluoroacetate, **12**, 481

EPOXIDATION (see also ASYMMETRIC REACTIONS)**OF C=C**

- Benzeneperoxseleninic acid, **8**, 22
 N-Benzoylperoxycarbamic acid, **6**, 35
 O-Benzylmonoperoxy-carbonic acid, **6**, 40
 (–)-Benzylquininium chloride, **7**, 311; **10**, 27
 Bis(acetonitrile)chloronitro-palladium(II), **11**, 45
 3-Bromo-4,5-dihydro-5-hydroperoxy-4,4-dimethyl-3,5-diphenyl-3H-pyrazole, **11**, 76
 2,3-Butanedione, **7**, 21
t-Butyl hydroperoxide, **2**, 49; **9**, 78
t-Butyl hydroperoxide + co-reagent, **2**, 287; **3**, 331; **4**, 346; **7**, 63; **8**, 62; **11**, 95
 [(–)-Camphor-10-ylsulfonyl]-3-aryloxaziridines, **11**, 108
m-Chloroperbenzoic acid, **1**, 135; **3**, 49; **4**, 85; **5**, 120; **6**, 110; **7**, 62; **8**, 97; **9**, 108; **11**, 124
 3,5-Dinitroperbenzoic acid, **9**, 196; **11**, 217
 O-Ethylperoxycarbonic acid, **9**, 220
 Hydrogen peroxide, **1**, 457
 Hydrogen peroxide + co-reagent, **1**, 475; **3**, 156; **5**, 307; **6**, 35; **8**, 248; **9**, 242;

10, 204; **11**, 256

2-Hydroperoxyhexafluoro-2-propanol, **9**, 244

(S)-(2-Hydroxy-N,N-dimethylpropanamide-O,O')-oxodiperoxymolybdenum(VI), **10**, 206

Iodine-Silver oxide, **7**, 180

Iodosylbenzene, **10**, 213

p-Methoxycarbonylperbenzoic acid, **4**, 68

2-Nitrobenzeneseleninic acid, **8**, 359

p-Nitroperbenzoic acid, **1**, 743

Oxodiperoxymolybdenum(pyridine)-(hexamethylphosphoric triamide), **4**, 203

μ_3 -Oxohexakis(μ -trimethylacetato)-trimethanoltriiron(III) chloride, **11**, 382

Oxomethoxymolybdenum(V) 5,10,15,20-tetraphenylprophyrin, **11**, 383

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Oxygen, singlet, **5**, 486; **6**, 431

Ozone, **5**, 491

Peracetic acid, **1**, 785, 787; **2**, 307; **3**, 219; **4**, 372

Perbenzoic acid, **1**, 791; **6**, 453; **7**, 279

Perlauric acid, **3**, 220

Permaleic acid, **1**, 819

Permonophosphoric acid, **10**, 304

Peroxyacetimidic acid, **1**, 470; **8**, 387

Peroxyacetyl nitrate, **5**, 510

Peroxybenzimidic acid, **4**, 375; **5**, 121, 511

Peroxytrichloroacetimidic acid, **12**, 379

Perphthalic acid, **1**, 819

Potassium *o*-nitrobenzeneperoxy-sulfonate, **12**, 412

Potassium peroxomonosulfate, **11**, 442; **12**, 413

Potassium superoxide, **12**, 413

Sodium hypochlorite, **8**, 461

Sodium perborate, **2**, 387

Succinoyl peroxide, **1**, 1117

o-Sulfo-perbenzoic acid, **4**, 469

Tetralin hydroperoxide, **3**, 278

Trifluoroperacetic acid, **1**, 821

Triphenylsilyl hydroperoxide, **9**, 509

OF C=C SUBSTITUTED BY C=O, CN, TMS, ETC.

O-Benzylmonoperoxy-carbonic acid, **6**, 40

EPOXIDATION (*Continued*)

- (-)-Benzylquininium chloride, 7, 311; 10, 27
 - 1-Bromo-1-trimethylsilyl-1(Z),4-pentadiene, 11, 80
 - t*-Butyl hydroperoxide, 1, 88; 2, 49; 7, 43; 9, 78
 - t*-Butyl hydroperoxide + co-reagent, 5, 338; 9, 80, 81; 11, 97; 12, 90
 - m*-Chloroperbenzoic acid, 1, 135; 2, 68; 6, 110
 - Hydrogen peroxide, 1, 51, 466; 3, 155; 5, 337; 9, 241; 12, 246
 - (E)-1-Iodo-3-trimethylsilyl-2-butene, 5, 355
 - (1-Lithiovinyl)trimethylsilane, 5, 374
 - Lithium aluminum hydride–Aluminum chloride, 8, 289
 - α -Methoxyvinylolithium, 7, 233
 - Osmium tetroxide–*t*-Butyl hydroperoxide, 1, 88
 - Oxygen, 5, 482
 - Peracetic acid, 1, 787; 7, 279
 - Peroxytrichloroacetimidic acid, 12, 379
 - Potassium hydroxide, 6, 486
 - Quinine, 10, 338
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 - Sodium hypochlorite, 1, 1084; 7, 337; 8, 430, 461
 - Sodium perborate, 2, 387
 - [(Trimethylsilyl)allyl]lithium, 8, 273
- OF ALLYLIC, HOMOALLYLIC ALCOHOLS**
- t*-Butyldimethylsilyl hydroperoxide–Mercury(II) trifluoroacetate, 12, 85
 - t*-Butyl hydroperoxide, 10, 64
 - t*-Butyl hydroperoxide + co-reagent, 5, 75; 7, 44, 63; 8, 393; 9, 81; 11, 92, 97, 99; 12, 90, 91
 - m*-Chloroperbenzoic acid, 1, 135; 4, 85; 7, 44, 62; 9, 81, 108
 - Dibenzyltartaric acid diamide, 12, 91
 - Hydrogen peroxide–Iron(III) acetylacetonate, 6, 304
 - 2-Hydroperoxyhexafluoro-2-propanol, 9, 244
 - Lead tetrakis(trifluoroacetate), 6, 318
 - Lithium alkyl(cyano)cuprates, 9, 329
 - Oxidoperoxymolybdenum(pyridine)-(hexamethylphosphoric triamide), 9, 197

- Oxoperoxobis(N-phenylbenzohydroxamato)molybdenum(VI), 10, 292
 - Perbenzoic acid, 1, 791; 5, 76
 - Tetraethylammonium fluoride, 7, 356
 - Triphenylsilyl hydroperoxide, 9, 509
- ESCHENMOSER FRAGMENTATION**
- N-Bromosuccinimide, 10, 57
 - 2,4-Dinitrobenzenesulfonylhydrazide, 6, 232
 - Hydrazine, 5, 327; 7, 170
 - Hydroxylamine-O-sulfonic acid, 2, 217; 5, 343
 - Mesitylenesulfonylhydrazide, 10, 255
 - p*-Toluenesulfonylhydrazide, 2, 417
- ESCHWEILER–CLARKE REACTION**
- Formaldehyde, 4, 238
- ESTERIFICATION** (*see* SYNTHESIS INDEX—ESTERS)
- EXTRUSION REACTIONS**
- CO
 - Alumina, 10, 8
 - Benzylsulfonyldiazomethane, 11, 43
 - CO₂
 - 1,8-Diazabicyclo[5.4.0]undecene-7, 7, 87
 - Lithium phenylethynolate, 6, 343; 7, 210
 - SO₂
 - N-Chlorosuccinimide, 5, 127; 6, 115
 - 1,3-Dihydrobenzo[*c*]thiophene 2,2-dioxide, 9, 168; 10, 146
 - 1,3,3a,4,7,7a-Hexahydro-4,7-methanobenzo[*c*]thiophene 2,2-dioxide, 12, 236
 - Lithium aluminum hydride, 8, 286
 - Sodium acetate, 5, 591
 - 3-Sulfolene, 3, 272; 12, 455
 - Sulfur dioxide, 5, 633; 9, 440
 - Vinyltriphenylphosphonium bromide, 6, 666
- TWO-FOLD EXTRUSION**
- Selenium, 6, 507
 - Triethyl phosphite, 5, 693
 - Triphenylphosphine, 3, 317; 4, 548; 5, 725; 6, 643
- FAVORSKII REARRANGEMENT**
- 1,2-Dimethoxyethane, 1, 267
 - Dimethylsulfoxonium methylide, 3, 125
 - Potassium hydroxide–Carbon tetrachloride, 5, 96
 - Sodium methoxide, 1, 1091; 4, 457
 - Triethylamine, 1, 1198

FINKELSTEIN REACTIONDicyclohexyl-18-crown-6, **6**, 174Dimethyl sulfoxide, **7**, 133**FISHER INDOLE SYNTHESIS**Ethylene glycol, **1**, 375; **5**, 296Phenylhydrazine, **1**, 838; **6**, 457; **7**, 284; **8**, 424Phosphorus(III) chloride, **10**, 318Polyphosphate ester, **1**, 892; **3**, 229Polyphosphoric acid, **1**, 894; **10**, 321Zinc chloride, **1**, 1289**FLUORINATION (see also ADDITION REACTIONS)****OF RCHO, R₂CO AND RELATED COMPOUNDS**Acetyl hypofluorite, **12**, 3N-Alkyl-N-fluoro-*p*-toluene-sulfonamides, **12**, 231N-Bromosuccinimide, **7**, 37Cesium fluoroxysulfate, **11**, 118Fluorine–Sodium trifluoroacetate, **9**, 223Perchloryl fluoride, **1**, 802Sodium hexamethyldisilazide, **3**, 261Trifluoromethyl hypofluorite, **2**, 200; **4**, 237; **9**, 224; **10**, 420**OF RH**Carbonyl difluoride, **12**, 106Cesium fluoroxysulfate, **10**, 84; **11**, 118Sulfur tetrafluoride, **1**, 1123Trifluoromethyl hypofluorite, **7**, 156**AT ALLYLIC C–H (see ALLYLIC REACTIONS)****OF ArH, C = C–H**Acetyl hypofluorite, **11**, 5Bis(fluoroxy)difluoromethane, **4**, 36Cesium fluoroxysulfate, **10**, 84; **11**, 118Crown ethers, **7**, 76Fluorine, **5**, 309Potassium fluoride, **8**, 480Trifluoromethyl hypofluorite, **9**, 224Xenon(II) fluoride, **6**, 669Xenon(VI) fluoride, **7**, 425**OF RCOOH, RCOX**N-Alkyl-N-fluoro-*p*-toluene-sulfonamides, **12**, 231Perchloric acid, **7**, 279Perchloryl fluoride, **1**, 802; **2**, 310**OF ArN₂⁺X[–], RN₂⁺X[–]**Arenediazonium salts, **1**, 42, 43Dinitrogen trioxide–Boron trifluoride, **1**, 329Pyridinium poly(hydrogen fluoride), **6**, 285, 473; **9**, 399; **11**, 453Tetrafluoroboric acid, **1**, 394Tetrahydrofuran, **1**, 1140**OF RM, ArM**N-Alkyl-N-fluoro-*p*-toluene-sulfonamides, **12**, 231Perchloryl fluoride, **1**, 802**FLUOROLACTAMIZATION, FLUOROLACTONIZATION (see HALO-)****FORMYLATION (see also CARBONYLATION)****AT ACTIVE C–H***t*-Butoxybis(dimethylamino)methane, **5**, 712-Chloro-1,3-dithiane, **8**, 88Diethoxycarbenium tetrafluoroborate, **11**, 1751,2-Dimethoxyethane, **1**, 2671,3-Dithienium tetrafluoroborate, **11**, 227Ethyl formate, **1**, 380, 1077; **2**, 197; **4**, 233; **12**, 226N-Formylimidazole, **8**, 233Lithium diisopropylamide, **3**, 184Methoxymethylenetriphenylphosphorane, **5**, 438Methyl formate, **5**, 446Sodium alkoxide, **1**, 1065, 1091Sodium hydride, **1**, 1075Titanium(IV) chloride, **6**, 590Trimethyl orthoformate, **11**, 568Vilsmeier reagent, **1**, 284; **7**, 422Zinc chloride, **11**, 602**OF C = C–H**Dimethylformamide–Phosphoryl chloride, **5**, 251Vilsmeier reagent, **8**, 529; **9**, 514**OF ArH****Vilsmeier reaction**Dichloromethylenedimethylammonium chloride, **5**, 195Dimethylthioformamide–Acetic anhydride, **3**, 128N-Methylformanilide, **1**, 680N-Methylformanilide–Phosphoryl chloride, **1**, 681, 878Phosphoryl chloride, **1**, 876Triphenylphosphine dibromide, **3**, 320Vilsmeier reagent, **1**, 284, 286

FORMYLATION (*Continued*)

Related reactions

- Acetic-formic anhydride, 2, 10
 - Acetone cyanohydrin, 11, 1
 - Aluminum chloride, 1, 24
 - Bis(1,3-diphenyl-2-imidazolidinylidene), 7, 22
 - n*- or *sec*-Butyllithium, 6, 85; 12, 97
 - Chloroform-Sodium hydroxide, 12, 151
 - N-Chlorosuccinimide + co-reagent, 6, 119, 120
 - Copper(I) chloride, 1, 166
 - Dichloromethyl methyl ether, 1, 220; 2, 120; 5, 671; 9, 154
 - Dimethyl(methylthio)sulfonium tetrafluoroborate, 12, 207
 - N,N-Dimethyl-4-nitrosoaniline, 1, 746
 - N,N'-Diphenylformamidine, 1, 339
 - 1,3-Dithiane, 6, 248
 - Formaldehyde, 8, 242
 - Formaldoxime, 1, 402
 - Formyl fluoride, 1, 407, 1018
 - Hexamethylenetetramine, 1, 427, 898; 4, 243
 - Hydrogen cyanide, 1, 454
 - Iron carbonyl, 8, 265
 - N-Methyl-N-phenylcarbamoyl chloride, 1, 694
 - Oxalyl chloride, 7, 257; 11, 379
 - Polyphosphoric acid, 1, 894
 - Thioanisole, 5, 660
 - Titanium(IV) chloride, 2, 414
 - 1,3,5-Triazine, 2, 423
 - Triethyl orthoformate, 1, 1204; 2, 430
 - Zinc cyanide, 1, 1293
- OF N-H (*see* SYNTHESIS INDEX—AMIDES)
- OF RM, RX
- Acetic-formic anhydride, 2, 10
 - 2-Alkoxy-1,3-benzodithiolanes, 8, 236
 - 1,3-Benzodithiolylum perchlorate, 8, 34
 - gem*-Dichloroallyllithium, 8, 150
 - Dichloromethyl methyl ether, 9, 154
 - Diethyl phenyl orthoformate, 3, 97
 - Dihalobis(triphenylphosphine)-palladium(II), 6, 60
 - p*-Dimethylaminobenzaldehyde, 2, 146
 - N,N-Dimethylformamide, 1, 278; 5, 247; 7, 124; 8, 189; 11, 198; 12, 98
 - 4,4-Dimethyl-1,3-oxathiolane-3,3-

- dioxide, 9, 186
 - Dipotassium(or Disodium) tetracarbonylferrate, 3, 267; 8, 214; 10, 174
 - Ethoxymethyleneaniline, 1, 362
 - 2-(N-Formyl-N-methyl)aminopyridine, 8, 341
 - N-Formylpiperidine, 11, 244
 - Grignard reagents, 1, 415; 10, 189
 - Lithium, 5, 376
 - Methyl methylthiomethyl sulfoxide, 5, 456; 8, 344
 - 3-Methylthio-1,4-diphenyl-5-triazolium iodide, 6, 396
 - Methylthiomethyl-N,N'-dimethyl-dithiocarbamate, 6, 398
 - Methylthiomethyl *p*-tolyl sulfone, 12, 327
 - 1-Phenylthio-1-trimethylsilylethylene, 12, 394
 - Tetrabutylammonium iodide, 7, 355
 - Tetrakis(triphenylphosphine)-palladium(0), 12, 468
 - 1,1,3,3-Tetramethylbutyl isocyanide, 3, 279; 4, 480
 - Thionyl chloride, 4, 503
 - Titanium(IV) chloride, 8, 483
 - Triethyl orthoformate, 1, 1204
 - N,4,4-Trimethyl-2-oxazolinium iodide, 4, 540; 6, 630
 - s*-Trithiane, 4, 564
- OF O-H (*see* SYNTHESIS INDEX—ESTERS)
- FRAGMENTATION REACTIONS** (*see also* BECKMANN, ESCHENMOSER FRAGMENTATIONS)
- Aluminum isopropoxide, 8, 15
 - Birch reduction, 8, 38
 - Borane-Tetrahydrofuran, 3, 76
 - N-Bromosuccinimide, 10, 57
 - Cesium fluoride, 11, 115
 - α -Chloro-N-cyclohexylpropanal-donitrone, 4, 80
 - m*-Chloroperbenzoic acid, 11, 122
 - Copper(II) acetate-Ferrous(II) sulfate, 10, 103
 - Copper(I) trifluoromethanesulfonate, 8, 125
 - Lead(IV) acetate azides, 4, 276
 - Lead tetraacetate, 9, 265
 - Lithium aluminum hydride, 9, 274

Methylolithium, **8**, 342
3,3,6,9,9-Pentamethyl-2,10-diazabicyclo-
[4.4.0]decene, **9**, 354
Phenyliodine(III) diacetate—
Azidotrimethylsilane, **6**, 297

Potassium *t*-butoxide, **7**, 296
1,3-Propanedithiol, **4**, 413
Sodium methylsulfinylmethylide, **7**, 338

FRIEDEL-CRAFTS ACYLATION

2-Acetoxypyridine, **1**, 9
Aluminum halides, **1**, 24, 35; **2**, 19; **5**, 10;
10, 9; **11**, 25
Boric acid, **1**, 63
Boron trifluoride etherate, **11**, 72
 γ -Butyrolactone, **1**, 101
Carbonyl sulfide, **11**, 112
Chloroacetylum hexafluoroantimonate,
6, 103
Chloroform, **1**, 130
Copper(II) trifluoromethanesulfonate,
10, 110
Diethyl ethoxymethylenemalonate, **5**, 216
Fluorosulfuric acid, **1**, 396
Grignard reagents, **9**, 229
Hydrogen fluoride, **1**, 455; **6**, 285; **9**, 240
Lithium *o*-lithiobenzoate, **10**, 246
Methanesulfonic acid, **11**, 321
Methylene chloride, **1**, 676
Nitroethane, **4**, 357
Oxalyl chloride, **1**, 767
Phosphorus(V) oxide, **1**, 871
Phosphoryl chloride, **2**, 330
Polyphosphate ester, **2**, 333
Polyphosphoric acid, **1**, 894; **3**, 231; **4**,
395; **7**, 294
Pyridinium chloride, **6**, 497
Sodium tetrachloroaluminate, **1**, 1027; **4**,
438
Succinic anhydride, **4**, 468
Tetrachloroethane—Nitrobenzene, **4**, 479
Thionyl chloride, **1**, 1158
Tin(IV) chloride, **1**, 1111
Trichloroacetyl chloride, **4**, 521
Trifluoroacetic anhydride, **1**, 1221; **9**, 484
Trifluoromethanesulfonic acid, **5**, 701;
12, 531
Trifluoromethanesulfonic-carboxylic
anhydrides, **4**, 533; **10**, 420
2-Trimethylsilylethanol, **8**, 510
Trimethylsilyl
trifluoromethanesulfonate, **11**, 584

Zinc chloride, **1**, 1289
Zirconium(IV) chloride, **1**, 1295

FRIEDEL-CRAFTS ALKYLATION

Aluminum chloride, **1**, 24; **4**, 10; **5**, 10;
11, 25; **12**, 26
Boron trifluoride, **1**, 68
 γ -Butyrolactone, **1**, 101
Ethylmagnesium bromide, **9**, 218
Hydrobromic acid, **6**, 282
Iodine, **2**, 220
Iodotrimethylsilane, **10**, 216
Ion-exchange resins, **1**, 511
Iron, **2**, 229
Methyl chloride, **1**, 674
Methylene chloride, **4**, 337
Methyl fluoride—Antimony(V) fluoride,
3, 201
2-Methylfuran, **1**, 682
Nafion-H, **9**, 320
Nickel(II) acetylacetonate, **9**, 51
Oxalic acid, **1**, 764
Phosphorus(V) oxide, **10**, 319
Polyphosphoric acid, **1**, 894; **5**, 540
Potassium bisulfate, **1**, 909
Silver perchlorate, **11**, 469
Titanium(IV) chloride, **1**, 1169

FRIEDLANDER QUINOLINE

SYNTHESIS

Cobalt(II) phthalocyanine, **10**, 102

FRIES REARRANGEMENT

Aluminum chloride, **1**, 24; **5**, 10; **8**, 13
Boric acid, **1**, 63
Boron trifluoride etherate, **7**, 31
Cyclodextrins, **6**, 151
Hydrogen fluoride, **5**, 336
Ion-exchange resins, **1**, 511
Sodium tetrachloroaluminate, **1**, 1027
Titanium(IV) chloride, **1**, 1169
Trifluoromethanesulfonic acid, **5**, 701

GABRIEL SYNTHESIS

N-Benzyl trifluoromethanesulfonamide,
5, 29; **6**, 43
t-Butyl methyl iminodicarboxylate
potassium salt, **8**, 72
Copper(I) bromide, **3**, 67
Di-*t*-butyl iminodicarboxylate, **1**, 210
Tributylhexadecylphosphonium
bromide, **7**, 166

GATTERMAN SYNTHESIS

Acetone cyanohydrin, **11**, 1

GATTERMAN SYNTHESIS (*Continued*)

Aluminum chloride, 1, 24
 Copper(I) chloride, 1, 166
 Hydrogen cyanide, 1, 454
 1,3,5-Triazine, 2, 423

GLASER AND RELATED COUPLINGS

t-Butylamine, 1, 84
 Copper(II) acetate, 1, 159; 4, 105
 Copper(I) chloride, 1, 166; 4, 109
 Copper(I) chloride-Ammonium chloride, 1, 165

GOMBERG-BACKMANN REACTION

Crown ethers, 8, 128
 Dinitrogen trioxide-Boron trifluoride, 1, 329
 Phase-transfer catalysts, 9, 356; 12, 379

HALLER-BAUER REACTION

Sodium amide, 6, 525; 8, 446

HALOALKYLATION

Aluminum halides, 1, 22; 6, 17
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OF C = C-H

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OF RCH₂Z → RZC=NOH

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- Iodotrimethylsilane, 10, 216
- 3-Methyl-3-trimethylsilyl-1-butene, 8, 181
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RCOCI

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WITH O₂

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- Dimethyl sulfoxide–Phosgene, 1, 856; 6, 226
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 Ruthenium(IV) oxide-Sodium periodate, 2, 358
 Ruthenium tetroxide, 1, 986; 2, 357; 3, 243; 4, 420
 Silver carbonate-Celite, 2, 363; 4, 425; 5, 577; 6, 511; 7, 319
 Silver(II) picolinate, 3, 16; 5, 20
 Sodium hypochlorite, 7, 337; 10, 365; 11, 487
 Sodium ruthenate, 5, 622
 2,2,6,6-Tetramethylpiperidiny-1-oxy, 12, 479
 Trialkylaluminums, 11, 539
 Triethyltin methoxide, 6, 613
 Triphenylcarbenium tetrafluoroborate, 8, 524
 Urushibara catalysts, 4, 571

ALCOHOLS $\rightarrow$ RCOOH

m-Chloroperbenzoic acid-2,2,6,6-Tetramethylpiperidine, 6, 110
 Chromium(VI) oxide-Diethyl ether, 9, 115
 Copper(II) permanganate, 11, 142
 Heyn's catalyst, 1, 432
 Iodosylbenzene-Ruthenium catalysts, 11, 270
 Nickel peroxide, 1, 731; 2, 294
 Nitric acid, 1, 733
 Nitrogen dioxide, 1, 324
 Oxygen, singlet, 5, 486
 Platinum catalysts, 1, 432
 Potassium ruthenate, 9, 391
 Pyridinium dichromate, 9, 399
 Silver(II) oxide, 2, 369
 Silver(II) picolinate, 3, 16
 Sodium ruthenate, 5, 622; 9, 432
 Tetrabutylammonium salts, 5, 644; 8, 468

ALCOHOLS $\rightarrow$ RCOOR'

t-Butyl hydroperoxide-Benzyltrimethylammonium tetrabromooxomolybdate, 12, 89
t-Butyl hypochlorite, 1, 90
m-Chloroperbenzoic acid-2,2,6,6-Tetramethylpiperidine, 8, 99
 Collins reagent, 12, 139
 Dibenzoyl peroxide-Nickel(II) bromide, 9, 136

Dihydridotetrakis(triphenylphosphine)-
ruthenium(II), 11, 182
p-Nitroperbenzoic acid, 9, 324
Sodium bromite, 12, 445
Sodium dichromate, 1, 1059

ALDEHYDES, KETONES $\rightarrow$ RCOX, RCN

Aluminum chloride-Ethanol, 8, 15
N-Amino-4,6-diphenylpyridone, 7, 10
Chloramine, 5, 103
Dicyclohexylcarbodiimide, 5, 206
S,S-Diphenylsulfilimine, 10, 174
Hydroxylamine, 2, 217; 7, 176; 9, 245
Hydroxylamine-O-sulfonic acid, 6, 290;
9, 245
N-Imino-N,N-dimethyl-2-hydroxy-
propanaminium ylide, 8, 256
Manganese(IV) oxide, 4, 317
N-Methyl-2-pyrrolidone, 11, 346
Nickel peroxide, 1, 731
Nitroethane-Pyridinium chloride, 11,
359
1-Nitropropane, 1, 745
Selenium(IV) oxide, 9, 409
Uranium(VI) fluoride, 7, 417

ALDEHYDES $\rightarrow$ RCOOH

t-Butyl hydroperoxide-
Benzyltrimethylammonium
tetrabromooxomolybdate, 12, 89
Calcium hypochlorite, 11, 107
Caro's acid, 3, 43
Cetyltrimethylammonium bromide, 6, 70
Copper(II) permanganate, 11, 142
1,3-Dithiane, 4, 216
Hydrogen peroxide + co-reagent, 1,
477; 12, 245
2-Hydroperoxyhexafluoro-2-propanol,
9, 244; 10, 206
Hypohalite solution, 1, 488
Nickel peroxide, 8, 357
Nitric acid, 1, 733
Peroxyacetyl nitrate, 5, 510
Potassium hydroxide, 1, 935
Potassium permanganate, 1, 942; 4, 143;
6, 70
Potassium ruthenate, 9, 391
Pyridinium dichromate, 9, 399; 10, 335
Silver(I) nitrate, 1, 1008
Silver(I) oxide, 1, 1011; 11, 468
Silver(II) oxide, 2, 369
Silver(II) picolinate, 3, 16

Sodium chlorite, 5, 603; 9, 423
Sodium permanganate, 10, 368
Tetrabutylammonium permanganate, 8,
468

Tollens reagent, 1, 1171

ALDEHYDES $\rightarrow$ RCOOR', RCOH

3-Benzylthiazolium bromide, 10, 27
N-Bromosuccinimide, 7, 37; 8, 54; 9, 70
t-Butyl hydroperoxide-Benzyltrimethyl-
ammonium tetrabromooxomolybdate,
12, 89
Caro's acid, 3, 43
m-Chloroperbenzoic acid, 5, 120; 11, 124
Crown ethers, 8, 128
2-Lithio-2-methylthio-1,3-dithiane, 4,
217

Manganese(IV) oxide, 2, 257; 3, 191
Ozone, 8, 374

Peracetic acid, 1, 787

Sodium hypochlorite, 11, 487

1-ALKENES $\rightarrow$ RCH₂CHO

N-Chlorosuccinimide, 7, 368
Chromyl chloride, 2, 79; 3, 62
Disiamylborane, 10, 40
Lead tetraacetate, 5, 365
Palladium(II) chloride-Copper(I)
chloride, 12, 372
Thallium(III) nitrate, 4, 492

1-ALKENES $\rightarrow$ RCOCH₃

Allyltrimethylsilane, 10, 6
Bis(acetonitrile)chloronitro-
palladium(II), 10, 30; 11, 45
[Bis(salicylidene- γ -iminopropyl)]-
methylaminocobalt(II), 11, 138
Hydrogen peroxide-Palladium acetate,
10, 203

Jones reagent, 6, 123

Mercury(II) acetate, 4, 319

Oxotris(*t*-butylimido)osmium(VIII), 8,
206

Palladium(or Platinum) *t*-butyl peroxide
trifluoroacetate, 10, 299; 11, 430

Palladium(II) chloride, 10, 300

Palladium(II) chloride + co-reagent, 7,
278; 11, 396; 12, 380

Thallium(III) trifluoroacetate, 5, 658

ALKENES $\rightarrow$ 1,2-DICARBONYLS

Potassium permanganate, 4, 412; 5, 563;
6, 487; 9, 388

ALKENES $\rightarrow$ α -HYDROXY C=O's (AND RELATED COMPOUNDS)

OXIDATION REACTIONS (*Continued*)

- Chromyl chloride, 4, 98
- Hydrogen peroxide–N-Methyl-morpholine oxide, 1, 690; 3, 204
- Osmium tetroxide + co-reagent, 1, 475; 2, 363
- Oxygen difluoride, 1, 772
- Phenyliodine(III) diacetate, 1, 508
- Potassium permanganate, 9, 388
- Zinc permanganate, 12, 576

ALKENES $\rightarrow$ R_2CO

- Allyltrimethylsilane, 10, 6
- Benzyl chloroformate, 3, 59
- Bis(acetonitrile)chloronitropalladium(II), 10, 30; 11, 45
- [Bis(salicylidene- γ -iminopropyl)]-methylaminocobalt(II), 11, 138
- Borane–Tetrahydrofuran, 1, 199
- Bromine–Silver nitrate, 5, 59
- Chromium(II) acetate, 3, 59
- Chromyl chloride, 2, 79; 3, 62
- Dimethyl(methylthio)sulfonium tetrafluoroborate, 11, 204
- Disodium tetrachloropalladate(II)–*t*-Butyl hydroperoxide, 10, 175
- Hydrogen peroxide–Palladium acetate, 10, 203
- Jones reagent, 6, 123
- Lead tetraacetate, 5, 365
- Mercury(II) acetate, 4, 319
- Nitrosyl chloride, 2, 298
- Oxotris(*t*-butylimido)osmium(VIII), 8, 206
- Palladium(or Platinum) *t*-butyl peroxide trifluoroacetate, 10, 299; 11, 430
- Palladium(II) chloride, 10, 300
- Palladium(II) chloride + co-reagent, 11, 396; 12, 380
- Picryl azide, 1, 885
- Pyridinium chlorochromate, 9, 397
- Thallium(III) nitrate, 4, 492; 5, 656
- Trifluoroacetic acid, 1, 821; 2, 316

ALKYLARENES ($ArR \rightarrow ArCOOH$)

- Benzyl(triethyl)ammonium permanganate, 10, 28
- Chromium(VI) oxide, 1, 144
- Cobalt(II) acetate, 1, 154; 4, 99
- Hexamethylphosphoric triamide, 1, 430
- Lead(IV) oxide, 1, 533
- Nitric acid, 1, 733
- Palladium(II) chloride, 6, 447

- Potassium *t*-butoxide, 1, 911
- Potassium ferricyanide, 1, 929
- Potassium hypochlorite, 1, 938
- Potassium permanganate, 1, 942; 4, 143
- Potassium peroxomonosulfate, 1, 952
- Selenium, 4, 422
- Selenium(IV) oxide, 10, 345
- Sodium dichromate, 1, 1059; 7, 68
- Sodium hypochlorite, 1, 1084

ALKYLARENES ($ArR \rightarrow RCOOH$)

- Ozone, 6, 436
- Potassium *t*-butoxide, 8, 128
- Potassium permanganate, 1, 942
- Ruthenium(IV) oxide–Sodium hypochlorite, 6, 506
- Ruthenium tetroxide, 2, 357; 6, 504; 11, 462

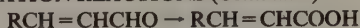
ALKYLARENES $\rightarrow ArCHO$

- Benzeneseleninic anhydride, 9, 32
- Cerium(IV) ammonium nitrate, 1, 120; 2, 63
- Chromium(VI) oxide–Acetic anhydride, 1, 146
- Chromyl chloride, 1, 151
- 2,3-Dichloro-5,6-dicyano-1,4-benzoquinone, 3, 83; 10, 135; 11, 166
- N,N-Dimethyl-4-nitrosoaniline, 1, 746
- Oxygen, 6, 477
- Potassium *t*-butoxide, 6, 477
- Potassium persulfate, 11, 441
- Selenium(IV) oxide, 2, 360
- Silver(II) oxide, 2, 369
- Sodium persulfate, 1, 1102
- Thallium(III) nitrate, 12, 481

ALKYL HALIDES $\rightarrow RCHO$, R_2CO

- Bis(tetrabutylammonium) dichromate, 9, 53
- N-Chlorosuccinimide, 7, 65
- N,N-Dimethyl-4-nitrosoaniline, 1, 746
- Dimethyl sulfoxide, 1, 296; 2, 157; 3, 119, 161
- Hexamethylenetetramine, 1, 427; 4, 243
- Mercury(I) nitrate, 6, 360
- Potassium chromate, 7, 298
- Pyridine, 1, 958
- Silver chromate, 1, 1005
- Silver tetrafluoroborate, 1, 1015; 5, 264
- Silver *p*-toluenesulfonate, 1, 1018
- Sodium benzeneselenoate, 7, 341
- Sodium 4,6-diphenyl-1-oxido-2-pyridone, 8, 456

- Sodium ethoxide, 1, 1065
 Sodium 2-nitropropanenitronate, 1, 1101
 Trimethylamine N-oxide, 1, 1230; 2, 434
- ALKYNES → α -DICARBONYLS**
 Dimethyl sulfoxide—
 N-Bromosuccinimide, 4, 51
 Iodosylbenzene—Ruthenium catalysts, 11, 270
 Osmium tetroxide—Potassium chlorate, 9, 334
 Oxygen, 9, 335
 Potassium permanganate, 1, 942; 9, 388
 Ruthenium tetroxide, 4, 420
 Tetracyanoethylene, 5, 647
 Thallium(III) nitrate, 4, 492
 Zinc permanganate, 12, 576
- ALKYNES → α -HYDROXY C=O's**
 Thallium(III) nitrate, 4, 492
- ALKYNES → OTHER COMPOUNDS**
 Chromium(VI) oxide, 4, 96
 Collins reagent, 9, 121
 Iodosylbenzene—Ruthenium catalysts, 11, 270
 Oxygen difluoride, 1, 772
- ALLYLIC ALCOHOLS → α,β -UNSATURATED C=O's**
 Barium manganate, 9, 23
 2,2'-Bipyridinium chlorochromate, 11, 44
 Bis(tetraalkylammonium) dichromate, 10, 42; 11, 50
 Bis(tributyltin) oxide, 7, 26
 Bis(trimethylsilyl) peroxide, 12, 63
t-Butyl hydroperoxide—Diaryl diselenides, 9, 79; 10, 65
 Chloranil, 1, 125
o-Chloranil, 1, 128
 N-Chlorosuccinimide, 6, 115
 N-Chlorosuccinimide—Dialkyl sulfide, 8, 200; 12, 195
 Chromium(VI) oxide, 1, 144; 4, 96; 7, 70
 Chromium(VI) oxide + co-reagent, 7, 71; 8, 110
 Collins reagent, 3, 55; 4, 215
 Collins reagent—Celite, 5, 285
 Copper(I) chloride, 8, 118
 Copper(II) permanganate, 11, 142
 2,3-Dichloro-5,6-dicyano-1,4-benzoquinone, 1, 215; 2, 112; 9, 148; 12, 174
 Dichlorotris(triphenylphosphine)-ruthenium(II), 11, 171
 4-(Dimethylamino)pyridinium chlorochromate, 11, 196
 Dimethyl sulfoxide, 1, 296
 Dimethyl sulfoxide + co-reagent, 2, 165; 8, 200; 10, 167; 11, 215
 N,N-Dimethylthiocarbamoyl chloride, 8, 200
 3,5-Dinitrobenzoyl *t*-butyl nitroxyl, 8, 204
 Dodecacarbonyltris-*triangulo*-ruthenium, 7, 244
 Hexakis(acetato)trihydrato- μ_3 -oxotrisrhodium acetate, 11, 252
 Hexamethylphosphoric triamide, 3, 149
 Jones reagent, 6, 123
 Manganese(IV) oxide, 1, 637; 2, 257; 5, 422; 6, 357
 Nickel peroxide, 1, 731; 2, 294
 μ -Oxybis(chlorotriphenylbismuth), 9, 335; 11, 381
 Palladium(II) acetate—Triphenylphosphine, 10, 298
 Peracetic acid, 4, 372
 Phase-transfer catalysts, 9, 356
 Potassium dichromate, 10, 324
 Potassium ferrate(VI), 4, 405
 Potassium permanganate—Copper sulfate, 11, 441
 Pyridinium chlorochromate, 6, 498; 7, 308; 8, 425; 10, 334; 12, 419
 Pyridinium dichromate, 9, 399
 Pyruvyl chloride, 7, 310
 Ruthenium(III) chloride, 7, 244
 Ruthenium(IV) oxide, 12, 428
 Selenium(IV) oxide, 4, 422
 Silver carbonate—Celite, 2, 363; 3, 247; 6, 511
 Silver(II) oxide, 2, 369
 Sodium dichromate, 2, 70
 Sodium permanganate, 10, 368
 Sulfur trioxide—Pyridine, 2, 393
 Tetraabutylammonium chlorochromate, 12, 458
 2,2,6,6-Tetramethylpiperidiny-1-oxy, 12, 479
 Triphenylbismuth carbonate, 9, 501
 Tris(aquo)hexa- μ -acetato- μ_3 -oxotriruthenium(III,III,III) acetate, 6, 425, 650
- ALLYLIC ALCOHOLS OR**

OXIDATION REACTIONS (Continued)

Hydrogen peroxide–Selenium(IV) oxide,
1, 477

Lithium bis(3,3-diethoxy-1-propen-2-yl)-
cuprate, 6, 331

Silver(II) oxide, 2, 369

Sodium chlorite, 9, 423; 11, 481

Sodium ruthenate, 5, 622

ALLYLIC HALIDES →

α, β -UNSATURATED C = O's

Potassium chromate, 7, 298

Silver tetrafluoroborate–Dimethyl
sulfoxide, 5, 264

ALLYLIC SILANES → ALLYLIC**ALCOHOLS**

Benzeneselenenyl halides, 11, 34

(Chloromethyl)dimethylsilane, 12, 27

Dimethylphenylsilyllithium, 12, 210

Hydrogen peroxide, 12, 242

1-Trimethylsilyl-1,3-butadiene, 7, 395

ALLYLIC SILANES →

α, β -UNSATURATED C = O's

Iodosylbenzene, 12, 258

AMINES → RCHO, R₂CO

Aluminum chloride, 4, 10

Benzeneseleninic anhydride, 7, 139

Benzo-1,3-thiazole-2-carboxaldehyde, 5,
24

5-Bromo-3-methylthio-1,4-diphenyl-

5-triazolium bromide, 8, 53

t-Butyl hypochlorite, 1, 90

t-Butyl nitrite, 7, 48

m-Chloroperbenzoic acid, 6, 110

Copper halide nitrosyls, 7, 73

3,5-Di-*t*-butyl-1,2-benzoquinone, 3, 78

Dimethyl sulfoxide, 7, 133

4-Formyl-1-methylpyridinium

benzenesulfonate, 11, 244

Hexamethylenetetramine, 1, 427; 2, 208

Hexamethylphosphoric triamide, 5, 323

Hydrogen tetrachloroaurate(III), 7, 277

Hypochlorous acid, 1, 487

Manganese(IV) oxide, 1, 636

p-Nitrobenzenesulfonyl peroxide, 7, 251

Palladium(II) chloride, 7, 277

Potassium ferrate(VI), 4, 405

Potassium permanganate, 2, 348

Potassium superoxide, 8, 417

4-Pyridinecarboxaldehyde, 11, 448

Ruthenium(III) chloride, 8, 437

Silver(II) oxide, 2, 369

Sodium hypochlorite, 7, 337

Sodium nitrite, 2, 386

Sodium persulfate, 3, 267

Sodium ruthenate, 5, 622

N-Sulfinylaniline, 6, 556

2,2,6,6-Tetramethylpiperidyl-1-oxy,
12, 479

Trifluoromethanesulfonic anhydride, 11,
560

AMINES → RCONR₂

Acetic anhydride–Manganese(III)
acetate, 6, 355

Benzyl(triethyl)ammonium
permanganate, 10, 28

Bromine, 6, 70

Chromium(VI) oxide–Pyridine, 2, 74

2,6-Di-*t*-butyl-*p*-benzoquinone, 9, 139

Manganese(IV) oxide, 1, 637; 2, 257

Mercury(II) acetate–Ethylenediamine-
tetraacetic acid, 5, 427

Ruthenium tetroxide, 6, 504

Sarett reagent, 2, 74

AMINES → –N = N–

Benzeneseleninic acid, 10, 22

Chloramine, 4, 74

Hydrogen peroxide, 1, 457

Iodine pentafluoride, 1, 503

Manganese(IV) oxide, 1, 637

Nickel peroxide, 1, 731

Phenyliodine(III) diacetate, 1, 508; 3,
166

Potassium superoxide, 9, 391

Silver carbonate–Celite, 6, 511

Silver(II) oxide, 4, 431

Sodium hypochlorite, 4, 456

Sodium perborate, 1, 1102

AMINES → C = N

t-Butyl hypochlorite, 1, 90

Diphenyldi(1,1,1,3,3,3-hexafluoro-2-
phenyl-2-propoxy)sulfurane, 6, 239

Diphenylselenium bis(trifluoroacetate),
11, 223

Manganese(IV) oxide, 1, 637

p-Nitrobenzenesulfonyl peroxide, 7, 251

Potassium superoxide, 8, 417

Sodium persulfate, 3, 267

AMINES → RCN

Copper(I) chloride, 8, 118

Diphenyldi(1,1,1,3,3,3-hexafluoro-2-
phenyl-2-propoxy)sulfurane, 6, 239

Hydridotris(triisopropylphosphine)-rhodium(I), 9, 238

Iodine pentafluoride, 1, 503

Lead tetraacetate, 1, 537

Nickel peroxide, 1, 731

Ruthenium(III) chloride, 8, 437

Silver(II) oxide, 2, 369

Silver(II) picolinate, 5, 20

Sodium hypochlorite, 7, 337

2,2,6,6-Tetramethylpiperidiny-1-oxy, 12, 479

AMINES $\rightarrow$ RNO₂

m-Chloroperbenzoic acid, 1, 135

Ozone-Silica gel, 8, 375

Potassium permanganate, 1, 942

AMINES $\rightarrow$ RNO

Caro's acid, 1, 118; 6, 97

m-Chloroperbenzoic acid, 11, 122

Hydrogen peroxide, 1, 457

Oxygen difluoride, 1, 772

Potassium peroxomonosulfate, 1, 952

ANILINES, ArNO $\rightarrow$ ArNO₂

t-Butyl hydroperoxide + co-reagent, 3, 331; 5, 77

Hydrogen peroxide, 1, 457

2-Hydroperoxyhexafluoro-2-propanol, 3, 149

Nitric acid, 1, 733

Peracetic acid, 1, 787

Permaleic acid, 1, 819

Sodium perborate, 12, 452

Trifluoroperacetic acid, 1, 821; 2, 316; 3, 221

ARENES $\rightarrow$ *o*- or *p*-QUINONES

Cerium(IV) ammonium salts, 5, 101; 8, 80; 12, 107

Chromium(VI) oxide, 1, 144

Hexamethylphosphoric triamide, 3, 149

Hydrogen peroxide, 1, 457

Lithium, 3, 150

Manganese(III) sulfate, 9, 289

Periodic acid, 2, 313

Pyridinium fluorochromate, 11, 453

Sodium chlorate, 1, 1056

Thallium(III) trifluoroacetate, 5, 658

AZO $\rightarrow$ AZOXY COMPOUNDS

Hydrogen peroxide, 1, 457

CARBOXYLIC ACIDS $\rightarrow$ RCO₃H

Hydrogen peroxide, 1, 457

Methanesulfonic acid, 1, 666

CATECHOLS (AND RELATED

COMPOUNDS) $\rightarrow$ *o*-QUINONES

Bis(*p*-methoxyphenyl) telluroxide, 9, 50

Cerium(IV) ammonium nitrate, 4, 71

Cerium(IV) sulfate, 2, 65

Chloranil, 4, 76

o-Chloranil, 1, 128; 5, 104

N-Chlorosuccinimide-Triethylamine, 6, 120

2,3-Dichloro-5,6-dicyano-1,4-benzoquinone, 2, 112

Diphenyl selenoxide, 5, 280; 9, 201

Ferric chloride, 1, 390

Lead(IV) oxide, 1, 533; 2, 233

Nickel peroxide, 1, 731

Periodates, 1, 809

Phenyliodine(III) diacetate, 4, 266

Potassium ferricyanide, 4, 406

Silver carbonate-Celite, 5, 577

Silver(I) oxide, 1, 1011

Succinimidodimethylsulfonium tetrafluoroborate, 6, 555

CYCLIC ETHERS $\rightarrow$ LACTONES

Bromine, 3, 34

N-Bromosuccinimide, 7, 37

t-Butyl chromate, 3, 37

Copper(I) trifluoromethanesulfonate, 11, 142

Ruthenium tetroxide, 1, 986; 3, 243; 10, 343

Zinc permanganate, 12, 576

1,2-DIOLS (AND RELATED COMPOUNDS) $\rightarrow$ α -SUBSTITUTED

C=O's

Alumina, 8, 9

Bis(tributyltin) oxide, 7, 26

N-Bromosuccinimide, 1, 78

t-Butyl hydroperoxide-Diaryl diselenides, 10, 65

Chlorine-Pyridine, 5, 106

N-Chlorosuccinimide-Dimethyl sulfide, 5, 129

Chromium(VI) oxide-Graphite, 5, 732

Dibutyltin oxide, 5, 188; 9, 141

Dimethyl sulfoxide + co-reagent, 2, 163; 9, 192; 10, 168

Silver carbonate-Celite, 3, 247; 4, 425; 5, 577; 6, 511

Sodium dichromate-Manganese(II) nitrate, 2, 72

Triphenylcarbenium tetrafluoroborate, 4, 565; 8, 524

OXIDATION REACTIONS (Continued)**1,4- OR 1,5-DIOLS $\rightarrow$ LACTONES**

- Barium manganate, 12, 38
 Bromine–Nickel(II) alkanoates, 11, 358; 12, 72
 N-Bromosuccinimide, 9, 70
 Butyllithium–Potassium *t*-butoxide, 8, 67
 Copper chromite, 1, 156
 Dibenzoyl peroxide–Nickel(II) bromide, 10, 121
 Dichlorotris(triphenylphosphine)-ruthenium(II), 10, 141
 Dihydridotetrakis(triphenylphosphine)-ruthenium(II), 11, 182
 Formic acid, 11, 243
 Heyn's catalyst, 5, 326; 7, 320
 Platinum catalysts, 5, 326
 Pyridinium chlorochromate, 11, 450
 Silver carbonate–Celite, 3, 247; 6, 511; 7, 319; 8, 441; 12, 433
 Sodium bromite, 12, 445
 Tetra- μ_3 -carbonyldodecacarbonyl-hexarhodium, 5, 326
 Thexylborane, 11, 516

ENOL ETHERS (AND RELATED COMPOUNDS) $\rightarrow$ α -HYDROXY C=O's

- t*-Butyl hydroperoxide, 12, 88
 Chloramine-T, 9, 101
m-Chloroperbenzoic acid, 6, 110; 8, 97; 10, 92
 Chlorotrimethylsilane, 3, 310
 Chromyl chloride, 11, 134
 1-(Methoxymethoxy)styrene, 12, 99
 N-Methylanilinium trifluoroacetate, 8, 331
 Ozone, 8, 374
 Peracetic acid, 1, 785
 2-Trimethylsilyloxy-1,3-butadiene, 7, 401

ENOL ETHERS (AND RELATED**COMPOUNDS) $\rightarrow$ α,β -UNSATURATED C=O's**

- Allyl chloroformate, 12, 15
 Boron trifluoride, 11, 71
 Chlorodimethyl(2,4,6-tri-*t*-butylphenoxy)silane, 11, 217
 Chloromethylcarbene, 10, 90
 2,3-Dichloro-5,6-dicyano-1,4-benzoquinone, 9, 148
 Palladium(II) acetate, 8, 378; 9, 344; 12, 367

Potassium hydride, 9, 386

Pyridinium chlorochromate, 11, 450

Triphenylcarbenium tetrafluoroborate, 8, 524

ETHERS, $\text{RCH}_2\text{OSiR}'_3$, $\text{RCH}_2\text{OSnR}'_3 \rightarrow \text{RCHO}$, R_2CO

- Bromine, 3, 34
 N-Bromosuccinimide, 7, 37; 8, 54
 Butyl azide, 1, 84
 Cerium(IV) ammonium nitrate, 10, 79
 2,3-Dichloro-5,6-dicyano-1,4-benzoquinone, 12, 174
 Nitronium tetrafluoroborate, 8, 361
 Nitrosonium tetrafluoroborate, 7, 253
 Trichloroisocyanuric acid, 2, 426
 Triethyltin methoxide, 6, 613
 Triphenylcarbenium salts, 4, 548, 565; 7, 414
 Uranium(VI) fluoride, 7, 417

ETHERS, $\text{RCH}_2\text{OSiR}'_3 \rightarrow \text{RCOOR}'$ (see also CYCLIC ETHERS $\rightarrow$ LACTONES)

- Benzyl(triethyl)ammonium permanganate, 9, 43
 N-Bromosuccinimide, 8, 54
 Chromium(VI) oxide, 2, 72; 3, 54
 Pyridinium chlorochromate, 8, 425
 Ruthenium(IV) oxide, 12, 428
 Ruthenium tetroxide, 11, 462
 Trichloroisocyanuric acid, 2, 426

HOMOALLYLIC ALCOHOLS $\rightarrow$ α,β -UNSATURATED C=O's

- Aluminum *t*-butoxide, 1, 23
 Aluminum isopropoxide, 1, 35
 Raney nickel, 1, 723
 Rochelle salt, 1, 983

HOMOALLYLIC ALCOHOLS $\rightarrow$ β,γ -UNSATURATED C=O's

- Chromium(VI) oxide–Diethyl ether, 9, 115
 Diisobutylaluminum hydride, 7, 111
 Dimethyl sulfoxide, 2, 157
 N-Iodosuccinimide–Tetrabutylammonium iodide, 10, 216
 Jones reagent, 1, 142
 Palladium(II) acetate–Triphenylphosphine, 10, 298
 Pyruvyl chloride, 7, 310

HYDRAZO COMPOUNDS $\rightarrow$ $-\text{N}=\text{N}-$
 Benzeneseleninic anhydride, 8, 29; 10, 22
 N-Bromosuccinimide, 6, 74

- 1-Chlorobenzotriazole, 2, 67; 3, 46
 Copper(II) chloride, 2, 84; 3, 66
 Iodine pentafluoride, 1, 503
 Manganese(IV) oxide, 1, 637; 8, 312
 Oxygen-Palladium, 5, 491
 Periodic acid, 3, 220
 Phenyl iodine(III) bis(trifluoroacetate), 6, 301
 Potassium superoxide, 8, 417
 Sodium periodate, 11, 492
 Triphenylbismuth carbonate, 9, 501
- HYDRAZONES → DIAZO COMPOUNDS**
- N-Chlorosuccinimide-Triethylamine, 6, 120
 Copper(I) chloride, 5, 164
 Manganese(IV) oxide, 1, 637
 Mercury(II) oxide, 1, 655
 Mercury(II) trifluoroacetate, 1, 659
 Nickel peroxide, 2, 294
 Silver carbonate-Celite, 6, 511
 Silver(I) oxide, 2, 368
 Triphenylbismuth carbonate, 9, 501
- HYDROQUINONES → p-QUINONES**
- Ammonium metavanadate, 1, 39
 Benzeneseleninic anhydride, 10, 22
 Bis(*p*-methoxyphenyl) telluroxide, 9, 50
 Boron trifluoride etherate, 11, 72
 Cerium(IV) ammonium nitrate, 4, 71; 7, 55; 9, 99; 10, 79
o-Chloranil, 5, 104
 Chlorine, 6, 101
 N-Chlorosuccinimide-Triethylamine, 6, 120
 Cyclodextrins, 8, 133
 2,3-Dichloro-5,6-dicyano-1,4-benzoquinone, 1, 215; 7, 96
 3,5-Dinitrobenzoyl *t*-butyl nitroxyl, 8, 204
 4,4'-Dinitrodiphenylnitroxide, 2, 174
 Ferric chloride, 1, 390; 11, 237
 Hydrogen peroxide, 1, 466
 Hydrogen tetrachloroaurate(III), 1, 414
 Lead(IV) oxide, 1, 533
 Lead tetraacetate, 1, 537
 Manganese(IV) oxide, 11, 311
 Mercury(II) oxide, 8, 316
 Nitric acid, 1, 733
 Nitrogen dioxide, 1, 324, 737
 Phenyl iodine(III) bis(trifluoroacetate), 6, 301
- Phosphatolead(IV) acids, 3, 225
 Pyridinium chlorochromate, 11, 450
 Silver carbonate, 2, 363; 4, 425
 Silver(II) dipicolinate, 10, 348
 Silver(I) oxide, 1, 1011
 Silver(II) oxide, 4, 431; 7, 322; 9, 412; 10, 352; 11, 469
 Silver(II) picolinate, 3, 16
 Sodium nitrite, 1, 1097
 Sodium periodate, 11, 492
 Succinimidodimethylsulfonium tetrafluoroborate, 6, 555
 Thallium(III) nitrate, 7, 362
 Thallium(III) trifluoroacetate, 3, 286
 Vanadium(V) oxide, 1, 1057
- α -HYDROXY C=O's (AND RELATED COMPOUNDS) → 1,2-DICARBONYLS**
- Bismuth(III) oxide, 1, 59
 Bromine, 4, 46, 537
 N-Bromosuccinimide, 2, 40
t-Butyl hydroperoxide, 12, 88
 N-Chlorosuccinimide, 8, 103
 Chlorotrimethylsilane, 4, 537
 Chromium(VI) oxide-Diethyl ether, 9, 115
 Copper(II) acetate, 1, 159
 Copper carbonate, basic, 1, 163
 Copper(II) sulfate, 1, 164; 6, 141
 Dimethyl sulfide-Trifluoroacetic anhydride, 6, 225
 Dimethyl sulfoxide, 1, 296; 6, 225
 Dimethyl sulfoxide + co-reagent, 2, 163; 6, 227
 Epichlorohydrin, 4, 222
 Ferric chloride, 1, 390
 Jones reagent, 4, 95
 Lead tetraacetate, 2, 234
 Manganese(IV) oxide, 1, 637
 Mercury(II) acetate, 5, 424
 Nickel(II) acetate, 5, 470
 Nitric acid, 1, 733
 Oxygen, 7, 258
 Phenyl benzenethiosulfonate, 8, 391
 Potassium ferricyanide, 8, 410
 Selenium(IV) oxide, 1, 992; 3, 245
 Sodium acetate, 1, 1024
 Sodium bromate, 1, 1055
 Sulfuryl chloride, 1, 1128
 Thallium(III) nitrate, 9, 460
 Thionyl chloride, 1, 1158

OXIDATION REACTIONS (*Continued*)

Triphenylphosphine dibromide, 4, 555

Ytterbium(III) nitrate, 6, 671

HYDROXYLAMINES $\rightarrow$ RNO

Benzeneseleninic anhydride, 8, 29; 10, 22

Bis(*p*-methoxyphenyl) telluroxide, 9, 50

1-Chlorobenzotriazole, 3, 46

Manganese(IV) oxide, 1, 637

Silver carbonate–Celite, 4, 425

Tetraethylammonium periodate, 2, 397; 9, 448

KETONES (AND RELATED COM-**POUNDS)** $\rightarrow$ 1,2-DICARBONYLS*t*-Butoxybis(dimethylamino)methane, 7, 41*t*-Butyl hydroperoxide, 1, 88*m*-Chloroperbenzoic acid, 10, 92*N,N*-Dimethyl-4-nitrosoaniline, 1, 746

Dimethyl sulfoxide, 6, 225

Dimethyl sulfoxide–Iodine, 8, 200; 9, 190

Iodine–Silver salts, 1, 504

Methyl 2-nitrophenyl disulfide, 9, 314

S-Methyl *p*-toluenethiosulfonate, 6, 400

Nitrosyl chloride, 1, 748

Osmium tetroxide–*t*-Butyl hydroperoxide, 1, 88

Oxygen, 1, 921

Oxygen, singlet, 6, 431; 9, 338; 12, 363

Ozone, 11, 387

Phenyl benzenethiosulfonate, 8, 391

Phenyl iodine(III) diacetate, 12, 384

Potassium permanganate, 1, 942

Pyridine, 1, 958

Selenium(IV) oxide, 1, 992; 7, 319

Sodium methoxide, 8, 463

Sodium nitrite, 1, 1097

Thionyl chloride, 8, 481

LACTOLS (AND RELATED**COMPOUNDS)** $\rightarrow$ LACTONES

Bromocarbamide, 1, 76

m-Chloroperbenzoic acid, 8, 97

Cobaloxime(I), 11, 135

B-Crotyl-9-borabicyclo[3.3.1]nonane, 12, 81

Crotyl carbamates, 12, 82

Lead tetraacetate, 1, 537

1-Methoxy-1,3-butadiene, 10, 258

Ozone, 6, 436

Pyridinium dichromate, 11, 453

Sodium tris(3,5-di-*t*-butylphenoxy)-

borohydride, 10, 369

Tributyltin hydride, 11, 545; 12, 516

METHYLENE GROUPS $\rightarrow$ C=O's (*see also* ArR $\rightarrow$ ArCHO, ALLYLIC OXIDATION)

Ammonium persulfate–Silver nitrate, 3, 15

Benzeneseleninic anhydride, 9, 32

Benzyl(trialkyl)ammonium salts, 1, 1252; 9, 43; 10, 28

Cerium(IV) ammonium nitrate, 2, 63; 7, 55

Chlorotris(triphenylphosphine)-rhodium(I), 2, 448

Chromium(VI) oxide, 5, 140; 7, 70; 9, 115

Chromyl acetate, 2, 78

Cobalt(II) acetate–Hydrogen bromide, 1, 154

2,3-Dichloro-5,6-dicyano-1,4-benzoquinone, 3, 83; 8, 153; 10, 135

Hexafluoroantimonic acid, 8, 239

Hexamethylphosphoric triamide, 3, 149

Manganese(III) acetylacetonate, 3, 194

Nitrogen dioxide, 1, 737

Oxygen, 1, 1253; 7, 258; 8, 366

Ozone–Silica gel, 8, 375; 9, 343

Potassium permanganate, 1, 942

Potassium persulfate, 11, 441

Pyridinium chlorochromate, 12, 417

Selenium(IV) oxide, 2, 360; 6, 509

Sodium dichromate, 1, 1059

Sodium hypochlorite, 1, 1084

Thallium(III) perchlorate, 8, 478

Thionyl chloride, 8, 481

NITRO COMPOUNDS $\rightarrow$ C=O's*t*-Butyl hydroperoxide, 8, 62*N''*-(*t*-Butyl)-*N,N,N',N'*-tetramethylguanidium *m*-iodylbenzoate, 12, 102

Cerium(IV) ammonium nitrate, 10, 79

Hydrogen peroxide, 10, 201

Mercury(II) nitrite, 9, 292

Nitroethylene, 5, 476

Nitrogen dioxide–Iodine, 8, 205

Oxidiperoxymolybdenum(pyridine)-(hexamethylphosphoric triamide), 11, 218

Oxygen, singlet, 8, 367

Ozone, 5, 491; 8, 374

Potassium permanganate, 1, 942; 10, 330; 11, 440

- Propyl nitrite–Sodium nitrite, 5, 565
Sodium hydroxide, 8, 461
Sodium methoxide, 6, 545
1,1,3,3-Tetramethylbutyl isocyanide, 5, 650
Titanium(III) chloride, 4, 506; 5, 669
Vanadium(II) chloride, 7, 418
NITROSO COMPOUNDS → RNO_2
t-Amyl hydroperoxide, 4, 20
t-Butyl hydroperoxide, 5, 75
Hypochlorous acid, 10, 208
Nitric acid, 1, 733; 3, 212
Trifluoroperacetic acid, 1, 821
PHENOLS (AND RELATED COMPOUNDS) → 6-SUBSTITUTED-1,4-CYCLOHEXADIEN-3-ONES
Acetic anhydride–Nitric acid, 5, 475
Antimony(V) chloride, 6, 22
Benzeneseleninic anhydride, 6, 240
Chromium(VI) oxide, 5, 140
2,3-Dichloro-5,6-dicyano-1,4-benzoquinone, 9, 148
Hydrogen peroxide–Cerium(IV) oxide, 6, 99
Lead tetraacetate, 6, 313; 7, 185
Manganese(IV) oxide, 1, 637
Oxygen, 6, 426
Oxygen, singlet, 11, 385
Perchloryl fluoride, 1, 802
Salcomine, 3, 245
Thallium(III) nitrate, 7, 362
Thallium(III) perchlorate, 5, 657; 8, 478
Trifluoromethyl hypofluorite, 2, 200
Tris(tetrabutylammonium)-hexacyanoferrate(III), 6, 656
PHENOLS → *o,p*-QUINONES
Benzeneseleninic anhydride, 7, 139; 9, 32; 10, 22
Bis(tricaprylylmethyl)ammonium nitrosodisulfonate, 10, 42
Copper(II)–Amine complexes, 8, 115
2,3-Dichloro-5,6-dicyano-1,4-benzoquinone, 6, 168; 7, 96; 10, 135
3,5-Dinitrobenzoyl *t*-butyl nitroxyl, 8, 204
4,4'-Dinitrodiphenylnitroxide, 2, 174
Ferric chloride, 7, 153
Hydrogen peroxide, 1, 457
Hydrogen peroxide + co-reagent, 6, 99; 7, 174
Iodylbenzene, 11, 275
Lead(IV) oxide, 3, 168
Mercury(II) oxide, 8, 316
Oxygen, singlet, 7, 261
Peracetic acid, 8, 386
Potassium nitrosodisulfonate, 1, 940; 2, 347; 4, 411; 10, 329
Salcomine, 2, 360; 3, 245; 6, 507; 12, 429
Sodium dichromate, 12, 131
Thallium(III) nitrate, 7, 362; 9, 460; 10, 395
Thallium(III) perchlorate, 8, 478
Thallium(III) trifluoroacetate, 3, 286; 4, 498; 9, 462
P COMPOUNDS
Bis(trimethylsilyl) peroxide, 11, 67
Dimethyl selenoxide, 8, 197
Nitrogen oxides, 1, 324
Oxygen, singlet, 6, 431
PROPARGYL ALCOHOLS → ACETYLENIC C=O's
Lead(IV) oxide, 2, 233
Manganese(IV) oxide, 1, 637; 4, 317
Nickel peroxide, 2, 294
Pyridinium chlorochromate, 6, 498
Se COMPOUNDS
Benzeneselenenyl halides, 5, 518; 6, 459
t-Butyl hydroperoxide, 8, 64
t-Butyl hypochlorite, 10, 66
m-Chloroperbenzoic acid, 11, 122; 12, 118
Oxygen, singlet, 7, 261
2-Pyridineselenenyl bromide, 11, 455
SULFIDES → RSOR
Acetyl nitrate, 7, 3
Benzoyl nitrate, 7, 3
Bis(tributyltin) oxide, 8, 43
Bromine, 9, 65
3-Bromo-4,5-dihydro-5-hydroperoxy-4,4-dimethyl-3,5-diphenyl-3H-pyrazole, 11, 76
N-Bromosuccinimide, 3, 34
t-Butyl hydroperoxide + co-reagent, 12, 90
t-Butyl hypochlorite, 1, 90
[(–)-Camphor-10-ylsulfonyl]-3-aryloxaziridines, 11, 108
Cerium(IV) ammonium nitrate, 4, 71
1-Chlorobenzotriazole, 3, 46
1,4-Diazabicyclo[2.2.2]octane–Bromine, 2, 99

OXIDATION REACTIONS (*Continued*)

- Dimethyl sulfoxide, 1, 296
 - Diphenyl sulfide, 6, 241
 - Hydrogen peroxide, 1, 471
 - Hydrogen peroxide + co-reagent, 8, 248; 9, 244
 - Hydrogen tetrachloroaurate(III), 5, 647
 - 2-Hydroperoxyhexafluoro-2-propanol, 10, 206
 - Iodolbenzene, 11, 275
 - Manganese(III) acetylacetonate, 3, 194
 - Manganese(IV) oxide, 1, 637
 - Nitrogen tetroxide, 1, 324
 - Oxygen, 9, 335
 - Perbenzoic acid, 3, 219; 7, 279
 - Periodates, 1, 809; 2, 311
 - Perlauric acid, 2, 315
 - Phenyl iodine(III) diacetate, 3, 166
 - Phenyl iodine(III) dichloride, 3, 164
 - Potassium peroxomonosulfate, 10, 328
 - Ruthenium tetroxide, 1, 986
 - Sodium perborate, 12, 452
 - Sodium permanganate, 10, 368
 - Sulfuryl chloride, 5, 641; 7, 350
 - Tetrabutylammonium periodate, 10, 381
 - Titanium(III) chloride-Hydrogen peroxide, 10, 401
 - Trifluoroperacetic acid, 11, 562
- SULFIDES, RSOR $\rightarrow$ RSO₂R**
- Benzyl(triethyl)ammonium permanganate, 11, 44
 - Bis(trimethylsilyl) peroxide, 11, 67
 - N-Bromosuccinimide, 3, 34
 - Hydrogen peroxide, 1, 471, 475; 10, 205
 - 2-Hydroperoxyhexafluoro-2-propanol, 10, 206
 - Iodosylbenzene, 1, 507
 - Manganese(III) acetylacetonate, 3, 194
 - Oxygen, 9, 335
 - Potassium permanganate, 8, 416
 - Potassium peroxomonosulfate, 10, 328
 - Ruthenium catalysts, 7, 314
 - Ruthenium tetroxide, 2, 357
 - Sodium perborate, 12, 452
 - Sodium periodate, 11, 492
 - Trifluoroperacetic acid, 11, 562
- THIOLS $\rightarrow$ RSSR**
- Alumina, 9, 8
 - Bis(*p*-methoxyphenyl) telluroxide, 9, 50
 - o*-Carboxyphenyl *o*-carboxybenzenethiosulfonate, 5, 100

- Cyanogen bromide, 5, 169
 - Diethyl azodicarboxylate, 2, 128
 - Dimethyl dithiobis(thioformate), 5, 247
 - Dimethyl sulfoxide, 1, 296; 5, 263; 12, 212
 - 2,4-Dinitrobenzenesulfonyl chloride, 6, 231
 - Ferric chloride, 1, 390
 - Ferric nitrate/K10 Bentonite, 12, 231
 - Hydrogen peroxide, 1, 471
 - Lead(II) acetate, 4, 276
 - Lead tetraacetate, 1, 537
 - Manganese(IV) oxide, 1, 637; 8, 312
 - Nickel peroxide, 10, 277
 - Phenyl iodine(III) bis(trifluoroacetate), 6, 301
 - Potassium superoxide, 9, 391
 - 1,3-Propanedithiol, 9, 394
 - 2-Pyridinesulfonyl chloride, 9, 397
 - Sodium trithiocarbonate, 9, 435
 - 2,4,4,6-Tetrabromo-2,5-cyclohexadienone, 6, 563
 - Tetramethylene sulfoxide, 1, 1145
 - Triphenylbismuth carbonate, 9, 501
- THIOLS $\rightarrow$ OTHER S COMPOUNDS**
- Barium permanganate, 1, 46
 - m*-Chloroperbenzoic acid, 5, 120
 - Hexamethylphosphoric triamide, 1, 430
 - Hydrofluoric acid, 6, 284
 - N-Hydroxymethylphthalimide, 8, 253
 - Potassium peroxomonosulfate, 1, 952
- OXIDATIVE CLEAVAGE OF ALCOHOLS**
- Cerium(IV) ammonium nitrate, 3, 44; 5, 101
 - 2,3-Dichloro-5,6-dicyano-1,4-benzoquinone, 10, 135
 - Fieser reagent, 1, 145
 - Hypohalite solution, 1, 488
 - Lead tetrakis(trifluoroacetate), 6, 318
 - Mercury(II) oxide-Iodine, 5, 347; 11, 267
 - Nitric acid, 1, 733
 - Potassium *t*-butoxide, 1, 911
 - Pyridinium dichromate, 10, 335
 - Silver carbonate-Celite, 5, 577
 - Sodium dichromate, 3, 54; 5, 138; 7, 68
- OF C=C $\rightarrow$ RCHO, R₂CO**
- Chromyl chloride, 4, 98
 - Chromyl trichloroacetate, 1, 152
 - Dimethyl sulfide, 2, 156; 5, 260

- Dioxygentetrakis(triphenylarsine)-rhodium(I) hexafluorophosphate, **8**, 206
- Ethoxycarbonylformonitrile oxide, **7**, 145
- Ferric chloride, **12**, 230
- Glyoxylic acid, **5**, 320
- Lindlar catalyst, **3**, 171
- Osmium tetroxide, **2**, 301
- Oxygen, **5**, 482; **9**, 335
- Oxygen, singlet, **6**, 431
- Ozone, **1**, 773; **4**, 363; **5**, 491; **8**, 374; **9**, 341; **10**, 295; **11**, 387
- Phosphatolead(IV) acids, **3**, 225
- Potassium permanganate, **5**, 562; **9**, 388
- Ruthenium tetroxide, **1**, 986; **2**, 357
- Sodium periodate + co-reagent, **1**, 810, 812; **2**, 312
- Thallium(III) nitrate, **5**, 656
- Thiourea, **11**, 519
- Trimethyl phosphite, **1**, 1233
- Triphenylphosphine, **1**, 1238
- OF C=C → RCOOH, R₂CO
- t*-Butyl hydroperoxide–Molybdenyl acetylacetonate, **11**, 91; **12**, 89
- 2,3-Dichloro-1-propene, **8**, 158
- Jones reagent, **3**, 54
- Ozone, **6**, 436; **7**, 269; **9**, 341
- Potassium permanganate, **1**, 942; **4**, 30, 143, 412; **6**, 175
- Potassium superoxide, **9**, 391
- Ruthenium tetroxide, **11**, 462
- Ruthenium tetroxide–Sodium periodate, **1**, 813
- Sodium periodate–Potassium permanganate, **1**, 810; **2**, 312; **6**, 455
- Sodium ruthenate, **5**, 622
- Tetrabutylammonium salts, **5**, 644; **8**, 468
- OF ArR (*see* OXIDATION REACTIONS)
- OF C≡C
- Oxygen, **9**, 335
- Ruthenium(IV) oxide–Sodium hypochlorite, **4**, 421
- Thallium(III) nitrate, **4**, 492
- OF ArH → DICARBONYLS
- N-Benzoylperoxycarbamic acid, **6**, 35
- Dimethyl sulfide, **2**, 156
- Glyoxal, **1**, 413
- Hydrogen peroxide, **1**, 457
- Oxygen, **6**, 426
- Ozone, **1**, 773; **6**, 436; **9**, 341
- Peracetic acid, **1**, 785
- Potassium permanganate, **1**, 942
- Ruthenium(IV) oxide–Sodium hypochlorite, **6**, 506
- Ruthenium tetroxide, **2**, 357
- BICYCLIC ALKENES →
- MACROLIDES
- m*-Chloroperbenzoic acid, **1**, 135; **2**, 68
- Lithium–Alkylamines, **2**, 241
- Molybdenum carbonyl, **3**, 206
- Oxygen, singlet, **8**, 367; **9**, 9
- Ozone, **6**, 436; **12**, 365
- OF CYCLOALKANEDIONES →
- DIACIDS
- Dicyclopentadienylcobalt–Oxygen adduct, **5**, 145
- Hydrogen peroxide, **1**, 457, 466
- Perbenzoic acid, **1**, 791
- Periodates, **1**, 809
- Phenyl benzenethiosulfonate, **8**, 391
- Potassium superoxide, **7**, 304
- Sodium hypochlorite, **1**, 1084; **9**, 430
- OF CYCLOALKENES → DIACIDS (*see also* OXIDATIVE CLEAVAGE OF C=C)
- Brij 30, **1**, 892
- t*-Butyl hydroperoxide–Molybdenyl acetylacetonate, **11**, 91
- Ozone, **1**, 773; **9**, 341
- Ruthenium(IV) oxide–Sodium periodate, **5**, 508
- Sodium dichromate, **3**, 54
- Sodium periodate–Potassium permanganate, **1**, 810
- OF α-DICARBONYLS (*see also* OXIDATIVE CLEAVAGE—CYCLOALKANEDIONES)
- Calcium hypochlorite, **11**, 107
- Copper(I) chloride, **11**, 140
- Dicyclopentadienylcobalt–Oxygen adduct, **5**, 145
- Dimethyl sulfoxide, **7**, 133
- Hydrogen peroxide, **1**, 466
- Iodosylbenzene, **10**, 213
- Nickel peroxide, **1**, 731
- Oxygen, **9**, 335
- Oxygen, singlet, **7**, 261; **11**, 385
- Perbenzoic acid, **1**, 791
- Perchloric acid, **1**, 796

OXIDATIVE CLEAVAGE (*Continued*)

Potassium superoxide, 7, 304

Trimethyl phosphite, 1, 1233

OF β -DICARBONYLS (*see also***OXIDATIVE CLEAVAGE—
CYCLOALKANEDIONES**)

Hydrogen peroxide, 1, 457

Periodates, 1, 809

OF DIOLS (AND RELATED**COMPOUNDS) $\rightarrow$ RCHO, R₂CO**

Benzoin, 6, 34

N^{''}-(*t*-Butyl)-N,N,N',N'-tetramethyl-
guanidinium *m*-iodylbenzoate, 12, 102

Calcium hypochlorite, 11, 107

Cerium(IV) ammonium nitrate, 4, 71

Chlorotrimethylsilane, 6, 626

Chromium(VI) oxide, 2, 72; 4, 96

Cobalt(II) acetate, 2, 80

N-Iodosuccinimide, 10, 216

Iodylbenzene, 11, 275

Lead tetraacetate, 1, 537

Lead tetrakis(trifluoroacetate)-Diphenyl
disulfide, 9, 269

Manganese(IV) oxide, 5, 422

Oxygen, 9, 335

Periodates, 2, 311

Periodic acid, 1, 815; 2, 313; 4, 374

Phenyliodine(III) bis(trifluoroacetate), 6,
301

Phenyliodine(III) diacetate, 1, 508

Phosphatolead(IV) acids, 3, 225

Potassium persulfate-Silver nitrate, 1,
954

Pyridinium chlorochromate, 11, 450

Silver carbonate-Celite, 5, 577; 6, 511

Silver iododibenzoate, 3, 251

Sodium bismuthate, 1, 1045

Sodium periodate, 11, 492

Thallium(III) nitrate, 4, 492

Triphenylbismuth carbonate, 9, 501; 11,
587

Zinc, 2, 459

OF DIOLS (AND RELATED**COMPOUNDS) $\rightarrow$ RCOOH, R₂CO**

Cobalt(II) acetate, 2, 80

Kiliani reagent, 1, 144

Lead tetraacetate, 6, 313

Periodic acid-Chromium(VI) oxide, 2,
315

Ruthenium tetroxide, 11, 462

Xenic acid, 2, 458

OF EPOXIDES

2-Butanone, 1, 678

Dimethyl sulfoxide, 1, 296; 2, 157

Hydrogen peroxide, 7, 174

Periodic acid, 1, 815; 5, 508

OF α -HYDROXY C=O's (AND**RELATED COMPOUNDS) $\rightarrow$
RCOOH, R₂CO**

Calcium hypochlorite, 11, 107

Cerium(IV) ammonium nitrate, 4, 71

Hydrogen peroxide, 8, 247

Lead tetraacetate, 7, 185

Nickel peroxide, 1, 731

Potassium superoxide, 7, 304

Sodium bismuthate, 1, 1045

Tetrabutylammonium periodate, 10, 381

OF α -HYDROXY C=O's (AND**RELATED COMPOUNDS) $\rightarrow$
RCHO, R₂CO**

Benzeneseleninic anhydride, 8, 29

N-Bromosuccinimide, 1, 78

Calcium hypochlorite, 11, 107

Cerium(IV) ammonium nitrate, 4, 71

2-Chloro-3-ethylbenzoxazolium
tetrafluoroborate, 8, 90; 9, 105

2,4-Dinitrofluorobenzene, 1, 321

Dipotassium tetrachloroplatinate(II), 4,
215

Hydrogen peroxide, 1, 472; 8, 247

N-Iodosuccinimide, 12, 258

Lead tetraacetate, 1, 537; 5, 365; 8, 269

Methylthioacetic acid, 6, 395

Periodic acid, 1, 815; 2, 313

Phosphonitrilic chloride trimer, 6, 469

Phosphoryl chloride, 1, 876

Potassium *t*-butoxide, 2, 336

Pyridine N-oxide, 2, 353

Sodium bismuthate, 1, 1045

Sodium hypochlorite, 1, 1084

N-Sulfinylaniline, 6, 556

Tetrabutylammonium periodate, 10, 381

Tributyl(iodoacetoxy)tin, 12, 258

OF KETONES

Butyl azide, 1, 84

Caro's acid, 1, 118

Chloramine, 1, 122

Cobalt(II) acetate, 4, 99

4,4-Dichloro-3-buten-1-ol, 5, 192

Diphenyl phosphoroazide, 10, 173

Ferric chloride, 12, 230

Hexamethylphosphoric triamide, 1, 430

- Hydrogen peroxide–Selenium(IV) oxide, 1, 477
- Hypohalite solution, 1, 488
- Iodine–Pyridine, 1, 503
- Nitric acid, 1, 733
- Potassium *t*-butoxide, 1, 911; 2, 336; 9, 380
- Potassium hydroxide–Carbon tetrachloride, 5, 96
- Potassium permanganate, 1, 942
- Potassium superoxide, 9, 391; 11, 442
- Silver perchlorate, 2, 369
- Sodium dichromate, 1, 1059
- Sodium hypohalite, 1, 1083, 1084
- Tetra- μ_3 -carbonyldodecacarbonyl-hexarhodium, 6, 504
- Zinc permanganate, 12, 576
- OF *o*-PHENYLENEDIAMINES
- Copper(I) chloride, 5, 164; 7, 80; 8, 118
- Lead tetraacetate, 1, 537
- Nickel peroxide, 1, 731
- OXIDATIVE COUPLING** (*see also* COUPLING REACTIONS)
- OF CARBANIONS, RM
- Copper, 12, 140
- Copper(I) iodide–Tributylphosphine, 2, 400
- Copper(II) tetrafluoroborate, 12, 144
- Hydrogen peroxide, 8, 247
- Lithium aluminum hydride, 9, 274
- Lithium dibutylcuprate, 3, 79
- (R)-4-Methylcyclohexylidene-methylcopper, 7, 238
- Molybdenum carbonyl, 7, 247
- Nickel(II) acetylacetonate, 11, 58
- Silver(I) nitrate, 2, 366; 4, 429
- Triphenyl phosphite ozonide, 7, 408
- OF ArH (*see* COUPLING REACTIONS)
- OF ArOH
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 - t*-Butyldimethylchlorosilane, 9, 77
 - N,N'-Carbonyldiimidazole, 6, 97
 - Copper(II) sulfate, 8, 125
 - Dibromomethane, 11, 157
 - Di-*t*-butyldichlorosilane, 11, 159
 - Dichlorodimethylsilane, 3, 114
 - Diisopropylbis(trifluoromethanesulfonato)silane, 11, 189
 - 2,2-Dimethoxypropane, 5, 226
 - N,N-Dimethylacetamide dimethyl acetal, 4, 166
 - Dimethyl sulfoxide, 3, 119
 - Dimethyl sulfoxide-N-Bromosuccinimide, 4, 199
 - 2-Methoxypropene, 11, 329; 12, 317
 - Perchloric acid, 3, 220
 - Phase-transfer catalysts, 8, 387
 - 2-Phenyl-1,3-dithiolane, 6, 26
 - Tetramethyl orthocarbonate, 3, 285
 - 2-Trimethylsilyloxy-1-propene, 5, 718
 - 1,3-
 - Acetone, 3, 4
 - Benzaldehyde, 6, 26
 - Benzeneboronic acid, 5, 513; 7, 284
 - Bis(1-methoxy-2-methyl-1-propenyloxy)dimethylsilane, 12, 58
 - Boronic acid resins, 7, 284
 - Diacetoxymethylsilane, 3, 113
 - Dibromomethane, 11, 157
 - Di-*t*-butyldichlorosilane, 11, 159
 - 2,2-Diethoxypropane, 5, 208
 - Diisopropylbis(trifluoromethanesulfonato)silane, 11, 189
 - 2-Methoxypropene, 11, 329
 - 2-Phenyl-1,3-dithiolane, 6, 26
- LACTONES**
- Bis(dimethylaluminum) 1,2-ethanedithiolate, 5, 35
 - m*-Chloroperbenzoic acid, 8, 97
- α -METHYLENE LACTONES**
- Bromine, 11, 75
 - Dimethylamine, 7, 119
 - Diphenyl diselenide, 5, 272
 - Sodium thiophenoxide, 6, 552
- PHENOLS**
- Benzyl *p*-toluenesulfonate, 11, 44
 - p*-Bromophenacyl bromide, 3, 34

- Chloromethyl methyl ether, 1, 132; 7, 61
- Chloromethyl methyl sulfide, 8, 94
- 2-Chlorotetrahydrofuran, 9, 112
- Crown ethers, 5, 152
- 3,4-Dihydro-2H-pyran, 1, 256
- Fluorene-9-carboxylic acid, 1, 394
- Hexamethyldisilazane, 6, 273
- Ion-exchange resins, 9, 256
- Isopropyl bromide, 9, 69
- Ketene alkyl trialkylsilyl acetals or ketals, 9, 310
- Phase-transfer catalysts, 8, 387
- Sodium methanethiolate, 5, 626
- Sulfuryl chloride, 7, 356
- Trimethylacetyl chloride, 8, 404
- Triphenylmethyl chloride, 1, 1254
- Vinyl chloroformate, 8, 530
- Zinc, 10, 459

PHOSPHATES

- t*-Butylamine, 10, 62
- 9-Fluorenylmethanol, 5, 308
- 2-Phenylthioethanol, 5, 516
- Tetrabutylammonium fluoride, 7, 353
- 2-Trimethylsilyl-2-propen-1-ol, 9, 497
- 2-(*p*-Triphenylmethylphenyl)-thioethanol, 7, 414

QUINONES

- Cyanotrimethylsilane, 5, 720; 7, 397
- Hexamethyldisilane, 11, 253
- Silver(II) oxide, 4, 431

THIOLS, THIOPHENOLS

- o*-Carboxyphenyl *o*-carboxy-benzenethiosulfonate, 5, 100
- Diethyl methylenemalonate, 3, 96
- 3,4-Dihydro-2H-pyran, 1, 256
- Methoxymethyl isocyanate, 5, 439
- o*-Nitrobenzenesulfonyl chloride, 10, 277
- 2-Picolyl chloride 1-oxide hydrochloride, 6, 472

- Sodium methanethiolate, 5, 626
- Sulfuryl chloride, 7, 356

- Trifluoroacetic anhydride, 12, 530
- Triphenylmethyl chloride, 1, 1254

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- 6-Methoxy-7-hydroxy-3,4-dihydro-isoquinolinium methiodide, 4, 329
- Phase-transfer catalysts, 12, 379
- Sodium iodide, 3, 267; 12, 449
- Zinc carbonate, 4, 579

PUMMERER REARRANGEMENT

- Acetic anhydride, 5, 3; 11, 1

Acetic anhydride + co-reagent, 6, 3, 5;
7, 2; 8, 2

Acetyl chloride, 4, 5

Cerium(IV) ammonium nitrate, 4, 71

Chlorotrimethylsilane, 6, 626

2,2-Dimethyl-6-(*p*-chlorophenyl-
thiomethylene)cyclohexanone, 6, 208

Iodine, 2, 220

Methoxy(phenylthio)methyl lithium, 6,
369

Methyl methylthiomethyl sulfone, 11,
242

Phenylthiotrimethylsilylmethane, 10, 313

Sodium methylsulfinylmethylide, 1, 310

Tin(II) trifluoromethanesulfonate, 12,
490

Trifluoroacetic anhydride, 12, 530

RAMBERG-BACKLUND REACTION

(see ELIMINATION REACTIONS)

REDUCTION REACTIONS (see also

ACYLOIN REACTION, ASYMMETRIC REACTIONS, DEOXYGENATION, REDUCTIVE...)

ACETALS, KETALS → ROR

Diborane, 5, 184

Diisobutylaluminum hydride, 1, 260

Lithium aluminum hydride, 1, 595; 5,
382, 389; 9, 277

Rhodium catalysts, 1, 979

Sodium bis(2-methoxyethoxy)aluminum
hydride, 9, 418

Sodium cyanoborohydride, 8, 454; 11,
481

Triethylsilane, 1, 1218

Trimethylsilyl trifluoromethane-
sulfonate, 9, 497; 11, 584

ACETATES, OTHER ROCOR' → RH

Calcium-Ammonia, 1, 106

Chromium(II) chloride, 1, 149; 2, 76

Lithium-Ethylamine, 8, 284

Palladium(II) acetate, 12, 367

Palladium catalysts, 2, 303

Potassium, 9, 377

Sodium, 9, 416

Tetrakis(triphenylphosphine)-
palladium(0), 10, 384

Trichlorosilane, 6, 606

Zinc, 1, 1276; 4, 574

ACETYLENIC C=O's → PROPARGYL

ALCOHOLS

Darvon alcohol, 10, 154

2,2'-Dihydroxy-1,1'-binaphthyl, 12, 190

NB-Enanthrene, 11, 229

Lithium aluminum hydride, 1, 581

Lithium aluminum hydride +
co-reagent, 8, 184; 9, 308; 10, 148

Phosphorus(V) sulfide, 10, 320

B-3-Pinanyl-9-borabicyclo[3.3.1]nonane,
11, 429; 12, 397

Potassium tri-*sec*-butylborohydride, 7,
307

ACYL HALIDES → ROH

9-Borabicyclo[3.3.1]nonane, 7, 29

Borane-Alkylamines, 1, 16

Diisobutylaluminum hydride, 12, 191

Lithium aluminum hydride, 1, 581; 12,
272

Lithium aluminum hydride-Aluminum
chloride, 1, 595

Lithium borohydride, 1, 603

Sodium bis(2-methoxyethoxy)aluminum
hydride, 3, 260

Sodium borohydride, 1, 1049

Sodium borohydride + co-reagent, 1,
1053; 9, 421; 12, 444

Sodium cyanoborohydride, 4, 448

Sodium trimethoxyborohydride, 1, 1108

Tetrabutylammonium octahydro-
triborate, 11, 501

ACYL HALIDES → RCHO

Aziridine, 1, 378

μ -Bis(cyanotrihydroborato)tetrakis-
(triphenylphosphine)dicopper(I), 10,
33

Bis(triphenylphosphine)copper(I)
borohydride, 8, 47; 9, 57; 10, 47

Cadmium borohydride, 12, 574

N,O-Dimethylhydroxylamine, 11, 201

Disodium tetracarbonylferrate, 4, 461

Hydrido(tributylphosphine)copper(I), 3,
154

Imidazole, 1, 492

Lithium aluminum hydride, 1, 581

Lithium tri-*t*-butoxyaluminum hydride,
1, 620; 2, 251

Methanesulfonic acid, 4, 326

S-Methyl-1,4-diphenylisothiosemi-
carbazine, 5, 445

3-Methyl-1-phenyl-2-phospholene, 6,
392

Palladium catalysts, 1, 975; 4, 368; 9, 351

REDUCTION REACTIONS (*Continued*)

- Palladium on barium sulfate, 7, 275
- Pyridine, 11, 448
- Rosenmund catalyst, 1, 975; 4, 367
- Sodium borohydride, 10, 357
- Sodium borohydride-Cadmium chloride-DMF, 8, 451; 10, 359
- Tetracarbonyl(cyclopentadienyl)-vanadium, 8, 468
- Tetramethylammonium tetracarbonylhydridoferrate, 8, 476
- Tetramethylthiourea, 1, 1145
- 1,3-Thiazolidine-2-thione, 11, 518
- Tributyltin hydride, 1, 1192; 10, 411; 11, 545
- Triethylsilane, 3, 304
- Zinc borohydride, 12, 574

ALCOHOLS → RH (*see* DEOXYGENATION)**ALDEHYDES, KETONES** → ROH

Al-based reagents

- Alumina, 8, 9
- Aluminum amalgam, 1, 20
- Aluminum *t*-butoxide, 2, 21
- Aluminum hydride, 5, 13
- Aluminum isopropoxide, 1, 35; 4, 15
- N,N*-(Diethylethanamine)-trihydridoaluminum, 6, 607
- Diisobutylaluminum hydride, 6, 198; 12, 191
- Isobornyloxyaluminum dichloride, 1, 522
- Lithium aluminum hydride, 1, 581; 12, 272
- Lithium aluminum hydride + co-reagent, 1, 595, 599; 11, 293
- Lithium *n*- or *t*-butyldiisobutylaluminum hydride, 10, 239; 11, 296; 12, 276
- Lithium trialkoxyaluminum hydrides, 1, 620, 625; 2, 251; 3, 188; 4, 312; 5, 392
- Sodium bis(2-methoxyethoxy)-aluminum hydride, 3, 260; 5, 596; 9, 418
- Tetra- μ -hydridotetrahydroaluminummagnesium, 4, 316
- Tetramethylammonium borohydride, 1, 1143
- Trialkylaluminums, 1, 1188; 9, 486; 11, 539

B-based reagents

- μ -Bis(cyanotrihydroborato)tetrakis-(triphenylphosphine)dicopper(I), 10, 33
- Bis(triphenylphosphine)copper(I) borohydride, 10, 47
- 9-Borabicyclo[3.3.1]nonane, 7, 29
- 9-Borabicyclo[3.3.1]nonane ate complexes, 7, 30
- Borane-Alkylamines, 1, 16, 963, 1229; 9, 59; 10, 12; 11, 87, 188, 219
- Borane-Tetrahydrofuran, 1, 199; 2, 106; 3, 76
- Butyllithium-Pyridine, 2, 351
- Calcium borohydride, 2, 57
- Catecholborane, 8, 79
- Chlorobis(cyclopentadienyl)tetrahydroboratozirconium(IV), 9, 103
- Dicyclohexylborane, 5, 39
- Diisopinocampheylborane, 5, 39
- Disiamylborane, 1, 57; 3, 22; 5, 39
- Lithium borohydride, 1, 603
- Lithium butylborohydride, 11, 294
- Lithium cyanoborohydride, 3, 183
- Lithium 9,9-dibutyl-9-borabicyclo[3.3.1]nonanate, 7, 30
- Lithium dimesitylborohydride bis-(dimethoxymethane), 5, 408
- Lithium perhydro-9b-boraphenylhydride, 3, 187; 4, 309
- Lithium tri-*sec*-butylborohydride, 4, 312; 12, 286
- Lithium triethylborohydride, 8, 309; 11, 288; 12, 289
- Lithium trisiamylborohydride, 7, 216
- Potassium borohydride-($-$)-*N*-Dodecylmethylephedrinium bromide, 6, 249
- Potassium 9-(2,3-dimethyl-2-butoxy)-9-borabicyclo[3.3.1]nonane, 12, 406
- Potassium tri-*sec*-butylborohydride, 5, 557; 6, 490; 11, 445
- Potassium triisopropoxyborohydride, 5, 565
- Sodium acetanilidoborohydride, 7, 325
- Sodium borohydride, 1, 1049; 3, 262; 5, 597; 10, 357; 12, 441
- Sodium borohydride + co-reagent, 1, 1053; 6, 175, 249; 10, 198, 359; 11, 479

- Sodium borohydride, sulfurated, **3**, 264; **4**, 444
- Sodium cyanoborohydride, **4**, 448; **5**, 607
- Sodium triacetoxyborohydride, **12**, 453
- Sodium trimethoxyborohydride, **1**, 1108
- Tetrabutylammonium borohydride, **7**, 352; **10**, 378
- Tetrabutylammonium cyanoborohydride, **5**, 645
- Tetrabutylammonium octahydrotriborate, **11**, 501
- Tetramethylammonium borohydride, **1**, 1143
- Thexylborane, **4**, 175
- Thexylborane–N,N-Diethylaniline, **9**, 464
- Tributylborane, **10**, 410
- Zinc borohydride, **3**, 337; **10**, 460; **11**, 599; **12**, 572, 574
- Zinc bromide, **11**, 600
- Catalytic hydrogenation
- Chlorotris(triphenylphosphine)-rhodium(I), **3**, 325
- Iridium catalysts, **2**, 434
- Nickel(II) acetate–Sodium hydride–*t*-Amyloxide, **10**, 365
- Nickel catalysts, **1**, 718; **7**, 312; **11**, 356
- Palladium catalysts, **3**, 218
- Platinum catalysts, **1**, 1220
- Raney nickel, **5**, 570; **7**, 312
- Rhenium heptaselenide, **1**, 979
- Rhodium catalysts, **1**, 982; **6**, 503; **8**, 433
- Ruthenium catalysts, **1**, 983
- Ruthenium–Silica, **10**, 342
- Tin(II) chloride, **1**, 1113
- Trihydridobis(triphenylphosphine)-iridium(III), **2**, 434
- Urushibara catalysts, **4**, 571; **5**, 743; **6**, 659; **7**, 417
- Metals + solvents
- Lithium + solvent, **4**, 246; **5**, 543; **7**, 195
- Potassium–Graphite, **4**, 397
- Potassium–Hexamethylphosphoric triamide, **4**, 245; **5**, 543
- Sodium + solvent, **4**, 246; **5**, 543; **11**, 472
- Sodium amalgam, **1**, 1030
- using other Methods
- Butyllithium–Pyridine, **2**, 351
- Butylphenyltin dihydride, **6**, 92
- Chlorotris(triphenylphosphine)-rhodium(I), **3**, 325; **6**, 652
- Copper(I) bromide–Lithium trimethoxyaluminum hydride, **8**, 120
- Copper–Chromium oxide, **1**, 157
- Copper hydride ate complexes, **5**, 330; **6**, 492
- Dichlorobis(cyclopentadienyl)-titanium, **10**, 130
- Dichlorotris(triphenylphosphine)-ruthenium(II), **6**, 654; **11**, 171
- Dicyclopentadienyltitanium, **5**, 672
- Dihydridotetrakis(triphenylphosphine)ruthenium(II), **7**, 109
- 2,6-Diisopropylphenoxymagnesium hydride, **8**, 175
- Dimethylphenylsilane, **12**, 209
- Diphenyltin dihydride, **1**, 349; **11**, 224
- Ferric chloride–Sodium hydride, **7**, 155
- Formamidinesulfinic acid, **4**, 506; **5**, 668; **6**, 586
- Hydrogen hexachloroiridate(IV), **1**, 131; **2**, 67; **3**, 47; **4**, 83; **5**, 119
- Hydrogen telluride, **10**, 205
- Iridium(IV) chloride, **2**, 228; **3**, 166
- Lithium butyl(hydrido)cuprate, **5**, 330
- Lithium dibutylcuprate, **5**, 187
- Lithium pyrrolidide, **5**, 416
- Nickel(II) acetate–Sodium hydride–*t*-Amyloxide, **10**, 365
- Polymethylhydrosiloxane, **4**, 393
- Potassium hydroxide, **3**, 238
- Samarium(II) iodide, **8**, 439; **10**, 344
- Sodium dithionite, **8**, 456; **9**, 426
- Tributyltin hydride, **1**, 1192; **3**, 294; **9**, 477; **12**, 525
- Triethoxysilane, **11**, 554
- Trifluoroacetic acid–Alkylsilanes, **6**, 616
- Ytterbium(II) iodide, **8**, 439
- Reduction to axial alcohols
- Aluminum *t*-butoxide, **2**, 21
- Butyllithium–Pyridine, **2**, 351
- Chlorotris(triphenylphosphine)-rhodium(I), **3**, 325
- 2,6-Diisopropylphenoxymagnesium hydride, **8**, 175

REDUCTION REACTIONS (*Continued*)

- Hydrogen hexachloroiridate(IV), 1, 131; 2, 67; 3, 47; 4, 83; 5, 119
 Iridium(IV) chloride, 2, 228; 3, 166
 Isobornyloxyaluminum dichloride, 1, 522
 Lithium *t*-butyldiisobutylaluminum hydride, 10, 239; 11, 296
 Lithium perhydro-9b-boraphenylhydride, 3, 187
 Lithium trialkoxyaluminum hydrides, 1, 620; 5, 392
 Lithium tri-*sec*-butylborohydride, 4, 312
 Lithium trisiamylborohydride, 7, 216
 Nickel catalysts, 5, 570
 Potassium 9-(2,3-dimethyl-2-butoxy)-9-boratabicyclo[3.3.1]nonane, 12, 406
 Potassium tri-*sec*-butylborohydride, 5, 557
 Potassium triisopropoxyborohydride, 5, 565
 Rhodium catalysts, 8, 433
 Triisobutylaluminum, 1, 1188
 Urushibara catalysts, 5, 743; 6, 659
 Reduction to equatorial alcohols
 μ -Bis(cyanotrihydroborato)tetrakis-(triphenylphosphine)dicopper(I), 10, 33
 Chlorotris(triphenylphosphine)-rhodium(I), 3, 325
 N,N-(Diethylethanamine)-trihydridoaluminum, 6, 607
 Lithium aluminum hydride, 1, 581
 Lithium aluminum hydride-Aluminum chloride, 1, 595
 Lithium butylborohydride, 11, 294
 Lithium perhydro-9b-boraphenylhydride, 3, 187
 Sodium-Ammonia, 11, 472
 Sodium borohydride, 3, 262
 Sodium borohydride-Palladium(II) chloride, 11, 479
 Sodium borohydride, sulfurated, 4, 444
 Sodium cyanoborohydride, 5, 607
 Selective reduction of RCHO
 Alumina, 6, 16; 8, 9
 Bis(triphenylphosphine)copper(I) borohydride, 10, 47
 9-Borabicyclo[3.3.1]nonane-Pyridine, 8, 49
 Catecholborane, 8, 79
 Dichlorotris(triphenylphosphine)-ruthenium(II), 8, 159
 Formaldehyde, 1, 397
 8-Hydroxyquinolinedihydroboronite, 12, 252
 Lithium cyanoborohydride, 1, 618; 3, 183
 Lithium 9,9-dibutyl-9-borabicyclo-[3.3.1]nonanate, 7, 30
 Lithium tris(3-ethyl-3-pentyloxy)-aluminum hydride, 11, 305
 B-(3-Methyl-2-butyl)-9-borabicyclo-[3.3.1]nonane, 8, 334
 Samarium(II) iodide, 8, 439; 10, 344
 Sodium borohydride-Alkanethiols, 8, 449
 Sodium borohydride, sulfurated, 4, 444
 Sodium triacetoxymethylborohydride, 6, 553
 Sodium tris(3,5-dimethylphenoxy)-borohydride, 10, 369
 Tetrabutylammonium borohydride, 10, 378; 11, 499
 Tetrabutylammonium cyanoborohydride, 5, 645
 Tin(II) chloride, 1, 1113
 Tributyltin hydride, 9, 477; 12, 525
 Trihydridobis(triphenylphosphine)-iridium(III), 2, 434
 Ytterbium(II) iodide, 8, 439
 Selective reduction of R₂CO
 Borane-Tetrahydrofuran, 11, 487
 Erbium(III) chloride, 11, 232
 Lithium dibutylcuprate, 5, 187
 Lithium pyrrolidide, 5, 416
 Lithium tri-*t*-butoxyaluminum hydride, 10, 248
 Sodium borohydride-Cerium(III) chloride, 9, 422
 Reduction of ArCHO
 Borane-Tetrahydrofuran, 2, 106
 Chromium(II) chloride, 1, 149
 Diimide, 3, 99
 Reduction of Ar₂CO
 Lithium diisopropylamide, 8, 292
 Sodium-Ammonia, 4, 290
 Sodium bis(2-methoxyethoxy)-aluminum hydride, 4, 441

- Sodium hydride, 1, 1075; 4, 452
Zinc, 1, 1276
- ALDEHYDES, KETONES $\rightarrow$ C=C
OR $-\text{CH}_2-$ (see DEOXYGENATION)
- ALKENES $\rightarrow$ RH
- Catalytic hydrogenation
- Chloro(hexamethylbenzene)-hydridotriphenylphosphine-rhodium, 8, 153
 - Chlorohydridotris(triphenylphosphine)ruthenium(II), 7, 60
 - Chlorotris(triphenylphosphine)-rhodium(I), 1, 140, 1252; 2, 448; 4, 559; 6, 652; 9, 113
 - (1,5-Cyclooctadiene)bis(trialkyl- or arylphosphine)iridium(I) hexafluorophosphate, 8, 135; 10, 116; 12, 151
 - Dicarbonyldichlorobis(triphenylphosphine)ruthenium(II), 4, 421
 - Di- μ -chlorodichlorobis(pentamethylcyclopentadienyl)dirhodium, 8, 152
 - Hydrogen hexachloroplatinate(IV) + co-reagent, 1, 890; 3, 51
 - Iridium catalysts, 2, 228; 8, 135; 9, 257
 - Lindlar catalyst, 4, 283
 - Nickel(II) acetate-Sodium hydride-*t*-Amyloxide, 10, 365
 - Nickel boride, 1, 720; 3, 208; 4, 351; 5, 471
 - Nickel catalysts, 1, 720; 2, 293; 7, 312; 10, 339
 - Palladium catalysts, 6, 443, 445; 9, 351
 - Palladium(II) chloride-Diphenylbenzylphosphine, 6, 450
 - Perchloric acid, 1, 796
 - Polymethylhydrosiloxane, 4, 393
 - Potassium-Graphite, 7, 296
 - Raney nickel, 1, 723; 2, 293; 5, 570; 7, 312; 10, 339
 - Rhodium catalysts, 1, 979; 12, 426
 - Ruthenium catalysts, 1, 983
 - Tetrahydrofuran, 1, 1140
 - Tributylborane, 1, 1190
 - Urushibara catalysts, 4, 571; 6, 659
- Diimide reduction
- Diimide, 1, 42, 257; 2, 139; 4, 535; 6, 195; 8, 172
 - Potassium azodicarboxylate, 1, 909
- Hydrometallation-protonation
- Borane-Tetrahydrofuran, 1, 199
 - Borane-Trimethylamine, 1, 1229
 - Chlorobis(cyclopentadienyl)-hydrido-zirconium(IV), 6, 175
 - Dichlorobis(cyclopentadienyl)-titanium, 9, 46; 10, 130
 - Dichlorobis(cyclopentadienyl)-zirconium-*t*-Butylmagnesium chloride, 12, 171
 - Lithium aluminum hydride, 9, 274
 - Lithium aluminum hydride-Dichlorobis(cyclopentadienyl)-zirconium, 10, 237
 - Lithium triethylborohydride, 8, 309
 - Sodium bis(2-methoxyethoxy)-aluminum hydride, 6, 528
 - Thexylborane, 1, 276
 - Tributylborane, 1, 1190
- Metals + acid
- Birch reduction, 4, 31
 - Lithium-Ethylenediamine, 1, 614; 9, 274
 - Magnesium-Methanol, 10, 251
 - Sodium + solvent, 2, 27; 3, 151
 - Zinc-copper couple, 12, 569
- other Methods
- Chlorotris(triphenylphosphine)-rhodium(I), 6, 652
 - Chromium(II) sulfate, 2, 77
 - Cobalt(II) phthalocyanine, 11, 138
 - Dicyclopentadienyltitanium, 5, 672
 - Lithium aluminum hydride, 2, 242
 - Lithium aluminum hydride-Cobalt(II) chloride, 8, 291
 - Lithium tri-*sec*-butylborohydride, 12, 286
 - Palladium(II) chloride, 12, 371
 - Sodium hydrazide, 1, 1074
 - Sodium hydrogen telluride, 8, 459
 - Titanium(IV) chloride-Lithium aluminum hydride, 7, 372
 - Trifluoroacetic acid-Alkylsilanes, 6, 616
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- Aluminum chloride, 7, 7
 - Aluminum hydride, 6, 19
 - Ammonium acetate, 1, 38
 - 1-Benzyl-1,4-dihydronicotinamide, 7, 15
 - 9-Borabicyclo[3.3.1]nonane, 6, 62
 - 9-Borabicyclo[3.3.1]nonane ate complexes, 11, 295
 - Borane + co-reagent, 3, 76, 299

REDUCTION REACTIONS (*Continued*)

- B-Butyl-9-borabicyclo[3.3.1]nonane, **11**, 88
 Butylphenyltin dihydride, **6**, 92
 Chromium(II) acetate, **1**, 147; **2**, 75; **5**, 143
 Chromium(II)-Amine complexes, **3**, 57
 Chromium(II) chloride, **1**, 149; **3**, 60; **5**, 144
 Chromium(II) perchlorate-Butanethiol, **10**, 101
 Chromium(II) sulfate, **1**, 150
 Cobalt(II) phthalocyanine, **11**, 138
 Copper hydride ate complexes, **3**, 154; **5**, 168, 330; **6**, 492; **8**, 120
 Dichlorobis(cyclopentadienyl)titanium, **6**, 179
 Dicyclopentadienyltitanium, **5**, 672; **6**, 596
 Diethyl phosphite, **12**, 187
 2,6-Diisopropylphenoxy magnesium hydride, **8**, 175
 Diphenyltin dihydride, **3**, 134
 Grignard reagents, **1**, 415
 Hexaethylphosphorous triamide, **3**, 148
 Hydrazine, **5**, 327
 Iodoform, **3**, 165
 Lithium + solvent, **1**, 604; **4**, 291; **6**, 322
 Lithium aluminum hydride, **1**, 581; **4**, 291; **5**, 382; **10**, 236; **11**, 289; **12**, 272
 Lithium aluminum hydride-Cobalt(II) chloride, **8**, 291
 Lithium butyldiisobutylaluminum hydride, **12**, 276
 Lithium 4,4'-di-*t*-butylbiphenylide, **7**, 200
 Lithium 9,9-dibutyl-9-borabicyclo[3.3.1]nonane, **11**, 295
 Lithium triethylborohydride, **4**, 313; **10**, 249
 Magnesium, **1**, 627
 Mercury(II) oxide, **7**, 224
 Methyl lithium, **5**, 448
 Methylmagnesium bromide, **1**, 689
 Nickel catalysts, **9**, 321; **11**, 355
 Potassium-Crown ether, **11**, 431
 Potassium tetracarbonylhydridoferrate, **6**, 483
 Potassium thiocyanate, **1**, 954
 Raney nickel, **1**, 723
 Samarium(II) iodide, **10**, 344
 Sodium-Alcohol, **2**, 378; **9**, 416
 Sodium-Ammonia, **5**, 31
 Sodium bis(2-methoxyethoxy)aluminum hydride, **3**, 260
 Sodium borohydride, **1**, 1049; **3**, 120, 262; **4**, 443; **6**, 530; **11**, 477; **12**, 444
 Sodium cyanoborohydride, **4**, 448; **12**, 446
 Sodium 9-cyano-9-hydrido-9-borabicyclo[3.3.1]nonane, **11**, 483
 Sodium methylsulfinylmethylide, **1**, 310
 Tetrabutylammonium cyanoborohydride, **5**, 645
 Tetracarbonyl(cyclopentadienyl)-vanadium, **8**, 468
 Tin(II) chloride, **1**, 1113
 Titanium(III) chloride-Tetrahydrofuran-Magnesium, **6**, 590
 Tributyltin hydride, **1**, 1192; **2**, 424; **3**, 294; **4**, 518; **5**, 685; **6**, 604; **7**, 379; **8**, 497; **11**, 545
 Trichlorosilane, **3**, 298
 Triethylamine, **2**, 427
 Triethyl phosphite, **11**, 555
 Trifluoroacetic acid-Alkylsilanes, **6**, 616
 Triphenyltin hydride, **1**, 1250; **3**, 324
 Urushibara catalysts, **5**, 743
 Zinc, **1**, 1276
 Zinc borohydride, **12**, 572
 Zinc-copper couple, **8**, 533
- ALKYL SULFONATES → RH**
 Copper hydride ate complexes, **5**, 168, 330
 Lithium aluminum hydride, **1**, 581; **8**, 286
 Lithium triethylborohydride, **7**, 215; **10**, 249; **12**, 289
 Nickel-Alumina, **9**, 321
 Nickel catalysts, **1**, 723
 Palladium catalysts, **5**, 499
 Potassium thiocyanate, **1**, 954
 Samarium(II) iodide, **10**, 344
 Sodium borohydride, **1**, 1049; **3**, 262; **11**, 477
 Sodium borohydride + co-reagent, **8**, 449; **12**, 443, 444
 Sodium cyanoborohydride, **4**, 448
 Sodium 9-cyano-9-hydrido-9-borabicyclo[3.3.1]nonane, **11**, 483
 Sodium iodide, **1**, 1087
 Sodium iodide-Zinc, **7**, 338

ALKYNES $\rightarrow$ $-\text{CH}_2\text{CH}_2-$ Chlorotris(triphenylphosphine)-
rhodium(I), 1, 140, 1252; 2, 448; 4, 559Cobalt boride-Borane-*t*-Butylamine,
11, 138

Diimide, 4, 154

Hexamethylphosphoric triamide, 3, 149

Nickel boride, 3, 208

Palladium(II) acetate-Sodium hydride-
t-Amyloxide, 12, 370

Ruthenium catalysts, 1, 983

Titanium(IV) chloride-Lithium
aluminum hydride, 7, 372

Urushibara catalysts, 4, 571

ALKYNES $\rightarrow$ $-\text{CH}=\text{CH}_2$

Chromium(II)-Amine complexes, 9, 117

Dichloroborane diethyl etherate, 5, 191

Disiamylborane, 1, 57

Lithium aluminum hydride-Nickel(II)
chloride, 8, 291

Monochloroborane diethyl etherate, 5, 465

Zinc-copper couple, 10, 459

ALKYNES $\rightarrow$ *cis* $\text{C}=\text{C}$ Bis(cyclopentadienyl)trihydridoniobium,
6, 47

9-Borabicyclo[3.3.1]nonane, 9, 57

Borane-Tetrahydrofuran, 1, 199

Catecholborane, 4, 69; 8, 79

Chromium(II)-Amine complexes, 9, 117

Copper hydride ate complexes, 6, 492; 7,
80Dichlorobis(cyclopentadienyl)titanium,
10, 130; 11, 163

Dichloroborane diethyl etherate, 5, 191

Dichlorotris(triphenylphosphine)-
ruthenium(II), 2, 121

Dicyclohexylborane, 4, 141

Diisobutylaluminum hydride, 1, 260

Disiamylborane, 3, 22; 4, 37

Ethylmagnesium bromide-Copper(I)
iodide, 7, 149

Gold, 5, 321

Hydrogen hexachloroplatinate(IV)-
Triethylsilane, 3, 51

Iodine, 6, 293

Lindlar catalyst, 6, 319; 9, 270

Lithium, 4, 286

Lithium aluminum hydride-Nickel(II)
chloride, 8, 291Magnesium hydride-Copper(I) iodide,
8, 311Monochloroborane diethyl etherate, 5,
465Nickel(II) acetate-Sodium hydride-
t-Amyloxide, 10, 365

Nickel boride, 1, 720; 5, 471

Nickel-Graphite, 11, 356

Palladium(II) acetate, 8, 378

Palladium(II) acetate-Sodium hydride-
t-Amyloxide, 12, 370Palladium catalysts, 2, 356; 7, 275; 9,
351; 10, 297; 11, 392

Palladium(II) chloride, 9, 352

Palladium on barium sulfate, 1, 778

Palladium, poisoned catalyst, 1, 566; 2,
356

Raney nickel, 1, 723

Sodium borohydride-Palladium(II)
chloride, 12, 399Titanium(IV) chloride-Lithium
aluminum hydride, 7, 372Triethylammonium formate-Palladium,
9, 481Tris(dimethylphenylphosphine)-
(norbornadiene)rhodium(I)
hexafluorophosphate, 7, 411

Zinc, 6, 672

Zinc-1,2-Dibromoethane, 12, 570

ALKYNES $\rightarrow$ *trans* $\text{C}=\text{C}$

Borane-Tetrahydrofuran, 7, 321

Chromium(II) sulfate, 1, 150

Copper hydride ate complexes, 7, 80

Dichlorobis(cyclopentadienyl)titanium,
11, 163Lithium aluminum hydride, 2, 242; 8,
286; 9, 274

Lithium-Ammonia, 1, 601; 8, 282

Lithium bronze, 11, 293

Lithium diisobutylmethylaluminum
hydride, 8, 292

Lithium-Ethylamine, 1, 574

Palladium catalysts, 4, 366

Sodium-Ammonia, 5, 589

Ytterbium-Ammonia, 9, 517

ALLENES $\rightarrow$ $\text{C}=\text{C}$ Chlorotris(triphenylphosphine)-
rhodium(I), 4, 559

Diimide, 3, 99

Diisobutylaluminum hydride, 10, 149

Disiamylborane, 5, 39

Sodium-Ammonia, 2, 374; 4, 438; 5,
589; 6, 523

REDUCTION REACTIONS (*Continued*)**AMIDES** → ROH

- 9-Borabicyclo[3.3.1]nonane, 7, 29
 Lithium triethylborohydride, 8, 309
 Sodium (dimethylamino)borohydride, 12, 446
 Sodium-Hexamethylphosphoric triamide, 5, 324

AMIDES → RCHO

- Aziridine, 1, 378
 Bis(N-methylpiperaziny)aluminum hydride, 6, 52
 N,N'-Carbonyldiimidazole, 1, 114, 591
 1,4-Dichloro-1,4-dimethoxybutane, 12, 175
 N,O-Dimethylhydroxylamine, 11, 201
 Disiamylborane, 1, 57; 3, 22
 Lithium aluminum hydride, 1, 581
 Lithium butyldiisobutylaluminum hydride, 12, 276
 Lithium diethoxyaluminum hydride, 1, 610
 Lithium-Methylamine, 1, 574
 Lithium triethoxyaluminum hydride, 1, 625
 N-Methyl-N-phenylcarbamoyl chloride, 1, 694
 Phosphorus(V) chloride, 1, 866
 Sodium aluminum hydride, 3, 259
 Tin(II) chloride, 1, 1116
 Trifluoromethanesulfonic anhydride, 5, 702
 Zinc, 7, 426

AMIDES → KNH_2

- Aluminum hydride, 2, 23
 Borane-Dimethyl sulfide, 6, 64; 11, 69
 Borane-Tetrahydrofuran, 1, 199; 2, 106; 4, 124
 N-Ethylmorpholine, 1, 383
 Iodosylbenzene, 12, 258
 Lead tetraacetate, 6, 313
 Lithium aluminum hydride, 1, 581; 4, 291; 5, 382
 Lithium 9-boratabicyclo[3.3.1]nonane, 12, 275
 Lithium borohydride, 12, 276
 Monochloroalane, 12, 333
 Sodium acetoxyborohydride, 7, 325
 Sodium borohydride, 3, 262; 4, 443; 7, 329
 Sodium borohydride + co-reagent, 1,

1053; 3, 264; 7, 330; 11, 479

- Sodium (dimethylamino)borohydride, 12, 446
 Sodium trifluoroacetoxyborohydride, 7, 326
 Tetrabutylammonium borohydride, 10, 378
 Thexylborane-N,N-Diethylaniline, 9, 464
 Tin(IV) chloride-Sodium borohydride, 8, 452; 9, 438
 Triethyloxonium tetrafluoroborate, 2, 430; 5, 691

AMINE OXIDES → RNH_2

- Boron trifluoride etherate, 6, 65
 Chlorotrimethylsilane-Sodium iodide-Zinc, 11, 128
 Chromium(II) chloride, 7, 73
 9-Diazofluorene, 1, 190
 Diphosphorus tetraiodide, 10, 174
 Hexachlorodisilane, 10, 195
 Iron carbonyl, 4, 268
 Molybdenum(V) chloride-Zinc, 10, 274
 Phenyl(trichloromethyl)mercury, 1, 851
 Phosphorus(III) chloride, 1, 875
 Sodium azide, 5, 593
 Sodium borohydride, sulfurated, 7, 331
 Sulfur dioxide, 2, 392
 Titanium(III) chloride, 6, 587
 Titanium(IV) chloride-Sodium borohydride, 10, 404
 Triphenylphosphine, 1, 1238

ANHYDRIDES → ROH

- Diborane, 5, 184
 Diisobutylaluminum hydride, 12, 191
 Lithium aluminum hydride, 1, 581
 Sodium bis(2-methoxyethoxy)aluminum hydride, 3, 260
 Sodium borohydride-Aluminum chloride, 1, 1053
 Sodium trimethoxyborohydride, 1, 1108
 Tin(IV) chloride-Sodium borohydride, 9, 438

ANHYDRIDES → RCHO

- Disodium tetracarbonylferrate, 5, 624; 6, 550
 Pyridine N-oxide, 5, 567

ANHYDRIDES → LACTONES

- Diborane, 5, 184
 Dichlorotris(triphenylphosphine)-ruthenium(II), 6, 654; 7, 99

- 2,3-O-Isopropylidene-2,3-dihydroxy-1,4-bis(diphenylphosphine)butane, **11**, 277
 Sodium borohydride, **3**, 262; **5**, 597
- ARENES** → **DIHYDRO-**,
TETRAHYDROARENES (see also **BIRCH REDUCTION**)
 1-Benzyl-1,2-dihydroisonicotinamide, **12**, 46
 Borane-Amines, **5**, 708; **8**, 50
 Dichlorotris(triphenylphosphine)-ruthenium(II), **12**, 179
 Lithium trialkoxyaluminum hydrides, **12**, 286
 Methyl chloroformate, **6**, 376
 Palladium catalysts, **8**, 382
 Potassium borohydride, **8**, 407
 Sodium amalgam, **2**, 373
 Sodium borohydride, **3**, 262
 Sodium cyanoborohydride, **9**, 424
 Sodium dithionite, **1**, 1081
 Sodium hydride, **5**, 610
 Tetrabutylammonium borohydride, **10**, 378
 Tin, **1**, 1168
 Triethylsilane-Boron trifluoride, **9**, 483
 Trifluoroacetic acid, **1**, 1219; **6**, 613
 Trimethylsilane, **1**, 1235
- ARENES** → **HEXAHYDROARENES**
*tri***h***ap***t***o*-Allyltris(trimethylphosphite)-cobalt(I), **6**, 15
 Calcium hexamine, **1**, 104
 Chloro(hexamethylbenzene)hydrido-triphenylphosphinerhodium, **8**, 153
 Di- μ -chlorobis(1,5-hexadiene)-dirhodium, **12**, 172
 Lithium-Ethylenediamine, **1**, 614
 Nickel catalysts, **1**, 723, 731
 Palladium catalysts, **8**, 382
 Palladium(II) chloride, **9**, 352
 Palladium hydroxide, **8**, 385
 Rhodium catalysts, **1**, 979, 982; **4**, 418; **6**, 503
 Rhodium oxide-Platinum oxide, **9**, 408
 Ruthenium catalysts, **1**, 983; **5**, 574
 Sodium borohydride-Rhodium(III) chloride, **11**, 480
 Sodium sulfite, **2**, 387
- ARYL HALIDES** → **ArH**
 Aluminum chloride-Ethanethiol, **12**, 29
 Butyllithium, **6**, 85
 Butylphenyltin dihydride, **6**, 92
 Chromium(II)-Amine complexes, **3**, 57; **4**, 97
 Copper, **12**, 140
 Copper-Ascorbic acid, **1**, 155
 Copper-Benzonic acid, **1**, 158
 Copper(II) bromide, **1**, 161
 Copper hydride ate complexes, **3**, 154; **5**, 168; **6**, 492
 Copper(I) trifluoromethanesulfonate, **6**, 130
 Cyclodextrins, **9**, 129
 Dichlorobis(cyclopentadienyl)titanium, **6**, 179
 Dicyclopentadienyltitanium, **6**, 596
 Dimethyl sulfoxide, **3**, 119
 Hydrido(tributylphosphine)copper(I), **3**, 154
 Hydriodic acid, **1**, 449
 Hypophosphorous acid, **1**, 489
 Lithium aluminum hydride, **3**, 176; **11**, 289; **12**, 272
 Lithium aluminum hydride-Cobalt(II) chloride, **8**, 291
 Lithium-*t*-Butanol-Tetrahydrofuran, **1**, 604
 Magnesium, **1**, 627
 Magnesium oxide, **1**, 633
 Manganese(II) chloride, **7**, 222
 Nickel catalysts, **1**, 718; **6**, 502
 Palladium catalysts, **11**, 392
 Phosphorus, red, **1**, 861
 Potassium *t*-butoxide, **2**, 336
 Raney nickel, **1**, 723; **6**, 502
 Sodium acetate, **1**, 1024
 Sodium bis(2-methoxyethoxy)aluminum hydride, **3**, 260
 Sodium borohydride, **5**, 597, 602; **11**, 479
 Sodium formate, **8**, 458
 Sodium hydride, **5**, 610
 Sodium naphthalenide, **9**, 431
 Sodium telluride, **2**, 388
 Tetracarbonyl(cyclopentadienyl)-vanadium, **8**, 468
 Tin, **2**, 414
 Titanium(III) chloride-Tetrahydrofuran-Magnesium, **6**, 590
p-Toluenesulfonylhydrazide, **1**, 1185
 Tributyltin hydride, **3**, 294
 Trimethyltinsodium, **9**, 500
 Triphenylphosphine, **1**, 1238
 Triphenyltin hydride, **1**, 1250

REDUCTION REACTIONS (*Continued*)

Zinc, 1, 1276; 5, 753

AZIDES $\rightarrow$ RNH₂, ArNH₂Bis(triphenylphosphine)copper(I)
borohydride, 10, 47

1,4-Dimercapto-2,3-butanediol, 9, 394

Lindlar catalyst, 6, 319

1,3-Propanedithiol, 9, 394

Raney nickel, 8, 433

Sodium borohydride, 1, 1049; 11, 477

Sodium hydride, 5, 610

Titanium(III) chloride, 7, 418; 8, 482

Triphenylphosphine, 12, 550

AZO COMPOUNDS $\rightarrow$ RNH₂

Palladium catalysts, 8, 382

Sodium dithionite, 1, 1081

AZO COMPOUNDS $\rightarrow$ -NHNH-

Dicyclopentadienyltitanium, 6, 596

Diimide, 1, 257; 5, 220

Hydrazine, 1, 434

Hydrogen hexachloroplatinate(IV)-
Triethylsilane, 3, 51

Hydrogen telluride, 10, 205

Palladium catalysts, 6, 445

Phenylhydrazine, 1, 838

Potassium azodicarboxylate, 1, 909

Sodium borohydride-Palladium on
charcoal, 1, 10542,4,6-Triisopropylbenzene-
sulfonylhydrazide, 7, 392**AZOXY COMPOUNDS** $\rightarrow$ -N=N-Hexamethylphosphorous triamide-
Iodine, 9, 236

Trialkyl phosphites, 1, 1212; 5, 717

Triphenylphosphine, 1, 1238

BENZYL ETHERS $\rightarrow$ ROHBoron trifluoride-Dimethyl sulfide, 10,
51*sec*-Butyllithium, 9, 87

Chromium(VI) oxide, 3, 54

(Diphenylphosphine)lithium, 1, 345

Ferric chloride, 11, 237

Lithium aluminum hydride-Boron
trifluoride etherate, 1, 599

Palladium catalysts, 10, 299

Perchloric acid, 1, 796

Phenylthiotrimethylsilane, 10, 426

Sodium-Ammonia, 9, 415

Sodium bis(2-methoxyethoxy)aluminum
hydride, 7, 327

Sodium-Potassium alloy, 1, 1102

Titanium(IV) chloride, 11, 529

Trifluoroacetic acid, 1, 1219

Uranium(VI) fluoride, 7, 417

CARBOXYLIC ACIDS $\rightarrow$ ROH

9-Borabicyclo[3.3.1]nonane, 7, 29

Borane + co-reagent, 6, 64; 11, 219

Borane-Tetrahydrofuran, 1, 199; 3, 76;
5, 48; 11, 69

Diborane, 5, 184

Diisobutylaluminum hydride, 1, 260

N-Ethyl-5-phenylisoxazolium-3'-
sulfonate, 5, 306Lithium aluminum hydride, 1, 581; 12,
272

Magnesium methyl carbonate, 5, 420

Peracetic acid, 1, 787

Rhenium catalysts, 1, 978

Sodium bis(2-methoxyethoxy)aluminum
hydride, 3, 260; 5, 596Sodium borohydride + co-reagent, 1,
1053; 11, 479; 12, 565Tetra- μ -hydridotetrahydroaluminum-
magnesium, 4, 316Thexylborane-N,N-Diethylaniline, 9,
464Tin(IV) chloride-Sodium borohydride,
9, 438Titanium(IV) chloride-Sodium
borohydride, 10, 404**CARBOXYLIC ACIDS** $\rightarrow$ RCHOBis(N-methylpiperazinyl)aluminum
hydride, 6, 52; 12, 60

Borane-Dimethyl sulfide, 9, 398

N,N'-Carbonyldiimidazole, 1, 114

Chlorothexylborane-Dimethyl sulfide,
12, 485Dichlorobis(cyclopentadienyl)titanium,
11, 163

Disodium tetracarbonylferrate, 6, 550

Ethyl formate, 3, 185

Lithium aluminum hydride, 1, 581

Lithium diisopropylamide, 3, 184

Lithium-Methylamine, 3, 175; 4, 288

Pyridinium chlorochromate, 9, 397

Raney nickel, 2, 293

Tetrabutylammonium borohydride, 6,
564

1,3-Thiazolidine-2-thione, 11, 518

p-Toluenesulfonylhydrazide, 5, 678Trifluoromethanesulfonic anhydride, 5,
702

2,4,6-Triisopropylbenzene-sulfonylhydrazide, **10**, 422
Vilsmeier reagent—Lithium tri-*t*-butoxyaluminum hydride, **12**, 201

CARBOXYLIC ACIDS, RCOX → RCH₃

Borane—Tetrahydrofuran, **6**, 161
Dicyclopentadienyltitanium, **5**, 672
Iodotrimethylsilane, **9**, 251
Lead tetraacetate, **5**, 365
Lithium aluminum hydride—Aluminum chloride, **5**, 389
Nickel on alumina, **11**, 355
Sodium bis(2-methoxyethoxy)aluminum hydride, **3**, 260; **9**, 418
Trichlorosilane, **3**, 298; **4**, 525
Trichlorosilane—*t*-Amines, **4**, 525; **5**, 688; **8**, 499

DIAZONIUM SALTS → ArH, RH (see DEDIAZOTIZATION)

DIENES → C = C

Aluminum amalgam, **1**, 20
Arene(tricarbonyl)chromium complexes, **12**, 34
9-Borabicyclo[3.3.1]nonane, **8**, 47
Chlorotris(triphenylphosphine)-rhodium(I), **3**, 325; **5**, 736
Chromium carbonyl, **5**, 142
Dicarbonyldichlorobis(triphenylphosphine)ruthenium(II), **5**, 193
Dichlorotris(triphenylphosphine)-ruthenium(II), **8**, 159
Diimide, **3**, 99; **4**, 154; **6**, 195; **7**, 121
Gold, **5**, 321
Lithium aluminum hydride, **2**, 242
Lithium—Amines, **1**, 618; **11**, 287
Magnesium oxide, **7**, 221
Nickel boride, **3**, 208
Palladium black, **6**, 443
Palladium(II) chloride, **9**, 352
Ruthenium(III) chloride, **4**, 421
Sodium—Ammonia, **2**, 374
Triethylamine, **5**, 689
Triethylammonium formate—Palladium, **9**, 481
Urushibara catalysts, **6**, 659
Zinc, **1**, 1276

DISULFIDES → RSR

Hexaethylphosphorous triamide, **2**, 207; **4**, 242
Hexamethylphosphorous triamide, **6**, 279; **9**, 235

Sodium cyanide, **5**, 606
Triethyl phosphite, **1**, 1212
Triphenylphosphine, **3**, 317

EPOXIDES → ROH

with Metal hydrides

9-Borabicyclo[3.3.1]nonane, **7**, 29
9-Borabicyclo[3.3.1]nonane ate complexes, **7**, 201
Borane—Tetrahydrofuran, **1**, 199; **9**, 136
t-Butyl hydroperoxide—Dialkyl tartrate—Titanium(IV) isopropoxide, **11**, 92
Copper hydride ate complexes, **5**, 168
Diborane + co-reagent, **2**, 107, 108
Diisobutylaluminum hydride, **4**, 158
Lithium aluminum hydride, **1**, 581; **7**, 196

Lithium aluminum hydride—

Aluminum chloride, **1**, 595; **8**, 289

Lithium borohydride, **1**, 603; **12**, 276

Lithium 9,9-dibutyl-9-borabicyclo-[3.3.1]nonanate, **7**, 201

Lithium triethylborohydride—

Aluminum *t*-butoxide, **9**, 287

Lithium trimethoxyaluminum hydride, **1**, 625

Sodium bis(2-methoxyethoxy)-aluminum hydride, **10**, 357; **11**, 476

Sodium borohydride, **11**, 477

Sodium borohydride—Aluminum chloride, **1**, 1053

Sodium cyanoborohydride, **9**, 424

with other Reagents

t-Butyl hydroperoxide, **7**, 43

Chromium(II) acetate, **1**, 147; **4**, 97

Dimethylsulfoxonium methyllide, **10**, 168

Lithium—Alkylamines, **1**, 574; **3**, 186; **4**, 291

Lithium—Ammonia, **4**, 288; **11**, 286

Lithium dimethylcuprate, **5**, 234

Raney nickel, **10**, 339

Sodium hydrogen telluride, **12**, 449

Sodium iodide, **6**, 544

Triphenyltin hydride, **10**, 451

Zinc—Acetic acid, **12**, 568

ESTERS → ROH

9-Borabicyclo[3.3.1]nonane, **7**, 29

Borane—Dimethyl sulfide, **6**, 64; **10**, 49; **11**, 69; **12**, 64

REDUCTION REACTIONS (*Continued*)

- Calcium borohydride, **2**, 57
 Copper–Chromium oxide, **1**, 157
 Dichlorobis(cyclopentadienyl)titanium, **10**, 130
 Diisobutylaluminum hydride, **1**, 260; **12**, 191
 Lithium aluminum hydride, **1**, 581; **12**, 272
 Lithium–Ammonia, **1**, 601; **9**, 273
 Lithium 9-boratabicyclo[3.3.1]nonane, **12**, 275
 Lithium borohydride, **1**, 603; **11**, 293; **12**, 276
 Lithium butyldiisobutylaluminum hydride, **12**, 276
 Lithium triethylborohydride, **6**, 348; **9**, 286
 Methylene chloride, **1**, 676
 Phenol, **1**, 828
 Platinum catalysts, **1**, 890
 Sodium acetanilidoborohydride, **7**, 325
 Sodium–Ammonia–Ethanol, **1**, 1041
 Sodium bis(2-methoxyethoxy)aluminum hydride, **3**, 260; **5**, 596
 Sodium borohydride, **1**, 1049; **11**, 477; **12**, 441
 Sodium borohydride + co-reagent, **1**, 1053; **6**, 532; **11**, 479
 Sodium (dimethylamino)borohydride, **12**, 446
 Sodium trimethoxyborohydride, **3**, 268
 Thexylborane, **4**, 175
 Triethoxysilane, **11**, 554
- ESTERS** → **RCHO**, **R₂CO**
 Bis(N-methylpiperazinyl)aluminum hydride, **6**, 52
 Diisobutylaluminum hydride, **1**, 260; **2**, 140; **6**, 198
 Lithium naphthalenide, **8**, 305
 Lithium tri-*t*-butoxyaluminum hydride, **1**, 620
 Sodium aluminum hydride, **1**, 1030
 Sodium bis(2-methoxyethoxy)aluminum hydride, **3**, 260; **7**, 329
 Tributyltin hydride, **10**, 411
- ESTERS** → **RH** (*see* **REDUCTION OF ACETATES, OTHER ESTERS**)
ESTERS → **ROR**
 2,4-Bis(4-methoxyphenyl)-1,3-dithia-2,4-diphosphetane-2,4-disulfide, **10**, 39

- Lithium aluminum hydride–Boron trifluoride etherate, **1**, 599
 Sodium borohydride–Boron trifluoride, **1**, 1053
 Trichlorosilane, **4**, 525; **6**, 606
- HYDROPEROXIDES**, **ROOR**, **RCO₃R'**, **ETC.**
 Dimethyl sulfoxide, **5**, 263
 Hexamethylphosphorous triamide, **2**, 210
 Palladium black, **4**, 365
 Sodium iodide, **1**, 1087
 Tetramethoxyethylene, **2**, 401
 Thiourea, **6**, 586
 Trialkyl phosphites, **1**, 1212, 1233; **2**, 432
 Triphenylphosphine, **1**, 1238; **2**, 443; **5**, 725
 Zinc, **1**, 1276
- α-HYDROXY(ALKOXY) C = O's** →
1,2-DIOLS
 Borane–Dimethyl sulfide, **12**, 64
 Calcium–Ammonia, **1**, 106
 Copper chromite, **1**, 156
 Dimethylphenylsilane, **12**, 209
 Dimethyl sulfoxide–Trifluoroacetic anhydride, **10**, 168
 Hexahydro-4,4,7-trimethyl-4H-1,3-benzothiine, **12**, 237
 Lithium aluminum hydride, **6**, 206; **11**, 289
 Lithium cyanoborohydride, **3**, 183
 Potassium formate, **5**, 556
 Sodium bis(2-methoxyethoxy)aluminum hydride, **12**, 440
 Sodium borohydride, **10**, 357
 Tetrabutylammonium fluoride, **12**, 458
 Triisobutylaluminum, **4**, 535
 Zinc borohydride, **12**, 572
- IMINES** → **RNH₂**
 (S)-N-Benzoyloxycarbonylproline, **11**, 447
 Borane + co-reagent, **1**, 273, 1229; **6**, 161
 Chlorotris(triphenylphosphine)-rhodium(I), **5**, 736
 Cobalt(II) phthalocyanine, **11**, 138
 Di-μ-carbonyldecacarbonyltri-*triangulo*-iron, **4**, 534
 (S)-1-(Dimethoxymethyl-2-methoxymethyl)pyrrolidine, **10**, 152
 Hydrogen hexachloroplatinate(IV)–Triethylsilane, **3**, 51

- 2,3,-O-Isopropylidene-2,3-dihydroxy-1,4-bis(diphenylphosphine)butane, **5**, 360
Lithium pyrrolidide, **5**, 416
Lithium tri-*sec*-butylborohydride, **12**, 286
Potassium-Graphite, **9**, 378
Sodium 9-cyano-9-hydrido-9-borabicyclo[3.3.1]nonane, **11**, 483
Sodium dithionite, **10**, 363
Trifluoroacetic acid-Alkylsilanes, **6**, 616
- LACTONES → CYCLIC ETHERS**
Diborane, **5**, 184
Lithium aluminum hydride-Boron trifluoride etherate, **1**, 599
Perchloric acid, **1**, 796
Sodium borohydride-Boron trifluoride, **1**, 1053
Triethylsilane-Boron trifluoride, **10**, 418
- LACTONES → LACTOLS**
Borane-Tetrahydrofuran, **1**, 199
Diisobutylaluminum hydride, **1**, 260; **2**, 140; **6**, 198; **9**, 171
Disiamylborane, **1**, 57; **2**, 29; **3**, 22
Lithium triethoxyaluminum hydride, **2**, 252
Sodium amalgam, **1**, 1030
Sodium bis(2-methoxyethoxy)aluminum hydride, **6**, 528; **7**, 327
Triethylsilane-Boron trifluoride, **10**, 418
- NITRILES → RCHO**
Diisobutylaluminum hydride, **1**, 260; **4**, 158; **6**, 198; **11**, 185
Lithium aluminum hydride, **1**, 581
Lithium triethoxyaluminum hydride, **1**, 625
Raney nickel, **1**, 723; **2**, 293; **9**, 405
1:1 Raney nickel alloy, **4**, 350
Semicarbazide, **2**, 98
Sodium bis(2-methoxyethoxy)aluminum hydride, **8**, 448; **9**, 418
Sodium hypophosphite, **1**, 1087
Sodium triethoxyaluminum hydride, **1**, 1108
Tin(II) chloride, **1**, 1116
Triethylsilane, **5**, 694
- NITRILES → RNH₂**
Aluminum hydride, **2**, 23
Borane + co-reagent, **1**, 199; **11**, 69
Cobalt boride-Borane-*t*-Butylamine, **11**, 138
- Cobalt(II) phthalocyanine, **11**, 138
Diborane, **5**, 184
Hydridotris(triisopropylphosphine)-rhodium(I), **9**, 238
Lithium aluminum hydride-Aluminum chloride, **1**, 595
Nickel catalysts, **1**, 723; **4**, 351
1:1 Raney nickel alloy, **1**, 718
Rhodium catalysts, **1**, 979
Sodium bis(2-methoxyethoxy)aluminum hydride, **3**, 260; **5**, 596
Sodium borohydride + co-reagent, **1**, 1053; **3**, 264
Sodium trifluoroacetoxyborohydride, **7**, 342
Tetrabutylammonium borohydride, **10**, 378
Tin(IV) chloride-Sodium borohydride, **9**, 438
- NITRILE OXIDES → RCN**
Trimethyl phosphite, **1**, 1233
Triphenylphosphine, **1**, 1238
- NITRO COMPOUNDS → RNH₂**
Borane-Tetrahydrofuran, **12**, 65
Cobalt(II) phthalocyanine, **10**, 102; **11**, 138
Hydrogen hexachloroplatinate(IV)-Triethylsilane, **3**, 51
Iron-Acetic acid, **8**, 264
Molybdenum(V) chloride-Zinc, **10**, 274
Palladium-Graphite, **10**, 297
Raney nickel, **1**, 723; **7**, 312; **12**, 422
Sodium borohydride, **4**, 443
Sodium borohydride, sulfurated, **4**, 444
Sulfides, **5**, 632
Tin(IV) chloride + co-reagent, **9**, 438; **12**, 503
Tributyltin hydride, **11**, 545
- NITRO COMPOUNDS → ArNH₂**
Aluminum, **4**, 9
Ammonium sulfide, **3**, 270
Borane-Dimethylamine, **1**, 273
Cobalt(II) phthalocyanine, **10**, 102; **11**, 138
Di- μ -carbonyldecacarbonyltri-*triangulo*-iron, **4**, 534; **8**, 130
Dichlorotris(triphenylphosphine)-ruthenium(II), **6**, 654; **12**, 179
Ferrous sulfate, **1**, 393
Hydrazine, **1**, 434; **6**, 280; **7**, 170; **9**, 236; **11**, 255

REDUCTION REACTIONS (*Continued*)

- Hydrogen hexachloroplatinate(IV)-Triethylsilane, 3, 51
 - Hydrogen telluride, 10, 205
 - Hydroxylamine, 12, 251
 - Iron, 1, 519
 - Iron-Acetic acid, 8, 264
 - Lithium aluminum hydride, 5, 382
 - Lithium-Ethylamine, 1, 574
 - Molybdenum(V) chloride-Zinc, 10, 274
 - Palladium(II) acetylacetonate, 6, 45
 - Palladium catalysts, 6, 445; 10, 297; 11, 392
 - Phase-transfer catalysts, 8, 387
 - Phenylhydrazine, 1, 838
 - Platinum oxide, 1, 890
 - Platinum sulfide-on-carbon, 1, 892
 - Polymethylhydrosiloxane, 4, 393
 - Rhodium(III) chloride, 7, 313
 - Sodium borohydride, 7, 329
 - Sodium borohydride + co-reagent, 1, 1054; 3, 264; 5, 602; 9, 421
 - Sodium borohydride, sulfurated, 7, 331
 - Sodium disulfide, 1, 1064
 - Sodium dithionite, 1, 1081
 - Sodium hydrogen sulfide, 3, 266
 - Sodium sulfide, 1, 1104
 - Sodium sulfide-Sulfur, 3, 270
 - Tin, 1, 1168
 - Tin(II) bromide, 1, 1112
 - Tin(II) chloride, 1, 1113; 3, 271
 - Tin(II) chloride-Sodium borohydride, 11, 480
 - Titanium(III) chloride, 5, 669; 10, 400
 - Titanium(IV) chloride-Magnesium amalgam, 12, 503
 - Urushibara catalysts, 4, 571
 - Zinc, 1, 1276
- NITRO COMPOUNDS** $\rightarrow$ RNHOH
- Aluminum amalgam, 1, 20
 - Iridium catalysts, 2, 228
 - Nitromethane, 1, 903
 - Phenylhydrazine, 1, 838
 - Zinc, 1, 1276
- NITRO COMPOUNDS** $\rightarrow$ OTHER N COMPOUNDS
- Hexamethylditin, 6, 273
 - Lead, 2, 233
 - Phosphine, 1, 859
 - Ruthenium catalysts, 1, 983
 - Sodium borohydride, 4, 443

- Sodium borohydride-Cobalt(II) chloride, 3, 264
 - Thallium, 3, 285
 - Tributylphosphine-Diphenyl disulfide, 12, 514
 - Zinc, 1, 1276
- NITROSO COMPOUNDS** $\rightarrow$ RNH₂
- Iron carbonyl, 4, 268
 - Tin(II) chloride, 1, 1113
 - Zinc, 1, 1276
- OXIMES** $\rightarrow$ RNH₂
- Aluminum hydride, 2, 23
 - Borane-Tetrahydrofuran, 3, 76; 4, 124
 - Diisobutylaluminum hydride, 12, 191
 - Lithium aluminum hydride, 12, 272
 - Lithium aluminum hydride-Aluminum chloride, 1, 595
 - Lithium-Ethylamine, 4, 288
 - 1:1 Raney nickel alloy, 1, 718; 2, 289
 - Rhodium catalysts, 1, 979; 6, 503
 - Sodium amalgam, 1, 1030
 - Sodium bis(2-methoxyethoxy)aluminum hydride, 3, 260; 5, 596
 - Sodium borohydride, sulfurated, 3, 264
 - Tributylphosphine-Diphenyl disulfide, 12, 514
 - Zinc, 1, 1276
- OXIMES** $\rightarrow$ RNHOH
- Borane-Tetrahydrofuran, 1, 199; 3, 76
 - Hydroxylamine, 11, 257
 - Organoaluminum reagents, 12, 339
 - Sodium cyanoborohydride, 4, 448; 5, 607; 6, 537; 11, 481
- PHENOLS** $\rightarrow$ ArH (*see* DEOXYGENATION)
- P COMPOUNDS**
- Hexachlorodisilane, 3, 148
 - Phenylsilane, 5, 523
 - Trichlorosilane, 5, 687
- PROPARGYL ALCOHOLS (AND RELATED COMPOUNDS)** $\rightarrow$ ALLYLIC ALCOHOLS
- Butyllithium-Diisobutylaluminum hydride, 12, 96
 - Chlorotris(triphenylphosphine)-rhodium(I), 6, 652
 - Chromium(II) sulfate, 1, 150
 - Dichlorobis(cyclopentadienyl)titanium, 11, 163
 - Diisobutylaluminum hydride, 3, 174; 9, 171

- Lithium aluminum hydride, 1, 581; 4, 295
Lithium methoxyaluminum hydride, 6, 341
Sodium-Ammonia, 5, 589
Sodium bis(2-methoxyethoxy)aluminum hydride, 12, 440
Zinc-Potassium cyanide, 8, 534
- QUINONES $\rightarrow$ HYDROQUINONES
Chromium(II) chloride, 3, 60
Polymethylhydrosiloxane, 4, 393
Tetramethoxyethylene, 2, 401
Titanium(III) chloride, 7, 418
Trimethyl phosphite, 1, 1233
- QUINONES $\rightarrow$ ArOH
Borane-Tetrahydrofuran, 3, 76
Chromium(II) chloride, 3, 60
N,N-Diethylhydroxylamine, 6, 187
Lithium tri-*t*-butoxyaluminum hydride, 7, 329
Polymethylhydrosiloxane, 4, 393
Sodium borohydride, 7, 329
Sodium dithionite, 1, 1081
Trimethyl phosphite, 12, 536
- SUBSTITUTED $C=C \rightarrow C=C$
Dealkoxylation
Borane-Tetrahydrofuran, 6, 161
2,6-Di-*t*-butyl-4-methylpyridine, 8, 145
Diethyl phosphorochloridate, 3, 98
Diisobutylaluminum hydride, 1, 260
Titanium(0), 8, 481
Triethyl phosphite, 3, 304
- Deamination, Denitration
Aluminum hydride, 3, 9
Borane-Tetrahydrofuran, 1, 199
Diethyl phosphite, 12, 187
Lithium aluminum hydride, 11, 289
Lithium aluminum hydride-Aluminum chloride, 1, 595
Sodium sulfide-Thiophenol, 9, 434
- Dehalogenation
Chromium(II)-Amine complexes, 3, 57
Dichlorobis(cyclopentadienyl)-titanium, 6, 179
Difluoromethylenetriphenylphosphorane, 9, 166
Iron carbonyl, 4, 268
Lithium aluminum hydride, 4, 291
Lithium-*t*-Butanol-Tetrahydrofuran, 4, 291
- Magnesium, 11, 307
Manganese(II) chloride, 7, 222
Potassium (or Sodium) tetracarbonylhydridoferrate, 6, 483; 9, 435
Sodium-*t*-Butanol-Tetrahydrofuran, 2, 378
Tin(II) chloride, 1, 1116
Tributyltin hydride, 2, 424
Triethyl phosphite, 11, 555
Zinc-Silver couple, 5, 760; 9, 519
- Deselenylation
Diphosphorus tetraiodide, 11, 224
- Desilylation
Hydriodic acid, 6, 281
(1-Lithiovinyl)trimethylsilane, 7, 193; 9, 498
Potassium fluoride, 6, 481
Tetraethylammonium fluoride, 7, 356
p-Toluenesulfonic acid, 8, 488
- Desulfurization
Allyl phenyl sulfone, 8, 405
Aluminum amalgam, 5, 9
Dichlorobis(triphenylphosphine)-nickel(II), 11, 165
Nickel(II) chloride-Triphenylphosphine, 11, 358
- Reduction of $C=C-OPO(OR)_2$
Diethyl phosphorochloridate, 3, 98
Lithium dimethylcuprate, 4, 177
Titanium(0), 8, 481
Triethyl phosphite, 3, 304
- α -SUBSTITUTED $C=O's \rightarrow C=O's$
Aluminum chloride-Ethanethiol, 12, 29
Cerium(III) sulfate, 9, 99
Chlorotrimethylsilane + co-reagent, 7, 429; 10, 97
Chromium(II) acetate, 1, 147
Chromium(II) chloride, 1, 149
Chromium(III) chloride-Lithium aluminum hydride, 8, 110
Di- μ -carbonylhexacarbonyldicobalt, 8, 148
Dicyclopentadienyltitanium, 6, 596
Diisobutylaluminum hydride, 11, 185
N,N-Dimethylaniline, 2, 147
Hydriodic acid, 1, 449; 2, 213
Hydrobromic acid, 2, 214
Iron carbonyl, 4, 268
Lithium dimethylcuprate, 5, 234
Lithium iodide-Boron trifluoride, 4, 305
Molybdenum carbonyl, 7, 247; 9, 317

REDUCTION REACTIONS (*Continued*)

- Phosphorus(III) iodide, **10**, 318
 Potassium tetracarbonylhydridoferrate, **6**, 483
 Pyridine, **6**, 497
 Pyridine–Sodium hydrosulfite, **5**, 566
 Sodium O,O-diethyl phosphotelluroate, **11**, 485
 Sodium α -(N,N-dimethylamino)-naphthalenide, **10**, 362
 Sodium dithionite, **11**, 485
 Sodium iodide, **10**, 365
 Sulfur trioxide–Pyridine, **9**, 396
 Titanium(III) chloride, **5**, 669
 Tributylphosphine, **1**, 1191
 Tributyltin hydride, **9**, 476; **10**, 411
 Trichloro(methyl)silane–Sodium iodide, **12**, 527
 Triethylamine, **2**, 427
 Triphenylphosphine, **1**, 1238
 Vanadium(II) chloride, **7**, 418
 Zinc, **1**, 1276; **2**, 459; **5**, 753; **6**, 672
 Zinc–Acetic acid, **5**, 757

 α -SUBSTITUTED C=O's $\rightarrow$ 1,2-**DISUBSTITUTED COMPOUNDS**

- Diisobutylaluminum hydride, **6**, 198
 Isobutylaluminum dichloride, **6**, 307
 Lithium diisopropylamide, **8**, 292
 Lithium tri-*t*-butoxyaluminum hydride, **1**, 620
 Sodium borohydride, **1**, 1049

SULFIDES, RSSR $\rightarrow$ RSH

- Formamidinesulfinic acid, **6**, 586
 Lithium–Ethylamine, **1**, 574
o-Nitrobenzenesulfonyl chloride, **10**, 277
 Sodium hydrogen selenide, **6**, 542
 Triphenylphosphine, **5**, 725

SULFONES $\rightarrow$ RSOR

- Arenediazonium tetrahaloborates, **9**, 102

SULFONIC ACIDS, RSO₂X $\rightarrow$ RSSR

- Hydriodic acid, **1**, 449
 Iodotrimethylsilane, **11**, 271
 Molybdenum carbonyl, **3**, 206
 Potassium iodide–Boron triiodide, **10**, 329
 Trichlorosilane, **3**, 298

SULFONIC ACIDS, RSO₂X $\rightarrow$ RSH

- Benzenesulfonyl chloride, **1**, 46
 Phosphorus(V) sulfide, **11**, 428
 Triphenylphosphine–Iodine, **10**, 220
 Zinc, **1**, 1276

Zinc amalgam, **1**, 1287

SULFOXIDES, RSO₂R $\rightarrow$ RSR

- Acetyl chloride, **4**, **5**; **5**, **4**
 Benzeneselenol, **9**, 35
 Bromine, **5**, 55
 Bromodimethylborane, **12**, 199
 Bromotrimethylsilane, **8**, 262
 2-Chloro-1,3,2-benzodioxaphosphole, **7**, 58
 Chlorotrimethylsilane–Zinc, **10**, 98
 Cyanuric fluoride, **10**, 115
 Dichloroborane, **4**, 129
 O,O-Diethyl hydrogenphosphoro-selenoate, **8**, 169
 Diisobutylaluminum hydride, **5**, 224
 Dimethyl sulfide–Trifluoroacetic anhydride, **9**, 188
 Diphosphorus tetraiodide, **9**, 203
 Ethylmagnesium bromide–Copper(I) iodide, **9**, 219
 Formamidinesulfinic acid, **8**, 232
 Hexamethylcyclotrisilathiane, **8**, 240
 Hexamethyldisilathiane, **8**, 240
 Hexamethylphosphorous triamide–Iodine, **9**, 236
 Iodine–Pyridine–Sulfur dioxide, **6**, 296
 Iodotrimethylsilane, **8**, 261; **9**, 251
 Iron carbonyl, **3**, 167
 Methanesulfinyl chloride, **7**, 224
 Molybdenum(V) trichloride oxide, **7**, 248
 Oxalyl chloride–Sodium iodide, **9**, 335
 Palladium catalysts, **6**, 445
 2-Phenoxy-1,3,2-benzodioxaphosphole, **5**, 512
 Phenyl trimethylsilyl selenide, **9**, 496
 Phosphorus(III) iodide, **10**, 318
 Phosphorus(V) sulfide, **7**, 290; **8**, 401
 Samarium(II) iodide, **10**, 344
 Sodium bis(2-methoxyethoxy)aluminum hydride, **6**, 528
 Sodium borohydride–Cobalt(II) chloride, **11**, 479
 Sodium cyanoborohydride, **5**, 607
 Thionyl chloride, **6**, 585
 Thiophosphoryl bromide, **9**, 466
 Tin(II) chloride, **5**, 631
 Titanium(III) chloride, **5**, 669
 Titanium(IV) chloride + co-reagent, **7**, 372; **8**, 487; **10**, 404
 Trichloro(methyl)silane–Sodium iodide, **12**, 527

- Trifluoroacetic anhydride—Sodium iodide, **8**, 504
Triphenylphosphine, **1**, 1238
Triphenylphosphine—Iodine, **8**, 518
Tripotassium tri- μ -chlorohexachloroditungstate, **8**, 522
Tris(phenylseleno)borane, **9**, 511
THIOL ESTERS $\rightarrow$ RCHO
1,2-Dianilinoethane, **2**, 98
Raney nickel, **2**, 293
 α,β -UNSATURATED C=O's $\rightarrow$ ROH
Di- μ -carbonylhexacarbonyldicobalt, **1**, 224
Lithium aluminum hydride, **1**, 581
Lithium borohydride, **4**, 296
Osmium-on-carbon, **3**, 216
Potassium—Graphite, **4**, 397
Raney nickel, **6**, 502
Rhodium catalysts, **1**, 982
Sodium borohydride—Pyridine, **10**, 360
Sodium cyanoborohydride, **5**, 607; **6**, 537
Trifluoroacetic acid—Alkylsilanes, **5**, 695
Urushibara catalysts, **7**, 417
 α,β -UNSATURATED C=O's $\rightarrow$
ALLYLIC ALCOHOLS
Alumina, **6**, 16
Aluminum hydride, **1**, 34; **3**, 9
Aluminum isopropoxide, **1**, 35; **6**, 19
Bis(triphenylphosphine)copper(I) borohydride, **10**, 47
9-Borabicyclo[3.3.1]nonane, **6**, 62; **7**, 29; **8**, 47
Borane—Dimethyl sulfide, **8**, 49
Calcium borohydride, **5**, 89
Chlorotris(triphenylphosphine)-rhodium(I)—Hydrosilanes, **11**, 130
Corey's reducing agent, **4**, 103
Dichlorotris(triphenylphosphine)-ruthenium(II), **6**, 654
N,N-(Diethylethanamine)-trihydridoaluminum, **6**, 607
Diisobutylaluminum 2,6-di-*t*-butyl-4-methylphenoxide, **9**, 171
Diisobutylaluminum hydride, **3**, 101; **6**, 198; **12**, 191
2,6-Diisopropylphenoxymagnesium hydride, **8**, 175
Dimethylformamide dialkyl acetals, **6**, 222
Dimethylphenylsilane, **12**, 209
Erbium(III) chloride, **11**, 232
Ethane-1,2-diaminoborane, **1**, 355
Lithium aluminum hydride, **1**, 581; **4**, 291; **9**, 274; **11**, 289
Lithium aluminum hydride + co-reagent, **5**, 389; **9**, 169; **10**, 148, 238; **12**, 33, 190
Lithium butylborohydride, **11**, 294
Lithium *n*- or *t*-butyldiisobutylaluminum hydride, **10**, 239; **12**, 276
Lithium tri-*t*-butoxyaluminum hydride, **1**, 620, 983; **4**, 312
B-(3-Methyl-2-butyl)-9-borabicyclo-[3.3.1]nonane, **8**, 334
Nitromethane, **4**, 357
B-3-Pinanyl-9-borabicyclo[3.3.1]nonane, **11**, 429
Platinum catalysts, **1**, 890
Polymethylhydrosiloxane, **4**, 393
Potassium tri-*sec*-butylborohydride, **6**, 490; **7**, 307
Raney nickel, **7**, 312
Sodium bis(2-methoxyethoxy)aluminum hydride, **12**, 440
Sodium borohydride + co-reagent, **8**, 451; **9**, 422; **12**, 444
Sodium cyanoborohydride, **5**, 607; **6**, 538
Sodium hydride—Sodium *t*-amyloxide—Zinc chloride, **11**, 486
Triisobutylaluminum—Bis(N-methylsalicylaldimine)nickel, **11**, 562
Zinc borohydride, **3**, 337; **5**, 761
 α,β -UNSATURATED C=O's, C $\equiv$ N $\rightarrow$
C=O's, C $\equiv$ N
Aluminum chloride, **8**, 13
Birch reduction, **3**, 19
Chlorotris(triphenylphosphine)-rhodium(I), **2**, 448; **3**, 325; **4**, 562; **6**, 652; **11**, 130
Chromium(II)—Amine complexes, **5**, 142
Chromium(II) chloride, **3**, 60
Chromium(II) sulfate, **2**, 77
Cobalt boride—Borane—*t*-Butylamine, **11**, 138
Copper hydride ate complexes, **5**, 330; **6**, 144; **8**, 120; **10**, 237
Cryptates, **9**, 127
(1,5-Cyclooctadiene)(pyridine)-(tricyclohexylphosphine)iridium(I) hexafluorophosphate, **12**, 151
Di- μ -carbonylhexacarbonyldicobalt, **1**, 224; **6**, 172

REDUCTION REACTIONS (*Continued*)

Dichlorotris(triphenylphosphine)-
ruthenium(II), 4, 564
Diimide, 5, 220
Diisobutylaluminum hydride, 11, 185
Ethoxydiethylsilane, 5, 293
Fluorosulfuric acid, 5, 310
Hexafluoroantimonic acid, 6, 272
Hexamethylphosphoric triamide, 2, 208;
3, 149
Hydrazine, 1, 434
Hydridotetrakis(triphenylphosphine)-
rhodium(I), 11, 255
Hydrogen sulfide, 12, 247
Hydrogen telluride, 10, 205
Iron carbonyl, 4, 268
Lithium aluminum hydride, 11, 289
Lithium aluminum hydride-Copper(I)
iodide, 6, 326; 7, 196; 10, 237
Lithium-Ammonia, 1, 601; 5, 379
Lithium bronze, 11, 293
Lithium tri-*sec*-butylborohydride, 6, 348
Lithium trimethoxyaluminum hydride,
1, 625
Magnesium, 6, 351
Magnesium-Methanol, 10, 251
Nickel catalysts, 1, 718; 8, 433; 11, 356
Palladium catalysts, 5, 499
2-Phenylbenzothiazoline, 12, 384
Platinum catalysts, 1, 890
Polymethylhydrosiloxane, 4, 393
Potassium di- μ -carbonyloctacarbonyl-
 μ -hydridochromate, 7, 299
Potassium-Graphite, 9, 378
Potassium tetracarbonylhypodiferrate,
8, 419
Potassium tri-*sec*-butylborohydride, 6,
490; 7, 307
Rhodium catalysts, 11, 460
Ruthenium catalysts, 1, 983
Samarium(II) iodide, 8, 439; 10, 344
Sodium amalgam, 1, 1030
Sodium bis(2-methoxyethoxy)aluminum
hydride, 5, 596
Sodium borohydride, 2, 377; 12, 441
Sodium borohydride, sulfurated, 7, 331
Sodium cyanoborohydride, 7, 334
Sodium di- μ -carbonylhexacarbonyl-
 μ -hydridoferrate, 7, 340
Sodium dithionite, 11, 485
Sodium hydrogen telluride, 8, 459; 10,

365
Sodium iodide-Hydrochloric acid, 10,
366
Tetrabutylammonium borohydride, 10,
378
Tin, 1, 1168
Titanium(III) chloride, 5, 669
Tributyltin hydride, 11, 545
Tributyltin trifluoromethanesulfonate,
12, 524
Triethylammonium formate, 3, 300; 9,
481
Trifluoroacetic acid-Alkylsilanes, 5, 695
Triisobutylaluminum-Bis(N-methyl-
salicylaldimine)nickel, 11, 562
Trimesitylborane, 3, 308
Triphenyltin hydride, 2, 448; 3, 324; 4,
559; 5, 734; 6, 649
Urushibara catalysts, 6, 659
Ytterbium, 9, 517
Zinc, 1, 1276; 5, 753
Zinc-copper couple, 12, 569
Zinc-Zinc chloride, 7, 430

REDUCTIVE ACYLATION

Acetic anhydride, 1, 3; 6, 4
Di- μ -carbonylhexacarbonyldicobalt, 11,
162
Formic acid-Formamide, 1, 407
Lead tetraacetate, 3, 168
Sodium acetate, 1, 1024
Tetramethylammonium bromide, 1, 1143
Triethylamine, 1, 1198
Triphenyltin hydride, 2, 448
Zinc-Acid anhydride-Catalyst, 1, 1143;
4, 577

REDUCTIVE ALKYLATION

$R_2C=O \rightarrow R_2CHR'$
Lithium-Ammonia, 5, 379
Methylithium, 5, 448
Potassium tetracarbonylhypodiferrate,
6, 483
Sodium bis(2-methoxyethoxy)aluminum
hydride, 4, 441; 6, 528
p-Toluenesulfonyl chloride, 5, 676
p-Toluenesulfonylhydrazide, 8, 489
 $R_2C=O \rightarrow R_2CHOR'$
Palladium hydroxide, 2, 305
Triethylsilane, 4, 530
ArH
Birch reduction, 7, 21; 8, 38
Lead tetraacetate, 7, 185

Lithium–Ammonia, 10, 234
 α,β -UNSATURATED C=O's
t-Butyllithium, 8, 70
 Hexamethylphosphoric triamide, 3, 149
 Lithium–Ammonia, 1, 601; 3, 179; 8, 282; 10, 234
 Lithium N-isopropylcyclohexylamide, 4, 306
 Lithium tri-*sec*-butylborohydride, 6, 348; 8, 308
 Nickel carbonyl, 7, 250
 Sodium–Ammonia, 5, 589
 Titanium(III) chloride, 11, 529

REDUCTIVE AMINATION
 Benzylamine, 1, 51
 Borane–Amines, 1, 273; 12, 65
 Borane–Tetrahydrofuran, 1, 199
 N,N-Dimethylformamide, 2, 153
 5,5-Dimethylhydantoin, 7, 126
 Ephedrine, 11, 230
 Formaldehyde, 1, 397; 4, 238; 6, 305; 12, 232
 Hexamethylphosphoric triamide, 4, 244
 Iron carbonyl, 5, 357; 6, 304
 Isovaline, 4, 274
 Lithium aluminum hydride, 6, 325
 Lithium cyanoborohydride, 3, 183
 α -Methylbenzylamine, 11, 411
 Morpholine, 1, 705
 Nickel catalysts, 1, 723
 Organotitanium reagents, 11, 374
 Potassium tetracarbonylhidoferate, 6, 483
 Sodium borohydride, 6, 530; 11, 477
 Sodium cyanoborohydride, 4, 448; 5, 607; 6, 537; 10, 360; 12, 445
 Sodium hydrogen telluride, 12, 449
 Tetrabutylammonium cyanoborohydride, 11, 499
 Titanium(IV) chloride, 5, 671

REDUCTIVE COUPLING (*see also* ACYLOIN REACTION, COUPLING REACTIONS)
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 Magnesium, 1, 627; 6, 351
 Magnesium–Mercuric chloride, 2, 255
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 Samarium(II) iodide, 12, 429
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 Titanium(III) chloride, 6, 587; 12, 492
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- Chromium(II) sulfate, **5**, 144
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 Nickel carbonyl, **1**, 720; **2**, 290; **3**, 210; **4**,
 353; **5**, 472; **6**, 417
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 Silver(I) nitrate, **7**, 321
 Silver(I) trifluoromethanesulfonate, **7**,
 324
 Sodium, **4**, 437
 Sodium naphthalenide, **4**, 349; **11**, 490
 Sodium telluride, **6**, 550
 Tetrakis(triphenyl phosphite)nickel(0),
 11, 503
 Titanium(0), **11**, 526
 Titanium(III) chloride + co-reagent, **8**,
 483; **9**, 468; **12**, 493
 Triphenylphosphine, **5**, 725
 Zinc-copper couple, **1**, 1292; **7**, 428

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HYDROLYSIS)**REDUCTIVE Silylation** (*see also*
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- Chlorotrimethylsilane, **5**, 709
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 rhodium(I), **6**, 652; **11**, 130
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- Bis(chloromethyl) ether, **5**, 34
 Chlorotrimethylsilane, **12**, 126
 Diethylaluminum chloride, **8**, 164
 3,4-Dihydro-2H-pyran, **10**, 147
 Ethyl trichloroacetate, **4**, 233
 Indium, **6**, 293
 Iodine, **1**, 495
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- Samarium(II) iodide, **10**, 344
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 Zinc, **1**, 1285; **3**, 334; **5**, 753; **6**, 672; **11**,
 598; **12**, 567
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- 3 β -Acetoxy- Δ^5 -etienic acid, **1**, 9
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- (S)-(-)-1-Amino-2-(silyloxymethyl)-
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 2,3-Butanediol, **1**, 81
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C = C = C

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Titanium(IV) isopropoxide, 12, 90
Camphor-10-sulfonic acid, 1, 108
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 α -Methylbenzylamine, 1, 838; 5, 441

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2,2-dioxide, 12, 236
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Chlorotrimethylsilane, 3, 310
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 Ethyl azidoformate, **7**, 146
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 Lithium aluminum hydride-Aluminum
 chloride, **4**, 293
 Lithium diisopropylamide, **5**, 400
 Lithium iodide, **11**, 300
 Lithium naphthalenide, **4**, 348
 Lithium piperidide, **6**, 344
 Magnesium bromide etherate, **9**, 288
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 Methylithium, **1**, 686; **5**, 448; **6**, 384
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 Perchloric acid, **5**, 506; **6**, 453
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 Phenyl(trihalomethyl)mercury, **6**, 468
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Potassium hydride, **12**, 407
 Pyridine, **2**, 349; **6**, 497
 Pyridinium chlorochromate, **9**, 397
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 Silver perchlorate, **4**, 432; **6**, 518
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 Silver tetrafluoroborate, **2**, 365; **4**, 428
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 Sodium chlorodifluoroacetate, **5**, 603
 Sodium ethoxide, **1**, 1065
 Sodium hydrogen sulfite, **1**, 1047
 Sodium methylsulfinylmethylide, **1**, 310
 Sodium nitrite, **1**, 1097
 Tetrabutylammonium fluoride, **12**, 458
 Tetracarbonyldi- μ -chlorodirrhodium, **5**,
 572; **6**, 108
 Tetrafluoroboric acid, **1**, 394; **10**, 382
 Thallium(III) nitrate, **8**, 476
 Thallium(III) perchlorate, **5**, 657
 Tributyltin hydride, **12**, 516
 Triethyloxonium tetrafluoroborate, **8**,
 500
 Trifluoroacetic acid, **5**, 695; **9**, 483
 Tris(methylthio)methylithium, **10**, 453
 Zinc, **6**, 672
 Zinc-Acetic acid, **5**, 757
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Arene(tricarbonyl)chromium complexes,
10, 13
 Hydrogen peroxide, **4**, 254
 Iodine azide, **5**, 350
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 5-Chloro-1-penten-3-one, **3**, 47
 1,3-Dibromo-2-pentene, **7**, 90
 1,3-Dichloro-2-butene, **1**, 214
 Ethyl phenyl sulfoxide, **6**, 257
 Ethyl vinyl ketone, **1**, 388
 2-Fluoro-1-buten-3-one, **6**, 263
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- (E)-1-Iodo-3-trimethylsilyl-2-butene, **5**, 355
1-Methoxy-3-buten-2-one, **3**, 198
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Methyl 5-methoxy-3-oxopentanoate, **9**, 314
Methyl 3-oxo-4-pentenoate, **1**, 1272; **5**, 746
Methyl vinyl ketone, **1**, 697; **6**, 407
2-Methyl-6-vinylpyridine, **6**, 409
1,7-Octadien-3-one, **9**, 327; **10**, 280
trans-3-Penten-2-one, **2**, 306; **3**, 218; **4**, 371
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Pyrrolidine, **1**, 972
Sodium dicarbonyl(cyclopentadienyl)-ferrate, **6**, 538
Sodium methylsulfinylmethylide, **2**, 166
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- Palladium catalysts, **4**, 367, 368; **7**, 275
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SAKURAI REACTION (*see* CONJUGATE ADDITION)**SANDMEYER REACTION**

- Copper(I) halides, **1**, 165, 166
Copper(II) chloride-Nitric oxide, **2**, 87
Phase-transfer catalysts, **9**, 356
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SARETT OXIDATION (*see* REAGENT INDEX)**SCHIEMANN REACTION**

- Arenediazonium salts, **1**, 42, 43
Tetrafluoroboric acid, **1**, 394
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- Azidotrimethylsilane, **7**, 394; **10**, 14
Chloramine, **1**, 122
Diphenyl phosphoroazide, **11**, 222
Hydrazoic acid, **1**, 446; **2**, 211; **5**, 329
Sodium azide, **1**, 901, 1041, 1225; **2**, 376; **4**, 440
Trifluoroacetic acid, **12**, 529

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- Antimony(III) chloride, **8**, 19

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- Ethyl chlorothioformate, **6**, 252

- Formyl fluoride, **1**, 407
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- Benzeneselenenyl halides, **5**, 518; **6**, 459; **7**, 286; **8**, 25; **9**, 25; **10**, 16; **11**, 33
Benzeneselenenyl trifluoroacetate, **6**, 459
Benzeneseleninic acid, **8**, 28
N,N-Diethylbenzeneselenenamide, **11**, 178
Diphenyl diselenide, **5**, 272; **7**, 136; **11**, 219
Lithium diisopropylamide, **6**, 334
Phenylselenenyl chloride, **6**, 459
Phenyl selenocyanate, **11**, 416
1-Phenylthiovinyl lithium, **8**, 281
2-Pyridineselenenyl bromide, **11**, 455
Selenium, **10**, 345; **11**, 465
p-Toluenesulfonylhydrazide, **11**, 537

SEMMLER-WOLFF REACTION

- Tetramethylene sulfone, **5**, 651

SERINI REACTION

- Zinc, **1**, 1276; **2**, 459; **3**, 334

SHAPIRO REACTION (*see*

ELIMINATION REACTIONS)

SHARPLESS EPOXIDATION

- t*-Butyl hydroperoxide, **5**, 75; **7**, 43; **8**, 62; **10**, 64
t-Butyl hydroperoxide + co-reagent, **5**, 75; **9**, 81; **11**, 92, 97; **12**, 90
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Diphenylsulfonium cyclopropylide, **4**, 211
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1-Hydroxycyclopropanecarboxaldehyde, **12**, 247
Lead carbonate, **9**, 265
1-Lithiocyclopropyl phenyl sulfide, **7**, 190
(1-Lithiovinyl)trimethylsilane, **11**, 286
Lithium cyclopropyl(phenylthio)cuprate, **7**, 211
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- Potassium hydride-Hexamethylphosphoric triamide, 7, 302
- 3-Tetrahydropyranyloxy-1-tributylstannyl-1-propene, 6, 602
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- 3-Acetoxy-2-trimethylsilylmethyl-1-propene, 11, 578
- S-Allyl N,N-dimethyldithiocarbamate, 6, 11
- Allyl trifluoromethanesulfonate, 8, 8
- Benzenesulfonyl chloride, 6, 30; 9, 35
- Bis(methoxycarbonyl)sulfur diimide, 12, 57
- Cesium fluoride, 9, 100
- (3-Chloro-3-methyl-1-butynyl)lithium, 8, 93
- m*-Chloroperbenzoic acid, 12, 118
- (Z)-1,2-Dichloro-4-phenylthio-2-butene, 7, 98
- Diethylzinc-Diodomethane, 11, 182
- Dimethyl diazomalonate, 5, 244
- Dimethylformamide dimethyl acetal, 8, 191
- 2,4-Dinitrobenzenesulfonyl chloride, 9, 194
- 1,3-Dithiane, 4, 216
- 1,3-Dithienium tetrafluoroborate, 4, 218
- Dodecamethylcyclohexasilane, 12, 219
- Lithium diisopropylamide, 5, 400; 6, 334
- Lithium thiophenoxide, 5, 418
- (Z)-2-Methoxy-1-(phenylthio)-1,3-butadiene, 11, 328
- Methyl (allylthio)acetate, 10, 261
- Methyl bromide-Lithium bromide, 10, 262
- Methyl cyanodithioformate, 7, 237
- Methyl methanethiosulfonate, 7, 243
- p*-Nitrophenyl selenocyanate, 9, 325
- Phase-transfer catalysts, 8, 387
- Phenylselenenyl benzenesulfonate, 11, 407
- Potassium carbonate, 10, 323
- Potassium thiophenoxide, 8, 420
- Silver tetrafluoroborate, 5, 587
- Sodium benzeneselenoate, 8, 447
- Sulfur dioxide, 8, 464
- p*-Toluenesulfonyl-S-methylcarbazate, 5, 681
- Tributyl(iodomethyl)tin, 9, 250
- Trichloroacetonitrile, 12, 526
- Triethyloxonium tetrafluoroborate, 2, 430
- Trimethyl phosphite, 11, 570
- Trimethylsilylmethanethiol, 11, 576
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- Benzeneselenenyl halides, 9, 25
- Benzylamine, 10, 26
- Boron trichloride, 5, 50
- Boron trifluoride etherate, 1, 70
- N-Bromosuccinimide, 4, 49
- (E)-(Carboxyvinyl)trimethylammonium betaine, 12, 106
- μ -Chlorobis(cyclopentadienyl)-(dimethylaluminum)- μ -methylenetitanium, 11, 52
- Chlorotrimethylsilane, 8, 107
- Claisen's alkali, 6, 127
- Copper(I) trifluoromethanesulfonate, 10, 108
- Dichlorotris(triphenylphosphine)-ruthenium(II), 8, 159
- 3,3-Diethoxy-1-propene, 9, 158
- Diethylaluminum benzenethiolate, 12, 343
- N,N-Dimethylacetamide dimethyl acetal, 8, 179
- Ethyl vinyl ether, 1, 386; 3, 300; 4, 234; 11, 235
- Iodine, 8, 256
- 2-(E)-Lithiovinyltrimethylsilane, 10, 443
- Lithium methylsulfinylmethylide, 12, 283
- Mercury(II) acetate, 1, 644
- (S)-N-Methanesulfonylphenylalanyl chloride, 8, 320
- 2- or 3-Methoxypropene, 2, 230; 4, 330
- Organoaluminum reagents, 12, 339
- Organotitanium reagents, 11, 52
- Phenylselenoacetaldehyde, 10, 310
- Phenylthioacetylene, 9, 370
- Potassium hydride, 11, 435
- Sodium dithionite, 11, 485

- Sodium methylsulfinylmethylide, **12**, 451
- 1,1,1,3-Tetramethoxypropane, **10**, 424
- Titanium(IV) chloride, **7**, 370; **11**, 529
- p*-Toluenesulfonic acid, **5**, 673
- Trialkylaluminums, **11**, 539
- Triethyl orthoacetate, **3**, 300; **4**, 527; **6**, 607; **10**, 417
- Trifluoroacetic acid, **4**, 530; **11**, 557
- 1,1,1-Trimethoxy-3-phenylselenopropane, **9**, 489
- Trimethyl orthoformate, **8**, 180
- Zinc carbonate, **8**, 535
- Zinc chloride, **10**, 461
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- Chlorotris(triphenylphosphine)-rhodium(I), **2**, 448
- N,N-Dimethylacetamide dialkyl acetals, **1**, 271; **4**, 166; **5**, 226; **8**, 179
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- Titanium(IV) chloride, **9**, 468
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- Chlorotrimethylsilane, **6**, 626
- Hexamethylphosphoric triamide, **6**, 273; **8**, 240
- Lithium diisopropylamide, **11**, 296
- Lithium hexamethyldisilazide, **12**, 280
- Lithium N-isopropylcyclohexylamide, **4**, 306; **7**, 209
- Triethyl orthoacetate, **6**, 607
- Zinc, **4**, 574
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- Aluminum chloride, **11**, 25
- Diethyl allylthiomethylphosphonate, **3**, 94
- 2-Ethoxyallyl vinyl sulfide, **5**, 292
- Potassium *t*-butoxide, **4**, 399
- Sodium N,N-dimethyldithiocarbamate, **6**, 539
- Tetraethylthiuram disulfide, **6**, 569
- Triethylamine, **7**, 385
- 1-Vinylthioallyllithium, **5**, 749
- Cope rearrangement
- Antimony(V) fluoride, **6**, 23
- Bis(aceto- or benzonitrile)-dichloropalladium(II), **10**, 31; **11**, 46; **12**, 50
- Chlorotrimethylsilane, **6**, 626
- 1-Lithio-2-vinylcyclopropane, **7**, 192; **9**, 273
- Lithium bis(2-vinylcyclopropyl)-cuprate, **7**, 199
- Lithium cyclopropyl(phenylthio)-cuprate, **7**, 211
- Methyl 2-acetylacrylate, **11**, 334
- 2-Methylcyclopentenone-3-dimethylsulfoxonium methylide, **6**, 378
- Methyl 4-methylthiocrotonate, **6**, 389
- Methyl vinyl ketone, **5**, 464
- Organocopper reagents, **9**, 328
- Phenylselenoacetaldehyde, **10**, 310
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ACETONIDES

Acetone, 3, 4

Bis(*p*-nitrophenyl) hydrogen phosphate, 1, 331

Copper(II) sulfate, 2, 89; 8, 125

2,2-Dialkoxypropane, 1, 244, 268; 3, 120; 5, 208, 226

Ferric chloride, 8, 228

Ion-exchange resins, 1, 511

2-Methoxypropene, 11, 329; 12, 317

Perchloric acid, 1, 796; 3, 220

p-Toluenesulfonic acid, 1, 1172

2-Trimethylsilyloxy-1-propene, 5, 718

ACETYLENES (*see* ALKYNES)**ACETYLENIC CARBONYL****COMPOUNDS** **α,β -ACETYLENIC ACIDS**

Acetylene, 1, 712

Carbon dioxide, 1, 1037

Lithium acetylides, 4, 551

Lithium 2,6-di-*t*-butyl-4-methylphenoxide, 5, 412

Pyridinium chlorochromate, 6, 498

Sodium hydride, 1, 1075

 α,β -ACETYLENIC ALDEHYDES**(KETONES)**

from RCOX and alkynes

Bis(trimethylsilyl)acetylene, 5, 44

Boron trifluoride etherate, 12, 66

Copper(I) trimethylsilylacetylide, 6, 148

Dichlorobis(triphenylphosphine)-palladium(II), 8, 151

N,N-Dimethylformamide, 1, 278

N,O-Dimethylhydroxylamine, 11, 201

Lithium iodide, 5, 410

Manganese(II) iodide, 9, 289

Silver tetrafluoroborate, 12, 434

by Oxidation at propargyl carbons

o-Chloranil, 1, 128

Chlorotris(triphenylphosphine)-rhodium(I), 5, 736

Chromium(VI) oxide-Pyridine, 4, 96; 9, 121

Lead(IV) oxide, 2, 233

Manganese(IV) oxide, 1, 637; 4, 317

Nickel peroxide, 2, 294

Other methods

Benzyltrimethylammonium hydroxide, 5, 29; 7, 20

[1,1'-Bis(diphenylphosphine)-ferrocene](dichloro)palladium(II), 12, 171

Ferrocenylphosphines, 10, 37

Formic acid, 5, 316

Iodine, 8, 256

Triethyl orthoformate, 1, 1204

 γ,δ -ACETYLENIC ALDEHYDES**(KETONES)** β -1-Alkynyl-9-borabicyclo[3.3.1]-nonanes, 8, 6

Copper(I) iodide, 8, 121

Di- μ -carbonylhexacarbonyldicobalt, 10, 129

Diethylaluminum chloride, 4, 144

Diethylaluminum trimethylsilylacetylide, 8, 42

Triethylborane, 9, 482

ACETYLENIC ALDEHYDES

(KETONES) FROM α,β -EPOXY CARBONYLS

2,4-Dinitrobenzenesulfonylhydrazide, **6**, 232

Hydrazine, **5**, 327; **7**, 170

Hydroxylamine-O-sulfonic acid, **2**, 217; **5**, 343

Mesitylenesulfonylhydrazide, **10**, 255

p-Toluenesulfonylhydrazide, **2**, 417

 α,β -ACETYLENIC AMIDES

Dimethylcarbamoyl chloride, **8**, 151

 α,β -ACETYLENIC ESTERS

Benzyltrimethylammonium hydroxide, **5**, 29

Ethyl propiolate, **8**, 259

Methyl chloroformate, **9**, 306

Palladium(II) chloride-Copper(II) chloride, **10**, 302

Thallium(III) nitrate, **4**, 492; **7**, 362

Triethyl phosphonoiodoacetate, **1**, 1218

OTHER ACETYLENIC CARBONYLS

m-Chloroperbenzoic acid, **11**, 122

Di- μ -carbonylhexacarbonyldicobalt, **8**, 148

Ethyl diazoacetate, **4**, 228

Methyl lithium, **8**, 342

Potassium 3-aminopropylamide, **8**, 406

Propargyl bromide, **6**, 493

Trichloroethylene, **9**, 479; **11**, 552

ACYL AZIDES

Dimethylformamide-Thionyl chloride, **12**, 204

Hydrazoic acid, **5**, 329

Nitrosyl chloride, **1**, 748

Phenyl dichlorophosphate, **12**, 384

Sodium azide, **1**, 1041

Sodium nitrite, **1**, 1097

Tetrabutylammonium azide, **6**, 563

ACYL HALIDES**ACYL FLUORIDES**

Acyl fluorides, **1**, 14

Carbonic difluoride, **1**, 116

Cyanuric fluoride, **5**, 171

(Diethylamino)sulfur trifluoride, **6**, 183

2-Halopyridinium salts, **9**, 234

Potassium fluoride, **2**, 346; **5**, 153

Pyridinium poly(hydrogen fluoride), **9**, 399

Selenium(IV) fluoride, **5**, 576

Sodium fluoride, **2**, 382

Uranium(VI) fluoride, **7**, 417

ACYL CHLORIDES

from RCOOH

Amidines, bicyclic, **4**, 16

Benzoyl chloride, **1**, 50

N,N'-Carbonyldiimidazole, **1**, 114

Dichloromethyl methyl ether, **1**, 220

N,N-Diethyl-1,2,2-

trichlorovinylamine, **1**, 253

Dimethylformamide-Thionyl chloride, **1**, 286

Hexamethylphosphoric triamide-Thionyl chloride, **3**, 153

Oxalyl chloride, **1**, 767; **8**, 365

N-Phenyltrimethylacetimidoyl chloride, **1**, 854

Phosgene, **5**, 532

Phosphorus(III) chloride, **1**, 875

Phosphorus(V) chloride, **1**, 866

Phthaloyl chloride, **1**, 882

Thionyl chloride, **1**, 1158

2,2,2-Trichloro-1,3,2-

benzodioxaphosphole, **1**, 120

(Trichloromethyl)carbonimidic dichloride, **4**, 523

Triphenylphosphine-Carbon

tetrachloride, **1**, 1247; **6**, 644; **9**, 503

Triphenylphosphine dichloride, **6**, 646

from Other sources

Chlorosulfuric acid, **1**, 139

Diisopropyl peroxydicarbonate, **1**, 263

Dimethylformamide-Oxalyl chloride, **9**, 335

Hexamethyldisiloxane, **8**, 240

Oxalyl chloride, **8**, 366; **11**, 379

Phthaloyl chloride, **1**, 882

Triphenylphosphine dihalide, **5**, 730; **6**, 645

Zinc chloride, **1**, 1289

ACYL BROMIDES

N-Bromosuccinimide, **9**, 70

Bromotrimethylsilane, **10**, 59

Thionyl bromide, **5**, 663

2,2,2-Tribromobenzo-1,3,2-dioxaphosphole, **2**, 63

Triphenylphosphine dibromide, **1**, 1247; **5**, 729

ACYL IODIDES

Iodotrimethylsilane, **10**, 59

Sodium iodide, **12**, 450

ACYL NITRILES

t-Butyl hydroperoxide, **12**, 88

ACYL NITRILES (*Continued*)

- Copper(I) cyanide, 5, 166
- Cyanotrimethylsilane, 10, 1
- Iodophenylbis(triphenylphosphine)-palladium, 11, 269
- Phenyl selenocyanate, 11, 416
- Potassium cyanide, 11, 433
- Tetrabutylammonium bromide, 5, 644
- Thallium(I) cyanide, 8, 476
- Tributyltin cyanide, 10, 411

ACYLOINS (*see* HYDROXY

ALDEHYDES AND KETONES)

ACYL SILANES (*see* SILANES)**ALCOHOLS** (*see also* ALLENIC

ALCOHOLS, ALLYLIC ALCOHOLS,
CHIRAL COMPOUNDS, DIOLS,
HOMOALLYLIC ALCOHOLS,
HYDROXY..., PROPARGYL
ALCOHOLS)

BY ADDITION OF RM TO C=O

General methods

- Cerium(III) iodide, 11, 114
- Cesium fluoride, 11, 115
- Grignard reagents, 1, 415, 1170
- Lithium, 4, 286
- Organocerium reagents, 12, 345
- Organolithium reagents, 10, 3
- Organozirconium reagents, 12, 358
- Pentane-1,5-di(magnesium bromide), 9, 355
- Samarium(II) iodide, 8, 439; 10, 344; 12, 429
- Tributyltinlithium, 8, 495

Addition of CH_3M

- Dilithium trimethylcuprate, 6, 386; 7, 115
- Iodo(methyl)calcium, 5, 442
- Lithium dimethylcuprate, 6, 209; 10, 193
- N-Methylphenylsulfonimidoyl-methylithium, 5, 458
- Organotitanium reagents, 10, 138, 270, 422

Addition of ArM

- Benzeneboronic acid, 9, 23
- Boron trichloride, 9, 62
- Chromium carbonyl, 9, 117
- Chromium(II) chloride, 12, 136
- Dichlorophenylborane, 12, 178
- Lithium *o*-lithiophenoxide, 12, 283
- Methyl phenyl selenide, 6, 86

Phenyltetrabutylbismuth iodide, 11, 249

Phenylzinc bromide, 5, 753

Selective additions ($\text{RCHO} \rightarrow$ R_2CHOH)

2-(N-Formyl-N-methyl)-aminopyridine, 10, 265

Selective additions ($\text{R}_2\text{CO} \rightarrow \text{R}_3\text{COH}$)

1,4-Dichloro-1,4-dimethoxybutane, 12, 175

Diethyl carbonate, 1, 247

Other RM additions

- Benzylsodium, 6, 40
- Butyllithiums, 1, 96; 4, 60; 5, 80
- Chromium carbonyl, 11, 131
- Dichloromethylithium, 1, 223
- gem*-Difluoroallyllithium, 10, 146
- Dilithium tributylcuprate, 7, 115
- Trichloromethylithium, 1, 223
- Zinc, 11, 598

BY CLEAVAGE OF CYCLIC ETHERS

Copper(I) bromide, 7, 79

1,1-Diphenylhexyllithium, 5, 277

Grignard reagents—Copper(I) halides, 9, 124

Lithium aluminum hydride—Aluminum chloride, 4, 293

Lithium—Ethylenediamine, 4, 291

Lithium naphthalenide, 4, 348

Lithium triethylborohydride—Aluminum *t*-butoxide, 9, 287

Phenyllithium—Boron trifluoride etherate, 12, 68

Sodium, 4, 437

Trimethylene oxide, 1, 1232

BY CLEAVAGE OF ROCH_3 , ROR' (*see* TYPE OF REACTIONINDEX, DEALKYLATION,
DEMETHYLATION)**BY CLEAVAGE OF EPOXIDES WITH RM**

Dimethylmagnesium, 1, 292

Grignard reagents, 1, 415; 9, 124

2-Lithio-1,3-dithianes, 3, 135; 12, 573

3-Lithio-1-triisopropylsilyl-1-propyne, 11, 566

Organoaluminum reagents, 12, 339

Organocopper reagents, 3, 106; 5, 288; 11, 365

Organolithium reagents, 1, 571; 12, 68

p-(Tolylsulfinyl)methylithium, 4, 513

Trialkylaluminums, 11, 539

Trimethylsilylmethylpotassium, 6, 637

BY HYDROLYSIS OF RX

m-Chloroperbenzoic acid, 8, 97

Mercury(II) oxide–Tetrafluoroboric acid, 12, 306

Potassium superoxide, 6, 488

Silver sulfate, 4, 435

BY HYDROLYSIS OF RO₃R'

Hexamethylphosphoric triamide, 6, 273

Potassium *t*-butoxide, 1, 911

Potassium nitrite, 10, 329

Potassium superoxide, 6, 488

Sodium amalgam, 1, 1030

Sodium benzylate, 1, 1045

Sodium naphthalenide, 1, 711; 5, 468

Tetrabutylammonium hydroxide, 5, 645

BY HYDROMETALLATION-

OXIDATION OF ALKENES

Hydroboration-oxidation

Bis(3,6-dimethyl)borepane, 4, 35

9-Borabicyclo[3.3.1]nonane, 2, 31; 5, 46; 6, 62; 8, 47; 9, 57

Borane + co-reagents, 1, 199, 963; 5, 47; 9, 136; 11, 69

Dichlorobis(cyclopentadienyl)-titanium-Lithium borohydride, 9, 146

Dicyclohexylborane, 6, 62

Diisopinocampheylborane, 6, 202

Disiamylborane, 1, 57; 6, 62; 11, 226

Lithium triethylborohydride, 8, 309

Monochloroborane diethyl etherate, 4, 346

Thexylborane, 11, 516

Triisopinocampheylborane, 1, 1228

Other routes

Diethoxymethylsilane, 12, 182

Hydrogen hexachloroplatinate(IV) + co-reagents, 8, 98; 12, 243

Sodium borohydride–Acetic acid, 5, 601

Tin(IV) chloride–Sodium borohydride, 9, 438

Titanium(IV) chloride + co-reagents, 9, 276; 10, 404

BY HYDROXYLATION OF C–H

BONDS (see TYPE OF REACTION INDEX)

FROM ORGANOBORANES

2-Alkyl-1,3-benzodithiolanes, 9, 4

Bis(3,6-dimethyl)borepane, 4, 35

Bis(phenylthio)methane, 7, 25

Borane–Tetrahydrofuran, 1, 199; 4, 124

N-Bromosuccinimide, 4, 49

Carbon monoxide, 2, 60; 4, 69; 9, 393

Dichloromethyl methyl ether, 5, 200

Hydrochloric acid, 6, 283

Lithium triethylmethoxide, 4, 314

α -Methoxyvinylolithium, 7, 233

Oxygen, 4, 362

Sodium cyanide, 4, 446; 7, 333

Tris(phenylthio)methylolithium, 11, 305

Vinylolithium, 6, 325

BY OXIDATION OF ALKYL SILANES

(see TYPE OF REACTION INDEX)

BY OXYMERCURATION–

DEMERCURATION INDEX

Mercury(II) acetate, 2, 264; 3, 194; 4, 319; 5, 424; 6, 358; 10, 252

BY REACTION OF RM WITH O₂

Chlorobis(cyclopentadienyl)-hydridoziurconium(IV), 6, 175

Sodium borohydride, 5, 597

BY REDUCTION OF RCHO, R₂CO,

RCOOH, RCOX, EPOXIDES, α,β -UNSATURATED CARBONYLS

(see TYPE OF REACTION INDEX)

BY REDUCTION OF ROOH

Triethyl phosphite, 1, 1212

OTHER METHODS

Allyl alcohol, 5, 80

Aluminum hydride, 5, 13

9-Borabicyclo[3.3.1]nonane, 9, 57

sec-Butyllithium, 9, 88

m-Chloroperbenzoic acid, 1, 135

Chlorotrimethylsilane, 7, 66

Diborane, 5, 184

Di- μ -carbonylhexacarbonyldicobalt, 1, 224

S,S'-Diethyl dithiomalonate, 9, 160

N-Ethyl-2-pyrrolidone, 9, 220

Ferrous perchlorate, 6, 260

Hydroxylamine-O-sulfonic acid, 3, 156

Lithium borohydride, 12, 276

Nitrogen dioxide, 1, 324

Sodium borohydride, 8, 449

Sodium dithionite, 10, 363

Tributyltinmethanol, 7, 378

Trimethylamine N-oxide, 9, 488

ALDEHYDES (see also α,β -ACETYLENIC

CARBONYLS, ALLENIC

CARBONYLS, CHIRAL

ALDEHYDES (*Continued*)

COMPOUNDS, CYANO
CARBONYLS, DICARBONYLS,
 α,β -EPOXY CARBONYLS,
UNSATURATED CARBONYLS)

FROM RX + CARBANIONS

Allyldimesitylborane, **12**, 12
Allylmercaptan, **5**, 84
3-Chloro-1-phenylthio-1-propene, **6**, 605
3,3-Diethoxy-1-propene, **6**, 270
N,N-Diethylaminoacetonitrile, **9**, 159
Diethyl phenyl orthoformate, **3**, 97
7,8-Dimethyl-1,5-dihydro-2,4-benzodithiepin, **6**, 216
4,4-Dimethyl-1,3-oxathiolane-3,3-dioxide, **9**, 186
2-(2,6-Dimethylpiperidino)acetonitrile, **11**, 212
2,4-Dimethylthiazole, **4**, 202
1,3-Dithiane, **5**, 287; **6**, 248
(Z)-2-Ethoxyvinylithium, **8**, 221
Ethyl ethylthiomethyl sulfoxide, **5**, 299
2-Lithio-4,5-dihydro-5-methyl-[4H]-1,3,5-dithiazine, **8**, 305
Methoxymethyl phenyl sulfide, **12**, 316
Methyl methylthiomethyl sulfoxide, **4**, 341; **5**, 456
2-Methyl-2-thiazoline, **6**, 403
Methylthioacetic acid, **6**, 395
3-Methylthio-1,4-diphenyl-5-triazolium iodide, **6**, 396
Methylthiomethyl-N,N'-dimethyldithiocarbamate, **6**, 398
Phenylselenotrimethylsilylmethylithium, **7**, 402
Phenylthiotrimethylsilylmethane, **10**, 313
2,4,4,6-Tetramethyl-5,6-dihydro-1,3-(4H)-oxazine, **3**, 280; **4**, 481; **5**, 651
3-Triethylsilyloxy-1-propene, **6**, 607
s-Trithiane, **3**, 329; **4**, 564

BY ARYLATION OF ALLYL

ALCOHOLS (*see* TYPE OF REACTION INDEX)

BY CARBONYLATION OF RM

Dihalobis(triphenylphosphine)-palladium(II), **6**, 60
Dipotassium(or Disodium) tetracarbonylferrate, **3**, 267; **8**, 214; **10**, 174
Tetrakis(triphenylphosphine)-palladium(0), **12**, 468

BY FORMYLATION OF ArH

(*see* TYPE OF REACTION INDEX)

BY FORMYLATION OF RM

Acetic-formic anhydride, **2**, 10
2-Alkoxy-1,3-benzodithiolanes, **8**, 236
1,3-Benzodithiolium perchlorate, **8**, 34
p-Dimethylaminobenzaldehyde, **2**, 146
N,N-Dimethylformamide, **1**, 278; **11**, 198; **12**, 98
Ethoxymethyleneaniline, **1**, 362
2-(N-Formyl-N-methyl)aminopyridine, **8**, 341
N-Formylpiperidine, **11**, 244
Grignard reagents, **10**, 189
Lithium, **5**, 376
Methyl methylthiomethyl sulfoxide, **8**, 344
Methylthiomethyl p-tolyl sulfone, **12**, 327
1-Phenylthio-1-trimethylsilylethylene, **12**, 394
1,1,3,3-Tetramethylbutyl isocyanide, **3**, 279; **4**, 480
Triethyl orthoformate, **1**, 1204
N,4,4-Triethyl-2-oxazolinium iodide, **4**, 540; **6**, 630

FROM HALOHYDRINS AND SIMILAR COMPOUNDS

Methanesulfonyl chloride, **1**, 662
Phosphoric acid, **4**, 387
Silver carbonate-Celite, **5**, 577
Sodium hydroxide, **5**, 616

BY HYDROFORMYLATION OF C=C

9-Borabicyclo[3.3.1]nonane, **3**, 24
Carbon monoxide, **2**, 253
Carbonylchlorobis(triphenylphosphine)-rhodium(I), **5**, 46
Carbonylhydridotris(triphenylphosphine)rhodium(I), **5**, 331; **7**, 53; **9**, 259
Chlorobis(cyclopentadienyl)-hydrido-zirconium(IV), **6**, 175
Di- μ -carbonylhexacarbonyldicobalt, **1**, 224; **5**, 204
Rhodium(II) carboxylates, **12**, 423
Rhodium(III) oxide, **4**, 420; **8**, 437
Tetracarbonylhydridocobalt, **2**, 80

BY HYDROLYSIS OF C=C-X, CX₂
(*see* TYPE OF REACTION INDEX)**BY HYDROMETALLATION-
OXIDATION OF C $\equiv$ C**

- Borane-Tetrahydrofuran, **1**, 199
 Catecholborane, **4**, 69
 Dichloroborane diethyl etherate, **5**, 191
 Di-2-mesitylborane, **12**, 195
 Disiamylborane, **1**, 57
 Lithium acetylide, **6**, 324
 Monochloroborane diethyl etherate, **5**, 465
 Thiolacetic acid, **1**, 1154
 FROM IMINES AND RELATED C = N
 (see TYPE OF REACTION INDEX)
 BY ISOMERIZATION OF ALLYLIC ALCOHOLS
 Diisobutylaluminum hydride, **12**, 191
 Iridium catalysts, **8**, 135
 FROM NITRO COMPOUNDS
 N''-(*t*-Butyl)-N,N,N',N'-tetramethylguanidinium *m*-iodylbenzoate, **12**, 102
 Ozone, **5**, 491
 Potassium permanganate, **1**, 942; **10**, 330; **11**, 440
 Sodium hydroxide, **8**, 461
 Sodium methoxide, **6**, 545
 1,1,3,3-Tetramethylbutyl isocyanide, **5**, 650
 Titanium(III) chloride, **4**, 506; **5**, 669
 BY OXIDATION OF ROH, RX, RNH₂, 1-ALKENES, ArR, ROR', and R₃SiOR' (see TYPE OF REACTION INDEX)
 BY OXIDATIVE CLEAVAGE OF C = C, 1,2-DIOLS AND RELATED, EPOXIDES, OTHER SUBSTRATES (see TYPE OF REACTION INDEX)
 BY REARRANGEMENT OF EPOXIDES
 Boron trifluoride etherate, **1**, 70; **5**, 52
 Dimethyl sulfoxide-Sulfur trioxide, **2**, 165
 Lithium bromide, **4**, 297; **5**, 395
 Lithium diethylamide, **1**, 610
 Molybdenum carbonyl, **7**, 247
 BY REDUCTION OF RCOOH, RCOCl, RCN (see TYPE OF REACTION)
 BY VILSMEIER FORMYLATION (see TYPE OF REACTION INDEX)
 BY WITTIG AND RELATED REAGENTS
 [Bis(1,3,2-dioxaborola-2-nyl)methyl]-lithium, **6**, 328; **10**, 239
 Bis(methylthio)methylolithium, **7**, 24
 Chloro(trimethylsilyl)methylolithium, **8**, 277; **12**, 118
 Diazo(trimethylsilyl)methylolithium, **7**, 216
 Dibutyl tetrahydropyranoloxymethylphosphonate, **9**, 163
 Diethyl N-benzylideneaminomethylphosphonate, **9**, 161; **11**, 178
 Diethyl methoxyethoxymethylphosphonate, **9**, 162
 Diethyl [(2-tetrahydropyranoloxymethyl)phosphonate, **11**, 181; **12**, 188
 Dimesityl(trimethylsilylmethyl)borane, **12**, 12
 Diphenylmethoxymethylphosphine, **10**, 172
 Methoxymethyl(diphenyl)phosphine oxide, **9**, 301
 Methoxymethylenetriphenylphosphorane, **1**, 671; **2**, 271; **6**, 368
 Methoxy(trimethylsilyl)methylolithium, **9**, 284; **10**, 246; **11**, 331
 Methyl methylthiomethyl sulfoxide, **6**, 446
 N-Methyl-N-trimethylsilylmethyl-N'-*t*-butylformamidine, **11**, 347
 N-Morpholinomethyldiphenylphosphine oxide, **9**, 318
 Phenoxymethylenetriphenylphosphorane, **1**, 1240
 Trimethylsilyllithium, **9**, 493
 OTHER METHODS
 Acetic anhydride, **5**, 3
 Benzoic anhydride, **1**, 49
 Bis(trimethylsilyl) peroxide, **12**, 63
 Carbon monoxide, **9**, 393
 α -Chloro-N-cyclohexylpropanal-donitrone, **5**, 110; **6**, 106
 Diazoacetaldehyde, **3**, 73
 2-Lithio-2-trimethylsilyl-1,3-dithiane, **4**, 284
 Potassium fluoride, **10**, 325
 Raney nickel, **12**, 422
 α -SUBSTITUTED ALDEHYDES
 (see also AMINO CARBONYLS, HALO CARBONYLS, HYDROXY CARBONYLS)
 α -Acetoxy
m-Chloroperbenzoic acid, **6**, 110
 Lead tetraacetate, **1**, 537; **7**, 185
 Sodium borohydride, **12**, 441
 α -Acyloxy
 N-*t*-Butylhydroxylamine, **12**, 95

ALDEHYDES (Continued)

Lead tetrabenzoate, 7, 189

 α -Alkoxy

(-)-10-Mercaptoisoborneol, 9, 290

(S)-(+)-*p*-Tolyl *p*-tolylthiomethyl sulfide, 9, 474; 10, 408; 12, 510

(-)-4,6,6-Trimethyl-1,3-oxathiane, 8, 508

 α -Alkyl(or Phenyl)seleno

Benzeneselenenic anhydride, 9, 25

Benzeneselenenyl halides, 5, 518; 9, 25

Benzeneselenol, 11, 537

N,N-Diethylbenzeneselenenamide, 11, 178

Diphenyl diselenide-Selenium(IV) oxide, 11, 219

 α -Alkyl(or Phenyl)thio

Copper(I) trifluoromethanesulfonate, 6, 130

Diphenyl disulfide, 9, 386

Methoxy(phenylthio)methyl lithium, 10, 260

Thiophenol, 11, 537

 α -Silyl*t*-Butyldimethylchlorosilane, 11, 88 **α -Trialkylsilyloxy***m*-Chloroperbenzoic acid, 6, 110**ALICYCLIC HYDROCARBONS—****GENERAL METHODS****FROM ACYCLIC STARTING****MATERIALS**

1,3-Dithiane, 2, 182

N-Phenylketeniminyl(triphenyl)-phosphorane, 12, 387

Sodium hydride, 4, 453

Titanium(0), 11, 526

Titanium(III) chloride + co-reagent, 8, 483; 12, 493

Tosylmethyl isocyanide, 11, 539

BY RING EXPANSION

Arenesulfonyl azides, 5, 475

Diazomethane, 1, 191

Dibromomethyl lithium, 6, 162

Ethyl diazoacetate, 8, 222

Thallium(III) nitrate, 8, 476

Thallium(III) perchlorate, 5, 657

ALICYCLIC HYDROCARBONS—**THREE-MEMBERED RINGS**

(see also CHIRAL COMPOUNDS)

ALKYLIDENE CYCLOPROPANES

1-Chloro-2-methyl-1-trimethylsilyl-

1-propene, 8, 410

Cyclopropyltriphenylphosphonium bromide, 2, 95

Isopropylidenecarbene, 3, 118; 6, 619; 7, 358

1-(N-Nitrosoacetylaminomethyl)-cyclohexanol, 4, 30

Phosphorus(III) iodide, 10, 318

Trifluoromethanesulfonic anhydride, 5, 702

CYCLOPROPANES**by Cyclization**

Boron trifluoride etherate, 2, 35

3-Butenyltributyltin, 4, 53

t-Butyllithium, 11, 103

Chromium(II) sulfate, 5, 144

Grignard reagents, 9, 229

Ion-exchange resins, 4, 267

Lithium diethylamide, 2, 247

Lithium diisopropylamide, 7, 207; 8, 292

Potassium fluoride, 2, 346

Silver(I) nitrate, 4, 429

Silver(I) oxide, 1, 1011

Sodium-Ammonia, 5, 31

Trimethylstannylmethyl lithium, 12, 547

Zinc-copper couple, 1, 1292

Zinc-Silver couple, 4, 436

by Cyclopropanation of C = C

Chloromethyl methyl ether, 1, 672

Copper(I) iodide, 3, 69

Diazomethane, 2, 90; 3, 68; 6, 442, 577; 11, 391

2,2-Dibromopropane, 11, 102

Dicarbonyl(cyclopentadienyl)-[(dialkylsulfonium)methyl]iron tetrafluoroborate, 9, 143; 10, 128

Diethyl(iodomethyl)aluminum, 1, 245

Diethylzinc-Diiodomethane(or -ethane), 1, 253; 2, 134; 3, 141; 4, 153; 8, 172

Diiodomethane, 7, 74; 9, 170

Diphenylsulfonium methylide, 5, 281

Ethyl(iodomethyl)zinc, 3, 257

Iodo(iodomethyl)mercury, 1, 506

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- Chromium(II) chloride, 1, 149; 2, 76
- Copper, 2, 82
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- Difluoramine, 1, 253
- Hydrazine, 2, 211
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- Lithium aluminum hydride, 1, 581
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- Dichloromethyl 2-chloroethyl ether, 2, 118
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- Oxygen, 3, 174
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- 1,2-Dimethoxyethane, 1, 267
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- Lithium 2,2,6,6-tetramethylpiperide, 4, 310; 7, 213
- Methyl diazoacetate, 8, 434
- Rhodium(II) carboxylates, 11, 458
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$C = C + :CHCHO$ (see also

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- Diazoacetaldehyde, 2, 101; 4, 5
- 2-Diazo-1,1-dimethoxyethane, 10, 120

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- 3-Chloro-3-methyl-1-butyne, 7, 77; 8, 93
- Dimethylvinylidenecarbene, 5, 27
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- 1,2-Dibromoethane, 6, 42
- Dicyclohexylcarbodiimide, 3, 91; 4, 141
- Guanidines, 12, 477
- Iodine, 3, 159; 4, 258
- Potassium trifluoromethanesulfonate, 5, 564
- Sodium alkoxide, 1, 1091; 4, 451

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(Continued)

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Sodium chloride, 6, 534

Titanium(IV) chloride, 11, 529

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 $C = C + :CHCOOR$ (see alsoCYCLOPROPYL CARBONYL
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propenylamine, **4**, 94; **5**, 136
Dichloroketene, **1**, 221; **2**, 118; **3**, 87;
4, 134; **8**, 156; **9**, 152; **11**, 168
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Dimethyl(or Diphenyl)ketene, **1**, 290;
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phenyloxosulfonium
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Chlorotrimethylsilane, **5**, 709
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carboxaldehyde, **12**, 247
1-Lithiocyclopropyl phenyl sulfide, **5**,
372; **6**, 319; **8**, 139
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383
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 α -Lithiomethylselenocyclobutane, **10**,
232
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286
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chloride, **4**, 293
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Sodium dicarbonyl(cyclopentadienyl)-
ferrate, **11**, 483
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Tetrakis(triphenylphosphite)nickel(0),
11, 503
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369; **8**, 483
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9, 494
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propenylamine, 6, 122

Dichloroketene, 9, 152

Ketene diethyl acetal, 10, 226

Lithium aluminum hydride, 5, 382

Methyl fluorosulfonate, 6, 381

Trifluoromethanesulfonic anhydride, 11,
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126

Nickel carbonyl, 4, 353

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by Cation-olefin reaction

Alumina, 9, 8

4,4-Dichloro-3-buten-1-ol, 5, 192

Trifluoroacetic acid, 4, 530; 5, 695; 8,
503

Trimethylsilylmethyl

trifluoromethanesulfonate, 10, 434

by Intramolecular displacement

Butyllithium, 12, 96

Lithium diethylamide, 2, 247

Potassium hexamethyldisilazide, 4,
407Tetrakis(triphenylphosphine)-
palladium(0), 8, 4722,4,4,6-Tetramethyl-5,6-dihydro-1,3-
(4*H*)-oxazine, 3, 280

2,4,4-Trimethyl-2-oxazoline, 6, 629

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Acetyl methanesulfonate, 5, 5

N-Alkylhydroxylamines, 12, 13

Butyllithiums, 8, 67; 11, 103

Calcium carbonate, 2, 57

2-Chloroacrylonitrile, 9, 75

1,3-Diiodopropane, 6, 129

Lithium dibutylcuprate, 6, 163

Magnesium, 11, 246

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Silver(I) trifluoromethanesulfonate, 7,
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Chlorotrimethylsilane-Zinc, 12, 568

Chromium carbonyl, 7, 71

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Lithium dibutylcuprate, 3, 79

Magnesium, 11, 307

Potassium-Ammonia, 9, 377

Sodium naphthalenide, 11, 490

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1,5-Diazabicyclo[4.3.0]nonene-5, 2, 98

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Methyl methylthiomethyl sulfoxide(or
sulfone), 6, 390; 11, 242

by [3 + 2]Cycloaddition

3-Bromo-3-methyl-2-
trimethylsilyloxy-1-butene, 9, 68

Iron carbonyl, 8, 533

Tri- μ -carbonylhexacarbonyldiiron, 5,
221; 8, 498; 9, 477

from Diazoketones + C = C

Boron trifluoride etherate, 4, 44; 10, 52

Copper, 3, 63

Copper(II) oxide, 5, 161

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Simmons-Smith reagent, 6, 521

Trifluoroacetic acid, 11, 557

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Dichlorobis(trifluoromethane-
sulfonato)titanium(IV), 12, 173

Polyphosphoric acid, 4, 395

Potassium *t*-butoxide, 1, 911

Potassium fluoride, **1**, 933
 Potassium (or Sodium) hydride, **1**, 1075; **6**, 482; **9**, 427
 Sodium, **2**, 158
 Sodium methylsulfinylmethylide, **1**, 310
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 Di- μ -carbonylhexacarbonyldicobalt, **12**, 163
 Disodium tetracarbonylferrate, **6**, 550
 Nickel carbonyl, **2**, 290
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 Diphenylsulfonium cyclopropylide, **4**, 211
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 Dichloroketene, **10**, 139; **12**, 176
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 Tetracarbonyldi- μ -chlorodirrhodium, **6**, 108
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 Bis[1,2-bis(diphenylphosphine)ethane]-palladium(0), **10**, 32
 Boron trifluoride etherate, **12**, 66
 5,5-Dimethoxy-1,2,3,4-tetrachloro-cyclopentadiene, **8**, 178
 Dimethyl 1,3-acetonedicarboxylate, **11**, 193
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 Dimethylsulfoxonium methylide, **1**, 315
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 (3-Iodopropyl)trimethylsilane, **12**, 26
 Magnesium, **6**, 351
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Palladium(II) acetate, **9**, 344; **10**, 297
 1-Phenylthiocyclopropyltriphenylphosphonium tetrafluoroborate, **6**, 465
 Polyphosphoric acid, **5**, 540
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 Rhodium(II) carboxylates, **11**, 458
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 Triphenyl(1-phenylthiovinyl)-phosphonium iodide, **9**, 502
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 Dibenzylammonium trifluoroacetate, **9**, 136
 Diethyl acetylmethylmalonate, **7**, 102
 Methyl 4-methylthiocrotonate, **6**, 389
 Morpholine-Camphoric acid, **9**, 317
 Piperidine, **1**, 886
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 Lithium divinylcuprate, **12**, 345
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 Lead carbonate, **9**, 265
 (1-Lithiovinyl)trimethylsilane, **11**, 286
 Lithium cyclopropyl(phenylthio)-cuprate, **7**, 211
 Organocopper reagents, **11**, 365
 by Wittig reaction
 Ethoxycarbonylcyclopropyl-triphenylphosphonium tetrafluoroborate, **5**, 90; **6**, 93
 Vinyltriphenylphosphonium bromide, **2**, 456
 Other routes
 Boron trifluoride etherate, **5**, 52; **10**, 52
 Hydrazine, **8**, 245
 Lithium bromide, **5**, 395
 Methylthium, **9**, 311
 Palladium(II) acetate, **9**, 344
 Potassium *t*-butoxide, **5**, 544
 Tetracarbonyldi- μ -chlorodirrhodium, **5**, 572
 Tungsten(VI) chloride-Ethylaluminum dichloride, **5**, 742

**ALICYCLIC HYDROCARBONS—
FIVE-MEMBERED RINGS***(Continued)*Zinc iodide, **5**, 765**3-CYCLOPENTENOLS**2-(Chloroethoxy)carbene, **9**, 83; **10**, 89Palladium(II) chloride–Copper(II) chloride, **9**, 353**2-CYCLOPENTENONES**

by Acylation

2-(E)-Lithiovinyltrimethylsilane, **10**, 443Nitromethane, **4**, 357Polyphosphoric acid, **12**, 399Tin(IV) chloride, **12**, 486

by Aldol reactions

3-Benzyl-5-(2-hydroxyethyl)-4-methyl-1,3-thiazolium chloride, **6**, 38*t*-Butoxybis(dimethylamino)methane, **5**, 71Copper(I) acetylacetonate, **4**, 1001,3-Dichloro-2-butene, **4**, 472Isopropenyl acetate, **6**, 3562-Nitropropene, **7**, 253Potassium *t*-butoxide, **1**, 911Potassium fluoride, **8**, 410Pyrrolidine, **7**, 309Rexyn® ion-exchange resin, **10**, 2202,4,4,6-Tetramethyl-5,6-dihydro-1,3-(4*H*)-oxazine, **4**, 481

by [3 + 2]Cycloaddition

Cyclopropanone 1,3-propanediyl ketal, **12**, 1522,4-Dibromo-3-pentanone, **4**, 158*gem*-Dichloroallyllithium, **8**, 150Lithium 2,2,6,6-tetramethylpiperidide, **9**, 285Tri- μ -carbonylhexacarbonyldiiron, **8**, 498

by Nazarov and related reactions

Benzylchlorobis(triphenylphosphine)-palladium(II), **12**, 44(2-Bromovinyl)trimethylsilane, **11**, 82Iodotrimethylsilane, **11**, 2711-Phenylthio-1-trimethylsilyl ethylene, **11**, 583Phosphoric acid–Formic acid, **1**, 860; **5**, 534; **10**, 317Propargyl alcohol, **9**, 3941-Trimethylsilyl-2-trimethylstannylethylene, **12**, 469Vinyltrimethylsilane, **9**, 498; **10**, 444; **12**, 26from β , γ -Unsaturated diazoketonesBoron trifluoride etherate, **6**, 65; **10**, 52
by Wittig and related reactionsBromoacetylmethylenetriphenylphosphorane, **9**, 66(Dimethoxyphosphinyl)methyl lithium, **6**, 339Dimethyl 3-bromo-2-ethoxypropenylphosphonate, **9**, 180Potassium carbonate, **12**, 403Triphenyl(1-phenylthiovinyl)phosphonium iodide, **11**, 425Vinyltriphenylphosphonium bromide, **6**, 666

Other routes

Aluminum chloride, **11**, 25Bis(alkylnitrile)dichloropalladium(II), **6**, 45; **12**, 50Bis(cyclopentadienyl)diiodozirconium, **12**, 53Copper(I) trifluoromethanesulfonate, **10**, 108Di- μ -carbonylhexacarbonyldicobalt, **11**, 162; **12**, 163Dilithium dialkyl(cyano)cuprates, **12**, 3495,5-Dimethoxy-1,2,3,4-tetrachlorocyclopentadiene, **10**, 1532-(Dimethylamino)-3-pentenitrile, **10**, 155Dimethyl methylphosphonate, **3**, 117Disodium tetracarbonylferrate, **9**, 205Ethyl β -(1-pyrrolidinyl)acrylate, **8**, 226Hydrobromic acid, **5**, 332Hydrochloric acid, **6**, 2832-Hydroxymethyl-3-trimethylsilyl-1-propene, **12**, 252Mercury(II) acetate, **7**, 222Methanesulfonic acid, **10**, 256*p*-Nitroperbenzoic acid, **11**, 360Organolithium reagents, **8**, 396, **11**, 13Polyphosphoric acid, **6**, 474Potassium hydroxide, **11**, 439Silver tetrafluoroborate, **6**, 519Trimethyl orthoformate, **10**, 425Zinc–Zinc chloride, **7**, 430**3-CYCLOPENTENONES**1,3-Dithienium tetrafluoroborate, **4**, 218Methyl methylthiomethyl sulfoxide, **6**, 390

- Tetrakis(triphenylphosphine)-palladium(0), 11, 503
- 4-HYDROXY-2-CYCLOPENTENONES**
 Alumina, 8, 9
 Chloral, 6, 100
 Ethyl ethylthiomethyl sulfoxide, 5, 299
 Ketene dimethyl thioacetal monoxide, 8, 268
 β -Nitropropionyl chloride, 8, 363
 Pyridinium chlorochromate, 10, 334
 Sodium hypochlorite, 9, 519
 Thiophenol, 7, 367
- ALICYCLIC HYDROCARBONS—SIX-MEMBERED RINGS** (*see also* CHIRAL COMPOUNDS)
- CYCLOHEXADIENES**
 by Birch reduction
 Birch reduction, 1, 54; 5, 30; 8, 38
 Calcium hexamine, 1, 104
 Lithium–Methylamine, 1, 574; 5, 378
 Sodium–Ammonia, 3, 259; 10, 355
 Ytterbium–Ammonia, 9, 517
 by Wittig reaction
 Allylidenetriphenylphosphorane, 5, 7, 70
 trans-1-Butadienyltriphenylphosphonium bromide, 6, 76
 Butane-1,4-bis(triphenylphosphonium) dibromide, 10, 60
 2-Butenyliidenetriphenylphosphorane, 5, 69
 Other routes
 Bis(1,5-cyclooctadiene)nickel(0), 4, 33
 Diazadieneiron(0) complexes, 12, 156
 Ethynyl *p*-tolyl sulfone, 10, 183
 Methyl *trans*-2,4-pentadienoate, 2, 279
- 1,4-CYCLOHEXADIEN-3-ONES**
 from Diazoketones + phenols
 Copper(I) chloride, 8, 118; 9, 123
 Trifluoroacetic acid, 6, 613
 by Diels–Alder reaction
 4-Methoxy-1-phenylseleno-2-trimethylsilyloxy-1,3-butadiene, 8, 398
 trans-1-Methoxy-3-trimethylsilyloxy-1,3-butadiene, 8, 328; 9, 303
 by Oxidation of phenols and related substrates (*see* TYPE OF REACTION INDEX)
 by Oxidative phenol coupling
 Copper(II)–Amine complexes, 8, 114
 Ferric chloride, 4, 236
 Potassium ferricyanide, 4, 406; 6, 480
 Thallium(III) trifluoroacetate, 4, 498; 9, 462
 Vanadyl trihalide, 3, 331; 7, 418; 8, 527
- 2,4-CYCLOHEXADIEN-1-ONES**
 Chromium carbene complexes, 12, 132
 Hydrogen peroxide, 4, 253
 Lead tetraacetate, 7, 185
 Trifluoroacetic acid, 6, 613
 Trifluoroperacetic acid, 1, 821
- CYCLOHEXANES**
 by Cation–olefin routes
 Perchloric acid, 1, 796
 Sulfuric acid, 5, 633
 Tin(IV) chloride, 5, 627; 7, 342; 9, 436
 Trifluoroacetic acid, 3, 305; 4, 530; 5, 695; 6, 613; 7, 388; 8, 503
 Trimethylsilylmethyl trifluoromethanesulfonate, 10, 434
 by Cyclization
 1,8-Diazabicyclo[5.4.0]undecene-7, 7, 87
 S,S'-Diethyl dithiomalonate, 9, 160
 Potassium hexamethyldisilazide, 4, 407
 from 1,5-Dienes
 Benzeneselenenyl iodide, 11, 36
 Borane–Tetrahydrofuran, 7, 321
 N-Bromosuccinimide, 7, 37
 Mercury(II) trifluoroacetate, 9, 294
 by Hydrogenation of arenes
 trihapto-Allyltris(trimethyl phosphite)-cobalt(I), 6, 15
 Calcium hexamine, 1, 104
 Chloro(hexamethylbenzene)hydrido-triphenylphosphinerhodium, 8, 153
 Di- μ -chlorobis(1,5-hexadiene)-dirrhodium, 12, 172
 Palladium(II) chloride, 9, 352
 Palladium hydroxide, 8, 385
 Rhodium catalysts, 1, 979; 4, 418
 Rhodium oxide–Platinum oxide, 9, 408
 Ruthenium catalysts, 1, 983
 Sodium borohydride–Rhodium(III) chloride, 11, 480
 Other methods
 Acetyl *p*-toluenesulfonate, 6, 10
 Dibenzoyl peroxide, 4, 122; 5, 182

ALICYCLIC HYDROCARBONS—SIX-MEMBERED RINGS (*Continued*)

- Dimethylphenylsilyl(methyl)-magnesium, **12**, 352
- Grignard reagents, **11**, 245
- Iodine, **8**, 256
- Lithium diethylamide, **2**, 247
- Nickel carbonyl, **3**, 210
- Silver(I) trifluoromethanesulfonate, **7**, 324

1,3-CYCLOHEXANEDIONES

- Dimethylaluminum benzenethiolate, **11**, 194
- 1,3-Dithiane, **2**, 182
- Raney nickel, **1**, 723
- Sodium ethoxide, **1**, 1065

1,4-CYCLOHEXANEDIONES

- Copper(II) chloride, **9**, 123
- p*-Toluenesulfonic acid, **1**, 1172

CYCLOHEXANOLS

by Addition to carbonyls

- Chlorotris(triphenylphosphine)-rhodium(I), **4**, 559
- N-Ethyl-2-pyrrolidone, **9**, 220
- Lithium dibutylcuprate, **3**, 79
- Potassium-Ammonia, **9**, 377
- Sodium naphthalenide, **11**, 490
- Zinc bromide, **8**, 535

from 1,5-Dienes

- Benzeneselenenyl halides, **9**, 25; **10**, 16
- Mercury(II) acetate, **2**, 264; **5**, 424

from Epoxy-olefin cyclizations

- Alumina, **9**, 8
- Tin(IV) chloride, **5**, 627
- Titanium(IV) isopropoxide, **10**, 404

Other routes

- Alkylaluminum halides, **10**, 177; **11**, 7
- Tributyltin hydride, **11**, 545

CYCLOHEXANONES

by Carbonylation

- Carbon monoxide, **8**, 76
- Sodium tetracarbonylferrate, **9**, 205; **10**, 174
- Monochloroborane diethyl etherate, **7**, 249

Sodium cyanide, **6**, 535

from α -Diazoketones

- Bis(N-propylsaliicylideneaminato)-copper(II), **5**, 41
- Copper, **3**, 63
- Trifluoroacetic acid, **11**, 557

by Dieckmann (and related) condensations

- 1,3-Acetonedicarboxylic acid, **11**, 2
- Bromomagnesium diisopropylamide, **12**, 74
- 4-Phenylseleno-1-penten-3-one, **8**, 397
- Polyphosphoric acid, **4**, 395
- Titanium(III) chloride-Lithium aluminum hydride, **12**, 493
- Triphenylmethylpotassium, **9**, 502

by Displacements

- 1,3-Dithianes, **2**, 182; **10**, 380
- Lithium diisopropylamide, **8**, 292
- Magnesium, **6**, 351
- Methyl methylthiomethyl sulfoxide, **6**, 390
- Sodium methylsulfinylmethylide, **2**, 166

from Unsaturated carbonyls

- Benzeneselenenyl chloride-Aluminum chloride, **11**, 33
- Pyridinium chlorochromate, **7**, 308
- Tetrakis(triphenylphosphine)-palladium(0), **11**, 503
- Tin(IV) chloride, **11**, 522
- Tributyltin hydride, **4**, 518

Other methods

- t*-Butyl hypochlorite, **5**, 77
- 2,3-Dichloro-1-propene, **2**, 120
- Formic acid, **5**, 316
- Polyphosphoric acid, **1**, 894
- Pyridinium chlorochromate, **7**, 308
- Sodium dichromate, **5**, 138
- Thallium(III) perchlorate, **5**, 657
- 2,4,6-Triisopropylbenzene-sulfonylhydrazide, **11**, 563
- 2-Trimethylsilyloxy-1,3-butadiene, **7**, 401

CYCLOHEXENES (*see also* TYPE OF COMPOUND INDEX, DIELS-ALDER DIENES AND DIENOPHILES)

by Cation-olefin reactions

- 3-Ethyl-2-fluorobenzothiazolium tetrafluoroborate, **8**, 223
- Sulfuric acid, **4**, 470
- 2,4,4,6-Tetrabromo-2,5-cyclohexadienone, **10**, 377
- Tetrakis(2-methylpropyl)- μ -oxodialuminum, **8**, 471
- Titanium(IV) chloride-

- N-Methylaniline, **9**, 470
 Trifluoroacetic acid, **3**, 305
 by Reduction of benzenes
 Calcium–Amines, **12**, 103
 Lithium–Ammonia, Amines, **1**, 574; **2**, 28, 250; **4**, 287
 Sodium–Ammonia, **2**, 374
 Other routes
 1-Butadienyldimethylsulfonium tetrafluoroborate, **9**, 74
 Copper(I) iodide, **3**, 69
 Dimethyl(methylthio)sulfonium tetrafluoroborate, **11**, 204
 Hydrazine, **8**, 245
 Lithium 1,3-butadiene-1-olate, **8**, 291
 Sodium bicarbonate, **5**, 595
 Sodium hydride–Dimethylformamide, **4**, 453
 Titanium(III) chloride–Lithium aluminum hydride, **7**, 369
 Vinyltriphenylphosphonium bromide, **2**, 456

2-CYCLOHEXENONES

- Birch reduction
 Birch reduction, **1**, 54; **2**, 27
 Butyllithium, **9**, 87
 Lithium–Ammonia, **1**, 54; **2**, 245; **7**, 21
 Ytterbium–Ammonia, **9**, 517
 from 1,5-Dicarbonyls
 2-(2-Bromoethyl)-2-methyl-1,3-dioxolane, **1**, 75
 4-Chloromethyl-3,5-dimethylisoxazole, **1**, 276
 1-Chloro-3-pentanone, **3**, 49
 5-Chloro-1-penten-3-one, **3**, 47
 1,3-Dichloro-2-butene, **1**, 214; **2**, 111; **7**, 203
 Diethyl lithiomorpholinomethylphosphonate, **7**, 105
 2,2-Dimethyl-3(2*H*)-furanone, **10**, 159
 Ethyl vinyl ketone, **1**, 388
 2-Fluoro-1-buten-3-one, **6**, 263
 Lithium–Ammonia, **3**, 179
 Lithium diisopropylamide, **8**, 292; **10**, 241
 Methyl 5-methoxy-3-oxopentanoate, **9**, 314
 Methyl vinyl ketone, **1**, 697; **7**, 247; **12**, 329
 2-Methyl-6-vinylpyridine, **6**, 409

- 1,7-Octadien-3-one, **9**, 327
trans-3-Penten-2-one, **2**, 306; **3**, 218; **4**, 371
 Piperidine, **1**, 886; **7**, 293
 (S)-(–)-Proline, **12**, 414
 Pyrrolidine, **1**, 972; **2**, 354; **7**, 309
 by Diels–Alder reactions
 1,3-Bis(trimethylsilyloxy)-1,3-butadiene, **7**, 27
 1-Chloro-1-dimethylamino-2-methyl-1,3-butadiene, **9**, 104
 3-Hydroxy-2-pyrone, **6**, 291
 Iron, **9**, 257
 2-Lithio-2-trimethylsilyl-1,3-dithiane, **4**, 284
 2-Methoxy-3-phenylthio-1,3-butadiene, **7**, 232
 trans-1-Methoxy-3-trimethylsilyloxy-1,3-butadiene, **6**, 370; **8**, 328; **9**, 303; **11**, 475
 (Z)-3-Methyl-1-phenylthio-2-trimethylsilyloxy-1,3-butadiene, **11**, 344
 3-Nitro-2-cyclohexenone, **10**, 277
 3-Trimethylsilyloxy-1,3-pentadiene, **10**, 271
 Trimethylsilylvinylketene, **10**, 441

Other routes

- Arene(tricarbonyl)chromium complexes, **9**, 21
 Dimethyl methylphosphonate, **3**, 117
 2-Ethoxyallylidenetriphenylphosphorane, **8**, 219
 Ferric chloride, **7**, 153
 Hexafluoroantimonic acid, **7**, 166; **8**, 239
 Iron carbonyl, **12**, 266
 Lead tetraacetate, **6**, 313
 Methanesulfonic acid, **10**, 256
 Methyl 4-methylthiocrotonate, **6**, 389
 Piperidine, **1**, 886
 Trimethyl orthoformate, **10**, 425

3-CYCLOHEXENONES

- by Birch reduction
 Lithium–Ammonia, **8**, 282
 Oxalic acid, **1**, 764
 by Diels–Alder reactions
 2-Acetoxyacrylonitrile, **1**, 7
 2-Chloroacrylonitrile, **4**, 76; **5**, 107
 2-Chloroacrylyl chloride, **4**, 77
 Copper(II) tetrafluoroborate, **3**, 66

ALICYCLIC HYDROCARBONS—SIX-MEMBERED RINGS (*Continued*)

- Methyl methoxypropionate, **11**, 340
 Oxodiperoxymolybdenum(pyridine)-(hexamethylphosphoric triamide), **10**, 169

ALICYCLIC HYDROCARBONS—SEVEN-MEMBERED RINGS
(*see also* MEDIUM-LARGE RINGS)**BY CLEAVAGE OF BICYCLO[4.1.0]-HEPTANES**

- Allylidenetriphenylphosphorane, **5**, 7
 Ferric chloride, **7**, 153; **10**, 185
 Quinoline, **1**, 975
 Silver sulfate, **3**, 254

CYCLIZATION

- Dodecamethylcyclohexasilane, **12**, 219
 Ethyl cyanoacetate, **7**, 406
 Lithium diisopropylamide, **8**, 292
 Methylaluminum bis(trifluoroacetate), **8**, 471
 Palladium(II) acetate, **10**, 297
 Sodium hexamethyldisilazide, **1**, 1046
 Sodium hydride, **4**, 453
 Titanium(IV) chloride-N-Methylaniline, **9**, 470

BY [3 + 4]CYCLOADDITION

- 3-Bromo-3-methyl-2-trimethylsilyloxy-1-butene, **9**, 68
 Dimethyl(methylthio)sulfonium tetrafluoroborate, **11**, 204
 2-Methoxyallyl bromide, **4**, 327
 Silver perchlorate, **11**, 469
 Tri- μ -carbonylhexacarbonyldiiron, **4**, 157; **9**, 477

- Zinc-copper couple, **8**, 533

- Zinc-Silver couple, **9**, 519

BY REARRANGEMENT OF**DIVINYLCYCLOPROPANES**

- 1-Lithio-2-vinylcyclopropane, **7**, 192; **9**, 273
 Lithium phenylthio(2-vinylcyclopropyl)-cuprate, **7**, 212; **9**, 329

BY RING EXPANSION

- Cyanogen azide, **3**, 71; **5**, 169
 Diazoethane, **3**, 73
 Diazomethane, **1**, 191
 Diethylzinc-Haloform, **4**, 153; **6**, 194
 Dimethyl acetylenedicarboxylate, **4**, 168
 Ethyl diazoacetate, **1**, 367; **2**, 464; **8**, 222
 Isocyanomethyl lithium, **4**, 272

- Nitromethane, **1**, 739

- Phenyldiazomethane, **1**, 366

OTHER ROUTES

- N-Bromosuccinimide, **4**, 49
 Copper(II) acetylacetonate, **3**, 62
 Sodium, **5**, 589
 Zinc-Copper-Isopropyl iodide, **10**, 460

ALICYCLIC HYDROCARBONS—EIGHT-MEMBERED RINGS
(*see also* MEDIUM-LARGE RINGS)

- Allene, **1**, 18
 Bis(1,5-cyclooctadiene)nickel(0), **12**, 52
 4,4'-Bis(dimethylamino)benzophenone, **2**, 285
 Dicarbonylbis(triphenylphosphine)-nickel, **1**, 61
 Dimethyl acetylenedicarboxylate, **4**, 168
 Lithium naphthalenide, **4**, 348
 Potassium hydride, **12**, 407
 Silver perchlorate, **4**, 432
 Sodium N-methylanilide, **1**, 1095
 Tetrakis(trichlorophosphine)nickel(0), **1**, 1142
 Zinc chloride, **9**, 272

ALICYCLIC HYDROCARBONS—MEDIUM-LARGE RINGS**BY ACYLOIN REACTIONS**

- Chlorotrimethylsilane-Sodium, **2**, 435; **3**, 311

- Sodium-Potassium alloy, **1**, 1102

BY COUPLING OF ALLYLIC HALIDES

- Nickel carbonyl, **1**, 720; **2**, 290; **5**, 472; **6**, 417

BY CYCLIZATION

- Bis(*o*-methylaninophenyl) disulfide, **9**, 305

- Butyllithium, **6**, 85; **7**, 46

- Diisobutylaluminum phenoxide, **9**, 172; **10**, 150

- Potassium *t*-butoxide, **1**, 911

- Sodium hexamethyldisilazide, **12**, 446

- Sodium N-methylanilide, **4**, 459

- Tetrakis(triphenylphosphine)-palladium(0), **8**, 472; **11**, 503

- Tin(IV) chloride, **6**, 553

- Tosylmethyl isocyanide, **11**, 539

BY ESCHENMOSER**FRAGMENTATION**

- N-Bromosuccinimide, **10**, 57
 Mesitylenesulfonylhydrazide, **10**, 255

p-Toluenesulfonylhydrazide, 2, 417

BY ONE-CARBON RING EXPANSION

Benzylsulfonyldiazomethane, 11, 43

Chloromethylcarbene, 10, 90

Dibromomethylithium, 6, 162

Methylithium, 6, 384

Perchloric acid, 5, 506

Silver perchlorate, 6, 518

Silver *p*-toluenesulfonate, 7, 323

Sodium-Ammonia, 4, 438; 6, 523

BY OXY-COPE REACTION

Potassium hydride, 8, 412; 10, 327

BY REDUCTIVE COUPLING OF C=O

Titanium(0), 11, 526

Titanium(III) chloride-Lithium
aluminum hydride, 12, 493

OTHER METHODS

Borane-Tetrahydrofuran, 3, 76

Copper(II) acetylacetonate, 9, 51

2-Hydroxymethyl-3-trimethylsilyl-
1-propene, 11, 258

Sodium methylsulfinylmethylide, 1, 310

ALICYCLIC HYDROCARBONS— CYCLOALKYNES

BY DIENE COUPLING

Copper(II) acetate, 4, 105; 6, 138

Silver(I) nitrate, 1, 1008

BY ELIMINATION

1,3-Diphenylisobenzofuran, 4, 209

Phenyl azide, 1, 829

Potassium *t*-butoxide, 2, 336; 7, 298

Selenium(IV) oxide, 9, 409

Silver(I) nitrate, 2, 366

Silver(I) oxide, 3, 252

Sodium amide-Sodium *t*-butoxide, 5,
593

BY ESCHENMOSER

FRAGMENTATION

N-Bromosuccinimide, 10, 57

Mesitylenesulfonylhydrazide, 10, 255

p-Toluenesulfonylhydrazide, 2, 417

OTHER ROUTES

Diethyl (diazomethyl)phosphonate, 12,
186

Potassium *t*-butoxide, 1, 911

Sodium hydride, 5, 610

ALICYCLIC HYDROCARBONS— BICYCLO[2.2.1]HEPTANES

2-Acetoxyacrylonitrile, 1, 7

Aluminum chloride, 2, 21

Bis(acrylonitrile)nickel(0), 11, 48

Boron trifluoride, 5, 51

Butyllithium, 9, 83

2-Chloroacrylyl chloride, 4, 77

5,5-Dimethoxy-1,2,3,4-tetrachloro-
cyclopentadiene, 2, 143

Ethynyl *p*-tolyl sulfone, 10, 183

Methyl 2-acetylacrylate, 11, 334

Methyl methoxypropiolate, 11, 340

Methyl vinyl ketone, 1, 697

Nitroethylene, 5, 476

Tri- μ -carbonylhexacarbonyldiiron, 9,
477

ALICYCLIC HYDROCARBONS— BICYCLIC [5,5] RING SYSTEMS FROM ACYCLIC STARTING MATERIALS

2-Bromo-3-trimethylsilyl-1-propene, 11,
80

Di- μ -carbonylhexacarbonyldicobalt, 12,
163

Dimethyl 1,3-acetonedicarboxylate, 11,
193

BY CYCLOPENTANNELATION

(R)-(+)-*o*-Anisylcyclohexyl-
methylphosphine, 11, 31

Polyphosphoric acid, 12, 399

FROM EIGHT-MEMBERED RINGS

Benzeneselenenyl iodide, 11, 36

9-Borabicyclo[3.3.1]nonane, 6, 62

Chloroform, 1, 131

Lithium diethylamide, 2, 247

Lithium diisopropylamide, 6, 334

Lithium phosphate, 4, 309

Potassium hydride, 2, 346

Thallium(III) trifluoroacetate, 8, 478

ALICYCLIC HYDROCARBONS— BICYCLIC [5,6] RING SYSTEMS

FROM ACYCLIC STARTING MATERIALS

Aluminum chloride, 11, 25

Boron trifluoride etherate, 10, 52

2-Bromo-3-trimethylsilyl-1-propene, 11,
80

Carbon monoxide, 3, 41

2-Oxazolidones, chiral, 12, 359

3-Triethylsilyloxypentadienyllithium, 11,
556

Trifluoroacetic acid, 4, 530

Trifluoromethanesulfonic acid, 12, 531

Zirconium(IV) propoxide, 11, 605

BY CYCLOHEXANNELATION

ALICYCLIC HYDROCARBONS—**BICYCLIC [5,6] RING SYSTEMS***(Continued)***Aldol reaction**Ethyl phenyl sulfoxide, **6**, 2572-Methyl-6-vinylpyridine, **6**, 409(S)-Proline, **7**, 307; **12**, 414**Other routes**Acrolein, **11**, 111,2-Bis(trimethylsilyloxy)cyclobutene,
10, 452-Bromomethyl-3-(trimethylsilyl-
methyl)-1,3-butadiene, **12**, 77Dimethylphenylsilyllithium, **12**, 2104-Iodobutyltrimethyltin, **10**, 219Phenylselenenyl benzenesulfonate, **12**,
390**BY CYCLOPENTANNELATION****Aldol reaction**Bromoacetylmethylenetriphenyl-
phosphorane, **9**, 662-(2-Bromoethyl)-1,3-dioxolane, **9**, 70Isopropenyl acetate, **6**, 3562-Lithiobenzothiazole, **8**, 2742-Methoxyallyl bromide, **8**, 322Morpholine-Camphoric acid, **9**, 317;
11, 3522-Nitropropene, **7**, 253Phenylsulfinylacetone, **5**, 524Potassium fluoride, **8**, 410Potassium hydride, **8**, 412Tetrakis(triphenylphosphine)-
palladium(0), **10**, 384Titanium(IV) chloride, **12**, 494Triphenyltin hydride, **12**, 555**Carbonyl addition**Chlorotrimethylsilane-Zinc, **12**, 568Lithium dibutylcuprate, **3**, 79Tin-Aluminum, **12**, 486**Nazarov reaction**(2-Bromovinyl)trimethylsilane, **11**, 82*gem*-Dichloroallyllithium, **8**, 150Phosphoric acid-Formic acid, **1**, 860Propargyl alcohol, **9**, 394Vinyltrimethylsilane, **9**, 498; **10**, 444**from Vinylcyclopropanes**Allyltrimethylsilane, **12**, 23Lead carbonate, **9**, 265(1-Lithiovinyl)trimethylsilane, **11**, 286Organocopper reagents, **11**, 365Simmons-Smith reagent, **6**, 521**Wittig reaction**(Dimethoxyphosphinyl)methylolithium,
6, 339Dimethyl 3-bromo-2-ethoxypropenyl-
phosphonate, **9**, 180Ethoxycarbonylcyclopropyltriphenyl-
phosphonium tetrafluoroborate, **5**,
90**Other routes**Alkylaluminum halides, **10**, 177; **12**, 5Boron trifluoride etherate, **6**, 65Bromine, **5**, 554-Chloro-1-butenyl-2-lithium, **12**, 113Chlorotris(triphenylphosphine)-
rhodium(I), **10**, 982-(Dimethylamino)-3-pentenonitrile,
10, 155Hydrazine, **8**, 245Mercury(II) acetate, **11**, 315Methanesulfonic acid, **10**, 256Organocopper reagents, **9**, 328Palladium(II) acetate, **9**, 344Palladium(II) chloride-Copper(II)
chloride, **9**, 3531-Phenylthiocyclopropyltriphenyl-
phosphonium tetrafluoroborate, **6**,
465Potassium carbonate, **8**, 408Potassium hexamethyldisilazide, **4**,
407Tetrakis(triphenylphosphine)-
palladium(0), **8**, 472; **9**, 451Thexylborane, **2**, 148Titanium(IV) chloride-Magnesium
amalgam, **7**, 373Tributyltin hydride, **11**, 545; **12**, 5162,4,6-Triisopropylbenzenesulfonyl-
hydrazide, **12**, 533Trimethylsilyllallene, **10**, 428**FROM NINE-MEMBERED RINGS**Acetic anhydride-Zinc chloride, **4**, 4Benzeneselenenyl chloride, **9**, 25Organomagnesium reagents, **12**, 352**ALICYCLIC HYDROCARBONS—****BICYCLIC [5,7] RING SYSTEMS****BY CYCLOHEPTANNELATION**2-(2-Buten-2-yl)-1,3-dithiane, **11**, 447Lead carbonate, **9**, 2651-Lithio-2-vinylcyclopropane, **7**, 1922-Methylcyclopentenone-3-dimethyl-
sulfoxonium methyliide, **6**, 378

BY CYCLOPENTANNELATION

- Boron trifluoride etherate, **6**, 65; **11**, 72
- Diphenylsulfonium cyclopropylide, **4**, 211
- Titanium(IV) chloride, **9**, 468
- Triethyloxonium tetrafluoroborate, **8**, 500

FROM TEN-MEMBERED RINGS

- Acetic acid, **7**, 1
- Boron trifluoride etherate, **9**, 64
- Phosphoric acid-Formic acid, **10**, 317

OTHER ROUTES

- Calcium carbonate, **1**, 103
- Dibromomethylithium, **11**, 158
- Ethyl diazoacetate, **3**, 138
- Thallium(III) nitrate, **9**, 460

ALICYCLIC HYDROCARBONS—**BICYCLIC [6,6] RING SYSTEMS****FROM ACYCLIC STARTING****MATERIALS**

- Alkylaluminum halides, **12**, 5
- D-(−)- and L-(+)-2,3-Butanediol, **11**, 84
- Carbon monoxide, **3**, 41
- Ion-exchange resins, **2**, 227
- Mercury(II) trifluoroacetate, **9**, 294
- Mercury(II) trifluoromethanesulfonate—N,N-Dimethylaniline, **12**, 307
- Potassium hydride, **11**, 435
- Tin(IV) chloride, **5**, 627; **7**, 342

BY CYCLOHEXANNELATION

- Benzeneselenenyl hexafluorophosphate, **10**, 21
- Benzenesulfonyl chloride, **11**, 39
- 1,2-Bis(trimethylsilyloxy)cyclobutene, **10**, 45
- 1-Butadienyldimethylsulfonium tetrafluoroborate, **9**, 74
- 4-Chloro-1-butenyl-2-lithium, **12**, 113
- 1,1-Dichloro-3-bromopropene, **5**, 191
- 1,4-Dichloro-2-butanone, **9**, 75
- Dimethyl 1,3-acetonedicarboxylate, **9**, 176
- Disodium tetracarboxylferrate, **10**, 174
- Formic acid, **5**, 316
- 4-Iodobutyltrimethyltin, **10**, 219
- Lithium dimethylcuprate, **5**, 234; **6**, 209
- Mercury(II) acetate, **5**, 424; **9**, 461
- Methyl cyclobutenecarboxylate, **10**, 263
- Methyl vinyl ketone, **5**, 464; **11**, 10
- Potassium hexamethyldisilazide, **4**, 407
- Potassium hydride, **7**, 302

- Samarium(II) iodide, **12**, 429
- Thexylborane, **2**, 148
- Titanium(IV) chloride, **12**, 494
- Triphenyltin hydride, **12**, 555
- Vinyltriphenylphosphonium bromide, **5**, 750

FROM NAPHTHALENES

- trihapto*-Allyltris(trimethyl phosphite)-cobalt(I), **6**, 15
- Calcium-Amines, **9**, 94
- Chlorotris(triphenylphosphine)-rhodium(I), **3**, 325
- Lithium-Alkylamines, **1**, 574, 614; **2**, 241

FROM TEN-MEMBERED RINGS

- Boron trifluoride etherate, **4**, 44
- N-Bromosuccinimide, **10**, 57
- Formic acid, **5**, 316
- Iodine, **8**, 256
- Ion-exchange resins, **6**, 302

SOME SPECIFIC [6,6] SYSTEMS

- $\Delta^{1(9)}$ -2-Octalones
 - 2-(2-Bromomagnesiumethyl)-2-methyl-1,3-dioxolane, **7**, 148
 - t*-Butyl γ -iodotiglate, **6**, 82
 - 1-Chloro-3-pentanone, **3**, 49; **6**, 110
 - 5-Chloro-1-penten-3-one, **3**, 47
 - 1,3-Dibromo-2-pentene, **7**, 90
 - 1,3-Dichloro-2-butene, **2**, 111; **8**, 152
 - 4-Diethylamino-2-butanone, **1**, 698
 - Ethyl acetoacetate, **6**, 264
 - Ethyl 3-ethyl-5-methyl-4-isoxazolecarboxylate, **4**, 232
- (E)-1-Iodo-3-trimethylsilyl-2-butene, **5**, 355
- 1-Methoxy-3-buten-2-one, **3**, 198
- Methyl 5-methoxy-3-oxopentanoate, **9**, 314
- Methyl 3-oxo-4-pentenoate, **1**, 1272; **5**, 746
- 1,7-Octadien-3-one, **10**, 280
- trans*-3-Penten-2-one, **2**, 306; **3**, 218; **4**, 371
- Piperidine, **1**, 886
- Pyrrolidine, **1**, 972; **2**, 354
- Sodium dicarbonyl(cyclopentadienyl)-ferrate, **6**, 538
- Triethylamine, **1**, 1198
- 3-Trimethylsilyl-3-buten-2-one, **5**, 461; **6**, 406

 Δ^1 -3-Octalones

ALICYCLIC HYDROCARBONS—**BICYCLIC [6,6] RING SYSTEMS***(Continued)*N,N-Dimethylhydrazine, **9**, 1842-Ethoxyallylidenetriphenylphosphorane, **8**, 2192-Lithiobenzothiazole, **8**, 274*trans*-1-Methoxy-3-trimethylsilyloxy-1,3-butadiene, **6**, 370; **8**, 328 **Δ^2 -1-Octalones**N,N-Dimethylhydrazine, **9**, 184Pyridinium chlorochromate, **8**, 425 **$\Delta^{9(10)}$ -1-Octalones**Methanesulfonic acid, **10**, 256**ALKANES (see also ALICYCLIC****HYDROCARBONS, CHIRAL COMPOUNDS)****BY *gem*-ALKYLATION OF C=O**Dichlorodimethyltitanium, **10**, 138Trimethylaluminum, **5**, 707; **6**, 622**BY CATALYTIC HYDROGENATION (see TYPE OF REACTION INDEX-REDUCTION)****BY COUPLING REACTIONS**

Cross-coupling of R,R'

Dichlorodimethyltitanium, **10**, 138Diethyl sulfate, **1**, 253Dilithium tetrachlorocuprate(II), **4**, 163; **5**, 226Grignard reagents, **1**, 415Lithium alkyl(*t*-butoxy)cuprate, **5**, 395Lithium alkyl(phenylthio)cuprates, **5**, 414Lithium dibutylcuprate, **7**, 92; **8**, 291Lithium dimethylcuprate, **2**, 151; **3**, 106; **5**, 234Lithium trimethylferrate (and related), **3**, 112, 3123-Methoxy-3-methylbutynylcopper, **8**, 324Organocopper reagents, **11**, 365Trimethylaluminum, **5**, 707; **6**, 622**Homocoupling of ROH**Titanium(III) chloride, **2**, 415Titanium(IV) chloride, **1**, 1169Titanium(III) chloride-Lithium aluminum hydride, **6**, 588Tungsten carbonyl, **8**, 525**Homocoupling of RX**Chromium(II) chloride, **11**, 132

Chromium(III) chloride-Lithium

aluminum hydride, **8**, 110Magnesium, **4**, 315Sodium naphthalenide, **1**, 711Tetraphenylethylene, **2**, 404

Titanium(III) chloride-Lithium

aluminum hydride, **7**, 369Vanadium(II) chloride tetrapyridine complex, **5**, 744**Oxidative coupling of RM**Copper, **12**, 140Copper(I) iodide, **2**, 400Lithium aluminum hydride, **9**, 274Lithium dibutylcuprate, **3**, 79Silver(I) nitrate, **2**, 366; **4**, 429**Other couplings**Copper(II) acetylacetonate, **2**, 81Difluoramine, **1**, 253N,N-Dimethylformamide, **1**, 278Sodium bis(2-methoxyethoxy)-aluminum hydride, **4**, 441**BY DEAMINATION (see TYPE OF REACTION INDEX)****BY DECARBONYLATION OF RCHO**Bis[1,3-bis(diphenylphosphine)propane]-chlororhodium(I), **12**, 111Chlorotris(triphenylphosphine)-rhodium(I), **1**, 140, 1252; **2**, 448Nickel-Alumina, **9**, 321**BY DECARBOXYLATION OF RCOOH AND DERIVATIVES***t*-Butyl hydroperoxide, **1**, 882-Pyridinethiol-1-oxide, **12**, 417Tributyltin hydride, **10**, 411**BY DECYANATION**Iron(III) acetylacetonate, **4**, 268Nickel-Alumina, **9**, 321Potassium, **4**, 245; **10**, 322**BY DEHALOGENATION (see TYPE OF REACTION INDEX-REDUCTION)****BY DENITRATION (see TYPE OF REACTION INDEX)****BY DEOXYGENATION OF ROH, C=O (see TYPE OF REACTION INDEX)****BY DESELENYLATION (see TYPE OF REACTION INDEX)****BY DESULFURATION (see TYPE OF REACTION INDEX)****BY HYDROMETALLATION-PROTONATION (see TYPE OF REACTION INDEX)**

BY REDUCTION OF $C=C$, $C\equiv C$, RX , $ROSO_2R'$, $ROCOR'$ AND RELATED, $RCOOH$, $RCOX$ (see TYPE OF REACTION INDEX)

BY REDUCTIVE ALKYLATION OF $C=O$ (see TYPE OF REACTION INDEX)

OTHER ROUTES

Chlorotris(triphenylphosphine)-rhodium(I), 3, 325

Dicyclopentadienyltitanium, 5, 672

Methyl fluoride–Antimony(V) fluoride, 3, 201

Nickel–Alumina, 9, 321

ALKENES (see also CHIRAL COMPOUNDS, DIENES, α -METHYLENE CARBONYLS, METHYLENE CYCLOALKANES, UNSATURATED. . . , TYPE OF REACTION INDEX FOR ELIMINATION REACTIONS)

FROM ACYL DERIVATIVES + WITTIG REAGENTS

Methylenetriphenylphosphorane, 6, 380; 9, 307

BY ADDITIONS TO $C\equiv C$, $C\equiv C-X$

1-Alkenes

Grignard reagents, 6, 269

Organocopper reagents, 10, 282

Trimethylaluminum, 8, 506

(E)-Alkenes

Chlorobis(cyclopentadienyl)-hydrido-zirconium(IV), 8, 84

Copper(I) iodide, 12, 143

Cyanogen bromide, 4, 110

Dibromoborane–Dimethyl sulfide, 11, 262

Diisobutylaluminum hydride, 7, 111

Dilithium acetylide, 6, 148

Palladium(II) acetate, 8, 378

Tetrakis(triphenylphosphine)nickel(0), 7, 357

Thexylborane, 4, 175; 5, 232

(Z)-Alkenes

Bis(*trans*-2-methylcyclohexyl)borane, 4, 37

Dibromoborane–Dimethyl sulfide, 11, 262

Iodine, 6, 293; 11, 261

Lithium acetylide, 6, 324

Organocopper reagents, 10, 282

Palladium(II) acetate, 8, 378

Tributyltin chloride, 7, 378

Trisubstituted alkenes

Cyanogen bromide, 4, 110

Dichlorobis(cyclopentadienyl)-titanium, 9, 488; 10, 130

Iodine, 6, 293; 11, 261

Organocopper reagents, 9, 328

Tetrakis(triphenylphosphine)-palladium(0), 9, 451

Thexylborane, 6, 207

Tributyltin chloride, 7, 378

Vinylcopper reagents, 6, 662

BY ALKYLATION (ARYLATION) OF $C=C$

Bis(cyclopentadienyl)isoprenozirconium, 11, 174

μ -Chlorobis(cyclopentadienyl)-(dimethylaluminum)- μ -methylenetitanium, 8, 83

Diacetato-bis(triphenylphosphine)-palladium(II), 6, 156

2,6-Di-*t*-butyl-4-methylpyridine, 9, 141

Dichlorobis(cyclopentadienyl)titanium–

Trialkylaluminum, 9, 146

Palladium(II) acetate, 5, 496

Palladium(II) acetate–

Triphenylphosphine, 5, 497

Rhodium(III) chloride, 6, 504

FROM $C=O$ AND WITTIG (OR RELATED) REAGENTS

Peterson olefination

Lithium 1-(dimethylamino)-naphthalenide, 12, 279

Lithium naphthalenide, 11, 302

Sodium methoxide, 5, 617

Trimethylsilylmethylolithium, 6, 637; 10, 433; 11, 581

Trimethylsilylmethylmagnesium chloride, 5, 724; 6, 636

Trimethylsilylmethylsodium, 5, 617

Wittig (Wittig–Horner) reaction—

General methods

Ethylene oxide, 5, 297

Lithium chloride, 12, 277

Pentamethylphosphonic diamide, 2, 280

Phosphonamides, chiral, 12, 396

Potassium *t*-butoxide, 11, 432

Potassium carbonate, 11, 433

Sodium hexamethyldisilazide, 1, 1046

ALKENES (*Continued*)

- Sodium methylsulfinylmethylide, **1**, 310
- Triphenylphosphine, **1**, 1238
- Wittig reaction, **4**, 573; **5**, 752
- Wittig (Wittig–Horner) methylenation (*see* TYPE OF REACTION INDEX)
- Wittig (Wittig–Horner) reaction, $C=O \rightarrow E$ -Alkenes
 - Alkyldiphenylphosphine oxides, **10**, 2
 - Crown ethers, **6**, 133
 - Diethyl benzylphosphonate, **1**, 1212; **2**, 432
 - Lithium hexamethyldisilazide, **11**, 300
 - Triphenylphosphine, **1**, 1238
- Wittig (Wittig–Horner) reaction, $C=O \rightarrow Z$ -Alkenes
 - Alkyldiphenylphosphine oxides, **10**, 2
 - Benzyltriphenylphosphonium chloride, **1**, 279
 - Crown ethers, **6**, 133; **11**, 143
 - Hexamethylphosphoric triamide, **6**, 273
 - Sodium hexamethyldisilazide, **7**, 329
 - N,N,N',N'-Tetramethylethylenediamine, **12**, 477
 - Zirconium carbene complexes, **12**, 577
- Wittig (Wittig–Horner) reactions—
 - Miscellaneous
 - Benzyltriphenylphosphonium chloride, **5**, 30
 - Benzyltris(dimethylamino)-phosphonium bromide, **2**, 210
 - Bis(trifluoromethyl)methylene-triphenylphosphorane, **9**, 54
 - Crown ethers, **10**, 110
 - Ethylidenetriphenylphosphorane, **3**, 141
 - N,N,P-Trimethyl-P-phenyl-phosphinothioic amide, **11**, 569
 - 2-Trimethylstannylethylidene-triphenylphosphorane, **6**, 640
 - Vinyltriphenylphosphonium bromide, **5**, 750
- Methylenation reactions (other methods) (*see* TYPE OF REACTION INDEX)
- Other methods for $C=O \rightarrow C=CR_2$
 - Alkyldimesitylboranes, **12**, 12
 - N-Methylphenylsulfonimidoyl-1-ethyl lithium, **5**, 459

Tris(2,2-dimethylpropyl)(2,2-dimethylpropylidene)niobium (or tantalum), **7**, 403

BY CLAISEN REARRANGEMENT

(*see* γ,δ -UNSATURATED $C=O$'s)

BY CLEAVAGE OF CYCLIC ETHERS

Butyllithium, **2**, 51
Sodium, **4**, 437, 438; **7**, 324

BY CLEAVAGE OF CYCLOPROPYL CARBINYL HALIDES

Cyclopropyl methyl ketone, **1**, 676
Hydrobromic acid, **4**, 249
N,N,N',N'-Tetramethylethylenediamine, **4**, 485
Zinc bromide, **2**, 463

BY COUPLING OF ALLYL + ALKYL

- Allylic acetates + RM
 - Alkylcopper reagents–Aluminum chloride, **10**, 286
 - Boron trifluoride etherate, **12**, 66
 - Dilithium tetrachlorocuprate(II), **5**, 226
 - Lithium dimethylcuprate, **2**, 151; **3**, 106; **7**, 120
 - Lithium trimethylferrate, **3**, 312
 - Triisobutylaluminum, **7**, 391
- Allylic alcohols + RM
 - Alkylcopper reagents–Boron trifluoride, **9**, 333; **10**, 282
 - [1,2-Bis(diphenylphosphine)ethane]-(dichloro)nickel(II), **10**, 36
 - 1-Chloro-2-methyl-N,N-tetramethylenepropenylamine, **12**, 124
 - Grignard reagents–Nickel(II) reagents, **2**, 110
 - N,N-Methylphenylaminotriphenylphosphonium iodide, **8**, 346
 - Tributyl(methylphenylamino)-phosphonium iodide, **8**, 345
- Allylic halides + RM
 - Alkylcopper reagents–Boron trifluoride, **8**, 334; **10**, 282
 - α -Chloroallyllithium, **10**, 87
 - 2,3-Dibromopropene, **1**, 420
 - Dilithium tetrachlorocuprate(II), **11**, 190
 - Lithium aluminum hydride, **9**, 274
- Allylic metals + RX
 - Butyllithium, **5**, 80
 - Copper(I) iodide, **8**, 121
 - Di- μ -bromobis(3-methyl-2-butenyl)-

dinickel, **8**, 181
 Palladium(II) chloride, **5**, 500
 Other allylic substrates + RM
 Allyl phenyl ether, **11**, 14
 [1,1'-Bis(diphenylphosphine)-ferrocene](dichloro)palladium(II), **12**, 171
 Dichlorobis(triphenylphosphine)-nickel(II), **9**, 147
 Ferrocenylphosphines, **10**, 37
 Grignard reagents, **6**, 269
 Organocopper reagents, **9**, 328; **10**, 282
BY COUPLING OF VINYL + ALKYL
 Enol phosphates + RM
 Lithium dibutylcuprate, **7**, 92
 Tetrakis(triphenylphosphine)-palladium(0), **10**, 384
 Vinyl halides + RM
trans-2,3-Bis(diphenylphosphine)-bicyclo[2.2.1]hept-5-ene, **10**, 36
 [1,1'-Bis(diphenylphosphine)-ferrocene](dichloro)palladium(II), **9**, 147; **12**, 171
 [1,3-Bis(diphenylphosphine)propane]-(dichloro)nickel(II), **11**, 167
 Butyllithium, **6**, 85
 (S)- α -(R)-2-Diphenylphosphino-ferrocenyl ethyldimethylamine, **9**, 200; **11**, 237
 Ferric chloride, **6**, 259
 Grignard reagents-Iron(III) reagents, **4**, 236; **6**, 50; **7**, 411
 Lithium dimethylcuprate, **2**, 151; **3**, 106; **4**, 295; **6**, 209
 Lithium trimethylferrate, **3**, 312
 Lithium trimethylmanganate, **3**, 112
 Pentane-1,5-di(magnesium bromide), **9**, 355
 Tetrakis(triphenylphosphine)nickel(0), **12**, 467
 Tetrakis(triphenylphosphine)-palladium(0), **6**, 571; **8**, 472; **9**, 451
 Vinyl metal reagents + RX
n- or *t*-Butyllithium, **7**, 47
 Copper(I) iodide, **12**, 141
 Grignard reagents-Copper(I) halides, **7**, 82
 Lithium di[(E)-1-propenyl]cuprate, **7**, 141
 Methylcopper, **7**, 236

Organocopper reagents, **11**, 365; **12**, 345
 Pentylsodium, **7**, 400
 (E)-1-Propenyllithium, **6**, 308, 495
p-Toluenesulfonylhydrazide, **9**, 472
 2,4,6-Triisopropylbenzenesulfonylhydrazide, **9**, 486
 Vinylithium, **2**, 456; **6**, 665
 Vinyl sulfides + RM
 [1,3-Bis(diphenylphosphine)propane]-(dichloro)nickel(II), **10**, 191
 Dichlorobis(triphenylphosphine)-nickel(II), **9**, 147
 Nickel(II) chloride-
 Triphenylphosphine, **11**, 358
 Other vinyl substrates + RM
 Grignard reagents-Nickel(II) reagents, **10**, 189
 Organocopper reagents, **10**, 282
BY DEHYDROGENATION (see TYPE OF REACTION INDEX)
BY DESULFURATION OF CYCLIC SULFIDES
 Raney nickel, **5**, 263, 381
BY DOUBLE EXTRUSION (see TYPE OF REACTION INDEX)
BY ELIMINATION REACTIONS TO FORM SPECIFIC C = C (see also TYPE OF REACTION INDEX for a complete list of elimination reactions)
1-Alkenes
 Chloramine-T, **10**, 85
 Chloromethyldiphenylsilane, **12**, 321
 Copper, **1**, 157
 Dimethyl(methylene)ammonium iodide, **8**, 194
 Dimethyl sulfoxide, **2**, 157
 Diphenyl disulfide, **6**, 235
 Ethyl α -trifluoromethyl-sulfonyloxyacetate, **7**, 149
 Ethyl trimethylsilylacetate, **11**, 247
 Hexamethylphosphoric triamide, **4**, 244
 Methylselenomethylolithium, **9**, 307
o-Nitrophenyl selenocyanate, **6**, 420
 Phenylthioacetic acid, **6**, 463
 2-Pyridineselenenyl bromide, **11**, 455
 Sodium dicarbonyl(cyclopentadienyl)-ferrate, **9**, 426
 Sodium hydride, **1**, 1075
 Sodium pyridylselenate, **10**, 368

ALKENES (*Continued*)Tetrabutylammonium fluoride, **9**, 444Thorium oxide, **1**, 1167; **5**, 669**(E)-** or **(Z)-Alkenes**Benzyl phenyl sulfoxide, **6**, 394Bis(1,5-cyclooctadiene)nickel(0), **5**, 34*t*-Butyldimethylchlorosilane, **11**, 88Butyllithium, **2**, 51N-Chlorosuccinimide, **5**, 127Chlorotrimethylsilane-Sodium iodide, **10**, 97Chromium(II) sulfate, **1**, 150Copper(I) trifluoromethanesulfonate, **6**, 1301,3-Dibenzyl-2-methyl-1,3,2-diazaphospholidine, **2**, 105Diisobutylaluminum hydride, **6**, 198Dimethylformamide dimethyl acetal, **8**, 191N,N-Dimethylphosphoramidic dichloride, **6**, 215Diphenyl diselenide, **6**, 235Diphosphorus tetraiodide, **9**, 203Dipotassium hexachlorotungstate(IV), **4**, 407Ethyl(carboxysulfamoyl)triethylammonium hydroxide inner salt, **5**, 442Lithium diethylamide, **5**, 398Lithium dipropylcuprate, **6**, 245N-Methanesulfinyl-*p*-toluidine, **2**, 269Phosphoryl chloride, **1**, 881; **2**, 330Sodium amalgam, **11**, 473Sodium iodide, **1**, 1116; **6**, 543; **7**, 338Sodium sulfide, **12**, 453*p*-Toluenesulfonylhydrazide, **8**, 489Tributyltin hydride, **8**, 497Trimethyl phosphite, **1**, 1233; **2**, 439Triphenylphosphine-Diethyl azodicarboxylate, **9**, 504; **12**, 552Zinc, **1**, 1276**BY PROTONATION OF ALLYL METAL REAGENTS**Boron trifluoride etherate, **12**, 66Hydrogen chloride, **9**, 239Tributyltin hydride, **7**, 379; **9**, 476 β -Trimethylsilylethylidene-triphenylphosphorane, **9**, 492

2-Trimethylsilylmethyl-1,3-butadiene,

10, 4322-Trimethylstannylethylidene-triphenylphosphorane, **6**, 640**BY REDUCTION OF $C \equiv C$, $C = C - X$, DIENES** (*see* TYPE OF REACTION INDEX)**BY REDUCTION OF ALLYLIC ETHERS AND RELATED**Allyl phenyl ether, **11**, 14Lithium triethylborohydride, **11**, 304Tributyltin hydride, **7**, 379; **9**, 476; **10**, 411**BY REDUCTIVE COUPLING** (*see* TYPE OF REACTION INDEX)**BY 2,3-SIGMATROPIC**REARRANGEMENT (*see also* TYPE OF REACTION INDEX)S-Allyl N,N-dimethyldithiocarbamate, **6**, 11Benzenesulfonyl chloride, **9**, 35Dimethyl diazomalonate, **5**, 244Lithium diisopropylamide, **5**, 400**FROM THREE-MEMBERED**HETEROCYCLES (*see* TYPE OF REACTION INDEX)**OTHER ROUTES**Bismuth(III) oxide-Tin(IV) oxide, **6**, 55
(Bromodichloromethyl)phenylmercury, **1**, 851Cerium(IV) ammonium nitrate, **4**, 71Chlorotris(triphenylphosphine)-rhodium(I), **3**, 325Dibromodifluoromethane, **1**, 207Iodo(methyl)calcium, **5**, 442Lithium naphthalenide, **11**, 302Methylolithium, **7**, 242Nickel(II) chloride-Ethylene, **10**, 276Palladium(II) acetate, **12**, 367Propargyl chloride, **5**, 565*p*-Toluenesulfonylhydrazide, **6**, 537Tributyltin hydride, **10**, 411Tributyltinlithium, **10**, 413 β -[(Trimethylsilyl)ethyl]lithium, **11**, 574Trimethylsilylmethylolithium, **6**, 635Triphenylcarbenium salts, **1**, 1256; **8**, 524; **10**, 455Triphenyl phosphite ozonide, **7**, 408**ALKYL HALIDES** (*see also* ALLYLIC COMPOUNDS, CHIRAL COMPOUNDS, DIHALIDES,

HALO-, VINYL HALIDES)

GENERAL METHODS

2-Dimethylamino-N,N'-diphenyl-1,3,2-diazaphospholidine, 11, 196

Sodium borohydride, 1, 1049; 2, 377

Triphenylphosphine-

N-Halosuccinimides, 5, 728

Triphenyl phosphite, 1, 1249

ALKYL FLUORIDES

from ROH

N,N-Diethylaminopropyne, 2, 133

(Diethylamino)sulfur trifluoride, 6, 183; 8, 166

Diethyl(2-chloro-1,1,2-trifluoroethyl)-amine, 1, 249; 3, 95

Phenyltetrafluorophosphorane, 5, 526

Pyridinium poly(hydrogen fluoride), 6, 473; 7, 294

Selenium(IV) fluoride, 5, 576

Sodium fluoride, 6, 473

Sulfur tetrafluoride, 6, 560

Triphenylphosphine difluoride, 2, 135

from RH (see TYPE OF REACTION INDEX)

from RX'

Amberlyst ion-exchange resin, 7, 182

Antimony(V) fluoride-Graphite, 5, 19

Ethylene glycol, 1, 375

Potassium fluoride, 1, 933; 5, 153, 322; 8, 390

Silver fluoride, 6, 514

Tributylmethylphosphonium fluoride, 9, 223

from ROSO₂R'

Amberlyst ion-exchange resin, 7, 182

Potassium fluoride, 5, 153, 322; 6, 405

Tributylmethylphosphonium fluoride, 9, 223

Other methods

Potassium fluoride, 8, 410

Pyridinium poly(hydrogen fluoride), 5, 538; 9, 399

2,4,6-Triphenylpyrylium fluoride, 9, 508

ALKYL CHLORIDES

from ROH

Arsenic trichloride, 3, 16

Benzyltriethylammonium chloride, 4, 27

Bis(benzonitrile)dichloro-palladium(II), 9, 44

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CARBONYLS, DIYNES, ENYNES,

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PROPARGYL ALCOHOLS)

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(see HALOALKYNES)

ALLENES, CUMULENES AND ALLENE

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- N-Acetylhydrazide, 1, 13
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- Dicyclohexylethylamine, 1, 370
- Dihydridotetrakis(triphenylphosphine)ruthenium(II), 11, 182
- Diisopropylethylamine, 1, 371
- Lithium amide, 1, 600
- Lithium naphthalenide, 2, 288
- N,N-Methylphenylaminotriphenylphosphonium iodide, 6, 392
- Sodium hydride, 1, 1075
- Triethyloxonium tetrafluoroborate, 1, 1210

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- Diethylaluminum iodide, 12, 5
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- Hexachlorodisilane, 10, 195
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- N*-Benzoylperoxycarbamic acid, **6**, 35
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- t*-Butyl hydroperoxide-Vanadyl acetylacetonate, **2**, 456; **3**, 331
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- 2-Hydroperoxyhexafluoro-2-propanol, **10**, 206
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 - Potassium fluoride, 1, 296, 933; 5, 556
 - Pyridinium poly(hydrogen fluoride), 9, 399

ARYL CHLORIDES

- by Chlorination of ArH (*see* TYPE OF REACTION INDEX)
- by Chlorination of $\text{ArN}_2^+ \text{X}^-$
 - Copper(I) chloride, 1, 166
 - Sodium chloride, 6, 285
- from ArOH
 - Phenylphosphonic dichloride, 1, 846
 - Triphenylphosphine dichloride, 1, 1247
- Other routes
 - Carbon tetrachloride, 3, 43
 - Chlorotrimethylsilane, 8, 107
 - Chlorotris(triphenylphosphine)-rhodium(I), 1, 140; 4, 559
 - Copper(II) chloride-Nitric oxide, 2, 87
 - Hydrogen bromide, 4, 251
 - Palladium catalysts, 11, 392
 - Sodium chlorate, 1, 1056

ARYL BROMIDES

by Bromination of ArH (*see* TYPE OF REACTION INDEX)

- by Bromination of $\text{ArN}_2^+ \text{X}^-$
 - Copper(I) bromide, 1, 165
 - Hexamethylphosphoric triamide, 5, 323
 - Sodium bromide, 6, 285
- Other routes
 - Bromoform, 9, 91
 - Chlorotris(triphenylphosphine)-rhodium(I), 4, 559
 - Dioxane-Bromine, 1, 333
 - Hydrogen bromide, 4, 251
 - Phenyl(tribromomethyl)mercury, 6, 468
 - Phosphorus(V) bromide, 1, 865
 - Triphenylphosphine dihalides, 1, 1247; 2, 446; 3, 320; 12, 554

ARYL IODIDES

- by Iodination of ArH (*see* TYPE OF REACTION INDEX)
- by Iodination of $\text{ArN}_2^+ \text{X}^-$
 - Potassium iodide, 11, 440
 - Sodium iodide, 6, 285
- Other routes
 - Aryllithium bis(trifluoroacetates), 4, 498
 - Iodine, 9, 91
 - Sodium iodide + co-reagent, 1, 1087; 11, 488
 - Thallium(III) trifluoroacetate, 3, 286; 6, 579

AZIDES**FROM ROH**

- Diphenyl phosphoroazide, 8, 211
- Hydrazoic acid, 12, 242
- Silver azide, 9, 296
- Sodium azide, 5, 326; 6, 279
- Triphenylphosphine + co-reagent, 6, 644; 7, 404

FROM C=C

- Bromine azide, 2, 37; 3, 34
- Iodine azide, 2, 222; 4, 262; 6, 297
- Mercury(II) azide, 3, 196; 4, 323
- Sodium azide, 8, 258
- Tris(dimethylamino)mesityloxyphosphonium azide, 9, 296

FROM RX OR RO₂R'

- Azidotrimethylsilane, 11, 32
- 2,3-Bis(bromomethyl)-1,3-butadiene, 5, 32

Sodium azide, 2, 209; 6, 676; 7, 246

Tetramethylguanidinium azide, 2, 403

FROM RNH_2

Sodium azide, 1, 1041

p-Toluenesulfonyl azide, 2, 415; 3, 291;
7, 19

OTHER ROUTES

Azidotrimethylsilane, 5, 207

Ferric azide, 7, 153

Lead(IV) acetate azides, 4, 276

Palladium(II) acetate, 5, 496

Phenylodine(III) diacetate–

Azidotrimethylsilane, 5, 354

Sodium nitrite, 1, 1097

AZIRIDINES

FROM $\text{C}=\text{C}$ (see TYPE OF REACTION INDEX)

FROM AMINO ALCOHOLS

Sodium hydride, 6, 541

Triphenylphosphine + co-reagent, 5,
727; 9, 504

Triphenylphosphine dibromide, 3, 320

FROM IMINES

(Bromodichloromethyl)phenylmercury,
5, 514

N-Chlorosuccinimide, 6, 115

Dichloromethyl lithium, 1, 223

(Dimethylamino)phenyloxosulfonium
methylide, 3, 105

Methyl diazoacetate, 7, 76

Methylphenyl-N-*p*-
toluenesulfonylsulfoximine, 3, 204

Potassium cyanide, 11, 433

Trichloromethyl lithium, 1, 223

OTHER ROUTES

Chloroacetyl chloride, 3, 46

Diethyl N-phenylamidophosphate, 7,
106

(E)-(Dimethylamino)phenyl-
(2-phenylethenyl)sulfoxonium
tetrafluoroborate, 4, 174

Hydrazine, 1, 434; 5, 327

Lithium aluminum hydride, 1, 581; 2,
242

Sodium amide, 1, 1034

Sodium azide, 9, 418

Triethyl phosphonoacetate, 6, 612

Triphenylphosphine–Carbon
tetrachloride, 8, 516

AZO COMPOUNDS

FROM AZOXY COMPOUNDS

(see TYPE OF REACTION INDEX)

FROM DIAZONIUM COUPLING

(see TYPE OF REACTION INDEX)

BY OXIDATION OF ANILINES, HYDRAZO COMPOUNDS

(see TYPE OF REACTION INDEX)

OTHER ROUTES

t-Butyl hypochlorite, 4, 58; 5, 77

Hydroxylamine-O-sulfonic acid, 1, 481

Lithium methanethiolate, 8, 303

Nitrosobenzene, 5, 478

Sodium bis(2-methoxyethoxy)aluminum
hydride, 2, 382

Sodium borohydride, 4, 443

Sodium hydride–*t*-Butyl hypochlorite, 4,
455

p-Toluenesulfonyl azide, 1, 1178

Zinc, 1, 1276

AZOXY COMPOUNDS

t-Butyl hydroperoxide–Titanium(IV)
isopropoxide, 5, 76

Copper(I) chloride, 6, 145

Hexamethylditin, 6, 273

Hydrogen peroxide, 1, 457

Lead, 2, 233

Nitrosobenzene, 5, 478

Phosphine, 1, 859; 2, 329

Sodium bis(2-methoxyethoxy)aluminum
hydride, 2, 382

Sodium borohydride–Cobalt(II)
chloride, 3, 264

Thallium, 3, 285

Triethyloxonium tetrafluoroborate, 4,
527; 5, 691

Triethyl phosphite, 1, 1212

BENZOINS (see HYDROXY

ALDEHYDES AND KETONES)

BIARYLS (see also CHIRAL COMPOUNDS)

BY COUPLING OF ArX

Bis(1,5-cyclooctadiene)nickel(0), 4, 33;
11, 51

trans-Bromo-*o*-tolylbis(triethyl-
phosphine)nickel(II), 10, 58

Copper, 1, 157; 5, 146; 7, 73; 9, 122

Copper bronze, 1, 155; 4, 100

Copper(II) chloride, 2, 84

Copper(I) trifluoromethanesulfonate, 6,
130

Diethyltrimethylsilylamine, 6, 184

BIARYLS (*Continued*)

- N,N-Dimethylformamide, **1**, 278
- Nickel, **12**, 335
- Nickel(II) bromide–Zinc, **9**, 322
- Palladium(II) acetate, **6**, 442
- Tetramethylurea, **1**, 1146
- Thallium(I) bromide, **2**, 405; **7**, 361
- Tris(triphenylphosphine)nickel(0), **6**, 653; **8**, 523

BY CROSS-COUPLING OF ArM + Ar'H

- (1S,2S)-2-Amino-3-methoxy-1-phenyl-1-propanol, **12**, 310, 381
- [1,3-Bis(diphenylphosphine)propane]-(dichloro)nickel(II), **11**, 167
- Cobalt(II) chloride, **1**, 155
- Copper(I) iodide, **8**, 122
- Dichlorobis(triphenylphosphine)-nickel(II), **6**, 59; **9**, 147
- 1,3-Dichloro-2-butene, **10**, 134
- Grignard reagents–Nickel(II) reagents, **7**, 250
- 2-(*o*-Methoxyphenyl)-4,4-dimethyl-2-oxazoline, **6**, 368
- Pentafluorophenylcopper, **5**, 504
- Tetrakis(triphenylphosphine)-palladium(0), **8**, 472

BY NONPHENOLIC OXIDATIVE COUPLING

- Cerium(IV) trifluoroacetate, **5**, 102
- Ferric chloride, **1**, 390; **10**, 185
- Periodic acid, **2**, 313
- Raney nickel, **1**, 723
- Tellurium(IV) chloride, **5**, 643
- Thallium(III) trifluoroacetate, **8**, 478; **10**, 397; **11**, 516; **12**, 481, 484
- Vanadyl trifluoride, **5**, 745; **7**, 418; **8**, 528; **9**, 513

BY OXIDATIVE PHENOLIC COUPLING

- Chloramine, **2**, 65
- Copper(II)–Amine complexes, **8**, 114
- Diphenyl selenoxide, **9**, 201
- Ferric chloride, **10**, 185
- Manganese(III) acetylacetonate, **2**, 264
- Potassium ferricyanide, **7**, 300
- Vanadium(IV) chloride, **3**, 332

OTHER ROUTES FOR**SYMMETRICAL Ar–Ar**

- Arenediazonium tetrahaloborates, **12**, 380

Silver(I) nitrate, **4**, 429

Tetracarbonyldi- μ -chlorodirrhodium, **8**, 469

Tetrakis(pyridine)copper(I) perchlorate, **4**, 479

Thallium(I) bromide, **3**, 286; **5**, 655

OTHER ROUTES FOR**UNSYMMETRICAL Ar–Ar'**

- Arenediazonium halides, **1**, 1177
- Bis-3,4-dichlorobenzoyl peroxide, **3**, 21
- t*-Butyl thionitrate, **9**, 91
- Copper, **8**, 113
- Copper(I) *t*-butoxide, **9**, 122
- Dimethylformamide dimethyl acetal, **10**, 158
- Isoamyl nitrite, **1**, 40
- Nitrosylsulfuric acid, **2**, 299
- Potassium acetate, **8**, 130
- Tetrakis(triphenylphosphine)-palladium(0), **11**, 503
- Tetraphenylbismuth trifluoroacetate, **11**, 515

Thallium(III) trifluoroacetate, **3**, 286

Titanium(IV) chloride, **11**, 529

Trifluoromethanesulfonic acid, **6**, 617

BUTENOLIDES (*see* **UNSATURATED LACTONES**)**CARBAMATES****FROM ROH**

- Benzenesulfonyl isocyanate, **1**, 48
- 3-Bromopropionyl isocyanate, **1**, 78
- 1-Chlorocarbonylbenzotriazole, **8**, 87
- Chlorosulfonyl isocyanate, **1**, 117
- Diphenyl phosphoroazide, **4**, 210
- Ethyl- or Methyl(carboxysulfamoyl)-triethylammonium hydroxide inner salt, **5**, 442; **8**, 334
- Isopropyl isocyanate, **11**, 277
- Methyl N-sulfonylurethane triethylamine complex, **4**, 343
- α -Naphthyl isocyanate, **1**, 718
- Phenyl isocyanate, **2**, 322; **8**, 396
- Sodium azide, **1**, 1041
- Sodium cyanate, **1**, 1059
- Tin(II) octoate, **7**, 346
- Tributyltin azide, **7**, 377
- Trichloroacetyl isocyanate, **2**, 425
- Trifluoroacetic acid, **1**, 1219

FROM RNH₂

- Benzyl chloroformate, **1**, 109

t-Butyl isocyanide, 9, 123
1-Chlorocarbonylbenzotriazole, 8, 87
Cholesteryl chloroformate, 1, 141
Copper(II) methoxide, 4, 107
Ethyl chloroformate, 1, 364; 12, 223
Phenyl chloroformate, 2, 318
Rhodium catalysts, 12, 426

OTHER ROUTES

Bis(methoxycarbonyl)sulfodiimide, 12, 57
Bis(*p*-methoxyphenyl) telluroxide, 9, 50
Bromonium dicollidine perchlorate, 12, 78
Chromium(II) chloride, 3, 60
Dichloromethylenedimethylammonium chloride, 5, 195
N,N-Dichlorourethane, 2, 121
Diphenyl phosphoroazide, 4, 210
Iodine, 11, 261; 12, 253
Iodine isocyanate, 2, 223; 3, 161
Lead tetraacetate, 1, 537; 6, 313
Methyl hypobromite, 5, 446
Phase-transfer catalysts, 10, 305
Silver tetrafluoroborate, 1, 1015
Thallium(III) nitrate, 4, 492

CARBODIIMIDES

Butyllithium, 7, 45
Diethyl azodicarboxylate, 4, 148
Diethyl phosphite, 1, 251
Diphenylcarbodiimide, 1, 337
1-Ethyl-3-methyl-3-phospholene 1-oxide, 1, 679
2-Halopyridinium salts, 8, 95; 9, 234
Iron carbonyl, 3, 167
3-Methyl-1-phenyl-3-phospholene 1-oxide, 1, 695
Palladium(II) chloride, 6, 447
Phosphorus(V) oxide-*t*-Amine, 2, 329
p-Toluenesulfonyl chloride, 1, 1179
Triphenylphosphine-Carbon tetrachloride, 4, 551
Triphenylphosphine dibromide, 3, 320; 4, 555; 10, 60

CARBOHYDRATES AND DERIVATIVES

ALKYLATED CARBOHYDRATES

Benzyl bromide, 5, 25
Bis(tributyltin) oxide, 9, 53
Diazomethane, 2, 102
2,6-Di-*t*-butyl-4-methylpyridine, 9, 141
Dimethyl sulfate, 1, 293, 295
Dimethyl sulfoxide, 2, 157

Methyl trifluoromethanesulfonate, 6, 406
Sodium hydride, 1, 1075
Sodium methylsulfinylmethyllide, 2, 166
Triphenylmethyl chloride, 1, 1254

AMINO SUGARS

Iodonium di-*sym*-collidine perchlorate, 10, 212
Nitromethane, 1, 739
Nitrosyl chloride, 1, 748
Trifluoromethanesulfonic anhydride, 12, 532

DISACCHARIDES,

OLIGOSACCHARIDES

(Diethylamino)sulfur trifluoride, 12, 183
Iodonium di-*sym*-collidine perchlorate, 10, 212
Mercury(II) cyanide, 1, 655
Polyphosphate ester, 1, 892
Tetraethylammonium bromide, 6, 568
Tin(IV) chloride, 7, 342

C-GLYCOSIDES

Allyltributyltin, 12, 21
Allyltrimethylsilane, 11, 16; 12, 544
Benzeneselenenyl halides, 12, 39
(Diethylamino)sulfur trifluoride, 12, 183
2-Lithio-1,3-dithianes, 11, 285
Lithium naphthalenide, 12, 284
Tetrakis(triphenylphosphine)-palladium(0), 11, 503
Tributyltin hydride, 12, 516
Trimethylsilyl trifluoromethanesulfonate, 12, 543
Triphenylphosphine, 12, 550

O-GLYCOSIDES

Benzeneselenenyl halides, 10, 16
Boron trifluoride etherate, 4, 44
Bromotrimethylsilane, 10, 59
Bromotrimethylsilane-Cobalt(II) bromide, 10, 59
Ion-exchange resins, 1, 511
Mercury(II) cyanide, 1, 655
Mercury(II) nitrate, 10, 254
Mercury(II) oxide-Mercury(II) bromide, 6, 360
Nitromethane, 1, 739
Phenylthiotrimethylsilane, 12, 535
Silver carbonate, 6, 511
Silver carbonate-Celite, 6, 511
Silver imidazolate, 10, 349; 11, 467
Tetraethylammonium bromide, 6, 568

CARBOHYDRATES AND DERIVATIVES*(Continued)*

Tetrafluorosilane, 12, 466

Tin(IV) chloride, 7, 342

Tin(II) chloride–Silver perchlorate, 10, 374

2-Trimethylsilylethanol, 11, 574

Trimethylsilyl trifluoromethane-sulfonate, 11, 584; 12, 543

Triphenylcarbenium perchlorate, 12, 549

GLYCOSYL HALIDES

Aluminum chloride, 2, 21

Bromodimethylborane, 12, 199

(Diethylamino)sulfur trifluoride, 12, 183

Hydrogen bromide, 1, 453

Mercury(II) oxide, 1, 655

Pyridinium poly(hydrogen fluoride), 12, 419

Silver tetrafluoroborate, 3, 250

Triphenylphosphine–

N-Halosuccinimides, 4, 555

OTHER CARBOHYDRATES

Benzeneboronic acid, 1, 833

Benzyl chloroformate, 1, 109

Benzylthiocarbonyl chloride, 2, 26

Bis(tributyltin) oxide, 8, 43

Bromine–Silver acetate, 1, 73

t-Butyl hydroperoxide–Dialkyl tartrate–

Titanium(IV) isopropoxide, 11, 92

Cadmium carbonate, 4, 67

1,1-Dimethoxyethane, 2, 4

Dimethyl sulfoxide–Sulfur trioxide, 4, 200

N,N-Dimethylthiocarbamoyl chloride, 3, 127

Diphenyl phosphorochloridate, 2, 180

1,3-Dithiane, 4, 216

Formaldehyde, 8, 231

Hydrogen bromide–Acetic acid, 1, 452

Levulinic acid, 10, 230

Mercury(II) acetate, 1, 644; 12, 298

trans-1-Methoxy-3-trimethylsilyloxy–

1,3-butadiene, 11, 332

1-Methyl-1-phenylhydrazine, 1, 694

Methyl tributylstannyl sulfide, 8, 352

p-Nitrobenzoyl chloride, 1, 736

Phenyl isocyanate, 2, 322

Ruthenium tetroxide, 1, 986; 3, 243

Silver carbonate, 1, 1005; 4, 425

Silver fluoride, 2, 364

Sodium amalgam, 1, 1030

Sodium azide, 5, 593

Sodium tetraborate, 4, 461

Tetrabutylammonium iodide, 9, 447

Tetrakis(triphenylphosphine)-palladium(0), 11, 503

Trifluoroacetic anhydride, 5, 701

Triphenylphosphine + co-reagent, 9, 506, 507

Tris(dimethylamino)mesityloxy-phosphonium azide, 9, 296

CARBONATES

Benzeneseleninic anhydride, 8, 29

Bis(triphenylphosphine)nickel(0), 4, 41

Carbon dioxide, 9, 94

N,N'-Carbonyldiimidazole, 6, 97

Cerium(IV) ammonium nitrate, 4, 71

Chlorosulfonyl isocyanate, 5, 132

Copper(I) cyanoacetate, 7, 74

Dichloromethylenedimethylammonium chloride, 4, 135

Diisopropyl peroxydicarbonate, 1, 263

Dimethyl sulfate, 4, 188

Ethyl chloroformate, 1, 364

Hexamethylphosphorous triamide–

Dialkyl azodicarboxylates, 6, 280

Molybdenum(V) chloride, 10, 274

Performic acid, 4, 373

Phosgene, 1, 856; 2, 328

Selenium, 5, 575

Triphenylphosphine–Diethyl

azodicarboxylate, 11, 589

CARBOXYLIC ACIDS *(see also* AMINO

ACIDS, CHIRAL COMPOUNDS,

DICARBONYLS, HALO

CARBOXYLIC ACIDS, HYDROXY

CARBOXYLIC ACIDS,

UNSATURATED CARBOXYLIC

ACIDS)

BY CARBOXYLTION

of RH, ArH

Bromine–Antimony(V) chloride–

Sulfur dioxide, 5, 57

2,2-Dichloro-1,3-benzodioxole, 1, 119; 4, 70

Diphenylcarbamoyl chloride, 1, 337; 2, 177

Oxalyl chloride, 1, 28, 767

of $\text{ArN}_2^+ \text{X}^-$ *(see* TYPE OF REACTION INDEX)

of ArM

Arene(tricarbonyl)chromium

- complexes, 10, 13
- Butyllithiums, 1, 95; 6, 109
- Carbon dioxide, 6, 94
- Grignard reagents, 1, 415
- Lithium naphthalenide, 8, 305
- Lithium nitride, 1, 618
- Magnesium, 7, 218; 10, 251
- Magnesium methyl carbonate, 3, 190
- Nickel carbonyl, 1, 720; 5, 472
- Phenylpotassium, 1, 848
- Sodium amalgam, 1, 1033
- N,N,N',N'-Tetramethyl-ethylenediamine, 5, 652
- of Other substrates
 - Copper(I) carbonyl ion, 5, 149
 - Cyclodextrins, 12, 151
 - Disodium tetracarbonylferrate, 4, 461
 - Formic acid, 1, 404
 - Hexafluoroantimonic acid, 2, 216
 - Iron carbonyl, 8, 265
 - Nickel carbonyl, 1, 720; 5, 472
 - Tetrabutylammonium iodide, 7, 355
- BY HOMOLOGATION OF RCHO,
 - $R_2CO; R_2CO \rightarrow R_2CHCOOH$
 - Carbon dioxide, 6, 94
 - Chloroacetonitrile, 6, 102
 - Cyanotrimethylsilane, 11, 147
 - Diethyl *t*-butoxy(cyano)-methylphosphonate, 8, 167
 - 1,3-Dithiocyclohexane-2-thione, 2, 441
 - 2-Lithio-2-trimethylsilyl-1,3-dithiane, 4, 284
 - Tetraethyl dimethylaminomethylene-diphosphonate, 3, 277; 11, 502
 - Tosylmethyl isocyanide, 4, 272; 5, 684
- BY HYDROCARBOXYLATION OF C=C
 - Chlorobis(cyclopentadienyl)-hydrido-zirconium(IV), 6, 175
 - Dichlorobis(triphenylphosphine)-palladium(II), 3, 81
 - Formic acid, 4, 239
 - Nickel carbonyl, 5, 472
 - Palladium(II) chloride-
 - Triphenylphosphine, 5, 503
 - Trifluoromethanesulfonic acid, 9, 485
 - Tris(methylthio)methyl lithium, 7, 412
- BY HYDROLYSIS OF RCOX
 - Amides
 - α -Chloro-N-cyclohexyl-propanaldonitrone, 4, 80
 - Claisen's alkali, 1, 153
 - Diphenyldi(1,1,1,3,3,3-hexafluoro-2-phenyl-2-propoxy)sulfurane, 6, 239
 - Ephedrine, 9, 209
 - Ion-exchange resins, 1, 511; 11, 276
 - Lithium hydroxide, 12, 282
 - Nitrogen dioxide, 1, 324
 - Nitrosonium tetrafluoroborate, 1, 747
 - Nitrosyl chloride, 1, 748
 - Potassium hydroxide, 8, 415; 10, 328
 - Sodium peroxide, 6, 548
- Esters (General methods)
 - Aluminum chloride-Ethanethiol, 9, 13; 10, 11
 - Boron tribromide, 5, 49
 - Cinchonine, 6, 501
 - Claisen's alkali, 1, 153
 - Dimethylaluminum methylselenolate, 8, 182
 - Dimethyl sulfoxide, 1, 296
 - Iodotrimethylsilane, 8, 261
 - Ion-exchange resins, 1, 511
 - Lithium iodide, 7, 209
 - Lithium methanethiolate, 8, 303
 - Methanesulfonic acid, 1, 666
 - Potassium hydroxide, 8, 415; 10, 328
 - Potassium superoxide, 7, 304
 - Sodium benzeneselenoate, 8, 447; 11, 475
 - Sodium thiophenoxide, 1, 1106
 - Tetrabutylammonium hydrogen sulfate, 9, 356
 - Trichloro(methyl)silane-Sodium iodide, 12, 527
 - Trifluoroacetic acid, 5, 695
- Hydrazides
 - Cerium(IV) ammonium nitrate, 4, 71
 - Copper(II) acetate, 6, 429; 10, 103
 - Copper(I) chloride, 7, 80
 - Ion-exchange resins, 11, 276
 - Lead tetraacetate, 3, 168
 - Manganese(IV) oxide, 1, 637
- Methyl esters
 - Boron trichloride, 4, 42
 - 1,8-Diazabicyclo[5.4.0]undecene-7, 4, 119
 - Dimethylaluminum methylselenolate, 8, 182
 - N,N-Dimethylhydrazine, 6, 223
 - Lithium-Ammonia, 1, 601

CARBOXYLIC ACIDS (*Continued*)

- Lithium iodide, **1**, 615; **7**, 209
- Lithium 1-propanethiolate, **3**, 188; **5**, 415
- Potassium *t*-butoxide, **1**, 911
- Potassium cryptate[2.2.2], **5**, 156
- Pyridinium chloride, **11**, 449
- Sodium cyanide, **5**, 606

Other specific esters

- Lithium dimethylcuprate, **8**, 301
- Mercury(II) acetate, **8**, 315
- Nitrosonium tetrafluoroborate, **8**, 364
- Sodium ethanedithiolate, **6**, 540
- Sodium trithiocarbonate, **6**, 553
- Trimethylsilyl trifluoromethanesulfonate, **10**, 438

BY KOCH-HAAF REACTION

(see TYPE OF REACTION INDEX)

BY OXIDATION OF ROH, RCHO, ArR

(see TYPE OF REACTION INDEX)

BY OXIDATIVE CLEAVAGE (see TYPE OF REACTION INDEX)**BY WILLGERODT REACTION**

(see TYPE OF REACTION INDEX)

OTHER ROUTES

- Arenesulfonyl azides, **5**, 19
- t*-Butyl lithioacetate, **10**, 67
- Cerium(IV) acetate, **4**, 71
- Chloramine, **1**, 122
- Cobalt(II) acetate, **4**, 99
- Copper(I) carbonyl ion, **5**, 149
- Diazomethane, **1**, 191
- 4,4-Dichloro-3-buten-1-ol, **5**, 192
- 1,1-Dichloroethylene, **1**, 220; **2**, 118
- Dicyclohexylborane, **8**, 162
- Dilithium tetrachlorocuprate, **7**, 114
- Diphenyl phosphoroazidate, **10**, 173
- Hexafluoroantimonic acid, **11**, 252
- Hydrogen peroxide-Selenium dioxide, **1**, 477
- 2-(*o*-Methoxyphenyl)-4,4-dimethyl-2-oxazoline, **6**, 368
- Oxidiperoxymolybdenum(pyridine)-(hexamethylphosphoric triamide), **11**, 218
- Phenoxyacetic acid, **9**, 361
- (Phenylsulfonyl)nitromethane, **11**, 419
- Potassium *t*-butoxide, **10**, 323
- Propyl nitrite-Sodium nitrite, **5**, 565
- Sodium-Ethanol, **11**, 472
- 2,4,4,6-Tetramethyl-5,6-dihydro-1,3-

(4*H*)-oxazine, **3**, 280Thallium(III) nitrate, **8**, 4762,4,4-Trimethyl-2-oxazoline, **3**, 313; **5**, 714 **α -SUBSTITUTED CARBOXYLIC**

ACIDS (see also AMINO ACIDS, HALO CARBOXYLIC ACIDS, HYDROXY CARBOXYLIC ACIDS)

 α -AcyloxyCarbon tetrabromide-Tin(II) fluoride, **11**, 111Pyridine N-oxide, **5**, 567Thallium(III) acetate, **4**, 492 **α -Aryl***d*- and *l*-10-Camphorsulfonyl chloride, **11**, 109Diphenyl phosphoroazidate, **8**, 211Methyl methylthiomethyl sulfoxide, **9**, 314Silver tetrafluoroborate, **11**, 471Sodium benzeneselenoate, **12**, 452 **α -Methoxy**Chloroform, **8**, 92*trans*-2,4-Dimethoxymethyl-5-phenyloxazoline, **6**, 204(-)-10-Mercaptoisoborneol, **9**, 290 **α -Silyl**Trimethylsilylacetic acid, **6**, 631**CHIRAL COMPOUNDS****ALCOHOLS**

by Additions to C=O

(S,S)-(+)-1,4-Bis(dimethylamino)-2,3-dimethoxybutane, **9**, 47N,S-Dimethyl-S-phenylsulfoximine, **11**, 210(2S,2'S)-2-Hydroxymethyl-1-[(1-methylpyrrolidin-2-yl)methyl]-pyrrolidine, **8**, 253; **9**, 246Lithium tetrabutylaluminate-(-)-N-Methylephedrine, **7**, 240(S)-(-)-Methyltri(2-methyl-1-butoxy)-titanium, **10**, 422Organotitanium reagents, **11**, 374*p*-Tolylsulfinylacetic acid, **11**, 538*p*-(Tolylsulfinyl)methyl lithium, **4**, 513

by Hydroboration

Diisopinocampheylborane, **5**, 283; **6**, 202; **11**, 188, 225; **12**, 193Dilongifolylborane, **11**, 191Monoisopinocampheylborane, **8**, 267; **9**, 317; **10**, 224

by Reduction of C=O

(R)-1-(S)-1',2-Bis(diphenylphosphine)-ferrocenylethanol, **11**, 239

Borane-(S)-(-)-2-Amino-3-methyl-1,1-diphenyl-1-butanol, **12**, 31

Diisobutylaluminum hydride, **12**, 191

Diisopinocampheylborane, **1**, 262; **8**, 174

(-)-N-Dodecyl-N-methylephedrinium bromide, **11**, 337

NB-Enantride, **11**, 229

Lithium aluminum hydride + chiral co-reagent, **2**, 243; **5**, 231, 387; **8**, 184, 423; **9**, 169, 308; **10**, 458; **11**, 153, 289, 292; **12**, 60, 190, 191, 322

Lithium B-isopinocampheyl-9-borabicyclo[3.3.1]nonyl hydride, **8**, 303

Monoisopinocampheylborane, **11**, 350

B-3-Pinanyl-9-borabicyclo[3.3.1]nonane, **8**, 403; **10**, 320; **11**, 429; **12**, 397

Sodium borohydride + chiral co-reagent, **7**, 144, 239; **8**, 431; **9**, 422

Other routes

1,4-[Bis(diphenylphosphine)butane]-(norbornadiene)rhodium(I) tetrafluoroborate, **12**, 426

2,3-Butanediol, **12**, 80

Dibromoalane, **12**, 377

Hexahydro-4,4,7-trimethyl-4*H*-1,3-benzothiin, **12**, 237

(S)-(+)- α -Hydroxy- β , β -dimethyl-propyl vinyl ketone, **12**, 248

Lithium dimethylcuprate-Boron trifluoride, **12**, 348

Organotitanium reagents, **12**, 353

2-Oxazolidones, chiral, **11**, 379

ALDEHYDES

 Chiral at the α carbon

(S)-1-Amino-2-methoxymethyl-1-pyrrolidine, **8**, 16

(1*S*,2*S*)-2-Amino-3-methoxy-1-phenyl-1-propanol, **12**, 310

Dimethyl sulfoxide-Sulfur trioxide, **11**, 216

Leucine *t*-butyl esters, **10**, 229

(-)-10-Mercaptoisoborneol, **9**, 290

α -Methylbenzylamine, **9**, 363

(S)-(-)-Proline, **9**, 393

Sodium borohydride, **12**, 441

(S)-(+)-*p*-Tolyl *p*-tolylthiomethyl sulfoxide, **9**, 474; **10**, 408; **12**, 510

Trialkylaluminums, **12**, 512

(-)-4,6,6-Trimethyl-1,3-oxathiane, **8**, 508

 Chiral at the β carbon

(1*S*,2*S*)-2-Amino-3-methoxy-1-phenyl-1-propanol, **12**, 310

Diisobutylaluminum hydride, **12**, 191

2,3-O-Isopropylidene-2,3-dihydroxy-1,4-bis(diphenylphosphine)butane, **9**, 259

Leucine *t*-butyl esters, **7**, 189; **10**, 229

(S)-(+)-2-Methoxymethylpyrrolidine, **10**, 259

ALICYCLIC HYDROCARBONS

Three-membered

Bis[(-)-camphorquinone- α -dioximato]cobalt(II) hydrate, **8**, 39

Bromoform (or Chloroform), **6**, 220

N,S-Dimethyl-S-phenylsulfoximine, **11**, 210

Dimethylsulfoxonium methylide, **9**, 186

Ephedrine, **11**, 230

Iron carbonyl, **10**, 221

d- and *l*-Menthol, **12**, 294

Four-membered

Bis(1,5-cyclooctadiene)nickel(0), **4**, 33

Cobaltcyclopentan-2-ones, **11**, 136

Five-membered

(R)-(+)-*o*-Anisylcyclohexylmethylphosphine, **11**, 31

(S)- or (R)-Menthyl *p*-toluenesulfinate, **11**, 312; **12**, 295

Rhodium(II) carboxylates, **12**, 423

Six-membered

D-(-)- and L-(+)-2,3-Butanediol, **11**, 84

Camphor-10-sulfonic acid, **12**, 103

Copper(II) acetate-Ferrous(II) sulfate, **10**, 103

Dichlorodiisopropoxytitanium(IV), **11**, 164

Ethyl (S)-lactate, **12**, 226

(R)-Ethyl *p*-tolylsulfynylmethylene-propionate, **12**, 228

(S)-Histidine, **9**, 393

(S)-(+)- α -Hydroxy- β , β -dimethyl-propyl vinyl ketone, **12**, 248

CHIRAL COMPOUNDS (Continued)

- (1R)-(-)-*cis*-3-Hydroxyisobornyl neopentyl ether, **12**, 249
 Methoxyaluminum dichloride, **9**, 289
 (S)- or (R)-Menthyl *p*-toluenesulfinate, **12**, 295
 2-Oxazolidones, chiral, **12**, 359
 8-Phenylmenthol and esters, **10**, 402; **11**, 412
 (S)-(-)-Proline, **6**, 411; **7**, 307; **8**, 421; **9**, 393; **12**, 414
 Tetrakis(triphenylphosphine)-palladium(0), **11**, 503
 Tetramethyltartaric acid diamide, **12**, 480
 Tin(IV) chloride, **11**, 522

ALKANES

- Dichloro[2,3-O-isopropylidene-2,3-dihydroxy-1,4-bis(diphenylphosphine)-butane]nickel(II), **5**, 360
 Neomenthyl(diphenylphosphine), **6**, 416

ALKENES (HAVING A CHIRAL SP³C)

- Bis(acetonitrile)dichloropalladium(II), **11**, 46
trans-2,3-Bis(diphenylphosphine)-bicyclo[2.2.1]hept-5-ene, **10**, 36
 Ferrocenylphosphines, **9**, 200
 Phosphonamides, chiral, **12**, 396

ALKYL HALIDES

- Iodine, **7**, 179

ALLENES

- 1-Chloro-2-methyl-N,N-tetramethylenepropenylamine, **12**, 124
 Chromium(III) chloride-Lithium aluminum hydride, **10**, 101
 Diisopinocampheylborane, **4**, 161
 Methylolithium, **7**, 242
 (R)-1-(1-Naphthyl)ethyl isocyanate, **8**, 356
 Triethyl orthoacetate, **10**, 417

ALLYLIC ALCOHOLS

- (S)-4-Anilino-3-methylamino-1-butanol, **12**, 33
 Butyllithium, **12**, 96
 2,2'-Dihydroxy-1,1'-binaphthyl, **9**, 169; **10**, 148; **12**, 190
 Diisobutylaluminum hydride, **12**, 191
 (+)- α -Ethyl camphorate, **1**, 100
 Lithium aluminum hydride-(-)-N-Methylephedrine, **10**, 238
 Lithium L- α , α' -dimethyldibenzylamide, **10**, 245

- B-3-Pinanyl-9-borabicyclo[3.3.1]nonane, **11**, 429

- (S)-(+)-2-(1-Pyrrolidinyl)-methylpyrrolidine, **12**, 421

ALLYLIC SILANES

- α -(Trimethylsilyl)benzylmagnesium bromide, **11**, 19

AMINES

- (S)-1-Amino-2-methoxymethyl-1-pyrrolidine, **12**, 30
 (1S,2S)-2-Amino-1-phenyl-1,3-propanediol, **12**, 32, 383
 (S)-N-Benzoyloxycarbonylproline, **11**, 447
 Borane-Tetrahydrofuran, **4**, 124
 O-(Diphenylphosphinyl)-hydroxylamine, **11**, 221
 Ephedrine, **11**, 230
 Iron, **1**, 519
 2,3-O-Isopropylidene-2,3-dihydroxy-1,4-bis(diphenylphosphine)butane, **5**, 360
 α -Methylbenzylamine, **6**, 162; **11**, 411
 2-Methylpyrrolidine, **4**, 471
 8-Phenylmenthol, **11**, 412
 Pyridinium (*d*)-camphor-10-sulfonate, **11**, 449
 Tin(IV) chloride, **11**, 522
p-(Tolylsulfenyl)methylolithium, **5**, 682

AMINO ACIDS

- 2-Acetoxy-1-methoxy-3-trimethylsilyloxy-1,3-butadiene, **11**, 2
 (2R,4R)- and (2S,4S)-N-Acryloyl-4-(diphenylphosphine)-2-[(diphenylphosphine)methyl]pyrrolidine, **11**, 6
 1-Amino-(S)-2-[(R)-1-hydroxyethyl]-indoline, **3**, 11
 (S)-1-Amino-2-hydroxymethylindoline, **3**, 12
 (S)-15-Aminomethyl-14-hydroxy-5,5-dimethyl-2,8-dithia[9](2,5)-pyridinophane, **11**, 29
 2,3-Bis(diphenylphosphine)bicyclo-[2.2.1]hept-5-ene, **9**, 49
 2,2'-Bis(diphenylphosphine)-1,1'-binaphthyl, **10**, 36
 (2S,4S)-N-(*t*-Butoxycarbonyl)-4-(diphenylphosphine)-2-[(diphenylphosphine)methyl]pyrrolidine, **8**, 57
 7-Chloro-5-phenyl-1-[(S)- α -phenylethyl]-1,3-dihydro-2*H*-1,4-benzodiazepine-2-one, **11**, 124

(3S,6S)-(+)-2,5-Dimethoxy-3,6-dimethyl-3,6-dihydropyrazine, **10**, 151; **11**, 192

(S)-1-(Dimethoxymethyl-2-methoxymethyl)pyrrolidine, **10**, 152

(S)- α -(R)-Diphenylphosphineferrocenylethyl dimethylamine, **9**, 200

(2R,3R)-Dipivaloyltartaric acid, **9**, 204

Ethylaluminum dichloride, **10**, 177

Hydrogen cyanide, **4**, 252

(1S,2S,5S)-2-Hydroxypinan-3-one, **7**, 177

2,3-O-Isopropylidene-2,3-dihydroxy-1,4-bis(diphenylphosphine)butane, **4**, 273; **9**, 259

α -Methylbenzylamine, **8**, 393

Methyl 2,3-bis-O-diphenylphosphine-4,6-O-benzylidene- α -D-glucopyranoside, **8**, 333

Palladium hydroxide, **9**, 353

Potassium tri-*sec*-butylborohydride-Copper(II) iodide, **6**, 492

1,1,3,3-Tetramethylbutyl isocyanide, **5**, 650

AMINO ALCOHOLS

Aluminum chloride, **10**, **9**

(R)-1-(S)-1',2-Bis(diphenylphosphine)-ferrocenylethanol, **11**, 237

p-Tolyl vinyl sulfoxide, **11**, 538

AMINO NITRILES

α -Methylbenzylamine, **8**, 393; **12**, 319

BIARYLS

(1S,2S)-2-Amino-3-methoxy-1-phenyl-1-propanol, **12**, 381

CARBOXYLIC ACIDS AND ACYL DERIVATIVES

Chiral at the α carbon

[1,2-Bis(diphenylphosphine)propane]-(norbornadiene)rhodium perchlorate, **9**, 452

trans-2,5-Bis(methoxymethyl)-pyrrolidine, **12**, 59

(2S,4S)-N-(*t*-Butoxycarbonyl)-4-(diphenylphosphino)-2-[(diphenylphosphino)methyl]-pyrrolidine, **11**, 87

d- and *l*-10-Camphorsulfonyl chloride, **11**, 109

trans-2,4-Dimethoxymethyl-5-phenyloxazoline, **6**, 204

Ephedrine, **9**, 209

2,3-O-Isopropylidene-2,3-dihydroxy-1,4-bis(diphenylphosphine)butane, **6**, 309

(4S,5S)-4-Methoxymethyl-2-methyl-5-phenyl-2-oxazoline, **6**, 386

2-Oxazolidones, chiral, **11**, 379

(S)-Prolinol, **10**, 332

Chiral at the β carbon

(2S,4S)-N-(*t*-Butoxycarbonyl)-4-(diphenylphosphino)-2-[(diphenylphosphino)methyl]-pyrrolidine, **11**, 87

Chlorotris(neomenthyl)diphenylphosphine)rhodium(I), **6**, 416

Ephedrine, **11**, 230

(1R)-(-)-*cis*-3-Hydroxyisobornyl neopentyl ether, **12**, 249

Lithium dibutylcuprate, **10**, 191

Mercury(II) acetate, **12**, 298

(4S,5S)-4-Methoxymethyl-2-methyl-5-phenyl-2-oxazoline, **7**, 229; **9**, 312

8-Phenylmenthol, **11**, 412

CYANOHYDRINS

(2R,4R)-Pentanediol, **12**, 375

DICARBONYLS WITH CHIRAL α OR β CARBONS

(S)-1-Amino-2-methoxymethyl-1-pyrrolidine, **12**, 30

Lithium diisopropylamide, **10**, 241

2-Oxazolidones, chiral, **12**, 359

Quinine, **9**, 403

(+)-(R)-*trans*- β -Styryl *p*-tolyl sulfoxide, **4**, 466

(S)-(+)-*p*-Tolyl *p*-tolylthiomethyl sulfoxide, **10**, 408

L-Valinol, **12**, 563

DIENES

(R)-4-Methylcyclohexylidene-methylcopper, **7**, 238

DIOLS

1,2-Diols

t-Butyl hydroperoxide-Dialkyl tartrate, **12**, 91

(+)-Camphanic acid, **8**, 74

(S)-N-Formyl-2-methoxymethylpyrrolidine, **11**, 243

Hexahydro-4,4,7-trimethyl-4*H*-1,3-benzothiine, **12**, 237

Lithium aluminum hydride-Darvon alcohol, **6**, 206

Osmium tetroxide-Dihydroquinine

CHIRAL COMPOUNDS (*Continued*)acetate, **10**, 291

1,3-Diols

t-Butyl hydroperoxide-Dialkyl tartrate, **11**, 92Organocopper reagents, **12**, 345(2R,4R)-Pentanediol, **12**, 375Raney nickel, **9**, 405Titanium(IV) chloride, **12**, 494Trichloromethyltitanium, **12**, 355**ENAMINES WITH CHIRAL CARBONS**2,2'-Bis(diphenylphosphine)-1,1'-binaphthyl, **11**, 53; **12**, 56**EPOXIDES**(-)-Benzylquininium chloride, **8**, 430Chloromethyl *p*-tolyl sulfone, **8**, 3402,2'-Dihydroxy-1,1'-binaphthyl, **12**, 190Dimethylsulfonium methylide, **6**, 219Hydrogen bromide-Acetic acid, **12**, 242(S)-(2-Hydroxy-N,N-dimethylpropanamide-O,O')-oxodiperoxymolybdenum(VI), **10**, 206(R)-1-(1-Naphthyl)ethyl isocyanate, **9**, 321Tellurium(IV) chloride, **12**, 457**EPOXY ALCOHOLS***t*-Butyl hydroperoxide, **10**, 64*t*-Butyl hydroperoxide + co-reagent, **8**, 393; **12**, 90Dibenzyltartaric acid diamide, **12**, 91**EPOXY CARBONYL COMPOUNDS**(-)-Benzylquininium chloride, **7**, 311; **10**, 27(S)-(-)-Proline, **11**, 446Quinine, **10**, 338**HALOHYDRINS AND DERIVATIVES**Hydrogen bromide-Acetic acid, **12**, 242Lithium aluminum hydride-(R)- and (S)-2,2'-Dihydroxy-1,1'-binaphthyl, **12**, 190B-3-Pinanyl-9-borabicyclo[3.3.1]nonane, **12**, 397Tellurium(IV) chloride, **12**, 457**HETEROCYCLES**(1S,2S)-2-Amino-1-phenyl-1,3-propanediol, **12**, 32, 383(S)-N-Benzoyloxycarbonylproline, **11**, 447Dimethyl sulfoxide, **5**, 263*trans*-1-Methoxy-3-trimethylsilyloxy-1,3-butadiene, **11**, 3322-Methylpyrrolidine, **4**, 471Palladium(II) acetate, **9**, 3448-Phenylmenthol, **11**, 412Pyridinium (*d*)-camphor-10-sulfonate, **11**, 449**HOMOALLYLIC ALCOHOLS**B-Allyldiisocaranylborane, **12**, 18B-Allyl(or Methallyl)diisopinocampheylborane, **12**, 172-Crotyl-4,4,5,5-tetramethyl-1,3,2-dioxaborolane, **11**, 86Diisopinocampheylborane, **4**, 161Dilithium dialkyl(cyano)cuprates, **12**, 349Hydrogen peroxide, **12**, 242B-(3-Methyl-2-butenyl)-diisopinocampheylborane, **12**, 17(2R,4R)-Pentanediol, **12**, 375(+)-3-Phenylbornane-2,3-diol, **9**, 363Titanium(IV) chloride, **12**, 494Trialkylaluminums, **12**, 512 α -(Trimethylsilyl)benzylmagnesium bromide, **11**, 19**HOMOPROPARGYL ALCOHOLS**Diethyl tartrate, **11**, 181**HYDROXY ALDEHYDES AND****KETONES** α -Hydroxy(S)-2-(Anilinomethyl)pyrrolidine, **9**, 19(S)-N-Formyl-2-methoxymethylpyrrolidine, **11**, 243Hexahydro-4,4,7-trimethyl-4H-1,3-benzothiin, **12**, 237(-)-10-Mercaptoisoborneol, **9**, 290(S)-(+)-*p*-Tolyl *p*-tolylthiomethyl sulfoxide, **9**, 474; **10**, 408(-)-4,6,6-Trimethyl-1,3-oxathiane, **8**, 508 β -Hydroxy3-Acetylthiazolidine-2-thione, **12**, 4901-Amino-2-methoxymethyl-1-pyrrolidine, **8**, 16; **9**, 172,3-Butanediol, **11**, 84Isobornylamine, **9**, 62Mandelic acid, **12**, 291(-)-Norephedrine, **12**, 338(S)-(-)-Proline, **6**, 411; **7**, 307Tin(IV) chloride, **12**, 486Tin(II) trifluoromethanesulfonate, **11**, 525Titanium(IV) chloride, **12**, 494**HYDROXY CARBOXYLIC ACIDS**

AND ACYL DERIVATIVES

α-Hydroxy

- Allyltrimethylsilane, 12, 23
 [1,2-Bis(diphenylphosphine)propane]-
 (norbornadiene)rhodium
 perchlorate, 9, 452
 (2S,4S)-N-(*t*-Butoxycarbonyl)-4-
 (diphenylphosphino)-2-
 [(diphenylphosphino)methyl]-
 pyrrolidine, 8, 57; 11, 87
 Dicyclohexylborane, 11, 172
 Hexahydro-4,4,7-trimethyl-4*H*-1,3-
 benzothiin, 12, 237
 8-Phenylmenthol, 11, 412; 12, 389
 B-3-Pinanyl-9-borabicyclo[3.3.1]-
 nonane, 11, 429; 12, 397
 (S)-(-)-Proline, 8, 421
 Titanium(IV) chloride, 12, 494
 Tributylcrotyltn, 12, 513

β-Hydroxy

- (R)-2-Acetoxy-1,1,2-triphenylethanol,
 12, 3
 3-Acetylthiazolidine-2-thione, 12, 490
 Bromomagnesium diethylamide, 5,
 209
 Dichlorobis(cyclopentadienyl)-
 zirconium(II), 10, 131
 N,N-Dimethyl-α-*p*-tolylsulfinyl-
 acetamide, 12, 509
 (4S,5S)-2-Ethyl-4-(methoxymethyl)-
 5-phenyloxazoline, 11, 232
 Menthyl *p*-toluenesulfinate, 12, 295
trans-1-Methoxy-3-trimethylsilyloxy-
 1,3-butadiene, 11, 332
 2-Oxazolidones, chiral, 11, 379; 12,
 359
 Raney nickel, 9, 405
 Rhodium catalysts, 12, 426
p-Tolylsulfinylacetic acid, 10, 405; 11,
 538
 Zinc borohydride, 12, 572

γ-Hydroxy

- Diisopinocampheylborane, 5, 283

KETONES

- Chiral at the α carbon
 (S)-1-Alkoxyethyl-2-aminopropane,
 polymeric, 9, 3
 (S)-1-Amino-2-methoxymethyl-1-
 pyrrolidine, 7, 10; 8, 16; 9, 17
 (S)-(-)-2-Amino-1-methoxy-3-
 phenylpropane, 10, 11

- (S)-2-Aminopropyl-benzyl ether, 11,
 30
 (Benzylmethoxymethyl)methylamine,
 7, 17; 9, 42
 (+)-*trans*-2,5-Dimethylpyrrolidine, 8,
 197
 Ephedrine, 9, 209
 Leucine *t*-butyl esters, 8, 272
erythro-2-Methoxy-1,2-diphenyl-
 ethylamine, 12, 313
 (S)-(+)-2-Methoxymethylpyrrolidine,
 11, 326
 Monoisopinocampheylborane, 11, 350
 Trialkylaluminums, 12, 512
 Valine *t*-butyl ester, 12, 563
 Chiral at the β carbon
 (2S,4S)-(Anilinomethyl)-1-ethyl-4-
 hydroxypyrrolidine, 10, 12
 (S,S)-(+)-1,4-Bis(dimethylamino)-
 2,3-dimethoxybutane, 9, 47
 (4S)-*t*-Butylthio-(2S)-methoxymethyl-
 N-pivaloylpyrrolidine, 12, 315
 N,N'-Dimethyltartaramide, 12, 480
 (S)-2-Hydroxymethyl-1-
 methylpyrrolidine, 10, 266
 (S)- or (R)-Menthyl *p*-toluenesulfinate,
 11, 312; 12, 295
 Methylmagnesium iodide, 10, 191
 Quinine, 9, 403
 Thiophenol, 8, 431
 (S)-(+)-*p*-Tolyl *p*-tolylthiomethyl
 sulfoxide, 10, 408

LACTAMS

- Dimethylketene methyl trimethylsilyl
 ketal, 10, 401
 Quinine, 11, 456

LACTONES

- (R)-(+)-*t*-Butyl (*p*-tolylsulfinyl)acetate,
 11, 106
 Cinchona alkaloids, 11, 134
 Dimethylsulfoxonium methylide, 9, 186
 2,3-O-Isopropylidene-2,3-dihydroxy-
 1,4-bis(diphenylphosphine)butane, 11,
 277
 Lithium aluminum hydride-(-)-
 N-Methylephedrine-3,5-
 Dimethylphenol, 10, 265
 (S)- or (R)-Menthyl *p*-toluenesulfinate,
 12, 295
 4(R)-Methoxycarbonyl-1,3-
 thiazolidine-2-thione, 11, 323

CHIRAL COMPOUNDS (*Continued*)

- (4*S*,5*S*)-4-Methoxymethyl-2-methyl-5-phenyl-2-oxazoline, **6**, 386; **7**, 229; **9**, 312
 (γ-Methoxypropyl)-α-phenylethylamine, **12**, 318
trans-1-Methoxy-3-trimethylsilyloxy-1,3-butadiene, **11**, 332
 2-Oxazolidones, chiral, **11**, 379
 B-3-Pinanyl-9-borabicyclo[3.3.1]nonane, **10**, 320; **11**, 429
p-Tolylsulfonilacetic acid, **10**, 405

NITRILES

- Chlorosulfonyl isocyanate, **11**, 125
 Hydrogen cyanide, **9**, 239

PEPTIDES

- (-)-3-Hydroxy-5-methylhydantoin, **8**, 252

- Thioglycolic acid, **7**, 366

PHOSPHORUS COMPOUNDS

- Boron trisulfide, **5**, 55
 Camphor-10-sulfonic acid, **4**, 68

PROPARGYL ALCOHOLS

- Darvon alcohol, **8**, 184; **10**, 154
 NB-Enantrane, **11**, 229
 Lithium aluminum hydride + co-reagent, **9**, 308; **10**, 148
 (2*R*,4*R*)-Pentenediol, **12**, 375
 B-3-Pinanyl-9-borabicyclo[3.3.1]nonane, **10**, 320; **11**, 429; **12**, 397
 Trimethylsilylacetylene, **9**, 246

SULFUR COMPOUNDS

- (2*S*,4*S*)-(Anilinomethyl)-1-ethyl-4-hydroxypyrrolidine, **10**, 12
t-Butyl hydroperoxide-Dialkyl tartrate, **12**, 90
 (S)- or (R)-Menthyl *p*-toluenesulfinate, **11**, 312; **12**, 295

UNSATURATED CHIRAL**CARBONYL COMPOUNDS**

- Lithium hexamethyldisilazide, **12**, 280
 Palladium(II) chloride, **5**, 500
 8-Phenylmenthol, **11**, 412

UNSATURATED LACTONES

- 1,3-Dimethoxy-1-trimethylsilyloxy-1,3-butadiene, **12**, 196
 (2*S*,2'*S*)-2-Hydroxymethyl-1-[(1-methylpyrrolidin-2-yl)methyl]-pyrrolidine, **10**, 207
 Lithium aluminum hydride-(-)-N-Methylephedrine-3,5-Dimethyl-

- phenol, **10**, 265

- (R)-(+)-3-(*p*-Tolylsulfinyl)propionic acid, **12**, 509

CHLOROFORMATES (*see* HALOFORMIC ESTERS)**CYANO AMINES** (*see* AMINO NITRILES)**CYANO CARBONYL COMPOUNDS**

(*see also* ACYL NITRILES)

α-CYANO CARBONYLS

- O,N-Bis(trifluoroacetyl)hydroxylamine, **1**, 40

- t*-Butylcyanoketene, **4**, 55

- Chlorosulfonyl isocyanate, **5**, 132

- Diethyl carbonate, **1**, 247

- 5-Methylisoxazole, **9**, 309

- Phase-transfer catalysts, **9**, 356

- Sodium ethoxide, **1**, 1065

- p*-Toluenesulfonyl cyanide, **11**, 536

β-CYANO CARBONYLS

- Acetone cyanohydrin, **1**, 5

- 3-Benzyl-5-(2-hydroxyethyl)-4-methyl-1,3-thiazolium chloride, **6**, 289; **7**, 16

- t*-Butyl isocyanide, **11**, 99

- O,O-*t*-Butyl O-isopropenyl peroxy carbonate, **11**, 100

- Cyanotrimethylsilane-

- Triethylaluminum, **10**, 113

- Diethylaluminum cyanide-

- Chlorotrimethylsilane, **8**, 130

- Hydrogen cyanide, **1**, 1197, 1198; **5**, 689

- N-Methyl-2-pyrrolidone, **2**, 281

- Organoaluminum cyanides, **1**, 244; **2**, 127; **4**, 146; **6**, 180; **9**, 158, 328

- Potassium cyanide, **5**, 553; **8**, 409

- Sodium cyanide, **4**, 446; **6**, 535; **8**, 453

- Triethylaluminum, **2**, 427

ω-CYANO CARBONYLS

- Formamide, **2**, 201

- Mercury(II) acetate, **12**, 298

- Nitrosyl chloride, **3**, 214

- Phosphonitrilic chloride trimer, **6**, 469

OTHER CYANO CARBONYLS

- Acrylonitrile, **1**, 973

- Hydrogen cyanide-Triethylaluminum, **4**, 526

- Methanesulfonyl chloride, **7**, 225

- Phosphonitrilic chloride trimer, **6**, 469

- Thallium(I) cyanide, **8**, 476

CYANOHYDRINS AND DERIVATIVES

(*see also* CHIRAL COMPOUNDS)

CYANOHYDRINS

Acetonecyanohydrin, **1**, 5
 Acetyl cyanide, **10**, 1
 Formaldehyde, **1**, 397
 Oxodiperoxymolybdenum(pyridine)-
 (hemamethylphosphoramidic triamide),
7, 136
 (2R,4R)-Pentenediol, **12**, 375
 Sodium cyanide, **5**, 606
 Sodium hydrogen sulfite, **1**, 1047

CYANOHYDRIN ESTERS

Lithium iodide, **9**, 283
 Phosphorus(III) chloride, **8**, 400
 Potassium cyanide, **12**, 405

CYANOHYDRIN ETHERS

Arene(tricarbonyl)chromium complexes,
12, 34
 Benzyltriethylammonium chloride, **5**, 26
t-Butyl isocyanide, **12**, 95
 Cyanotrimethylsilane, **11**, 147
 Diethylaluminum cyanide, **12**, 182
 (2R,4R)-Pentenediol, **12**, 375
 Sodium hexamethyldisilazide, **6**, 529

CYANOHYDRIN SILYL ETHERS

Chlorotrimethylsilane, **4**, 537
 Cyanotrimethylsilane, **4**, 542; **5**, 720; **6**,
80, 632; **9**, 127
 Dicyclohexyl-18-crown-6, **5**, 207
 Potassium cyanide, **8**, 409; **12**, 148

CYCLOALKANES (see ALICYCLIC HYDROCARBONS)

DIACETATES

1,1-DIACETATES

Acetic anhydride-Ferric chloride, **12**, 1
 Lead tetraacetate, **4**, 278
 Mercury(II) acetate, **4**, 319

1,2-DIACETATES

Ammonium persulfate, **12**, 33
 Phenyliodine(III) diacetate, **1**, 508
 Selenium(IV) oxide, **3**, 245
 Silver acetate, **1**, 1002
 Thallium(I) acetate, **5**, 654
 Thallium(III) acetate, **1**, 1150

1,3-DIACETATES

Formaldehyde, **7**, 158
 Lead tetraacetate, **1**, 537
 Thallium(III) acetate, **1**, 1150

1,4-DIACETATES

Palladium(II) acetate, **12**, 367

DIALDEHYDES (see DICARBONYLS)

1,2-DIAMINES

Aziridine, **1**, 378

Bis(cyclopentadienyl)bis(μ -nitrosyl-
 N:N)dicobalt, **10**, 116

Bis(*p*-toluenesulfonyl)selenodiimide, **7**,
316

Cyanamide, **12**, 147

Dioxobis(*t*-butylimido)osmium(VIII), **8**,
206

Iodine isocyanate, **2**, 223

Mercury(II) oxide-Tetrafluoroboric
 acid, **9**, 293

DIAZO COMPOUNDS AND DIAZONIUM SALTS

DIAZO COMPOUNDS—GENERAL METHODS

Chloramine, **1**, 122

Hydrazine, **5**, 327

Lead tetraacetate, **1**, 537

Manganese(IV) oxide, **1**, 637

Mercury(II) oxide, **1**, 655

Phenyl diazomethane, **10**, 308

Silver(I) oxide, **1**, 1011

Sodium nitrite, **1**, 1097

p-Toluenesulfonyl azide, **1**, 1178; **2**, 415;
11, 535

p-Toluenesulfonylhydrazide, **1**, 1185; **8**,
460

2,4,6-Triisopropylbenzene-
 sulfonylhydrazide, **11**, 563

Triphenylbismuth carbonate, **9**, 501

α -DIAZO ALDEHYDES AND KETONES

p-Carboxybenzenesulfonyl azide, **2**, 62

Chloramine, **1**, 122; **3**, 45

Copper(I) chloride-Oxygen, **5**, 165

α -Diaoacetophenone, **3**, 253

Diazomethane, **3**, 91; **4**, 120; **7**, 88

Lead tetraacetate, **8**, 269

Manganese(IV) oxide, **1**, 637

Mercury(II) trifluoroacetate, **1**, 659

Nitrosylsulfuric acid, **2**, 299

p-Toluenesulfonyl azide, **1**, 1178; **3**, 291;
4, 510; **5**, 460, 675; **6**, 597

p-Toluenesulfonylhydrazide, **1**, 1185; **2**,
417

Triethylamine, **1**, 1198

2,4,6-Triisopropylbenzenesulfonyl azide,
10, 422

α -DIAZO ESTERS

Bis(N-*t*-butylsalicylaldiminato)-
 copper(II), **12**, 52

DIAZO COMPOUNDS AND**DIAZONIUM SALTS** (*Continued*)*p*-Carboxybenzenesulfonyl azide, 2, 62

Diazooacetyl chloride, 9, 133

Ethyl diazoacetate, 3, 253

Isoamyl nitrite, 4, 270; 6, 307

Mercury bis(ethyl diazoacetate), 4, 325

Silver(I) oxide, 2, 368

Sodium nitrite, 1, 1097

p-Toluenesulfonyl azide, 2, 415; 3, 291**DIAZONIUM SALTS**

Dinitrogen trioxide-Boron trifluoride, 1, 329

Isoamyl nitrite, 1, 520

Nitrogen dioxide, 1, 324

Nitrosylsulfuric acid, 1, 755

p-Toluenesulfonyl azide, 1, 1178; 2, 415

Trichloroacetic acid, 1, 1194

DICARBONYL COMPOUNDS(see also **CHIRAL COMPOUNDS**)**DIACIDS** (see also **CARBOXYLIC ACIDS, DIESTERS**)by Oxidative cleavage of arenes, cycloalkanediones, cycloalkanones, cycloalkenes, ketones (see **TYPE OF REACTION INDEX**)

Other routes

Copper(I) bromide, 5, 163; 6, 143

Formaldehyde, 1, 397

Hypohalite solution, 1, 488

Lithium diisopropylamide, 12, 277

Methylenebis(magnesium bromide), 2, 273

Potassium superoxide, 7, 304

Sodium methoxide, 5, 617

Vanadium(V) oxide, 1, 733, 1057

1,3-DIALDEHYDES

2-Chloro-1,3-dithiane, 8, 88

Methoxymethylenetriphenylphosphorane, 5, 438

Thallium(III) nitrate, 7, 362

1,4-DIALDEHYDES

Dimethyl sulfide, 2, 156

Dimethyl sulfoxide-Oxalyl chloride, 11, 215

Triphenylphosphine, 2, 443

1,5-DIALDEHYDES

Raney nickel, 1, 723

 α,ω -DIALDEHYDES

Lead tetrakis(trifluoroacetate), 6, 318; 9, 269

Manganese(IV) oxide, 5, 422

Ozone, 5, 261

Periodic acid, 5, 508

Potassium permanganate, 9, 388

Sodium bismuthate, 1, 1045

Triphenylbismuth carbonate, 9, 501

DIAMIDES

Dichloromethylenedimethylammonium chloride, 4, 135

DIESTERS (see also **DICACIDS, ESTERS**)

Diethyl carbonate, 1, 247; 5, 213

Diethyl oxalate, 1, 929

Dimethyl carbonate, 12, 201

Hexamethylphosphoric triamide, 12, 239

Lead tetraacetate, 8, 269

Lithium diisopropylamide, 6, 334

Methyl 2-methylthioacrylate, 5, 455

Ozone, 6, 436; 9, 341

Sodium ethoxide, 1, 1065

(+)-(R)-*trans*- β -Styryl *p*-tolyl sulfoxide, 4, 466

Titanium(IV) chloride, 8, 483

1,2-DIKETONESby Oxidation of C=C, C $\equiv$ C, α -hydroxy ketones and related ketones (see **TYPE OF REACTION INDEX**)

by Rearrangement of epoxy carbonyl compounds

Acetic acid, 8, 1

Boron trifluoride etherate, 1, 70

Magnesium iodide, 6, 353

Sulfuric acid, 7, 347

Other routes

Acetic anhydride-Acetyl chloride, 7, 1

Acyllithium reagents, 12, 4

m-Chloroperbenzoic acid, 6, 110

Dichlorotris(triphenylphosphine)-ruthenium(II), 4, 564

Dichlorovinylene carbonate, 2, 122

3,5-Dinitrobenzoyl *t*-butyl nitroxyl, 8, 204

1,3-Dithianes, 2, 182; 4, 216; 10, 231

Grignard reagents, 7, 163

Iodosylbenzene, 10, 213

Iron carbonyl, 8, 265

Lead, 2, 233

Lithium naphthalenide, 8, 305

Lithium alkyl(phenylthio)cuprates, 7, 211

 α -Methoxyvinylolithium, 6, 372

Nickel carbonyl, 1, 720

Oxalyl chloride, 1, 28
Oxygen, singlet, 6, 431
Ozone, 8, 374; 10, 295
Samarium(II) iodide, 11, 464
Silver(I) trifluoroacetate, 7, 323
Sodium acetate, 5, 591
Sodium dichromate–Cerium(III) acetate, 1, 1062
1,1,3,3-Tetramethylbutyl isocyanide, 5, 650
Thallium(III) nitrate, 4, 492; 8, 476
Titanium(III) chloride, 6, 587
Tosylmethyl isocyanide, 8, 493
Trimethylenebis(thiotosylate), 6, 628

1,3-DIKETONES
by Acylation of C=O
Acetic anhydride, 1, 69
Acetyl chloride, 6, 164
Acetyl tetrafluoroborate, 11, 6
Boron trifluoride, 3, 32
Boron trifluoride–Acetic acid, 1, 69
Butyllithium, 10, 73
N,N-Dimethylhydrazine, 9, 184
Dimethyl sulfoxide, 1, 296
Grignard reagents, 9, 229
Hydrogen fluoride, 6, 285
Lithium hexamethyldisilazide, 7, 197
Magnesium methoxide, 3, 189
Mesityllithium, 8, 317; 10, 234
1-Morpholino-1-cyclohexene, 1, 707
Potassium *t*-butoxide–*t*-Butyl alcohol, 12, 402
Sodium amide, 1, 1034
Sodium ethoxide, 1, 1065
Sodium hydride, 1, 1076; 2, 382
Triphenylbis(2,2,2-trifluoroethoxy)-phosphorane, 10, 43
Zinc chloride, 11, 602

Other routes
Bis(3-dimethylaminopropyl)-phenylphosphine, 5, 36
1-Diazolithioacetone, 11, 155
Dimethylaluminum benzenethiolate, 11, 194
Dimethyl sulfoxide–Oxalyl chloride, 11, 215
Disodium tetrachloropalladate(II)–*t*-Butyl hydroperoxide, 10, 175
Ferric chloride, 7, 153
Hydroxylamine, 11, 257
Sodium chromate, 5, 605

Sodium methoxide, 1, 1091
Tetrakis(triphenylphosphine)-palladium(0), 10, 384
Trifluoroacetic anhydride, 1, 1221
Triphenylphosphine–Thiocyanogen, 9, 507
Zinc–Copper–Isopropyl iodide, 10, 460

1,4-DIKETONES
by Acetonylation α to C=O
3-Chloro-2-trimethylsilyloxy-1-propene, 11, 129
2,3-Dichloro-1-propene, 6, 332
Isopropenyl acetate, 6, 356
Mercury(II) trifluoroacetate, 9, 294
2-Methoxyallyl bromide, 8, 322
Tetrakis(triphenylphosphine)-palladium(0), 12, 468
by Conjugate addition of acyl anions
3-Benzyl-5-(2-hydroxyethyl)-4-methyl-1,3-thiazolium chloride, 6, 289; 7, 16; 10, 27
Bis(methylthio)(trimethylsilyl)-methylithium, 6, 53
Disodium tetracarbonylferrate, 8, 216
Ethyl ethylthiomethyl sulfoxide, 5, 299
Lithium di(α -methoxyvinyl)cuprate, 6, 204
Methyl bis(ethylthio)acetate, 5, 444
2-Methylfuran, 1, 682
Methyl vinyl ketone, 6, 38
Nickel carbonyl, 3, 210
Ozone, 8, 374
Potassium permanganate, 11, 440
Sodium cyanide, 4, 446
Titanium(III) chloride, 4, 506
by Coupling of enolates and related compounds
Copper(I) chloride, 6, 145
Copper(II) chloride, 6, 139; 9, 123
Copper(II) trifluoromethanesulfonate, 8, 126; 10, 110
Nickel peroxide, 5, 474
Silver(I) oxide, 6, 515
Zinc-copper couple, 7, 428
by Reduction of enediones
Chromium(II) chloride, 3, 60
Sodium iodide–Hydrochloric acid, 10, 366
Tin, 1, 1168
Titanium(III) chloride, 5, 669

DICARBONYL COMPOUNDS (*Continued*)Titanium(IV) chloride, **12**, 494Zinc, **1**, 1276

Other routes

Chlorotrimethylsilane, **6**, 626Copper(I) acetylacetonate, **4**, 1001,3-Dichloro-2-butene, **4**, 472(Dimethoxyphosphinyl)methyl lithium, **6**, 339Jones reagent, **7**, 68S-(2-Methoxyallyl)-N,N-dimethyldithiocarbamate, **6**, 3642-Nitropropene, **7**, 253Oxygen, singlet, **9**, 338Ozone, **7**, 269; **9**, 341Palladium(II) chloride-Copper(I) chloride, **11**, 396Phenylsulfonilacetone, **5**, 524Phthaloyl peroxide, **6**, 4711,3-Propanedithiol, **6**, 493Silver carbonate-Celite, **3**, 247N,N,N',N'-Tetramethylsuccinamide, **4**, 490Tin(II) trifluoromethanesulfonate, **12**, 4904-Trimethylsilyloxyvaleronitrile, **8**, 513Zinc-copper couple, **5**, 758**1,5-DIKETONES**

by Alkylation of enolates and related compounds

1,3-Dichloro-2-butene, **7**, 203; **8**, 152N,N-Dimethylhydrazine, **7**, 126(E)-1-Iodo-3-trimethylsilyl-2-butene, **5**, 355Mercury(II) trifluoroacetate, **9**, 294Tetrakis(triphenylphosphine)-palladium(0), **11**, 503; **12**, 468Triethylamine, **1**, 1198

by Conjugate addition of acetonide anions

Acetoacetic acid, **6**, 21Allyltrimethylsilane, **10**, 6Cesium fluoride, **10**, 81; **12**, 1081,4-Diazobicyclo[2.2.2]octane, **11**, 1531-Ethylsulfanyl-3-pentanone, **9**, 221Lithium diisopropylamide, **10**, 241Methyl lithiodithioacetate, **11**, 340Methyl vinyl ketone, **1**, 697Titanium(IV) chloride, **6**, 590Triphenylphosphine, **12**, 550

Other routes

2-(2-Bromomagnesioethyl)-2-methyl-1,3-dioxolane, **7**, 148Chromium(VI) oxide, **2**, 72Cobalt *meso*-tetraphenylporphine, **12**, 138Hexafluoroantimonic acid, **8**, 2396-Lithio-3,4-dihydro-(2*H*)-pyran, **8**, 70Palladium(II) chloride-Copper(I) chloride, **7**, 278N,N,N',N'-Tetramethylglutaramide, **4**, 490Titanium(IV) chloride, **10**, 401Zinc-Zinc chloride, **6**, 675**1,6-DIKETONES**Chlorotrimethylsilane-Magnesium, **5**, 713Chromium(VI) oxide, **2**, 72Copper(II) tetrafluoroborate, **12**, 1441,3-Dichloro-2-butene, **1**, 214Manganese(IV) oxide, **5**, 422Palladium(II) chloride-Copper(I) chloride, **7**, 278Ruthenium tetroxide, **1**, 986Vinylmagnesium chloride, **4**, 572Zinc, **2**, 459Zinc-Zinc chloride, **6**, 675 **α -KETO ACIDS**Bis(ethylthio)acetic acid, **10**, 382,2-Difluoro-1-tolylsulfonyloxyvinyl-lithium, **9**, 1661,3-Dithiane, **2**, 182Potassium bisulfate, **1**, 909Potassium permanganate, **1**, 942; **5**, 5624-Pyridinecarboxaldehyde, **11**, 4481,1,3,3-Tetramethylbutyl isocyanide, **3**, 279; **5**, 650 **β -KETO ACIDS**Bis(trimethylsilyl) lithiomalonate, **9**, 55*t*-Butyl α -lithioisobutyrate, **6**, 84Carbon dioxide, **1**, 1102; **3**, 40; **6**, 94Chlorotrimethylsilane, **4**, 537Dimethylsulfoxonium methylide, **1**, 315Lithium 2,6-di-*t*-butyl-4-methylphenoxide, **5**, 412Lithium diisopropylamide, **7**, 204Magnesium methyl carbonate, **3**, 190; **6**, 354Sodium amide, **1**, 1034Triethylamine, **1**, 1198Triphenylmethylpotassium, **1**, 1258 **γ -KETO ACIDS**

- O,O-*t*-Butyl O-isopropenyl
 peroxycarbonate, **11**, 100
 Grignard reagents, **11**, 245
 Ketene, **1**, 528
 Oxygen, singlet, **11**, 385
 Ruthenium tetroxide, **2**, 357
 Tetrachloroethane–Nitrobenzene, **4**, 479
- δ-KETO ACIDS**
 Periodates, **5**, 507
 Potassium superoxide, **11**, 442
 β-Propiolactone, **1**, 957
 Ruthenium tetroxide, **2**, 357
 Sodium dichromate, **5**, 138
 Sodium periodate–Potassium
 permanganate, **2**, 312
- KETO ACID HALIDES**
 Dichloromethyl methyl ether, **6**, 171; **9**,
 154
 Diketene, **1**, 264
 Oxalyl bromide, **1**, 767
- α-KETO ALDEHYDES**
 Diethyl azodicarboxylate, **1**, 245
 Dimethyl sulfoxide, **1**, 296
 Ethyl ethylthiomethyl sulfoxide, **5**, 299
 Iodine, **2**, 220
 Lithium diethylamide, **7**, 201
 S-Methyl *p*-toluenethiosulfonate, **6**, 400
 Nafion-H, **12**, 335
 Nitrosyl chloride, **1**, 748
 Selenium(IV) oxide, **1**, 992
 Sodium acetate, **1**, 1024
 Sodium methylsulfinylmethylide, **2**, 166
 Sodium nitrite, **1**, 1097
 Thallium(III) nitrate, **9**, 460
 Triphenylphosphine, **1**, 1238
- β-KETO ALDEHYDES**
 by Formylation α to C=O
 2-Chloro-1,3-dithiane, **8**, 88
 Dithoxycarbenium tetrafluoroborate,
11, 175
 1,2-Dimethoxyethane, **1**, 267
 1,3-Dithienium tetrafluoroborate, **11**,
 227
 Ethyl formate, **1**, 380, 1077; **4**, 233
 Sodium ethoxide, **1**, 1065
 Titanium(IV) chloride, **6**, 590
 Trimethyl orthoformate, **11**, 568
- Other routes
 1,3-Benzodithiolium
 tetrafluoroborate, **10**, 24
 Boron trifluoride etherate, **1**, 70
 4-Methoxy-3-buten-1-ynylcopper, **9**,
 297
 3-Methoxy-1-methylthio-1-propyne, **6**,
 397
 Thallium(III) acetate, **2**, 406
 Thallium(III) nitrate, **8**, 476
- γ-KETO ALDEHYDES**
 by Conjugate addition
 Ethyl ethylthiomethyl sulfoxide, **5**, 299
 Ketene dimethyl thioacetal monoxide,
6, 311; **8**, 268; **9**, 261
 2-Lithio-1,3-dithianes, **9**, 235
 Methyl vinyl ether, **8**, 276
 (S)-(+) *p*-Tolyl *p*-tolylthiomethyl
 sulfoxide, **10**, 408
 Tris(phenylthio)methylthallium, **9**, 511
- Other routes
 2-(2-Bromoethyl)-1,3-dioxane, **7**, 37
 2-Ethoxyallyl vinyl sulfide, **5**, 292
 Mercury(II) acetate, **8**, 315
 2,4,4,6-Tetramethyl-5,6-dihydro-1,3-
 (4*H*)-oxazine, **4**, 481
 3-Trimethylsilyl-3-trimethylsilyloxy-
 1-propene, **8**, 485
- δ-KETO ALDEHYDES**
 Acetone N,N-dimethylhydrazone, **8**, 276
 Allyltrimethylsilane, **10**, 6
 3,3-Diethoxy-1-propene, **9**, 158
 2,2-Dimethyl-3(2*H*)-furanone, **10**, 159
 1,3-Dithienium tetrafluoroborate, **11**,
 227
 (Z)-2-Ethoxyvinylthallium, **8**, 221
 2,2,6-Trimethyl-1,3-dioxolenone, **10**, 424
 α-Trimethylsilyl-2-methylbenzothiazole,
8, 511
- ε-KETO ALDEHYDES**
 Ozone, **1**, 773
 Potassium hydride, **8**, 412; **10**, 327
 Ruthenium tetroxide, **1**, 986
- α-KETO AMIDES**
 Dichlorobis(methyldiphenylphosphine)-
 palladium(II), **11**, 165
 Iodosylbenzene–Ruthenium catalysts,
11, 270
 Lithium bis(N,N-diethylcarbamoyl)-
 cuprate, **9**, 279
 Methyl methylthiomethyl sulfoxide, **8**,
 344
 Oxygen, **7**, 258
- β-KETO AMIDES**
 Acetoacetyl fluoride, **1**, 4

DICARBONYL COMPOUNDS (*Continued*)

- Di- μ -carbonylhexacarbonyldicobalt, **11**, 162
- Diketene, **1**, 264
- Mercury(II) acetate, **2**, 264
- 2-Oxazolidones, chiral, **12**, 359
- Polyphosphoric acid, **1**, 894
- α -KETO ESTERS
- Arene(tricarbonyl)chromium complexes, **12**, 34
- Boron trifluoride, **1**, 68
- t*-Butyl hydroperoxide, **12**, 88
- Cyanotrimethylsilane, **12**, 148
- 1,2-Diethoxy-1,2-bis(trimethylsilyloxy)-ethylene, **12**, 181
- Diphenyl disulfide, **6**, 235
- 2-Ethoxycarbonyl-1,3-dithiane, **4**, 230
- Ethyl 2-methylsulfinylacetate, **6**, 255
- Grignard reagents, **11**, 245
- Iodosylbenzene–Ruthenium catalysts, **11**, 270
- Lead tetraacetate, **2**, 234
- Lithium bromide, **2**, 245
- Magnesium iodide, **6**, 353
- Methyl methylthiomethyl sulfoxide, **8**, 344
- S-Methyl *p*-toluenethiosulfonate, **5**, 456
- Osmium tetroxide, **9**, 334
- Oxygen, **7**, 258; **9**, 338
- Ozone, **5**, 491
- Potassium permanganate, **1**, 942
- Selenium(IV) oxide, **1**, 992
- N-Sulfinylaniline, **6**, 556
- Trimethylphosphonoglycolate, **12**, 537
- Triphenylphosphine, **1**, 1238
- β -KETO ESTERS
- from RCOX
 - Benzoyl chloride, **5**, 403
 - t*-Butyl trimethylsilylacetate, **7**, 50
 - Ethoxycarbonylmethylenetriphenylphosphorane, **11**, 24
 - Isobutene, **1**, 522
 - Ketene alkyl trialkylsilyl acetals, **5**, 689
 - Lithium 2,2,6,6-tetramethylpiperidine, **4**, 310
 - Magnesium, **1**, 627
 - Meldrum's acid, **8**, 313; **10**, 252
 - Tetrakis(triphenylphosphine)-palladium(0), **11**, 503
 - Trimethylsilyl 2-lithio-2-ethoxy-

- carbonylacetate, **5**, 722; **9**, 493
- Triphenylmethylsodium, **1**, 1259
- Triphenylphosphine, **1**, 1238
- by Alkoxyacylation
 - Carbon disulfide, **5**, 95
 - Diethyl (or Dimethyl) carbonate, **1**, 247; **2**, 129, 149; **5**, 234
 - Diethyl oxalate, **1**, 250
 - Ethyl diazoacetate, **6**, 252
 - Ethyl diethoxyphosphinylformate, **1**, 370
 - Magnesium methyl carbonate, **1**, 631; **6**, 354
 - Mercury(II) oxide–Boron trifluoride, **11**, 318
 - Methyl cyanofornate, **12**, 321
- by Claisen (Dieckmann) reaction
 - t*-Butyl lithioacetate, **9**, 82
 - Dichlorobis(trifluoromethanesulfonato)titanium(IV), **12**, 173
 - Ethyl acetate, **1**, 1075
 - Magnesium naphthalenide, **1**, 711
 - Molecular sieves, **5**, 465
 - Potassium, **12**, 400
 - Potassium hydride, **6**, 482
 - Sodium, **2**, 158
 - Sodium ethoxide, **1**, 1065
 - Triphenylmethylpotassium, **1**, 1258; **9**, 502
- Other routes
 - Acetoacetyl fluoride, **1**, 4
 - 1,5-Diazabicyclo[4.3.0]nonene-5, **7**, 86
 - 3,3-Diethoxy-1-methylthiopropyne, **5**, 207
 - Diethyl(2-chloro-1,1,2-trifluoroethyl)-amine, **4**, 149; **5**, 214
 - Diketene, **1**, 264; **6**, 202
 - Dimethyl sulfoxide–Oxalyl chloride, **11**, 215
 - Disodium tetrachloropalladate(II)–*t*-Butyl hydroperoxide, **10**, 175
 - Ethyl acetoacetate, **9**, 438
 - Ethyl diazoacetate, **1**, 367; **3**, 138
 - Ethyl 2-phenylsulfinylacetate, **6**, 256
 - Lithium–Ammonia, **3**, 179; **8**, 282
 - Potassium tetracarbonylhydridoferrate, **6**, 483
 - Rhodium(II) acetate, **9**, 406
 - Triethyloxonium tetrafluoroborate, **8**, 500
 - Zinc, **1**, 1285; **12**, 567

γ-KETO ESTERS (OR LACTONES)

by Conjugate additions

3-Benzyl-5-(2-hydroxyethyl)-4-methyl-1,3-thiazolium chloride, 7, 16

Disodium tetracarboxylferrate, 8, 216

Ethyl acrylate, 6, 251

Ethyl ethylthiomethyl sulfoxide, 5, 299

Lithium di(α-methoxyvinyl)cuprate, 6, 204

Sodium cyanide, 4, 446

Titanium(IV) chloride, 12, 494

Tris(phenylthio)methyl lithium, 6, 650

Other routes

Copper(II) chloride, 6, 139

Cyclopropanone 1,3-propanediyl ketal, 12, 152

1-Ethoxy-1-trimethylsilyloxy-cyclopropane, 12, 221

Ethyl diazoacetate, 4, 228

2,2'-Ethylenebis(1,3-dithiane), 8, 223

Hexamethylphosphoric triamide, 3, 149

Lithium diisopropylamide, 11, 296

Lithium N-isopropylcyclohexylamide, 7, 209

2-Methoxyallyl bromide, 8, 322

Methyl α-chloro-α-phenylthioacetate, 12, 320

Palladium(II) chloride-Copper(I) chloride, 10, 301; 11, 396

Titanium(III) chloride, 5, 669

Triethylammonium fluoride, 10, 415

δ-KETO ESTERS (OR LACTONES)

(S)-1-Amino-2-methoxymethyl-1-pyrrolidine, 12, 30

1-*t*-Butylthio-1-trimethylsilyloxyethylene, 9, 92

Cesium fluoride, 10, 81; 12, 108

N,N-Dimethylhydrazine, 9, 184

Ketene alkyl trialkylsilyl acetals, 7, 371; 10, 261; 11, 279

Magnesium ethyl malonate, 8, 311

Methyl α-(methylphenylsilyl)acetate, 12, 325

Methyl 2-methylthioacrylate, 5, 455

Nickel(II) acetylacetonate, 10, 42

Quinine, 9, 403

2,4,4,6-Tetramethyl-5,6-dihydro-1,3-(4*H*)-oxazine, 4, 481

ε-KETO ESTERS (OR LACTONES)

6,6-Dimethyl-5,7-dioxaspiro[2.5]-octane-4,8-dione, 6, 216

1-Ethoxy-1-trimethylsilyloxy-cyclopropane, 12, 221

Ferric chloride, 12, 230

Mercury(II) acetate, 12, 298

KETO THIOLESTERS

N,N'-Carbonyldiimidazole, 9, 96

Carbonyl sulfide, 11, 112

S,S'-Dimethyl dithiocarbonate, 9, 181

Sodium hydride, 9, 427

1,2,3-TRICARBONYLS

t-Butyl hypochlorite, 4, 58

2,3-Dichloro-5,6-dicyano-1,4-benzoquinone, 6, 168

Dimethyl sulfoxide, 6, 225; 8, 200; 9, 190

Oxygen, singlet, 12, 363

Ozone, 11, 387

Phenyliodine(III) diacetate, 12, 384

Selenium(IV) oxide, 6, 227

1,3,5-TRICARBONYLS

Butyllithium, 10, 73

Magnesium methoxide, 7, 220

Sodium hydride, 1, 1075

DICARBOXYLIC ACIDS

(see DICARBONYLS)

DIENALS

2,2'-Bipyridinium chlorochromate, 11, 44

trans-4-(*t*-Butylthio)-3-buten-2-one, 9, 90

Dichloromethyl methyl ether, 9, 154

4-Ethoxy-1,3-butadienyllithium, 8, 278

1-Methoxy-1-buten-3-yne, 1, 669

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phosphorane, **3**, 932-Ethoxycarbonyl-1,3-dithiolane, **5**, 304Methoxyallene, **8**, 320Oxygen, singlet, **12**, 363Phthaloyl peroxide, **6**, 471Pyridinium chloride, **5**, 566Pyridinium chlorochromate, **10**, 334; **11**,
450Pyruvaldehyde 2-phenylhydrazone, **6**,
500Ruthenium tetroxide, **2**, 357Selenium(**IV**) oxide, **1**, 992Sodium dichromate, **1**, 1059Sodium peroxide, **11**, 492Tin(**II**) trifluoromethanesulfonate, **12**,
490**1,5-ENEDIONES**1,3-Dithienium tetrafluoroborate, **11**,
227 α -Ketoketene dithioacetals, **11**, 282

Zinc bromide, 11, 600

**2-METHYLENE(OR ALKYLIDENE)-
1,3-DICARBONYLS**

Benzeneselenenyl halides, 5, 518; 7, 286

Boron oxide, 3, 33

2,3-Dichloro-5,6-dicyano-1,4-

benzoquinone, 1, 215; 2, 112

N-Methylthiomethylpiperidine, 12, 326

Selenium, 11, 465

Trimethylsilyl trifluoromethane-
sulfonate, 10, 438

ENOL CARBAMATES

Benzyltrimethylammonium fluoride, 10,
29

Crotyl carbamates, 12, 82

ENOL CARBONATES

Benzyltrimethylammonium fluoride, 10,
29

Ethyl(or Methyl) chloroformate, 8, 307;
11, 336

ENOL ESTERS

ENOL ACETATES

by Acetoxylation of $C=C$ (see TYPE
OF REACTION INDEX)

from $C=O$

Acetic anhydride, 4, 509

Acetyl chloride, 2, 383, 408; 9, 387

4-Dimethylaminopyridine, 9, 178

Dimethylformamide diethyl acetal, 9,
182

Hydrobromic acid, 3, 154

Isopropenyl acetate, 1, 524; 3, 103

Perchloric acid, 1, 796; 2, 309

Potassium acetate, 1, 906

Sulfoacetic acid, 1, 1117

Sulfosalicylic acid, 1, 1118

p-Toluenesulfonic acid, 1, 1172

Other routes

Acetyl methanesulfonate, 9, 2

Copper(I) acetate, 6, 142

Lithium dimethylcuprate, 4, 177

Silver(I) trifluoroacetate, 10, 355

Zinc-Acid anhydride-Catalyst, 4, 577

OTHER ENOL ESTERS

Acetylene, 1, 11

Benzoic anhydride, 3, 262

Chloro(trimethylsilyl)methylolithium, 8,
277

Dimethyl oxomalonate, 11, 207

Divinylmercury, 1, 352

Mercury(II) acetate, 1, 644

Potassium persulfate, 5, 563

Trifluoroacetyl trifluoromethane-
sulfonate, 9, 485

ENOL ETHERS

FROM CARBONYLS, $RCOCH_2R' \rightarrow$
 $R(OR)C=CHR'$

Boron trichloride, 1, 67

Chloromethyl methyl ether, 4, 83

2,2-Dimethoxypropane, 1, 268

Lithium diisopropylamide, 12, 277

Methyl fluorosulfonate, 4, 339; 6, 381

Pentaethoxyphosphorane, 2, 305

Phase-transfer catalysts, 9, 356

Thallium(I) ethoxide, 4, 501

p-Toluenesulfonic acid, 1, 1172

Trialkyl orthoformate, 1, 1204; 5, 356,
714

Triethyloxonium tetrafluoroborate, 2,
430; 6, 611

Trimethylsilyldiazomethane, 12, 538

FROM CARBONYLS, $R_2C=O \rightarrow$
 $R_2C=CHOR$

Carbon disulfide, 12, 316

Diethyl methoxyethoxymethyl-
phosphonate, 9, 162

Dimethyl diazomethylphosphonate, 10,
157

α -Methoxyethylidenetriphenyl-
phosphorane, 1, 669

Methoxymethyl(diphenyl)phosphine
oxide, 7, 229; 9, 301

Methoxymethylenetriphenyl-
phosphorane, 1, 671; 2, 271

Methoxy(trimethylsilyl)methylolithium, 9,
284

**BY ISOMERIZATION OF ALLYLIC
ETHERS**

Bis(benzonitrile)dichloropalladium(II),
5, 31

Chlorotris(triphenylphosphine)-
rhodium(I), 5, 736

Dimethyl sulfoxide, 1, 296; 2, 157

Iridium catalysts, 8, 135

Palladium catalysts, 10, 299

Potassium *t*-butoxide, 5, 544

BY METHYLENATION OF ESTERS

μ -Chlorobis(cyclopentadienyl)-
(dimethylaluminum)- μ -
methylenetitanium, 10, 87; 11, 52

OTHER ROUTES

Benzenesulfonyl chloride, 5, 22

ENOL ETHERS (*Continued*)

- Bis(benzonitrile)dichloroplatinum(II),
11, 49
- Diisopropylethylamine, **1**, 371
- Dimethylformamide dineopentyl acetal,
12, 204
- Divinylmercury, **1**, 352
- (Z)-2-Ethoxyvinylithium, **8**, 221
- 1,2-Ethylenebis(triphenylphosphonium)
dibromide, **6**, 665
- Grignard reagents, **6**, 269; **7**, 226; **10**, 190
- Iodotrimethylsilane, **11**, 271
- Magnesium–Iodine–Ether, **1**, 630
- Mercury(II) acetate, **1**, 644
- Methoxyallene, **7**, 163
- Methoxy(phenylthio)methylithium, **9**,
473
- Pentacarbonyl(methoxyphenyl-
methylene)chromium(0) or
-tungsten(0), **4**, 378; **11**, 397
- Pentacarbonyl(trimethylsilyl)manganese,
11, 401
- Phase-transfer catalysts, **9**, 356
- Phosphoryl chloride, **2**, 330
- Potassium *t*-butoxide, **12**, 401

ENOL PHOSPHATES (*see* PHOSPHORUS COMPOUNDS)**ENYNES****1,3-ENYNES**

- by Coupling of vinyl + allyl substrates
(*see* TYPE OF REACTION INDEX)

by Elimination

- Chromium(II)–Amine complexes, **3**,
57

- 1,5-Diazabicyclo[4.3.0]nonene-5, **1**,
189; **4**, 16

- Di- μ -carbonylhexacarbonyldicobalt,
7, 99; **8**, 148

- Diphosphorus tetraiodide, **1**, 349

- Potassium bisulfate, **1**, 909

- Potassium *t*-butoxide, **9**, 126; **12**, 401

- Sodium amide, **2**, 373

- Zinc oxide, **1**, 1294

by Reduction of diynes

- Lithium diisobutylmethylaluminum
hydride, **8**, 292

- Palladium catalysts, **7**, 275

- Zinc–1,2-Dibromoethane, **12**, 570

Other routes

- Benzyltrimethylammonium hydroxide,
5, 29

- 1,3-Bis(triisopropylsilyl)propyne, **11**,
63

- t*-Butyl hypochlorite, **6**, 82

- Chlorotris(triphenylphosphine)-
rhodium(I), **8**, 109

- Copper(I) oxide, **1**, 169

- Diethyl phosphorochloridate, **8**, 171

- Dihydridotetrakis(tributylphosphine)-
ruthenium(II), **10**, 148

- Dimethyl(methylthio)sulfonium
tetrafluoroborate, **12**, 207

- Ethylene glycol, **1**, 375

- Methylithium, **5**, 448

- Pyridazine 1-oxide, **9**, 395

- Sodium amalgam, **9**, 416

- Sodium methoxide, **5**, 617

- Tributyl(methylphenylamino)-
phosphonium iodide, **10**, 268

- Triethyl orthoacetate, **6**, 607

- Triphenylpropargylphosphonium
bromide, **2**, 447

1,4-ENYNES

- Copper(I) chloride, **1**, 166

- Dilithium tri(1-pentynyl)cuprate, **6**, 203

- Lead tetraacetate, **8**, 269

- Propargyl bromide, **6**, 493

1,5-ENYNES

- Di- μ -carbonylhexacarbonyldicobalt, **10**,
129

- 3-Lithio-1-trimethylsilyl-1-propyne, **2**,
239

- Lithium 3-chloropropargylide, **11**, 294

- Lithium 2,2,6,6-tetramethylpiperidide, **6**,
345

- Tetrakis(triphenylphosphine)-
palladium(0), **10**, 384

- Trimethylaluminum–Dichlorobis-
(cyclopentadienyl)zirconium, **11**, 567

- 1-Trimethylsilylpropynylcopper, **6**, 638

- Zinc chloride, **11**, 602

EPISULFIDES

- Diazomethane, **5**, 179

- 4,4-Dimethyl-2-methylthio-2-oxazoline,
6, 584

- cis*-3a,4,5,6,7,7a-Hexahydrobenzo-
thiazolidine-2-thione, **11**, 304

- Iodine thiocyanate, **4**, 263

- 3-Methylbenzothiazole-2-thione, **6**, 374

- Phthalimide-*N*-sulfenyl chloride, **9**, 375

- Potassium thiocyanate, **6**, 487

- Sulfur monochloride, **3**, 275

Thiourea, 1, 1164
 Triphenylphosphine, 7, 403
 Triphenylphosphine sulfide, 5, 732

EPOXIDES (*see also* CHIRAL COMPOUNDS, EPOXY..., GLYCIDIC ACIDS, ETC., HALO EPOXIDES)

BY ADDITION TO C = O

Adding CH₂

Bromomethylthium, 6, 74; 12, 77
m-Chloroperbenzoic acid, 7, 62
 Diazomethane, 3, 6
 Dibromomethane-Lithium, 3, 201
 (N,N-Diethylamino)methyloxosulfonium methylide, 5, 210
 (Dimethylamino)phenyloxosulfonium methylide, 3, 105
 Dimethylsulfonium methylide, 1, 314; 2, 169; 3, 124; 5, 646; 6, 219; 8, 198; 9, 188; 11, 213
 Dimethylsulfoxonium methylide, 1, 315; 2, 171; 3, 125; 4, 197; 5, 646; 10, 168
 Dimethyl N-(*p*-toluenesulfonyl)sulfoximine, 3, 205; 9, 193; 12, 216
 Lauryldimethylsulfonium chloride, 5, 363
 Methyl(phenyl)selenoniomethanide, 11, 343
 Methylphenyl-N-*p*-toluenesulfonylsulfoximine, 3, 204
 Phenylthiomethylthium, 5, 527

Adding CHR, CR₂

Benzeneselenol, 6, 28, 362
 Diphenyl selenide, 6, 240
 Diphenylsulfonium cyclopropylide, 4, 211; 5, 281; 8, 212
 Diphenylsulfonium isopropylide, 2, 180
 Hexamethylphosphoric triamide, 12, 239
 Methaneselenol, 6, 361
 Triphenylarsonium ethylide, 10, 445
 Zinc chloride, 8, 536

Other routes

Hexamethylphosphorous triamide, 1, 431
 Nickel carbonyl, 2, 290

BY CYCLIZATION

from 1,2-Diols

Dimethylformamide dimethyl acetal, 3, 115
 Diphenyldi(1,1,1,3,3,3-hexafluoro-

2-phenyl-2-propoxy)sulfurane, 4, 205; 5, 270; 8, 208

Hydrogen bromide-Acetic acid, 12, 242

p-Toluenesulfonyl chloride, 8, 489

Triphenylphosphine + co-reagent, 9, 504; 12, 551

from Halohydrins and related

Acetyl hypobromite, 1, 12
 N-Bromoacetamide, 5, 61
 N-Bromosuccinimide, 4, 49; 5, 65; 9, 70
t-Butyl hydroperoxide-Titanium(IV) chloride, 12, 94
 Chlorotrimethylsilane, 5, 709
 2,2'-Dihydroxy-1,1'-binaphthyl, 12, 190

Iodine, 3, 159; 8, 256

Silica, 10, 346

Silver carbonate-Celite, 5, 577

Silver(I) oxide, 1, 1011

Tellurium(IV) chloride, 12, 457

from β -Hydroxy sulfides

Lithium tri-*sec*-butylborohydride, 12, 286
 (R)-1-(1-Naphthyl)ethyl isocyanate, 9, 321

Organotitanium reagents, 11, 374

Phenylthioacetic acid, 6, 463

Potassium *t*-butoxide, 9, 380

Other routes

Methanesulfonyl chloride, 1, 662
 Potassium *t*-butoxide, 2, 336; 4, 399

BY EPOXIDATION (*see* TYPE OF REACTION INDEX)

BY OXYGENATION OF 1,3-DIENES

Cobalt *meso*-tetraphenylporphine, 12, 138

Dichlorotris(triphenylphosphine)-ruthenium(II), 11, 171

Oxygen, singlet, 4, 362; 6, 431; 8, 367

OTHER ROUTES

Ozone, 8, 375

Periodates, 4, 373

Tetraethylammonium fluoride, 7, 356

Trifluoromethanesulfonic anhydride, 10, 419

Triphenylphosphine, 5, 725

EPOXY ALCOHOLS (*see also* CHIRAL COMPOUNDS)

β , γ -EPOXY ALCOHOLS

EPOXY ALCOHOLS (*Continued*)

by Epoxidation of allylic alcohols -
(see TYPE OF REACTION INDEX)

by Reduction of α,β -epoxy carbonyls

Sodium borohydride-Cerium(III)
chloride, **10**, 359

Sodium cyanoborohydride, **5**, 607

Triisobutylaluminum, **9**, 486

Zinc borohydride, **11**, 599

Other routes

Iodine, **11**, 261

Potassium permanganate, **9**, 388

Tetracarbonyl(cyclopentadienyl)-
vanadium, **5**, 174

Vanadyl acetylacetonate-

Azobisisobutyronitrile, **10**, 457

 γ,δ -EPOXY ALCOHOLS

t-Butyl hydroperoxide-Dialkyl tartrate,
12, 90

Lead tetrakis(trifluoroacetate), **6**, 318

 **α,β -EPOXY ALDEHYDES AND
KETONES** (see also CHIRAL
COMPOUNDS)

BY EPOXIDATION OF α,β -
UNSATURATED CARBONYLS
(see TYPE OF REACTION INDEX)

BY OXIDATION OF EPOXY
ALCOHOLS

m-Chloroperbenzoic acid-2,2,6,6-

Tetramethylpiperidine, **8**, 99

Jones reagent, **2**, 70

OTHER ROUTES

1-Chloro-3-diazoacetone, **5**, 114

1,4-Dichloro-2-butanone, **9**, 75

Hydrogen peroxide, **10**, 201

(S)-(-)-Proline, **10**, 331; **11**, 446

Silver(I) oxide, **6**, 515

Sodium hydroxide, **8**, 430

Tin(II) fluoride, **11**, 524

Tin(II) trifluoromethanesulfonate, **11**,
525

 α,β -EPOXY SILANES

Chloromethyltrimethylsilane, **12**, 118

m-Chloroperbenzoic acid, **8**, 290

Chloro(trimethylsilyl)methyl(or ethyl)-
lithium, **8**, 277

(E)-1-Iodo-3-trimethylsilyl-2-butene, **5**,
355

(1-Lithiovinyl)trimethylsilane, **5**, 374

Peracetic acid-Sodium acetate, **7**, 279

 α,β -EPOXY SULFONES

Chloromethyl *p*-tolyl sulfone, **6**, 41; **8**,
340

Hydrogen peroxide, **3**, 155; **6**, 486

Potassium *t*-butoxide, **5**, 544

Potassium hypochlorite, **6**, 486

ESTERS—GENERAL METHODS

(see also α,β -ACETYLENIC ESTERS,
DICARBONYLS, ESTERS—
SPECIFIC KINDS OF ESTERS,
GLYCIDIC ESTERS,
UNSATURATED CARBONYLS)

BY ACYLATION OF ROH

with ROCl

Alumina, **1**, 20

Bis(methylcyclopentadienyl)tin(II), **12**,
201

Dibutyltin oxide, **10**, 123

3-Dimethylaminopropylamine, **1**, 274

Silver cyanide, **7**, 320

Thallium(I) 2-methyl-2-
propanethiolate, **6**, 581

with RCOOH

Aluminum chloride, **5**, 10

3-Benzylthiazolium bromide, **10**, 27

N,N-Bis(2-oxo-3-oxazolidinyl)-
phosphorodiamidic chloride, **10**, 41

Boron trifluoride etherate, **3**, 33; **4**, 44

N,N'-Carbonyldiimidazole, **1**, 114

Cesium fluoride, **10**, 81

6-Chloro-1-*p*-chlorobenzene-
sulfonyloxybenzotriazole, **6**, 106

Chlorotrimethylsilane, **11**, 125

Dicyclohexylcarbodiimide +
co-reagent, **1**, 231; **8**, 163; **9**, 156

Diethyl phosphorocyanidate, **7**, 107

4-Dimethylaminopyridine, **10**, 155

4-(N,N-Dimethylamino)pyridinium
chlorosulfite chloride, **12**, 199

N,N-Dimethylphosphoramidic
dichloride, **9**, 187

2-Fluoro-1,3,5-trinitrobenzene, **8**, 230

Graphite bisulfate, **6**, 269

2-Halopyridinium salts, **6**, 375; **7**, 110;
8, 95; **9**, 234

1-Methylsulfonyloxybenzotriazole, **6**,
106

Molecular sieves, **1**, 703; **2**, 286

3-Nitro-2-pyridinesulfonyl chloride, **9**,
325

Silver perchlorate, **6**, 519

Silver(I) trifluoroacetate, **8**, 444

- N,N,N',N'-Tetramethylchloroformamidine chloride, 12, 477
 Thionyl chloride, 5, 663
p-Toluenesulfonic acid, 1, 1172
p-Toluenesulfonyl chloride, 1, 1179
 Triphenylphosphine bis(trifluoromethanesulfonate), 6, 648
 Triphenylphosphine + co-reagent, 5, 727; 6, 246; 9, 167; 11, 589
 Vilsmeier reagent, 8, 186; 9, 514
 with other RCOX
 Dimethylaluminum methylselenolate, 8, 182
 4-Dimethylaminopyridine, 3, 118
 Guanidines, 9, 179
 Ion-exchange resins, 11, 276
 Nickel carbonyl, 1, 720
 3-Nitro-2-pyridinesulfonyl chloride, 9, 325
 Oxygen, 6, 426
 Silver(I) trifluoroacetate, 8, 444
 p-Toluenesulfonic acid, 1, 1172
 FROM ADDITION OF
 ORGANOBORANES TO C = C
 9-Borabicyclo[3.3.1]nonane, 3, 24
 Ethyl diazoacetate, 2, 193; 4, 228; 5, 295
 Ethyl dibromoacetate, 2, 195
 BY ALCOHOLYSIS OF RCN
 Sodium borohydride, 5, 597
 p-Toluenesulfonic acid, 1, 1172
 Vilsmeier reagent, 7, 422
 BY ALKOXYCARBONYLATION
 of RH, ArH
 Arylthallium bis(trifluoroacetates), 10, 300
 Bromine-Antimony(V) chloride-Sulfur dioxide, 5, 57
 Ferrous sulfate, 4, 237
 Hexafluoroantimonic acid, 2, 216
 Oxalyl chloride, 3, 216
 Trichloroacetyl chloride, 4, 521
 of RX with loss of X
 Dichlorobis(triphenylphosphine)-palladium(II), 6, 59, 60
 Disodium tetracarboxylferrate, 4, 461
 Ethyl chloroformate, 1, 364
 Grignard reagents, 1, 415
 Iron carbonyl, 8, 265
 Methyl methylthiomethyl sulfone, 11, 242
 Nickel carbonyl, 3, 210
 Sodium tetracarboxylcobaltate, 1, 1058
 BY ALKYLATION OF RCOO⁻, RCOOH
 Alkyl chloroformates, 12, 12
 Benzyltrimethylammonium chloride, 1, 53
 t-Butyl methyl ether, 4, 333
 Calcium sulfate, 4, 266
 Cesium propionate, 11, 118
 Chlorotrimethylsilane, 7, 66
 Copper(I) acetate-*t*-Butyl isocyanide, 5, 163
 Cryptates, 6, 137
 1,8-Diazabicyclo[5.4.0]undecene-7, 9, 132
 Dicyclohexylethylamine, 1, 370
 N,N-Dimethylformamide, 2, 153
 Dimethylformamide dialkyl acetals, 1, 281, 283
 Guanidines, 11, 105, 249
 Hexamethylphosphoric triamide, 6, 273
 Ion-exchange resins, 6, 302
 Phase-transfer catalysts, 11, 403
 Sodium hydroxide, 4, 247
 Triethylamine, 1, 1198
 Triphenylphosphine-Diethyl azodicarboxylate, 7, 404
 2,4,6-Triphenylpyrylium tetrafluoroborate, 8, 520
 Tris(2-hydroxypropyl)amine, 3, 325
 BY ARNDT-EISTERT REACTION OR WOLFF REARRANGEMENT
 t-Butyllithium, 11, 103
 Copper(I) iodide, 1, 169
 Diazomethane, 2, 102; 3, 74
 Trimethylsilyldiazomethane, 10, 431
 BY BAEYER-VILLIGER REACTION (see TYPE OF REACTION INDEX)
 BY HYDROCARBOXYLATION OF C = C
 Chlorobis(cyclopentadienyl)-hydrido-zirconium(IV), 6, 175
 Di- μ -carbonylhexacarbonyldicobalt, 1, 224
 Dichlorobis(triphenylphosphine)-palladium(II), 3, 81
 Ethyl bromoacetate, 2, 192
 Hydrogen hexachloroplatinate(IV)-Tin(II) chloride, 4, 87
 BY OXIDATION OF ACETALS,

ESTERS—GENERAL METHODS

(Continued)

ALCOHOLS, ALDEHYDES,

ETHERS, SILYL ETHERS (*see* TYPE OF REACTION INDEX)BY OXIDATIVE CLEAVAGE OF C=C
(*see* TYPE OF REACTION INDEX)BY THIELE REACTION, TISH-
CHENCKO REACTION, TRANS-
ESTERIFICATION, WILLGERODT-
KINDLER REACTION (*see* TYPE
OF REACTION INDEX)**OTHER ROUTES**

Benzeneseleninic anhydride, 8, 29

N-Bromosuccinimide, 7, 37

Cobalt(III) acetate, 6, 127

2-Diethylamino-4-phenylsulfonyl-
2-butenenitrile, 12, 182

Diphenyl phosphoroazidate, 7, 138

Ethyl malonate, 6, 255

Lead tetraacetate, 10, 228

2-Lithio-2-methylthio-1,3-dithiane, 7,
191Methyl methylthiomethyl sulfoxide, 4,
341; 9, 314

Nitrogen dioxide, 1, 324; 2, 175

Pyridinium chlorochromate, 8, 425

Silver tetrafluoroborate, 11, 471

Sodium methoxide, 1, 1091

Sulfur dioxide, 7, 346

Tetramethoxyethylene, 2, 401

Thallium(III) nitrate, 4, 492

Triethyl orthoformate, 6, 610

2,4,4-Trimethyl-2-oxazoline, 3, 313; 5,
714**ESTERS—SPECIFIC TYPES OF ESTERS**(*see also* ESTERS—GENERAL
METHODS)**ACETATES**

by Acetoxylation of RH, ArH

Bis(2,2-dipyridyl)silver(II)

peroxydisulfate, 6, 51

Cerium(IV) ammonium nitrate, 1, 120;
4, 71

Lead tetraacetate, 1, 537

Manganese(III) acetate, 4, 318

Palladium(II) acetate, 2, 303; 5, 496; 7,
274

by Acetylation of ROH

Acetic anhydride, 1, 3, 797, 958, 1024,
1228, 1289; 2, 353; 11, 1

Acetic-phosphoric anhydride, 2, 12

2-Acetoxy pyridine, 1, 9

Acetyl bromide, 6, 9

Acetyl chloride, 9, 357

Acetyl hexafluoroantimonate, 1, 692

3-Acetyl-1,5,5-trimethylhydantoin, 3,
4

Alumina, 11, 22

Bismuth(III) acetate, 4, 40

Calcium hydride, 2, 58

Cyanogen bromide, 1, 174

4-Dimethylaminopyridine, 9, 178

Ketene, 1, 528; 2, 232

Molecular sieves, 9, 316

Perchloric acid, 1, 796

Phenyl acetate, 1, 829

4-Pyrrolidinopyridine, 4, 416

Silica, 11, 466

1,3,4,6-Tetraacetylglycouril, 6, 563

Tetraethylammonium hydroxide, 1,
1138by Alkylation of AcO^- , AcOHPotassium acetate, 5, 154; 6, 137, 278,
640

Sodium acetate, 8, 390

Tetraalkylammonium acetate, 1, 1136,
1142; 3, 277

by Reductive acylation

Triethylamine, 1, 1198

Triphenyltin hydride, 2, 448

Zinc-Acid anhydride-Catalyst, 1,
1143; 4, 577

Other routes

Acetic anhydride, 1, 72

Acetyl *p*-toluenesulfonate, 2, 14Arenediazonium tetrahaloborates, 1,
43

Cerium(IV) acetate, 4, 71

Chlorotrimethylsilane-Acetic
anhydride, 12, 126

Lead tetraacetate, 3, 168

Lithium bromide-Boron trifluoride
etherate, 1, 604

Silver(I) oxide, 5, 583

Thallium(III) nitrate, 10, 395

ARYL ESTERS2-Benzoylthio-1-methylpyridinium
chloride, 9, 40

Boric acid, 4, 41

Dibenzoyl peroxide, 6, 160

N,N-Dimethylformamide, 5, 247

Phosphoryl chloride, **1**, 876
Polyphosphate ester, **9**, 376
Polyphosphoric acid, **1**, 894
Silica, **11**, 466
1,3,4,6-Tetraacetylglucosyl, **6**, 563
Thallium(I) ethoxide, **2**, 407

BENZOATES

Benzoic anhydride, **5**, 23
Benzoyl chloride, **1**, 959
Benzoyl cyanide, **6**, 35
2-Benzoylthio-1-methylpyridinium chloride, **9**, 40
Benzoyl trifluoromethanesulfonate, **12**, 44
t-Butyl perbenzoate, **9**, 90
Dibenzoyl peroxide, **6**, 160
Diethyl benzoylphosphonate, **11**, 178
Fieser reagent, **3**, 56
Heptafluoro-1-methylethyl phenyl ketone, **7**, 165
Organocopper reagents, **11**, 365
Polyphosphate ester, **9**, 376
Sodium benzoate, **1**, 1044

BENZYL ESTERS

Benzyltrimethylammonium hydroxide, **6**, 37
Dimethylformamide dioneopentyl acetal, **1**, 283
Sodium acetate, **1**, 1024
Sulfuryl chloride, **1**, 1128

***t*-BUTYL ESTERS**

t-Butyl acetate, **1**, 82
Collins reagent, **12**, 139
1,5-Diazabicyclo[5.4.0]undecene-5, **11**, 155
N,N-Dimethylaniline, **1**, 274
Dimethylketene, **1**, 290
Isobutene, **1**, 522
Lithium *t*-butoxide, **3**, 183; **4**, 297
Magnesium, **1**, 627
Potassium *t*-butoxide, **2**, 336
Silver benzoate, **1**, 1004

ETHYL ESTERS

Dicyclohexylethylamine, **1**, 370
2,2-Diethoxyvinylidenetriphenylphosphorane, **11**, 175
Pentaethoxyphosphorane, **2**, 305
Triethyl orthoformate, **1**, 1204
Triethyloxonium tetrafluoroborate, **1**, 1210; **4**, 527; **8**, 500; **9**, 482

FORMATES

Acetic-formic anhydride, **1**, **4**; **2**, 10

Fieser reagent, **2**, 72
Formamide, **1**, 402
Formic acid, **1**, 404
Formyl fluoride, **1**, 407
N-Formylimidazole, **1**, 407
Hexamethylphosphorous triamide, **6**, 279

p-Toluenesulfonyl chloride, **1**, 1184
Triphenylphosphine dibromide, **5**, 732

METHYL ESTERS

Alumina, **10**, 8
Boron trifluoride-Methanol, **1**, 73
Copper(II) acetate, **10**, 103
Diazomethane, **1**, 191; **2**, 102; **3**, 74; **5**, 179; **6**, 159
1,4-Dichloro-1,4-dimethoxybutane, **12**, 175

Dicyclohexylethylamine, **1**, 370
Dicyclopentadienylcobalt-Oxygen adduct, **5**, 145
2-Diethylamino-4-phenylsulfonyl-butenenitrile, **12**, 182
Dimethylacetamide, **2**, 144
Dimethylformamide-Dimethyl sulfate, **5**, 250

Dimethyl sulfate, **2**, 153; **3**, 325; **4**, 188, 189

Dimethylsulfoxonium methylide, **1**, 315
Methanol, **1**, 678; **6**, 645

Methyl iodide, **1**, 682; **3**, 202
1-Methyl-3-*p*-tolyltriazene, **1**, 696
Methyl trichloroacetate, **12**, 329

Molecular sieves, **1**, 703
Pentamethoxyphosphorane, **9**, 353
Sodium methoxide, **1**, 1091

Triethyloxonium tetrafluoroborate, **9**, 482

2,2,2-Trimethoxy-5-methyl- Δ^4 -oxaphospholene, **5**, 707

Trimethylanilinium hydroxide, **5**, 708
Trimethyloxonium tetrafluoroborate, **5**, 693

Trimethyl phosphate, **5**, 716
Trimethyl phosphite, **4**, 541
Trimethylselenonium hydroxide, **9**, 491

METHYLTHIOMETHYL ESTERS

Chlorodimethylsulfonium chloride, **9**, 105
Chloromethyl methyl sulfide, **4**, 84; **8**, 94
Dimethyl sulfoxide-*t*-Butyl bromide, **9**, 190

ESTERS—SPECIFIC TYPES OF ESTERS

(Continued)

Lithium methylsulfinylmethylide—

Tributylborane, 11, 302

TRIFLUOROACETATES

Cobalt(III) trifluoroacetate, 5, 146

Lead tetrakis(trifluoroacetate), 4, 282; 6, 318

Trifluoroacetic acid, 7, 109

Trifluoroacetic anhydride, 1, 1221

Trifluoroacetyl trifluoromethanesulfonate, 9, 485

TRITYL ESTERS

Triphenylmethyl bromide, 1, 1254

ESTERS— α -SUBSTITUTED (see also α -HALO ESTERS, α -HYDROXY ESTERS) **α -ACYLOXY**

Lead tetraacetate, 3, 168; 12, 270

 α -ALKOXY

Ethyl diazoacetate, 5, 571

Phenyl iodine(III) diacetate, 11, 411

Thallium(III) nitrate, 7, 362

 α -ALKYL(OR PHENYL)SELENO

Benzeneselenenyl bromide, 5, 518

Selenium, 10, 345

Sodium benzeneselenoate, 5, 519

 α -ALKYL(OR PHENYL)THIO

Sodium ethanethiolate, 11, 492

Thallium(I) ethanethiolate, 9, 460

 α -SILYL

Chloromethyldiphenylsilane, 10, 91

Trimethylsilyl trifluoromethanesulfonate, 8, 514

ETHERS (EXCLUDING PROTECTING

GROUPS)—(see also ALLYLIC

ETHERS, ENOL ETHERS,

HOMOALLYLIC ETHERS)

GENERAL METHODSby Displacements with RO^- , ROH *m*-Chloroperbenzoic acid, 10, 92

Cryptates, 9, 127

Dimethyl sulfoxide, 3, 119

Mercury(II) perchlorate, 5, 428

Nickel(II) acetylacetonate, 8, 42

Potassium fluoride, 11, 434

Sodium methylsulfinylmethylide, 4, 195

Tetrabutylammonium hydrogen sulfate, 6, 565

Thallium(I) ethoxide, 6, 577; 10, 395

Triethyloxonium tetrafluoroborate, 1, 1210

by Reduction of acetals and ketals, esters (see TYPE OF REACTION INDEX)

by Reductive alkylation of $\text{C}=\text{O}$

(see TYPE OF REACTION INDEX)

Other routes

Aluminum chloride, 4, 10

Borane-Pyridine, 9, 59

Mercury(II) acetate, 3, 194

Organocopper reagents, 12, 345

Perchloric acid, 2, 309

Tributyltin hydride, 4, 518

ALKYL ARYL ETHERS

Aryl methyl ethers

Diazomethane, 5, 179; 6, 159; 9, 133

Dimethyl sulfate, 1, 293, 295; 2, 153

Ion-exchange resins, 8, 263

Methyl iodide, 1, 682

Methyl trichloroacetate, 12, 329

Pentamethoxyphosphorane, 9, 353

Phenyltrimethylammonium ethoxide, 1, 854

Potassium hydroxide, 9, 388

Potassium methoxide, 5, 154

Sodium hydride, 4, 452; 5, 614

Sodium methoxide, 1, 1091

Trimethylselenonium hydroxide, 9, 491

Trimethylsilyldiazomethane, 12, 538

Trimethylsulfoxonium iodide, 1, 1236

Alkyl aryl ethers

Barium oxide, 9, 23

Benzyltriethylammonium chloride, 5, 26

t-Butyl perbenzoate, 1, 98

Copper(I) alkoxides, 5, 148

Copper(I) oxide, 1, 169

Dicyclohexylcarbodiimide, 1, 231

N,N-Dimethylformamide, 2, 153; 5, 247

Grignard reagents, 1, 415

Hexamethylphosphoric triamide, 6, 273

Hexamethylphosphorous triamide, 6, 279

Ion-exchange resins, 1, 511

Pentaethoxyphosphorane, 2, 305

Potassium *t*-butoxide, 1, 298

Silver(I) oxide, 4, 430; 5, 583

Tetraethylammonium fluoride, 9, 448

Triphenylbismuth diacetate, 12, 548

Triphenylphosphine–Diethyl
azodicarboxylate, 6, 645

BENZYL ETHERS

Arene(tricarbonyl)chromium complexes,
12, 34

Benzyl bromide, 5, 25

Benzyl *p*-toluenesulfonate, 11, 44

Benzyl trichloroacetimidate, 11, 44

Benzyl trifluoromethanesulfonate, 6, 44

Bis(tributyltin) oxide, 9, 53

Ion-exchange resins, 1, 511

Mercury(II) perchlorate, 5, 428

Sodium hydride, 1, 1075

Tetrabutylammonium iodide, 11, 501

t-BUTYL ETHERS

Antimony(V) fluoride, 6, 23

t-Butyl perbenzoate, 1, 98

Grignard reagents, 1, 45

Isobutene, 1, 522

Potassium *t*-butoxide, 1, 298; 5, 544; 8, 128

Silver carbonate, 8, 441

DIARYL ETHERS

Copper, 1, 157

Copper(I) chloride, 3, 67

Copper(I) oxide, 1, 169

Copper(I) phenylacetylide, 12, 143

2,4-Dinitrofluorobenzene, 1, 321

Diphenyliodonium bromide, 1, 340

Pentafluorophenylcopper, 6, 451

Tetraphenylbismuth trifluoroacetate, 10,
393

Triaryl phosphates, 11, 542

METHYL ETHERS

by Displacements with CH_3O^-

Sodium methoxide, 1, 298

Thallium(III) nitrate, 7, 362

Trifluoromethanesulfonic anhydride,
5, 702

by Methylation of ROH

Diazomethane, 1, 191; 2, 102; 6, 554;
9, 135

Dimethyl phosphite, 4, 188

Dimethyl sulfate, 1, 293; 5, 647

Iodine, 2, 220

Mercury(II) perchlorate, 5, 428

Methyl iodide, 2, 274

Phase-transfer catalysts, 10, 305

Potassium hydroxide, 9, 388

Potassium methylsulfinylmethylide,
10, 329

Ruthenium(III) chloride, 11, 462

Sodium hydride, 4, 452; 5, 614; 6, 541

Tetrafluoroboric acid, 1, 394

2,2,2-Trimethoxy-5-methyl- Δ^4 -
oxaphospholene, 5, 707

Trimethylanilinium hydroxide, 5, 708

Trimethylsulfoxonium iodide, 1, 1236

Other routes

m-Chloroperbenzoic acid, 12, 118

Dimethyl sulfoxide–Acetic anhydride,
9, 190

Sodium cyanoborohydride, 8, 454

TRITYL ETHERS

4-Dimethylaminopyridine, 10, 155

Trimethyl(triphenylmethoxy)silane, 10,
444

Triphenylmethylpyridinium
tetrafluoroborate, 5, 741

FULVENES AND DERIVATIVES

Chloranil, 2, 66

Copper, 7, 73

Copper(I) bromide, 2, 90

Crown ethers, 10, 110

Dichlorocarbene, 4, 130

Dimethylformamide diethyl acetal, 1,
281

Dimethylformamide–Dimethyl sulfate,
1, 282; 2, 154

Hexabutylditin, 7, 165

Ion-exchange resins, 1, 511

Lithium bromide, 7, 200

Molybdenum carbonyl, 7, 247

Phase-transfer catalysts, 8, 387

Tetracyanoethylene, 5, 647

Triethyl phosphite, 1, 1212; 4, 529; 7, 387

Triphenylcarbenium tetrafluoroborate,
2, 454

Vilsmeier reagent, 7, 422

FURANS

Benzeneselenenyl bromide, 6, 459

Boron trifluoride etherate, 6, 65

t-Butyllithium, 9, 89

2-Carboxy-1-methoxycarbonyl-
ethylidenetriphenylphosphorane, 8, 77

m-Chloroperbenzoic acid, 8, 97

1-Chloro-*N,N*,2-trimethyl-
propenylamine, 12, 123

Chlorotris(triphenylphosphine)-
rhodium(I), 5, 736

Copper bronze, 12, 140

FURANS (*Continued*)

- Copper(I) trifluoromethanesulfonate, **6**, 130
- Cyclopropanone 1,3-propanediyl ketal, **12**, 152
- Dichlorobis(cyclopentadienyl)titanium, **12**, 168
- Diethylaluminum benzenethiolate, **10**, 281
- Diisobutylaluminum hydride, **1**, 260; **2**, 140; **6**, 198
- Dimethyl diazomalonate, **8**, 187
- Dimethylformamide dimethyl acetal, **10**, 158
- Dimethylsulfonium methylide, **4**, 196; **11**, 213
- Dimethyl sulfoxide, **1**, 296
- β -Ethoxyvinyltriphenylphosphonium iodide, **5**, 294
- Ethyl diazoacetate, **2**, 193
- Ethyl 4,4-dimethoxy-2-phenylthiobutyrate, **8**, 222
- (α -Formylethylidene)triphenylphosphorane, **12**, 234
- Ion-exchange resins, **5**, 355
- Isocyanomethylithium, **10**, 231; **11**, 285
- Lithium diisopropylamide, **7**, 204
- Methoxyallene, **7**, 225
- 1-Methoxy-1-trimethylsilyllallene, **11**, 577
- Nickel carbonyl, **2**, 290
- Nickel peroxide, **8**, 357
- 1-Nitro-1-(phenylthio)propene, **10**, 279
- 2-Nitropropene, **6**, 481
- Oxygen, singlet, **7**, 261
- 4-Phenyloxazole, **12**, 389
- α -(Phenylsulfinyl)acetonitrile, **11**, 418
- Pyridinium chlorochromate, **11**, 450
- Rhodium(II) acetate, **5**, 571
- Sulfur, **3**, 273
- Tetrakis(triphenylphosphine)palladium(0), **10**, 384
- Titanium(IV) chloride, **6**, 590; **9**, 468
- Tributyltin hydride, **12**, 516
- 2,4,6-Trimethylpyrylium sulfoacetate, **11**, 571
- Zinc, **2**, 459

GLYCIDIC ACIDS, ESTERS, NITRILES
BY DARZENS REACTION (*see* TYPE OF REACTION INDEX)
BY EPOXIDATION OF α,β -UNSATURATED SUBSTRATES

(*see* TYPE OF REACTION INDEX)**OTHER ROUTES**

- 2-Chloroacrylonitrile, **9**, 75
- Chloromethyl methyl ether, **7**, 61
- Dimethylsulfonium ethoxycarbonylmethylide, **10**, 164
- Ethyl (dimethylsulfuranylidine)acetate, **2**, 196
- Iodine, **8**, 256
- Potassium carbonate, **9**, 382
- Sodium cyanide, **8**, 430

HALIDES (*see* ALKYL HALIDES, ALLYLIC HALIDES, ARYL HALIDES, DIHALIDES, HALO...)

HALOACETALS

- Bromine, **5**, 55; **6**, 70
- t*-Butyl hypobromite, **1**, 90
- Dibromo(or Dichloro)carbene, **8**, 388
- Dioxane-Bromine, **3**, 130
- Phenyltrimethylammonium perbromide, **1**, 855; **11**, 426
- Pyridine perbromide, **1**, 966
- Pyridinium bromide perbromide, **1**, 967
- Tetrachlorosilane, **12**, 463

 α -HALO ACID HALIDES

- Bromine-Phosphorus(III) bromide, **1**, 874
- N-Bromosuccinimide, **3**, 34; **6**, 74
- N-Chlorosuccinimide, **6**, 75, 115
- Iodine, **6**, 75, 117
- Thionyl chloride, **5**, 663

 α -HALO ALDEHYDES AND KETONES**GENERAL METHODS**

- Lead tetraacetate-Metal halides, **11**, 283

 α -FLUORO

from C = C

- Nitrosyl fluoride, **1**, 755; **2**, 299; **3**, 214
- Oxygen difluoride, **1**, 772

from Enol ethers, silyl enol ethers, etc.

(*see* TYPE OF REACTION INDEX)**Other routes**

- Acetyl hypofluorite, **12**, 3
- 2-Fluoro-1-buten-3-one, **6**, 263
- Lithium tri-*t*-butoxyaluminum hydride, **2**, 251
- Perchloryl fluoride, **1**, 802; **7**, 39
- Pyridinium poly(hydrogen fluoride), **6**, 473
- Silver tetrafluoroborate, **9**, 414

 α -CHLORO

by Chlorination α to C=O (*see* TYPE OF REACTION INDEX)

Other routes

Barium hydroxide, 4, 23

t-Butyl hypochlorite, 1, 90

Chloroacetylium

hexafluoroantimonate, 6, 103

Chlorodimethylsulfonium chloride, 9, 67

Chloromethyl phenyl sulfoxide, 8, 94

Chromyl chloride, 4, 98

Dichloromethyl lithium, 4, 138; 5, 199; 6, 344

Ferric chloride, 12, 230

Levulinic acid, 2, 239

Sodium dichromate, 1, 1059

Thionyl chloride, 1, 1158

α -BROMO

by Bromination α to C=O (*see* TYPE OF REACTION INDEX)

Other routes

Bromine, 8, 52

Bromoacetylium hexafluoroantimonate, 6, 103

2-Bromoacrolein, 2, 15

Bromodimethylsulfonium bromide, 9, 66

Bromomethyl phenyl sulfoxide, 9, 68

Dimethyl sulfoxide—

N-Bromosuccinimide, 9, 73

Magnesium bromide etherate, 7, 218

Silver chromate, 1, 1005

α -IODO

1,3-Diiodo-5,5-dimethylhydantoin, 1, 258

Iodine, 1, 495; 9, 249, 386; 10, 211; 12, 256

N-Iodosuccinimide, 1, 510

Iodotrimethylsilane, 10, 216

Lithium iodide—Hydrogen peroxide, 7, 220

Silver chromate—Iodine, 8, 442

Thallium(I) acetate—Iodine, 8, 260

β -HALO ALDEHYDES AND KETONES

β -CHLORO

Acetylene, 1, 11

Aluminum chloride, 4, 10

Ferric chloride, 7, 153

Tetraethylammonium iodide, 12, 465

β -BROMO

Bromine, 6, 70

Dioxane—Bromine, 5, 58

Tetraethylammonium iodide, 12, 465

β -IODO

Iodotrimethylsilane, 9, 251; 10, 216

Tetraethylammonium iodide, 12, 465

HALOALKYNES

CHLORO-

N-Chlorosuccinimide, 5, 127; 9, 111

Dichloro(diethoxyphosphinyl)-methyl lithium, 6, 188

Potassium superoxide, 11, 442

Tetraethylammonium hydrogen sulfate, 7, 354

Trichloroethylene, 11, 552

BROMO-

Benzyltrimethylammonium hydroxide, 7, 20

N-Bromosuccinimide, 12, 79

Bromotrifluoromethane, 2, 42

Sodium hypobromite, 1, 1083

IODO-

N-Bromosuccinimide, 12, 79

Heptafluoro-1-iodopropane, 2, 226

Iodine—Morpholine complex, 1, 502

Methyltriphenoxyphosphonium iodide, 1, 1249

HALOAMIDES AND -AMINES

N-HALOAMIDES

t-Butyl halites, 1, 90, 94

Tetrafluorohydrazine, 1, 1139

N-HALOAMINES

t-Butyl hypochlorite, 1, 90

Carbonyl difluoride, 12, 106

N-Chlorosuccinimide, 1, 139

Difluoramine, 2, 134

Hypochlorous acid, 1, 487

Tetrafluorohydrazine, 1, 1139

Trifluoromethyl hypofluorite, 5, 312; 6, 263

HALO CARBONYLS—POLYHALO CARBONYLS

α -DI- AND TRIFLUORO-

Diethyl(2-chloro-1,1,2-trifluoroethyl)-amine, 6, 66

Oxygen fluoride, 1, 772

Perchloryl fluoride, 1, 802

Trifluoromethyl hypofluorite, 7, 156; 9, 224

α -DI- AND TRICHLORO-

N-Chlorosuccinimide, 6, 115; 8, 103, 463

N,N-Dimethylformamide, 9, 182

HALO CARBONYLS—POLYHALO**CARBONYLS** (*Continued*)Ethyl dichloroacetate, **6**, 331Sodium trichloroacetate, **2**, 388Trimethylsilyl dichloroacetate, **9**, 491 **α -DI- AND TRIBROMO-**Bromine-Sulfur, **1**, 1120N-Chlorosuccinimide, **6**, 115 **α -HALO CARBOXYLIC ACIDS** **α -FLUORO**N-Bromoacetamide-Hydrogen fluoride, **2**, 39(Diethylamino)sulfur trifluoride, **10**, 142Pyridinium poly(hydrogen fluoride), **6**, 473; **11**, 453Trifluoromethyl hypofluorite, **10**, 420 **α -CHLORO**Bromomethylithium, **12**, 77Chlorine-Chlorosulfuric acid, **8**, 83; **10**, 86(-)-2-Chloromethyl-4-methoxymethyl-5-phenyloxazoline, **6**, 204Ethyl dichloroacetate, **3**, 26Pyridinium poly(hydrogen fluoride), **12**, 4197,7,8,8-Tetracyanoquinodimethane, **12**, 464 **α -BROMO***p*-Aminoacetophenone, **4**, 18Barium hydroxide, **4**, 23Bromine-Phosphorus(III) chloride, **1**, 875Bromomethylithium, **12**, 77N-Bromosuccinimide, **3**, 34; **5**, 65; **7**, 37Chlorosulfuric acid, **10**, 86Diethyl dibromomalonate, **8**, 169Ethyl dibromoacetate, **3**, 26Phosphorus, red, **1**, 861Pyridinium poly(hydrogen fluoride), **12**, 419 **α -IODO**Chlorosulfuric acid, **10**, 86Iodine-Copper(II) acetate, **12**, 256**HALOEPOXIDES***t*-Butyl hydroperoxide, **7**, 43Dichloromethylithium, **3**, 89; **5**, 199; **6**, 170Lithium diisopropylamide, **5**, 400 **α -HALO ESTERS AND LACTONES** **α -FLUORO**N-Alkyl-N-fluoro-*p*-toluene-sulfonamides, **12**, 231Perchloryl fluoride, **1**, 802; **2**, 310; **7**, 280Trifluoromethyl hypofluorite, **10**, 420 **α -CHLORO**N-Chlorosuccinimide, **6**, 115Ethylene oxide, **3**, 140Lithium diethylamide, **6**, 331Thionyl chloride, **1**, 1158Trimethylsilyl dichloroacetate, **9**, 491Triphenylphosphine-Carbon tetrachloride, **2**, 445 **α -BROMO**Barium hydroxide, **4**, 23Bromine, **1**, 1159; **4**, 306Dibromoacetonitrile, **5**, 186Diethyl dibromomalonate, **8**, 169

Dimethyl sulfoxide-

N-Bromosuccinimide, **9**, 73Ethylene oxide, **3**, 140Magnesium bromide etherate-Hydrogen peroxide, **7**, 220Triphenylphosphine-Carbon tetrabromide, **2**, 445 **α -IODO**Iodine, **4**, 306**HALO ETHERS***t*-Butyl hypohalites, **1**, 90; **2**, 50Formaldehyde, **4**, 238Sodium fluoride, **2**, 382Sulfur tetrafluoride, **5**, 640Sulfuryl chloride, **1**, 11282,4,4,6-Tetrabromo-2,5-cyclohexadienone, **7**, 351Tetrahydrofuran, **1**, 1140Trichloroisocyanuric acid, **3**, 297**HALOFORMIC ESTERS**Carbonic difluoride, **1**, 116Phosgene, **1**, 856Pyridinium poly(hydrogen fluoride), **6**, 473**HALOHYDRINS AND DERIVATIVES**

(see also CHIRAL COMPOUNDS)

1,2-FLUOROHYDRINSAcetyl hypofluorite, **10**, 1Ethyl fluoroacetate, **5**, 304Oxygen fluoride, **1**, 772Perchloryl fluoride, **1**, 802Trifluoromethyl hypofluorite, **3**, 146; **7**, 156**1,2-CHLOROHYDRINS**

from C=C

t-Butyl hydroperoxide–Titanium(IV) chloride, 12, 94

Chloramine-T, 10, 85

N-Chlorosuccinimide, 5, 127

Chromyl chloride, 1, 151; 5, 144; 8, 112

Dimethylformamide–Chlorine, 5, 249

Hypochlorous acid, 10, 208

Titanium(IV) chloride, 6, 590

Trifluoroacetyl chloride, 10, 419

Urea, 1, 1262

from Epoxides

Bis(benzonitrile)dichloro-palladium(II), 9, 44

Chlorotrimethylsilane, 11, 125

Dimethylformamide–Phosphoryl chloride, 1, 284

Pyridinium chloride, 5, 566; 10, 333

Triphenylphosphine dihalides, 12, 554

Other routes

2-Acetoxyisobutryl chloride, 8, 3

Bromomethylithium, 12, 77

Chlorotrimethylsilane, 5, 709

B-3-Pinanyl-9-borabicyclo[3.3.1]-nonane, 12, 397

Tetrahydrofuran, 1, 1140

Triphenylmethyl chloride, 4, 565

Triphenylphosphine–Carbon tetrachloride, 12, 551

OTHER CHLOROHYDRINS

2-Acetylsalicylic acid chloride, 5, 6

2,2-Dimethyl-1,3-propanediol, 5, 259

Molybdenum carbonyl, 4, 346

Triphenylphosphine–Carbon tetrachloride, 12, 551

Zinc chloride, 1, 1289

1,2-BROMOHYDRINS

from C=C

Acetyl hypobromite, 1, 12

N-Bromoacetamide, 1, 74; 4, 47

N-Bromosuccinimide, 1, 78; 3, 34; 6, 74; 7, 182

t-Butyl hypobromite, 1, 90

Dimethyl sulfoxide–

N-Bromosuccinimide, 2, 159; 9, 71

Hypobromous acid, 1, 800; 4, 49

Sodium hypobromite, 1, 1083

from Epoxides

Bromotrimethylsilane, 10, 59, 216

Dilithium tetrabromonickelate, 12, 195

Hydrobromic acid, 1, 450

Triphenylphosphine dihalides, 12, 554

Other routes

Hydrogen bromide–Acetic acid, 5, 335

Lithium tri-*t*-butoxyaluminum hydride, 1, 620

B-3-Pinanyl-9-borabicyclo[3.3.1]-nonane, 12, 397

Sodium borohydride, 1, 1049

OTHER BROMOHYDRINS

Acetic anhydride–Magnesium bromide, 6, 352

Bromotrimethylsilane, 10, 59

1,2-iodohydrins

from C=C

Iodine, 3, 159; 4, 261; 8, 256, 260

N-Iodosuccinimide–Carboxylic acids, 7, 182

Peracetic acid, 2, 220

Silver(I) trifluoroacetate, 1, 1018

Thallium(I) acetate–Iodine, 5, 654; 9, 458

from Epoxides

Hydriodic acid, 8, 246

Hydrogen iodide, 7, 173

Iodotrimethylsilane, 10, 216

Sodium iodide–Acetic acid, 1, 881; 5, 595

Triphenylphosphine dihalides, 12, 554

OTHER IODOHYDRINS

Aluminum chloride–Sodium iodide, 12, 29

Borane–Tetrahydrofuran, 1, 199

Iodotrimethylsilane, 9, 251

Sodium iodide–Trimethylacetyl chloride, 11, 489

HALO SULFUR COMPOUNDS

HALO SULFIDES

Benzenesulfonyl chloride, 8, 32

Diethyl phenylthiomethylphosphonate, 6, 191

Sulfuryl chloride, 1, 1128

Trifluoromethylthiocopper, 6, 621; 7, 391

Trimethylsilyl trifluoromethane-sulfonate, 12, 543

HALO SULFONES

Bromomethyl *p*-tolyl sulfone, 6, 41

5-Bromo-2,2,5-trimethyl-1,3-dioxane-4,6-dione, 5, 66

Copper(II) chloride, 4, 105; 5, 158

HALO SULFUR COMPOUNDS

(Continued)

Dichloromethyl phenyl sulfone, 6, 41

Potassium hydroxide, 5, 96

Sulfuryl chloride, 4, 474

HALO SULFOXIDES

Diazomethane, 4, 120

Nitrosyl chloride, 3, 214

Potassium iodide, 7, 134

Sulfuryl chloride, 3, 276; 4, 474

HETEROCYCLES—THREE-MEMBERED**RINGS** (see also AZIRIDINES, EPISULFIDES, EPOXIDES)**1 N** (see also AZIRIDINES)

1,4-Diazabicyclo[2.2.2]octane, 2, 99; 6, 157

Iodine azide, 1, 500; 2, 222; 8, 260

Lead tetraacetate, 5, 365

1 N, 1 O*t*-Amyl hydroperoxide, 4, 20*N*-Benzoylperoxycarbamic acid, 6, 35*m*-Chloroperbenzoic acid, 2, 68; 5, 120; 6, 110 α -Methylbenzylamine, 6, 457

Peracetic acid, 1, 787

2 N

Diaziridines

Chloramine, 2, 65

Hydroxylamine-O-sulfonic acid, 1, 481; 2, 217

Potassium *t*-butoxide, 1, 911; 3, 233

Diazirines

Chloramine, 1, 122

Dichloramine, 1, 213

Difluoramine, 1, 253; 2, 134

Hydroxylamine-O-sulfonic acid, 1, 481; 2, 217

Sodium hypochlorite, 1, 1084

1 S (see also EPISULFIDES)

Diazomethane, 2, 102

Methylbis(methylthio)sulfonium hexachloroantimonate, 6, 375

Perbenzoic acid, 3, 219

Phenyldiazomethane, 5, 515

Triphenylphosphine, 5, 725

HETEROCYCLES—FOUR-MEMBERED**RINGS** (see also DIOXETANES, β -LACTAMS, β -LACTONES)**1 N—AZETIDINES**

Benzenesulfonyl azide, 3, 17

Dimethylsulfoxonium methylide, 10, 168

Potassium *t*-butoxide, 1, 911

Triphenylphosphine + co-reagent, 9, 503; 12, 552

Triphenylphosphine dibromide, 5, 729; 6, 645

1 N, 1 O

Acetyl chloride, 7, 3

2 N

Boron trichloride, 3, 31

1 O—OXETANES

Bis(tributyltin) oxide, 6, 56

2,2-Dimethyl-1,3-propanediol, 5, 259

Dimethylsulfoxonium methylide, 12, 213

Dimethyl *N*-(*p*-toluenesulfonyl)-sulfoximine, 9, 193; 12, 216

Diphenyldi(1,1,1,3,3,3-hexafluoro-2-phenyl-2-propoxy)sulfurane, 5, 270

Lead tetraacetate, 2, 234

Lithium carbonate, 5, 396

Lithium hydroxide, 7, 208

Sodium methylsulfinylmethylide, 7, 338

Triphenylphosphine-Diethyl azodicarboxylate, 9, 504

Zinc chloride, 8, 536

2 O (see also DIOXETANES)

Triphenyl phosphite ozonide, 8, 519

1 S*p*-Nitrophenyl α -toluenesulfonate, 5, 477

Potassium 2-methylcyclohexoxide, 5, 560

Sulfur dichloride, 4, 469

Thionyl chloride, 5, 663

2 S

2,4-Bis(4-methoxyphenyl)-1,3-dithia-2,4-diphosphetane-2,4-disulfide, 11, 54

HETEROCYCLES—FIVE-MEMBERED**RINGS** (see also FURANS, LACTAMS, LACTONES, PEROXIDES)**1 N—CARBAZOLES**

Triethyl phosphite, 1, 1212

1 N—INDOLES

by Fisher indole synthesis (see TYPE OF REACTION INDEX)

Other routes

Benzeneseleninic anhydride, 11, 37

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t-Butyl isocyanide, 2, 50

- Butyllithium, 10, 68
Chlorodimethylsulfonium chloride, 5, 114
Copper(I) iodide, 12, 141
Di-*t*-butyl nitroxide, 11, 160
Di- μ -carbonylhexacarbonyldicobalt, 7, 99
Diethyl oxalate, 1, 250
Dimethylformamide dimethyl acetal, 11, 198
Dimethyl sulfide, 4, 190
Dimethylsulfonium methylide, 3, 124
Ferric chloride, 3, 145
Ion-exchange resins, 1, 511
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Manganese(IV) oxide, 1, 637
Meldrum's acid, 11, 311
4-Methoxy-3-buten-1-ynylcopper, 9, 297
Organoaluminum reagents, 12, 339
Oxidiperoxymolybdenum(pyridine)-(hexamethylphosphoric triamide), 11, 218
Phenacylidenedimethylsulfurane, 6, 456
Potassium *t*-butoxide, 9, 380
Potassium ferricyanide, 1, 929
Potassium nitrosodisulfonate, 2, 347
Sodium amide, 1, 1034; 6, 526
Sodium borohydride-Acetic acid, 5, 599
Sodium cyanoborohydride, 9, 424
Sulfuric acid, 5, 633
Thallium(III) trifluoroacetate, 12, 481
Titanium(III) chloride, 9, 467
Triethyl phosphite, 1, 1212
Trimethylsilyl polyphosphate, 11, 427
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- 1 N—INDOLINES
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Borane + co-reagent, 5, 708; 8, 50
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Palladium(II) chloride, 10, 300
N-Phenylselenophthalimide, 12, 390
Zinc, 2, 459
- 1 N—OXINDOLES
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Dimethyl sulfoxide, 7, 133
Phenylhydrazine, 1, 838
Potassium amide, 1, 907
Potassium hydride, 8, 412
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- 1 N—PYRROLES
from 1,4-Dicarbonyls
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2,5-Dimethoxytetrahydrofuran, 2, 144
Tributylphosphine-Diphenyl disulfide, 12, 514
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1,8-Diazabicyclo[5.4.0]undecene-7, 6, 158
Dimethyl acetylenedicarboxylate, 2, 145; 5, 227
Hydroxylamine-O-sulfonic acid, 4, 256
Lithium, 5, 376
Lithium diisopropylamide, 7, 204
Methyl N-tolylsulfonylmethylthio-benzimidate, 7, 245
Methyl vinyl ketone, 1, 697
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- 1 N—PYRROLIDINES (*see also* AMIDES $\rightarrow$ AMINES)
from Unsaturated N compounds
Benzeneselenenyl bromide, 10, 16
Benzenesulfonyl chloride, 12, 42
Formaldehyde, 7, 158
Mercury(II) acetate, 12, 298
N-Phenylselenophthalimide, 9, 366
Tetrakis(triphenylphosphine)-palladium(0), 7, 357
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2,3-Bis(bromomethyl)-1,3-butadiene, 5, 32
Bis(chlorodimethylsilyl)ethane, 12, 179
Copper(I) trifluoromethanesulfonate, 12, 144
Dichlorotris(triphenylphosphine)-

HETEROCYCLES—FIVE-MEMBERED RINGS (*Continued*)

- ruthenium(II), **10**, 141
- Dimethylaluminum chloride, **10**, 177
- Iodotrimethylsilane, **9**, 251
- 8-Phenylmenthol, **11**, 412
- Sodium cyanoborohydride, **10**, 360
- Trimethylamine N-oxide, **12**, 533
- 1 N—PYRROLINES**
 - 1-Pyrrolines
 - Diisobutylaluminum hydride, **12**, 191
 - Lithium trichloropalladate(II), **12**, 288
 - Titanium(III) chloride, **12**, 492
 - 2-Pyrrolines
 - Ethoxycarbonylcyclopropyltriphenylphosphonium tetrafluoroborate, **10**, 78
 - Methyl vinyl ketone, **2**, 283
- 3-Pyrrolines
 - Hydroxylamine-O-sulfonic acid, **2**, 217
 - Mercury(II) oxide–Tetrafluoroboric acid, **11**, 318
 - Phosphonium iodide, **1**, 859
 - Trimethylsilylmethyltrifluoromethanesulfonate, **10**, 434
- 1 N—OTHERS**
 - N-Chlorosuccinimide, **8**, 103
 - Di- μ -carbonylhexacarbonyldicobalt, **1**, 224
 - Dichloromethylenedimethylammonium chloride, **5**, 195
 - Dimethyl acetylenedicarboxylate, **4**, 168
 - N-Ethylmorpholine, **1**, 383
 - Methylamine, **5**, 598
 - Nitrosocarbonylmethane, **11**, 362
 - Tetra- μ_3 -carbonyldodecacarbonylhexarhodium, **5**, 326
- 1 N, 1 O—AZLACTONES**
 - Ethyl chloroformate, **12**, 223
 - Hippuric acid, **1**, 432
 - Polyphosphoric acid, **7**, 294
 - Sodium acetate, **1**, 1024
 - Sulfur trioxide–Dimethylformamide, **1**, 1125
- 1 N, 1 O—BENZISOXAZOLES**
 - Hydroxylamine-O-sulfonic acid, **1**, 481
- 1 N, 1 O—BENZOXAZOLES**
 - Dichloromethylenedimethylammonium chloride, **5**, 195
 - Nickel peroxide, **1**, 731
 - Phosphoryl chloride, **11**, 429
 - Polyphosphate ester, **2**, 333; **3**, 229
 - Triphenylpropargylphosphonium bromide, **6**, 494
- 1 N, 1 O—ISOXAZOLES**
 - Dichlorobis(triphenylphosphine)palladium(II), **5**, 190
 - 2,3-Dichloro-5,6-dicyano-1,4-benzoquinone, **9**, 148
 - Dichloroformoxime, **1**, 221
 - N,N-Dimethylformamide, **8**, 189
 - Ethylene glycol, **1**, 375
 - Hydroxylamine, **9**, 438; **11**, 257
 - Hydroxylamine sulfate, **1**, 481
 - Iodine–Potassium iodide, **4**, 260
 - Sodium nitrite, **4**, 459
 - p*-Toluenesulfonic acid, **12**, 507
- 1 N, 1 O—ISOXAZOLINES**
 - N-Alkylhydroxylamines, **7**, 241; **12**, 13, 322
 - Hydrogen peroxide–Sodium tungstate, **12**, 246
 - 1-Pyrroline 1-oxide, **9**, 401
 - p*-Tolyl vinyl sulfoxide, **11**, 538
- 1 N, 1 O— Δ^2 -ISOXAZOLINES**
 - Benzenesulfonylnitrile oxide, **9**, 39
 - Cyanogen chloride N-oxide, **11**, 146
 - Ethoxycarbonylformonitrile oxide, **7**, 145
 - Phenyl isocyanate, **8**, 205; **10**, 309; **12**, 386
 - Raney nickel, **11**, 457
 - Triphenylacetoneitrile oxide, **7**, 146
- 1 N, 1 O—OXAZOLES**
 - Benzonitrile, **5**, 742
 - (Bromodichloromethyl)phenylmercury, **5**, 514
 - Copper(II) acetylacetonate, **2**, 81
 - 1,8-Diazabicyclo[5.4.0]undecene-7, **5**, 177
 - Diphenyl phosphoroazidate, **11**, 222
 - Hydrogen fluoride, **4**, 252
 - Isocyanomethyl lithium, **10**, 231
 - Methyl N-tolylsulfonylmethylthio-benzimidate, **7**, 245
 - Nickel peroxide, **9**, 322
 - Tosylmethyl isocyanide, **4**, 514
- 1 N, 1 O—2-OXAZOLIDINONES**
 - Calcium ethoxide, **7**, 52
 - Carbon dioxide, **7**, 52
 - N,N'-Carbonyldiimidazole, **2**, 61

- Iodine isocyanate, 3, 161
- Lead tetraacetate, 4, 278
- Selenium, 6, 507
- Tin(II) octoate, 7, 346
- 1 N, 1 O—OXAZOLINES
 - Acetonitrile, 6, 69
 - 2-Amino-2-methyl-1-propanol, 3, 14, 314
 - Benzonitrile, 6, 69
 - m*-Chloroperbenzoic acid, 5, 120
 - Copper(I) oxide, 10, 107
 - Cyanotrimethylsilane, 11, 147
 - Diethyl isocyanomethylphosphonate, 4, 271; 6, 187
 - Iodine, 11, 261
 - Isocyanotolylthiomethyl lithium, 4, 516
 - Lithium 2,2,6,6-tetramethylpiperide, 7, 213
 - Sulfuric acid, 5, 633
 - Trichloroacetonitrile, 12, 526
 - Triphenylphosphine—Carbon tetrachloride, 11, 588
- 1 N, 1 O—OTHERS
 - 2-Aminoethanol, 6, 225
 - Aziridine, 1, 378
 - Chlorosulfonyl isocyanate, 5, 132
 - 1-Cyclohexyl-3-(2-morpholinoethyl)-carbodiimide metho-*p*-toluene-sulfonate, 11, 151
 - Meldrum's acid, 11, 311
 - Oxalyl chloride, 2, 301
 - Phosgene, 5, 532
 - Triethyl phosphite, 1, 1212
 - Zinc, 5, 753
- 1 N, 1 S—BENZOTHAZOLE
 - Dichloromethylenedimethylammonium chloride, 5, 195
 - Ethyl ethoxyiminoacetate, 11, 109
 - Polyphosphate ester, 3, 229
 - Silver cyanide, 5, 581
 - Sodium thiocyanate, 1, 1105
 - Triethyl orthoformate, 1, 1204
 - Trimethylsilyl polyphosphate, 11, 427
- 1 N, 1 S—THIAZOLES
 - Ethoxycarbonyl isothiocyanate, 6, 250
 - Nickel peroxide, 8, 357; 9, 322
 - Phosphorus(V) sulfide, 1, 870
 - Thiourea, 1, 1164
 - Tosylmethyl isocyanide, 8, 493
- 1 N, 1 S—THIAZOLINES
 - Aziridine, 1, 378
 - Sodium ethoxide, 3, 265
 - Triphenylphosphine, 11, 588
- 1 N, 1 S—OTHERS
 - Selenium, 6, 507
 - Thionyl chloride, 3, 290; 5, 663; 10, 399
- 2 N—BENZIMIDAZOLES
 - Cyanamide, 5, 168
 - Cyanogen bromide, 2, 93
 - Dimethylformamide dimethyl acetal, 5, 254
 - Formic acid, 1, 404
 - o*-Phenylenediamine, 1, 834
 - Polyphosphate ester, 1, 892
 - Polyphosphoric acid, 1, 894
 - Silver cyanide, 5, 581
 - Trifluoroperacetic acid, 1, 821
 - Trimethylsilyl polyphosphate, 11, 427
- 2 N—IMIDAZOLES
 - Barium manganate, 10, 16
 - Diaminomaleonitrile, 5, 175
 - Formamide, 1, 402
 - Formamidinium acetate, 3, 147
 - Imidazole, 1, 492
 - Mercury(II) sulfate, 1, 658
 - Methyl *N*-tolylsulfonylmethylthio-benzimidate, 7, 245
 - Nickel peroxide, 8, 357
 - Nitrosonium tetrafluoroborate, 4, 360
 - Potassium cyanide, 10, 324
 - Rhodium(III) oxide, 4, 420
 - Silver chloride, 10, 347
 - p*-Tolylmethyl isocyanide, 7, 377
 - Tosylmethyl isocyanide, 4, 514; 8, 493
 - Triethyloxonium tetrafluoroborate, 5, 691
- 2 N—PYRAZOLES
 - Ammonium persulfate—Silver nitrate, 5, 16
 - o*-Chloranil, 7, 355
 - Diazoacetyl azide, 4, 120
 - 2-Diazo-1,1-dimethoxyethane, 10, 120
 - Dichloromethylenedimethylammonium chloride, 4, 135; 5, 195
 - Dimethyl acetylenedicarboxylate, 4, 168; 5, 227
 - Ethylene glycol, 1, 375; 5, 296
 - Hydrazine, 1, 434; 4, 248
 - Nickel peroxide, 8, 357
 - 2,4-Pentanedione, 1, 10
 - Phenyl(trichloromethyl)mercury, 2, 326
 - Sodium hydroxide, 8, 460

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- Thionyl chloride, **9**, 465
 Vinyltriphenylphosphonium bromide, **5**, 750
- 2 N—PYRAZOLIDINES**
dl-Dianilino-1,2-diphenylethane, **1**, 187
 Manganese(IV) oxide, **1**, 637
- 2 N—PYRAZOLINES**
 1-Pyrazolines
 Diazomethane, **4**, 120; **5**, 179; **9**, 133
 Phenyldiazomethane, **1**, 834
 2-Pyrazolines
 Diphenyldiazomethane, **1**, 338
 Hydrazine, **2**, 211
 Manganese(IV) oxide, **2**, 257
 Phenylhydrazine, **2**, 322
 Potassium diazomethanedisulfonate, **1**, 928

p-Toluenesulfonylhydrazide, **2**, 417
 Trimethylsilyldiazomethane, **4**, 543
- 2 N—OTHERS**
 Benzamidine, **6**, 27
 N,N'-Carbonyldiimidazole, **2**, 61
 Cyanotrimethylsilane, **6**, 632
 Diiminosuccinonitrile, **4**, 155
 Diketene, **1**, 264
 Dimethylformamide diethyl acetal, **5**, 253
 Diphenyldiazomethane, **4**, 204
 Ethylene diisocyanate, **2**, 100
 Ethyl formate, **1**, 380
 Methylhydrazine, **4**, 340
 Phenylhydrazine, **1**, 838
 Polyphosphoric acid, **2**, 334
 Sodium methoxide, **1**, 1091
 Sodium nitrite, **1**, 1097
 Tetrabutylammonium fluoride, **5**, 645
 Triethyl phosphite, **1**, 1212
 Triphenylphosphine, **11**, 588
 Urea, **1**, 1262
- 2 N, 1 O**
 Benzonitrile oxide, **2**, 383
 2,4-Bis(4-methoxyphenyl)-1,3-dithia-2,4-diphosphetane-2,4-disulfide, **11**, 54
 (Bromodichloromethyl)phenylmercury, **5**, 514
 Dichloromethylenedimethylammonium chloride, **5**, 195
 Dimethylformamide-Thionyl chloride, **1**, 286
- Nitrobenzene, **7**, 251
 Nitrogen dioxide, **2**, 175
 Phenyliodine(III) diacetate, **1**, 508
 Sodium azide, **1**, 1041; **2**, 376
 Sodium hypochlorite, **1**, 1084; **7**, 337
 Sulfur trioxide-Dimethylformamide, **1**, 1125
 Thionyl chloride, **4**, 503
 (Trichloromethyl)carbonimidic dichloride, **4**, 523
 Triphenylphosphine, **1**, 1238
- 2 N, 1 S**
 Diiminosuccinonitrile, **4**, 155
 Dipotassium cyanodithioimido-carbonate, **4**, 215
 Ethoxycarbonyl isothiocyanate, **6**, 250
- 3 N—BENZOTRIAZOLES**
o-Phenylenediamine, **1**, 834
 Sodium nitrite, **1**, 1097
- 3 N—1,2,3-TRIAZOLES**
 Azidotrimethylsilane, **1**, 1236
 Chloramine, **4**, 74
 Ethyl azidoformate, **3**, 138; **4**, 225
 Phenyl azide, **1**, 829; **2**, 45; **4**, 375; **5**, 513
 Sodium azide, **4**, 440; **5**, 593
p-Toluenesulfonyl azide, **2**, 415
 Trimethylsilyldiazomethane, **11**, 573
 Trimethylsilylmethyl azide, **12**, 538
- 3 N—1,2,4-TRIAZOLES**
 Dichloromethylenedimethyl-ammonium chloride, **4**, 135; **5**, 195
 Ethyl ethoxyminoacetate, **11**, 109
 Ethyl formate, **1**, 380
 Formic acid, **1**, 404
 Thiosemicarbazine, **1**, 1164
 (Trichloromethyl)carbonimidic dichloride, **4**, 523
 Triethyloxonium tetrafluoroborate, **5**, 691
- 3 N—OTHERS**
 Chloramine, **1**, 122
 Dichloromethylenedimethyl-ammonium chloride, **8**, 156
 Dicyclohexylcarbodiimide, **3**, 91
- 4 N**
 Aluminum azide, **5**, 9
 Hydrazoic acid, **1**, 446
 Iodine azide, **5**, 350
 Tetramethylguanidinium azide, **2**, 403
 Trimethylsilyldiazomethane, **11**, 573
- 1 O—BENZOFURANS**

- Acetic anhydride–Acetic acid, 2, 5
 Bis(benzonitrile)dichloropalladium(II), 4, 129
t-Butyl hypochlorite–Dialkyl sulfides, 6, 118
 α -Chloro-*N*-cyclohexylpropanal-donitrone, 5, 110
N-Chlorosuccinimide–Dimethyl sulfide, 6, 118
 2,3-Dichloro-5,6-dicyano-1,4-benzoquinone, 11, 166
 Mercury(II) acetate, 12, 298
 3-Methyl-3-buten-1-ynylcopper, 8, 123
 Oxodiperoxymolybdenum(pyridine)-(hexamethylphosphoric triamide), 11, 218
 Phosphoryl chloride, 5, 535
 Silver tetrafluoroborate, 5, 587
1 O—2,3-DIHYDROBENZOFURANS
sec-Butyllithium, 12, 97
 Butyllithium–Magnesium bromide, 10, 71
 Di-*t*-butyl nitroxide, 11, 160
N,N-Diethylaniline, 5, 212
 Dilithium tetrachloropalladate(II), 7, 114
 Dimethyl sulfoxide, 5, 263
 Dimethylsulfoxonium methylide, 2, 171
 Methyl bis(methylthio)sulfonium hexachloroantimonate, 11, 335
 Palladium(II) acetate, 9, 344
 Titanium(IV) chloride, 11, 529
1 O—DIHYDROFURANS
 2,3-Dihydrofurans
 t-Butyl perbenzoate, 1, 98
 (E)-(Dimethylamino)phenyl-(2-phenylethenyl)sulfoxonium tetrafluoroborate, 4, 174
 Ethoxycarbonylcyclopropyltriphenylphosphonium tetrafluoroborate, 6, 93
 Grignard reagents, 11, 245
 Manganese(III) acetate, 6, 355
 Perchloric acid, 5, 506
 Zinc, 5, 753
 Zinc chloride, 9, 522
 2,5-Dihydrofurans
 Lithium–Ammonia, 6, 322
 Silver perchlorate, 11, 469
 Titanium(IV) chloride, 6, 590
 Vinyltriphenylphosphonium bromide, 2, 456

1 O—TETRAHYDROFURANS

- by Cyclization of unsaturated alcohols
 Benzeneselenenyl chloride, 8, 25
 N-Bromosuccinimide, 4, 49
 t-Butyl hydroperoxide–Vanadyl acetylacetonate, 8, 62
 Collins reagent, 11, 139
 Ethyl 4-diphenylphosphinyl-3-oxobutanoate, 10, 181
 Formic acid, 4, 239
 Iodine, 8, 256; 11, 261; 12, 253
 Iodine–Potassium iodide, 9, 249
 Mercury(II) acetate, 3, 194
 Mercury(II) trifluoroacetate, 11, 320
 Palladium(II) chloride, 12, 371
 2,4,4,6-Tetrabromo-2,5-cyclohexadienone, 12, 457
 by Cyclodehydration of 1,4-diols
 Benzeneselenenyl halides, 10, 16
 Benzenesulfonyl chloride, 1, 46
 3-Bromopropyl 1-ethoxyethyl ether, 4, 226
 Dimethyl sulfoxide, 1, 296
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 Nafion-H, 11, 354
 Palladium(II) acetate, 12, 367

p-Toluenesulfonic acid, 1, 1172

 Triphenylphosphine + co-reagent, 9, 504; 12, 551
 by Cyclodehydrogenation of ROH
 Bromine–Silver(I) salts, 1, 73; 5, 60
 t-Butyl hypoiodite, 1, 94
 Cerium(IV) ammonium nitrate, 3, 44
 Lead tetraacetate, 1, 537; 12, 270
 Mercury(II) oxide–Iodine, 1, 658
 Silver(I) oxide, 3, 252
 Trifluoromethanesulfonyl chloride, 9, 485
 Other routes
 Benzeneselenenic acid, 9, 24
 2,3-Bis(bromomethyl)-1,3-butadiene, 5, 32
 Boron trifluoride etherate, 10, 52
 4-Chloro-1-butenyl-2-lithium, 12, 113
 N,N-Dimethylformamide, 12, 203
 Fluorosulfuric acid, 6, 262
 Iodosylbenzene, 11, 270
 Lithium aluminum hydride–Boron trifluoride etherate, 1, 599
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HETEROCYCLES—FIVE-MEMBERED RINGS (*Continued*)

- naphthalenide, **12**, 279
- Mercury(II) oxide–Iodine, **11**, 267
- 3-Methyl-3-trimethylsilyl-1-butene, **8**, 181
- Oxalic acid, **12**, 408
- Phenyl selenocyanate–Copper(II) chloride, **9**, 34
- N-Phenylselenophthalimide, **9**, 366
- Potassium permanganate, **9**, 388
- Silver(I) trifluoroacetate, **11**, 471
- Sodium borohydride–Boron trifluoride, **1**, 1053
- Triethylsilane–Boron trifluoride, **10**, 418
- Triisobutylaluminum, **1**, 1188
- Zinc chloride, **9**, 522
- 1 O—OTHERS**
 - Bis(trimethylsilyl)acetylene, **5**, 44
 - Butyllithium, **8**, 67; **9**, 83
 - Chlorotris(triphenylphosphine)-rhodium(I), **11**, 130
 - Copper(II)–Amine complexes, **8**, 114
 - Copper(I) bromide, **11**, 140
 - Copper(I) iodide, **5**, 717
 - 1,5-Diazabicyclo[4.3.0]nonene-5, **4**, 116
 - 1,4-Diazabicyclo[2.2.2]octane, **2**, 99
 - 2-(2,2-Dimethoxyethyl)-1,3-dithiane, **4**, 164
 - Dimethylsulfoxonium methylide, **5**, 254
 - Ferric chloride, **4**, 236
 - Hydrobromic acid, **6**, 282
 - Hydrogen chloride–Titanium(IV) chloride, **10**, 201
 - Hydrogen peroxide, **5**, 337
 - α -Lithio- α -methoxyallene, **9**, 272
 - Lithium morpholide, **12**, 284
 - Mercury(II) acetate, **6**, 358; **12**, 303
 - 3-Methoxy-1-methylthio-1-propyne, **6**, 397
 - Osmium tetroxide, **4**, 361
 - Oxalic acid, **5**, 481
 - Oxalyl chloride, **6**, 424
 - Peroxybenzimidic acid, **7**, 281
 - Phenyl iodine(III) diacetate, **12**, 384
 - Piperazine, **4**, 392
 - Potassium *t*-butoxide, **5**, 544
 - Potassium ferricyanide, **1**, 929
 - Potassium superoxide, **6**, 488; **7**, 304
 - Thallium(III) acetate, **10**, 393

- Tri- μ -carbonylhexacarbonyldiiron, **5**, 221
- 1 O, 1 S**
 - Adogen 464, **7**, 4
 - (N,N-Diethylamino)methyloxosulfonium methylide, **5**, 210
 - Diphenylketene, **4**, 210
- 2 O** (*see also* PEROXIDES for ENDOPEROXIDES)
 - 2-Acetoxyisobutryl chloride, **8**, 3
 - Potassium superoxide, **6**, 488
- 1 S—BENZOTHIOPHENES**
 - Boron trifluoride–Trifluoroacetic anhydride, **4**, 45
 - Polyphosphoric acid, **5**, 540
 - Tetraphenylcyclopentadienone, **4**, 490
 - Thionyl chloride, **5**, 663
- 1 S—THIOLANES**
 - Hexaethylphosphorous triamide, **2**, 207; **4**, 242
 - Hexamethylphosphoric triamide, **2**, 208
 - Palladium catalysts, **8**, 382
 - Potassium thiolacetate, **10**, 325
 - Sulfur dichloride, **2**, 391
 - Trifluoroacetic acid–Alkylsilanes, **6**, 616
- 1 S—THIOPHENES**
 - Hydrogen sulfide, **1**, 962
 - Phosphorus heptasulfide, **1**, 864
 - Phosphorus(V) sulfide, **6**, 470
 - Tetracyanoethylene, **1**, 1133
- 1 S—OTHERS**
 - Alumina, **4**, 8
 - 2,3-Bis(bromomethyl)-1,3-butadiene, **5**, 32
 - N-Chlorosuccinimide, **5**, 127
 - Sodium hydroxide, **7**, 336
 - Sulfur dioxide, **6**, 558; **9**, 440
 - Sulfuryl chloride, **10**, 375
 - Vinyltriphenylphosphonium bromide, **5**, 750; **6**, 666
- 2 S**
 - Dimethyl sulfoxide, **5**, 263
 - Phosgene, **5**, 532

HETEROCYCLES—SIX-MEMBERED RINGS (*see also* LACTAMS, LACTONES)

- 1 N—DIHYDROPYRIDINES**
 - Copper hydride ate complexes, **12**, 286
 - Formaldehyde, **1**, 397
 - Methyl chloroformate, **6**, 376
 - Organocopper reagents, **11**, 365

- Sodium dithionite, **1**, 1081
Trimethylsilane, **1**, 1235
- 1 N—ISOQUINOLINES AND RELATED**
- Isoquinolines
[1,3-Bis(diphenylphosphine)propane]-(dichloro)nickel(II), **11**, 167
Boron trifluoride, **4**, 45; **6**, 65
Hydrochloric acid, **5**, 333
Ozone, **11**, 387
Potassium nitrosodisulfonate, **5**, 562
Thallium(III) trifluoroacetate, **10**, 397
Trimethylsilyl polyphosphate, **11**, 427
- Dihydroisoquinolines
Benzeneseleninic anhydride, **11**, 37
t-Butyllithium, **10**, 76
Copper(I) iodide, **12**, 141
Diphenylselenium bis-(trifluoroacetate), **11**, 223
Isocyanomethyl lithium, **10**, 231
Polyphosphate ester, **1**, 892; **2**, 333; **3**, 229; **4**, 394; **5**, 539
Potassium superoxide, **11**, 442
Sodium hydride, **5**, 610
- Tetrahydroisoquinolines
Dihydridotetrakis(triphenylphosphine)ruthenium(II), **11**, 182
6-Methoxy-7-hydroxy-3,4-dihydroisoquinolinium methiodide, **4**, 329
Polyphosphoric acid, **5**, 540
Sodium tris[(S)-N-benzyloxycarbonyl-propyloxy]hydroborate, **12**, 454
- 1 N—PIPERIDINES**
- by Cyclization of unsaturated amines
Benzeneselenenyl halides, **10**, 16
Benzenesulfonyl chloride, **12**, 42
Mercury(II) acetate, **11**, 315; **12**, 298
Organoaluminum reagents, **12**, 339
- Other routes
Dichlorotris(triphenylphosphine)-ruthenium(II), **10**, 141
Palladium nitrate, **6**, 451
Raney nickel, **7**, 312
Rhodium catalysts, **1**, 979, 982
Ruthenium catalysts, **5**, 574
Sodium borohydride–Rhodium(III) chloride, **11**, 480
Sodium cyanoborohydride, **12**, 445
Sulfuric acid, **5**, 633
Trialkylaluminum, **11**, 539
- 1 N—PYRIDINES**
- by Deoxygenation of N-oxides
Chlorotrimethylsilane–Sodium iodide–Zinc, **11**, 128
9-Diazofluorene, **1**, 190
Diphosphorus tetraiodide, **10**, 174
Phenyl(trichloromethyl)mercury, **1**, 851
Phosphorus(III) chloride, **1**, 875
Sulfur dioxide, **2**, 392
Titanium(IV) chloride–Sodium borohydride, **10**, 404
Triphenylphosphine, **1**, 1238
- by Diels–Alder reaction
N-Butoxycarbonylmethylene-*p*-toluenesulfonamide, **1**, 98
1-Chloro-1-dimethylamino-2-methyl-1,3-butadiene, **9**, 104
3-Methylsulfonyl-2,5-dihydrofuran, **10**, 270
1,2,4-Triazine, **10**, 409
Trichloro-1,2,4-triazine, **9**, 480
Triethyl 1,2,4-triazine-3,5,6-tricarboxylate, **12**, 528
- Other routes
Alkanoylketene dithioacetals, **11**, 286
O-Allylhydroxylamine, **10**, 5
t-Butyldimethylsilyl trifluoromethanesulfonate, **11**, 90
4-Chloromethyl-3,5-dimethylisoxazole, **2**, 150; **4**, 177
Cyanotrimethylsilane, **12**, 148
Cyclopentadienyl(triphenylphosphine)cobaltatetraphenylcyclopentadiene, **5**, 173
Dicarbonylcyclopentadienylcobalt, **12**, 160
Dicyclopentadienylcobalt, **6**, 128; **12**, 180
Ferric nitrate/K10 Bentonite, **12**, 231
Formaldehyde, **1**, 397
Hexamethyldisilazane, **12**, 239
Hydrazoic acid, **2**, 211
Lithium aluminum hydride–Pyridine, **4**, 294
Nitric acid, **1**, 733
2,4,6-Trimethylpyrylium sulfoacetate, **11**, 571
Triphenylcarbenium perchlorate, **1**, 1256
- 1 N—PYRIDONES**
Azidotrimethylsilane, **5**, 719

HETEROCYCLES—SIX-MEMBERED RINGS (*Continued*)

Bis[1,2-bis(diphenylphosphine)ethane]-palladium(0), 10, 32

1,3-Bis(*t*-butyldimethylsilyloxy)-2-aza-1,3-diene, 11, 50

Dicarbonylcyclopentadienylcobalt, 12, 160

Dimethyl sulfoxide, 5, 263

Ethyl formate, 1, 380

Mercury(II) acetate–Ethylenediamine-tetraacetic acid, 5, 427

Molecular sieves, 10, 273

Piperidine, 1, 886

Potassium *t*-butoxide, 6, 477

Potassium ferricyanide, 1, 929

Sodium methoxide, 1, 1091

1 N—QUINOLINES AND RELATED**Quinolines**

Benzyltriethylammonium chloride, 7, 18

Boron trifluoride etherate, 6, 65

Cobalt(II) phthalocyanine, 10, 102

Cyanotrimethylsilane, 12, 148

Dichlorobis(norbornadiene)-dirhodium(I), 9, 108

Dichlorotris(triphenylphosphine)-ruthenium(II), 11, 171

N,N-Diethylaminopropyne, 5, 217

Diisopropyl peroxydicarbonate, 12, 194

Dimethyl acetylenedicarboxylate, 2, 145

Ferrous sulfate, 1, 393

Hexamethylphosphoric triamide, 6, 273

Methyl vinyl ketone, 1, 697

Polyphosphoric acid, 1, 894; 4, 395

Sodium acetate, 1, 1024

N-*p*-Tolylvinylmethylketenimine, 5, 683

Triphenylpropargylphosphonium bromide, 6, 494

Vilsmeier reagent, 9, 514; 12, 564

Dihydroquinolines

1-Benzyl-1,2-dihydroisonicotinamide, 12, 46

Diisobutylaluminum hydride, 1, 260

Lithium–Ammonia, 5, 379

Tetrahydroquinolines

Borane–Pyridine, 8, 50

Cesium fluoride, 11, 115

Dichlorotris(triphenylphosphine)-

ruthenium(II), 12, 179

Diisobutylaluminum hydride, 1, 260

Trifluoroacetic acid, 6, 613

1 N—OTHERS

Acetic acid, 5, 3

Aluminum chloride, 1, 24

Birch reduction, 5, 30

1,3-Bis(*t*-butyldimethylsilyloxy)-2-aza-1,3-diene, 11, 50

Butyllithium, 10, 68

Carbon monoxide, 9, 95

1-Chloro-N,N,2-trimethylpropenylamine, 5, 136

Chlorotrimethylsilane, 11, 125

Diethyl ethoxymethylenemalonate, 5, 216

Diisobutylaluminum hydride, 12, 191

N,N-Dimethylhydrazine, 11, 200

Dimethyl sulfoxide, 5, 263

trans-1-Methoxy-3-trimethylsilyloxy-1,3-butadiene, 11, 332

Methylene bis(urethane), 1, 677

Methyl isothiocyanate, 5, 173

5-Methylisoxazole, 9, 309

Methyl 3-oxo-4-pentenoate, 1, 1272

1-*o*-Nitrophenyl-1,3-butadiene, 1, 743

Organocopper reagents, 11, 365

Oxygen, 8, 366

Palladium(II) acetate, 8, 378

Phenyldiazomethane, 2, 320

Phosphoric acid–Boron trifluoride complex, 7, 289

Phosphoryl chloride, 1, 876

Polyphosphoric acid, 1, 894; 2, 334

Potassium amide, 4, 398

Sodium cyanoborohydride, 9, 424

Sodium ethoxide, 1, 1065

Sodium tetrachloroaluminate, 2, 372

Thallium(III) trifluoroacetate, 12, 481

Tin(IV) chloride, 7, 342

N-*p*-Toluenesulfonyltrifluoromethylimine, 5, 681

Trimethylsilyl trifluoromethanesulfonate, 12, 543

Vilsmeier reagent, 7, 422

1 N, 1 O

Acetyl chloride, 7, 3

Azidotrimethylsilane, 5, 719; 6, 632

O-*t*-Butyldimethylsilylhydroxylamine, 12, 85*t*-Butyl isocyanide, 5, 581

- α -Chloro-N-cyclohexylpropanal-donitrone, **4**, 80; **5**, 110
 Chlorosulfonyl isocyanate, **5**, 132; **6**, 122
 N-Cyclohexylhydroxylamine, **8**, 135
 Dimethyl acetylenedicarboxylate, **7**, 117
 N-(2,3-Epoxypropylidene)-cyclohexylamine N-oxide, **9**, 209
 Ethyl 3-bromo-2-hydroxyimino-propanoate, **9**, 212
 Iodine, **11**, 261
 Methyl α -phenylglycinate, **8**, 395
 Potassium ferricyanide, **1**, 929
 Sodium bicarbonate, **11**, 476
 Trichloroacetyl isocyanate, **7**, 382
 (Trichloromethyl)carbonimidic dichloride, **4**, 523
 Triphenylphosphine-Thiocyanogen, **8**, 518
1 N, 2 O
 Diphenylketene, **5**, 278
1 N, 1 S
 Boron trifluoride etherate, **5**, 52
 Dimethyl acetylenedicarboxylate, **6**, 206
 Polyphosphate ester, **4**, 394
 Triethyl phosphite, **1**, 1212
2 N—PYRAZINES
 Diaminomaleonitrile, **5**, 175
 Diiminosuccinonitrile, **4**, 155
 Glyoxal, **1**, 413
 Silver perchlorate, **7**, 322
 Sodium nitrite, **4**, 459
 Titanium(IV) chloride, **5**, 671
2 N—PYRIDAZINES
 1,5-Diazabicyclo[4.3.0]nonene-5, **5**, 176
 Di-*t*-butyl azodiformate, **1**, 209
 Diethyl azodicarboxylate, **1**, 245
 Hydrazine, **9**, 236
 Lithium diisopropylamide, **7**, 204
2 N—PYRIMIDINES
 Azidotrimethylsilane, **5**, 719
 Benzyltriethylammonium chloride, **7**, 18
 N,N-Bis(phenylthio)benzene-sulfenamide, **5**, 732
 Carbonylisocyanatidic chloride, **5**, 109
 Chlorosulfonyl isocyanate, **5**, 132
 Dichloromethylenedimethylammonium chloride, **4**, 135; **8**, 156
 Dicyclohexylcarbodiimide, **1**, 231
 Diketene, **5**, 225
 Dimethylformamide diethyl acetal, **10**, 157
 Ethoxycarbonyl isothiocyanate, **4**, 223
 Ethylene glycol, **1**, 375
 Ethyl ethoxymethylenecyanoacetate, **1**, 380
 Formamide, **1**, 402
 Formamidine acetate, **1**, 403
 Hydrogen chloride, **5**, 335
 Malonaldehyde bis(diethyl acetal), **2**, 257
 Palladium black, **5**, 498
 Phosgene, **5**, 532
 Polyphosphoric acid, **7**, 294
 Raney nickel, **1**, 723
 Sodium alkoxides, **1**, 1065, 1091
 Thiourea, **1**, 1164
 (Trichloromethyl)carbonimidic dichloride, **4**, 523
 Tris(formamino)methane, **1**, 1251
 Urea, **1**, 1262
2 N—QUINAZOLINES
 Formamidinoyl isothiocyanates, **5**, 315
 Phosphoryl chloride, **4**, 390
 Tetrafluoroboric acid, **2**, 397
 (Trichloromethyl)carbonimidic dichloride, **4**, 523
2 N—QUINOXALINES
 Ethyl ethoxyiminoacetate, **11**, 109
 Glyoxal, **1**, 413
 Hydrogen peroxide—Iron salts, **1**, 472
 α -Phenylenediamine, **1**, 834
 Vilsmeier reagent, **9**, 514
2 N—OTHERS
 Diphenyl-N-*p*-tolylketenimine, **5**, 282
 Hydrazine, **1**, 434
 Nitrobenzene, **2**, 295
 Silver carbonate—Celite, **6**, 511
2 N, 1 S
 2-Chloroethanesulfonyl chloride, **5**, 116
 O-Mesitylenesulfonylhydroxylamine, **5**, 430
 Potassium persulfate, **10**, 331
3 N
 N-Cyanoguanidine, **1**, 229
 Dichloromethylenedimethylammonium chloride, **8**, 156
 Diketene, **5**, 225
 Dimethylformamide diethyl acetal, **1**, 281
 Dimethyl 1,2,4,5-tetrazine-3,6-dicarboxylate, **12**, 214
 Formamidinoyl isothiocyanates, **5**, 315
 Hydrazine, **5**, 327

HETEROCYCLES—SIX-MEMBERED**RINGS (Continued)**

Iron carbonyl, 1, 519

Sodium azide, 5, 593

Sodium methoxide, 1, 1091

Tri- μ -carbonylhexacarbonyldiiron, 12, 525

(Trichloromethyl)carbonimidic dichloride, 4, 523

Tris(formamino)methane, 1, 1251

1 O—CHROMENES

Copper(II) sulfate, 2, 89

2,3-Dichloro-5,6-dicyano-1,4-benzoquinone, 2, 112; 3, 83

Grignard reagents, 8, 235

Menthyl *p*-toluenesulfinate, 12, 295

Mercury(II) oxide, 5, 428

Potassium borohydride, 8, 407

Potassium dichromate, 9, 383

Silver tetrafluoroborate, 5, 587

Sodium borohydride-Palladium(II) chloride, 11, 479

Sodium hydride, 1, 1075

Triphenylcarbenium tetrafluoroborate, 12, 550

Vinyltriphenylphosphonium bromide, 1, 1274; 2, 456

1 O—COUMARINS

Acetic anhydride, 9, 1

Diketene, 1, 264

N,N-Dimethylformamide, 5, 247

Ethyl acetoacetate, 1, 29, 514

Hydrogen fluoride, 2, 215

Piperidine, 1, 886

Selenium, 11, 465

Trifluoroacetic acid, 1, 1219

Zinc carbonate, 4, 579

Zinc chloride-Phosphoryl chloride, 1, 1292

1 O—FLAVONES

Aluminum chloride, 4, 10

2,3-Dichloro-5,6-dicyano-1,4-benzoquinone, 8, 153

Dimethyl sulfoxide-Iodine, 9, 190

Mercury(II) acetate, 12, 298

Oxygen, singlet, 7, 261

Selenium(IV) oxide, 4, 422; 5, 575

Thallium(III) nitrate, 9, 460

1 O—ISOCOUMARINS

Butyllithium, 6, 85

Di- μ -bromobis(2-methoxy-2-propenyl)-

dinickel, 8, 324

Dimethylsulfoxonium methylide, 12, 213

4-Methoxy-6-methyl-2-pyranone, 9, 302

Thallium(III) trifluoroacetate, 12, 481

Trifluoroacetic acid, 10, 418

Vilsmeier reagent, 7, 422

1 O—ISOFLAVONES

N-Formylimidazole, 8, 233

Silver hexafluoroantimonate, 7, 320

1,3,5-Triazine, 10, 410

1 O—PYRONES

2-Pyrones

Bromine, 12, 70

sec-Butyllithium, 12, 97

Chloroketene dimethyl acetal, 5, 119

Dimethyl methoxymethyl-enemalonate, 12, 206

Iron carbene complexes, 12, 265

Ketene dimethyl acetal, 11, 279

Palladium catalysts, 1, 778

Sulfur, 3, 273; 5, 632; 6, 556

Sulfuric acid, 5, 633

Tetracarbonyl(ethoxyphenyl-methylidene)iron(0), 12, 265

Thallium(I) hydroxide, 6, 578

2,4,6-Trichlorophenylcyanoacetate, 7, 384

Vinylketene, 11, 596

4-Pyrones

Dibenzyl ketone, 1, 198

4-Methoxy-3-buten-2-one, 10, 258

Methyl fluorosulfonate, 6, 381

Polyphosphoric acid, 1, 894

Sodium ethoxide, 1, 1065

1 O—PYRYLIUM SALTS

Alkanoylketene dithioacetals, 11, 282

t-Butyl chloride, 2, 46

2,3-Dichloro-5,6-dicyano-1,4-benzoquinone, 5, 193

Lithium perchlorate, 5, 413

Perchloric acid, 5, 506

Sulfoacetic acid, 1, 1117; 10, 374

Tin(IV) chloride, 5, 627

Triphenylcarbenium

hexachloroantimonate, 3, 330

1 O—TETRAHYDROPYRANS

by Cyclization of unsaturated ROH

Benzeneselenenyl chloride, 8, 25

Mercury(II) acetate, 3, 194

Mercury(II) trifluoroacetate, 9, 294

Palladium(II) chloride, 12, 371

- Silver(I) nitrate, **12**, 433
 2,4,4,6-Tetrabromo-2,5-cyclohexadienone, **7**, 351
 by Cyclodehydration of 1,5-diols
 Diphenyldi(1,1,1,3,3,3-hexafluoro-2-phenyl-2-propoxy)sulfurane, **5**, 270
 Formic acid, **4**, 239
 Ion-exchange resins, **5**, 355
 Triphenylphosphine + co-reagent, **9**, 504; **12**, 551
 by Reduction of γ -lactones
 Lithium aluminum hydride–Boron trifluoride etherate, **1**, 599
 Perchloric acid, **1**, 796
 Triethylsilane–Boron trifluoride, **10**, 418
 Other routes
 Benzeneselenenic acid, **9**, 24
 Benzeneselenenyl bromide, **9**, 25
 Diborane, **5**, 184
 Hexamethylphosphoric triamide, **6**, 273
 Iodosylbenzene, **11**, 270
 Lead tetraacetate, **6**, 313
 Lithium 1-(dimethylamino)-naphthalenide, **12**, 279
 Mercury(II) oxide–Iodine, **11**, 267; **12**, 305
 N-Phenylselenophthalimide, **11**, 417
 Silver(I) trifluoroacetate, **11**, 471
 Titanium(IV) chloride, **11**, 529
 Trifluoromethanesulfonyl chloride, **9**, 485
1 O—XANTHONES
 Copper(II) bromide, **6**, 138
 4-Dimethylaminopyridine, **9**, 178
 Oxygen, **8**, 366
 Phosphoryl chloride–Zinc chloride, **1**, 880
 Polyphosphoric acid, **4**, 395
 Potassium ferricyanide, **5**, 554
 Potassium fluoride, **12**, 406
 Pyridinium chloride, **4**, 415
 Sodium tetrachloroaluminate, **9**, 435
 Zinc chloride–Phosphoryl chloride, **1**, 1292
1 O—OTHERS
 Alkylaluminum halides, **11**, 7
 Allyltrimethyltin, **11**, 20
 Aluminum chloride, **9**, 14; **11**, 25
 Bornyloxyaluminum dichloride, **11**, 70
 Bromine–Silver tetrafluoroborate, **7**, 36
 1-Bromo-3-methyl-2-butene, **5**, 64
 Butyllithium, **6**, 85; **10**, 71
 Carbonyl cyanide, **2**, 60
 Chlorotris(triphenylphosphine)cobalt, **12**, 128
 Diethyl oxomalonate, **7**, 396
 5,6-Dihydro-4-methoxy-2*H*-pyran, **5**, 438
 Diisobutylaluminum hydride, **5**, 224; **11**, 185
 2-(2,2-Dimethoxyethyl)-1,3-dithiane, **4**, 164
 4-Dimethylaminopyridine, **10**, 155
 Dimethylformamide dimethyl acetal, **4**, 184
 Dimethylformamide–Phosphoryl chloride, **5**, 251
 Diphenyl disulfide, **10**, 171
 N-Ethyl(diethoxyphosphinyl)-methylketenimine, **9**, 216
 Lithium trichloropalladate(II), **12**, 288
 Mercury(II) trifluoroacetate, **4**, 325; **11**, 320
 1-Methoxy-1,3-bis(trimethylsilyloxy)-1,3-butadiene, **11**, 66
 1-Methoxy-1,3-butadiene, **10**, 258
 1-Methoxy-2-methyl-3-trimethylsilyloxy-1,3-pentadiene, **11**, 326; **12**, 312
 trans-1-Methoxy-3-trimethylsilyloxy-1,3-butadiene, **11**, 332
 Methyl diformylacetate, **8**, 338
 Methyl methylthiomethyl sulfoxide, **6**, 390
 Nickel(II) acetylacetonate, **9**, 51
 Peroxybenzimidic acid, **7**, 281
 2-(2-Phenylsulfonyl)ethyl-1,3-dioxolane, **6**, 461
 Ruthenium tetroxide, **1**, 986
 Sodium borohydride, **5**, 597
 Sodium dihydrogen phosphate, **4**, 451
 Sulfuric acid, **4**, 470
 Thallium(III) sulfate, **5**, 658
 Titanium(IV) chloride, **12**, 494
 Trifluoroacetic acid, **2**, 433
 Trifluoroacetic anhydride, **9**, 484
 Trimethylsilyl trifluoromethanesulfonate, **11**, 584
 Triphenylcarbenium perchlorate, **1**, 1256
 Tris(6,6,7,7,8,8,8-heptafluoro-2,2-dimethyl-3,5-octanedionato)-

HETEROCYCLES—SIX-MEMBERED RINGS (*Continued*)

europium(or -ytterbium), 12, 559

1 O, 1 S

Acetyl chloride, 4, 5

Crown ethers, 7, 76

Sulfur, 1, 1118

Sulfur dioxide, 7, 346

2 O—(see also PEROXIDES for ENDOPEROXIDES)

Copper(II) sulfate, 8, 125

Diphenyldi(1,1,1,3,3,3-hexafluoro-2-phenyl-2-propoxy)sulfurane, 5, 270

Formaldehyde, 1, 397

Lead(IV) oxide, 1, 533

N-Methyl-N,N'-di-*t*-butylcarbo-diium tetrafluoroborate, 6, 378

Oxygen, 5, 482

Phosphoric acid, 10, 317

Silver(I) oxide, 6, 515; 10, 350

Silver(II) oxide, 9, 412

3 O

Hydrogen peroxide, 4, 253

Tungsten(VI) oxide—Chlorosulfonic acid, 11, 591

1 S

Carbon disulfide, 5, 173

Polyphosphoric acid, 5, 540

Sulfur dichloride, 1, 1121; 2, 391

2*H*-Thiopyran, 8, 242

Triethylamine, 7, 385

2 S

Sodium ethoxide, 1, 1065

3 S

Formaldehyde, 1, 397

HETEROCYCLES—SEVEN-MEMBERED RINGS**1 N**

Aluminum chloride, 3, 7

Chloramine, 1, 122

Dichlorotris(triphenylphosphine)-ruthenium(II), 10, 141

Diethylaluminum iodide, 12, 5

Dimethyl acetylenedicarboxylate, 4, 168

Ethyl azidoformate, 1, 363; 7, 146

Hexaethylphosphorous triamide, 5, 323

Hydrazoic acid, 2, 211

Iodine isocyanate, 2, 223; 3, 161

Mercury(II) oxide—Tetrafluoroboric acid, 11, 318

Polyphosphate ester, 1, 892

Triphenylphosphine, 2, 443

1 O*m*-Chloroperbenzoic acid, 1, 135

1,5-Diazabicyclo[4.3.0]nonene-5, 1, 189

Dimethylsulfoxonium methylide, 7, 133

Ethoxycarbonylcyclopropyltriphenylphosphonium tetrafluoroborate, 5, 90

Lithium aluminum hydride—Boron trifluoride etherate, 1, 599

N-Methyl-N,N'-di-*t*-butylcarbo-diium tetrafluoroborate, 6, 378

Potassium bisulfate, 1, 909

Potassium *t*-butoxide, 3, 233Tri- μ -carbonylhexacarbonyldiiron, 5, 221

Trichlorosilane, 4, 525

Triphenylphosphine—Diethyl azodicarboxylate, 9, 504

1 SDi- μ -chlorobis(allyl)dipalladium, 7, 5

Sulfur dioxide, 2, 392; 4, 469; 7, 346

OTHER HETEROCYCLES**PYRROLIZIDINES**

Benzenesulfonyl chloride, 12, 42

Ethoxycarbonylcyclopropyltriphenylphosphonium tetrafluoroborate, 10, 78

Iodotrimethylsilane, 9, 251

Potassium nitrosodisulfonate, 10, 329

Pyridinium (*d*)-camphor-10-sulfonate, 11, 449

Rhodium catalysts, 1, 979, 982

Tributyltin hydride, 11, 545; 12, 516

Trimethylsilylmethyl trifluoromethanesulfonate, 10, 434

PURINES

Acetic acid, 8, 1

Benzyltrimethylammonium iodide, 1, 53

Diethoxymethyl acetate, 1, 243

Diethyl azodicarboxylate, 2, 128; 6, 185

N,N-Dimethylhydrazine, 7, 126

Formamidine acetate, 1, 403

N-Nitrosodimethylamine, 5, 479

Polyphosphoric acid, 1, 894

Triethyl orthoformate, 5, 690

Vilsmeier reagent, 1, 284

HOMOALLYLIC ALCOHOLS

(see also CHIRAL COMPOUNDS)

BY ADDITION OF ALLYL TO C=O

B-Allyl-9-borabicyclo[3.3.1]nonane, 12, 15

- Allyl bromide, **1**, 1287
 B-Allyldiisopinocampheylborane + derivatives, **12**, 17
 Allyllithium, **1**, 1250; **5**, 82
 Allylmagnesium bromide, **1**, 415
 Allyl phenyl selenide-Trialkylborane, **12**, 20
 Allyltin difluoriodide, **10**, 6, 374
 Allyltrimethylsilane, **7**, 8, 370; **9**, 445
 Allyltrimethyltin, **9**, 8, 47
 9-Borabicyclo[3.3.1]nonane, **9**, 57
 Cerium amalgam, **11**, 114
 2-Chloromethyl-4,4,5,5-tetramethyl-1,3,2-dioxaborolane, **12**, 397
 Chromium(II) chloride, **11**, 132; **12**, 136
 Chromium(III) chloride-Lithium aluminum hydride, **8**, 110
 B-Crotyl-9-borabicyclo[3.3.1]nonane, **12**, 81
 Crotylmagnesium chloride, **12**, 28
 2-Crotyl-4,4,5,5-tetramethyl-1,3,2-dioxaborolane, **11**, 86
 Crotyltri(isopropoxy)titanium, **12**, 354
 Crotyltrimethylsilane, **12**, 146
 Di- μ -bromobis(2-methallyl)nickel, **6**, 361
gem-Dichloroallyllithium, **5**, 188
 Dichlorobis(cyclopentadienyl)titanium, **10**, 130; **12**, 168
 Dichlorobis(cyclopentadienyl)-zirconium(II), **11**, 51
gem-Difluoroallyllithium, **12**, 188
 Fluorodimethoxyborane, **11**, 240
 Hypochlorous acid, **11**, 260
 Manganese(II) chloride-Lithium aluminum hydride, **11**, 310
 B-Methallyldiisopinocampheylborane, **12**, 18
 Methallyllithium, **5**, 82
 Organotitanium reagents, **11**, 374
 (E)-(2,4-Pentadienyl)trimethylsilane, **10**, 303
 (2R,4R)-Pentandiol, **12**, 375
 (+)-3-Phenylbornane-2,3-diol, **9**, 363
 Samarium(II) iodide, **11**, 464
 Tetrakis(triphenylphosphine)-palladium(0), **11**, 503
 N,N,N',N'-Tetramethylethylenediamine, **4**, 485
 Tin, **11**, 519
 Tin-Aluminum, **12**, 486
 Tin(II) fluoride, **11**, 202, 524
 Titanium(IV) chloride, **12**, 494
 Tributylcrotyltin, **10**, 411, 451; **11**, 143, 542; **12**, 146, 513
 Triethylaluminum, **10**, 415
 Triethylborane, **10**, 416
 [(Trimethylsilyl)allyl]lithium, **9**, 155; **11**, 12
 α -(Trimethylsilyl)benzylmagnesium bromide, **11**, 19
 α -Trimethylsilylcrotyl-9-borabicyclo[3.3.1]nonane, **10**, 430
 3-Trimethylsilyl-1-cyclopentene, **8**, 509
 Zinc iodide, **12**, 21
 by Ene reactions
 Alkylaluminum halides, **10**, 177; **12**, 5
 Chloral, **8**, 82
 Formaldehyde, **11**, 8
 by Epoxide cleavage
 Diisobutylaluminum hydride, **6**, 198; **7**, 111; **8**, 173
 Dilithium dialkyl(cyano)cuprates, **12**, 349
 Lithium divinylcuprate, **5**, 288
 Methylenetriphenylphosphorane, **11**, 338
 Trimethylaluminum-Dichlorobis-(cyclopentadienyl)zirconium, **10**, 423
 α -Trimethylsilylvinylmagnesium bromide, **8**, 515
 by Wittig and related reactions
 2,2-Dihydro-2,2,2-triphenyl-1,2-oxaphospholane, **2**, 442
 3-Hydroxy-3-methylbutylidene-triphenylphosphorane, lithium salt, **8**, 251
 2-Methyl-2-thiazoline, **6**, 403
 Other routes
 Acetic anhydride, **6**, 3
 Diethylaluminum N-methylanilide, **8**, 165
 Diisopinocampheylborane, **4**, 161
 Disiamylborane, **11**, 226
 Grignard reagents, **6**, 147
 Hydrogen peroxide, **12**, 242
 Lithium aluminum hydride, **5**, 382; **9**, 274
 Lithium bronze, **11**, 293
 Lithium dimethylcuprate, **4**, 177
 Lithium tri-*sec*-butylborohydride, **12**, 286

HOMOALLYLIC ALCOHOLS (*Continued*)

- Peracetic acid, **2**, 307
- Perchloric acid, **5**, 506
- Phenylselenoacetaldehyde, **10**, 310
- p*-Toluenesulfonylhydrazide, **8**, 489
- Trialkylaluminums, **12**, 512
- Tributyl(iodomethyl)tin, **9**, 250, 475
- Urushibara catalysts, **6**, 659

HOMOALLYLIC AMINES

- B-Allyl-9-borabicyclo[3.3.1]nonane, **12**, 15
- Palladium(II) acetate, **8**, 378
- N-Sulfinyltoluenesulfonamide, **12**, 455

HOMOALLYLIC ETHERS

- Allyltrimethylsilane, **7**, 370; **10**, 439
- Iodotrimethylsilane, **10**, 216; **12**, 259
- 3-Methyl-3-trimethylsilyl-1-butene, **8**, 181
- Peracetic acid, **2**, 307
- Silver tetrafluoroborate, **12**, 434
- Titanium(IV) chloride, **11**, 529

HOMOPROPARGYLIC ALCOHOLS

(*see also* CHIRAL COMPOUNDS)

- Chloro(methoxy)methylalane, **5**, 438
- Chromium(III) chloride-Lithium aluminum hydride, **10**, 101
- Diethylaluminum ethoxyacetylde, **7**, 103
- Diethyl tartrate, **11**, 181
- Hexamethylphosphoric triamide, **10**, 196
- Lithium acetylde, **8**, 285
- Lithium amide, **9**, 278
- Lithium 3-chloropropargylde, **9**, 279
- Organoaluminum reagents, **4**, 144; **12**, 339
- Organotitanium reagents, **11**, 374
- Organozinc reagents, **11**, 25; **12**, 356
- Organozirconium reagents, **11**, 378
- Propargyl bromide, **1**, 1285; **2**, 19
- Samarium(II) iodide, **11**, 464
- Trimethylsilyllallene, **10**, 428

HYDRAZIDES

- N,N'-Diisopropylhydrazine, **4**, 162
- N,N-Dimethylhydrazine, **5**, 254
- Hydrazine, **6**, 280
- Phosphonitric chloride trimer, **2**, 206

HYDRAZINES

- 1-Acetyl-1-methylhydrazine, **4**, 7
- N-Aminophthalimide, **1**, 38
- t*-Butyl carbazate, **11**, 88
- Hydrazine, **1**, 434
- Hydroxylamine-O-sulfonic acid, **1**, 481
- Lithium aluminum hydride, **5**, 382

- O-Mesitylhydroxylamine, **1**, 660
- Sodium hydrazide, **1**, 1074
- Sodium hypochlorite, **1**, 1084
- Tetrabutylammonium chloride, **7**, 353
- Tris(trimethylsilyl)hydrazidocopper, **6**, 651
- Zinc-Acetic acid, **1**, 1276

HYDRAZONES**FROM C = O**

- 1-Acetyl-1-methylhydrazine, **4**, 7
- Azobenzene-4-carboxylic acid hydrazide, **1**, 44
- Diethyl phosphite, **1**, 251
- N,N-Dimethylhydrazine, **1**, 289; **2**, 154; **3**, 117
- 2,4-Dinitrophenylhydrazine, **1**, 330
- 1,1-Diphenylhydrazine, **1**, 340
- Ethyl carbazate, **1**, 360
- Hydrazine, **1**, 434; **3**, 153
- 5-Iodo-2,4-dinitrophenylhydrazine, **1**, 506
- Phenylhydrazine, **1**, 838
- Polyphosphoric acid, **4**, 395
- Triethylamine, **1**, 1198

OTHER ROUTES

- Arenediazonium salts, **2**, 62; **8**, 22
- N-Benzoyl-N'-trifluoromethanesulfonylhydrazine, **6**, 36
- p*-Carboxybenzenediazonium chloride, **2**, 62
- Lead tetraacetate, **1**, 537

ARENESULFONYLHYDRAZONES

- N,N-Methyltoluenesulfonylhydrazide, **9**, 411
- p*-Toluenesulfonylhydrazide, **1**, 1185; **12**, 508

HYDROPEROXIDES (*see also* ALLYLIC COMPOUNDS, α -HYDROPEROXY CARBONYLS)

- Alkyl hydroperoxides, **1**, 17
- Hydrogen peroxide + co-reagent, **1**, 471; **4**, 253; **6**, 99; **7**, 174, 175; **8**, 250
- Oxygen, **1**, 1253; **5**, 482; **7**, 261; **8**, 367

HYDROXAMIC ACIDS

- Bis(N,N-dimethylformamido)-oxodiperoxymolybdenum(VI), **9**, 48
- Diborane, **7**, 89
- Hydroxylamine, **1**, 478

HYDROXY ALDEHYDES AND KETONES (*see also* CHIRAL COMPOUNDS)

α -HYDROXY

- by Acyloin reaction (*see* TYPE OF REACTION INDEX)
- by Addition of acyl anions to C=O
 - Acyllithium reagents, 12, 4
 - 1-(Alkylthio)vinylolithium, 5, 6
 - 3-Benzyl-5-(2-hydroxyethyl)-4-methyl-1,3-thiazolium chloride, 6, 289
 - t*-Butylhydrazine, 12, 87
 - Cyanotrimethylsilane, 9, 127
 - Dichloromethylolithium, 5, 199
 - Diethyl 1-phenyl-1-trimethylsilyloxy-methylphosphonate, 10, 145
 - 1,3-Dithiane, 7, 142; 8, 217
 - Ethyl ethylthiomethyl sulfoxide, 5, 299
 - (S)-N-Formyl-2-methoxymethylpyrrolidine, 11, 243
 - Grignard reagents, 12, 235
 - Hexahydro-4,4,7-trimethyl-4*H*-1,3-benzothiin, 12, 237
 - 2-Lithio-4,5-dihydro-5-methyl-[4*H*]-1,3,5-dithiazine, 11, 302
- α -Methoxyvinylolithium, 6, 372; 7, 233; 8, 331
- Methyl methylthiomethyl sulfoxide, 4, 341
- Potassium cyanide, 7, 299
- Potassium fluoride, 10, 325
- Sodium bis(2-methoxyethoxy)-aluminum hydride, 8, 448; 9, 418
- Tosylmethyl isocyanide, 5, 684
- 2,4,6-Triisopropylbenzenesulfonylhydrazide, 11, 563
- by Benzoin condensation (*see* TYPE OF REACTION INDEX)
- from 1,2-Dicarbonyls
 - 1-Benzyl-1,4-dihydronicotinamide, 6, 36
 - Chlorotris(triphenylphosphine)-rhodium(I), 6, 652
 - Hexahydro-4,4,7-trimethyl-4*H*-1,3-benzothiin, 12, 237
 - Hydroxylamine, 7, 176
 - Magnesium iodide, 5, 420
 - Titanium(III) chloride, 7, 418
 - Trimethyl-1,3-oxathianes, 8, 508; 12, 534
 - Zinc, 4, 574
- by Hydroxylation α to C=O (*see* TYPE OF REACTION INDEX)
- by Oxidation of alkenes, 1,2-diols, enol

- ethers and related compounds (*see* TYPE OF REACTION INDEX)
- from Propargyl alcohols
 - Benzenesulphenyl chloride, 9, 35
 - Ion-exchange resins, 1, 511
 - Mercury(II) oxide, 1, 655; 6, 360
 - Mercury(II) sulfate, 1, 658
 - Mercury(II) *p*-toluenesulfonamide, 1, 660
 - Phenylmercuric hydroxide, 11, 415
- Other routes
 - Acetic acid, 8, 1
 - Acetic anhydride, 5, 3
 - t*-Butyl acetoacetate, 1, 83
 - Dibenzoyl peroxide, 1, 196
 - Diethylmethylsilane, 9, 145
 - Dimethyl sulfoxide, 1, 296; 2, 94, 157
 - Formic acid, 5, 698
 - Hydrogen peroxide, 1, 466
 - Methyltriphenylphosphonium permanganate, 10, 446
 - Osmium tetroxide, 1, 759
 - Palladium(II) acetate, 9, 344
 - Periodic acid, 1, 815
 - Potassium formate, 5, 556
 - Potassium hydroxide, 12, 411
 - Potassium permanganate, 1, 942
 - Samarium(II) iodide, 12, 429
 - Sodium dichromate, 1, 678
 - Thallium(III) nitrate, 4, 492
 - Tosylmethyl isocyanide, 12, 511
 - 2,2,2-Trimethoxy-4,5-dimethyl-1,3-dioxaphospholene, 2, 97
 - Tris(trimethylsilyloxy)ethylene, 8, 523
 - Zinc, 1, 1276

β -HYDROXY

- by Aldol reaction (*see* TYPE OF REACTION INDEX)
- from Epoxy C=O
 - Chromium(II) acetate, 1, 147; 4, 97
 - Lithium alkyl(cyano)cuprates, 9, 329
 - Lithium dimethylcuprate, 5, 234; 6, 209
 - Lithium tri-*t*-butoxyaluminum hydride, 2, 251
 - Nickel-Graphite, 11, 356
 - Phenylcopper, 7, 282
 - Sodium hydrogen telluride, 12, 449
 - Sodium iodide-Acetic acid-Sodium acetate, 6, 544
- by Oxidation of 1,3-diols

HYDROXY ALDEHYDES AND**KETONES** (*Continued*)

- Bis(tributyltin) oxide, 7, 26
- Bromine, 7, 35
- Silver carbonate–Celite, 3, 247
- by Reduction of dicarbonyls
- Ethyl formate, 4, 233
- Sodium bis(2-methoxyethoxy)-aluminum hydride, 9, 418

Other routes

- 1,3-Bis(trimethylsilyloxy)-1,3-cyclohexadiene, 8, 46
- Di- μ -bromobis(2-methoxy-2-propenyl)dinickel, 5, 437
- Diethylmethylsilane, 9, 145
- Dimethylphenylsilyllithium, 12, 210
- 1,3-Dithiane, 3, 135
- S-(2-Methoxyallyl)-N,N-dimethyl-dithiocarbamate, 6, 364
- 2-Methyl-2-thiazoline, 4, 344; 6, 403
- Oxygen, singlet, 10, 294
- Raney nickel, 11, 457
- Sodium dichromate, 3, 54; 5, 138
- Tetrakis(triphenylphosphine)-palladium(0), 11, 503
- Triethylborane, 10, 416

 γ -HYDROXY

- t*-Butyl dilithioacetoacetate, 8, 60
- Butyllithium, 10, 73
- N,N-Dimethylhydrazine, 7, 126
- Disiamylborane, 1, 57, 201; 3, 22
- Hydrogen peroxide, 12, 242
- Jones reagent, 7, 68
- 5-Lithio-2,3-dihydrofuran, 8, 70
- Lithium diethylamide, 6, 332
- Lithium lithioacetate, 8, 175
- Silver carbonate–Celite, 3, 247
- Triphenyltin hydride, 10, 451

 δ -HYDROXY

- 2-(2-Bromomagnesiethyl)-2-methyl-1,3-dioxolane, 7, 148
- 3,4-Dihydro-2*H*-pyran, 1, 256
- 2-(2-Phenylsulfonylethyl)-1,3-dioxolane, 6, 461

HYDROXY AMIDES (*see also* CHIRAL COMPOUNDS) **α -HYDROXY**

- Acyllithium reagents, 5, 233
- Allyltrimethylsilane, 12, 23
- Cyanotrimethylsilane, 10, 112
- N,N-Diisopropylformamide, 8, 174

- Dimethyl sulfoxide, 1, 296
- Hexamethylphosphoric triamide, 8, 240
- Lithium diisopropylamide, 7, 204
- N-Methyl-C-(trichlorotitanio)-formimidoyl chloride, 12, 354
- Oxygen, 6, 426; 10, 293
- Titanium(IV) chloride, 12, 494
- Titanium(IV) isopropoxide, 12, 504

 β -HYDROXY

- Dichlorobis(cyclopentadienyl)-zirconium(II), 10, 131
- N,N-Dimethyl- α -*p*-tolylsulfanylacetamide, 12, 509
- Menthyl *p*-toluenesulfinate, 12, 295
- 2-Oxazolidones, chiral, 12, 359
- Rhodium catalysts, 12, 426
- Zinc borohydride, 12, 572

HYDROXYAMINES (*see* AMINO ALCOHOLS)**HYDROXY CARBOXYLIC ACIDS**(*see also* CHIRAL COMPOUNDS) **α -HYDROXY** (*see also* α -HYDROXY ESTERS)

- 1-Benzyl-1,4-dihydronicotinamide, 6, 36
- Benzyltriethylammonium chloride, 6, 41
- Borane–*t*-Butylamine, 11, 87
- m*-Chloroperbenzoic acid, 6, 110
- Cyano-*t*-butyldimethylsilane, 6, 80
- Dicyclohexylborane, 11, 172
- Dimethyl sulfoxide, 1, 296
- Hexahydro-4,4,7-trimethyl-4*H*-1,3-benzothiin, 12, 237
- Periodic acid, 1, 815
- (S)-(-)-Proline, 8, 421; 10, 331
- 1,1,3,3-Tetramethylbutyl isocyanide, 5, 650
- Tin(IV) chloride, 1, 1111
- Titanium(IV) isopropoxide, 12, 504
- Trialkylaluminums, 11, 539
- Triethyl phosphite, 8, 501
- Vanadium(II) perchlorate, 9, 513

 β -HYDROXY (*see also* β -HYDROXY ESTERS)by Aldol reaction (*see* TYPE OF REACTION INDEX)

Other routes

- Acetic anhydride–Sodium acetate, 6, 5
- Dicyclohexylborane, 11, 172
- Sodium bromate, 1, 1055
- 1,1,3,3-Tetramethylbutyl isocyanide, 5, 650

ω -HYDROXY

- Dimethyl sulfoxide, **2**, 157
- Hexahydro-4,4,7-trimethyl-4*H*-1,3-benzothiin, **12**, 237
- Hydrogen peroxide, **9**, 241
- Ozone, **7**, 269
- Permalleic acid, **12**, 379
- Sodium benzeneselenoate, **11**, 475

HYDROXY ESTERS AND LACTONES

(see also CHIRAL COMPOUNDS)

 α -HYDROXY

- by Hydroxylation α to C=O (see TYPE OF REACTION INDEX)
- by Reduction of α -keto esters
 - Aluminum amalgam, **1**, 20
 - (2*S*,4*S*)-*N*-(*t*-Butoxycarbonyl)-4-(diphenylphosphino)-2-[(diphenylphosphino)methyl]pyrrolidine, **8**, 57; **11**, 87
 - Lithium aluminum hydride, **11**, 293
 - 8-Phenylmenthol, **11**, 412; **12**, 389
 - B-3-Pinanyl-9-borabicyclo[3.3.1]nonane, **11**, 429; **12**, 397
 - Potassium *t*-butoxide, **1**, 911
 - Triethoxysilane, **11**, 554

Other routes

- m*-Chloroperbenzoic acid, **10**, 92
- B-Crotyl-9-borabicyclo[3.3.1]nonane, **12**, 81
- 2-Lithio-2-methylthio-1,3-dithiane, **7**, 191
- Lithium diisopropylamide, **8**, 292
- Tin(IV) chloride, **11**, 522
- Titanium(IV) chloride, **12**, 494
- Tributylcrotyltin, **12**, 513
- (-)-4,6,6-Trimethyl-1,3-oxathiane, **8**, 508
- Tris(phenylthio)methyl lithium, **11**, 591

 β -HYDROXY

- by Aldol-type reaction (see TYPE OF REACTION INDEX)
- by Reformatsky reaction
 - Chlorotrimethylsilane, **12**, 126
 - Diethylaluminum chloride, **8**, 164
 - Indium, **6**, 293
 - Magnesium, **1**, 627
 - Reformatsky reagent, **3**, 334; **5**, 753; **8**, 533
 - Trimethyl borate, **3**, 310
 - Zinc, **1**, 1285; **6**, 672; **11**, 598

Other routes

- Aluminum amalgam, **1**, 20
- Di- μ -carbonylhexacarbonyldicobalt, **1**, 224
- Dimethylphenylsilyllithium, **12**, 210
- (4*S*,5*S*)-2-Ethyl-4-(methoxymethyl)-5-phenyloxazoline, **11**, 232
- Ketene, **6**, 11
- Lithium aluminum hydride-Silica, **11**, 293
- Lithium dimethylcuprate, **3**, 106
- Menthyl *p*-toluenesulfinate, **12**, 295
- Periodates, **1**, 809
- Raney nickel, **9**, 405
- Titanium(IV) chloride, **12**, 494
- Tributyltin hydride, **12**, 516
- 2,4,4-Trimethyl-2-oxazoline, **3**, 313; **5**, 714
- Zinc borohydride, **10**, 460
- Zinc chloride, **8**, 536

 γ -HYDROXY

- (*t*-Butoxycarbonylmethyl)-diethylaluminum, **7**, 107
- Diethylaluminum ethoxyacetylde, **7**, 103
- Diisopinocampheylborane, **5**, 283
- 1-Ethoxy-1-trimethylsilyloxy-cyclopropane, **8**, 219
- Lithium lithioacetate, **7**, 113
- Ozone, **6**, 436
- Palladium *t*-butyl peroxide trifluoroacetate, **12**, 88
- Titanium(IV) chloride, **12**, 494

HYDROXYLAMINES AND DERIVATIVESBY REDUCTION OF RNO_2 , $\text{R}_2\text{C}=\text{NOH}$
(see TYPE OF REACTION INDEX)**OTHER ROUTES**

- m*-Chloroperbenzoic acid, **5**, 120
- Dibenzoyl peroxide, **12**, 157
- Hydrogen peroxide-Sodium tungstate, **12**, 246

ALKOXYAMINES

- N*-Hydroxyphthalimide, **7**, 177
- Sodium cyanoborohydride, **11**, 481
- Sodium hydroxide, **5**, 616
- Triphenylphosphine-Diethyl azodicarboxylate, **7**, 404

HYDROXY NITRILES (see also CYANOHYDRINS) **β -HYDROXY**

- Benzenesulfonylnitrile oxide, **9**, 39
- Cyanotrimethylsilane, **5**, 720; **11**, 147

HYDROXY NITRILES (*Continued*)

- Dialkylboryl trifluoromethanesulfonates, 11, 159
- Diethylaluminum cyanide, 1, 244
- Formaldehyde, 1, 1252
- Hydrogen cyanide-Triethylaluminum, 1, 1198
- Lithium diethylamide, 7, 201
- Phase-transfer catalysts, 8, 387
- Tetrabutylammonium fluoride, 12, 458
- Zinc, 8, 532

 γ -HYDROXY

- Ethyl 3-bromo-2-hydroxyiminopropanoate, 9, 212
- Lithium diethylamide, 7, 201
- α -(Phenylsulfinyl)acetonitrile, 11, 418

 β -HYDROXY SELENIDES

- Alumina, 8, 9
- Benzeneselenenic acid, 8, 24, 320
- Benzeneselenenyl halides, 9, 25; 10, 16
- Benzeneselenenyl trifluoroacetate, 5, 522
- Benzeneseleninic acid, 8, 28
- Dimethylaluminum methylselenolate, 8, 182
- Diphenyl diselenide-Copper(II) acetate, 9, 199
- Hydrogen peroxide-Acetoxymethyl methyl selenide, 8, 5
- Methaneselenenic acid, 8, 319
- Phenyl selenocyanate, 8, 119
- N-Phenylselenophthalimide, 9, 366
- Phenyl trimethylsilyl selenide, 9, 496
- Phenyl vinyl selenide, 9, 374
- Sodium benzeneselenoate, 9, 432
- Tris(phenylseleno)borane, 10, 454

HYDROXY SULFUR COMPOUNDS**BISULFITE ADDUCTS**

- Sodium hydrogen sulfite, 1, 1047

HYDROXY SULFIDES

- Acetic anhydride-Trifluoroacetic anhydride, 7, 2
- Alumina, 8, 9
- Benzenesulfenyl chloride, 9, 35
- Dimethyl(methylthio)sulfonium tetrafluoroborate, 11, 204
- Ethanethiol, 6, 16
- Lead tetrakis(trifluoroacetate)-Diphenyl disulfide, 9, 269
- Lithium tri-*sec*-butylborohydride, 12, 286
- Phenylthioacetic acid, 6, 463

Zinc iodide, 10, 462

HYDROXY SULFONES

t-Butylmagnesium chloride, 4, 63

HYDROXY SULFOXIDES

- Lithium aluminum hydride, 11, 289
- (R)-(+)-Methyl *p*-tolyl sulfoxide, 4, 513

HYDROXY THIOLS

- Sodium borohydride, sulfurated, 4, 444; 5, 399

IMIDES

- Acetic anhydride, 6, 4; 8, 228
- Acetyl hexafluoroantimonate, 1, 692
- Bis(methylcyclopentadienyl)tin(II), 12, 201
- Diketene-Iodotrimethylsilane, 10, 151
- Diphenylketene, 5, 278
- Diphenyl-N-*p*-tolylketenimine, 1, 345
- Hexamethylphosphorous triamide, 9, 235
- 1-Hydroxybenzotriazole, 5, 342
- N-Hydroxymethylphthalimide, 1, 484
- Manganese(III) acetylacetonate, 3, 194
- Molybdenum carbonyl, 12, 330
- Ruthenium tetroxide, 6, 504; 7, 315
- Thallium(III) trifluoroacetate, 12, 481
- Triphenylphosphine-Diethyl azodicarboxylate, 7, 404

IMINES**FROM C=O**

- p*-Aminobenzoic acid, 2, 24
- Boron trifluoride etherate, 1, 70
- Butylamine, 2, 286
- Dibutyltin dichloride, 11, 161
- N,N-Dimethyl-*p*-phenylenediamine, 1, 293
- 2,4-Dinitrobenzaldehyde, 1, 318
- α -Methylbenzylamine, 11, 411
- Molecular sieves, 3, 206; 4, 345
- Titanium(IV) chloride, 2, 414; 3, 291

BY OXIDATION OF AMINES

(*see* TYPE OF REACTION INDEX)

OTHER ROUTES

- Cadmium acetate-Zinc acetate, 1, 103
- Chromium(II) chloride, 1, 149
- Dicyclohexylcarbodiimide, 11, 173
- Diethyl N-benzylideneaminomethylphosphonate, 12, 185
- N-(Diphenylmethylene)methylamine, 8, 210
- Iron carbonyl, 6, 304

- Picryl azide, **1**, 885
 Raney cobalt catalyst, **1**, 977
 Titanium(III) chloride–
 Diisobutylaluminum hydride, **9**, 467
p-Toluenesulfonyl chloride, **1**, 1179
 Triphenylphosphine, **11**, 588

IMINO ETHERS, THIOETHERS

- 1,4-Diazabicyclo[2.2.2]octane, **2**, 99
 Diazidotin dichloride, **10**, 120
 Diazomethane, **9**, 135
 Dimethyl sulfate, **1**, 294
 Methyl fluorosulfonate, **6**, 381; **8**, 340
 Sodium borohydride, **5**, 597
 Triethyl orthoformate, **1**, 1204
 Triethyloxonium tetrafluoroborate, **1**, 1210; **2**, 430

ISOCYANATES

FROM RNH₂

- N,N'-Carbonyldiimidazole, **1**, 114
 Oxalyl chloride, **4**, 361
 Palladium(II) chloride, **1**, 782
 Phosgene, **1**, 856

FROM RCOOH AND RCOX

- Azidotrimethylsilane, **5**, 719; **10**, 14
 2-Halopyridinium salts, **9**, 234
 Lead tetraacetate, **1**, 537; **4**, 278; **6**, 313
 Sodium azide, **1**, 1041, 1225
 Tetrabutylammonium azide, **6**, 563
 Tributyltin azide, **7**, 377
 2,4,6-Triphenylpyrylium salts, **7**, 408; **8**, 520

OTHER ROUTES

- Carbon monoxide, **3**, 41
 2-Chloro-3-ethylbenzoxazolium
 tetrafluoroborate, **8**, 90
 Chlorotrimethylsilane, **2**, 435
 Cyanic acid, **1**, 170
 Cyanogen chloride, **4**, 110
 Dimethyl sulfoxide, **1**, 296; **3**, 119
 Iodine isocyanate, **3**, 161
 Oxalyl chloride, **1**, 767
 Palladium(II) chloride, **5**, 500
 Phosgene, **5**, 532
 Sulfur dioxide, **8**, 464
 Tetrahydro-2*H*-1,3-oxazine-2-one, **6**, 570
 Toluene diisocyanate, **1**, 1171

ISOCYANIDES

BY DEHYDRATION OF FORMAMIDES

- 1,1'-Carbonylbis(3-imidazolium)
 bismethanesulfonate, **11**, 112

- 2-Chloro-3-ethylbenzoxazolium
 tetrafluoroborate, **8**, 90; **9**, 105
 Diphosgene, **8**, 214
 Ethyl formate, **1**, 380
 Formic acid, **1**, 404
 Phenyl isocyanide, **1**, 843
 Phosgene, **1**, 856
 Phosphoryl chloride, **1**, 876, 924
 Thionyl chloride, **4**, 503
p-Toluenesulfonyl chloride, **1**, 1179
 Triphenylphosphine, **4**, 548, 553
 Triphenylphosphine dibromide, **3**, 320
 Vilsmeier reagent, **4**, 186

BY HOFMANN CARBYLAMINE REACTION (see TYPE OF REACTION INDEX)

OTHER ROUTES

- (Bromodichloromethyl)phenylmercury,
 1, 851
 Cyanotrimethylsilane, **11**, 147; **12**, 148
 Diethyl isocyanomethylphosphonate, **4**, 271
 Methylketene diethyl acetal, **1**, 685
 3-Methyl-2-phenyl-1,3,2-
 oxazaphospholine, **2**, 323
 Silver cyanide, **1**, 1006; **8**, 442
 Sodium hypobromite, **7**, 336
 1,1,3,3-Tetramethylbutyl isocyanide, **9**, 458
 Trichlorosilane–Triethylamine, **11**, 553
 Triethyl phosphite, **1**, 1212

ISOTHIOCYANATES

- Carbon disulfide, **5**, 94; **6**, 95
 Dicyclohexylcarbodiimide, **3**, 91
 2-Halopyridinium salts, **9**, 234
 Phenyl isocyanide, **1**, 843
 Sulfur, **5**, 632
 Thiophosgene, **5**, 667
 2,2,2-Trichloro-1,3,2-
 benzodioxaphosphole, **2**, 63

KETALS (see ACETALS AND KETALS)

KETENES

- Copper(II) acetylacetonate, **2**, 81
 Mercury(II) oxide, **1**, 655
 Phosphorus, red, **1**, 861
 Triethylamine, **1**, 1198; **4**, 527
 Trifluoroacetic anhydride, **1**, 1221
 Triphenylphosphine, **2**, 443
 Zinc, **1**, 1286; **6**, 672

KETENE DERIVATIVES

KETENE DERIVATIVES (Continued)

O,O-ACETALS AND KETALS
(Diethoxymethyl)diphenylphosphine
oxide, 12, 181

3,3-Diethoxy-1-methylthiopropyne, 5,
207

2,2-Diethoxyvinylidenetriphenyl-
phosphorane, 5, 209

Ethylene glycol, 1, 375

Potassium *t*-butoxide, 1, 911; 2, 336

Tetracyanoethylene, 1, 1133

O,S-ACETALS AND KETALS

Methoxy(phenylthio)trimethyl-
silylmethane, 12, 317

S,S-ACETALS AND KETALS

from RCHO, R₂CO

Bis(methylthio)(trimethylsilyl)-
methylolithium, 6, 53

Chloramine-T, 7, 58

Diethyl (1,3-dithian-2-yl)phosphonate,
8, 89

Dimethyl bis(methylthio)methyl-
phosphonate, 7, 125

1,3-Dithian-2-ylidenetriphenyl-
phosphorane, 8, 89

1,3-Dithiolan-2-yltriphenyl-
phosphonium tetrafluoroborate, 10,
176

Ethyl ethylthiomethyl sulfoxide, 5, 299

2-Lithio-2-trimethylsilyl-1,3-dithiane,
4, 284; 5, 374; 6, 320

Lithium iodide, 12, 282

from RCOOR'

Aluminum thiophenoxide, 9, 15

Bis(dimethylaluminum)

1,2-ethanedithiolate, 5, 35

Bis(dimethylaluminum)

1,3-propanedithiolate, 6, 49

Other routes

Carbon disulfide-Methyl iodide, 5, 95;
9, 94

Dimethylsulfonium methylide, 5, 254

Diphosphorus tetraiodide, 11, 224

Grignard reagents, 11, 245

Lead tetraacetate, 9, 265

Lithium diisopropylamide, 8, 292

Lithium dimethylcuprate, 5, 234

Methyl iodide-1,3-Propanedithiol, 9,
308

1-Phenylthiovinylolithium, 8, 281

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methylolithium, 12, 317

Triethylsilyl perchlorate, 12, 527

Trimethylsilyl trifluoromethane-
sulfonate, 7, 390

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(see DICARBONYLS)

KETONES—GENERAL METHODS (see

also α,β -ACETYLENIC CARBONYLS,
ALLENIC CARBONYLS, CHIRAL
COMPOUNDS, DICARBONYLS,
UNSATURATED ALDEHYDES
AND KETONES)

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t-Butylhydrazine, 12, 87

N,N-Diethylaminoacetonitrile, 9, 159

Diethyl 1-trimethylsilyloxyethyl-
phosphonate, 9, 165

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acetonitrile, 7, 123

Disodium tetracarbonylferrate, 4, 461

1,3-Dithiane, 2, 182

Ethyl ethylthiomethyl sulfoxide, 5, 299

Lithium di(α -methoxyvinyl)cuprate, 6,
204

α -Methoxyvinylolithium, 9, 304

Methyl methylthiomethyl sulfone
(or sulfoxide), 5, 456; 11, 242

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butylformamidine, 11, 347

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silylmethane, 10, 314

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 Iron carbonyl, **8**, 265
 Lithium aluminum hydride, **9**, 274
 Nickel carbonyl, **4**, 353; **12**, 335
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 Organotitanium reagents, **12**, 54, 110
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 N,O-Dimethylhydroxylamine, **11**, 201
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 1-Chloro-N,N,2-trimethylpropenylamine, **12**, 123
 Chlorotrimethylsilane, **12**, 126
 Methyl lithium, **1**, 686; **2**, 274
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 Arene(tricarbonyl)chromium complexes, **6**, 103
 Benzyltriethylammonium chloride, **5**, 26
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 Cyanotrimethylsilane, **5**, 720; **6**, 632; **9**, 127
 Lithium diisopropylamide, **4**, 298
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 Sodium hypochlorite, **1**, 1084
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(Continued)

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Hexafluoroantimonic acid, 2, 216

Hydrogen fluoride, 9, 240

Nafion-H, 9, 320

Nitroethane, 4, 357

Polyphosphoric acid, 7, 294

Sodium tetrachloroaluminate, 1, 1027

Tin(IV) chloride, 1, 1111

Trifluoromethanesulfonic acid, 5, 701

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FROM HALOHYDRINS AND RELATED SUBSTRATES

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Lithium aluminum hydride—Aluminum chloride, 8, 289

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Perchloric acid, 2, 309

Pyridinium chloride, 1, 964

Silver carbonate—Celite, 5, 577

Silver(I) nitrate, 2, 366

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BY HYDRATION OF $C \equiv C$

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9-Borabicyclo[3.3.1]nonane, 9, 57

Catecholborane, 4, 69

Chlorosulfonyl isocyanate, 3, 51

Dichloroborane diethyl etherate, 5, 191

Diethoxymethylsilane, 12, 182

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Mercury(II) acetate, 1, 644

Monochloroborane diethyl etherate, 5, 465

Nafion-H, 9, 320

Phenylmercuric hydroxide, 11, 415

Thallium(III) acetate, 7, 360

BY HYDROACYLATION OF $C=C$

Azobisisobutyronitrile, 1, 45

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Disodium tetracarbonylferrate, 6, 550

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(see TYPE OF REACTION INDEX)

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(see TYPE OF REACTION INDEX)

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Chlorohydridotris(triphenylphosphine)-ruthenium(II), 6, 425

Iridium catalysts, 8, 135

Raney nickel, 10, 339

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Tetracarbonyldi- μ -chlorodirhodium, 10, 382Tris(aquo)hexa- μ -acetato- μ -oxotri-ruthenium(III,III,III) acetate, 6, 425, 650**FROM RNC**

Monochloroborane diethyl etherate, 5, 465

1,1,3,3-Tetramethylbutyl isocyanide, 5, 650

Triphenylmethyl isocyanide, 5, 650; 6, 642

FROM RCN

Acetonitrile, 1, 1291

Boron trichloride, 9, 62

Methoxyacetonitrile, 1, 422

Methylolithium, 8, 342

Triethyl(or Trimethyl)aluminum, 1, 1197; 6, 622

FROM RNO₂*t*-Butyl hydroperoxide, 8, 62*N''*-(*t*-Butyl)-N,N,N',N'-tetramethylguanidinium *m*-iodylbenzoate, 12, 102

Hydrogen peroxide, 10, 201

Oxidiperoxymolybdenum(pyridine)-(hexamethylphosphoric triamide), 11, 218

Oxygen, singlet, 8, 367

Ozone, 5, 491; 8, 374

Propyl nitrite—Sodium nitrite, 5, 565

Sodium hydroxide, 8, 461

Titanium(III) chloride, 4, 506; 5, 669

BY OXIDATION OF ROH, $C=C$, R_2CHX , R_2NH , $-CH_2-$, ROR, $ROSiR_3$

(*see* TYPE OF REACTION INDEX)
 BY OXIDATIVE CLEAVAGE OF C=C,
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 BY OXIDATIVE DECARBOXYLATION
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 BY OXIDATIVE DECARBOXYLATION
 OF α -HYDROXY CARBOXYLIC
 ACIDS, DICARBOXYLIC ACIDS
 2-Chloro-3-ethylbenzoxazolium
 tetrafluoroborate, 8, 90; 9, 105
 N-Chlorosuccinimide, 8, 103
 Copper carbonate, basic, 4, 101
 Dipotassium tetrachloroplatinate(II), 4,
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 N-Iodosuccinimide, 12, 258
 Lead tetraacetate, 1, 537; 2, 234; 5, 365
 Tetrabutylammonium periodate, 10, 381
 BY OXIDATIVE DECYANATION
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 Bis(trimethylsilyl) peroxide, 12, 63
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 Calcium carbonate, 4, 67
 Ferric chloride, 8, 229
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 Nafion-H, 9, 320
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 BY REARRANGEMENT OF
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 AND RELATED SUBSTRATES
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 Boron trifluoride etherate, 2, 35; 5, 52
 1-Chloro-1-(trimethylsilyl)ethyl lithium,
 8, 277; 11, 128
 Di- μ -carbonylhexacarbonyldicobalt, 1,
 224
 Lithium bromide, 4, 297
 Lithium diethylamide, 1, 610
 Magnesium bromide etherate, 1, 629
o-Nitrophenyl selenocyanate, 10, 278
 Periodic acid, 1, 815
 Sodium hydride, 4, 455
 Tin(IV) chloride, 5, 627
 Tributylphosphine oxide, 1, 1192
 FROM THIONES

Benzeneseleninic anhydride, 8, 29
 Bis(*p*-methoxyphenyl) telluroxide, 9, 50
t-Butyldimethylsilyl ethylnitronate, 12,
 84
 Dimethyl selenoxide, 8, 197
 Dimethyl sulfoxide, 4, 192
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 Bis(phenylthio)methane, 7, 25
 Diethyl lithio-N-benzylideneamino-
 methylphosphonate, 9, 161
 Diethyl methylthiomethylphosphonate,
 3, 97
 Diphenyl-1-(phenylthiovinyl)phosphine
 oxide, 11, 424
 OTHER METHODS
 Arene(tricarbonyl)chromium complexes,
 6, 27
 α -Azidostyrene, 6, 24
 Benzenesulfonyl chloride, 5, 22
 1,3-Benzodithiolium perchlorate, 8, 34
 Bismuth(III) chloride, 7, 24
 1,1-Dibromoalkyllithium reagents, 9,
 138
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 Iron, 2, 229
 1-Lithiocyclopropyl phenyl sulfide, 11,
 284
 Lithium aluminum hydride, 12, 272
 Lithium 2-dimethylaminoethoxide, 10,
 244
 Nitrosyl chloride, 2, 298
 Palladium(II) acetate, 8, 378
 Raney nickel, 12, 422
 2,4,4,6-Tetramethyl-5,6-dihydro-1,3-
 (4*H*)-oxazine, 3, 280; 4, 481
 Tributyltinlithium, 8, 495
 Trifluoroacetic acid, 5, 695
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 ALICYCLIC HYDROCARBONS for
 CYCLOPROPYL KETONES)
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 Arene(tricarbonyl)chromium complexes,
 6, 103
 Benzoyl chloride, 1, 1295
 Bis(1,5-cyclooctadiene)nickel(0), 10, 33
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 Manganese(III) acetylacetonate, 3, 194
 Nafion-H, 9, 320
 Oxygen, 5, 482; 8, 366

KETONES—SPECIFIC TYPES

(Continued)

Polyphosphoric acid, 1, 894

Potassium cryptate[2.2.2], 5, 156

Potassium superoxide, 8, 417

Tetrabutylammonium permanganate, 8, 468

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Acetoacetic acid, 12, 1

Di- μ -bromobis(2-methoxyallyl)-dinickel, 5, 437

Lithium diethylamide, 6, 332

S-(2-Methoxyallyl)-N,N-dimethyldithiocarbamate, 6, 364

2-Oxo-3-(triphenylphosphoranylidene)propyllithium, 5, 375

Phenylsulfinylacetone, 5, 524

from Acyl anions + RX

Diethyl 1-trimethylsilyloxyethylphosphonate, 9, 165

7,8-Dimethyl-1,5-dihydro-2,4-benzodithiepin, 6, 216

(1-Lithiovinyl)trimethylsilane, 5, 374

 α -Methoxyvinylolithium, 6, 372; 9, 304

Phenylthioacetic acid, 6, 463

from RCOOH

Acetyl chloride, 8, 86

Chlorotrimethylsilane, 12, 126

Dibenzyl malonate, 1, 198

Di-*t*-butyl malonate, 1, 210

Dimethylzinc, 3, 128

Hydriodic acid, 1, 449; 2, 213

Lithium dimethylcuprate, 3, 106; 4, 177

Magnesium, 1, 627

Meldrum's acid, 10, 252

N-Methanesulfinyl-*p*-toluidine, 2, 269

Methylcopper, 4, 334

Methylolithium, 2, 274

Organotitanium reagents, 12, 54, 110

Phenylsulfonylmethylmagnesium bromide, 2, 166

Sodium methylsulfinylmethylide, 1, 310

Trimethylsilylmethylolithium, 9, 495

Trimethylsilylmethylmagnesium chloride, 5, 724

from Epoxy silanes

1-Chloro-1-(trimethylsilyl)ethylolithium, 11, 128

(1-Lithiovinyl)trimethylsilane, 5, 374

from RCN

Methylolithium, 8, 342

Trimethylaluminum, 6, 622

by Oxidation of vinyl groups

Allyltrimethylsilane, 10, 6

Bis(acetonitrile)chloronitropalladium(II), 10, 30; 11, 45

[Bis(salicylidene- γ -iminopropyl)]-methylaminocobalt(II), 11, 138

Hydrogen peroxide-Palladium acetate, 10, 203

Jones reagent, 6, 123

Oxotris(*t*-butylimido)osmium(VIII), 8, 206Palladium *t*-butyl peroxide trifluoroacetate, 10, 299

Palladium(II) chloride, 10, 300; 11, 396; 12, 380

Platinum *t*-butyl peroxide trifluoroacetate, 11, 430

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Acetaldoxime, 1, 3

Acetic acid, 1, 1291

Acetone, 6, 518

2-Acetoxy pyridine, 1, 9

Acetyl chloride-Aluminum chloride, 1, 131, 1295

Acetyl hexafluoroantimonate, 1, 692

Acetyl methanesulfonate, 5, 5

Azobisisobutyronitrile, 1, 45

Cyclodextrins, 6, 151

Dicarbonylbis(triphenylphosphine)-nickel, 10, 125

2,3-Dichloro-5,6-dicyano-1,4-benzoquinone, 10, 135

Diethyl (1-methylthio)ethylphosphonate, 4, 151

Dimethylacetamide, 1, 270

Diphenyl disulfide, 6, 235

Ethyl 2-phenylsulfinylacetate, 6, 256

Lead tetraacetate, 1, 537

Lithium acetylides, 6, 324

 α -Methoxyethylidenetriphenylphosphorane, 1, 669

Phenylmercuric hydroxide, 11, 415

Potassium permanganate, 1, 942

Potassium tetracarbonylhydridoferrate, 6, 483; 8, 419

Thallium(III) acetate, 7, 360

KETONES— α -SUBSTITUTED (see also AMINO CARBONYLS, DIAZO

COMPOUNDS, HALO ALDEHYDES
AND KETONES, HYDROXY
ALDEHYDES AND KETONES,
NITRO COMPOUNDS)

α -ACETOXY

- m*-Chloroperbenzoic acid, **8**, 97
- N,N-Dimethylhydrazine, **7**, 126
- Lead tetraacetate, **1**, 541; **2**, 234; **5**, 365;
6, 4; **7**, 185
- Manganese(III) acetate, **7**, 221; **12**, 292
- Mercury(II) acetate, **1**, 644
- Tetrabutylammonium fluoride, **9**, 446
- Tetramethylammonium acetate, **1**, 1142
- Thallium(III) acetate, **2**, 406
- p*-Toluenesulfonic acid, **1**, 1172
- Triethylamine, **1**, 1198
- Trimethyloxonium tetrafluoroborate, **3**,
314

α -ACYLOXY

- Dibenzoyl peroxide, **1**, 196
- Iodine-Silver carboxylates, **11**, 268
- Lead tetrabenzoate, **7**, 186, 189
- Lithium 2,2,6,6-tetramethylpiperidide, **6**,
345
- Triethylamine, **1**, 1198

α -ALKOXY

- Boron trifluoride etherate, **2**, 35
- t*-Butoxymethyl lithium, **12**, 350
- 2,3-Dichloro-5,6-dicyano-1,4-
benzoquinone, **6**, 168
- N,N-Dimethylhydrazine, **7**, 126
- Disiamylborane, **5**, 39
- Pyridinium chlorochromate, **10**, 334
- Thallium(III) nitrate, **4**, 492

α -ALKYL(OR ARYL)SELENO

by Selenylation of enolates

- Benzeneselenenyl bromide, **5**, 518; **6**,
459; **8**, 25
- Benzeneselenenyl trifluoroacetate, **6**,
459
- Diphenyl diselenide-Selenium
dioxide, **11**, 219
- Phenylseleninyl chloride, **6**, 459
- Selenium, **10**, 345
- Other routes
- Benzeneselenenic anhydride, **9**, 25
- Benzeneselenenyl halides, **7**, 286; **9**, 25;
10, 16
- Benzeneselenenyl trifluoroacetate, **5**,
522
- t*-Butyl hydroperoxide-Diaryl

diselenides, **10**, 65

- Diphenyl diselenide-Bromine-
Hexabutyldistannoxane, **8**, 209
- Phenylselenoacetaldehyde, **9**, 365
- p*-Toluenesulfonylhydrazide, **11**, 537

α -ALKYL(OR ARYL)SULFINYL

- Ethyl phenyl sulfoxide, **6**, 257
- Methyl *p*-toluenesulfinate, **11**, 312
- Methyl *p*-toluenesulfinate, **6**, 400
- Sodium methylsulfinylmethylide, **6**, 6

α -ALKYL(OR ARYL)THIO

by Sulfenylation α to C=O

- Benzenesulfinyl chloride, **9**, 429
- Diphenyl disulfide, **6**, 235; **9**, 429; **10**,
171
- N-Methylthiophthalimide, **11**, 493
- S-Methyl *p*-toluenethiosulfonate, **6**,
400
- Phenyl benzenethiosulfonate, **8**, 391;
9, 429
- Thiophenol, **9**, 447

Other routes

- Bis(phenylthio)methane, **6**, 131; **7**, 25
- Dimethyl disulfide, **8**, 189
- Dimethyl(methylthio)sulfonium
tetrafluoroborate, **11**, 204
- 2,2'-Dipyridyl disulfide, **8**, 214
- 2-Methoxy-3-phenylthio-1,3-
butadiene, **7**, 232
- (Z)-3-Methyl-1-phenylthio-2-tri-
methylsilyloxy-1,3-butadiene, **11**,
344
- S-Methyl *p*-toluenethiosulfonate, **5**,
460
- Phase-transfer catalysts, **11**, 403
- Phenylthiotrimethylsilylmethane, **11**,
423
- Sodium benzeneselenoate, **12**, 439
- p*-Toluenesulfonylhydrazide, **11**, 537

α -AZIDO

- Lead(IV) acetate azides, **4**, 276; **5**, 363
- Lithium azide, **6**, 327
- Phenyl iodine(III) diacetate-
Azidotrimethylsilane, **5**, 354; **6**, 297

α -HYDROPEROXY

- Benzyltrimethylammonium hydroxide,
1, 1252
- Oxygen, **1**, 921; **2**, 341; **7**, 258

α -SILYL

- Butyllithiums, **10**, 76; **12**, 97
- Grignard reagents, **9**, 229

KETONES— α -SUBSTITUTED (*Continued*)

- Hydriodic acid, **8**, 246
- Lithium 1-(dimethylamino)-naphthalenide, **10**, 244
- Magnesium bromide etherate, **7**, 218
- Trimethylsilylmethylolithium, **6**, 635; **9**, 495; **11**, 581
- Trimethylsilylmethylmagnesium chloride, **12**, 540

LACTAMS (*see also* CHIRAL COMPOUNDS)**GENERAL METHODS**

- Bromine, **6**, 70
- Iodine azide, **10**, 211
- p*-Toluenesulfonyl chloride, **6**, 598

 α -LACTAMS

- Catecholborane, **9**, 97
- Potassium *t*-butoxide, **1**, 911
- Sodium hydride, **1**, 1075
- Trifluoromethanesulfonic anhydride, **11**, 560

 β -LACTAMS

- by [2 + 2]Cycloaddition and related reactions
 - Arenesulfonyl halide–Antimony(V) halide complexes, **5**, 20
 - Azidoacetyl chloride, **5**, 21
 - Chlorocyanoketene, **8**, 88
 - Chlorosulfonyl isocyanate, **1**, 117; **3**, 51; **4**, 90; **5**, 132; **6**, 122; **8**, 105; **11**, 125; **12**, 122
 - 1-Chloro-N,N,2-trimethylpropenylamine, **5**, 136
 - Chlorotrimethylsilane, **5**, 709
 - Cyanuric chloride, **10**, 114
 - Dimethylketene, **9**, 185
 - Diphenyl-N-*p*-tolylketenimine, **5**, 282
 - Ketene alkyl trialkylsilyl acetals, **10**, 401
 - Ketene bis(trimethylsilyl)acetals, **12**, 268
 - Methyl(phenylthio)ketene, **8**, 348
 - Sulfur dioxide, **6**, 558
 - Tetramethoxyethylene, **2**, 401
 - Titanium(IV) chloride, **8**, 483
 - p*-Tolylsulfinylacetic acid, **12**, 508
 - Trimethylsilylbromoketene, **7**, 395
 - Triphenylphosphine + co-reagent, **9**, 504; **10**, 447; **11**, 589; **12**, 552
 - Vilsmeier reagent, **12**, 204

by Cyclization

- Benzenesulfonyl chloride, **11**, 39; **12**, 42
- 2-Chloro-1-methylpyridinium iodide, **12**, 116
- Dicyclohexylcarbodiimide, **1**, 231
- Diethylthallium *t*-butoxide, **7**, 108
- Grignard reagents, **10**, 189
- Methoxymethylbis(trimethylsilyl)amine, **12**, 62
- Phase-transfer catalysts, **9**, 356; **10**, 305; **11**, 403
- Sodium hydride, **7**, 335; **9**, 427
- Tetrabutylammonium iodide, **6**, 566
- p*-Toluenesulfonyl chloride, **11**, 536
- Triphenylphosphine–2,2'-Dipyridyl disulfide, **10**, 449

by Oxidation of azetidines

- m*-Chloroperbenzoic acid, **8**, 97
- Oxygen, **7**, 258
- Oxygen, singlet, **8**, 367

Other routes

- Aceto(carbonyl)cyclopentadienyl-(triphenylphosphine)iron, **12**, 1
- Bromine, **11**, 75
- Chromium carbene complexes, **11**, 397
- Ion-exchange resins, **1**, 511; **10**, 220
- Lithium phenylethynolate, **10**, 247
- Manganese(IV) oxide, **5**, 422
- Palladium(II) acetate, **9**, 344
- Periodates, **5**, 507
- Phenyl dichlorophosphate–Dimethylformamide, **11**, 410
- Raney nickel, **8**, 433
- Rhodium(II) acetate, **9**, 406
- Silver(I) nitrate, **4**, 429
- Sodium dicarbonyl(cyclopentadienyl)-ferrate, **8**, 454; **10**, 362
- Tetracarbonyldi- μ -chlorodirrhodium, **12**, 112
- p*-Toluenesulfonyl chloride, **5**, 676
- Zinc, **12**, 567

 γ -LACTAMS

from Amino acids

- Catecholborane, **9**, 97
- Dibutyltin oxide, **12**, 160
- Hexamethyldisilazane, **9**, 234
- o*-Nitrophenyl thiocyanate, **9**, 325
- Raney nickel, **1**, 723

Other methods

- Benzeneselenenyl halides, **12**, 39

Calcium hydride, 1, 105
 Chlorosulfonyl isocyanate, 4, 90
 Dichloroketene, 11, 168
 6,6-Dimethyl-5,7-dioxaspiro[2.5]-
 octane-4,8-dione, 6, 216
 Ion-exchange resins, 1, 511
 Ruthenium tetroxide, 6, 504
 Sodium hydride, 8, 458
 Tetraethylammonium periodate, 9,
 448

δ-LACTAMS

from Amino acids

Ammonium acetate, 7, 11
 Dibutyltin oxide, 12, 160
 Dowtherm A, 1, 353
 Hexamethyldisilazane, 9, 234
o-Nitrophenyl thiocyanate, 9, 325

Other routes

Benzeneselenenyl halides, 12, 39
 Hydrazoic acid, 1, 446
 Mercury(II) acetate, 5, 427
O-Mesitylenesulfonylhydroxylamine,
 5, 430
 Ruthenium tetroxide, 6, 504
 Triethyl orthoformate, 6, 610

ε-LACTAMS

from Amino acids

Dibutyltin oxide, 12, 160
 Hexamethyldisilazane, 9, 234
o-Nitrophenyl thiocyanate, 9, 325

by Beckmann rearrangement

Hydrochloric acid, 5, 333
 Phosphorus(V) oxide—
 Methanesulfonic acid, 5, 535
 Sodium azide, 1, 901
p-Toluenesulfonyl chloride, 9, 472
 Triphenylphosphine, 2, 443

Other routes

Hydrazoic acid, 1, 446; 5, 329
 Hydroxylamine-*O*-sulfonic acid, 10,
 207
 Methyl iodide, 9, 308
N-Phenyl-1,2,4-triazoline-3,5-dione, 4,
 381
 Sodium hydride, 8, 458
p-Toluenesulfonyl chloride, 4, 510

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from Amino acids

Catecholborane, 9, 97
 Dibutyltin oxide, 10, 123
 2-Mesitylenesulfonyl chloride, 8, 318

Tris(dimethylamino)borane, 11, 590

Other routes

Ferrous sulfate, 11, 276
 Nitrosylsulfuric acid, 1, 755
 Oxygen, singlet, 9, 338
 Potassium 3-aminopropylamide, 9,
 378
 Sodium borohydride, 11, 477

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COMPOUNDS, MACROLIDES,
 UNSATURATED LACTONES)

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 Bis(trimethylsilyl) peroxide, 11, 67
 Caro's acid, 1, 118
 Cerium(III) sulfate, 9, 99
m-Chloroperbenzoic acid, 4, 85
 Grignard reagents, 10, 189
 Hydrogen peroxide—Acetic acid, 6, 286
 2-Hydroperoxyhexafluoro-2-propanol,
 3, 149
 Lead tetraacetate, 10, 228; 12, 270
 Peracetic acid, 1, 787; 6, 286
 Potassium peroxomonosulfate, 1, 952
 Ruthenium tetroxide, 10, 343
 Silver carbonate—Celite, 3, 247; 6, 511
 Sodium bromite, 12, 445
 Trifluoroperacetic acid, 1, 821
 Zinc permanganate, 12, 576

α-LACTONES

Iodosylbenzene, 10, 213

β-LACTONES

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 Cinchona alkaloids, 11, 134
 Dichlorobis(triphenylphosphine)-
 palladium(II), 10, 133
 Dichloroketene, 3, 87; 4, 134
 Iron carbonyl, 8, 265
 Ketene, 1, 528
 Lithium phenylethynolate, 6, 343; 7, 210
 Thallium(I) acetate—Iodine, 10, 394
 Trimethyl orthoformate, 3, 313

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by Addition of $-\text{CH}_2\text{COO}-$ to $\text{C}=\text{C}$
 Cerium(IV) acetate, 4, 71
 α-Chloro-*N*-cyclohexylpropanal-
 donitrone, 4, 80
 Dichloroketene, 11, 168; 12, 176
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- propanoate, 9, 212
- Iodotrimethylsilane, 11, 271
- Manganese(III) acetate, 2, 263; 6, 355; 12, 292
- Tributyl(iodoacetoxy)tin, 12, 258
- by Baeyer–Villiger reaction
 - Bis(trimethylsilyl) peroxide, 11, 67
 - m*-Chloroperbenzoic acid, 5, 120
 - Hydrogen peroxide, 3, 155; 4, 254
 - Peracetic acid, 3, 155
 - Potassium dichromate, 6, 124
 - Sodium dichromate, 7, 68
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 - Borane–Dimethyl sulfide, 10, 49
 - (*t*-Butoxycarbonylmethyl)-diethylaluminum, 7, 103
 - t*-Butyl dilithioacetoacetate, 8, 60
 - 2-Chloro-1-methylpyridinium iodide, 12, 116
 - Dicyclohexylcarbodiimide, 1, 231
 - Diethyl succinate, 8, 296
 - Formaldehyde, 7, 158
 - Lithium aluminum hydride, 10, 265
 - Lithium lithioacetate, 8, 175
 - Lithium β -lithiopropionate, 8, 303
 - Lithium naphthalenide, 6, 415
 - (4S,5S)-4-Methoxymethyl-2-methyl-5-phenyl-2-oxazoline, 6, 386
 - Potassium tri-*sec*-butylborohydride, 6, 490
 - p*-Toluenesulfonic acid, 1, 1172
 - Triethyl orthoacetate, 6, 607
 - 2,4,4-Trimethyl-2-oxazoline, 5, 714
 - Triphenylcarbenium tetrafluoroborate, 9, 512
 - Zinc–copper couple, 1, 1292
- from Hydroxy nitriles
 - Diethylaluminum cyanide, 9, 158
 - Lithium aluminum hydride, 11, 289
 - Lithium diethylamide, 7, 201
 - Organoaluminum cyanides, 9, 158
 - Trimethylsilylacetonitrile, 10, 427
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- by Reduction of anhydrides (*see* TYPE OF REACTION INDEX)
- from Unsaturated carboxylic acids
 - Benzeneselenenyl chloride, 8, 25

- Benzenesulfonyl chloride, 8, 32
- Bis(benzonitrile)dichloro-palladium(II), 12, 51
- Bromine, 9, 65; 12, 70
- Chloramine-T, 11, 118
- Chloro(methoxycarbonyl)ketene, 11, 110
- Copper(II) acetate, 5, 156
- Dimethyl sulfoxide–Methanesulfonic anhydride, 9, 191
- Iodine, 8, 256; 11, 261; 12, 253
- Ion-exchange resins, 6, 302
- Lead tetraacetate, 2, 234; 9, 265; 10, 228
- Lithium–Ammonia, 10, 234
- Mercury(II) trifluoroacetate, 9, 294
- Potassium hydride, 12, 407
- Silver(I) nitrate, 12, 433
- Sulfuric acid, 9, 441
- Thallium(I) acetate–Iodine, 10, 394
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 - Allyltrimethylsilane, 8, 273; 10, 5, 8, 430
 - Ammonium persulfate, 6, 20
 - Benzeneselenenyl halides, 12, 39
 - Bis(N-*t*-butylsalicylaldiminato)-copper(II), 12, 52
 - Bis(3-dimethylaminopropyl)-phenylphosphine, 10, 34
 - Bis(trimethylsilyl) sulfate, 11, 67
 - Boron trifluoride etherate, 5, 52
 - t*-Butyl hypoiodite, 1, 94
 - t*-Butyl isocyanide, 11, 99
 - Carbon tetrabromide–Tin(II) fluoride, 11, 111
 - Cobalt(III) acetate, 6, 127
 - Copper(I) bromide, 11, 140
 - 1,5-Diazabicyclo[4.3.0]nonene-5, 4, 116
 - Dichlorobis(cyclopentadienyl)-titanium, 9, 146
 - Dichlorobis(triphenylphosphine)-palladium(II), 10, 133
 - 2,3-Dichloro-1-propene, 8, 158
 - Dihydridotetrakis(triphenylphosphine)ruthenium(II), 11, 182
 - Dimethyl diazomalonate, 5, 244
 - 1-Ethoxy-1-trimethylsilyloxy-cyclopropane, 8, 219
 - Ferric chloride, 9, 222
 - Lead tetraacetate, 7, 185

- Magnesium bromide etherate, **9**, 288
 Mercury(II) acetate, **12**, 298
 Methyl isocyanide, **11**, 11
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 Nickel carbonyl, **12**, 335
 Oxygen, singlet, **4**, 362
 Palladium(0)–Phosphines, **9**, 344
 Perchloric acid, **2**, 309
 Peroxybenzimidic acid, **7**, 281
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 Potassium carbonate, **5**, 552
 Potassium hydride, **8**, 412
 Selenium(IV) oxide, **1**, 992
 Silica, **12**, 431
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 Silver(I) trifluoroacetate, **11**, 471
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 Sulfuric acid, **5**, 633
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 Thallium(III) trifluoroacetate, **9**, 462; **12**, 481
p-Toluenesulfonyl-*S*-methylcarbazate, **5**, 681
 Tributyl(1-methoxymethoxy-2-butenyl)tin, **11**, 325
 Tri- μ -carbonylhexacarbonyldiiron, **6**, 195
 Trifluoromethanesulfonyl chloride, **9**, 485
 Trimethyl phosphonoacetate, **7**, 394
 Zinc, **11**, 598
 Zinc bromide, **11**, 600
- δ -LACTONES**
 by Baeyer–Villiger reaction
 Benzeneperoxyseleninic acid, **8**, 22
 Cerium(IV) ammonium sulfate, **7**, 56
 Hydrogen peroxide, **4**, 254
 Peracetic acid, **1**, 787
 Potassium persulfate, **2**, 348
 Trifluoroperacetic acid, **1**, 821
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 (R)-(+)–*t*-Butyl (*p*-tolylsulfinyl)-acetate, **11**, 106
 2,3-Dichloro-5,6-dicyano-1,4-benzoquinone, **1**, 215
 2,3-Dichloro-1-propene, **8**, 158
 Ethyl lithioacetate, **6**, 255; **8**, 225
 Iodotrimethylsilane, **12**, 259
 4(R)-Methoxycarbonyl-1,3-thiazolidine-2-thione, **11**, 323
 (4*S*,5*S*)-4-Methoxymethyl-2-methyl-5-phenyl-2-oxazoline, **7**, 229; **9**, 312
 (γ -Methoxypropyl)- α -phenylethylamine, **12**, 318
 Oxygen, singlet, **12**, 363
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 B-3-Pinanyl-9-borabicyclo[3.3.1]nonane, **11**, 429
 p-Tolylsulfinylacetic acid, **10**, 405
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- from Hydroxy nitriles
 Mercury(II) acetate, **11**, 315; **12**, 298
 by Oxidation of 1,5-diols, lactols and related compounds (*see* TYPE OF REACTION INDEX)
 by Reduction of anhydrides (*see* TYPE OF REACTION INDEX)
 from Unsaturated acids
 Benzeneselenenyl chloride, **8**, 25
 Bis(acetonitrile or benzonitrile)-dichloropalladium(II), **7**, 21; **12**, 51
 Bromine, **12**, 70
 Iodine, **9**, 248
 S-Methyl *p*-toluenethiosulfonate, **6**, 400
 Pyridinium chlorochromate, **12**, 417
- Other routes
 Arylthallium bis(trifluoroacetates), **10**, 300
 Bis(3-dimethylaminopropyl)phenylphosphine, **10**, 34
 Caro's acid, **1**, 118
 Dichlorobis(cyclopentadienyl)-titanium, **9**, 146; **12**, 168
 Diethyl (1,3-dithian-2-yl)phosphonate, **11**, 179
 Diisobutylaluminum hydride, **9**, 171
 1,3-Dimethoxy-1-trimethylsilyloxy-1,3-butadiene, **12**, 196
 Ethyl vinyl ether, **11**, 235
 Iron carbonyl, **8**, 265
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 Lithium trichloropalladate(II), **12**, 288
 Pyridinium chlorochromate, **8**, 425; **11**, 450
 Rhodium(II) carboxylates, **12**, 423
 Thallium(III) trifluoroacetate, **12**, 481
 Trifluoroacetic acid, **11**, 557
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268Nickel carbonyl, **4**, 353Phenylthioacetyl chloride, **9**, 370Potassium hexamethyldisilazide, **9**, 385Tetrabutylammonium fluoride, **11**, 499Tetrakis(triphenylphosphine)-
palladium(0), **8**, 472; **9**, 451; **12**, 468Thallium(III) trifluoroacetate, **11**, 515**BY BAEYER-VILLIGER REACTION**Peracetic acid, **1**, 787; **4**, 372Permaleic acid, **1**, 819; **12**, 379**FROM CARBOXYLATES WITH** **ω -LEAVING GROUPS**Cerium(III) sulfate, **9**, 99Cesium carbonate, **11**, 114Tetrabutylammonium fluoride, **12**, 458**FROM ω -HYDROXY ACIDS AND****RELATED COMPOUNDS**Alkylaluminum halides, **12**, 5N,N-Bis(2-oxo-3-oxazolidinyl)-
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108Cyanuric chloride, **12**, 1141-Cyclohexyl-3-(2-morpholinoethyl)-
carbodiimide metho-*p*-toluene-
sulfonate, **11**, 151

Dialkylboryl trifluoromethanesulfonates,

12, 1554,4'-Di(2-amino-6-methylpyrimidyl)
disulfide, **9**, 413Dibutyltin oxide, **10**, 123; **12**, 1602,2'-Di(1-isopropyl-4-*t*-butylimidazolyl)
disulfide, **7**, 1414-Dimethylamino-3-buten-2-one, **12**, 198Diphenyl phosphorochloridate, **11**, 2232-Halopyridinium salts, **8**, 95; **9**, 2342-Mesitylenesulfonyl chloride, **6**, 625Oxygen, singlet, **10**, 2941-Phenyl-2-tetrazoline-5-thione, **11**, 420Phosgene, **2**, 328Silver perchlorate, **6**, 519Silver(I) trifluoroacetate, **8**, 444N,N,N',N'-Tetramethylchloro-
formamidinium chloride, **12**, 477Thallium(I) 2-methyl-2-propanethiolate,
6, 581Thionyl chloride, **5**, 6632,4,6-Trichlorobenzoyl chloride, **9**, 478Triphenylphosphine + co-reagent, **5**,
285; **6**, 246; **7**, 404; **8**, 215, 517; **9**, 167;
12, 552**BY OXIDATIVE CLEAVAGE OF
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10, 103Dichloroketene, **9**, 152; **12**, 176N-Methyl-N-phenylaminoethynyl-
lithium, **10**, 2673,3,6,9,9-Pentamethyl-2,10-diazabicyclo-
[4.4.0]decene, **9**, 354N-Phenylselenophthalimide, **9**, 366Pyridinium dichromate, **11**, 453Sodium hydride, **6**, 5411,1,6,6-Tetrabutyl-1,6-distanna-2,5,7,10-
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ESTERS)** **α -METHYLENE ALDEHYDES AND
KETONES****GENERAL METHODS**

- Acetyl chloride-2-Trimethylsilylethanol, 11, 4
- Benzyl bromomethyl sulfide, 5, 25
- Bis(dimethylamino)methane, 7, 359
- Bromine, 11, 75
- Bromomethanesulfonyl bromide, 12, 75
- Chloromethyl phenyl sulfide, 9, 107
- Dicyclohexylcarbodiimide, 4, 141
- Dimethylformamide dineopentyl acetal, 9, 183
- Dimethyl sulfoxide, 1, 296
- Formaldehyde, 5, 314; 6, 264; 8, 231; 12, 232
- Lithium benzeneselenoate, 10, 238
- Lithium (3,3-diethoxy-1-propen-2-yl)-phenylthiocuprate, 7, 212
- Lithium methanethiolate, 8, 303
- Lithium alkyl(phenylthio)cuprates, 7, 212
- Methoxyallene, 8, 320
- Methylenetriphenylphosphorane, 8, 339
- N-Methylthiomethylpiperidine, 12, 326
- Organolithium reagents, 11, 13
- Simmons-Smith reagent, 9, 415
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- α -Methylenecyclobutanones**
- Chloro[(trimethylsilyl)methyl]ketene, 12, 127
- Dimethyl(or Diphenyl)ketene, 5, 278; 6, 223
- Methyl(phenylthio)ketene, 8, 348; 9, 315
- α -Methylenecyclopentanones**
- Di- μ -carbonylhexacarbonyldicobalt, 11, 162
- Methoxyallene, 12, 310
- Raney nickel, 11, 457
- α -Methylenecyclohexanones**
- 2-Methylthiomaleic anhydride, 8, 351
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- GENERAL METHODS**
- by Elimination
- 2-Bromoacrolein, 5, 62
- Hydrogen peroxide, 1, 471
- o*-Nitrophenyl selenocyanate, 6, 420
- Phenylselenomethyl lithium, 6, 549
- Phenylthioacetic acid, 6, 463
- Silver(I) oxide, 5, 583
- Sodium dicarbonyl(cyclopentadienyl)-ferrate, 9, 426
- Tetrabutylammonium fluoride, 9, 444
- Zinc, 1, 1276
- by Methylenation of C=O
- Dibromomethane-Zinc-Titanium(IV) chloride, 11, 337
- Dichloroketene, 4, 134
- Methylenetriphenylphosphorane, 8, 339
- Organotitanium reagents, 8, 83
- Titanium(0), 11, 526
- Triphenylstannyllithium, 9, 509
- Other routes**
- Bis(dimethylamino)methane, 3, 21
- 9-Borabicyclo[3.3.1]nonane, 10, 48
- Bromomethanesulfonyl bromide, 12, 75
- Catecholborane, 10, 79
- Dimethoxymethane, 11, 193
- Lithium dibutylcuprate, 3, 79
- Nickel carbonyl, 6, 417
- Potassium-Ammonia, 9, 377
- 2,4,6-Triisopropylbenzenesulfonylhydrazide, 12, 533
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- Methylenecyclopropanes**
- Potassium *t*-butoxide, 3, 233; 5, 544
- Sodium amide, 5, 591
- Sodium hexamethyldisilazide, 6, 529
- Methylenecyclobutanes**
- Allene, 1, 18; 6, 251
- Methylenecyclopentanes**
- 3-Acetoxy-2-trimethylsilylmethyl-1-propene, 9, 454; 11, 578
- Allyltrimethylsilane, 10, 6; 12, 23
- Bis(acrylonitrile)nickel(0), 3, 20
- 2-Bromomethyl-3-(trimethylsilylmethyl)-1,3-butadiene, 12, 77
- 2-Bromo-3-trimethylsilyl-1-propene, 11, 80
- 4-Chloro-1-butenyl-2-lithium, 12, 113
- 2-Chloromethyl-3-trimethylsilyl-1-propene, 11, 259
- Dibromobis(tributylphosphine)-nickel(II), 5, 42
- Diisobutylaluminum hydride, 7, 111
- 2-Hydroxymethyl-3-trimethylsilyl-1-propene, 11, 258; 12, 252
- 2-Iodomethyl-3-trimethylsilyl-1-propene, 11, 579
- Sodium naphthalenide, 11, 490

METHYLENELACTONES (*see*
UNSATURATED LACTONES)

NITRILES (*see also* AMINO NITRILES,
CHIRAL COMPOUNDS, CYANO
CARBONYLS, CYANOHYDRINS)

ALKYL NITRILES

from RCHO (RCHO $\rightarrow$ RCN)

N-Amino-4,6-diphenylpyridone, 7, 10

O,N-Bis(trifluoroacetyl)-
hydroxylamine, 1, 60

Dicyclohexylcarbodiimide, 5, 206

N,N-Dimethylhydrazine, 1, 289

S,S-Diphenylsulfilimine, 10, 174

Hydrazoic acid, 1, 446

Hydroxylamine, 1, 478; 2, 217; 7, 176;
9, 245

Hydroxylamine-O-sulfonic acid, 6,
290; 9, 245

N-Imino-N,N-dimethyl-2-
hydroxypropanaminium ylide, 8,
256

Manganese(IV) oxide, 4, 317

N-Methyl-2-pyrrolidone, 11, 346

Selenium(IV) oxide, 9, 409

by Dehydration of RCONH₂

Chloroform, 5, 27

Chlorosulfonyl isocyanate, 11, 125

Chlorotris(triphenylphosphine)-
rhodium(I), 3, 325; 5, 736

Dicyclohexylcarbodiimide, 1, 231; 2,
126

Dimethylformamide + co-reagent, 1,
286; 3, 228

Hexamethylphosphoric triamide, 4,
244

Methanesulfonyl chloride, 11, 322

Phosgene, 1, 856

Phosphonitrilic chloride trimer, 4, 386

Phosphorus(V) chloride, 1, 866

Phosphorus(V) oxide, 1, 871; 2, 329

Phosphoryl chloride, 1, 876

Polyphosphate ester, 3, 229

Sodium borohydride, 3, 262

Sodium tetrachloroaluminate, 1, 1027

Thionyl chloride, 1, 1158

p-Toluenesulfonyl chloride, 1, 1179

2,2,2-Trichloro-1,3,2-benzodioxo-
phosphole, 1, 120

(Trichloromethyl)carbonimidic
dichloride, 4, 523

Triethoxydiiodophosphorane, 9, 480

Triethyloxonium tetrafluoroborate, 2,
430

Trifluoroacetic anhydride-Pyridine, 8,
504

Triphenylphosphine bis(trifluoro-
methanesulfonate), 6, 648

Triphenylphosphine-Carbon
tetrachloride, 3, 320

by Dehydration of RNHOH are related
substrates

N,N'-Carbonyldiimidazole, 5, 97

Chlorodimethylsulfoxonium chloride,
6, 229

Chloroform, 5, 27

1-Chlorosulfinyl-4-dimethylamino-
pyridinium chloride, 12, 122

Cyanuric chloride, 4, 522

Dichloromethylenedimethyl-
ammonium chloride, 6, 170

O-2,4-Dinitrophenylhydroxylamine, 6,
233

Diphenyl phosphorochloridate, 3, 133

N-Ethylacetoneitrilium

tetrafluoroborate, 6, 250

Hexamethylphosphoric triamide, 5,
323

Hydroxylamine, 1, 478; 9, 245

Hydroxylamine-O-sulfonic acid, 6,
290; 9, 245

Methyl isocyanate, 4, 341

Methylketene diethyl acetal, 1, 685

N-Methyl-2-pyrrolidone, 11, 346

Phenyl chlorosulfite, 6, 456

Phenyl isocyanate, 1, 842

Phosphorus(III) iodide, 10, 318

Selenium(IV) oxide, 9, 409

Titanium(IV) chloride, 4, 507

Triethoxydiiodophosphorane, 9, 480

Triethyl orthoformate, 6, 610

Trifluoroacetic anhydride-Pyridine, 8,
504; 9, 484

Trifluoromethanesulfonic anhydride,
7, 390

Trifluorooperacetic acid, 1, 821

Trimethylamine-Sulfur dioxide, 9,
488

Triphenylphosphine-Carbon
tetrachloride, 5, 727

Vilsmeier reagent, 10, 457; 12, 204

by Displacements of RX, RO₂R', etc.

Benzyltrimethylammonium cyanide, **1**, 53
 18-Crown-6, **6**, 135
 Cyanotrimethylsilane, **11**, 147
 2-Halopyridinium salts, **9**, 234
 N-Methyl-2-pyrrolidone, **1**, 696
 Potassium cyanide, **6**, 406; **7**, 299; **10**, 324
 Sodium cyanide, **1**, 17, 297, 516, 1088; **2**, 445; **6**, 38; **7**, 109, 170; **11**, 481
 Tetraethylammonium cyanide, **6**, 569
 Triphenylphosphine-Diethyl azodicarboxylate, **7**, 404
 by Hydrocyanation of $C \equiv C$
 Di- μ -carbonylhexacarbonyldicobalt, **1**, 224
 Hydrogen cyanide, **9**, 239
 from RNO_2
 Diphosphorus tetraiodide, **9**, 203
 Iodotrimethylsilane, **12**, 259
 Phosphorus(III) chloride, **8**, 400
 Phosphorus(III) iodide, **10**, 318
 Sodium borohydride, sulfurated, **4**, 444
 Trimethylamine-Sulfur dioxide, **9**, 488
 by Oxidation of RNH_2 (see TYPE OF REACTION INDEX)
 by Reductive cyanation of $C=O$ and related compounds (see TYPE OF REACTION INDEX)
 Other routes
 Acetonitrile, **2**, 209
 Acrylonitrile, **7**, 4
 Bis(tributyltin) oxide, **11**, 62
 Bromine, **8**, 52
 t-Butoxybis(dimethylamino)methane, **9**, 246
 Chloroacetonitrile, **3**, 235
 Chloroform, **5**, 27
 Chlorosulfonyl isocyanate, **3**, 51
 Cyanogen chloride, **1**, 176
 Cyanotrimethylsilane, **12**, 148
 Dimethylaluminum amides, **9**, 177
 Dimethyl(methylthio)sulfonium tetrafluoroborate, **11**, 204
 Disodium tetracyanonickelate(II), **9**, 207
 Ethoxycarbonylformonitrile oxide, **7**, 145
 Ethyl diazoacetate, **2**, 193

Hydroxylamine, **6**, 400
 Lithium diethylamide, **7**, 201
 Methanesulfonyl chloride, **5**, 435; **11**, 322
 Phenyl isocyanate, **7**, 284
 (Phenylsulfonyl)nitromethane, **11**, 419
 Phosphonitrilic chloride trimer, **5**, 322; **6**, 469
 Succinonitrile, **4**, 241
 Trimethyl phosphite, **1**, 1233
 Triphenylmethyl isocyanide, **5**, 650; **6**, 642
 Triphenylphosphine, **1**, 1238
ARYL NITRILES
 from $ArCHO$
 Nitroethane-Pyridinium chloride, **11**, 359
 1-Nitropropane, **1**, 745
 from ArX
 Copper(I) cyanide, **1**, 278, 391, 696, 960
 Sodium cyanide, **9**, 423
 Sodium dicyanocuprate, **3**, 265
 by Cyanation of ArH
 Arylthallium bis(trifluoroacetates), **12**, 483
 Chlorosulfonyl isocyanate, **2**, 70
 Copper(I) cyanide, **5**, 166
 Palladium(II) acetate, **5**, 496
 Thallium(III) trifluoroacetate, **3**, 286
 Triphenylphosphine-Thiocyanogen, **8**, 518
 Other routes

p-Chlorophenyl chlorothionoformate, **3**, 50

 Cyanotrimethylsilane, **11**, 147; **12**, 148
 Dicyanoacetylene, **4**, 140
 N,N-Diethylaminopropyne, **8**, 165
 Diethyl phosphorocyanidate, **10**, 145
 Hydridotris(triisopropylphosphine)-rhodium(I), **9**, 238
 Hydrogen peroxide, **2**, 217
 Iron carbonyl, **5**, 357
 Lead(IV) acetate azides, **4**, 276
 Lead tetraacetate, **5**, 365
 Nickel peroxide, **1**, 731
 Silver(II) oxide, **2**, 369
 Tetrakis(triphenylphosphine)-palladium(0), **6**, 571
 Trichloroacetonitrile, **5**, 686
 Triethyl orthoformate, **6**, 610

NITRILES (*Continued*)

Triphenylphosphine dichloride, 6, 646

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N-Bromosuccinimide, 2, 40

Phenyl isocyanate, 10, 309; 12, 386

Sodium hypobromite, 2, 383

p-Toluenesulfonic acid, 12, 507**NITRO COMPOUNDS****NITRO ALDOLS**

Dicyclohexylcarbodiimide, 11, 173

Nitromethane, 1, 515, 739; 9, 323; 12, 337, 462

Sodium ethoxide, 1, 1065

Tetrabutylammonium fluoride, 9, 444; 10, 378; 11, 499

Titanium(IV) chloride, 4, 507

NITROALKANESby Addition of NO₂, X to C=C

Benzeneselenenyl bromide–Silver nitrate, 11, 33

Nitrogen dioxide–Iodine, 2, 225; 3, 130; 8, 205

Nitronium tetrafluoroborate, 4, 358

Nitrosyl chloride, 2, 298

Nitryl chloride, 1, 756

Nitryl iodide, 1, 757; 2, 300

Pyridinium poly(hydrogen fluoride), 5, 538

Silver nitrite–Mercury(II) chloride, 11, 467

by Displacement

Hexafluoroantimonic acid, 6, 272

Potassium nitrite, 6, 135

Silver nitrite, 1, 1011

by Oxidation of RNH₂, RNO, etc.

(see TYPE OF REACTION INDEX)

Other routes

Hypochlorous acid, 10, 208

Lithium diisopropylamide, 3, 184

Lithium tri-*sec*-butylborohydride, 12, 286

Methyl nitrate, 1, 691

Nitric acid, 4, 356

Nitrogen dioxide, 1, 324

Ozone, 12, 365

Sodium borohydride, 1, 1049

Trifluoroacetic acid, 1, 821

NITROALKENES

from C=C

Benzeneselenenyl bromide–Silver nitrate, 11, 33

Mercury(II) nitrite, 9, 292

Nitrogen dioxide, 1, 324; 2, 175, 225; 3, 130; 8, 205

Nitrosyl chloride, 1, 748; 2, 298

Nitryl chloride, 1, 756

Nitryl iodide, 1, 757; 2, 300

Pyridinium poly(hydrogen fluoride), 5, 538

Silver nitrite–Mercury(II) chloride, 11, 467

Other routes

Benzeneselenenyl halides, 10, 16

Dicyclohexylcarbodiimide, 11, 173

Nitromethane, 1, 739; 12, 337

Tetranitromethane, 10, 392

Trifluoroacetic acid, 8, 505

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Arenediazonium tetrahaloborates, 1, 43

Sodium nitrite, 1, 1097

Tetrafluoroboric acid, 1, 394

by Nitration of ArH (see TYPE OF REACTION INDEX)

by Oxidation of ArNH₂, ArNO

(see TYPE OF REACTION INDEX)

NITRO CARBONYL COMPOUNDS α -Nitro

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Amyl nitrite, 1, 923

Isoamyl nitrate, 1, 40; 2, 25

Lithium aluminum hydride, 12, 272

Nitryl chloride, 1, 756

Polyphosphoric acid, 1, 894

Potassium amide, 2, 336

Potassium dichromate, 12, 405

Pyridinium chlorochromate, 12, 417

Sodium hydride, 1, 1075

Sodium nitrite, 1, 298

Trifluoroacetyl nitrate, 12, 530

 γ -Nitro

Benzyltrimethylammonium hydroxide, 1, 1252

(S)-(+) -2-Methoxymethylpyrrolidine, 11, 326

Nitromethane, 8, 129, 430; 9, 447

2-Nitropropane, 5, 685

Potassium fluoride, 6, 481

1,1,3,3-Tetramethylguanidine, 1, 1145; 4, 489

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 N,N-Dimethyl-4-nitrosoaniline, 1, 746
 Hydrogen peroxide-Sodium tungstate,
 12, 246
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 N-Methylhydroxylamine, 12, 322
 N-Methylhydroxylamine-O-sulfonic
 acid, 8, 341
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NITROSO COMPOUNDS

BY NITROSATION

Sodium dithionite, 1, 1081
 Thallium(III) trifluoroacetate, 5, 658

BY OXIDATION OF RNH₂, RNHOH (see TYPE OF REACTION INDEX)

N-NITROSO COMPOUNDS

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 2-Nitroprop-2-yl hydroperoxide, 3, 213
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 Nitrosyl chloride, 1, 748; 7, 254
 Nitrosylsulfuric acid, 2, 299
 Silver nitrite, 6, 515
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O-*t*-Butyldimethylsilylhydroxylamine,
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m-Chloroperbenzoic acid, 5, 120
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NUCLEOSIDES

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 2, 29
 Mercury(II) cyanide, 3, 197
 Phase-transfer catalysts, 11, 403
 Polyphosphate ester, 1, 892
 Tin(IV) chloride, 11, 522
 Trimethylsilyl perchlorate, 6, 639
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 sulfonate, 10, 438

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 Bis(*p*-nitrophenyl) hydrogen phosphate,
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Bis(2,2,2-trichloroethyl)
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 phosphate, 6, 207
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 Phosphoryl chloride, 3, 228, 229
 Polyphosphoric acid, 1, 894
 Pyrophosphoryl chloride, 1, 971
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 1148

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 azodicarboxylate, 4, 553

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 415
p-Nitrophenyl chloroformate, 2, 297
 Sodium triphenylmethoxyacetate, 5, 627
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 423
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2,6-Dimethylpyridine, 1, 626
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N-Ethyl-5-phenylisoaxazolium-3'-

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Hexamethylphosphoric triamide, **3**, 149
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6, 288
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N-Hydroxy-5-norbornene-2,3-
dicarboximide, **6**, 290
N-Hydroxyphthalimide, **1**, 485
N-Hydroxypiperidine, **1**, 486
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2, 219
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N-Methyl-N,N'-di-*t*-butylcarbodiium
tetrafluoroborate, **6**, 378
N-Methylmorpholine, **2**, 278
N-Methyl-N-phenylbenzohydrazonyl
bromide, **10**, 269
4-(4'-Methyl-1'-piperazinyl)-3-butyne-
2-one, **8**, 348
2-Morpholinoethyl isocyanide, **11**, 352
5-Nitro-[3*H*]-1,2-benzoxathiole
S,S-dioxide, **11**, 359
(5-Nitropyridyl)diphenyl phosphinate,
11, 361
Nitrosyl chloride, **1**, 748
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phosphonium] bis(tetrafluoro-
borate), **6**, 425
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4-Pyrrolidinopyridine, **10**, 336
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1125

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Tetraethyl pyrophosphite, **1**, 1138; **2**, 397
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1,3-Thiazolidine-2-thione, **12**, 485
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acid, **10**, 398
Thioglycolic acid, **1**, 1153; **7**, 366
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Tin(II) chloride, **2**, 389
1,2,4-Triazole, **1**, 1188; **2**, 423
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Triethylsilane, **1**, 1218
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Tri-*p*-nitrophenyl phosphorotrithioite, **1**,
1237
Triphenylphosphine + co-reagent, **2**,
443; **3**, 322; **4**, 551
Triphenyl phosphite, **3**, 322
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GENERAL METHODS

from 1,3-Dienes

Hydrogen peroxide-Cerium(IV)
oxide, **6**, 99

Lithium diisopropylamide, **7**, 204

Oxygen, **5**, 482

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431; **7**, 261; **8**, 173, 367; **9**, 338; **11**,
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tetrafluoroborate, **4**, 565

Triphenyl phosphite ozonide, **3**, 323

Other routes

Di-*t*-butylperoxyoxalate, **7**, 93

Hydrogen peroxide, **1**, 457; **5**, 337; **7**,
175; **10**, 201

Hydrogen peroxide + co-reagent, **7**,
224; **8**, 248

Potassium superoxide, **6**, 488

Silver carbonate-Celite, **3**, 247

Tributyltin hydride, **11**, 545

DIACYL PEROXIDES

Bis(tributyltin) peroxide, **8**, 44

Diacyl peroxides, **1**, 186

Dicyclohexylcarbodiimide, **1**, 231

Hydrogen peroxide-Silver
trifluoroacetate, **8**, 249; **10**, 203

Ketene, **1**, 528

PEROXIDES (*Continued*)

- Perbenzoic acid, **8**, 386
- Potassium superoxide, **7**, 304; **8**, 417
- Silver acetate, **8**, 45

PEROXY ACIDS AND ESTERS

- t*-Butyl hydroperoxide, **1**, 88
- N,N'-Carbonyldiimidazole, **1**, 114
- Hydrogen peroxide, **1**, 457; **7**, 174
- Ketene, **1**, 528
- Methanesulfonic acid, **1**, 666
- Silver diethyl phosphate, **4**, 428
- Sodium methoxide, **1**, 1091

PHENOLS

**BY AROMATIZATION OF
CYCLOHEXANONES, -ENONES**
(*see* TYPE OF REACTION INDEX)

FROM ArX

- Borane-Tetrahydrofuran, **4**, 124
- t*-Butyl hydroperoxide, **1**, 88
- 2-*t*-Butylperoxy-1,3,2-dioxaborolane, **12**, 101
- Copper(II) sulfate, **1**, 164
- Dimethyl sulfoxide, **4**, 192
- Peroxytetrakis(triphenylarsine)-rhodium(I) hexafluorophosphate, **8**, 206
- Potassium superoxide, **7**, 304; **8**, 417
- Sodium methoxide, **6**, 147
- Trimethyl borate, **1**, 673; **2**, 435

BY CLAISEN REARRANGEMENT

- Acetic anhydride-Sodium acetate, **7**, 2
- Benzylamine, **10**, 26
- Boron trichloride, **5**, 50
- Sodium dithionite, **11**, 485
- Titanium(IV) chloride, **7**, 370
- Trifluoroacetic acid, **4**, 530
- Zinc chloride, **10**, 461

BY DAKIN REACTION (*see* TYPE OF REACTION INDEX)**BY DEALKYLATION OF ArOR**

(*see* TYPE OF REACTION INDEX)

BY DIELS-ALDER REACTION

- 1,4-Dihydronaphthalene-1,4-*endo*-oxide, **1**, 255
- 1,1-Dimethoxy-1-trimethylsilyloxy-1,3-butadiene, **8**, 178
- Dimethyl methoxymethylenemalonate, **12**, 206
- Homophthalic anhydride, **11**, 254
- 3-Methoxymethylene-2,4-bis(trimethylsilyloxy)-1,4-pentadiene, **12**, 315

trans-1-Methoxy-3-trimethylsilyloxy-1,3-butadiene, **6**, 370; **8**, 328

1,1,2,3-Tetrakis(trimethylsilyloxy)-1,3-butadiene, **10**, 384

1-Trimethylsilyloxy-1,3-butadiene, **8**, 512

2-Trimethylsilyloxy-1,3-cyclohexadiene, **8**, 512

Trimethylsilylvinylketene, **10**, 441

BY DIENONE-PHENOL

REARRANGEMENT (*see* TYPE OF REACTION INDEX)

BY FRIES REARRANGEMENT

(*see* TYPE OF REACTION INDEX)

BY HYDROXYLATION OF ArH

(*see* TYPE OF REACTION INDEX)

BY REDUCTION OF QUINONES

(*see* TYPE OF REACTION INDEX)

BY RING-FORMING REACTIONS

- Aluminum chloride, **11**, 25
- Chromium carbene complexes, **12**, 132
- Dibenzyl ketone, **4**, 123
- Iron carbonyl, **1**, 519
- Lithium diisopropylamide, **9**, 280
- Malonyl dichloride, **12**, 291
- 1-Methoxy-1,3-bis(trimethylsilyloxy)-1,3-butadiene, **9**, 54; **10**, 46, 257; **11**, 66
- Methyl phenylsulfinylacetate, **8**, 347
- Methyl vinyl ketone, **6**, 407; **10**, 272
- 3-Phenylsulfonyl-1(3*H*)-isobenzofuranone, **9**, 368
- 3-Phenylthio-3-buten-2-one, **11**, 421
- Phthalide, **8**, 402
- Potassium persulfate, **1**, 952; **8**, 417
- Potassium superoxide, **11**, 442
- Tin(II) chloride, **1**, 1113
- Titanium(IV) chloride, **6**, 590

OTHER ROUTES

- Antimony(V) chloride, **7**, 12
- m*-Chloroperbenzoic acid, **5**, 120
- Chlorotrimethylsilane, **8**, 107
- Copper(I) oxide-Copper(II) nitrate, **8**, 124
- Cyanotrimethylsilane, **7**, 397
- Dimethyl phosphite, **1**, 293
- N-Lithioethylenediamine, **1**, 567
- Lithium biphenylide, **1**, 612
- Nickel carbonyl, **4**, 353
- Nitrosyl chloride, **1**, 748
- Oxalyl chloride, **5**, 481
- Peracetic acid, **1**, 787
- Rhodium(III) chloride, **11**, 460

Tetracarbonyldi- μ -chlorodirhodium, 8, 469

Triethylamine, 9, 481

Trifluoroacetic anhydride, 1, 1221

Trimethyl phosphite, 12, 536

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(see also CHIRAL COMPOUNDS)

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Di-*t*-butyl phosphorobromidate, 8, 146

2-(N,N-Dimethylamino)-4-nitrophenyl phosphate, 6, 207

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Di-*p*-nitrobenzyl phosphorochloridate, 1, 321

Diphenyl phosphorochloridate, 1, 345

Metaphosphoric acid, 1, 665

N-Methylimidazole, 5, 447

Phosphoric acid, 1, 860

Pyrophosphoryl chloride, 2, 353

Silver diphenylphosphate, 1, 1006

Tetrabutylammonium

di-*t*-butylphosphate, 9, 443

Tetra-*p*-nitrophenyl pyrophosphate, 1, 1148

Trichloroacetonitrile, 1, 1194

2,2,2-Trichloroethanol, 6, 605

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Acetoinediacyclopypyrophosphate, 6, 6, 218

Cyclohexyl isocyanide, 6, 152

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p-Nitrophenyl(1,2-dimethylethylenedioxy)phosphate, 6, 8

Phenyl dichlorophosphate, 1, 847

Phenyl N-phenylphosphoramidochloridate, 7, 286

Phenyl 8-quinolyl phosphate, 5, 517

2,4,6-Triisopropylbenzenesulfonyl chloride, 3, 308

2,2,2-Trimethoxy-4,5-dimethyl-1,3-dioxaphospholene, 4, 535

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Cesium bicarbonate, 8, 81

Cesium fluoride, 7, 57

m-Chloroperbenzoic acid, 11, 122

2-Cyanoethyl phosphate, 1, 172

N,N-Dimethylformamide, 1, 278

Dimethyl selenoxide, 8, 197

Di-*p*-tolylcarbodiimide, 1, 351

Nitrogen dioxide, 1, 324

Oxygen, singlet, 6, 431

Phosphoryl chloride, 1, 876

Silver(II) oxide, 2, 369

Tetrabutylammonium bromide, 7, 353

Trimethyl phosphite, 1, 1233

Triphenyl phosphite ozonide, 3, 323

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Camphor-10-sulfonic acid, 4, 68

Hexachlorodisilane, 3, 148

Phenylsilane, 5, 523

Trichlorosilane, 5, 687

2,4,6-Triisopropylbenzenesulfonylhydrazide, 11, 563

PHOSPHINE OXIDES

Bis(trimethylsilyl) peroxide, 11, 67

Dimethyl selenoxide, 8, 197

Dimethyl sulfoxide, 5, 263; 6, 225, 295

(Diphenylphosphine)lithium, 6, 340

Nitrogen dioxide, 1, 324

2,4,6-Triisopropylbenzenesulfonylhydrazide, 11, 563

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Copper(I) iodide, 7, 81

Diethyl phosphite, 6, 192

(Dimethoxyphosphinyl)methyl lithium, 6, 339

Dimethyl phosphite, 5, 258

Diphenyl triphenylphosphoranylidene dimethylphosphonate, 2, 181

Methyl iodide, 1, 682

Methylphosphonic dichloride, 1, 666

Sodium borohydride, 6, 530

Tetrakis(triphenylphosphine)palladium(0), 10, 384

Triethyl phosphite, 1, 1212

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2-Chloro-4,5-dimethyl-2-oxo-1,3,2-dioxaphosphole, 6, 7

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(Continued)

- Dibromomalonamide, **1**, 208
- N,N-Dimethylformamide, **1**, 278
- Pyrophosphoryl chloride, **1**, 971

POLYNUCLEOTIDES

- Benzenesulfonyltetrazole, **7**, 13
- 3-Benzoylpropionic acid, **2**, 26
- t*-Butyldimethylchlorosilane, **8**, 59
- Chloro-N,N-dimethylamino-methoxyphosphine, **10**, 88
- m*-Chloroperbenzoic acid, **11**, 122
- 2-Chlorophenyl dichlorophosphite, **6**, 114
- Dicyclohexylcarbodiimide, **1**, 231
- Dimethylformamide-Thionyl chloride, **1**, 286
- 9-Fluorenylmethanol, **5**, 308
- 2-Mesitylenesulfonyl chloride, **1**, 661
- Mesitylenesulfonylimidazole, **5**, 434
- 1-(Mesitylenesulfonyl)-1,2,4-triazole, **5**, 434; **6**, 361
- p*-Nitrobenzenesulfonyl
 - 4-nitroimidazole, **11**, 359
- 4-Nitrophenyl phenyl phosphorochloridate, **8**, 362
- Picryl chloride, **1**, 885
- Polyphosphate ester, **1**, 892
- 2,2,2-Trichloroethanol, **6**, 605
- 2,4,6-Triisopropylbenzenesulfonyl chloride, **1**, 1228; **6**, 622

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- Acetylene, **1**, 11
- Bis(trimethylsilyl)acetylene, **7**, **8**; **9**, 311
- Butadiyne, **1**, 185
- 3-Butyn-2-ol, **4**, 423
- Chlorotris(triphenylphosphine)-rhodium(I), **5**, 736
- 1,3-Dilithiopropyne, **6**, 202
- Dilithium tris(1-pentynyl)cuprate, **6**, 203
- Ethoxyacetylene-Magnesium bromide, **7**, 145
- Ethynylmagnesium bromide, **1**, 389, 415
- (2S,2'S)-2-Hydroxymethyl-1-[(1-methylpyrrolidin-2-yl)methyl]-pyrrolidine, **10**, 207
- Lithium acetylides, **1**, 573; **2**, 166, 288; **6**, 324; **7**, 195; **12**, 272
- Lithium-Ethylamine, **11**, 287

- Methyl vinyl ketone, **1**, 697
- Organocerium reagents, **12**, 345
- Phase-transfer catalysts, **11**, 403
- 1-Phenyl-2-trimethylsilylacetylene, **7**, 354
- Sodium acetylides, **1**, 1027; **2**, 166
- 3-Tetrahydropyranyloxy-1-propynyllithium, **7**, 320
- Trimethylsilylacetylene, **9**, 246
- BY REDUCTION OF α,β -ACETYLENIC C=O's** (see TYPE OF REACTION INDEX)
- OTHER ROUTES**
 - t*-Butyl hydroperoxide-Selenium(IV) oxide, **9**, 79
 - Copper, **5**, 146
 - Dichloro(diethoxyphosphinyl)methyl lithium, **6**, 188
 - (2R,4R)-Pentenediol, **12**, 375
 - Sodium amide, **1**, 1034

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- Cesium fluoride, **10**, 81
- Chromium(II) chloride, **12**, 136
- 1,3-Dihydrobenzo[c]thiophene
 - 2,2-dioxide, **10**, 146
- Lithium 2,2,6,6-tetramethylpiperidine, **12**, 285
- Oxygen, **5**, 482
- Potassium *t*-butoxide, **1**, 911
- Tetrabutylammonium fluoride, **10**, 378
- Tri- μ -carbonylhexacarbonyldiiron, **2**, 139
- Zinc, **3**, 338; **11**, 598
- Zinc-Silver couple, **12**, 571

***p*-QUINODIMETHANES**

- 1,3-Dihydrobenzo[c]thiophene
 - 2,2-dioxide, **9**, 168
- Iodine, **1**, 495
- Tetrabutylammonium fluoride, **10**, 378

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- by Oxidation of ArH, catechols, phenols and related compounds (see TYPE OF REACTION INDEX)
- Other routes**
 - Cyanotrimethylsilane, **5**, 720
 - 2,3-Dichloro-5,6-dicyano-1,4-benzoquinone, **11**, 166
 - Dimethyl sulfoxide + co-reagent, **2**,

- 163; 4, 201; 6, 229
 Potassium-Graphite, 12, 400
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 Glyoxal, 1, 413
 2-Lithio-3,3,6,6-tetramethoxy-1,4-cyclohexadiene, 8, 280
 Magnesium methoxide, 2, 255
 Phosphorus(V) oxide, 1, 871
 Phthalide, 5, 537
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- by Diels-Alder routes
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 N,N-Dimethylhydrazine, 11, 200
 6-Methoxy-4-methyl-2-pyranone, 8, 325
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- Other routes**
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 N-Bromosuccinimide, 11, 79
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- Chlorotris(triphenylphosphine)-rhodium(I), 5, 736
 Di-*t*-butylsilyl bis(trifluoromethanesulfonate), 11, 189
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o-Chloranil, 1, 128
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FROM RCHO, R₂CO

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Methylithium, 3, 202

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Cyclobutylidene, 12, 150

Cyclopropyl phenyl sulfide, 8, 138

N,N-Dimethylaminocyclopropyl-phenyloxosulfonium tetrafluoroborate, 4, 173

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1-Lithiocyclopropyl phenyl sulfide, 5, 372; 6, 319

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Bis(1,5-cyclooctadiene)nickel(0), 5, 34

Boron trifluoride etherate, 8, 51

t-Butoxybis(dimethylamino)methane, 5, 71

Chlorotris(triphenylphosphine)-rhodium(I), 10, 98

Chromium carbonyl, 10, 100

1,4-Dibromobutane, 5, 404

Dichloromethyl lithium, 6, 170

Diethyl allylthiomethylphosphonate, 3, 94

Diisobutylaluminum hydride, 7, 111

N,N-Dimethylaminocyclopropyl-phenyloxosulfonium tetrafluoroborate, 4, 173

Dimethyl sulfoxide, 9, 189

Diphenylsulfonium cyclopropylide, 6, 242; 7, 140

Disodium tetracarbonylferrate, 10, 174

Ethoxycarbonylcyclopropyl-triphenylphosphonium tetrafluoroborate, 6, 93; 8, 76

Ethylaluminum dichloride, 12, 5

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Hydrogen chloride, 7, 172

1-Hydroxycyclopropane-carboxaldehyde, 12, 247

2-Hydroxymethyl-3-trimethylsilyl-1-propene, 12, 252

4-Iodobutyltrimethyltin, 10, 219

2-Lithiobenzothiazole, 8, 274

2-(E)-Lithiovinyltrimethylsilane, 10, 443

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Lithium iodide, 11, 300

Mercury(II) acetate, 8, 315; 11, 315

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Palladium(II) acetate, 11, 389

N-Phenylselenophthalimide, 10, 312

Polyphosphoric acid, 4, 395

Tin(IV) chloride, 12, 486

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2-Acetoxy-1-methoxy-3-trimethylsilyloxy-1,3-butadiene, 11, 2

Allylidene cyclopropane, 12, 19

Allylidenetriphenylphosphorane, 5, 7

Alumina, 2, 18

Arene(tricarbonyl)chromium complexes, 9, 21

Bis(N-propylsalicylideneamine)-copper(II), 5, 41

Chromium carbonyl, 10, 100

Copper(I) chloride, 8, 118; 9, 123

Diethyl allylthiomethylphosphonate, 3, 94

Diethyl lithiomorpholinomethylphosphonate, 7, 105

Dimethyl(methylthio)sulfonium tetrafluoroborate, 11, 204

Dimethyl sulfoxide, 9, 189

Ferric chloride, 4, 236

Hexafluoroantimonic acid, 8, 239

Iron carbonyl, 12, 266

Isoprene, 5, 630

Isopropylidene isopropylidenemalonate, 6, 309

Lithium dimethylcuprate, 6, 209; 7, 120

4-Methoxy-5-methyl-*o*-benzoquinone, 6, 363*trans*-1-Methoxy-3-trimethylsilyloxy-1,3-butadiene, 9, 303

N-Methyl-N-phenylaminoacetylene, 10, 266

Methyl vinyl ketone, 7, 247; 12, 329

Potassium ferricyanide, 4, 406

Pyrrolidine, 7, 309

Samarium(II) iodide, 11, 464

Tetrakis(2-methylpropyl)- μ -oxodialuminum, 8, 471

Thallium(III) trifluoroacetate, 4, 498

Tin(IV) chloride, 11, 522

Trifluoroacetic acid, 6, 613

 α -Trimethylsilyl-2-methylbenzothiazole, 8, 511

Vanadyl trichloride, 3, 331; 8, 527

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Organocopper reagents, 9, 328

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- Sodium thiophenoxide, 6, 272
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- N-Chlorosuccinimide-Dimethyl sulfide, 5, 129
- Dimethyl disulfide, 9, 91
- Dimethyl sulfoxide + co-reagent, 1, 306; 12, 213
- S,S-Dimethyl-N-*p*-toluenesulfonylsulfilimine, 9, 193
- 2,4-Dinitrobenzenesulfonyl chloride, 1, 319

- Ethanethiol, 2, 209
- Formamidinesulfinic acid, 6, 586
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 L(+)–Butane-2,3-dithiol, 1, 82
 Diethylene tetrathioorthocarbonate, 6, 187
 1,2-Ethanedithiol, 1, 356, 1174; 2, 433; 5, 290
 5,5'-Ethylene *p*-toluenethiosulfonate, 4, 540; 6, 628
 Nafion-H, 10, 275
 Perchloric acid, 1, 796
 Phase-transfer catalysts, 11, 403
 Zinc trifluoromethanesulfonate, 12, 577
- 1,3-OXATHIOLANES

- Chlorotrimethylsilane, 6, 626
 2-Mercaptoethanol, 1, 356, 643; 5, 718; 6, 381
 Organolithium reagents, 9, 5
- OTHER THIOKETALS**
 Aluminum chloride–Ethanethiol, 11, 28
 Boron trifluoride–Ethanethiol, 10, 51
 Chlorotrimethylsilane, 7, 66
 N,N-Dimethylhydrazine, 7, 126
 Methylthiotrimethylsilane, 6, 399; 8, 352
 Molybdenum carbonyl, 7, 165
 Phenylthiotrimethylsilane, 6, 399
 Tributylphosphine–Diphenyl disulfide, 9, 200
 Tricaprylylmethylammonium chloride, 6, 404
 Trimethylsilyl trifluoromethanesulfonate, 11, 584
 Tris(methylthio)methylolithium, 10, 453
- THIOALDEHYDES AND KETONES**
 2,4-Bis(4-methoxyphenyl)-1,3-dithia-2,4-diphosphetane-2,4-disulfide, 8, 327; 9, 49
 Bis(tricyclohexyltin) sulfide–Boron trichloride, 11, 63
 Carbon disulfide, 5, 94
 Phosphorus(V) sulfide, 3, 226; 5, 653; 10, 320
 Sodium hydrogen sulfide, 5, 251
 Sulfur monochloride, 9, 442; 11, 495
- THIOAMIDES**
 Bis(benzonitrile)dichloropalladium(II), 10, 31
 2,4-Bis(4-methoxyphenyl)-1,3-dithia-2,4-diphosphetane-2,4-disulfide, 9, 49
 Bis(trimethylsilyl)thioetene, 7, 28
 N,N-Dimethylformamide, 1, 278
 Dioxane, 1, 333
 Diphenylphosphinodithioic acid, 10, 171
 Ethoxycarbonyl isothiocyanate, 7, 146
 Phosphorus(V) sulfide, 9, 374; 11, 428
 Sodium hydrogen sulfide, 11, 487
 Sulfur, 1, 1118; 3, 273
 Thioacetamide, 4, 502
 Triphenylphosphine–Thiocyanogen, 9, 507
- THIOCYANATES**
 Cyanogen bromide, 1, 174
 Cyanotrimethylsilane, 9, 127
 Diethyl phosphorocyanidate, 11, 181
 Ferric thiocyanate, 6, 259; 7, 155

THIOCYANATES (*Continued*)

- Mercury(II) thiocyanate, 9, 293
- Palladium(II) acetate, 5, 496
- Potassium thiocyanate, 1, 954; 8, 390
- Sodium thiocyanate, 1, 1105
- Thiocyanogen, 1, 1152
- Thiocyanogen chloride, 1, 1153; 5, 661
- Triphenylphosphine–Thiocyanogen, 8, 518
- 2,4,6-Triphenylpyrylium thiocyanate, 8, 521
- Vinylsulfonyl chloride–Trimethylamine, 9, 211

THIOLS**BY DISPLACEMENTS WITH S
NUCLEOPHILES**

- 1-Acetyl-2-thiourea, 4, 7
- Potassium ethylxanthate, 5, 554
- Potassium hydrogen sulfide, 1, 935
- Potassium thiolacetate, 1, 955
- Sodium amide, 1, 1034
- Sodium borohydride, sulfurated, 6, 534
- Sodium trithiocarbonate, 2, 389; 11, 493
- Thiophenol, 6, 279
- Thiourea, 1, 1164; 2, 157

**BY REDUCTION OF SULFIDES,
DISULFIDES** (*see* TYPE OF
REACTION INDEX)**OTHER ROUTES**

- Butyllithium, 10, 68
- Ethylene sulfide, 1, 378
- Phosphorus(V) sulfide, 3, 226; 11, 428
- Sodium sulfide–Sulfur, 9, 434
- Thiolacetic acid, 1, 1154
- Thiourea, 11, 519

THIOL ESTERS**FROM RCOOH**

- 2,4-Bis(methylthio)-2,4-dithioxo-
cyclophosphathiane, 11, 56
- N,N'-Carbonyldiimidazole, 8, 77
- 2-Chloro-3-methyl-1,3-benzothiazolium
trifluoromethanesulfonate, 7, 61
- Dicyclohexylcarbodiimide, 7, 100
- Diethyl phosphorochloridate, 6, 192
- Diethyl phosphorocyanidate, 6, 192
- 4-Dimethylamino-3-butyne-2-one, 9, 177
- 4-Dimethylaminopyridine, 10, 155
- Diphenyl 2-keto-3-oxazolinyl-
phosphonate, 11, 220
- Diphenyl phosphoroazidate, 11, 222
- Ethyl chlorothiolfornate, 6, 252

- 2-Halopyridinium salts, 9, 234
- Lithium thiophenoxide, 8, 183
- Polyphosphate ester, 11, 430
- Sodium borohydride, 11, 477
- 2-Thiopyridyl chloroformate, 9, 466
- Triphenylphosphine–2,2'-Bis(3-cyano-
4,6-dimethylpyridyl) disulfide, 9, 167
- Tris(ethylthio)borane, 8, 522

OTHER ROUTES

- Aluminum thiophenoxide, 9, 15
- Bis(methylthio)(trimethylsilyl)-
methylolithium, 6, 53
- Carbon disulfide, 5, 94
- Carbonyl sulfide, 11, 112
- Cerium(IV) ammonium nitrate, 6, 197
- Chlorodiphenylphosphine, 11, 120
- Disodium tetracarbonylferrate, 9, 205
- Methoxy(phenylthio)trimethylsilyl-
methylolithium, 12, 317
- 1,3,4,6-Tetraacetylglucouril, 6, 563
- Tetrafluoroboric acid, 12, 465
- Thiolacetic acid, 1, 1154; 5, 326
- 2,4,6-Trichlorobenzoyl chloride, 11, 552
- Triethyl phosphite, 1, 1212
- Triphenylphosphine–Diethyl
azodicarboxylate, 11, 589
- Tris(methylthio)methylolithium, 7, 280

THIONOESTERS AND LACTONES

- 2,4-Bis(4-methoxyphenyl)-1,3-dithia-
2,4-diphosphetane-2,4-disulfide, 8,
327; 9, 49
- 2,4-Bis(methylthio)-2,4-dithioxocyclodi-
phosphathiane, 11, 56
- Bis(tricyclohexyltin) sulfide–Boron
trichloride, 11, 63
- Dicyclohexylcarbodiimide–4-Dimethyl-
aminopyridine, 9, 156
- Dimethylaluminum benzenethiolate, 5,
36
- Hydrogen sulfide, 12, 247
- Sodium hydrogen sulfide, 9, 429
- Thiobenzoyl chloride, 6, 582
- Triethyloxonium tetrafluoroborate, 10,
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THIOPHENOLS

- Amberlyst ion-exchange resin, 5, 355
- Benzenesulfonyl chloride, 1, 46
- N,N-Dimethylthiocarbamoyl chloride, 2,
173; 4, 202
- Hydrogen sulfide, 4, 256
- Sodium disulfide, 1, 1064

Sodium, 11, 473
 Tetraisopropylthiuram disulfide, 12, 466
 Trifluoroacetic anhydride, 12, 530
 Triphenylphosphine, 5, 725; 10, 220
 Zinc, 1, 1276
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Benzoylisothiocyanate, 1, 50
 Dichloromethylenedimethylammonium chloride, 4, 135
 Phosphorus(V) sulfide, 5, 534
 Sodium thiocyanate, 5, 626
 Triphenylphosphine-Thiocyanogen, 8, 518

TOSYLATES, TRIFLATES

(see SULFONIC ACID ESTERS)

TROPOLONES

Benzocyclopropene, 6, 33
 Copper(II) acetylacetonate, 3, 62
 Dichloroketene, 1, 221
 Dimethylsulfoxonium methylide, 8, 194
 Ethyl diazoacetate, 1, 367
 Pyridine, 2, 349
 Tri- μ -carbonylhexacarbonyldiiron, 5, 221; 6, 195
 Zinc-Acetic acid, 5, 757

TROPONES

Alumina, 4, 8
 Dimethyl sulfoxide, 9, 189
 Lithium carbonate, 3, 183
 Lithium dibutylcuprate, 5, 187
 Selenium(IV) oxide, 1, 992
 Silver tetrafluoroborate, 2, 365
 Sodium chlorodifluoroacetate, 5, 603
 Tributyltin hydride, 12, 516
 Tri- μ -carbonylhexacarbonyldiiron, 1, 259; 4, 157; 5, 221; 6, 195; 8, 498
 Zinc-Silver couple, 9, 519

UNSATURATED ACID HALIDES

Boron trichloride, 3, 31
 Oxalyl bromide (or chloride), 1, 767
 Thionyl chloride, 3, 290
 Triphenylphosphine dichloride, 5, 730

UNSATURATED ALDEHYDES AND

KETONES (see also ACETYLENIC CARBONYLS, ALICYCLIC

HYDROCARBONS—

2-CYCLOPENTENONES,

2-CYCLOHEXENONES, ALLENIC

CARBONYLS, CHIRAL

COMPOUNDS, DIENALS, DIENONES, ENEDIONES, α -METHYLENE ALDEHYDES AND KETONES)

α,β -UNSATURATED ALDEHYDES AND KETONES

by Acylation of C=C or vinyl nucleophiles
 Alumina, 11, 22
 Aluminum chloride, 3, 7; 7, 7
 Dichloromethyl methyl ether, 8, 485; 9, 154
 Dihalobis(triphenylphosphine)-palladium(II), 6, 60
 Dimethylformamide, 5, 252; 7, 124
 3-Methoxy-3-methylbutynylcopper, 9, 300
 Simmons-Smith reagent, 12, 437
 Tetraakis(triphenylphosphine)-palladium(0), 12, 468
 Tributylvinyltin, 9, 42
 Trifluoroacetic anhydride, 1, 1221
 2,4,6-Trisopropylbenzenesulfonylhydrazide, 9, 486
 Vilsmeier reagent, 9, 514
 Vinyl lithium, 5, 748
 by Aldol reaction, dehydration
 Aluminum *t*-butoxide, 1, 23
 Bis(*p*-methoxyphenyl) telluroxide, 11, 55
 Boric acid, 2, 32
 Calcium carbide, 3, 40
 Cesium fluoride, 10, 81
 Diethyl oxalate, 7, 106
 Formaldehyde, 9, 224
 Lithium diisopropylamide, 2, 249; 3, 184
 Lithium iodide, 10, 245
 Nickel carbonyl, 10, 276
 Potassium carbonate, 9, 382
 Sodium bicarbonate, 5, 595
 2,4,6-Trimethylphenoxymagnesium bromide, 9, 489
 Trimethylsilylmethylmagnesium chloride, 12, 540
 Triphenylmethyl lithium, 1, 1256
 by Alkylation of β -acyl vinyl anion equivalents
 S-Allyl N,N-dimethyldithiocarbamate, 6, 11
 1,3-Bis(methylthio)allyllithium, 4, 38

UNSATURATED ALDEHYDES AND KETONES (*Continued*)

- t*-Butoxyallene, **8**, 322
- Butyllithium, **10**, 68
- Lithium diisopropylamide, **6**, 334
- Methoxyallene, **8**, 320
- 3-Methoxy-1-phenylthio-1-propene, **8**, 327
- 3-Methylthio-2-propenyl *p*-tolyl sulfone, **12**, 327
- 2-(2-Phenylsulfonyl-ethyl)-1,3-dioxolane, **6**, 461
- Sodium *N,N*-dimethylthio-carbamate, **6**, 539
- from $C=O$ ($R_2CO \rightarrow R_2C=CH(R)CHO$)
 - Acetaldehyde *N-t*-butylimine, **9**, 1
 - 2,2-Diethoxyethylidenetriphenyl-phosphorane, **9**, 157
 - Diethyl β -(cyclohexylimino)-ethylphosphonate, **2**, 131
 - N,N*-Dimethylhydrazine, **7**, 126
 - N,N*-Dimethylthiocarbonyl chloride, **8**, 200
 - 1,3-Dioxolan-2-ylmethyltriphenyl-phosphonium bromide, **5**, 269
 - Ethoxyacetylene, **1**, 357
 - 1-Ethoxy-1-propene, **1**, 385
 - (*Z*)-2-Ethoxyvinyl-lithium, **8**, 221
 - Ethyl vinyl ether, **1**, 386; **10**, 184
 - Formylmethylenetriphenyl-phosphorane, **6**, 267; **8**, 234
 - Lithio propylidene-*t*-butylimine, **4**, 283
 - Lithium ethoxyacetylde, **1**, 613
 - Oxotris(triphenylsylanolato)vanadium, **6**, 655
 - Pyridinium bromide perbromide, **1**, 967
 - 2,4,4,6-Tetramethyl-5,6-dihydro-1,3-(4*H*)-oxazine, **3**, 280
 - (*Z*)-(Trimethylsilyloxy)vinyl-lithium, **11**, 582
 - Vinyltrimethylsilane, **12**, 566
- from $C=O$ ($R_2CO \rightarrow R_2C=CHCOR$)
 - Acetylmethylene(triphenyl)arsorane, **11**, 5
 - 1,3-Dithiane, **3**, 135
 - Propargyl bromide, **10**, 332
 - Titanium(IV) chloride, **12**, 494
 - Triethyl phosphonoacetate, **12**, 527
 - from $C=O$ [$R'COCH_2R \rightarrow RCH=CR'COH(R)$]
 - Chloromethyl phenyl sulfoxide, **8**, 94
 - 1,3-Dithiane, **2**, 182
 - Formic acid, **2**, 202; **5**, 316
 - Ion-exchange resins, **1**, 511
 - 2-Lithiobenzothiazole, **8**, 274
 - Mercury(II) sulfate, **1**, 658
 - Nafion-H, **11**, 354
 - Oxygen, **7**, 258; **8**, 367
 - Phosphorus(V) oxide, **1**, 871
 - Sodium methoxide, **8**, 461
 - Thiophenol, **12**, 485
 - Titanium(III) chloride, **5**, 669
 - Tosylmethyl isocyanide, **12**, 511
- by Dehydration of aldols
 - t*-Butyl acetoacetate, **1**, 83
 - t*-Butyllithium, **11**, 103
 - Dicyclohexylcarbodiimide, **2**, 126
 - Diisobutylaluminum phenoxide, **9**, 172
 - Florisil, **1**, 393
 - Girard reagent T, **1**, 410
 - Iodine, **1**, 495
 - Pyridine, **4**, 414
 - Silver perchlorate, **9**, 413
 - Tetrafluoropyrrolidine, **9**, 449
 - p*-Toluenesulfonic acid, **1**, 1172
- by Dehydrogenation of $C=O$ (*see* TYPE OF REACTION INDEX)
- by Dehydrohalogenation
 - Benzyltrimethylammonium mesitoate, **1**, 54
 - Calcium carbonate, **1**, 103; **5**, 89
 - Copper(I) bromide-Lithium carbonate, **6**, 18
 - 1,5-Diazabicyclo[4.3.0]nonene-5, **4**, 116
 - 1,8-Diazabicyclo[5.4.0]undecene-7, **4**, 119
 - Dichloromethyl-lithium, **5**, 199
 - N,N*-Dimethylhydrazine, **8**, 192
 - Dimethyl sulfoxide, **1**, 296; **4**, 192
 - 2,4-Dinitrophenylhydrazine, **1**, 330
 - Hexamethylphosphoric triamide, **2**, 208
 - Lithium-Ammonia, **1**, 54
 - Lithium bromide, **3**, 75
 - Lithium carbonate, **1**, 606; **4**, 298; **5**, 452; **6**, 17
 - Lithium chloride, **1**, 609

- Magnesium oxide, 2, 256
 Nitrosyl fluoride, 2, 299
 N-Phenylbenzamidine, 5, 513
 Potassium fluoride, 5, 153
 Silver(I) nitrate, 1, 1008
 Sodium carbonate, 7, 332
 Tetraethylammonium chloride, 1, 1137
 Tetrakis(triphenylphosphine)-palladium(0), 6, 571
 Tetramethylammonium dimethyl phosphate, 6, 573
 Tributylamine, 1, 1189
 by Deoxygenation of keto epoxides (see TYPE OF REACTION INDEX)
 from β -Dicarbonyls
 1-Butanethiol, 2, 53
 2-Cyclohexenone, 1, 180
 Lithium aluminum hydride, 1, 581
 Sodium borohydride, 6, 530
 N-(Trimethylsilyl)imidazole, 11, 575
 by Elimination of Se compounds
 Benzeneselenenyl halides, 5, 518; 6, 459; 7, 286; 8, 25; 10, 16
 Benzeneseleninic anhydride, 8, 29
 Diphenyl diselenide, 5, 272
 2-Pyridineselenenyl bromide, 11, 455
 by Elimination of S compounds
 m-Chloroperbenzoic acid, 10, 92
 Dimethyl disulfide, 5, 246
 Diphenyl disulfide, 6, 235
 2,2'-Dipyridyl disulfide, 8, 214
 Phenylsulfinylacetone, 5, 524
 Tetrakis(triphenylphosphine)-palladium(0), 9, 451
 by Oxidation of allylic OH, X, CH₂ (see TYPE OF REACTION INDEX)
 by Oxidation of allyl Pd complexes
 Chromium(VI) oxide—
 Dimethylformamide, 11, 131
 Palladium(II) chloride, 11, 393
 by Oxidation of allyltrimethylsilanes, homoallylic alcohols, silyl enol ethers (see TYPE OF REACTION INDEX)
 by Oxidative decarboxylation of keto acids, keto esters
 Lead(IV) oxide, 1, 533; 2, 233
 Lead tetraacetate, 5, 365
 Palladium(II) acetate—1,2-Bis-(diphenylphosphine)ethane, 11, 391
 Other routes
 1-(Alkyl or Phenylthio)vinyl lithium, 5, 6; 9, 371
 Benzeneselenenyl chloride, 9, 25
 Benzenesulfonyl chloride, 6, 30
 1,3-Benzodithiolium tetrafluoroborate, 10, 24
 Benzylchlorobis(triphenylphosphine)-palladium(II), 9, 41
 Bis(dimethylaluminum) 1,3-propanedithiolate, 6, 49
 Bis(trimethylsilyl)acetylene, 5, 44
 1-Bromo-2-ethoxycyclopropyllithium, 9, 67
 Butyllithium, 4, 60; 5, 80
 trans-4-(*t*-Butylthio)-3-buten-2-one, 9, 90
 3-Butyn-2-one, 3, 38
 Carbonylphenylbis(triphenylphosphine)rhodium(I), 5, 45
 Chlorobis(cyclopentadienyl)-hydrido-zirconium(IV), 9, 104
 α -Chloro-N-cyclohexylpropanal-donitrone, 5, 110
 (3-Chloro-3-methyl-1-butynyl)lithium, 8, 93
 Chloro(trimethylsilyl)methyl lithium, 8, 277
 Chlorotris(triphenylphosphine)-rhodium(I), 1, 1252
 Copper(I) bromide—Dimethyl sulfide, 8, 117
 Cyanotrimethylsilane, 11, 147
 1,5-Diazabicyclo[5.4.0]undecene-5, 11, 155
 Di- μ -bromobis(2-methoxyallyl)-dinickel, 5, 437
 2,3-Dichloro-5,6-dicyano-1,4-benzoquinone, 12, 174
 (Z)-1,2-Dichloro-4-phenylthio-2-butene, 7, 98
 3,3-Diethoxy-1-propyne, 7, 80
 Dimethylformamide diethyl acetal, 9, 182
 2-(1,3-Dioxan-2-ylethylidene)-triphenylphosphorane, 9, 196
 Disodium tetracarbonylferrate, 9, 205
 Disodium tetrachloropalladate(II), 9, 207
 Ethylidenetriphenylphosphorane, 8, 339
 Grignard reagents, 10, 189

UNSATURATED ALDEHYDES AND**KETONES** (*Continued*)

- Hydridodinitrogenbis(triphenylphosphine)cobalt(I), **5**, 331
 Isopropylidenetriphenylphosphorane, **8**, 339
 1-Lithiocyclopropyl phenyl sulfide, **11**, 284
 2-Lithio-2-trimethylsilyl-1,3-dithiane, **6**, 320
 Lithium bromide, **5**, 395
 Lithium diisopropylamide, **7**, 204; **10**, 241
 Lithium dimethylcuprate, **5**, 234
 Magnesium bromide etherate, **1**, 629
 Manganese(II) chloride, **9**, 288
 3-Methoxyallylidene-triphenylphosphorane, **8**, 323
 Methylthium, **6**, 384
 Organolithium reagents, **12**, 350
 Oxalic acid, **1**, 764
 Palladium(II) acetate, **10**, 297
 Perchloric acid, **1**, 796
 Phenylcopper, **7**, 282
 N-Phenylketeniminyldi(triphenylphosphorane), **12**, 387
 Potassium fluoride, **2**, 346
 Potassium hydride, **9**, 386
 Selenium(IV) oxide, **9**, 409
 Silver(I) oxide, **1**, 1011
 Silver perchlorate, **10**, 354
 Tetraethylthiuram disulfide, **6**, 569
 Thexylborane, **5**, 232
 Titanium(IV) isopropoxide, **12**, 504
 3-Triethylsilyloxypentadienyllithium, **11**, 556
 Trimethyl phosphite, **1**, 1233
 3-Trimethylsilyl-1-cyclopentene, **8**, 509
 Zinc halides, **9**, 520; **12**, 574

 β,γ -UNSATURATED ALDEHYDES AND KETONES

by Acylation

- Acetyl chloride, **11**, 11
 Acetyl hexachloroantimonate, **8**, 5
 Bis(1,5-cyclooctadiene)nickel(0), **10**, 33
 Lithium di(1-ethoxyvinyl)cuprate, **6**, 205
 Simmons-Smith reagent, **12**, 437
 Zinc-Silver couple, **10**, 460

by Deconjugation of α,β -unsaturated

carbonyls

- Potassium *t*-butoxide, **1**, 911; **5**, 544
 Pyridine, **12**, 416
 by Oxidation of homoallylic alcohols (*see* TYPE OF REACTION INDEX)
 by 2,3-Sigmatropic rearrangement
 Lithium diisopropylamide, **5**, 400
 Phase-transfer catalysts, **8**, 387
 Trimethylsilylmethanethiol, **11**, 576
 Other routes
 Aluminum chloride, **7**, 7
t-Butyldimethylchlorosilane, **11**, 88
 α -Chloro-N-cyclohexylpropanal-donitrone, **5**, 110
 Chlorotrimethylsilane, **8**, 107
 Chromium(II) acetate, **5**, 143
 Dichlorobis(tri-*o*-tolylphosphine)-palladium(II), **12**, 173
 Diethyl phosphite, **12**, 187
 Diethyl [(2-tetrahydroxypranyloxy)-methyl]phosphonate, **12**, 188
 2-(1,3-Dioxan-2-ylethylidene)-triphenylphosphorane, **9**, 196
 1,3-Dithianes, **4**, 216; **8**, 346
 1-Lithio-2-methoxycyclopropane, **6**, 366
 Lithium-Ammonia, **1**, 601
 Lithium dimethylcuprate, **8**, 301
 Magnesium bromide etherate, **1**, 629
 Manganese(II) chloride, **9**, 288
 Mercury(II) acetate, **5**, 424
 Methylthium, **6**, 384
 Methyl α -phenylglycinate, **8**, 395; **10**, 308
 Oxotris(triphenylsilanolato)vanadium, **7**, 413
 Phenylselenoacetaldehyde, **10**, 310
 Phenylthiomethylthium, **4**, 379
 Phenyl vinyl sulfide, **6**, 468
 Pyridinium chlorochromate, **9**, 397
 Sodium-Ammonia, **5**, 589
 Tetrakis(triphenylphosphine)-palladium(0), **9**, 451
 Titanium(IV) chloride, **6**, 590
 Trialkylaluminums, **12**, 512
 γ,δ -UNSATURATED ALDEHYDES AND KETONES
 by Alkylation of C=O with allylic electrophiles
 Bis(dibenzylideneacetone)-palladium(0), **11**, 53

- Diethyl lithio-*N*-benzylideneamino-methylphosphonate, **9**, 161
Lithium-Ammonia, **8**, 282
Potassium carbonate, **10**, 323
Potassium hydride, **8**, 412
Sodium amide, **1**, 1034
Tetrakis(triphenylphosphine)-palladium(0), **10**, 384; **11**, 503
Triethylborane, **9**, 482
by Claisen and related rearrangements
(*E*)-(Carboxyvinyl)trimethylammonium betaine, **12**, 106
Dichlorotris(triphenylphosphine)-ruthenium(II), **8**, 159
Diethyl allylthiomethylphosphonate, **3**, 94
Diethylaluminum benzenethiolate, **12**, 343
Ethyl vinyl ether, **4**, 234
Lithium(or Sodium) methylsulfinylmethylide, **12**, 283, 451
Mercury(II) acetate, **1**, 644
3-Methoxyisoprene, **4**, 330
2-Methoxypropene, **2**, 230
Organotitanium reagents, **11**, 52
Potassium *t*-butoxide, **4**, 399
Potassium hydride, **11**, 435
Titanium(IV) chloride, **9**, 468
Trialkylaluminums, **11**, 539
Triethylorthoacetate, **3**, 300
1-Vinylthioallyllithium, **5**, 749
by Conjugate addition of vinyl anions
9-Borabicyclo[3.3.1]nonane, **7**, 29
Chlorobis(cyclopentadienyl)-hydrido-zirconium(IV), **8**, 84
Copper(I) bromide-Dimethyl sulfide, **8**, 117
Diisobutylaluminum hydride, **5**, 224
Lithium dimethylcuprate, **5**, 234
Lithium di[(*E*)-1-propenyl]cuprate, **8**, 302
Lithium divinylcuprate, **4**, 219, 221
Lithium methyl(vinyl)cuprate, **6**, 342
Palladium(II) acetate, **4**, 365
3-Tetrahydropyranyloxy-1-tributylstannyl-1-propene, **6**, 602
2,4,6-Triisopropylbenzenesulfonylhydrazide, **10**, 422
Vinylmagnesium bromide-Methylcopper, **8**, 237
Other routes
Allyl chloroformate, **12**, 15
1-Bromo-1-trimethylsilyl-1(*Z*),4-pentadiene, **11**, 80
Chlorobis(cyclopentadienyl)-hydrido-zirconium(IV), **7**, 101
(*Z*)-2-Ethoxyvinyl lithium, **8**, 221
Hydrogen hexachloroplatinate(IV)-Ethoxydiethylsilane, **5**, 293
Lithium dimethylcuprate, **6**, 209
Methylenecyclopropane, **9**, 46
Nickel(II) bromide, **4**, 351
Palladium(II) chloride, **5**, 500
Palladium(II) chloride-P-Phenyl-1-phospha-3-methyl-3-cyclopentene, **5**, 503
Phenacyl bromide, **5**, 758
Potassium *t*-butoxide, **7**, 296
Vinyl lithium, **8**, 275
Vinylmagnesium chloride, **4**, 572
δ,ε-UNSATURATED ALDEHYDES AND KETONES
Allyltrimethylsilane, **7**, 370
Allyltrimethyltin, **9**, 47
Aluminum chloride, **9**, 11
Bis(benzonitrile)dichloropalladium(II), **12**, 51
Cesium fluoride, **11**, 115
m-Chloroperbenzoic acid, **11**, 122
Lithium diallylcuprate, **7**, 86
Mercury(II) trifluoroacetate, **11**, 320; **12**, 306
Potassium hydride, **7**, 302; **8**, 412; **10**, 327
Sodium methylsulfinylmethylide, **7**, 338
Titanium(IV) chloride, **11**, 529
UNSATURATED AMIDES
Acetic anhydride, **6**, 1
Benzeneseleninic anhydride, **8**, 29
Butyllithium, **10**, 73
Carbon dioxide, **5**, 93
Chlorotris(triphenylphosphine)rhodium, **2**, 448
N,N-Diethylaminopropyne, **8**, 165
Dimethylacetamide, **6**, 84
N,N-Dimethylacetamide dialkyl acetals, **1**, 271; **4**, 166; **5**, 226; **8**, 180
Dimethylformamide dialkyl acetals, **5**, 253; **8**, 191
Lithium diallylcuprate, **5**, 175
Lithium tricarbonyl(dimethylcarbamoyl)nickelate, **4**, 302

UNSATURATED AMIDES (*Continued*)

N-Phenyl-1,2,4-triazoline-3,5-dione, **4**, 381

Pyridine N-oxide, **9**, 396

Sodium cyanide, **4**, 317; **5**, 606

Tin(IV) chloride, **10**, 370

Trimethylsilylmethylolithium, **6**, 635

UNSATURATED CARBONYLS**SUBSTITUTED BY HETEROATOMS** **α -SUBSTITUTED- α,β -UNSATURATED CARBONYLS** **α -Acyloxy, α -Alkoxy**

Acetic anhydride-Triethylamine, **5**, 4

1,2-Dimethoxyvinylolithium, **7**, 116

N,N-Dimethylaniline, **1**, 274

Rhodium(II) carboxylates, **11**, 458

Sodium methoxide, **10**, 366

 α -Alkyl(or Phenyl)seleno

Benzeneselenenic anhydride, **9**, 25

Benzeneselenenyl halides, **9**, 25; **10**, 16

N,N-Dimethylbenzeneselenenamide, **7**, 119

 α -Alkyl(or Phenyl)thio, sulfinyl, etc.

Acetic anhydride, **6**, 3

Benzenesulfonyl chloride, **8**, 32; **12**, 42

Chlorotrimethylsilane-Sodium iodide, **10**, 97

N,N-Dimethylhydrazine, **7**, 126

Lead tetraacetate, **9**, 265

Lithium naphthalenide, **9**, 284

(S)- or (R)-Menthyl *p*-toluenesulfinate, **11**, 312

Polyphosphoric acid, **1**, 894

β -Vinylbutenolide, **11**, 594

 α -Halo

Benzeneselenenyl halides, **10**, 16; **11**, 34

Bromine-Acetic acid, **1**, 1025

(Bromodichloromethyl)phenyl-mercury, **7**, 282

Bromodimethylsulfonium bromide, **11**, 198

t-Butyl 2-chloro-2-lithiotrimethylsilylacetate, **8**, 60

Chlorotrimethylsilane, **7**, 66

Copper(II) chloride, **2**, 84

Diethyl carboxychloromethylphosphonate, **8**, 168

Diethyl 2,2-dichloro-1-ethoxyvinyl phosphate, **9**, 160

Iodine azide, **4**, 262

Lithium dimethylcuprate, **3**, 106

Perchloryl fluoride, **1**, 802

Pyridinium dichromate, **10**, 335

Sodium chlorodifluoroacetate, **5**, 603

Sulfonyl chloride, **1**, 1128

Sulfonyl chlorofluoride, **6**, 562

Trifluorovinylolithium, **6**, 622; **8**, 505

 α -N-Substituted

1-Chloro-N,N,2-trimethylpropenylamine, **7**, 66

Iodine azide, **4**, 262

Silver carbonate, **4**, 425

 α -Silyl

t-Butyl lithiobis(trimethylsilyl)acetate, **7**, 42

Methylaluminum dichloride, **12**, 5

 α -SUBSTITUTED- β,γ -UNSATURATED CARBONYLS

Benzenesulfonyl chloride, **12**, 42

Hypochlorous acid, **11**, 260

Perchloryl fluoride, **1**, 802

 β -SUBSTITUTED- β,γ -UNSATURATED CARBONYLS **β -Acyloxy, Alkoxy**

Chloromethyl methyl ether, **4**, 83

Dimethylformamide-Phosphoryl chloride, **1**, 284

 β -Amino

Bis(3-dimethylaminopropyl)phenylphosphine, **5**, 36

Molybdenum carbonyl, **11**, 350

Trifluoroacetic anhydride, **1**, 1221

 β -Halo

Aluminum chloride, **1**, 24

Dichloromethylenedimethylammonium chloride, **4**, 135

Oxalyl chloride, **5**, 481; **7**, 257

Phosphoryl chloride, **1**, 609

Tin(IV) chloride, **12**, 486

Trifluoroacetic acid, **5**, 695

Triphenylphosphine + co-reagent, **6**, 644, 647

 β -Thio

1-Butanethiol, **2**, 53; **4**, 64

3-Methoxy-1-methylthio-1-propyne, **6**, 397

 γ -SUBSTITUTED- α,β -UNSATURATED CARBONYLS **γ -Halo**

t-Butyl hypochlorite, **1**, 90

Copper(II) bromide, **1**, 161

- Copper(II) chloride, **5**, 158
- Dilithium tetrachlorocuprate(II), **7**, 79
- Perchloryl fluoride, **1**, 802; **2**, 310
- Trifluoromethyl hypofluorite, **4**, 237
- γ -Hydroxy (*see also* 4-Hydroxy-2-cyclopentenones)
 - 1,3-Bis(methylthio)allyllithium, **4**, 38; **6**, 53
- Borane-Tetrahydrofuran, **11**, 69
- t*-Butyl chromate, **2**, 48
- 2-Diethylamino-4-phenylthio-2-butenenitrile, **11**, 176
- 1,3-Dithiane, **2**, 182
- Magnesium methoxide, **11**, 309
- Methyl methanethiosulfonate, **7**, 243
- Methyl methylthiomethyl sulfoxide, **8**, 344
- Perchloryl fluoride, **10**, 304
- Potassium peroxomonosulfate, **11**, 442
- Pyridinium chlorochromate, **10**, 334
- Selenium(IV) oxide, **2**, 360

UNSATURATED CARBOXYLIC ACIDS

(*see also* DIENOIC ACIDS,

UNSATURATED ESTERS)

α,β -UNSATURATED CARBOXYLIC ACIDS

by Carboxylation of vinyl metal reagents

- Butyllithium, **7**, 47
- Carbon dioxide, **5**, 93
- Diisobutylaluminum hydride, **2**, 140; **7**, 147
- Lithium diisobutylmethylaluminum hydride, **2**, 248
- Nickel(II) acetylacetonate-Trimethylaluminum, **8**, 42; **9**, 52
- Nickel carbonyl, **1**, 720
- N,N,N',N'-Tetramethylethylenediamine, **3**, 284

Vinylcopper reagents, **6**, 662

Vinylolithium, **1**, 1273

from $C=O$ ($R_2CO \rightarrow R_2C=CHCOOH$)

- t*-Butyllithium, **11**, 103
- α -Dibenzylphosphonoacetic acid, **5**, 183
- Diethyl carboxymethylphosphonate, **8**, 168
- Diethyl trimethylsilyloxycarbonylmethylphosphonate, **8**, 171
- N,N-Dimethylformamide, **5**, 247
- Dimethyl phosphite-Chloroacetic acid, **11**, 211

- Ethoxyacetylene, **1**, 357
- Malonic acid, **1**, 887, 959
- Meldrum's acid, **1**, 526
- Potassium(or Sodium) acetate, **1**, 906, 1024
- Triethylamine, **1**, 1198
- 2,4,4-Trimethyl-2-oxazoline, **5**, 714
- Trimethylsilylacetic acid, **6**, 631
- (Trimethylsilyl)acetyltrimethylsilane, **11**, 572

by Oxidation of allylic alcohols or α,β -unsaturated aldehydes (*see* TYPE OF REACTION INDEX)

Other routes

- Benzyl bromomethyl sulfide, **5**, 25
- Copper(I) iodide, **10**, 107
- 2,3-Dichloro-5,6-dicyano-1,4-benzoquinone, **4**, 130
- Dicyclohexylborane, **8**, 162
- 2-Diethylamino-4-phenylthio-2-butenenitrile, **11**, 176
- Diphenyltelluride, **1**, 348
- Formic acid, **1**, 404
- Lithium diisopropylamide, **4**, 298
- Potassium *t*-butoxide, **1**, 911
- Sodium hydrogen telluride, **8**, 459
- Trichloroacetic acid, **2**, 425

β,γ -UNSATURATED CARBOXYLIC ACIDS

- Benzeneselenenyl chloride, **9**, 25
- Copper(I) iodide, **10**, 107
- Dicyclohexylborane, **8**, 162
- Diethyl oxomalonate, **10**, 143
- Diethyl succinate, **1**, 911, 1076
- Hydrogen fluoride, **9**, 240
- Lithium methanethiolate, **8**, 303
- Magnesium, **11**, 307
- Sodium cyanide, **7**, 333
- Sodium dithionite, **11**, 485
- Sodium naphthalenide, **9**, 431
- N,N,N',N'-Tetramethylethylenediamine, **4**, 485
- Triethanolamine, **1**, 1196

γ,δ -UNSATURATED CARBOXYLIC ACIDS

- Benzeneselenenyl chloride, **9**, 25
- t*-Butyldimethylchlorosilane, **6**, 78
- Copper(II) acetate, **5**, 156
- Ethyl diazoacetate, **5**, 151
- Hexamethylphosphoric triamide, **6**, 273; **8**, 240

UNSATURATED CARBOXYLIC ACIDS*(Continued)*Lithium diisopropylamide, **11**, 296Lithium hexamethyldisilazide, **12**, 280Lithium N-isopropylcyclohexylamide, **4**, 306Methoxycarbonylmethylene-triphenylphosphorane, **1**, 112Tetrakis(triphenylphosphine)-palladium(0), **9**, 451Zinc, **4**, 574 **ω -UNSATURATED CARBOXYLIC ACIDS**Lead tetraacetate, **3**, 1681,3-Propanedithiol, **4**, 413**UNSATURATED ESTERS** (*see also* DIENOIC ESTERS, UNSATURATED CARBOXYLIC ACIDS) **α,β -UNSATURATED ESTERS**by Addition to α,β -acetylenic estersAluminum chloride, **8**, 13Bromine, **5**, 55Carbonylhydridotris(triphenylphosphine)rhodium(I), **4**, 249Copper(I) iodide, **3**, 278Lithium dialkylcuprates, **3**, 106; **5**, 283; **6**, 163Organocopper reagents, **9**, 328

from C=O via Wittig, Wittig-Horner reagents

Benzoic acid, **1**, 49Ethoxycarbonylcyclopropyltriphenylphosphonium tetrafluoroborate, **5**, 90; **6**, 93Ethoxycarbonylmethylenetriphenylphosphorane, **1**, 111, 1241Ethylene oxide, **5**, 2971-Methoxycarbonylethyl(diphenyl)phosphine oxide, **12**, 105Methoxycarbonylmethylenetriphenylphosphorane, **1**, 112; **2**, 98Methyl bis(trifluoroethoxy)phosphinylacetate, **12**, 320Methyl 2-bis(2,2,2-trifluoroethoxy)phosphinylpropionate, **12**, 320Tetraethyl phosphonosuccinate, **1**, 1138Tetrahexylammonium bromide, **10**, 383

Triethyl(or Trimethyl)

phosphonoacetate, **1**, 1217; **2**, 442;**6**, 566; **7**, 394; **12**, 527Triethyl α -phosphonopropionate, **5**, 693Triphenylphosphine, **1**, 1238; **4**, 548
from C=O by other routesAlumina, **11**, 22*t*-Butyl lithio(trimethylsilyl)acetate, **5**, 371Chloromethyldiphenylsilane, **12**, 3211,8-Diazabicyclo[5.4.0]undecene-7, **5**, 177; **6**, 158

Dibutyltelluronium

carboethoxymethylide, **12**, 159Diethyl succinate, **1**, 911, 1076Ethoxyacetylene, **1**, 357Ethyl cyanoacetate, **1**, 121O-Ethyl-S-ethoxycarbonylmethyl dithiocarbonate, **7**, 148Ethyl trimethylsilylacetate, **5**, 373; **11**, 234; **12**, 228Ketene alkyl trialkylsilyl acetals, **10**, 261Malononitrile, **1**, 16Meldrum's acid, **1**, 526Piperidine, **1**, 886Raney nickel, **1**, 723Sodium ethoxide, **1**, 1065Sulfuryl chloride, **6**, 561Titanium(IV) chloride, **3**, 291; **4**, 5072,4,4-Trimethyl-2-oxazoline, **5**, 714
by Coupling reactionsDiacetatobis(triphenylphosphine)-palladium(II), **6**, 156Methyltris(triphenylphosphine)-rhodium(I), **5**, 463Palladium(II) acetate, **8**, 378; **9**, 350Palladium-Graphite, **10**, 297Tetrakis(triphenylphosphine)-palladium(0), **10**, 384by Deoxygenation of α,β -epoxy esters
(*see* TYPE OF REACTION INDEX)

by Elimination

Benzeneselenenyl bromide, **5**, 518Chloromethyl phenyl sulfide, **9**, 107*m*-Chloroperbenzoic acid, **8**, 97Diethoxyaluminum chloride, **6**, 180Dimethyl bromomalonate, **12**, 200Dimethyl disulfide, **5**, 246; **6**, 217Ethyl 2-methylsulfinylacetate, **6**, 255Ethyl α -trifluoromethylsulfonyloxyacetate, **7**, 149

- Methyl 3-dimethylaminopropionate, 9, 306
 Methyl phenylsulfinylacetate, 6, 393
 Oxalic acid, 1, 764
 Ozone, 10, 295
 Phosphorus(III) bromide, 1, 873
 Phosphorus(V) oxide, 7, 291
 Phosphoryl chloride, 8, 401
 Quinoline, 1, 975
 Sulfuryl chloride-Pyridine, 5, 642
 Thionyl chloride, 1, 1158
 Trimethylsilylmethyl trifluoromethanesulfonate, 9, 100
 by Hydrocarboxylation of $C \equiv C$
 Carbon monoxide, 7, 53; 9, 95
 Ethyl chloroformate, 7, 147
 Organopentafluorosilicates, 11, 373
 from β -Keto esters
 Lithium dimethylcuprate, 5, 234
 Organocopper reagents, 9, 328; 10, 282
 Other routes
 Bis(dimethylaluminum)
 1,3-propanedithiolate, 6, 49
 Chloromethylcarbene, 11, 121
 Copper(I) bromide-Sodium bis-(2-methoxyethoxy)aluminum hydride, 6, 144
 2-Diethylamino-4-phenylsulfonyl-2-butenenitrile, 12, 182
 2-Diethylamino-4-phenylthio-2-butenenitrile, 11, 176
 Dihalobis(triphenylphosphine)-palladium(II), 6, 60
 Formaldehyde, 9, 224
 Grignard reagents, 11, 245
 Lindlar catalyst, 9, 270
 Manganese(IV) oxide, 2, 257
 4-Methoxycarbonylthiolane-3-one, 11, 324
 Organocopper reagents, 12, 345
 Oxygen, singlet, 8, 367
 Peracetic acid, 1, 787
 Rhodium(II) carboxylates, 11, 458
 Sodium methoxide, 4, 457
 Triphenylcarbenium perchlorate, 1, 1256
 Zinc bromide, 9, 520
 β, γ -UNSATURATED ESTERS
 Bis(acetonitrile)dichloropalladium(II), 8, 39
 t-Butyldimethylchlorosilane, 11, 88
 t-Butyl lithioacetate, 6, 84
 Butyllithium-Nickel(II) bromide, 8, 66
 Ethyl 4-bromocrotonate, 3, 236
 Lithium diisopropylamide, 5, 406; 11, 296
 Lithium dimethylcuprate, 8, 301
 Lithium N-isopropylcyclohexylamide, 4, 306
 Methyl methylthiomethyl sulfone, 11, 242
 Organocopper reagents, 12, 345
 Palladium(II) acetate-
 Triphenylphosphine, 11, 392
 Palladium(II) chloride, 11, 393
 Phenyl 2-(trimethylsilyl)ethynyl sulfone, 11, 426
 Potassium hexamethyldisilazide, 12, 407
 Sodium dithionite, 11, 485
 Tetraethyl phosphonosuccinate, 1, 1138

-Toluenesulfonylhydrazide, 8, 489

 Trimethylsilylmethylolithium, 6, 635
 Vincylcopper, 5, 747
 γ, δ -UNSATURATED ESTERS
 by Alkylation of enolates with allylic electrophiles
 Bis(dibenzylideneacetone)-palladium(0), 10, 34
 [1,2-Bis(diphenylphosphine)ethane]-dichloropalladium(II), 6, 447
 Ethoxycarbonylmethylcopper, 4, 224
 Palladium(II) chloride, 4, 369; 5, 500
 Reformatsky reagent, 12, 422
 Tetrakis(triphenylphosphine)-palladium(0), 8, 472; 11, 503
 by Claisen rearrangement
 N,N-Dimethylacetamide dimethyl acetal, 4, 166
 Lithium N-isopropylcyclohexylamide, 7, 209
 Triethyl orthoacetate, 3, 300; 4, 527; 6, 607
 1,1,1-Trimethoxy-3-phenyl-selenopropane, 9, 489
 Trimethyl orthoformate, 8, 180
 Other routes
 Copper(II) sulfate, 6, 141
 8-Phenylmenthol, 11, 412
 δ, ϵ -UNSATURATED ESTERS
 Alkylaluminum halides, 11, 7
 Allyltrimethylsilane, 12, 23

UNSATURATED ESTERS (*Continued*)Aluminum chloride, **5**, 10; **7**, 7; **9**, 13Lithium diallylcuprate, **5**, 175**UNSATURATED LACTONES**(*see also* **CHIRAL COMPOUNDS**) **α -ALKYLIDENE LACTONES**Bis[methoxy(thiocarbonyl)] disulfide, **10**, 39Ethyl formate, **12**, 226 α -Mercapto- γ -butyrolactone, **8**, 314Mercury(II) trifluoroacetate, **11**, 320Phosphoryl chloride, **8**, 401Potassium carbonate, **9**, 382Tris(dimethylamino)methane, **7**, 411 **α -METHYLENE LACTONES**

by Carbonylation

Dimethylaluminum acetylide, **8**, 385Lithium acetylide, **6**, 451Nickel carbonyl, **6**, 451Palladium(II) chloride-Thiourea, **7**, 278; **11**, 397 α -Trimethylsilylvinylmagnesium bromide, **8**, 515

from Cyclopropanes

6,6-Dimethyl-5,7-dioxaspiro[2.5]-octane-4,8-dione, **7**, 122Iodotrimethylsilane, **9**, 251; **12**, 259Trifluoroacetic acid, **9**, 483Zinc bromide, **5**, 762

by Lactonization

Boron trifluoride etherate, **10**, 52Butyllithium, **10**, 73Lithium (1,1-diethoxy-2-propenyl)-(3,3-dimethyl-1-butynyl)cuprate, **8**, 300Lithium (3,3-diethoxy-1-propen-2-yl)-phenylthiocuprate, **7**, 2122-Phenylthiopropionic acid, **6**, 466by Methylenation α to C=O'sBis(dimethylamino)methoxymethane, **10**, 34Bromine, **11**, 75Bromomethyl methyl ether, **10**, 56Carbon dioxide, **5**, 93Chloromethyl phenyl sulfide, **9**, 107, 5211,5-Diazabicyclo[4.3.0]nonene-5, **6**, 157Dibenzoyl peroxide, **4**, 1221,2-Dibromoethane, **4**, 126; **5**, 187

Dimethyl(methylene)ammonium

trifluoroacetate, **7**, 132Diphenyl diselenide, **5**, 272; **7**, 136Diphenyl disulfide, **5**, 276Ethyl formate, **12**, 226Ethyl α -trifluoromethylsulfonyloxyacetate, **7**, 149Formaldehyde, **5**, 312; **6**, 264; **9**, 224Iodomethyl methyl sulfide, **5**, 353Lead tetraacetate, **5**, 365Lithium diisopropylamide, **4**, 298Magnesium methyl carbonate, **3**, 190; **5**, 420; **11**, 310Methyl formate, **5**, 446Potassium carbonate, **9**, 382Sodium benzeneselenoate, **10**, 368Sodium cyanoborohydride, **5**, 607; **6**, 537Sodium dicarbonyl(cyclopentadienyl)-ferrate, **11**, 483Trimethylsilyl dichloroacetate, **9**, 491Tris(methylthio)methylolithium, **7**, 412**Other routes**Bis(1,5-cyclooctadiene)nickel(0), **9**, 45
2-Bromo-3-trimethylsilyl-1-propene, **11**, 80 α -Chloro-N-cyclohexylpropanal-donitrone, **5**, 110Di- μ -bromobis[(2-ethoxycarbonyl)-2-propenyl]dinickel, **6**, 93Dicarbonylbis(triphenylphosphine)-nickel, **10**, 125Dimethyl diazomalonate, **8**, 187Dimethyl malonate, **8**, 193N-(2,3-Epoxypropylidene)-cyclohexylamine N-oxide, **9**, 209Formaldehyde, **7**, 158Lithium diisopropylamide, **7**, 204Lithium α -ethoxycarbonylvinyloxy-(1-hexynyl)cuprate, **6**, 329Methylalcohol, **8**, 67*p*-Methoxybenzyl itaconate, **6**, 365Methoxy(phenylthio)methylolithium, **6**, 369Nickel carbonyl, **11**, 3562-Phenylselenopropionic acid, **8**, 397Titanium(IV) chloride, **8**, 483Tributyltin hydride, **12**, 5162,4,6-Triisopropylbenzenesulfonylhydrazide, **9**, 4861,1,1-Trimethoxy-3-phenylselenopropene, **9**, 489

- Zinc, 3, 334
 Zinc-copper couple, 7, 428
 Zinc-Graphite, 12, 570
- γ-METHYLENE LACTONES**
 Dimethyl diazomalonate, 8, 187
 Iodine, 8, 256
 Mercury(II) acetate, 8, 315
 Mercury(II) oxide, 8, 316
 Palladium(0)-Phosphines, 9, 344
 Silver(I) nitrate, 12, 433
- α,β-UNSATURATED-γ-LACTONES
 (Δ²-BUTENOLIDES)**
 by Additions to C=O
 2-Carboxy-1-ethoxycarbonylethylidenetriphenylphosphorane, 8, 77
 Cyclopropenone 1,3-propanediyl ketal, 12, 152
 Ethyl lithiopropiolate, 9, 217
 Ethyl β-(1-pyrrolidinyl)acrylate, 8, 226
 Glyoxylic acid, 5, 320
 Iron, 5, 357
 Lithium ethoxyacetylde, 1, 613
- by Elimination
 Acetic anhydride, 11, 1
 Benzeneselenenyl chloride, 6, 459; 9, 25
 Chloroketene diethyl acetal, 9, 522
 1,2-Dibromoethane, 4, 126
 Dimethyl carbonate, 5, 234
 Diphenyl disulfide, 5, 276
 Ethyl α-trifluoromethylsulfoniloxyacetate, 7, 149
 Phenylthioacetic acid, 6, 463
 Pyridine, 11, 448
 (R)-(+)-3-(*p*-Tolylsulfanyl)propionic acid, 12, 509
 Triethylamine, 1, 1198
 Triethyl orthoformate, 11, 555
 Trimethylsilyl dichloroacetate, 9, 491
 Zinc bromide, 11, 600
- from Furans
 2,5-Bis(trimethylsilyloxy)furans, 10, 45
 2-*t*-Butoxyfuran, 8, 59
 β-Furyllithium, 10, 188
 2-Methoxy-4-furyllithium, 11, 325
 1-Methoxy-1-trimethylsilyllallene, 11, 577
 Organolithium reagents, 10, 290
 Peracetic acid, 11, 402; 12, 378
 Phenylthiomethylithium, 11, 422
 Pyridinium chlorochromate, 9, 397
- Titanium(IV) chloride, 11, 529
- Other routes
 Acetic anhydride, 6, 6
 Bis[1,2-bis(diphenylphosphine)-ethane]palladium(0), 9, 344
 N-Bromosuccinimide, 7, 37
t-Butyl diazomethyl ketone, 5, 162
 Carbon monoxide, 7, 53
 1-Chloro-N,N,2-trimethylpropenylamine, 12, 123
 Di-μ-carbonylhexacarbonyldicobalt, 8, 148; 9, 144
 Dichlorobis(triphenylphosphine)-palladium(II), 10, 133
 3,3-Diethoxy-1-methylthiopropyne, 5, 207
 N,N-Diethylaminopropyne, 8, 165
 Dihalobis(triphenylphosphine)-palladium(II), 10, 133
 Dimethylformamide dimethyl acetal, 11, 198
 Dimethylsulfonium methylide, 11, 213
 Dimethyl sulfoxide-Acetic anhydride, 2, 163; 4, 199
 Dimethylsulfoxonium methylide, 1, 315
 Grignard reagents, 11, 245
 α-Hydroxyhippuric acid, 6, 289
 Ketene, 1, 528
 Ketenylidenetriphenylphosphorane, 10, 450; 11, 281
 Lithium aluminum hydride, 10, 265
 (S)- or (R)-Menthyl *p*-toluenesulfinate, 12, 295
 S-Methyl *p*-toluenethiosulfonate, 6, 400
 Phosphorus(V) oxide-
 Methanesulfonic acid, 7, 291
 Potassium phenylacetate, 6, 137
 Pyridinium dichromate, 10, 335
 Selenium(IV) oxide, 1, 992; 2, 360
 Silver carbonate-Celite, 12, 433
 Sodium methylsulfynylmethylide, 7, 338
 Sulfuric acid, 5, 633; 9, 441
 Sulfur trioxide-Dimethylformamide, 1, 1125
 Tributyltin hydride, 12, 516
 Triethyl orthoacetate, 6, 607
 Trifluoroacetyl chloride, 11, 560
 Trimethyl phosphonoacetate, 7, 394

UNSATURATED LACTONES (*Continued*)

Tris(dimethylamino)methane, 7, 411

 β -Vinylbutenolide, 6, 661; 9, 515; 11, 594 α,β -UNSATURATED- δ -LACTONES

Benzeneseleninic anhydride, 11, 37

Boron trifluoride, 11, 71

2-Butynoic acid, 8, 308

2,3-Dichloro-5,6-dicyano-1,4-benzoquinone, 1, 215

Diethyl oxomalonate, 6, 188

1,3-Dimethoxy-1-trimethylsilyloxy-1,3-butadiene, 12, 196

2,2'-Dipyridyl disulfide, 8, 214

1-Methoxy-1,3-butadiene, 10, 258

Methyl phenylsulfinylacetate, 11, 343

Propiolic acid, 6, 495

Pyridinium chlorochromate, 11, 450; 12, 417

Sodium dicarbonyl(cyclopentadienyl)-ferrate, 11, 483

Zinc bromide, 11, 600

 β,γ -UNSATURATED- γ -LACTONES (Δ^3 -BUTENOLIDES)

Acetic anhydride, 8, 1

Bis(benzonitrile)dichloropalladium(II), 12, 51

Peracetic acid, 12, 378

 β,γ -UNSATURATED- δ -LACTONES

Diethyl oxomalonate, 8, 170

Ethyl lithioacetate, 8, 225

 γ,δ -UNSATURATED- δ -LACTONES

N,N-Dimethylhydrazine, 9, 184

Mercury(II) oxide, 12, 305

Silver(I) nitrate, 12, 433

OTHER UNSATURATED LACTONES

Benzeneselenenyl bromide, 9, 25

Ketenylidenetriphenylphosphorane, 12, 268

Lithium isopropoxide, 9, 283

UNSATURATED NITRILES α,β -ACETYLENIC NITRILES

Copper(I) cyanide, 6, 146

Lithium aluminum hydride, 9, 274

Phenyl cyanate, 10, 307

 α,β -UNSATURATED NITRILES

by Adding CN to C=O

Cyanotrimethylsilane, 10, 112

Diethylaluminum cyanide, 2, 127; 4, 146

Diethyl phosphorocyanidate, 12, 187

o-Nitrophenyl selenocyanate, 8, 362by Adding anions α to CN to C=O

Acetonitrile, 5, 621; 7, 303

Alumina, 11, 22

Benzyl nitrile, 1, 1066

t-Butyl cyanoacetate, 1, 87

Chlorocyanoketene, 9, 103

Cyanoacetic acid, 1, 39; 1, 959

Cyanomethyldiphenylphosphine oxide, 8, 133

Cyanomethylidenebis(triphenylphosphonium) dibromide, 4, 112

2-(Diethoxyphosphinyl)propionitrile, 7, 106

Diethyl cyanomethylphosphonate, 1, 250; 2, 130; 4, 150; 6, 566

Ethyl cyanoacetate, 1, 121

O-Ethyl S-cyanomethyl dithiocarbonate, 9, 215

Glycine, 1, 412

Ion-exchange resins, 1, 511

Malononitrile, 1, 16; 5, 6; 6, 11

Methylthioacetonitrile, 8, 349

Phosphoryl chloride, 1, 876

Potassium hydroxide, 9, 387

Sodium amide, 1, 1034

Titanium(IV) chloride-Titanium(IV) isopropoxide, 12, 503

Trimethylsilylacetonitrile, 10, 427; 11, 571

Triphenylphosphine, 4, 548

Tris(trimethylsilyl)ketenimine, 11, 591

by Oxidative cleavage of

o-phenylenediamines

Copper(I) chloride, 5, 165; 7, 80; 8, 118

Nickel peroxide, 1, 731

from α,β -Unsaturation C=O

Chlorosulfonyl isocyanate, 2, 70; 3, 51

N,N-Dimethylhydrazine, 1, 289

Lead tetraacetate, 1, 537

from Vinyl halides

Dibromobis(triphenylphosphine)-nickel(II)-Zinc, 11, 157

Nickel carbonyl, 3, 210

Potassium cyanide, 8, 473

Sodium dicyanocuprate, 3, 265

Other routes

Ascarite, 4, 21

2-(6-Bromopyridyl)lithium, 5, 63

1-Chlorobenzotriazole, 2, 67

Diisobutylaluminum hydride, **2**, 140
Dimethyl(methylthio)sulfonium
tetrafluoroborate, **11**, 204
Diphenyl diselenide, **5**, 272
Hydrogen cyanide, **9**, 293
Phenyl selenocyanate, **11**, 416
 α -(Phenylsulfinyl)acetonitrile, **6**, 395;
12, 391

Phosphorus(III) chloride, **8**, 400
Potassium cyanide, **11**, 433
Tetrakis(triphenylphosphine)-
palladium(0), **10**, 384; **11**, 503
Tetrakis(triphenyl phosphite)nickel(0),
11, 503

Trichloroacetyl isocyanate, **7**, 382

β,γ -UNSATURATED NITRILES

Acetonitrile, **6**, 84
Benzyltriethylammonium chloride, **7**, 18
Copper(I) cyanide, **5**, 166
Iodoacetonitrile, **6**, 494
Methylthioacetonitrile, **8**, 349
Sodium cyanide, **7**, 333
Trimethylsilylmethyl lithium, **6**, 635

γ,δ -UNSATURATED NITRILES

Cyanomethylcopper, **4**, 111
Palladium(II) chloride, **5**, 500

UREAS

Dichloromethylenedimethylammonium
chloride, **4**, 135
Dicyclohexylcarbodiimide, **8**, 162
Dimethyl selenoxide, **8**, 197
Dimethyl sulfoxide-Iodine, **6**, 295
Iron carbonyl, **7**, 183
Isopropyl isocyanate, **11**, 277
Phenylcarbonimidic dichloride, **6**, 458
Phenyl isocyanate, **1**, 842
Potassium superoxide, **11**, 442
Selenium, **4**, 422
Silicon tetrakisocyanate, **1**, 1002
Sodium azide, **1**, 1041
Sodium methoxide, **1**, 1091
Sodium naphthalenide, **5**, 468
Tellurium, **11**, 498
Tributyltin azide, **7**, 377
Urea, **1**, 1262

URETHANES (see CARBAMATES)

VINYL HALIDES

VINYL FLUORIDES

Alumina, **8**, 9; **9**, 8
Bromine fluoride, **8**, 53

Cesium fluoroxysulfate, **11**, 118
Difluoromethylenetriphenyl-
phosphorane, **9**, 166
Fluoromethylenetriphenylphosphorane,
3, 146; **6**, 262
Pyridinium poly(hydrogen fluoride)-
N-Bromosuccinimide, **11**, 454
Silver acetate, **6**, 511

VINYL CHLORIDES

from $RCHO$, $RCOCH_2R'$
 $(RCOCH_2R' \rightarrow R'CH = CRCl$ or
 $R'CH_2CR = CHCl)$
Chlorocyanoketene, **9**, 103
Chloromethylenetriphenyl-
phosphorane, **1**, 1239; **7**, 62; **8**, 96
N-Chlorosuccinimide, **3**, 142
Oxalyl chloride, **1**, 767
Phosphorus(III) chloride, **1**, 875
Phosphorus(V) chloride, **4**, 388
2,2,2-Trichloro-1,3,2-benzodioxaphosphole, **2**, 63
Triphenylphosphine-Carbon
tetrachloride, **4**, 551
Triphenylphosphine dichloride, **6**, 646

from Alkynes

N-Chlorosuccinimide, **6**, 178; **8**, 235;
9, 276
1,2-Dichloroethylene, **12**, 175
Diisobutylaluminum hydride, **11**, 185
Lithium aluminum hydride, **9**, 274
Trifluoroacetic acid, **5**, 695

by Elimination

Chloro(phenylsulfinyl)methyl lithium,
9, 271
N-Chlorosuccinimide, **8**, 103
Potassium *t*-butoxide, **9**, 380
Sodium amide-Sodium *t*-butoxide, **9**,
417

Other routes

Alumina, **8**, 9
Chlorine, **5**, 556
Grignard reagents, **10**, 189
Iodine monochloride, **8**, 261
Lithium 2-methoxyethoxide, **3**, 186
Potassium hydroxide, **5**, 560
Tetrabutylammonium fluoride, **10**,
378
Tetrakis(triphenylphosphine)nickel(0),
12, 467

VINYL BROMIDES

from $RCHO$, R_2CO

VINYL HALIDES (*Continued*)

Bromomethylenetriphenyl-
phosphorane, **10**, 56

Dibromomethylithium, **11**, 158

from Alkynes

N-Bromosuccinimide, **6**, 178; **8**, 54, 235

Catecholborane, **5**, 100

Diisobutylaluminum hydride, **2**, 140;
11, 185

B-Halo-9-borabicyclo[3.3.1]nonane,
12, 236

Hydrogen bromide, **6**, 284

Mercury(II) bromide, **6**, 663

by Elimination

Benzeneselenenyl bromide, **5**, 518; **8**,
25

Potassium *t*-butoxide, **8**, 407

Sodium amide–Sodium *t*-butoxide, **4**,
439; **5**, 593; **9**, 417

Other routes

Bromine, **5**, 556

N-Bromosuccinimide, **2**, 40

Diphosphorus tetraiodide, **11**, 224

Ethylene oxide, **5**, 297

Lithium 2-methoxyethoxide, **3**, 186

Silver perchlorate, **4**, 432

Silver *p*-toluenesulfonate, **7**, 323

VINYL IODIDES

from C $\equiv$ C

Chlorobis(cyclopentadienyl)-
hydrido-zirconium(IV), **8**, 84

Diallylzinc, **12**, 54

Dichlorobis(cyclopentadienyl)-
titanium, **10**, 130; **11**, 163; **12**, 168

Diisobutylaluminum hydride, **3**, 174;
11, 185

B-Halo-9-borabicyclo[3.3.1]nonane,
12, 236

Iodine, **5**, 346; **6**, 178, 662; **8**, 235; **9**,
248

Iodine monochloride, **10**, 212

Lithium aluminum hydride–Sodium
methoxide, **4**, 295

Mercury(II) trifluoroacetate, **11**, 320

Nickel(II) acetylacetonate–
Trimethylaluminum, **8**, 42; **9**, 52

Trifluoroacetic acid, **5**, 695

Trimethylaluminum–Dichlorobis-
(cyclopentadienyl)zirconium, **11**,
567

Other routes

Guanidines, **12**, 477

Hydrazine, **12**, 241

Iodine, **9**, 498

Iodine monochloride, **8**, 261

N-Iodosuccinimide, **2**, 40

Lithium 2-methoxyethoxide, **3**, 186

Potassium fluoride, **5**, 555

DIFLUOROALKENES

Chlorodifluoromethane, **7**, 60

Diethyl difluorotrimethylsilyl-
methylphosphonate, **11**, 180

Difluoromethylenetriphenyl-
phosphorane, **1**, 1058, 1227; **9**, 166

Sodium chlorodifluoroacetate, **2**, 281,
379

Triphenylphosphine–

Dibromodifluoromethane, **10**, 448

DICHLOROALKENES

Antimony(V) chloride, **7**, 12

Copper(II) chloride, **6**, 139

Dichloro(diethoxyphosphinyl)-
methylithium, **6**, 188

Dichloromethylenetriphenyl-
phosphorane, **1**, 222, 1239; **7**, 97

Lithium piperidide, **6**, 344

Molybdenum(V) chloride, **6**, 412

Phenyl iodine(III) dichloride, **6**, 298

Potassium superoxide, **11**, 442

DIBROMOALKENES

Copper(II) bromide, **1**, 161

Diethyl dibromomethylphosphonate, **7**,
104

**VINYL HALIDES WITH TWO
DIFFERENT HALOGENS**

N-Bromoacetamide–Hydrogen fluoride,
4, 48

Chlorofluoromethylenetriphenyl-
phosphorane, **2**, 443

Methyl iodine(III) difluoride, **7**, 242

VINYL SILANES**FROM ARENESULFONYL-
HYDRAZONES**

Chlorotrimethylsilane, **7**, 13; **8**, 492; **10**,
96

p-Toluenesulfonylhydrazide, **8**, 290

2,4,6-Triisopropylbenzenesulfonyl-
hydrazide, **9**, 486

**FROM SILYL-SUBSTITUTED
ALKYNES**

Bis(benzonitrile)dichloropalladium(II),
11, 48

N-Chlorosuccinimide, **8**, 103
 Copper(I) iodide, **7**, 81; **12**, 143
 Dichlorobis(cyclopentadienyl)titanium,
 10, 130; **11**, 163; **12**, 168
 Dichlorobis(cyclopentadienyl)titanium-
 Dialkylaluminum chloride, **9**, 471
 Nickel(II) acetylacetonate-
 Trimethylaluminum, **8**, 42; **9**, 52

OTHER ROUTES

Chlorotrimethylsilane-Sodium, **10**, 356;
 12, 126
 Diethyl[dimethyl(phenyl)silyl]aluminum,
 12, 342
 Dimethylphenylsilyllithium, **10**, 162
 (1-Lithiovinyl)trimethylsilane, **5**, 374; **7**,
 193; **9**, 498; **11**, 286
 Lithium diisopropylamide-
 Chlorotrimethylsilane, **12**, 279
 Organocopper reagents, **12**, 345
 Organomagnesium reagents, **12**, 352
 Tetrakis(triphenylphosphine)-
 palladium(0), **11**, 503
 Triethylsilane, **3**, 187
 2-Triethylsilyl-1,3-butadiene, **8**, 502
 Trimethylsilyllallene, **10**, 428
 α -Trimethylsilylcrotyl-9-borabicyclo-
 [3.3.1]nonane, **10**, 430
 1-Trimethylsilyl(pentadienyl)lithium, **10**,
 436
 Tris(trimethylsilyl)methylolithium, **5**, 618

VINYL SULFUR COMPOUNDS

VINYL SULFIDES

Benzenesulfonyl chloride, **8**, 32
 Butyllithiums, **5**, 79, 80
 2-Chloroethyl thiocyanate, **9**, 106
 Copper(I) bromide-Lithium
 trimethoxyaluminum hydride, **7**, 80
 Copper(I) trifluoromethanesulfonate, **6**,
 130; **7**, 75; **8**, 125
 Diethyl allylthiomethylphosphonate, **3**,
 94
 Diethyl (1-methylthio)ethylphosphonate,
 4, 151
 Diethyl methylthiomethylphosphonate,
 3, 97
 Diethyl phenylthiomethylphosphonate,
 6, 191
 Dimethylsulfonium methylide, **5**, 254
 Diphenyl disulfide, **7**, 47
 Divinylmercury, **1**, 352

Ethylmagnesium bromide-Copper(I)
 iodide, **9**, 219
 Iodotrimethylsilane, **10**, 216; **12**, 259
 Lithium aluminum hydride, **8**, 286
 Lithium diisopropylamide-
 Chlorotrimethylsilane, **12**, 279
 Lithium naphthalenide, **9**, 284
 Organolithium reagents, **9**, 5
 Phenyl phenylthiomethyl sulfoxide, **6**,
 394
 Phenylthiotrimethylsilylmethane, **11**, 423
 Sodium methylsulfinylmethylide, **9**, 431
 Tetrakis(triphenylphosphine)-
 palladium(0), **9**, 451
 Trichloroisocyanuric acid, **6**, 605
 Tris(phenylseleno)borane, **9**, 511
 Tris(phenylthio)borane, **7**, 409
 Vinyltrimethylsilane, **10**, 444

VINYL SULFONES

Allyl phenyl sulfone, **8**, 405
 Benzenesulfonyl chloride, **8**, 32
 Benzylsulfonyldiazomethane, **11**, 43
 Benzyltriethylammonium chloride, **6**, 41
 Butyllithium, **4**, 60
m-Chloroperbenzoic acid, **8**, 97
 Copper(II) acetate, **12**, 140
 Hexamethylphosphoric triamide, **10**, 196
 Methylolithium, **9**, 310
 Phenylselenenyl benzenesulfonate, **11**,
 407
 Phenylselenenyl *p*-toluenesulfonate, **10**,
 315; **12**, 394
 1-Phenylsulfonyl-2-trimethylsilylethane,
 11, 41
 Phenylsulfonyl(trimethylsilyl)methane,
 12, 393

VINYL SULFOXIDES

Bis(phenylsulfinyl)methane, **6**, 394
 Diethyl methylsulfinylmethyl-
 phosphonate, **6**, 193
 Grignard reagents, **8**, 235
 (S)- or (R)-Menthyl *p*-toluenesulfinate,
 12, 295
 Methylcopper, **6**, 377
 Organocopper reagents, **9**, 328

XANTHATES

p-Bromophenacyl bromide, **1**, 77
 Carbon disulfide, **4**, 195; **9**, 94
 Crown ethers, **11**, 143

TYPE OF COMPOUND INDEX

CARBENES AND METAL-CARBENE

COMPLEXES

1,3-Benzodithiole-2-carbene
Benzoylcarbene
Bis(methoxycarbonyl)carbene
Bromocarbene
Bromochlorocarbene
Bromofluorocarbene
Bromo(methoxycarbonyl)carbene
Bromophenylcarbene
Chlorocarbene
2-(Chloroethoxy)carbene
Chloro(ethoxycarbonyl)carbene
Chlorofluorocarbene
Chloromethylcarbene
Chloro(methylthio)carbene
Chlorophenylcarbene
Chlorotrifluoromethylcarbene
Chlorotrimethylsilylcarbene
Chromium carbene complexes
Cyclobutylidene
Dibromocarbene
Dichlorocarbene
Dicyanocarbene
Difluorocarbene
Dihalocarbene
Dimethoxycarbene
Dimethylcarbene
Dimethylvinylidenecarbene
Diphenylcarbene
Ethoxycarbene
Fluoroiodocarbene
Fluorophenylcarbene
Fluoro(trifluoromethyl)carbene
Formylcarbene
Iron-carbene complexes
Isopropylidenecarbene
Methoxycarbene
Pentacarbonyl(methoxyphenyl-
methylene)chromium(0) or -tungsten(0)
Phenoxycarbene
Phenylcarbene
Phenylsulfinylcarbene
Tetracarbonyl(ethoxyphenyl-
methylidene)iron(0)

Trimethylsilylcarbene

Trimethylstannylcarbene

Tris(2,2-dimethylpropyl)(2,2-dimethyl-
propylidene)niobium or -tantalum

Zirconium-carbene complexes

CHIRAL COMPOUNDS

CHIRAL ACIDS

(2R,3R)-Dipivaloyltartaric acid

CHIRAL AUXILIARIES, LIGANDS, AND CATALYSTS

(R)-2-Acetoxy-1,1,2-triphenylethanol

(2R,4R)- and (2S,4S)-N-Acryloyl-4-
(diphenylphosphine)-2-[(diphenyl-
phosphine)methyl]pyrrolidine

(S)-1-Alkoxyethyl-2-aminopropane,
polymeric

1-Amino-(S)-2-[(R)-1-hydroxyethyl]-
indoline

(S)-1-Amino-2-hydroxymethylindoline

(R)- or (S)-1-Amino-2-methoxymethyl-
1-pyrrolidine

(S)-(-)-2-Amino-1-methoxy-3-
phenylpropane

(1S,2S)-2-Amino-3-methoxy-1-phenyl-1-
propanol

(S)-(-)-2-Amino-3-methyl-1,1-diphenyl-
1-butanol

(S)-15-Aminomethyl-14-hydroxy-5,5-
dimethyl-2,8-dithia-[9](2,5)-
pyridinophane

(1S,2S)-2-Amino-1-phenyl-1,3-
propanediol

(S)-2-Aminopropyl benzyl ether

(S)-4-Anilino-3-methylamino-1-butanol

(2S,4S)-(Anilinomethyl)-1-ethyl-4-
hydroxypyrrolidine

(S)-2-(Anilinomethyl)pyrrolidine

(R)-(+)-o-Anisylcyclohexylmethyl-
phosphine

N-Benzylcinchoninium chloride

3-O-Benzyl-1,2-O-cyclohexylidene-
 α -D-glucofuranose

(Benzylmethoxymethyl)methylamine

(-)-N-Benzyl-N-methylephedrinium
bromide

CHIRAL COMPOUNDS (*Continued*)

- (S)-N-Benzoyloxycarbonylproline
 N-Benzylquinidinium chloride
 (-)-Benzylquininium chloride or fluoride
 Bis[(-)-camphorquinone- α -dioximate]-cobalt(II) hydrate
 Bis(1,5-cyclooctadiene)nickel(0)-(-)-Benzylmethylphenylphosphine
trans-2,3-Bis(diphenylphosphine)bicyclo-[2.2.1]hept-5-ene
 (R)-(+)- and (S)-(-)-2, 2'-Bis(diphenylphosphine)-1, 1'-binaphthyl
 [2,2'-Bis(diphenylphosphine)-1, 1'-binaphthyl](cyclooctadiene)-rhodium(I) perchlorate
 [2,2'-Bis(diphenylphosphine)-1, 1'-binaphthyl](norbornadiene)-rhodium(I) perchlorate
 [1,4-Bis(diphenylphosphine)butane]-(1,5-cyclooctadiene)iridium(I) tetrafluoroborate
 1,4-[Bis(diphenylphosphine)butane]-(norbornadiene)rhodium(I) tetrafluoroborate
trans-2,5-Bis(methoxymethoxymethyl)-pyrrolidine
trans-2,5-Bis(methoxymethyl)pyrrolidine
 (S,S)- or (R,R)-N,N'-Bis(α -methylbenzyl)sulfamide
 Bis(norbornadiene)rhodium(I) perchlorate-(R)-1-(S)-1',2-Bis(diphenylphosphine)ferrocenylethanol
 (-)-Borneol
 Bornyloxyaluminum dichloride
 D-(-) and L-(+)-2,3-Butanediol
 L(+)-Butane-2,3-dithiol
 [N-(*t*-Butoxycarbonyl)-4-diphenylphosphine]-2-[(diphenylphosphine)-methyl]pyrrolidine(cyclooctadiene)-rhodium chloride or perchlorate
 (2S,4S)-N-(*t*-Butoxycarbonyl)-4-(diphenylphosphine)-2-[(diphenylphosphine)methyl]pyrrolidine
 (4S)-*t*-Butylthio-(2S)-methoxymethyl-N-pivaloylpyrrolidine
 (R)-(+)-*t*-Butyl (*p*-tolylsulfinyl)acetate
 (R)-(+)-*t*-Butyl 2-(*p*-tolylsulfinyl)-propionate
 Camphor-10-sulfonic acid
 Carbonylhydridotris(triphenylphosphine)rhodium-2,3,O-Isopropylidene-2,3-dihydroxy-1,4-bis(diphenylphosphine)butane
 (-)-2-Chloromethyl-4-methoxymethyl-5-phenyloxazoline
 Chlorotris(neomenthyl)diphenylphosphine)rhodium(I)
 Cinchona alkaloids
 Cinchonidine
 Cinchonine
 (1,5-Cyclooctadiene)bis(methyldiphenylphosphine)iridium (I)hexafluorophosphate
 Darvon alcohol
 Dibenzyltaramide
 Dichlorobis(1,5-cyclooctadiene)-dirhodium + chiral co-reagents
 Di- μ -chlorobis(1,5-hexadiene)dirhodium + chiral co-reagents
 Dichlorobis(norbornadiene)dirhodium + chiral co-reagents
 (-)-*trans*-Dichloro(ethylene)- α -methylbenzylamineplatinum(II)
 Dichloro[2,3-O-isopropylidene-2,3-dihydroxy-1,4-bis(diphenylphosphine)butane]nickel(II)
 Di- μ -chlorotetra(ethylene)dirhodium-2,3-O-Isopropylidene-2,3-dihydroxy-1,4-bis(diphenylphosphine)butane
 Di- μ -chlorotetrakis(cyclooctene)-dirhodium-2,3-O-Isopropylidene-2,3-dihydroxy-1,4-bis(diphenylphosphine)butane
 Diethyl tartrate
 2,2'-Dihydroxy-1,1'-binaphthyl
 (S)-(-)-10,10'-Dihydroxy-9,9'-biphenanthryl
 Diisopropyl tartrate
 Dimenthyl fumarate
 (3S,6S)-(+)-2,5-Dimethoxy-3,6-dimethyl-3,6-dihydropyrazine
 (S)-1-(Dimethoxymethyl-2-methoxymethyl)pyrrolidine
trans-2,4-Dimethoxymethyl-5-phenyloxazoline
 R-(-)-(Dimethoxyphosphinyl)methyl *p*-tolyl sulfoxide
 3-Dimethylamino-2-methyl-1-propanol
 (S,R)-N,N-Dimethyl-1-[1',2-bis(diphenylphosphine)ferrocenyl]-ethylamine
 (-)-N,N-Dimethylephedrinium bromide

- N,N-Dimethyl- α -methylbenzylamine
 N,S-Dimethyl-S-phenylsulfoximine
 1,2-Dimethylpyrrolidine
 (+)-*trans*-2,5-Dimethylpyrrolidine
 N,N-Dimethyl- α -*p*-tolylsulfanyl-
 acetamide
 (S α R)- or (R α S)-2-Diphenylphosphine-
 ferrocenyl ethyldimethylamine
 (-)-N-Dodecyl-N-methylephedrinium
 bromide
 Ephedrine
 (R,R)-1,2-Ethanediylbis[*o*-methoxy-
 phenyl]phenylphosphine]
 Ethyl (S)-lactate
 Ethyl mandelate
 (4S,5S)-2-Ethyl-4-(methoxymethyl)-
 5-phenyloxazoline
 (-)-N,N-Ethylmethylephedrinium
 bromide
 (R)-Ethyl *p*-tolylsulfynylmethyl-
 enepropionate
 Ferrocenylphosphines
 (S)-N-Formyl-2-methoxymethyl-
 pyrrolidine
 L-N-Hexadecyl-N-methylephedrinium
 bromide
 Hexahydro-4,4,7-trimethyl-4*H*-1,3-
 benzothiiin
 (S)-Histidine
 (S)-(+)- α -Hydroxy- β , β -dimethylpropyl
 vinyl ketone
 (1R)-(-)-*cis*-3-Hydroxyisobornyl
 neopentyl ether
 (-)-3-Hydroxy-5-methylhydantoin
 (S)-2-Hydroxymethyl-1-methyl-
 pyrrolidine
 (2S,2'S)-2-Hydroxymethyl-1-[(1-
 methylpyrrolidin-2-yl)methyl]-
 pyrrolidine
 (1S,2S,5S)-2-Hydroxy-pinane-3-one
 Isopropyl glyoxylate
 2,3-O-Isopropylidene-2,3-dihydroxy-
 1,4-bis(diphenylphosphine)butane
 [2,3-O-Isopropylidene-2,3-dihydroxy-
 1,4-bis(diphenylphosphine)butane]-
 palladium
 2,3-O-Isopropylidene-2,3-dihydroxy-
 1,4-bis(di-*m*-tolylphosphine)butane
 4-Isopropyl-2-oxazolidinone
 2-Isopropylpyrrolidine
 Leucine *t*-butyl esters
 (S)-(+)- and (R)-(-)-Mandelic acid
d- and *l*-Menthyl
 (-)-Menthoxycetyl chloride
 Menthoxaluminum dichloride
 (S)-(-)-Menthyl *p*-methoxy-
 benzenesulfinate
 (S)- or (R)-Menthyl *p*-toluenesulfinate
 (-)-10-Mercaptoisoborneol
 4-(R)-Methoxycarbonyl-1,3-
 thiazolidine-2-thione
erythro-2-Methoxy-1,2-
 diphenylethylamine
 (4S,5S)-4-Methoxymethyl-2-methyl-
 5-phenyl-2-oxazoline
 (S)-(+)-2-Methoxymethylpyrrolidine
 α -Methylbenzylamine
 Methyl 2,3-bis-O-diphenylphosphine-
 4,6-O-benzylidene- α -D-
 glucopyranoside
 (-)-N-Methylephedrine
 N-Methylephedrinium chloride
 4-Methyl-5-phenyl-2-oxazolidinone
 (R)-(-)-Methylphenylpropylphosphine
 N-Methylphenylsulfonimidoyl-
 methyl lithium
 (S)-N-Methylprolinol
 2-Methylpyrrolidine
 (S)-1-[1-Methyl-2-pyrrolidinyl]-
 methylpiperidine
 (R)-(+)-Methyl *p*-tolyl sulfoxide
 Neomenthyl diphenylphosphine
 Nickel(II) chloride- α -2-Diphenyl-
 phosphineferrocenyl ethyldimethyl-
 amine
 (S)-1-Nitroso-2-methylindoline-2-
 carboxylic acid
 (-)-Norephedrine
 [(2S)-(2 α ,3 α ,4 α ,7 α ,7 α)]-
 2,3,3 α ,4,5,6,7,7 α -Octahydro-
 7,8,8-trimethyl-4,7-methano-
 benzofuran-2-ol
 2-Oxazolidones, chiral
 Palladium(II) acetate-(S,R)-N,N-
 Dimethyl-1-[1',2-bis(diphenyl-
 phosphine)ferrocenyl]ethylamine
 Palladium(II) chloride + chiral
 co-reagents
 (2R,4R)-Pentenediol
 (S)-Phenylalanine
 (+)-3-Phenylbornane-2,3-diol
 S-(+)-2-Phenylbutyl chloride

CHIRAL COMPOUNDS (*Continued*)

N-Phenylcampholylhydroxamic acid
 8-Phenylmenthol and esters
 (+)-1-Phenyl-2-propylamine
 (R)-(+)-Phenyl (*p*-tolylsulfinyl)acetate
 Pinanediol
 (S)-(-)-Proline
 (S)-Prolinol
 Pyridinium (*d*)-camphor-10-sulfonate
 Quinine
 (-)-Sparteine
 (+)-(R)-*trans*- β -Styryl *p*-tolyl sulfoxide
 Tartaric acid
 Tartrate esters
 (R,R)- and (S,S)-Tetramethyltartaric acid diamide
p-Tolylsulfinylacetic acid
 (R)-(4-Tolylsulfinyl)-ethyl-N-methoxyacetimidate
p-(Tolylsulfinyl)methyl lithium
 (R)-(+)-3-(*p*-Tolylsulfinyl)propionic acid
 (S)-(+)-*p*-Tolyl *p*-tolylthiomethyl sulfoxide
p-Tolyl vinyl sulfoxide
 N-*p*-Trifluoromethylbenzylcinchoninium bromide
 (-)-4,6,6-Trimethyl-1,3-oxathiane
 4,4,6-Trimethyl-1,3-oxathiane
 Tris[3-(heptafluoropropylhydroxymethylene)-*d*-camphorato]-europium(III)
 (S)-Valine *t*-butyl ester
 L-Valinol
 (S)-2-(2,6-Xylidinomethyl)pyrrolidine

CHIRAL BASES

L- α,α' -Dimethyldibenzylamine
 Lithium L- α,α' -dimethyldibenzylamide
 Lithium (γ -methoxypropyl)- α -phenylethylamide
 Lithium 2-(1-pyrrolidinyl)methylpyrrolidide
 (γ -Methoxypropyl)- α -phenylethylamine
 (S)-(+)-2-(1-Pyrrolidinyl)methylpyrrolidine

CHIRAL BORANES

B-Allyldiisocaranylborane
 B-Allyldiisopinocampheylborane
 Borane-(S)-(-)-2-Amino-3-methyl-1,1-diphenyl-1-butanol
 Diisopinocampheylborane

Dilongifolylborane
 NB-Enantrane
 NB-Enantride
 Lithium B-isopinocampheyl-9-borabicyclo[3.3.1]nonyl hydride
 B-Methallyldiisopinocampheylborane
 B-(3-Methyl-2-butenyl)-diisopinocampheylborane
 Monoisopinocampheylborane
 B-3-Pinanyl-9-borabicyclo[3.3.1]nonane
 Sodium tris[(S)-N-benzoyloxycarbonylprolyoxy]hydroborate
 Triisopinocampheylborane

CHIRAL METAL HYDRIDES

Lithium aluminum hydride-(S)-4-Anilino-3-methylamino-1-butanol
 Lithium aluminum hydride-(S)-2-(Anilinomethyl)pyrrolidine
 Lithium aluminum hydride-3-O-Benzyl-1,2-O-cyclohexylidene- α -D-glucofuranose complex
 Lithium aluminum hydride-(S,S)- or (R,R)-N,N'-Bis(methylbenzyl)-sulfamide
 Lithium aluminum hydride-Darvon alcohol
 Lithium aluminum hydride-(R)- and (S)-2,2'-Dihydroxy-1,1'-binaphthyl
 Lithium aluminum hydride-(S)-(-)-10,10'-Dihydroxy-9,9'-biphenanthryl
 Lithium aluminum hydride-(-)-N-Methylephedrine
 Lithium aluminum hydride-(-)-N-Methylephedrine-3,5-Dimethylphenol
 Lithium aluminum hydride-(-)-*cis*-Pinanediol
 Lithium aluminum hydride-(S)-2-(2,6-Xylidinomethyl)pyrrolidine
 Lithium tetrabutylaluminate-(-)-N-Methylephedrine
 Sodium borohydride-(-)-Benzylquininium chloride
 Sodium borohydride-1,2,5,6-Di-O-isopropylidene- α -D-glucofuranose
 Sodium borohydride-(-)-N-Dodecyl-N-methylephedrinium bromide
 Sodium borohydride-L-N-Hexadecyl-N-methylephedrinium bromide
 Sodium tris[(S)-N-benzoyloxycarbonylprolyoxy]hydroborate

CHIRAL RESOLVING AGENTS

(S)-(-)-1-Amino-2-(*t*-butyldialkylsilyloxymethyl)pyrrolidine
 (+)-3-Aminomethylpinane
 Amphetamine
 (S)-(+)- and (R)-(-)-1,1'-Binaphthyl-2,2'-diyl hydrogen phosphate
 (-)- α -Bromocamphor-10-sulfonic acid
 Brucine
 (+)-Camphanic acid
 Camphor-10-sulfonic acid
d- and *l*-10-Camphorsulfonyl chloride
 (-)-*trans*-Dichloro(ethylene)[α -methylbenzylamine]platinum(II)
 (-)-2,3,4,6-Di-O-isopropylidene-2-keto-L-gulonic acid hydrate
 Di-*p*-toluoyl-D-tartrate
 (S)-N-Methanesulfonylphenylalanyl chloride
 (R)- and (S)- α -Methoxy- α -trifluoromethylphenylacetic acid
 α -Methylbenzylamine
 (S)-1- α -Naphthylethylamine
 (R)-1-(1-Naphthyl)ethyl isocyanate
 [(2S)-(2 α ,3 α ,4 α ,7 α ,7 α)]-2,3,3 α ,4,5,6,7,7 α -Octahydro-7,8,8-trimethyl-4,7-methanobenzofuran-2-ol
 (S)-N-Phthaloylphenylalanyl chloride
 L-Pyrrolidonecarboxylic acid
 (+)- and (-)- α -(2,4,5,7-Tetranitro-9-fluorenylideneaminoxy)propionic acid

OTHER CHIRAL REAGENTS AND STARTING MATERIALS

(R)-(+)-*o*-Anisylcyclohexylmethylphosphine
 N-Benzylcinchoninium chloride
 (-)-N-Benzyl-N-methylephedrinium bromide
 N-Benzylquinidinium chloride
 (-)-Benzylquininium chloride or fluoride
 (S,S)-(+)-1,4-Bis(dimethylamino)-2,3-dimethoxybutane
t-Butyl hydroperoxide-Dialkyl tartrate-Dichlorodiisopropoxytitanium(IV)
t-Butyl hydroperoxide-Dialkyl tartrate-Titanium(IV) *t*-butoxide
t-Butyl hydroperoxide-Dialkyl tartrate-Titanium(IV) isopropoxide
t-Butyl hydroperoxide-Vanadyl acetylacetonate-N-Phenylcampholyl-

hydroxamic acid
 Butyllithium-(S,S)-(+)-1,4-Bis(dimethylamino)-2,3-dimethoxybutane
 [(-)-Camphor-10-ylsulfonyl]-3-aryloxaziridines
 7-Chloro-5-phenyl-1-[(S)- α -phenylethyl]-1,3-dihydro-2H-1,4-benzodiazepine-2-one
 Cyclic polyethers, chiral
 R-(-)-(Dimethoxyphosphinyl)methyl *p*-tolyl sulfoxide
 (-)-N,N-Dimethylephedrinium bromide
 Dimethyl tartrate
 (-)-N-Dodecyl-N-methylephedrinium bromide
 (-)-N,N-Ethylmethylephedrinium bromide
 Grignard reagents-(S,S)-(+)-1,4-Bis(dimethylamino)-2,3-dimethoxybutane
 L-N-Hexadecyl-N-methylephedrinium bromide
 2,3-O-Isopropylidene-2,3-dihydroxy-1,4-bis(diphenylphosphine)butane
 (S)-(+)-2-(*p*-Methoxyphenylsulfinyl)-2-cyclopentenone
 (R)-4-Methylcyclohexylenemethylcopper
 (S)-(-)-Methyltri(2-methyl-1-butoxy)-titanium
 Osmium tetroxide-Dihydroquinidine (or Dihydroquinine) acetate
 Phosphonamides, chiral
 L-(-)-Serine
 Tartrate esters
 (S,S)-(-)-1,2,3,4-Tetramethoxybutane
 (S)-(+)-2-(*p*-Tolylsulfinyl)-2-buten-4-olide
 (S)-2-(*p*-Tolylsulfinyl)-2-cyclopentenone
 N-*p*-Trifluoromethylbenzylcinchoninium bromide

DIELS-ALDER CATALYSTS

Alkylaluminum halides
 Alumina
 Aluminum chloride
 Bornyloxyaluminum dichloride
 Boron triacetate
 Boron trifluoride
 Boron trifluoride etherate
 Copper(II) acetate-Copper(II) tetrafluoroborate

DIELS-ALDER CATALYSTS (*Continued*)

Copper(II) tetrafluoroborate
 β -Cyclodextrin
 Diazadieneiron(0) complexes
 Dichlorodiisopropoxytitanium(IV)
 Dichloromaleic anhydride
 Diethylaluminum chloride
 Dimethylaluminum chloride
 Ethylaluminum dichloride
 Florisil
 Iron
 Menthoxyaluminum dichloride
 Nafion-H
 Silica
 Tin(IV) chloride
 Titanium(IV) chloride
 Tris(*p*-bromophenyl)ammoniumyl
 hexachloroantimonate
 Tris(6,6,7,7,8,8,8-heptafluoro-2,2-
 dimethyl-3,5-octanedionato)-
 europium(III) or -ytterbium(III)
 Tris[3-(heptafluoropropylhydroxymethyl-
 ene)-*d*-camphorato]europium(III)
 Zinc chloride
 Zinc iodide

DIELS-ALDER DIENES

1-Acetoxybutadiene
 2-Acetoxy-3-*p*-methoxyphenylthio-
 1,3-butadiene
 2-Acetoxy-1-methoxy-3-trimethyl-
 silyloxy-1,3-butadiene
 1-Acetoxy-4-trimethylsilyl-1,3-butadiene
 3-Acetoxy-1-trimethylsilyl-1,3-butadiene
 N-Acetylpyrrole
 Allylidenecyclopropane
 Benzene
 Benzyl *trans*-1,3-butadiene 1-carbamate
 5-Benzyloxymethyl-1,3-cyclopentadiene
 2,3-Bis(azidomethyl)-1,3-butadiene
 2,3-Bis(bromomethyl)-1,3-butadiene
 1,3-Bis(*t*-butyldialkylsilyloxy)-
 2-aza-1,3-dienes
 2,3-Bis(methoxymethyl)-1,3-butadiene
 1,2-Bis(methylthio)-1,3-butadiene
 2,5-Bis[(*Z*)-(2-nitrophenylsulfenyl)-
 methylene]-3,6-dimethylene-7-
 oxabicyclo[2.2.1]heptane
 2,3-Bis(trimethylsilylmethyl)-1,3-
 butadiene
 1,3-Bis(trimethylsilyloxy)-1,3-butadiene
 2,3-Bis(trimethylsilyloxy)-1,3-butadiene

1,3-Bis(trimethylsilyloxy)-1,3-
 cyclohexadiene
 2,3-Bis(trimethylsilyloxy)-1,3-
 cyclohexadiene
 2,5-Bis(trimethylsilyloxy)furan
 2,3-Bis(trimethylstannyl)-1,3-butadiene
 5-Bromocyclopentadiene
 2-Bromomethyl-3-(trimethylsilylmethyl)-
 1,3-butadiene
 1,3-Butadiene
 2-*t*-Butoxycarbonyl-1,3-butadiene
 1-Chloro-1-dimethylamino-2-methyl-
 1,3-butadiene
 Cyclopentadiene
 Cyclopentadienone ketals
 (E,E)-1,4-Diacetoxybutadiene
 2,5-Di-*p*-anisyl-3,4-diphenyl-
 cyclopentadienone
 2,3-Dicyano-1,3-butadiene
 3,4-Diethoxycarbonyl-2,5-dimethylfuran
 5,5-Diethoxycyclopentadiene
 1(E),3-Dimethoxybutadiene
 5,5-Dimethoxycyclopentadiene
 4,6-Dimethoxy-2-pyrone
 5,5-Dimethoxy-1,2,3,4-tetrachloro-
 cyclopentadiene
 1,3-Dimethoxy-1-trimethylsilyloxy-
 1,3-butadiene
 1,1-Dimethoxy-1-trimethylsilyloxy-
 1,3-butadiene
 1,2-Dimethoxy-1-trimethylsilyloxy-
 1,3-pentadiene
 4-Dimethylamino-1,1,2-trimethoxy-
 butadiene
 5,5-Dimethyl-1,3-bis(trimethylsilyloxy)-
 1,3-cyclohexadiene
 2,3-Dimethylbutadiene
 2,5-Dimethylfuran
 Dimethyl 1,2,4,5-tetrazine-3,6-
 dicarboxylate
 1,5-Dioxaspiro[4.5]deca-7,9-diene
 2,3-Diphenylbutadiene
 (E,E)-1,4-Diphenylbutadiene
 1,3-Diphenylisobenzofuran
 1,3-Diphenylnaphtho[2,3-*c*]furan
 1-Ethoxy-2-ethyl-3-trimethylsilyloxy-
 1,3-butadiene
 1-Ethoxy-4-tributylstannyl-1,3-butadiene
 Ethyl *trans*-1,3-butadiene-1-carbamate
 Furan
 1,3,4,6-Heptatetraene

Hexabromocyclopentadiene
 Hexachlorocyclopentadiene
 Homophthalic anhydride
 Indanocyclone
 Isobenzofuran
 Isoprene
 2-(2-Methoxy)allylidene-1,3-dithiane
 4-Methoxy-1,2-bis(trimethylsilyloxy)-1,3-butadiene
 1-Methoxy-1,3-bis(trimethylsilyloxy)-1,3-butadiene
 1-Methoxy-1,3-butadiene
 6-Methoxy-(E,E)-3,5-hexadienoic acid
 1-Methoxy-3-methyl-1,3-butadiene
 5-Methoxymethylcyclopentadiene
 3-Methoxymethylene-2,4-bis(trimethylsilyloxy)-1,4-pentadiene
 2-Methoxy-3-methyl-1-phenylthio-1,3-butadiene
 6-Methoxy-4-methyl-2-pyranone
 1-Methoxy-2-methyl-3-trimethylsilyloxy-1,3-butadiene
 1-Methoxy-3-methyl-1-trimethylsilyloxy-1,3-butadiene
 1-Methoxy-2-methyl-3-trimethylsilyloxy-1,3-pentadiene
 4-Methoxy-1-phenylseleno-2-trimethylsilyloxy-1,3-butadiene
 (Z)-2-Methoxy-1-(phenylthio)-1,3-butadiene
 2-Methoxy-3-phenylthio-1,3-butadiene
trans-1-Methoxy-3-trimethylsilyloxy-1,3-butadiene
 5-Methyl-1,3-bis(trimethylsilyl)-1,3-cyclohexadiene
 5-Methyl-1,3-bis(trimethylsilyloxy)-1,3-cyclohexadiene
 3-Methyl-1,2-butadiene
 Methyl *trans*-2,4-pentadienoate
 (Z)-3-Methyl-1-phenylthio-2-trimethylsilyloxy-1,3-butadiene
 Methyl α -pyrone-6-carboxylate
 Methyl N-sulfonylurethane
 1-*o*-Nitrophenyl-1,3-butadiene
 1,3-Pentadiene
 Perfluorotetramethylcyclopentadienone
 4-Phenyloxazole
 1-Phenylthio-1,3-butadiene
 N-Phenyl-1,2,4-triazoline-3,5-dione
 α -Pyrone
 Tetrachlorocyclopentadienone

6,7,8,9-Tetrachloro-1,4-dioxaspiro[4.4]nona-6,8-diene
 Tetrachlorofuran
 1,1,2,3-Tetrakis(trimethylsilyloxy)-1,3-butadiene
 2,3,5,6-Tetramethylidene-7-oxanorbornane
 Tetraphenylcyclopentadiene
 Tetraphenylcyclopentadienone
 1,2,4-Triazine
 Tricarbonyl(1,3-cyclobutadiene)iron
 2,2,2-Trichloroethyl *trans*-1,3-butadiene-1-carbamate
 Trichloro-1,2,4-triazine
 2-Triethylsilyl-1,3-butadiene
 1-Trimethylsilyl-1,3-butadiene
 2-Trimethylsilylmethyl-1,3-butadiene
 1-Trimethylsilyloxy-1,3-butadiene
 2-Trimethylsilyloxy-1,3-butadiene
 2-Trimethylsilyloxy-1,3-cyclohexadiene
 3-Trimethylsilyloxy-1,3-pentadiene
 Trimethylsilylvinylketene
 2-Trimethylstannylmethyl-1,3-butadiene

DIELS-ALDER DIENOPHILES

2-Acetoxyacrylonitrile
 5-Acetoxyethyl-4-methoxy-*o*-benzoquinone
 Acetylenedicarboxylic acid
 3-Acetyl-4-oxazoline-2-one
 Acrolein
 Benzocyclopropene
 1,4-Benzoquinone
 (Z)-1,2-Bis(phenylsulfonyl)ethylene
 1,2-Bis(β -tolylsulfonylethoxycarbonyl)-diazene
 Bis(2,2,2-trichloroethyl)azodicarboxylate
 2-Bromoacrolein
 1-Bromo-2-chlorocyclopropene
 Carbonyl cyanide
 2-Chloroacrylonitrile
 2-Chloroacrylyl chloride
 Chloroketene dimethyl acetal
 Chloromaleic anhydride
 Chloromethylmaleic anhydride
 1-Chloro-N,N,2-trimethylpropenylamine
 Chromium carbene complexes
 Cyclopropene
trans-1,2-Dibenzoylethylene
 Di-*t*-butyl azodiformate

DIELS-ALDER DIENOPHILES*(Continued)*

Dichlorovinylene carbonate
 Dicyanoacetylene
 1,2-Dicyanocyclobutene
 1,3-Diethoxycarbonyllallene
 Diethylacetylene dicarboxylate
 Diethyl azodicarboxylate
 Diethyl oxomalonate
 1,4-Dihydronaphthalene-1,4-endooxide
 Dimethyl acetylenedicarboxylate
 2,6-Dimethylbenzoquinone
 Dimethyl maleate
 2,3-Dimethylmaleic anhydride
 Diphenylacetylene
 Ethyl acrylate
 Ethylene
 Ethyl β -phenylsulfonylpropionate
 (R)-Ethyl *p*-tolylsulfinylmethyl-
 enepropionate
 Ethynyl *p*-tolyl sulfone
 Hexafluoro-2-butyne
 (S)-(+)- α -Hydroxy- β,β -dimethylpropyl
 vinyl ketone
 2-Hydroxy-5-oxo-5, 6-dihydro-2H-pyran
 3-Hydroxy-2-pyrone
 Isopropylidene isopropylidenemalonate
 Itaconic anhydride
 Maleic anhydride
 4-Methoxy-5-methyl-*o*-benzoquinone
 Methyl 2-acetylacrylate
 Methyl acrylate
 Methylene bis(urethane)
 4-Methyloxazole
 3-Methylsulfonyl-2,5-dihydrofuran
 2-Methylthiomaleic anhydride
 4-Methyl-1,2,4-triazoline-3,5-dione
 Methyl vinyl ketone
 Naphthacene-9,10,11,12-diquinone
 3-Nitro-2-cyclohexenone
 3-Nitro-2-cyclopentenone
 Nitroethylene
 Nitrosobenzene
 Oxygen, singlet
p-Phenylazomaleinanil
 N-Phenylmaleimide
 8-Phenylmenthyl acrylate
 8-Phenylmenthyl crotonate
 (E)-1-Phenylsulfonyl-2-trimethyl-
 silylethylene
 Phenyl vinyl sulfone

Phenyl vinyl sulfoxide
 1,4-Phthalazinedione
 3-Sulfolene
 Sulfur dioxide
 Tetracyanoethylene
 1,3,4-Thiadiazoline-2,5-dione
 2-Thioxo-1,3-dioxol-4-ene
 1,2,4-Triazoline-3,5-dione
 Vinylene carbonate
 Vinyltriphenylphosphonium bromide

HYDROGENATION CATALYSTS

trihapto-Allyltris(trimethyl phosphite)-
 cobalt(I)
 Arene(tricarbonyl)chromium complexes
 [2,2'-Bis(diphenylphosphine)-1,1'-
 binaphthyl](cyclooctadiene)-
 rhodium(I) perchlorate
 [2,2'-Bis(diphenylphosphine)-1,1'-
 binaphthyl](norbornadiene)-
 rhodium(I) perchlorate
 [1,4-Bis(diphenylphosphine)butane]-
 (1,5-cyclooctadiene)iridium(I)
 tetrafluoroborate
 1,4-[Bis(diphenylphosphine)butane]-
 (norbornadiene)rhodium(I)
 tetrafluoroborate
 [1,2-Bis(diphenylphosphine)propane]-
 (norbornadiene)rhodium perchlorate
 Carbonylchlorobis(triphenylphosphine)-
 iridium(I)
 Carbonylchlorobis(triphenylphosphine)-
 rhodium(I)
 Carbonyldihydridotris(triphenyl-
 phosphine)ruthenium
 Carbonylhydridotris(triphenyl-
 phosphine)rhodium(I)
 Chloro(hexamethylbenzene)hydrido-
 triphenylphosphinerhodium
 Chlorohydridotris(triphenylphosphine)-
 ruthenium(II)
 Chlorotris(neomenthyl)diphenyl-
 phosphine)rhodium(I)
 Chlorotris(triphenylphosphine)-
 rhodium(I)
 Chromium carbonyl
 Copper chromite
 Copper-Chromium oxide
 (1,5-Cyclooctadiene)bis(methyldiphenyl-
 phosphine)iridium(I) hexafluoro-
 phosphate

(1,5-Cyclooctadiene)(pyridine)-
(tricyclohexylphosphine)iridium(I)
hexafluorophosphate
(1,5-Cyclooctadiene)(pyridine)-
(triphenylphosphine)iridium(I)
hexafluorophosphate
Di- μ -carbonyldecacarbonyltri-*triangulo*-
iron
Dichlorobis(1,5-cyclooctadiene)-
dirhodium + co-reagents
Di- μ -chlorobis(1,5-hexadiene)dirhodium
+ co-reagents
Dichlorobis(norbornadiene)dirhodium
+ co-reagents
Di- μ -chlorodichlorobis(pentamethyl-
cyclopentadienyl)diiridium or
-dirhodium
Dichloro(dimethylformamido)bis-
(pyridine)rhodium borohydride
Di- μ -chlorotetra(ethylene)dirhodium-
2,3-O-Isopropylidene-2,3-dihydroxy-
1,4-bis(diphenylphosphine)butane
Di- μ -chlorotetrakis(cyclooctene)-
dirhodium-2,3-O-Isopropylidene-
2,3-dihydroxy-1,4-bis(diphenyl-
phosphine)butane
Dichlorotris(triphenylphosphine)-
ruthenium(II)
(S)- α -(R)-2-Diphenylphosphine-
ferrocenyl ethyldimethylamine
Hydridodinitrogentris(triphenyl-
phosphine)cobalt(I)
Hydridotris(triisopropylphosphine)-
rhodium(I)
Hydrogen hexachloroplatinate(IV)-
Triethylsilane
Iridium catalysts
Iridium(IV) chloride
Iron carbonyl
[2,3-O-Isopropylidene-2,3-dihydroxy-
1,4-bis(diphenylphosphine)butane]-
palladium
Lindlar catalyst
Magnesium oxide
Nickel(II) acetate-Sodium hydride-
t-Amyloxide
Nickel-Alumina
Nickel boride
Nickel catalysts
Nickel-Graphite
Nickel on alumina

Osmium-on-carbon
Palladium(II) acetate-Sodium hydride-
t-Amyloxide
Palladium catalysts
Palladium(II) chloride
Palladium-Graphite
Palladium hydroxide
Palladium hydroxide on barium sulfate
Palladium on barium sulfate
Palladium on calcium carbonate
Palladium on carbon
Palladium on charcoal
Palladium(0)-Phosphines
Palladium, poisoned
Palladium-Poly(ethylenimine)
Platinum catalysts
Platinum on carbon
Platinum oxide
Platinum-Silica
Platinum sulfide-on-carbon
Platinum-Tin(II) chloride
Raney cobalt catalyst
Raney nickel
Raney/nickel alloy
Rhenium catalysts
Rhodium catalysts
Rhodium on carbon
Rhodium oxide-Platinum oxide
Rosenmund catalyst
Ruthenium catalysts
Ruthenium(III) chloride
Ruthenium hydrogenation catalyst
Ruthenium on alumina
Ruthenium on carbon
Ruthenium-Silica
Trihydridobis(triphenylphosphine)-
iridium(III)
Tris(dimethylphenylphosphine)-
(norbornadiene)rhodium(I)
hexafluorophosphate
Urushibara catalysts

METAL CARBONYLS

Aceto(carbonyl)cyclopentadienyl-
(triphenylphosphine)iron
Arene(tricarbonyl)chromium complexes
Benzenechromium tricarbonyl
Benzylideneacetone(tricarbonyl)iron
(Butadiene)tricarbonyliron
Carbonylchlorobis(triphenylphosphine)-
iridium(I)

METAL CARBONYLS (*Continued*)

Carbonylchlorobis(triphenylphosphine)-rhodium(I)
 Carbonyldihydridotris(triphenylphosphine)ruthenium
 Carbonylhydridotris(triphenylphosphine)rhodium(I)
 Carbonylphenylbis(triphenylphosphine)rhodium(I)
 π -(Chlorobenzene)chromium tricarbonyl
 Chromium carbonyl
 Copper(I) carbonyl ion
 Dicarbonylbis(triphenylphosphine)nickel
 Dicarbonylbis(triphenyl phosphite)nickel
 Dicarbonylcyclopentadienylcobalt
 Dicarbonyl(cyclopentadienyl)-[(dimethylsulfonium)methyl]iron tetrafluoroborate
 Dicarbonyl(cyclopentadienyl)-[(methylphenylsulfonium)ethyl]iron trifluoromethanesulfonate
 Dicarbonylcyclopentadienyl(2-methyl-1-propene)iron tetrafluoroborate
 Di- μ -carbonyldecacarbonyltri-*triangulo*-iron
 Di- μ -carbonyldicarbonylbis-(cyclopentadienyl)diiron
 Dicarbonyldichlorobis(triphenylphosphine)ruthenium(II)
 Di- μ -carbonylhexacarbonyldicobalt
 Dipotassium tetracarbonylferrate
 Disodium tetracarbonylferrate
 Disodium tetracarbonylferrate-sesquidioxanate
 Dodecacarbonyltri-*triangulo*-ruthenium
 Hexacarbonyltetra- μ -chlorodiruthenium
 Hexacarbonyl[μ -(N,N',N''-tricyclohexylguanidinato(2-))-N,N';N,N'-diiron
 Hydridotris(triphenylphosphine)-carbonylrhodium(I)
 Iron carbonyl
 Lithium tricarbonyl(dimethylcarbamoyl)nickelate
 Molybdenum carbonyl
 Nickel carbonyl
 Nickel carbonyl-Butyllithium
 Pentacarbonyl(methoxyphenyl-methylene)chromium(0) or -tungsten(0)
 Pentacarbonyl(trimethylsilyl)manganese
 Pentacarbonyl(triphenylphosphine)-

tungsten
 Potassium di- μ -carbonyloctacarbonyl- μ -hydrido-chromate
 Potassium tetracarbonylhydridoferrate
 Sodium decacarbonyl- μ -hydrido-dichromate(1-)
 Sodium dicarbonyl(cyclopentadienyl)-ferrate
 Sodium di- μ -carbonylhexacarbonyl- μ -hydridoferrate
 Sodium tetracarbonylcobaltate
 Sodium tetracarbonylhydridoferrate
 Sodium tricarbonyl(cyclopentadienyl)-vanadate(2-)
 Tetracarbonyl(cyclopentadienyl)-vanadium
 Tetracarbonyldi- μ -chlorodirrhodium
 Tetracarbonyldi- μ -chlorodirrhodium-Lithium chloride
 Tetracarbonyldodecacarbonyl-hexarhodium
 Tetracarbonyl(ethoxyphenyl-methylidene)iron(0)
 Tetracarbonylhydridocobalt
 Tetramethylammonium tetracarbonylhydridoferrate
 Tricarbonyl(1,3-cyclobutadiene)iron
 Tri- μ -carbonylhexacarbonyldiiron
 Tricarbonyl(*p*-methoxybenzylidene-acetone)iron
 Tri- μ -carbonylnonacarbonyl-tettrarhodium
 Tris(acetonitrile)tricarbonyltungsten
 Tungsten carbonyl
 Zinc tetracarbonylcobaltate

METAL-CONTAINING COMPOUNDS**ALUMINUM COMPOUNDS**

Akylaluminum halides
 Allyldiisobutylaluminum
 Alumina
 Aluminum
 Aluminum amalgam
 Aluminum amalgam-Trifluoroacetic acid-*t*-Butanol
 Aluminum azide
 Aluminum bromide
 Aluminum bromide-Ethanethiol
 Aluminum *t*-butoxide
 Aluminum *t*-butoxide-Raney nickel
 Aluminum chloride
 Aluminum chloride + co-reagents

- Aluminum cyclohexoxide
 Aluminum ethoxide
 Aluminum hydride
 Aluminum iodide
 Aluminum isopropoxide
 Aluminum telluride
 Aluminum thiophenoxide
 Bis(diethylaluminum) sulfate
 Bis(diisobutylaluminum)
 1,2-ethanedithiolate
 Bis(diisopropylamino)aluminum hydride
 Bis(dimethylaluminum)
 1,2-ethanedithiolate
 Bis(dimethylaluminum)
 1,3-propanedithiolate
 Bis(N-methylpiperazinyl)aluminum
 hydride
 Bornyloxyaluminum dichloride
 Butyllithium-Diisobutylaluminum
 hydride
 (Carbo-*t*-butoxymethyl)diethyl-
 aluminum
 μ -Chlorobis(cyclopentadienyl)(dimethyl-
 aluminum)- μ -methylenetitanium
 Chloro(methoxy)methylalane
 Chloro(methyl)aluminum amides
 Chromium(III) chloride-Lithium
 aluminum hydride
 Copper(I) bromide + aluminum
 co-reagents
 Copper(II) chloride-Zinc chloride-
 Lithium aluminum hydride
 Copper(I) iodide-Lithium
 trimethoxyaluminum hydride
 Crotyldimethylaluminum
 Cyanotrimethylsilane-
 Triethylaluminum
 Dialkylaluminum amides
 Dibromoalane
 (2,6-Di-*t*-butyl-4-methylphenoxy)-
 methylaluminum trifluoromethane-
 sulfonate
 Dichloroalane
 Dichlorobis(cyclopentadienyl)titanium
 + aluminum co-reagents
 Diethoxyaluminum chloride
 Diethylaluminum amides
 Diethylaluminum anilide
 Diethylaluminum benzenethiolate
 Diethylaluminum chloride
 Diethylaluminum cyanide
 Diethylaluminum ethoxyacetylde
 Diethylaluminum iodide
 Diethylaluminum N-methylanilide
 Diethylaluminum phenylacetylde
 Diethylaluminum propylamide
 Diethylaluminum 2,2,6,6-tetramethyl-
 piperidide
 Diethylaluminum trimethylsilylacetylde
 Diethyl[dimethyl(phenyl)silyl]aluminum
 N,N-(Diethylethanamine)trihydrido-
 aluminum
 Diethyl(iodomethyl)aluminum
 Diiodomethane-Zinc-
 Trimethylaluminum
 Diisobutylaluminum chloride
 Diisobutylaluminum 2,6-di-*t*-butyl-4-
 methylphenoxide
 Diisobutylaluminum hydride
 Diisobutylaluminum phenoxide
 Dimethylaluminum acetylde
 Dimethylaluminum amides
 Dimethylaluminum benzenethiolate
 Dimethylaluminum benzylamide
 Dimethylaluminum chloride
 Dimethylaluminum cyanide
 Dimethylaluminum iodide
 Dimethylaluminum 2-methyl-2-
 propanethiolate
 Dimethylaluminum methylselenolate
 Dimethylaluminum
 phenylmethanethiolate
 Ethylaluminum dichloride
 Hydrogen cyanide + aluminum
 co-reagents
 Isobornyloxyaluminum dichloride
 Isobutylaluminum dichloride
 Lithium aluminum hydride
 Lithium aluminum hydride +
 co-reagents
 Lithium *n*- or *t*-butyldiisobutylaluminum
 hydride
 Lithium diethoxyaluminum hydride
 Lithium diisobutylmethylaluminum
 hydride
 Lithium methoxyaluminum hydride
 Lithium tetrabutylaluminate-(-)-N-
 Methylephedrine
 Lithium trialkoxyaluminum hydrides
 Lithium tri-*t*-butoxyaluminum hydride
 Lithium tri-*t*-butoxyaluminum hydride
 + co-reagents

METAL-CONTAINING COMPOUNDS*(Continued)*

Lithium triethoxyaluminum hydride

Lithium triethylborohydride-Aluminum
t-butoxide

Lithium trimethoxyaluminum hydride

Lithium tris(3-ethyl-3-pentyloxy)-
aluminum hydrideManganese(II) chloride-Lithium
aluminum hydride

Menthoxaluminum dichloride

Methylaluminum bis(trifluoroacetate)

Methylaluminum dichloride

Methylmagnesium bromide-Nickel(II)
acetylacetonate-Trimethylaluminum

Monochloroalane

Monoiodoalane

Nickel(II) acetylacetonate + aluminum
co-reagents

Organoaluminum cyanides

Organoaluminum reagents

Sodium aluminum hydride

Sodium bis(2-methoxyethoxy)aluminum
hydrideSodium bis(2-methoxyethoxy)aluminum
hydride + co-reagents

Sodium diethylaluminum hydride

Sodium tetrachloroaluminate

Sodium triethoxyaluminum hydride

Tetra- μ -hydridotetrahydroaluminum-
magnesiumTetrakis(2-methylpropyl)- μ -oxodi-
aluminumTetramethylcyclobutadiene-Aluminum
chloride

Tin-Aluminum

Titanium(IV) chloride + aluminum
co-reagentsTitanium(III) chloride + aluminum
co-reagents

Trialkylaluminums

Trialkynylalanes

Tri-*t*-butylaluminum

Tributyl (diethylaluminum)plumbate

Tributyl(diethylaluminum)tin

Tributyltinlithium-Diethylaluminum
chlorideTrichlorocyclopentadienyltitanium-
Lithium aluminum hydride

Triethylaluminum

Triisobutylaluminum

Triisobutylaluminum-Bis(N-methyl-
salicylaldimine)nickel

Trimethylaluminum

Trimethylaluminum + co-reagents

Triphenylaluminum

Tripropylaluminum

Tris(1-hexynyl)aluminum

Tris(phenylethynyl)aluminum

Tris(trimethylsilyl)aluminum

Tris(trimethylsilylethynyl)aluminum

Tungsten(VI) chloride + aluminum
co-reagentsVanadium(III) chloride-Lithium
aluminum hydrideVilsmeier reagent-Lithium
tri-*t*-butoxyaluminum hydrideZirconium(IV) chloride-Lithium
aluminum hydride**BORON COMPOUNDS**B-1-Alkenyl-9-borabicyclo[3.3.1]-
nonanes

Alkyldimesitylboranes

B-1-Alkynyl-9-borabicyclo[3.3.1]-
nonanes

Allenylboronic acid

B-Allyl-9-borabicyclo[3.3.1]nonane

B-Allyldiisocaranylborane

B-Allyldiisopinocampheylborane

Allyldimesitylborane

Allyl phenyl selenide-Trialkylborane

Alpine Borane

Benzeneboronic acid

Bis(benzoyloxy)borane

 μ -Bis(cyanotrihydroborato)tetrakis-
(triphenylphosphine)dicopper(I)

Bis(3,6-dimethyl)borepane

[Bis(1,3,2-dioxaborola-2-nyl)methyl]-
lithiumBis(*trans*-2-methylcyclohexyl)borane

Bis(trifluoroacetoxy)borane

Bis(triphenylphosphine)copper(I)
borohydride

9-Borabicyclo[3.3.1]nonanates

9-Borabicyclo[3.3.1]nonane

9-Borabicyclo[3.3.1]nonane-Pyridine

9-Borabicyclononyl
trifluoromethanesulfonate

Borane + co-reagents

Boric acid

Boronic acid resins

Boron oxide

- Boron triacetate
Boron tribromide
Boron tribromide + co-reagents
Boron trichloride
Boron trichloride-Dimethyl sulfide
Boron trifluoride
Boron trifluoride + co-reagents
Boron triiodide
Boron tris(trifluoroacetate)
Boron trisulfide
Bromobis(isopropylthio)borane
B-Bromo-9-borabicyclo[3.3.1]nonane
Bromodiethylborane
Bromodimethylborane
 α -Bromoethyldiethylborane
B-Butyl-9-borabicyclo[3.3.1]nonane
2-*t*-Butylperoxy-1,3,2-dioxaborolane
Cadmium borohydride-Dimethylformamide
Calcium borohydride
p-Carboxyphenyldihydroxyborane
Catecholborane
B-Chloro-9-borabicyclo[3.3.1]nonane
B-Chlorocatecholborane
2-Chloro-1,3,2-dioxaborolane
2-Chloro-1,3,2-dithioborolane
2-Chloromethyl-4,4,5,5-tetramethyl-1,3,2-dioxaborolane
Chlorothexylborane
Chlorothexylborane-Dimethyl sulfide
Cobalt boride-Borane-*t*-Butylamine
Copper(I) methyltrialkylborates
Copper(II) sulfate-Sodium borohydride
Corey's reducing agent
B-Crotyl-9-borabicyclo[3.3.1]nonane
Crotyldimethoxyborane
2-Crotyl-4,4,5,5-tetramethyl-1,3,2-dioxaborolane
Cyclohexyl metaborate trimer
Cyclopentylthexylboryl trifluoromethanesulfonate
B-Cyclopropyl-9-borabicyclo[3.3.1]nonane
Dialkylboryl trifluoromethanesulfonates
Diborane
Diborane + co-reagents
Dibromobis(tributylphosphine)-nickel(II)-Sodium borohydride
Dibromoborane-Dimethyl sulfide
Dibutylboryl trifluoromethanesulfonate
Di-*t*-butyl(*t*-butylthio)borane
Dibutylchloroborane
Dichlorobis(cyclopentadienyl)titanium-Lithium borohydride
Dichloroborane
Dichloroborane diethyl etherate
Dichloroborane-Dimethyl sulfide
Dichlorocyclohexylborane
Dichloro(diethylamino)borane
Dichloro(dimethylformamido)bis-(pyridine)rhodium borohydride
Dichloromethaneboronic acid
2-Dichloromethyl-4,5-dimethyl-1,3,2-dioxaborolane
Dichlorophenylborane
Dicyclohexylborane
Dicyclohexylmethylthioborane
Dicyclopentylboryl trifluoromethanesulfonate
Diethylboryl trifluoromethanesulfonate
p-Dihydroxyborylbenzyloxycarbonyl chloride
Diiodoborane
Diisopinocampheylborane
Dilongifolylborane
Di-2-mesitylborane
Dimesityl(methyl)borane
B-3,3-Dimethyl-1-butynyl-9-borabicyclo[3.3.1]nonane
Diphenylborane
Dipropylboryl trifluoromethanesulfonate
Disiamylborane
NB-Enantrane
NB-Enantride
Ethane-1,2-diaminoborane
B-Fluorodimesitylborane
Fluorodimethoxyborane
B-Halo-9-borabicyclo[3.3.1]nonane
B-Hexyl-9-borabicyclo[3.3.1]nonane
B-1-Hexynyl-9-borabicyclo[3.3.1]nonane
Hydrogen hexachloroplatinate(IV)-Sodium borohydride
10-Hydroxy-10,9-boroxarophenanthrene
8-Hydroxyquinolinedihydroboronite
B-Iodo-9-borabicyclo[3.3.1]nonane
Lithium 9-boratabicyclo[3.3.1]nonane
Lithium borohydride
Lithium butylborohydride
Lithium cyanoborohydride
Lithium 9, 9-dibutyl-9-borabicyclo[3.3.1]nonanate

METAL-CONTAINING COMPOUNDS*(Continued)*

- Lithium dimesitylborohydride
 bis(dimethoxymethane)
 Lithium B-isopinocampheyl-9-
 borabicyclo[3.3.1]nonyl hydride
 Lithium methylsulfinylmethylide-
 Tributylborane
 Lithium perhydro-9b-
 boraphenallylhydride
 Lithium tri-*t*-butoxyaluminum hydride-
 Triethylborane
 Lithium tri-*sec*-butylborohydride
 Lithium triethylborohydride
 Lithium triethylborohydride-Aluminum
 t-butoxide
 Lithium trisiamylborohydride
 Lithium tris(*trans*-2-methylcyclopentyl)-
 borohydride
 Mercury(II) acetate-Sodium
 trimethoxyborohydride
 B-Methallyldiisopinocampheylborane
 Methanol-Sodium tetraborate
 3-Methoxycatecholborane
 B-Methyl-9-borabicyclo[3.3.1]nonane
 B-(3-Methyl-2-butenyl)diisopino-
 campheylborane
 B-(3-Methyl-2-butyl)-9-borabicyclo-
 [3.3.1]nonane
 Monochloroborane diethyl etherate
 Monochloroborane-Dimethyl sulfide
 Monoisopinocampheylborane
 Nickel(II) acetylacetonate-
 Diisopropoxyphenylphosphine-
 Sodium borohydride
 4-Nitrocatecholborane
 B-3-Pinanyl-9-borabicyclo[3.3.1]nonane
 Potassium borohydride
 Potassium borohydride-(-)-N-
 Dodecylmethylephedrinium bromide
 Potassium 9-(2,3-dimethyl-2-butoxy)-
 9-boratabicyclo[3.3.1]nonane
 Potassium tri-*sec*-butylborohydride
 Potassium tri-*sec*-butylborohydride-
 Copper(II) iodide
 Potassium triisopropoxyborohydride
 Sodium acetanilidoborohydride
 Sodium acetoxyborohydride
 Sodium acyloxyborohydrides
 Sodium borohydride
 Sodium borohydride + co-reagents
 Sodium (*t*-butylamino)borohydride
 Sodium cyanoborohydride
 Sodium cyanoborohydride +
 co-reagents
 Sodium 9-cyano-9-hydrido-9-
 borabicyclo[3.3.1]nonane
 Sodium (dimethylamino)borohydride
 Sodium perborate
 Sodium tetraborate
 Sodium triacetoxylborohydride
 Sodium triethylborohydride +
 co-reagents
 Sodium trifluoroacetoxylborohydride
 Sodium triisopropoxyborohydride
 Sodium-Trimesitylborane
 Sodium trimethoxyborohydride
 Sodium tris[(S)-N-benzyloxycarbonyl-
 propyloxy]hydroborate
 Sodium tris(3,5-di-*t*-butylphenoxy)-
 borohydride
 Sodium tris(3,5-dimethylphenoxy)-
 borohydride
 Tetrabutylammonium borohydride
 Tetrabutylammonium
 cyanoborohydride
 Tetrabutylammonium
 octahydrotriborate
 Tetraethylammonium borohydride
 Tetrafluoroboric acid
 Tetralin hydroperoxide-Cyclohexyl
 metaborate
 Tetramethylammonium borohydride
 Thexylborane
 Thexylborane-N,N-Diethylaniline
 Tin(II) chloride-Sodium borohydride
 Tin(IV) chloride-Sodium borohydride
 Titanium(IV) chloride-Sodium
 borohydride
 Tributylborane
 Tributylboroxine
 Tricaprylylmethylammonium
 borohydride
 Tricyclohexylborane
 Tricyclopentylborane
 Triethanolamine borate
 Tetraethylammonium borohydride
 Triethylborane
 Trihexylborane
 Triisobutylborane
 Triisopinocampheylborane
 Trimesitylborane

Trimethyl borate
 Trimethylboroxine
 α -Trimethylsilylcrotyl-9-borabicyclo-
 [3.3.1]nonane
 Trimethylsilylmethyldimesitylborane
 Tri-2-norbornylborane
 Triphenylborane
 Tris(dimethoxyboryl)methane
 Tris(dimethylamino)borane
 Tris(1,3,2-dioxaborolan-2-yl)methane
 Tris(ethylthio)borane
 Tris(methylseleno)borane
 Tris(phenylseleno)borane
 Tris(phenylthio)borane
 Zinc borohydride
 Zinc borohydride-Dimethylformamide

CHROMIUM COMPOUNDS

Arene(tricarbonyl)chromium complexes
 Benzenechromium tricarbonyl
 2,2'-Bipyridinium chlorochromate
 Bis(benzyltriethylammonium)
 dichromate
 Bis(butylammonium) dichromate
t-Butyl chromate
 π -(Chlorobenzene)chromium tricarbonyl
 Chromium(II) acetate
 Chromium(II) acetate-Ethylenediamine
 Chromium(II)-Amine complexes
 Chromium carbene complexes
 Chromium carbonyl
 Chromium(II) chloride
 Chromium(III) chloride
 Chromium(III) chloride-Lithium
 aluminum hydride
 Chromium(VI) oxide
 Chromium(VI) oxide + co-reagents
 Chromium(II) perchlorate
 Chromium(II) perchlorate +
 co-reagents
 Chromium(II) sulfate
 Chromyl acetate
 Chromyl chloride
 Chromyl chloride + co-reagents
 Chromyl trichloroacetate
 Collins reagent
 Collins reagent-Celite
 Copper-Chromium oxide
 Cornforth reagent
 4-(Dimethylamino)pyridinium
 chlorochromate
 Fieser reagent

Jones reagent
 Palladium(II) chloride-Potassium
 dichromate
 Pentacarbonyl(methoxyphenyl-
 methylene)chromium(0)
 Periodic acid-Chromium(VI) oxide
 Potassium chromate
 Potassium chromate-Dicyclohexyl-
 18-crown-6
 Potassium di- μ -carbonyloctacarbonyl-
 μ -hydridochromate
 Potassium dichromate
 Potassium dichromate + co-reagents
 Potassium perchromate
 Pyridinium chlorochromate
 Pyridinium chlorochromate +
 co-reagents
 Pyridinium dichromate
 Pyridinium dichromate-Acetic
 anhydride
 Pyridinium fluorochromate
 Pyridinium tetrafluoroboratochromate
 Ratcliff's reagent
 Sarett reagent
 Silver chromate
 Silver chromate-Iodine
 Sodium chromate
 Sodium decacarbonyl- μ -
 hydridodichromate(1-)
 Sodium dichromate
 Sodium dichromate + co-reagents
 Tetrabutylammonium chlorochromate
 Tetrabutylammonium chromate

COBALT COMPOUNDS

trihapto-Allyltris(trimethyl phosphite)-
 cobalt(I)
 Bis[(-)-camphorquinone- α -dioximato]-
 cobalt(II) hydrate
 Bis(cyclopentadienyl)bis(μ -nitrosyl-
 N:N)dicobalt
 Bis(N-propylsalicylideneaminato)-
 cobalt(II)
 Bis(3-salicylideneaminopropyl)-
 aminocobalt(II)
 [Bis(salicylidene- γ -iminopropyl)]-
 methylaminocobalt(II)
 Chloro(pyridine)cobaloxime(III)
 Chlorotris(triphenylphosphine)cobalt
 Cobaloxime(I)
 Cobalt(II) acetate
 Cobalt(III) acetate

METAL-CONTAINING COMPOUNDS

(Continued)

Cobalt(II) acetate-Hydrogen bromide
 Cobaltacyclopentan-2-ones
 Cobalt boride-Borane-*t*-Butylamine
 Cobalt(II) chloride
 Cobalt(III) fluoride
 Cobalt(II) phthalocyanine
 Cobalt *meso*-tetraphenylporphine
 Cobalt(III) trifluoroacetate
 Cyclopentadienyl(diiodo)triphenylphosphinecobalt
 Cyclopentadienyl(triphenylphosphine)-cobaltatetraphenylcyclopentadiene
 Dibromobis(triphenylphosphine)-cobalt(II)
 Dicarboxylcyclopentadienylcobalt
 Di- μ -carbonylhexacarbonyldicobalt
 Dicyclopentadienylcobalt
 Dicyclopentadienylcobalt-Oxygen
 Diiodotris(triphenylphosphine)cobalt
 Grignard reagents-Cobalt(II) chloride
 Hydridodinitrogentris(triphenylphosphine)cobalt(I)
 4-Hydroxysalcomine
 Lithium trimethylcobaltate
 Phenylmagnesium bromide-Cobalt(II) chloride
 Raney cobalt catalyst
 Salcomine
 Sodium tetracarbonylcobaltate
 Tetracarbonylhydridocobalt
 Zinc tetracarbonylcobaltate

COPPER COMPOUNDS

Alkylcopper reagents
 Alkylcopper reagents + co-reagents
 Allylcopper
 Bis(N-*t*-butylsalicylaldiminato)-copper(II)
 μ -Bis(cyanotrihydroborato)tetrakis-(triphenylphosphine)dicopper(I)
 Bis(N-propylsalicylideneaminato)-copper(II)
 Bis(triphenylphosphine)copper(I) borohydride
 Bromomagnesium alkyl(methyl)cuprates
 Butylcopper
 Butylcopper + co-reagents
 3-Chloro-4,5-dihydrofuryl-2-copper
 Chloromagnesium dimethylcuprate
 Copper

Copper(I) acetate
 Copper(II) acetate
 Copper(I) acetate-*t*-Butyl isocyanide
 Copper(II) acetate + co-reagents
 Copper(I) acetylacetonate
 Copper(II) acetylacetonate
 Copper(I) alkoxides
 Copper(II)-Amine complexes
 Copper-Ascorbic acid
 Copper-Benzonic acid
 Copper(I) bromide
 Copper(II) bromide
 Copper(I) bromide + co-reagents
 Copper(II) bromide-Nitric oxide
 Copper bronze
 Copper(I) *t*-butoxide
 Copper *t*-butylacetylde
 Copper(0)-*t*-Butyl isocyanide
 Copper carbonate, basic
 Copper(I) carbonyl ion
 Copper(I) chloride
 Copper(II) chloride
 Copper(I) chloride + co-reagents
 Copper(II) chloride + co-reagents
 Copper chromite
 Copper chromite-Quinoline
 Copper-Chromium oxide
 Copper(I) cyanide
 Copper(II) cyanide
 Copper(I) cyanoacetate
 Copper(II) cyanoacetate
 Copper halide nitrosyls
 Copper(II) hexafluoroacetylacetonate
 Copper(I) hexamethyldisilazide
 Copper hydride ate complexes
 Copper(II) hydroxide
 Copper(I) iodide
 Copper(I) iodide + co-reagents
 Copper(0)-Isonitrile complexes
 Copper(II) methoxide
 Copper(I) methyltrialkylborates
 Copper(II) nitrate + co-reagents
 Copper(I) oxide
 Copper(II) oxide
 Copper(I) oxide-*t*-Butyl isocyanide
 Copper(I) oxide-Copper(II) nitrate
 Copper(II) perchlorate
 Copper(II) permanganate
 Copper(I) phenoxides
 Copper(I) phenylacetylde
 Copper(I) phenylacetylde-

- Tributylphosphine
 Copper(II) sulfate
 Copper(II) sulfate + co-reagents
 Copper(II) tetrafluoroborate
 Copper(I) trifluoromethanesulfonate
 Copper(II) trifluoromethanesulfonate
 Copper(I) trimethylsilylacetylide
 Cyanomethylcopper
 Di- μ -chlorodimethoxybis(pyridine)-dicopper
 (Dicyclohexylamido)copper(I)
 3,3-Diethoxy-1-propenyl-2-copper
 Dilithium dialkyl(cyano)cuprates
 Dilithium pentamethyltricuprate
 Dilithium tetrachlorocuprate(II)
 Dilithium tributylcuprate
 Dilithium trimethylcuprate
 Dilithium tris(1-pentynyl)cuprate
 Diphenylphosphidocopper(I)
 1-Hexynylcopper
 Hydrido(tributylphosphine)copper(I)
 Lithium alkyl(*t*-butoxy)cuprates
 Lithium alkyl(cyano)cuprates
 Lithium alkyl(diethylamino)cuprates
 Lithium alkyl(phenoxy)cuprates
 Lithium alkyl(phenylthio)cuprates
 Lithium anilidocyanocuprates
 Lithium bis(alkylamino)cuprates
 Lithium bis(3,3-diethoxy-1-propen-2-yl)-cuprate
 Lithium bis(N,N-diethylcarbamoyl)-cuprate
 Lithium bis(dimethylphenylsilyl)cuprate
 Lithium bis(N-methyl-N-phenylcarbamoyl)cuprate
 Lithium bis(3-trimethylsilyl-1-propen-2-yl)cuprate
 Lithium bis(2-vinylcyclopropyl)cuprate
 Lithium bromo(methyl)cuprate—Diisobutylamine complex
 Lithium *t*-butoxy(*t*-butyl)cuprate
 Lithium butyl(cyano)cuprate
 Lithium (*t*-butylethynyl)methylcuprate
 Lithium *t*-butylethynyl(vinyl)cuprate
 Lithium butyl(hydrido)cuprate
 Lithium *n*- or *t*-butyl(3-methoxy-3-methylbutynyl)cuprate
 Lithium *t*-butyl(phenylthio)cuprate
 Lithium *t*-butylthio(alkyl)cuprates
 Lithium cyano(dimethylphenylsilyl)-cuprate
 Lithium cyano(isohexyl)cuprate
 Lithium cyano(methyl)cuprate
 Lithium cyano(phenyl)cuprate
 Lithium cyano(trimethylsilyl)cuprate
 Lithium cyclopropyl(phenylthio)cuprate
 Lithium diallylcuprate
 Lithium dibutylcuprate
 Lithium di-*t*-butylcuprate
 Lithium (1,1-diethoxy-2-propenyl)-(3,3-dimethyl-1-butylnyl)cuprate
 Lithium (3,3-diethoxy-1-propen-2-yl)-phenylthiocuprate
 Lithium di(1-ethoxyvinyl)cuprate
 Lithium di(2-ethoxyvinyl)cuprate
 Lithium diethylcuprate
 Lithium diethylcuprate—Tributylphosphine
 Lithium di(α -methoxyvinyl)cuprate
 Lithium dimethylcuprate
 Lithium dimethylcuprate—Boron trifluoride
 Lithium diphenylcuprate
 Lithium di(2-propenyl)cuprate
 Lithium di[(E)-1-propenyl]cuprate
 Lithium dipropylcuprate
 Lithium di(*p*-tolyl)cuprate
 Lithium divinylcuprate
 Lithium divinylcuprate—Tributylphosphine
 Lithium α -ethoxycarbonylvinyl-(1-hexynyl)cuprate
 Lithium (1-hexynyl)(2-tributylstannylvinyl)cuprate
 Lithium α -methoxycarbonylvinyl-(1-hexynyl)cuprate
 Lithium methyl(phenylseleno)cuprate
 Lithium methyl(phenylthio)cuprate
 Lithium methyl(vinyl)cuprate
 Lithium (1-pentynyl)(3-tetrahydropyranyloxy-1-propenyl)cuprate
 Lithium (1-pentynyl)(2-tributylstannylvinyl)cuprate
 Lithium phenylthio(trimethylstannyl)-cuprate
 Lithium phenylthio(2-vinylcyclopropyl)-cuprate
 Magnesium hydride—Copper(I) *t*-butoxide
 Magnesium hydride—Copper(I) iodide
 4-Methoxy-3-buten-1-ynylcopper
 Methoxycarbonylcopper

METAL-CONTAINING COMPOUNDS

(Continued)

3-Methoxy-3-methylbutynylcopper
 3-Methyl-3-buten-1-ynylcopper
 Methylcopper
 Methylcopper + co-reagents
 (R)-4-Methylcyclohexylidene-methylcopper
 Organocopper reagents
 Organolithium reagents—Copper(I) halides
 Palladium(II) chloride + co-reagents
 Pentafluorophenylcopper
 1-Pentynylcopper
 1-Pentynylcopper—Hexamethylphosphoric triamide
 Phenylcopper
 Phenylcopper—Boron trifluoride
 Phenylselenocopper
 Phenylthiocopper
 Sodium dicyanocuprate
 Tetrakis(acetonitrile)copper(I) perchlorate or tetrafluoroborate
 Tetrakis(pyridine)copper(I) perchlorate
 Tributyltin copper
 Trifluoromethylcopper
 Trifluoromethylthiocopper
 Trimethylsilylcopper
 Trimethylsilylmethylcopper
 1-Trimethylsilylpropynylcopper
 Trimethylstannylcopper—Dimethyl sulfide
 Tris(2-picoline)copper(I) perchlorate
 Tris(trimethylsilyl)hydrazidocopper
 Vinylcopper

IRIDIUM COMPOUNDS

[1,4-Bis(diphenylphosphine)butane]-(1,5-cyclooctadiene)iridium(I) tetrafluoroborate
 Carbonylchlorobis(triphenylphosphine)-iridium(I)
 (1,5-Cyclooctadiene)bis(methyl-diphenylphosphine)iridium(I) hexafluorophosphate
 (1,5-Cyclooctadiene)(pyridine)-(tricyclohexylphosphine)iridium(I) hexafluorophosphate
 (1,5-Cyclooctadiene)(pyridine)-(triphenylphosphine)iridium(I) hexafluorophosphate
 Di- μ -chlorobis(1,5-cyclooctadiene)-

diiridium

Di- μ -chlorodichlorobis(pentamethylcyclopentadienyl)diiridiumDi- μ -chlorotetrakis(cyclooctene)-diiridium

Disodium hexachloroiridate(IV)

Hydrogen hexachloroiridate(IV)

Iridium(III) chloride

Iridium(IV) chloride

Iridium—Silica

Trihydridobis(triphenylphosphine)-iridium(III)

IRON COMPOUNDS

Aceto(carbonyl)cyclopentadienyl-(triphenylphosphine)iron
 Benzylideneacetone(tricarbonyl)iron
 1,1'-Bis(diphenylphosphine)ferrocene
 [1,1'-Bis(diphenylphosphine)ferrocene]-dichloronickel(II)
 [1,1'-Bis(diphenylphosphine)ferrocene]-(dichloro)palladium(II)
 (R)-1-(S)-1',2-Bis(diphenylphosphine)-ferrocenylethanol
 Bis(norbornadiene)rhodium(I) perchlorate—(R)-1-(S)-1',2-Bis-(diphenylphosphine)ferrocenylethanol
 (Butadiene)tricarbonyliron
 Butylmagnesium bromide—Iron(III) reagents
 Diaza dieneiron(0) complexes
 Dicarbonyl(cyclopentadienyl)-[(dimethylsulfonium)methyl]iron tetrafluoroborate
 Dicarbonyl(cyclopentadienyl)-[(methylphenylsulfonium)ethyl]iron trifluoromethanesulfonate
 Dicarbonylcyclopentadienyl(2-methyl-1-propene)iron tetrafluoroborate
 Di- μ -carbonyldecacarbonyltri-*triangulo*-iron
 Di- μ -carbonyldicarbonylbis-(cyclopentadienyl)diiron
 Di- μ -chlorobis(1,5-hexadiene)-dirhodium—(S α R)-2-Diphenylphosphineferrocenylethyl-dimethylamine
 (S,R)-N,N-Dimethyl-1-[1',2-bis-(diphenylphosphine)ferrocenyl]-ethylamine
 (S α R)- or (R α S)-2-Diphenylphosphine-

ferrocenyl ethyldimethylamine
 Dipotassiumtetracarbonylferrate
 Disodium tetracarbonylferrate
 Disodium tetracarbonylferrate-
 sesquidioxanate
 Ferric acetylacetonate
 Ferric azide
 Ferric chloride
 Ferric chloride + co-reagents
 Ferric ethoxide
 Ferric nitrate
 Ferric nitrate/K10 Bentonite
 Ferric selenocyanate
 Ferric sulfate
 Ferric thiocyanate
 Ferrocenylphosphines
 Ferrous chloride
 Ferrous chloride-Oxygen
 Ferrous perchlorate
 Ferrous sulfate
 Ferrous sulfate-Oxygen
 Grignard reagents-Iron(III) reagents
 Hexacarbonyl[μ -(N,N',N''-tricyclo-
 hexylguanidinato(2-))N,N';N,N'-
 diiron
 Iron
 Iron-Acetic acid
 Iron(III) acetylacetonate
 Iron-carbene complexes
 Iron carbonyl
 Iron-Graphite
 Isopropylmagnesium chloride-Iron(III)
 reagents
 Lithium trimethylferrate
 Methylmagnesium bromide-Iron(III)
 reagents
 Nickel(II) chloride- α -2-Diphenyl-
 phosphineferrocenyl ethyldimethyl-
 amine
 μ_3 -Oxohexakis(μ -trimethylacetato)-
 trimethanoltriiron(III) chloride
 Palladium(II) acetate-(S,R)-N,N-
 Dimethyl-1-[1',2-bis(diphenyl-
 phosphine)ferrocenyl]ethylamine
 Palladium(II) chloride- α -2-Diphenyl-
 phosphineferrocenyl ethyldimethyl-
 amine
 Potassium ferrate (VI)
 Potassium ferricyanide
 Potassium tetracarbonylhydridoferrate
 Sodium dicarbonyl(cyclopentadienyl)-

ferrate
 Sodium di- μ -carbonylhexacarbonyl-
 μ -hydridoferrate
 Sodium tetracarbonylhydridoferrate
 Tetracarbonyl(ethoxyphenyl-
 methyldiene)iron(0)
 Tetramethylammonium
 tetracarbonylhydridoferrate
 Tricarbonyl(1,3-cyclobutadiene)iron
 Tri- μ -carbonylhexacarbonyldiiron
 Tricarbonyl(*p*-methoxybenzyl-
 deneacetone)iron
 Tris(dibenzoylmethide)iron(III)
 Tris(tetrabutylammonium)-
 hexacyanoferrate(III)
LEAD COMPOUNDS
 Aryllead triacetates
 (3,3-Dichloroallyl)triphenyllead
 Lead
 Lead(II) acetate
 Lead(IV) acetate azides
 Lead carbonate
 Lead(IV) fluoride
 Lead(II) hydroxide
 Lead(II) oxide
 Lead(IV) oxide
 Lead(IV) oxide-Boron trifluoride
 etherate
 Lead tetraacetate
 Lead tetraacetate + co-reagents
 Lead tetrabenzoate
 Lead tetrakis(trifluoroacetate)
 Lead tetrakis(trifluoroacetate)-Diphenyl
 disulfide
 Lead(II) thiocyanate
 Phosphatolead(IV) acids
 Tetravinyllead
 Tributyl(diethylaluminum) plumbate
LITHIUM COMPOUNDS (excluding
 ionic, inorganic salts)
 Acyllithium reagents
 Alkoxyethylolithium reagents
 Alkylolithium reagents
 1-(Alkylthio)vinylolithium
 Allyl alcohol, O,2-dithio derivative
 Allyllithium
 Benzyl lithioacetate
 Benzylolithium
 [Bis(1,3,2-dioxaborola-2-nyl)methyl]-
 lithium
 1,3-Bis(methylthio)allyllithium

METAL-CONTAINING COMPOUNDS

(Continued)

- Bis(methylthio)methylithium
 Bis(methylthio)(trimethylsilyl)-methylithium
 Bis(methylthio)(trimethylstannyl)-methylithium
 Bis(phenylthio)methylithium
 Bis(trimethylsilyl) lithiomalonate
 1-Bromo-1-cyclopropyllithium
 1-Bromo-2-ethoxycyclopropyllithium
 1-Bromo-1-lithiocyclopropanes
 Bromomethylithium
 2-(6-Bromopyridyl)lithium
t-Butoxymethylithium
t-Butyl 2-chloro-2-lithiotrimethylsilylacetate
t-Butyl dilithioacetoacetate
t-Butyldiphenylsilyllithium
t-Butyl lithioacetate
t-Butyl lithiois(trimethylsilyl)acetate
t-Butyl α -lithioisobutyrate
t-Butyl lithio(trimethylsilyl)acetate
 Butyllithium
sec-Butyllithium
t-Butyllithium
 Butyllithium + co-reagents
sec-Butyllithium + co-reagents
t-Butyllithium-Tetramethylethylenediamine
S-t-Butylthio lithioacetate
 Carbon tetrabromide-Methylithium
 α -Chloroallyllithium
 4-Chloro-1-butenyl-2-lithium
 1-Chloro-2-butenyllithium
 (3-Chloro-3-methyl-1-butyne)lithium
 Chloromethylithium
 3-Chloro-2-methyl-1-propenyl-3-lithium
 5-Chloro-1-pentenyl-2-lithium
 Chloro(phenylsulfinyl)methylithium
 Chlorotrimethylsilane-Lithium
 1-Chloro-1-(trimethylsilyl)ethylithium
 Chloro(trimethylsilyl)methylithium
 Crotyllithium
 1-Cyclobutenylmethylithium
 1-Diazolithioacetone
 Diazo(trimethylsilyl)methylithium
 1,1-Dibromoalkyllithiums
 Dibromomethane-Lithium
 Dibromomethylithium
 1,3-Dibutoxy-1-propenyllithium
gem-Dichloroallyllithium
 α , α -Dichlorobenzylithium
 Dichloromethylithium
 (Diethoxyphosphinyl)difluoromethylithium
 3,3-Diethoxy-1-propenyl-2-lithium
 3,3-Diethoxy-1-propynyllithium
 Diethyl dichlorolithiomethylphosphonate
 Diethyl lithio-N-benzylideneamino-methylphosphonate
 Diethyl lithiomorpholinomethylphosphonate
 Diethyl lithiosuccinate
gem-Difluoroallyllithium
 2,2-Difluoro-1-tolylsulfonyloxyvinylithium
 4,5-Dihydro-5-methyl-1,3,5-dithiazin-2-yllithium
 Diiodomethylithium
 Diisopropylcarbamoyllithium
 Dilithioacetate
 1,3-Dilithiopropyne
 Dilithium acetylde
 2,2'-Dilithiumbiphenyl
 2-(2',2'-Dimethoxyethyl)-1,3-dithianyl-2-lithium
 (Dimethoxyphosphinyl)methylithium
 1,2-Dimethoxyvinylithium
 (Dimethylcarbamoyl)lithium
 Dimethylphenylsilyllithium
 Dimethylsulfamoylmethylithium
 Dimethylthiocarbamoyllithium
 (Diphenylarsinyl)methylithium
 1,1-Diphenylhexyllithium
 Diphenylmethylithium
 (Diphenylphosphine)lithium
 1-Diphenylphosphino-1-methoxymethylithium
 4-Ethoxy-1,3-butadienyllithium
 4-Ethoxy-3-buten-1-ynyllithium
 1-Ethoxycyclopropyllithium
 (Z)-2-Ethoxyvinylithium
 α -Ethoxyvinylithium
 Ethyl diazolithioacetate
 Ethyl lithioacetate
 Ethyl lithiopropiolate
 Ethyl lithio(trimethylsilyl)acetate
 Ethyllithium
 Ethyllithium-Tetramethylethylenediamine

- Ferric chloride-Butyllithium
 β -Furyllithium
 Isocyanomethylithium
 Isocyanotolylthiomethylithium
 Lithioacetonitrile
 2-Lithiobenzothiazole
 1-Lithiocyclopropyl methyl selenide
 1-Lithiocyclopropyl phenyl sulfide
 5-Lithio-2,3-dihydrofuran
 6-Lithio-3,4-dihydro-(2*H*)-pyran
 Lithio-N,N-dimethylacetamide
 Lithio-N,N-dimethylthiopivalamide
 2-Lithio-1,3-dithianes
 α -Lithio- α -methoxyallene
 1-Lithio-1-methoxycyclopropane
 1-Lithio-2-methoxycyclopropane
 2-(2-Lithio-4-methoxycyclophenyl)-4,4-dimethyl-2-oxazoline
 1-Lithio-3-methoxy-3-trimethylsilyllallene
 2-Lithio-2-methyl-1,3-dithiane
 α -Lithiomethylenetriphenylphosphorane
 2-Lithio-2-methylpropionitrile
 α -Lithiomethylselenocyclobutane
 2-Lithio-2-methylthio-1,3-dithiane
 1-Lithio-1-methyl-2-vinylcyclopropane
 2-Lithiopropionitrile
 2-Lithio-2-propyl-1,3-benzodithiolane
 Lithio propylidene-*t*-butylimine
 1-Lithio-3,3,6,6-tetramethoxy-1,4-cyclohexadiene
 2-Lithio-3,3,6,6-tetramethoxy-1,4-cyclohexadiene
 6-Lithio-2*H*-thiopyran
 3-Lithio-1-triisopropylsilyl-1-propyne
 Lithiotrimethylsilylacetonitrile
 2-Lithio-2-trimethylsilyl-1,3-dithiane
 3-Lithio-1-trimethylsilyl-1-propyne
 1-Lithio-3-trimethylsilyl-1-propyne
 2-Lithio-1,3,5-trithiane
 1-Lithio-2-vinylcyclopropane
 2-Lithiovinyltributyltin
 2-(*E*)-Lithiovinyltrimethylsilane
 (1-Lithiovinyl)trimethylsilane
 (1-Lithiovinyl)triphenylsilane
 Lithium
 Lithium acetylide
 Lithium acetylide-Ethylenediamine
 Lithium acetylides
 Lithium amalgam
 Lithium 1,3-butadien-1-olate
 Lithium chloroacetylide
 Lithium 3-chloropropargylide
 Lithium cryptates
 Lithium ethoxyacetylide
 Lithium *o*-lithiobenzoate
 Lithium *o*-lithiophenoxide
 Lithium α -lithiophenoxyacetate
 Lithium β -lithiopropionate
 Lithium methylsulfinylmethylide
 Lithium methylsulfinylmethylide-Tributylborane
 Lithium tributylmanganate
 Lithium tri-*t*-butylzincate
 Lithium triethylmanganate
 Lithium trimethylcobaltate
 Lithium trimethylferrate
 Lithium trimethylmanganate
 Lithium trimethylsilylacetylide
 Lithium trimethylzincate
 Mesityllithium
 Methallyllithium
 2-Methoxy-4-furyllithium
 Methoxymethylithium
 Methoxy(phenylthio)methylithium
 Methoxy(phenylthio)trimethylsilylmethylithium
 2-Methoxy-2-propyllithium
 Methoxy(trimethylsilyl)methylithium
 α -Methoxyvinylithium
 Methylene chloride-Butyllithium
 Methylene chloride-Methylithium
 Methyl lithiodithioacetate
 Methyl α -lithio- α -methylidiphenylsilylacetate
 Methyl 1-lithio-1-methylselenoacetate
 Methyl 1-lithio-1-phenylselenoacetate
 Methylithium
 Methylithium + co-reagents
 N-Methyl-N-phenylaminoethynyllithium
 N-Methylphenylsulfonimidoyl-1-ethylithium
 N-Methylphenylsulfonimidoylmethylithium
 Methylselenomethylithium
 Methylthiomethylithium
 1-(Methylthio)-3-triethylsilyloxy-pentadienyllithium
 Nickel carbonyl-Butyllithium
 Organolithium reagents
 Organolithium reagents + co-reagents

METAL-CONTAINING COMPOUNDS

(Continued)

2-Oxo-3-(triphenylphosphoranylidene)-propyllithium
 Pentadienyllithium
 Phenyllithium
 Phenyllithium + co-reagents
 Phenyl(phenylthio)methylolithium
 Phenyl(phenylthio)trimethylsilylmethylolithium
 Phenylselenomethylolithium
 Phenylselenotrimethylsilylmethylolithium
 α -Phenylsulfonyl ethyllithium
 Phenylsulfonyl(trimethylsilyl)methylolithium
 Phenylthiobenzyllithium
 Phenylthiomethylolithium
 Phenylthio(trimethylsilyl)methylolithium
 Phenylthio(triphenylstannyl)methylolithium
 1-Phenylthiovinylolithium
 2-Picolylolithium
 4-Picolylolithium
 Potassium hydride-*sec*-Butyllithium-Tetramethylethylenediamine
 (E)-1-Propenyllithium
 2-Propenyllithium
 Sodium hydride-Butyllithium
 2-(1,3-Thiazolyl)thiomethylolithium
 Titanium(III) chloride-Lithium
 Titanium(III) chloride-Methylolithium
p-Tolylolithium
p-(Tolylsulfinyl)methylolithium
 Tribromomethylolithium
 2,4,6-Tri-*t*-butylphenyllithium
 Tributyltinlithium
 Tributyltinlithium-Diethylaluminum chloride
 Trichloromethylolithium
 3-Triethylsilyloxy-pentadienyllithium
 Trifluorovinylolithium
 [(Trimethylsilyl)allyl]lithium
 Trimethylsilylbenzylolithium
 α -[(Trimethylsilyl)ethyl]lithium
 β -[(Trimethylsilyl)ethyl]lithium
 1-Trimethylsilylhexyllithium
 Trimethylsilyl 2-lithio-2-carboethoxyacetate
 Trimethylsilyllithium
 Trimethylsilylmethylolithium
 (Z)-(Trimethylsilyloxy)vinylolithium

1-Trimethylsilyl(pentadienyl)lithium
 Trimethylstannylmethylolithium
 Trimethyltinlithium
 Triphenylmethylolithium
 Triphenylmethylolithium-Tetramethylethylenediamine
 Triphenylstannylmethylolithium
 Tris(methylthio)methylolithium
 Tris(phenylthio)methylolithium
 Tris(trimethylsilyl)methylolithium
 Tungsten(VI) chloride-Butyllithium
 Vinylolithium
 1-Vinylthioallyllithium

MAGNESIUM COMPOUNDS

Acetylenedimagnesium bromide
 (Allyldimethylsilyl)methylmagnesium chloride
 Allylmagnesium bromide or chloride
 Allylmagnesium bromide-Copper(I) iodide
 Benzocyclobutenylmethylmagnesium bromide
 Benzylmagnesium bromide or chloride
 N,N-Bis(bromomagnesium)anilide
 2-(2-Bromomagnesiumethyl)-2-methyl-1,3-dioxolane
 Bromomagnesium alkyl(methyl)cuprates
 Bromomagnesium diethylamide
 Bromomagnesium diisopropylamide
 Bromomagnesium hexamethyldisilazide
 Bromomagnesium isopropylcyclohexylamide
 Bromomagnesium N-methylanilide
 1,3-Butadienyl-2-magnesium chloride
 Butane 1,4-(dimagnesium bromide)
 Butylmagnesium bromide or chloride
t-Butylmagnesium bromide or chloride
 Butylmagnesium bromide or chloride + co-reagents
 4-Chloro-1-butenyl-2-magnesium bromide
p-Chlorophenylmagnesium bromide
 Chlorotrimethylsilane + magnesium co-reagents
 Crotylmagnesium bromide or chloride
 Crotylmagnesium chloride-Dichlorobis(cyclopentadienyl)titanium
 Cyclopentadienylmagnesium hydride
 Cyclopropylmagnesium bromide
 Cyclopropylmethylmagnesium bromide
 Dibutylmagnesium

Dichlorobis(cyclopentadienyl)titanium–
 Magnesium
 Dichlorobis(cyclopentadienyl)zirconium–
z-Butylmagnesium chloride
 Dichlorodimethylsilane–Magnesium
 amalgam
 3,3-Diethoxypropynylmagnesium
 bromide
 Diethylmagnesium
 (Diisopropoxymethylsilyl)methyl-
 magnesium chloride
 2,6-Diisopropylphenoxymagnesium
 hydride
 4-Dimethylaminophenylmagnesium
 bromide
 Dimethylmagnesium
 Dimethylphenylsilyl(methyl)magnesium
 Ethoxyethynylmagnesium bromide
 Ethyl ethoxymagnesiummalonate
 Ethylmagnesium bromide or chloride
 Ethylmagnesium bromide + co-reagents
 Ethynylmagnesium bromide
 Grignard reagents
 Grignard reagents + co-reagents
 Isobutylmagnesium bromide
 Isopropylmagnesium bromide or
 chloride
 Isopropylmagnesium chloride–Iron(III)
 reagents
 Magnesium
 Magnesium acetate
 Magnesium amalgam
 Magnesium anthracenide
 Magnesium bromide
 Magnesium bromide etherate
 Magnesium bromide etherate–Hydrogen
 peroxide
 Magnesium carbonate
 Magnesium chloride
 Magnesium chloride–Potassium
 Magnesium chloride–Sodium
 Magnesium chloride–Sodium
 naphthalenide
 Magnesium ethoxide
 Magnesium ethyl malonate
 Magnesium hydride
 Magnesium hydride + co-reagents
 Magnesium iodide
 Magnesium iodide etherate
 Magnesium–Mercuric chloride
 Magnesium methoxide

Magnesium methyl carbonate
 Magnesium naphthalenide
 Magnesium oxide
 Magnesium permanganate
 Magnesium sulfate
 Magnesium trifluoromethanesulfonate
 2-Mesitylmagnesium bromide
 Methallylmagnesium chloride–
 Dichlorobis(cyclopentadienyl)-
 titanium
 Methallylmagnesium halides
p-Methoxybenzylmagnesium bromide
 4-Methoxy-3-buten-1-ynylmagnesium
 bromide
 Methoxymethylmagnesium chloride
 3-Methyl-2-butenylmagnesium chloride
 3-Methyl-2-butenylmagnesium halides–
 Copper(I) iodide
 Methylenebis(magnesium bromide or
 iodide)
 Methylmagnesium bromide(chloride,
 iodide)
 Methylmagnesium bromide or iodide +
 co-reagents
 1-Norbornylmagnesium chloride
 Organomagnesium reagents
 Pentane-1,5-di(magnesium bromide)
 Phenylethynylmagnesium bromide
 Phenylmagnesium bromide
 Phenylmagnesium bromide +
 co-reagents
 Phenylmagnesium fluoride
 Phenylsulfonylmethylmagnesium
 bromide
 2-Propenylmagnesium bromide
 2-Propenylmagnesium bromide–
 Copper(I) iodide
 Propynylmagnesium bromide
trans-Styrylmagnesium bromide
 Tetra- μ -hydridotetrahydro-
 aluminummagnesium
 2-Thiophenylmagnesium bromide
 Titanium(III) chloride + magnesium
 co-reagents
 Titanium(IV) chloride + magnesium
 co-reagents
p-Tolylmagnesium bromide or chloride
 Tributyltinmagnesium bromide
 2,4,6-Trimethylphenoxymagnesium
 bromide
 α -(Trimethylsilyl)benzylmagnesium

METAL-CONTAINING COMPOUNDS*(Continued)*

bromide

Trimethylsilylmagnesium chloride

Trimethylsilylmethylmagnesium chloride

2-(3-Trimethylsilyl-1-propenyl)-
magnesium bromide2-(3-Trimethylsilyl-1-propenyl)-
magnesium bromide-Copper(I) iodide α -Trimethylsilylvinylmagnesium
bromide β -Trimethylsilylvinylmagnesium
bromide α -Trimethylsilylvinylmagnesium
bromide-Copper(I) iodide

Vinylmagnesium bromide or chloride

Vinylmagnesium bromide or chloride +
copper co-reagents**MANGANESE COMPOUNDS**

Barium manganate

Barium permanganate

Benzyl(triethyl)ammonium
permanganate

Bispyridinesilver permanganate

Copper(II) permanganate

Ethylmanganese chloride

Grignard reagents-Manganese(II)
chloride

Lithium tributylmanganate

Lithium triethylmanganate

Lithium trimethylmanganate

Magnesium permanganate

Manganese(III) acetate

Manganese(III) acetylacetonate

Manganese(II) chloride

Manganese(II) chloride-Lithium
aluminum hydride

Manganese(II) iodide

Manganese(IV) oxide

Manganese(III) sulfate

3-Methyl-2-butenylmanganese chloride

Methyltriphenylphosphonium
permanganateOrganomanganese(II) chlorides or
iodidesPalladium(II) chloride-Manganese(IV)
oxide

Pentacarbonyl(trimethylsilyl)manganese

Potassium manganate

Potassium periodate-Potassium
permanganate

Potassium permanganate

Potassium permanganate + co-reagents

Sodium periodate-Potassium
permanganate

Sodium permanganate monohydrate

Tetrabutylammonium permanganate

Zinc permanganate

Zinc permanganate-Silica

MERCURY COMPOUNDSBis(dichlorotrimethylsilylmethyl)-
mercury

Bis(2-propenyl)mercury

Bis(tribromomethyl)mercury

Bis(trichloromethyl)mercury

Bis(trifluoromethylthio)mercury

Bis(trimethylsilyl)mercury

Bis(trimethylsilylmethyl)mercury

(1-Bromo-1-chloro-2,2,2-trifluoroethyl)-
phenylmercury

(Bromodichloromethyl)phenylmercury

(1-Bromo-1,2,2,2-tetrafluoroethyl)-
phenylmercury*t*-Butyldimethylsilyl hydroperoxide-
Mercury(II) trifluoroacetate

Dibromochloromethyl(phenyl)mercury

Dibromo(methoxycarbonyl)methyl-
(phenyl)mercuryDichloro(methoxycarbonyl)methyl-
(phenyl)mercuryDihalo(methoxycarbonyl)methyl-
(phenyl)mercury

Diphenylmercury

Divinylmercury

Iodo(iodomethyl)mercury

Mercury(II) acetate

Mercury(II) acetate + co-reagents

Mercury(II) azide

Mercury bis(ethyl diazoacetate)

Mercury(II) bis(*p*-toluenesulfonamide)

Mercury(II) bromide

Mercury(II) chloride

Mercury(II) chloride-Cadmium
carbonate

Mercury(II) cyanide

Mercury(II) iodide

Mercury(II) methanesulfonate

Mercury(I) nitrate

Mercury(II) nitrate

Mercury(II) nitrate-Hydrogen peroxide

Mercury(II) nitrite

Mercury(II) oxide

- Mercury(II) oxide + co-reagents
 Mercury(II) perchlorate
 Mercury(II) pivalate
 Mercury(II) propionate
 Mercury(II) sulfate
 Mercury(II) tetrafluoroborate
 Mercury(II) thiocyanate
 Mercury(I) trifluoroacetate
 Mercury(II) trifluoroacetate
 Mercury(II) trifluoromethanesulfonate—
 N,N-Dimethylaniline
 Phenylmercuric acetate
 Phenylmercuric bromide
 Phenylmercuric chloride
 Phenylmercuric hydroxide
 Phenylmercuric perchlorate
 Phenyl(tribromomethyl)mercury
 Phenyl(trichloromethyl)mercury
 Phenyl(trifluoromethyl)mercury
 Phenyl(trihalomethyl)mercury
MOLYBDENUM COMPOUNDS
 Bis(N,N-dimethylformamido)-
 oxodiperoxymolybdenum(VI)
 Cesium 1,1,1,2,2,2-hexachloro- μ -
 (hydrido)di- μ -(chloro)-
 dimolybdenum(III)
 Chloromethyleneoxomolybdenum
 Dichlorodimethylmolybdenum
 (S)-(2-Hydroxy-N,N-dimethyl-
 propanamide-O,O')-oxodiperoxy-
 molybdenum(VI)
 Molybdenum carbonyl
 Molybdenum(V) chloride
 Molybdenum(V) chloride + co-reagents
 Molybdenum(VI) fluoride
 Molybdenum(V) trichloride oxide
 Molybdenum(V) trichloride oxide—Zinc
 Organomolybdenum reagents
 Oxodiperoxymolybdenum(pyridine)-
 (hexamethylphosphoric triamide)
 Oxomethoxymolybdenum(V)
 5,10,15,20-tetraphenylporphyrin
 Oxoperoxobis(N-phenylbenzo-
 hydroxamate)molybdenum(VI)
 Tetrabutylammonium octamolybdate
 Tetrachlorooxomolybdenum
 Trichloromethylenemolybdenum
NICKEL COMPOUNDS
 π -Allylnickel halides
 Bis(acrylonitrile)nickel(0)
 Bis(1,5-cyclooctadiene)nickel(0)
 Bis(1,5-cyclooctadiene)nickel(0) +
 co-reagents
 [*trans*-2,3-Bis(diphenylphosphine)-
 bicyclo[2.2.1]hept-5-ene]-
 dichloronickel(II)
 [1,2-Bis(diphenylphosphine)ethane]-
 (dichloro)nickel(II)
 [1,1'-Bis(diphenylphosphine)ferrocene]-
 dichloronickel(II)
 [1,3-Bis(diphenylphosphine)propane]-
 (dichloro)nickel(II)
 Bis(triphenylphosphine)nickel(0)
trans-Bromo-*o*-tolylbis(triethyl-
 phosphine)nickel(II)
 Butylmagnesium bromide—Nickel(II)
 reagents
 Di- μ -bromobis(allyl)dinickel
 Di- μ -bromobis[(2-ethoxycarbonyl)-2-
 propenyl]dinickel
 Di- μ -bromobis(2-methallyl)dinickel
 Di- μ -bromobis(2-methoxyallyl)dinickel
 Di- μ -bromobis(3-methyl-2-butenyl)-
 dinickel
 Dibromobis(tributylphosphine)nickel(II)
 Dibromobis(tributylphosphine)-
 nickel(II)—Sodium borohydride
 Dibromobis(triethylphosphine)nickel(II)
 Dibromobis(triphenylphosphine)-
 nickel(II)
 Dibromobis(triphenylphosphine)-
 nickel(II)—Zinc
 Dicarboxylbis(triphenylphosphine)nickel
 Dicarboxylbis(triphenyl phosphite)-
 nickel
 Dichlorobis(tributylphosphine)nickel(II)
 Dichlorobis(triphenylphosphine)-
 nickel(II)
 Dichloro[2,3-O-isopropylidene-2,3-
 dihydroxy-1,4-bis(diphenyl-
 phosphine)butane]nickel(II)
 Dicyanobis(triphenylphosphine)nickel(0)
 Grignard reagents—Nickel(0) reagents
 Grignard reagents—Nickel(II) reagents
 Lithium tetrabromonickelate
 Lithium tricarbonyl(dimethyl-
 carbamoyl)nickelate
 Methylmagnesium bromide—Nickel(II)
 acetylacetonate—Trimethylaluminum
 Methylmagnesium bromide—Nickel(II)
 reagents
 Nickel

METAL-CONTAINING COMPOUNDS

(Continued)

- Nickel(II) acetate
- Nickel(II) acetate–Sodium hydride–*t*-Amyloxide
- Nickel(II) acetylacetonate
- Nickel(II) acetylacetonate + co-reagents
- Nickel–Alumina
- Nickel boride
- Nickel(II) bromide
- Nickel(II) bromide + co-reagents
- Nickel carbonyl
- Nickel carbonyl–Butyllithium
- Nickel catalysts
- Nickel(II) chloride
- Nickel(II) chloride + co-reagents
- Nickel cyanide
- Nickel–Graphite
- Nickel on alumina
- Nickel peroxide
- Nickel(II) sulfate
- Nickel tetraphenylporphine
- Phenylmagnesium bromide–Nickel(II) reagents
- Potassium hexacyanodinitrate(4-)
- Raney nickel
- Raney nickel alloy
- Sodium tetracyanonickelate(II)
- Tetrakis(trichlorophosphine)nickel(0)
- Tetrakis(triphenylphosphine)nickel(0)
- Tetrakis(triphenyl phosphite)nickel(0)
- Triisobutylaluminum–Bis(N-methylsalicylaldimine)nickel
- Tris(triphenylphosphine)nickel(0)

OSMIUM COMPOUNDS

- Dioxobis(*t*-butylimido)osmium(VIII)
- Dipotassium tetramethylosmate
- Osmium tetroxide
- Osmium tetroxide + co-reagents
- Oxotris(*t*-butylimido)osmium(VIII)
- Potassium hexachloroosmate(IV)–Zinc
- Potassium osmate
- Potassium triacetylosmate
- Sodium periodate–Osmium tetroxide
- Trioxo(*t*-butylimido)osmium(VIII)

PALLADIUM COMPOUNDS

- π -Allylpalladium complexes
- Benzylchlorobis(triphenylphosphine)-palladium(II)
- Bis[μ -(acetato)]bis(2-propenyl)-dipalladium

- Bis(acetonitrile)chloronitropalladium(II)
- Bis(acetonitrile)dichloropalladium(II)
- Bis(benzonitrile)dibromopalladium(II)
- Bis(benzonitrile)dichloropalladium(II)
- Bis[1,2-bis(diphenylphosphine)ethane]-palladium(0)
- Bis(dibenzylideneacetone)palladium(0)
- [1,2-Bis(diphenylphosphine)ethane]bis-(triphenylphosphine)palladium(0)
- [1,2-Bis(diphenylphosphine)ethane]-dichloropalladium(II)
- [1,1'-Bis(diphenylphosphine)ferrocene]-dichloro)palladium(II)
- Diacetatobis(triphenylphosphine)-palladium(II)
- Diacetatobis(tri-*o*-tolylphosphine)-palladium(II)
- Diammonium tetrachloropalladate(II)
- Dibromobis(triphenylphosphine)-palladium(II)
- Di- μ -chlorobis(allyl)dipalladium
- Dichlorobis(crotyl)dipalladium
- Dichlorobis(cyclohexene)palladium(II)
- Dichlorobis(methylidiphenylphosphine)-palladium(II)
- Dichlorobis(triphenylphosphine)-palladium(II)
- Dichlorobis(triphenylphosphine)-palladium(II) + co-reagents
- Dichlorobis(tri-*o*-tolylphosphine)-palladium(II)
- Dichloro(1,5-cyclooctadiene)-palladium(II)
- Dihalobis(triphenylphosphine)-palladium(II)
- Dilithium tetrachloropalladate(II)
- Disodium tetrachloropalladate(II)
- Grignard reagents–Palladium(0) reagents
- Grignard reagents–Palladium(II) reagents
- Iodophenylbis(triphenylphosphine)-palladium
- [2,3-O-Isopropylidene-2,3-dihydroxy-1,4-bis(diphenylphosphine)butane]-palladium
- Lithium trichloropalladate(II)
- (Maleic anhydride)bis(triphenylphosphine)palladium(0)
- Organolithium reagents–Palladium(0) reagents

Palladium(II) acetate
 Palladium(II) acetate + co-reagents
 Palladium(II) acetylacetonate
 Palladium(II) acetylacetonate—
 Triphenylphosphine
 Palladium black
 Palladium *t*-butyl peroxide
 trifluoroacetate
 Palladium catalysts
 Palladium(II) chloride
 Palladium(II) chloride + co-reagents
 Palladium—Graphite
 Palladium hydroxide
 Palladium hydroxide on barium sulfate
 Palladium nitrate
 Palladium on barium sulfate
 Palladium on calcium carbonate
 Palladium on carbon
 Palladium on charcoal
 Palladium(0)-Phosphines
 Palladium, poisoned
 Palladium—Poly(ethylenimine)
 Palladium(II) trifluoroacetate
 Peroxybis(triphenylphosphine)palladium
 Phenylpalladium acetate
 Rosenmund catalyst
 Tetrakis(acetonitrile)palladium
 tetrafluoroborate
 Tetrakis(triisopropyl phosphite)-
 palladium(0)
 Tetrakis(triphenylphosphine)-
 palladium(0)
 Tetrakis(triphenylphosphine)-
 palladium(0) + co-reagents
 Triethylsilane—Palladium(II) chloride
 Triethylsilane—Palladium on carbon
 Tris(dibenzylideneacetone)dipalladium-
 (chloroform)
 Tris(tribenzylideneacetylacetone)-
 tripalladium(chloroform)
 Zinc chloride—Benzylchlorobis-
 (triphenylphosphine)palladium(II)

PALLADIUM COMPOUNDS

Bis(benzonitrile)dichloroplatinum(II)
 [1,2-Bis(diphenylphosphine)ethane]-
 cyclohexyneplatinum(0)
 Chlorohydridobis(triethylphosphine)-
 platinum
 Diammonium hexachloroplatinate(IV)
 Dichlorobis(triphenylphosphine)-
 platinum(II)—Tin(II) chloride

(–)-*trans*-Dichloro(ethylene)-
 [α -methylbenzylamine]platinum(II)
 Dipotassium tetrachloroplatinate(II)
 Disodium tetrachloroplatinate(II)
 Ethylenebis(triphenylphosphine)-
 platinum(0)
 Hydrogen hexachloroplatinate(IV) +
 co-reagents
 Platinum
 Platinum—Alumina catalyst
 Platinum black
 Platinum *t*-butyl peroxide
 trifluoroacetate
 Platinum catalysts
 Platinum on carbon
 Platinum oxide
 Platinum—Silica
 Platinum sulfide on carbon
 Platinum—Tin(II) chloride
 Rhodium oxide—Platinum oxide

RHODIUM COMPOUNDS

Bis[1,3-bis(diphenylphosphine)propane]-
 chlororhodium(I)
 [2,2'-Bis(diphenylphosphine)-1,1'-
 binaphthyl](cyclooctadiene)-
 rhodium(I) perchlorate
 [2,2'-Bis(diphenylphosphine)-1,1'-
 binaphthyl](norbornadiene)-
 rhodium(I) perchlorate
 1,4-[Bis(diphenylphosphine)butane]-
 (norbornadiene)rhodium(I)
 tetrafluoroborate
 [1,2-Bis(diphenylphosphine)propane]-
 (norbornadiene)rhodium perchlorate
 Bis(norbornadiene)rhodium(I)
 perchlorate—(R)-1-(S)-1',2-Bis-
 (diphenylphosphine)ferrocenylethanol
 [N-(*t*-Butoxycarbonyl)-4-diphenyl-
 phosphine]-2-[(diphenylphosphine)-
 methyl]pyrrolidine(cyclooctadiene)-
 rhodium chloride or perchlorate
 Carbonylchlorobis(triphenylphosphine)-
 rhodium(I)
 Carbonylhydridotris(triphenyl-
 phosphine)rhodium(I)
 Carbonylhydridotris(triphenyl-
 phosphine)rhodium—2,3, O-
 Isopropylidene-2,3-dihydroxy-1,4-
 bis(diphenylphosphine)butane
 Carbonylphenylbis(triphenyl-
 phosphine)rhodium(I)

METAL-CONTAINING COMPOUNDS*(Continued)*

Chloro(hexamethylbenzene)hydrido-
triphenylphosphinerhodium
Chlorotris(methyldiphenylphosphine)-
rhodium(I)
Chlorotris(neomenthyl)diphenyl-
phosphine)rhodium(I)
Chlorotris(triphenylphosphine)-
rhodium(I)
Chlorotris(triphenylphosphine)-
rhodium(I)-Hydrosilanes
Dichlorobis(1,5-cyclooctadiene)-
dirhodium + co-reagents
Di- μ -chlorobis(1,5-hexadiene)dirhodium
Di- μ -chlorobis(1,5-hexadiene)dirhodium
+ co-reagents
Dichlorobis(norbornadiene)-
dirhodium(I)
Dichlorobis(norbornadiene)-
dirhodium(I) + co-reagents
Di- μ -chlorodichlorobis(pentamethyl-
cyclopentadienyl)dirhodium
Dichloro(dimethylformamido)bis-
(pyridine)rhodium borohydride
Di- μ -chlorotetra(ethylene)dirhodium
Di- μ -chlorotetra(ethylene)dirhodium-
2,3-O-Isopropylidene-2,3-dihydroxy-
1,4-bis(diphenylphosphine)butane
Di- μ -chlorotetrakis(cyclooctene)-
dirhodium-2,3-O-Isopropylidene-
2,3-dihydroxy-1,4-bis(diphenyl-
phosphine)butane
Diiodo(methyl)bis(triphenylphosphine)-
rhodium
Hexakis(acetato)trihydrato- μ_3 -
oxotrisrhodium acetate
Hydridotetrakis(triphenylphosphine)-
rhodium(I)
Hydridotris(triisopropylphosphine)-
rhodium(I)
Hydridotris(triphenylphosphine)-
carbonylrhodium(I)
Methyltris(triphenylphosphine)-
rhodium(I)
Peroxytetrakis(triphenylarsine)-
rhodium(I) hexafluorophosphate or
perchlorate
Rhodium(II) acetate
Rhodium(II) butanoate
Rhodium(II) carboxylates

Rhodium(III) chloride
Rhodium(III) chloride + co-reagents
Rhodium(II) methoxyacetate
Rhodium(III) oxide
Rhodium oxide-Platinum oxide
Rhodium(II) pivaloate
Rhodium(III) porphyrins
Rhodium(II) trifluoroacetate
Tetracarbonyldi- μ -chlorodirrhodium
Tetracarbonyldi- μ -chlorodirrhodium-
Lithium chloride
Tetra- μ_3 -carbonyldodecacarbonyl-
hexarhodium
Tri- μ -carbonylnonacarbonyl-
tetrarhodium
Tris(dimethylphenylphosphine)-
(norbornadiene)rhodium(I)
hexafluorophosphate
RUTHENIUM COMPOUNDS
Acetatohydridotris(triphenylphosphine)-
ruthenium
Carbonyldihydridotris(triphenyl-
phosphine)ruthenium
Chlorohydridotris(triphenylphosphine)-
ruthenium(II)
Dibromotris(triphenylphosphine)-
ruthenium(II)
Dicarbonyldichlorobis(triphenyl-
phosphine)ruthenium(II)
Dichlorotetrakis(triphenylphosphine)-
ruthenium(II)
Dichlorotris(triphenylphosphine)-
ruthenium(II)
Dihydridotetrakis(tributylphosphine)-
ruthenium(II)
Dihydridotetrakis(triphenylphosphine)-
ruthenium(II)
Dihydridotris(triphenylphosphine)-
ruthenium
Dodecacarbonyltri-*triangulo*-ruthenium
Hexacarbonyltetra- μ -chlorodiruthenium
Potassium ruthenate
Ruthenium(III) acetylacetonate
Ruthenium(III) acetylacetonate-
Alumina
Ruthenium catalysts
Ruthenium(III) chloride
Ruthenium(III) chloride + co-reagents
Ruthenium hydrogenation catalyst
Ruthenium on alumina
Ruthenium on carbon

Ruthenium(IV) oxide
 Ruthenium(IV) oxide + co-reagents
 Ruthenium—Silica
 Ruthenium tetroxide
 Ruthenium tetroxide—Sodium periodate
 Sodium ruthenate
 Tris(aquo)hexa- μ -acetato- μ_3 -
 oxotriruthenium(III,III,III) acetate

SILICON COMPOUNDS

Acetone cyanohydrin trimethylsilyl ether
 2-Acetoxy-1-methoxy-3-
 trimethylsilyloxy-1,3-butadiene
 1-Acetoxy-4-trimethylsilyl-1,3-butadiene
 3-Acetoxy-1-trimethylsilyl-1,3-butadiene
 3-Acetoxy-2-trimethylsilylmethyl-
 1-propene
 3-Acetoxy-1-trimethylsilyl-1-propene
 3-Acetoxy-3-trimethylsilyl-1-propene
 Acetyl chloride—2-Trimethylsilylethanol
 Allyl-*t*-butyldimethylsilane
 (Allyldimethylsilyl)methylmagnesium
 chloride
 Allyltrimethylsilane
 Allyltrimethylsilylzinc chloride
 (S)-(-)-1-Amino-2-(*t*-butyldialkyl-
 silyloxymethyl)pyrrolidines
 Azidotrimethylsilane
 Benzyltrimethylsilane
 1,3-Bis(*t*-butyldimethylsilyloxy)-2-
 aza-1,3-diene
 Bis(chlorodimethylsilyl)ethane
 Bis(cyclopentadienyl)(1-trimethyl-
 silylallyl)titanium
 Bis(dichlorotrimethylsilylmethyl)-
 mercury
 1,4-Bis(N,N-dimethylamino)-1,1,4,4-
 tetramethyldisilethylene
 Bis(1-methoxy-2-methyl-1-propenyloxy)-
 dimethylsilane
 Bis(methylthio)(trimethylsilyl)methane
 Bis(methylthio)(trimethylsilyl)-
 methyl lithium
 1,3-Bis(phenylseleno)-3-
 trimethylsilyl-1-propene
 1,3-Bis(triisopropylsilyl)propyne
 Bis(trimethylsilyl)acetamide
 Bis(trimethylsilyl)acetylene
 1,4-Bis(trimethylsilyl)butadiyne
 1,4-Bis(trimethylsilyl)-2-butene
 1,4-Bis(trimethylsilyl)-2-butyne
 N,O-Bis(trimethylsilyl)carbamate

1,1-Bis(trimethylsilyl)ethylene
 Bis(trimethylsilyl)formamide
 O,N-Bis(trimethylsilyl)hydroxylamine
 Bis(trimethylsilyl) lithiomalonate
 Bis(trimethylsilyl) malonate
 Bis(trimethylsilyl)mercury
 Bis(trimethylsilyl)methane
 2,3-Bis(trimethylsilylmethyl)-1,3-
 butadiene
 Bis(trimethylsilylmethyl)mercury
 Bis(trimethylsilyl) monoperoxy sulfate
 1,3-Bis(trimethylsilyloxy)-1,3-
 butadiene
 2,3-Bis(trimethylsilyloxy)-1,3-
 butadiene
 1,2-Bis(trimethylsilyloxy)cyclobutene
 1,3-Bis(trimethylsilyloxy)-1,3-
 cyclohexadiene
 2,3-Bis(trimethylsilyloxy)-1,3-
 cyclohexadiene
 2,5-Bis(trimethylsilyloxy)furans
 Bis(trimethylsilyl) peroxide
 1,3-Bis(trimethylsilyl)propyne
 N,O-Bis(trimethylsilyl) sulfamate
 Bis(trimethylsilyl) sulfate
 Bis(trimethylsilyl)thio ketene
 Bis(trimethylsilyl) trimethylsilyloxy-
 methylphosphonite
 Bis(trimethylsilyl)urea
 Bromo-*t*-butylmethoxyphenylsilane
 2-Bromoethyltrimethylsilane
 Bromomagnesium hexamethyldisilazide
 (Bromomethyl)chlorodimethylsilane
 2-Bromomethyl-3-(trimethylsilylmethyl)-
 1,3-butadiene
 3-Bromo-3-methyl-2-trimethylsilyloxy-
 1-butene
 Bromotrimethylsilane
 Bromotrimethylsilane-Cobalt(II)
 bromide
 (Z)-2-Bromo-1-(trimethylsilyloxy)-
 ethylene
 1-Bromo-3-trimethylsilyloxy-1-propyne
 1-Bromo-1-trimethylsilyl-1(Z),4-
 pentadiene
 3-Bromo-1-trimethylsilyl-1-propene
 2-Bromo-3-trimethylsilyl-1-propene
 1-Bromovinyltrimethylsilane
 (2-Bromovinyl)trimethylsilane
 (1-Bromovinyl)triphenylsilane
 Butadiynyl(trimethyl)silane

METAL-CONTAINING COMPOUNDS

(Continued)

- t*-Butoxytrimethylsilane
t-Butyl bis(trimethylsilyl)acetate
t-Butyl 2-chloro-2-lithiotrimethylsilylacetate
t-Butyl 2-chloro-2-trimethylsilylacetate
t-Butyldimethylchlorosilane
t-Butyldimethyliodosilane
t-Butyldimethylsilyl ethylnitronate
t-Butyldimethylsilyl hydroperoxide—Mercury(II) trifluoroacetate
O-t-Butyldimethylsilylhydroxylamine
N-(t-Butyldimethylsilyl)-*N*-methylacetamide
N-(t-Butyldimethylsilyl)-*N*-methyltrifluoroacetamide
4-*t*-Butyldimethylsilyloxy-3-penten-2-one
t-Butyldimethylsilyl perchlorate
t-Butyldimethylsilyl phenyl selenide
t-Butyldimethylsilyl trifluoromethanesulfonate
3-(*t*-Butyldimethylsilyl)-1-(trimethylsilyl)propyne
t-Butyldiphenylchlorosilane
t-Butyldiphenylsilyllithium
t-Butyl lithiobis(trimethylsilyl)acetate
t-Butyl lithio(trimethylsilyl)acetate
1-*t*-Butylthio-1-trimethylsilyloxyethylene
t-Butyl trimethylsilylacetate
Cesium fluoride—Tetraalkoxysilanes
Chlorodimethylphenylsilane
Chlorodimethyl(2,4,6-tri-*t*-butylphenoxy)silane
 α -Chloroethyltrimethylsilane
(Chloromethyl)dimethylsilane
Chloro(methyl)diphenylsilane
Chloromethyltrimethylsilane
3-Chloro-3-methyl-2-trimethylsilyloxy-1-butene
1-Chloro-2-methyl-1-trimethylsilyl-1-propene
2-Chloromethyl-3-trimethylsilyl-1-propene
Chlorotriisopropylsilane
Chlorotrimethylsilane
Chlorotrimethylsilane + co-reagents
(E)-1-Chloro-3-trimethylsilyl-2-butene
Chlorotrimethylsilylcarbene
1-Chloro-1-(trimethylsilyl)ethylolithium
Chloro[(trimethylsilyl)methyl]ketene
Chloro(trimethylsilyl)methylolithium
1-Chloro-1-trimethylsilyl-2-methylpropene
3-Chloro-2-trimethylsilyloxy-1-propene
Chlorotris(triphenylphosphine)-rhodium(I)—Hydrosilanes
(2-Chlorovinyl)trimethylsilane
Cinnamyltrimethylsilane
Copper(I) hexamethyldisilazide
Copper(I) trimethylsilylacetylide
Crotyltrimethylsilane
Cyano-*t*-butyldimethylsilane
Cyanotrimethylsilane
Cyanotrimethylsilane—Triethylaluminum
Cyclopropyltrimethylsilane
1-Cyclopropyl-1-trimethylsilyloxyethylene
Diacetoxymethylsilane
Diazo(trimethylsilyl)methylolithium
Di-*t*-butyldichlorosilane
Di-*t*-butylmethylsilyl perchlorate
Di-*t*-butylsilyl bis(trifluoromethanesulfonate)
Dichlorodimethylsilane
Dichlorodimethylsilane—Magnesium amalgam
1,3-Dichloro-3-methyl-2-trimethylsilyloxy-1-butene
Dichlorosilane
Dicyanodimethylsilane
1,2-Diethoxy-1,2-bis(trimethylsilyloxy)-ethylene
Diethoxymethylsilane
Diethylaluminum trimethylsilylacetylide
Diethyl difluorotrimethylsilylmethylphosphonate
Diethyl[dimethyl(phenyl)silyl]aluminum
Diethylmethylsilane
Diethyl 1-phenyl-1-trimethylsilyloxymethylphosphonate
Diethyltrimethylsilylamine
Diethyl trimethylsilyloxycarbonylmethylphosphonate
Diethyl 1-trimethylsilyloxyethylphosphonate
Diethyl trimethylsilyl phosphite
Diiododimethylsilane

- (Diisopropoxymethylsilyl)methyl-
 magnesium chloride
 Diisopropylbis(trifluoromethane-
 sulfonato)silane
 Diketene-Iodotrimethylsilane
 (Dimethoxymethyl)trimethoxysilane
 1,3-Dimethoxy-1-trimethylsilyloxy-1,3-
 butadiene
 1,1-Dimethoxy-1-trimethylsilyloxy-1,3-
 butadiene
 1,2-Dimethoxy-1-trimethylsilyloxy-1,3-
 pentadiene
 5,5-Dimethyl-1,3-bis(trimethylsilyloxy)-
 1,3-cyclohexadiene
 Dimethylketene methyl trimethylsilyl
 ketal
 Dimethylphenylsilane
 Dimethylphenylsilyllithium
 Dimethylphenylsilyl(methyl)magnesium
 Dimethylsilylene
 Dimethyl sulfoxide-
 Chlorotrimethylsilane
 N,N-Dimethyl- α -trimethylsilylacetamide
 Diphenylsilane
 Dodecamethylcyclohexasilane
 Ethoxydiethylsilane
 1-(1-Ethoxyethoxyallyl)-
 trimethylsilane
 1-Ethoxy-2-ethyl-3-trimethylsilyloxy-
 1,3-butadiene
 Ethoxy(trimethylsilyl)acetylene
 1-Ethoxy-1-trimethylsilyloxycyclo-
 propane
 Ethyl bis(2-trimethylsilylallyl) phosphate
 Ethyl lithio(trimethylsilyl)acetate
 Ethyl 2-(methyldiphenylsilyl)propionate
 Ethyl potassio(trimethylsilyl)acetate
 Ethylthiotrimethylsilane
 Ethyl trimethylsilylacetate
 Ethyl N-trimethylsilylcarbamate
 Ethyl trimethylsilyl malonate
 Ethyl 2-(trimethylsilylmethyl)acrylate
 Fluorotrimethylsilane
 Heptamethyldisilazane
 Hexachlorodisilane
 Hexamethylcyclotrisilathiane
 Hexamethylsilane
 Hexamethylsilane-Pyridinium
 bromide perbromide
 Hexamethylsilathiane
 Hexamethylsilazane
 Hexamethylsiloxane
 Hydrogen hexachloroplatinate(IV) +
 silicon co-reagents
 2-Hydroxymethyl-3-trimethylsilyl-
 1-propene
 Iodoethynyl(trimethyl)silane
 Iodomethyltrimethylsilane
 2-Iodomethyl-3-trimethylsilyl-1-propene
 (3-Iodopropyl)trimethylsilane
 Iodotrimethylsilane
 (E)-1-Iodo-3-trimethylsilyl-2-butene
 3-Iodo-1-trimethylsilylpropyne
 1-Isopropoxy-1-trimethylsilyl-
 oxycyclopropane
 Ketene alkyl trialkylsilyl acetals or ketals
 Ketene bis(trimethylsilyl) acetals or
 ketals
 Ketene *t*-butyldimethylsilyl methyl acetal
 1-Lithio-3-methoxy-3-trimethyl-
 silyllallene
 3-Lithio-1-triisopropylsilyl-1-propyne
 Lithiotrimethylsilylacetone nitrile
 2-Lithio-2-trimethylsilyl-1,3-dithiane
 3-Lithio-1-trimethylsilyl-1-propyne
 1-Lithio-3-trimethylsilyl-1-propyne
 2-(E)-Lithiovinyltrimethylsilane
 (1-Lithiovinyl)trimethylsilane
 (1-Lithiovinyl)triphenylsilane
 Lithium bis(dimethylphenylsilyl)cuprate
 Lithium 1,1-bis(trimethylsilyl)ethoxide
 Lithium 1,1-bis(trimethylsilyl)-3-
 methylbutoxide
 Lithium bis(3-trimethylsilyl-1-propen-
 2-yl)cuprate
 Lithium cyano(dimethylphenylsilyl)-
 cuprate
 Lithium cyano(trimethylsilyl)cuprate
 Lithium diisopropylamide-
 Chlorotrimethylsilane
 Lithium hexamethyldisilazide
 Lithium trimethylsilanolate
 Lithium trimethylsilylacetylde
 Methallyltrimethylsilane
 4-Methoxy-1,2-bis(trimethylsilyloxy)-
 1,3-butadiene
 1-Methoxy-1,3-bis(trimethylsilyloxy)-
 1,3-butadiene
 Methoxymethylbis(trimethylsilyl)amine
 3-Methoxymethylene-2,4-bis(trimethyl-
 silyloxy)-1,4-pentadiene
 (Methoxymethyl)trimethylsilane

METAL-CONTAINING COMPOUNDS

(Continued)

- 1-Methoxy-2-methyl-3-trimethylsilyloxy-1,3-butadiene
 1-Methoxy-3-methyl-1-trimethylsilyloxy-1,3-butadiene
 1-Methoxy-2-methyl-3-trimethylsilyloxy-1,3-pentadiene
 4-Methoxy-1-phenylseleno-2-trimethylsilyloxy-1,3-butadiene
 Methoxy(phenylthio)trimethylsilylmethane
 Methoxy(phenylthio)trimethylsilylmethyl lithium
 Methoxytrimethylsilane
 1-Methoxy-2-trimethylsilylacetylene
 1-Methoxy-1-trimethylsilyllallene
 1-Methoxy-1-trimethylsilylethylene
 Methoxy(trimethylsilyl)methyl lithium
trans-1-Methoxy-3-trimethylsilyloxy-1,3-butadiene
 1-Methoxy-1-trimethylsilyloxy-cyclopropane
 3-Methoxy-1-trimethylsilyl-1-propyne
 5-Methyl-1,3-bis(trimethylsilyl)-1,3-cyclohexadiene
 O-Methyl-C,O-bis(trimethylsilyl)ketene acetal
 5-Methyl-1,3-bis(trimethylsilyloxy)-1,3-cyclohexadiene
 3-Methyl-2-butenyltrimethylsilane
 Methyl 3-*t*-butyldimethylsilyloxycrotonate
 Methylketene bis(trimethylsilyl) acetal
 Methylketene methyl trimethylsilyl acetal
 Methyl α -lithio- α -methyl diphenylsilylacetate
 Methyl α -(methyl diphenylsilyl)acetate
 Methylneopentylphenylsilane-Boron trifluoride
 (Z)-3-Methyl-1-phenylthio-2-trimethylsilyloxy-1,3-butadiene
 1-Methylthio-3-triethylsilyloxy-1,4-pentadiene
 1-(Methylthio)-3-triethylsilyloxy-pentadienyl lithium
 Methylthiotrimethylsilane
 3-(Methylthio)-3-(trimethylsilyl)-1-propene
 Methyl trimethylsilylacetate
 Methyl 2-trimethylsilylacrylate
 3-Methyl-1-trimethylsilyl-1,2-butadiene
 3-Methyl-3-trimethylsilyl-1-butene
 3-Methyl-1-trimethylsilyl-3-buten-2-one
 N-Methyl-N-trimethylsilylmethyl-N'-*t*-butylformamide
 2-Methyl-1-(trimethylsilylmethyl)-pyridinium trifluoromethanesulfonate
 2-Methyl-2-trimethylsilyloxypentan-3-one
 Organopentafluorosilicates
 Oxotris(triphenylsilanolato)vanadium
 Pentacarbonyl(trimethylsilyl)manganese (2,4-Pentadienyl)trimethylsilane
 Phenyl iodine(III) diacetate-Azidotrimethylsilane
 Phenyl(phenylthio)trimethylsilylmethane
 Phenyl(phenylthio)trimethylsilylmethyl lithium
 Phenylselenotrimethylsilylmethyl lithium
 Phenylsilane
 (2-Phenylsulfonyl ethyl)trimethylsilane
 1-Phenylsulfonyl-2-trimethylsilylethane
 (E)-1-Phenylsulfonyl-2-trimethylsilylethylene
 Phenylsulfonyl(trimethylsilyl)methane
 Phenylsulfonyl(trimethylsilyl)methyl lithium
 Phenylthiotriethylsilane
 Phenylthiotrimethylsilane
 1-Phenylthio-1-trimethylsilylcyclopropane
 1-Phenylthio-1-trimethylsilylethylene
 1-Phenylthio-2-trimethylsilylethylene
 Phenylthiotrimethylsilylmethane
 Phenylthio(trimethylsilyl)methyl lithium
 2-Phenylthio-2-trimethylsilylpropane
 1-Phenyl-2-trimethylsilylacetylene
 Phenyl 2-(trimethylsilyl)ethynyl sulfone
 Phenyl trimethylsilylpropargyl ether
 Phenyl trimethylsilyl selenide
 Polymethylhydrosiloxane
 Potassium cyanide-Chlorotrimethylsilane
 Potassium hexamethyldisilazide
 Potassium trimethylsilanolate
 Silica
 Silicon tetrakisocyanate
 Siloxene

Sodium cyanide–Chlorotrimethylsilane–
Sodium iodide
Sodium hexamethyldisilazide
Sodium trimethylsilanolate
Tetrabutylammonium trimethylsilylate
Tetrachlorosilane
Tetrachlorosilane–Sodium iodide
Tetraethoxysilane
Tetrafluorosilane
3-Tetrahydropyranloxy-1-trimethyl-
silyl-1-propyne
1,1,2,3-Tetrakis(trimethylsilyloxy)-1,3-
butadiene
Tetramethoxysilane
Tribenzylchlorosilane
Tri-*t*-butylsilyl perchlorate
(E)-1-Tributylstannyl-2-trimethyl-
silylethylene
Tributyl(trimethylsilylmethyl)tin
Trichloro(iodo)silane
Trichloro(methyl)silane
Trichloro(methyl)silane–Sodium iodide
Trichlorosilane
Trichlorosilane–*t*-Amines
Triethoxysilane
Triethyl(iodo)silane
Triethylsilane
Triethylsilane + co-reagents
2-Triethylsilyl-1,3-butadiene
3-Triethylsilyl-3-buten-2-one
3-Triethylsilyloxy-1-butene
1-Triethylsilyloxy-2-butene
3-Triethylsilyloxy-1,4-pentadiene
3-Triethylsilyloxypentadienyllithium
3-Triethylsilyloxy-1-propene
Triethylsilyl perchlorate
Trifluoroacetic acid–Alkylsilanes
1-Trifluoromethylsulfonyl-2-
methyl-1-trimethylsilyl-1-propene
Trifluoro(trichloromethyl)silane
1-Triisopropylsilyl-1-propyne
Triisopropylsilyl trifluoromethane-
sulfonate
Trimethylphenylsilane–Iodine
Trimethylsilane
N-Trimethylsilylacetamide
N-Trimethylsilylacetanilide
Trimethylsilylacetic acid
Trimethylsilylacetone
Trimethylsilylacetoneitrile
Trimethylsilylacetyl chloride

Trimethylsilylacetylene
(Trimethylsilyl)acetyltrimethylsilane
Trimethylsilyallene
[(Trimethylsilyl)allyl]lithium
2-Trimethylsilyl-1,3-benzothiazole
Trimethylsilylbenzylolithium
 α -(Trimethylsilyl)benzylmagnesium
bromide
Trimethylsilylbromoketene
3-Trimethylsilyl-1,2-butadiene
1-Trimethylsilyl-1,3-butadiene
3-Trimethylsilyl-1-butene
1-Trimethylsilyl-1-buten-3-ol
(E)-3-Trimethylsilyl-2-buten-1-ol
4-Trimethylsilyl-2-buten-1-ol
3-Trimethylsilyl-3-buten-2-one
Trimethylsilylcarbene
Trimethylsilylcopper
 α -Trimethylsilylcrotyl-9-borabicyclo-
[3.3.1]nonane
3-Trimethylsilyl-1-cyclopentene
Trimethylsilyldiazomethane
Trimethylsilyl dichloroacetate
Trimethylsilyl 2,2-dichloropropionate
2-Trimethylsilyl-1,3-dithiane
2-Trimethylsilylethanol
 β -(Trimethylsilyl)ethoxymethyl chloride
2-(Trimethylsilyl)ethyl azidoformate
2-(Trimethylsilyl)ethyl chloroformate
 β -Trimethylsilylethylidenetriphenyl-
phosphorane
 α -[(Trimethylsilyl)ethyl]lithium
 β -[(Trimethylsilyl)ethyl]lithium
2-Trimethylsilylfuran
1-Trimethylsilylhexyllithium
N-(Trimethylsilyl)imidazole
Trimethylsilyl isocyanate
Trimethylsilylketene
Trimethylsilyl 2-lithio-2-
ethoxycarbonylacetate
Trimethylsilyllithium
Trimethylsilylmagnesium chloride
Trimethylsilylmethanethiol
Trimethylsilylmethyl azide
 α -Trimethylsilyl-2-methylbenzothiazole
2-Trimethylsilylmethyl-1,3-butadiene
3-Trimethylsilylmethyl-3-butenic acid
Trimethylsilylmethylcopper
Trimethylsilylmethyldimesityl-
borane
2-Trimethylsilylmethylene-

METAL-CONTAINING COMPOUNDS*(Continued)*

cyclobutane
 Trimethylsilylmethylene
 dimethylsulfurane
 Trimethylsilylmethylene-
 trimethylphosphorane
 Trimethylsilylmethylene-
 triphenylphosphorane
 Trimethylsilylmethylithium
 Trimethylsilylmethylmagnesium chloride
 Trimethylsilylmethylpotassium
 Trimethylsilylmethylsodium
 Trimethylsilylmethyl trifluoro-
 methanesulfonate
 2-Trimethylsilylmethyl-3-trimethyl-
 silyl-1-propene
 Trimethylsilyl nonaflate
 N-Trimethylsilyl-2-oxazolidinone
 3-Trimethylsilyl-2-oxazolidone
 2-Trimethylsilyloxyallyl chloride
 1-Trimethylsilyloxy-1,3-butadiene
 2-Trimethylsilyloxy-1,3-butadiene
 2-Trimethylsilyloxy-1,3-cyclohexadiene
 1-(Trimethylsilyloxy)cyclohexene
 3-Trimethylsilyloxy-1,3-pentadiene
 3-Trimethylsilyloxy-1,4-pentadiene
 2-Trimethylsilyloxy-1-propene
 4-Trimethylsilyloxyvaleronitrile
 1-Trimethylsilyloxy-1-vinylcyclopropane
 (Z)-(Trimethylsilyloxy)vinylithium
 1-Trimethylsilyl(pentadienyl)lithium
 Trimethylsilyl perchlorate
 Trimethylsilyl polyphosphate
 Trimethylsilylpotassium
 2-Trimethylsilyl-2-propen-1-ol
 3-Trimethylsilyl-2-propen-1-ol
 2-(3-Trimethylsilyl-1-propenyl)-
 magnesium bromide
 2-(3-Trimethylsilyl-1-propenyl)-
 magnesium bromide-Copper(I)
 iodide
 1-Trimethylsilyl-1-propyne
 3-Trimethylsilyl-1-propyne
 3-Trimethylsilyl-2-propyn-1-ol
 1-Trimethylsilylpropynylcopper
 N-Trimethylsilylpyrrole
 Trimethylsilylsodium
 Trimethylsilyl tribromoacetate
 Trimethylsilyl trichloroacetate
 Trimethylsilyl trifluoroacetamide

Trimethylsilyl trifluoromethanesulfonate
 3-Trimethylsilyl-3-trimethylsilyloxy-
 1-propene
 1-Trimethylsilyl-2-trimethyl-
 stannylethylene
 Trimethylsilylvinylketene
 α -Trimethylsilylvinylmagnesium
 bromide
 β -Trimethylsilylvinylmagnesium
 bromide
 α -Trimethylsilylvinylmagnesium
 bromide-Copper(I) iodide
 Trimethyl(triphenylmethoxy)silane
 Triphenylsilane
 Triphenylsilyl hydroperoxide
 Triphenyl(trimethylsilylmethyl)-
 phosphonium trifluoromethane-
 sulfonate
 Tris(diethylamino)sulfonium
 difluorotrimethylsilicate
 Tris(dimethylamino)sulfonium
 difluorotrimethylsilicate
 Tris(trimethylsilyl)aluminum
 Tris(trimethylsilylethynyl)aluminum
 Tris(trimethylsilyl)hydrazidocopper
 Tris(trimethylsilyl)hydrazidolithium
 Tris(trimethylsilyl)ketenimine
 Tris(trimethylsilyl)methane
 Tris(trimethylsilyl)methylithium
 Tris(trimethylsilyloxy)ethylene
 Tris(trimethylsilyl) phosphite
 Vinyltrichlorosilane
 Vinyltrimethylsilane
 Vinyltriphenylsilane

SILVER COMPOUNDS
 Bis(2,2-dipyridyl)silver(II)
 peroxydisulfate
 Bispyridinesilver permanganate
 Palladium(II) chloride-Silver(I) acetate
 Silver
 Silver acetate
 Silver azide
 Silver benzoate
 Silver carbonate
 Silver carbonate-Celite
 Silver chlorate
 Silver chloride
 Silver chlorodifluoroacetate
 Silver chromate
 Silver chromate-Iodine
 Silver crotonate

Silver cyanide
 Silver dibenzyl phosphate
 Silver diethyl phosphate
 Silver diphenylphosphate
 Silver(II) dipicolinate
 Silver fluoride
 Silver(II) fluoride
 Silver fluoride–Pyridine
 Silver heptafluorobutanoate
 Silver hexafluoroantimonate
 Silver imidazolate
 Silver iododibenzoate
 Silver(I) nitrate
 Silver nitrite
 Silver nitrite–Mercury(II) chloride
 Silver(I) oxide
 Silver(II) oxide
 Silver perchlorate
 Silver(II) picolinate
 Silver sulfate
 Silver tetrafluoroborate
 Silver tetrafluoroborate–Dimethyl sulfoxide
 Silver *p*-toluenesulfonate
 Silver(I) trifluoroacetate
 Silver(II) trifluoroacetate
 Silver(I) trifluoromethanesulfonate
 Tollens reagent

THALLIUM COMPOUNDS

Arylthallium bis(trifluoroacetates)
 Cyclopentadienylthallium(I)
 Diethylthallium *t*-butoxide
 Grignard reagents–Thallium(I) bromide
 Thallium
 Thallium(I) acetate
 Thallium(III) acetate
 Thallium(III) acetate–Bromine
 Thallium(I) acetate–Iodine
 Thallium(I) benzoate–Iodine
 Thallium(I) bromide
 Thallium(I) carbonate
 Thallium chlorodifluoroacetate
 Thallium(I) cyanide
 Thallium cyclopentadienide
 Thallium(I) ethoxide
 Thallium(I) hydroxide
 Thallium(I) 2-methyl-2-propanethiolate
 Thallium(III) nitrate
 Thallium(III) nitrate + co-reagents
 Thallium(III) oxide
 Thallium(III) perchlorate

Thallium 1-propanethiolate
 Thallium 2-propanethiolate
 Thallium(III) sulfate
 Thallium(I) trichloroacetate
 Thallium(III) trifluoroacetate
 Thallium(III) trifluoroacetate + co-reagents

TIN COMPOUNDS

Allyltin difluoroiodide
 Allyltributyltin
 Allyltrimethyltin
 Allyltriphenyltin
 Benzyl 3-tributylstannylacrylate
 Bis(methylcyclopentadienyl)tin(II)
 Bis(methylthio)(trimethylstannyl)-methane
 Bis(methylthio)(trimethylstannyl)-methylthium
trans-1,2-Bis(tributylstannyl)ethylene
 Bis(tributyltin) oxide
 Bis(tributyltin) peroxide
 Bis(tricyclohexyltin) selenide–Boron trichloride
 Bis(tricyclohexyltin) sulfide–Boron trichloride
 2,3-Bis(trimethylstannyl)-1,3-butadiene
 3-Butenyltributyltin
 Butylphenyltin dihydride, polymeric
 Chloromethyltrimethyltin
 4-Chloro-2-trimethylstannyl-1-butene
 Cinnamyltriphenyltin
 Diallyltin dibromide
 Diazidotin dichloride
 Dibutyldivinyltin
 Dibutyltin dichloride
 Dibutyltin dilaurate
 Dibutyltin oxide
 Dimethylaminotrimethyltin
 Diphenyl diselenide–Bromine–Hexabutyl-distannoxane
 Diphenyltin dihydride
 1-Ethoxy-4-tributylstannyl-1,3-butadiene
 1-Ethoxy-2-tributylstannylethylene
 Ethyl tributylstannyl sulfide
 Geranyltrimethyltin
 Hexabutyliditin
 Hexamethyliditin
 Hydrogen hexachloroplatinate(IV)–Tin(IV) chloride
 1-Hydroxymethyl-2-tributylstannyl-

METAL-CONTAINING COMPOUNDS*(Continued)*

cyclopropane
 4-Iodobutyltrimethyltin
 Iodomethyltriphenyltin
 2-Lithiovinyltributyltin
 Lithium (1-hexynyl)(2-tributylstannylvinyl)cuprate
 Lithium (1-pentynyl)(2-tributylstannylvinyl)cuprate
 Lithium phenylthio(trimethylstannyl)-cuprate
 3-Methyl-2-butenyltrimethyltin
 Methyl tributylstannyl sulfide
 Palladium(II) chloride-Tin(II) chloride-Triphenylphosphine
 Phenylthio(triphenylstannyl)methane
 Phenylthio(triphenylstannyl)-methylthium
 Propargyltriphenyltin
 Tetraallyltin
 1,1,6,6-Tetrabutyl-1,6-distanna-2,5,7,10-tetraoxacyclodecane
 Tetrabutyl diacetoxytin oxide, dimer
 3-Tetrahydropyranyloxy-1-tributylstannyl-1-propene
 Tetramethyltin
 Tetraphenyltin
 Tetravinyltin
 Tin
 Tin-Aluminum
 Tin amalgam
 Tin(II) bromide
 Tin(II) chloride
 Tin(IV) chloride
 Tin(IV) chloride + co-reagents
 Tin(II) chloride-Silver perchlorate
 Tin(II) fluoride
 Tin(IV) fluoride
 Tin(II) octoate
 Tin(II) oleate
 Tin(II) trifluoromethanesulfonate
 Tribenzyltin chloride
 Tributylcinnamyltin
 Tributylcrotyltin
 Tributyl(diethylaluminum)tin
 Tributyl(ethynyl)tin
 Tributyl(iodoacetoxy)tin
 Tributyl(iodomethyl)tin
 Tributylmethallyltin
 Tributyl(1-methoxymethoxy-2-butenyl)-

tin
 (E)-Tributyl(3-penten-2-yl)tin
 Tributylstannyl 2-iodopropionate
 3-Tributylstannyl-2-propen-1-ol
 (E)-1-Tributylstannyl-2-trimethylsilylethylene
 Tributyltin azide
 Tributyltin chloride
 Tributyltin chloride-Boron trifluoride
 Tributyltin copper
 Tributyltin cyanide
 Tributyltin fluoride
 Tributyltin hydride
 Tributyltinlithium
 Tributyltinlithium-Diethylaluminum chloride
 Tributyltinmagnesium bromide
 Tributyltinmethanol
 Tributyltin methoxide
 Tributyltin trifluoromethanesulfonate
 Tributyl(trimethylsilylmethyl)tin
 Tributylvinyltin
 Triethyltin methoxide
 Trimethyl(1-propenyl)tin
 1-Trimethylsilyl-2-trimethylstannylethylene
 Trimethylstannylcarbene
 Trimethylstannylcopper-Dimethyl sulfide
 2-Trimethylstannylethylidene-triphenylphosphorane
 2-Trimethylstannylmethyl-1,3-butadiene
 Trimethylstannylmethylthium
 Trimethyltin chloride
 Trimethyltin hydride
 Trimethyltinlithium
 Trimethyltinsodium
 Trimethyl(trifluoromethyl)tin
 Trimethylvinyltin
 Triphenylstannylmethylthium
 Triphenyltin chloride
 Triphenyltin hydride
 Tungsten(VI) chloride-Tetramethyltin

TITANIUM COMPOUNDS
 Alkyltris(dialkylamino)titanium derivatives
 Bis(cyclopentadienyl)(diiodozinc)- μ -methylenetitanium
 Bis(cyclopentadienyl)methyltitanium
 Bis(cyclopentadienyl)titanacyclobutanes
 Bis(cyclopentadienyl)(1-trimethyl-

silylallyl)titanium
 (E)-Bromocrotylbis(cyclopentadienyl)-
 titanium
 Bromotriisopropoxytitanium
 μ -Chlorobis(cyclopentadienyl)(dimethyl-
 aluminum)- μ -methylenetitanium
 Chlorotriisopropoxytitanium
 Chlorotriphenoxytitanium
 Crotylbis(cyclopentadienyl)halotitanium
 reagents
 Crotylmagnesium chloride-Dichlorobis-
 (cyclopentadienyl)titanium
 Crotyltri(isopropoxy)titanium
 Dichlorobis(cyclopentadienyl)titanium
 Dichlorobis(cyclopentadienyl)titanium
 + co-reagents
 Dichlorobis(trifluoromethanesulfonato)-
 titanium(IV)
 Dichlorodiisopropoxytitanium(IV)
 Dichlorodimethyltitanium
 Dicyclopentadienyltitanium
 Diisopropoxydimethyltitanium
 Ethylmagnesium bromide-Dichlorobis-
 (cyclopentadienyl)titanium
 Grignard reagents + titanium
 co-reagents
 Methallylmagnesium chloride-
 Dichlorobis(cyclopentadienyl)-
 titanium
 N-Methyl-C-(trichlorotitanio)-
 formimidoyl chloride
 (S)-(-)-Methyltri(2-methyl-1-butoxy)-
 titanium
 Organolithium reagents-Titanium(IV)
 chloride
 Organotitanium reagents
 Tetrakis(diethylamino)titanium
 Tetrakis(dimethylamino)titanium
 Titanium(0)
 Titanium(III) acetate
 Titanium(IV) alkoxides
 Titanium(IV) butoxide
 Titanium(III) chloride
 Titanium(IV) chloride
 Titanium(IV) chloride + co-reagents
 Titanium(III) chloride + co-reagents
 Titanium(IV) ethoxide
 Titanium(IV) fluoride
 Titanium(IV) isopropoxide
 Titanium(IV) methoxide
 Titanium(IV) propoxide

Tribenzylcyclopentadienyltitanium
 Trichlorocyclopentadienyltitanium-
 Lithium aluminum hydride
 Trichloromethyltitanium
 Triisopropoxymethyltitanium
 Trimethylaluminum-Titanium(IV)
 chloride
 Tris(diethylamino)methyltitanium
 Zinc-Titanium(IV) chloride
TUNGSTEN COMPOUNDS
 Dipotassium hexachlorotungstate(IV)
 Pentacarbonyl(methoxyphenyl-
 methylene)tungsten(0)
 Pentacarbonyl(triphenylphosphine)-
 tungsten
 Phosphotungstic acid
 Sodium tungstate
 Trichloro(phenyl)tungsten-Aluminum
 chloride
 Tripotassium tri- μ -chlorohexa-
 chloroditungstate
 Tris(acetonitrile)tricarbonyltungsten
 Tungsten carbonyl
 Tungsten carbonyl-Aluminum chloride
 Tungsten(VI) chloride
 Tungsten(VI) chloride + co-reagents
 Tungsten(VI) fluoride
 Tungsten(VI) oxide-Chlorosulfonic acid
VANADIUM COMPOUNDS
 Ammonium metavanadate
 Bis(trimethylsilyl) peroxide-Vanadyl
 acetylacetonate
 Dicyclopentadienylvanadium
 Oxotris(triphenylsilanolato)vanadium
 Sodium tricarbonyl(cyclopentadienyl)-
 vanadate(2-)
 Tetracarbonyl(cyclopentadienyl)-
 vanadium
 Vanadium(II) chloride
 Vanadium(III) chloride
 Vanadium(IV) chloride
 Vanadium(III) chloride-Lithium
 aluminum hydride
 Vanadium(IV) chloride-N-
 Methylaniline
 Vanadium(II) chloride tetrapyridine
 complex
 Vanadium(V) oxide
 Vanadium(II) perchlorate
 Vanadyl acetylacetonate
 Vanadyl acetylacetonate-

METAL-CONTAINING COMPOUNDS*(Continued)*

Azobisisobutyronitrile

Vanadyl trichloride

Vanadyl trifluoride

YTTERBIUM COMPOUNDS

Phenylytterbium iodide

Tris(6,6,7,7,8,8,8-heptafluoro-2,2-dimethyl-3,5-octanedionato)-ytterbium

Ytterbium

Ytterbium(II) chloride

Ytterbium(II) iodide

Ytterbium(III) nitrate

ZINC COMPOUNDS

Allyltrimethylsilylzinc chloride

Allylzinc bromide

Bis(cyclopentadienyl)(diiodozinc)- μ -methylenetitanium

Bromoform-Diethylzinc

Chloriodomethane-Zinc-copper couple

Chlorotrimethylsilane + zinc co-reagents

Diallylzinc

Dibromobis(triphenylphosphine)-nickel(II)-Zinc

Dibromomethane-Zinc-Titanium(IV) chloride

Dibutylzinc

Dichlorobis(triphenylphosphine)-palladium(II)-Zinc

Diethylzinc

Diethylzinc + co-reagents

Diiodomethane-Zinc-Trimethylaluminum

Dimethylzinc

Diphenylzinc

Dipotassium hexachloroosmate(IV)-Zinc

 α -Ethoxyvinylzinc chloride

Ethyl iodide-Zinc-copper couple

Ethyl(iodomethyl)zinc

Ethylzinc iodide

Lithium bromide-Zinc

Lithium tri-*t*-butylzincate

Lithium trimethylzincate

Molybdenum(V) chloride-Zinc

Molybdenum(V) trichloride oxide-Zinc

Nickel bromide-Zinc

Nickel chloride-Zinc

Organozinc reagents

Phenylzinc bromide

Phenylzinc chloride

Phosphorus(V) chloride-Zinc chloride

Potassium iodide + zinc co-reagents

Reformatsky reagent

Simmons-Smith reagent

Sodium iodide-Zinc

Tetrakis(triphenylphosphine)-palladium(0)-Zinc

Titanium(IV) chloride-Zinc

Titanium(III) chloride-Zinc-copper couple

Vinylzinc chloride

Zinc

Zinc + co-reagents

Zinc amalgam

Zinc borohydride

Zinc borohydride-Dimethylformamide

Zinc bromide

Zinc carbonate

Zinc chloride

Zinc chloride + co-reagents

Zinc-copper couple

Zinc cyanide

Zinc dithionite

Zinc fluoride

Zinc iodide

Zinc nitrate

Zinc oxide

Zinc perchlorate-(S)-15-Amino-14-hydroxy-5,5-dimethyl-2,8-dithia[9]-(2,5)pyridinophane

Zinc permanganate

Zinc permanganate-Silica

Zinc-silver couple

Zinc tetracarbonylcobaltate

Zinc *p*-toluenesulfonate

Zinc trifluoromethanesulfonate

ZIRCONIUM COMPOUNDS

Bis(cyclopentadienyl)diiodozirconium

Bis(cyclopentadienyl)isoprenезirconium

Chlorobis(cyclopentadienyl)-hydrido-zirconium(IV)

Chlorobis(cyclopentadienyl)-tetrahydroboratozirconium(IV)

Dibromobis(cyclopentadienyl)zirconium

Dichlorobis(cyclopentadienyl)-zirconium(II)

Dichlorobis(cyclopentadienyl)-zirconium-*t*-Butylmagnesium chloride

Organozirconium reagents

Tributoxychlorozirconium
 Trimethylaluminum-Dichlorobis-
 (cyclopentadienyl)zirconium
 Zirconium(IV) butoxide
 Zirconium carbene complexes
 Zirconium(III) chloride
 Zirconium(IV) chloride
 Zirconium(IV) chloride-Lithium
 aluminum hydride
 Zirconium(IV) propoxide
OTHER COMPOUNDS
 Allyltrimethylgermanium
 Bis(cyclopentadienyl)trihydridoniobium
 Gold
 Hydrogen tetrachloroaurate(III)
 Tris(2,2-dimethylpropyl)(2,2-
 dimethylpropylidene)niobium
 Tris(2,2-dimethylpropyl)(2,2-
 dimethylpropylidene)tantalum
 Tris(6,6,7,7,8,8,8-heptafluoro-2,2-
 dimethyl-3,5-octanedionato)-
 europium(III)
 Tris[3-(heptafluoropropylhydroxy-
 methylene)-*d*-camphorato]-
 europium(III)

WITTIG REAGENTS AND

PHOSPHONIUM SALTS

Acetone-1,3-bis(triphenylphosphonium)
 dichloride
 Acetylmethylenetriphenylphosphorane
 N-Alkyl- β -aminoethyltriphenyl-
 phosphonium bromides
 Allylidenetriphenylphosphorane
 Allyltriphenylphosphonium bromide
 N-Aminotriphenylphosphinimine
 Benzoylmethylenetriphenylphosphorane
 Benzylidenetriphenylphosphorane
 Benzyltriphenylphosphonium chloride
 Benzyltris(dimethylamino)phosphonium
 bromide
 Bis(trifluoromethyl)methylenetriphenyl-
 phosphorane
 Bromoacetylmethylenetriphenyl-
 phosphorane
 Bromomethylenetriphenylphosphorane
 3-Bromopropyltriphenylphosphonium
 bromide
trans-1-Butadienyltriphenyl-
 phosphonium bromide
 Butane-1,4-bis(triphenylphosphonium)

dibromide
 2-Butenylidenetriphenylphosphorane
 2-*t*-Butoxycarbonyl-1-methoxy-
 carbonylethylidenetriphenyl-
 phosphorane
 4-Carboxybutyltriphenylphosphonium
 bromide
 2-Carboxyethyltriphenylphosphonium
 perbromide
 2-Carboxy-1-methoxycarbonyl-
 ethylidenetriphenylphosphorane
 (2-Carboxy-2-propenyl)triphenyl-
 phosphonium bromide
 Chlorofluoromethylenetriphenyl-
 phosphorane
 2-[(Chloroformyl)oxy]ethyltriphenyl-
 phosphonium chloride
 Chloromethylenetriphenylphosphorane
 Chloromethyltriphenylphosphonium
 halides
 Cinnamyltriphenylphosphonium
 chloride
 Cyanomethylenetriphenylphosphorane
 Cyanomethylidenebis(triphenyl-
 phosphonium) dibromide
 Cyclopentylidenetriphenyl-
 phosphorane
 Cyclopropylidenetriphenyl-
 phosphorane
 Cyclopropyltriphenylphosphonium
 bromide
 Dibromomethylenetriphenyl-
 phosphorane
 Dichloromethylenetriphenyl-
 phosphorane
 Dichloromethylenetris(dimethylamino)-
 phosphorane
 2,2-Diethoxyethylidenetriphenyl-
 phosphorane
 2,2-Diethoxyvinylidenetriphenyl-
 phosphorane
 Difluoromethylenetriphenylphosphorane
 2-Dimethylaminoethylidenetriphenyl-
 phosphorane
 (2-Dimethylaminoethyl)triphenyl-
 phosphonium bromide
 2-(1,3-Dioxan-2-ylethylidene)-
 triphenylphosphorane
 [2-(1,3-Dioxan-2-yl)ethyl]triphenyl-
 phosphonium bromide
 1,3-Dioxolan-2-ylmethylenetriphenyl-

WITTIG REAGENTS AND**PHOSPHONIUM SALTS** (*Continued*)

phosphorane
 1,3-Dioxolan-2-ylmethyltriphenyl-
 phosphonium bromide
 Diphenyltriphenylphosphoranylidene-
 methylphosphonate
 1,3-Dithian-2-ylidenetriphenyl-
 phosphorane
 1,3-Dithiolan-2-yltriphenylphosphonium
 tetrafluoroborate
 2-Ethoxyallylidenetriphenylphosphorane
 Ethoxycarbonylcyclopropyltriphenyl-
 phosphonium tetrafluoroborate
 Ethoxycarbonylmethylenetriphenyl-
 phosphorane
 Ethoxycarbonylmethyltriphenyl-
 phosphonium bromide
 (2-Ethoxy-1-propenyl)triphenyl-
 phosphonium iodide
 β -Ethoxyvinyltriphenylphosphonium
 iodide
 1,2-Ethylenebis(triphenylphosphonium)
 dibromide
 Ethylidenetriphenylphosphorane
 Ethyltriphenylphosphonium salts
 Fluoromethylenetriphenylphosphorane
 (α -Formylethylidene)triphenyl-
 phosphorane
 Formylmethylenetriphenylphosphorane
 3-Hydroxy-3-methylbutylidenetriphenyl-
 phosphorane, lithium salt
 Isopropylidenetriphenylphosphorane
 Ketenylenetriphenylphosphorane
 α -Lithiomethylenetriphenylphosphorane
 3-Methoxyallylidenetriphenyl-
 phosphorane
 Methoxycarbonylmethylenetriphenyl-
 phosphorane
 α -Methoxyethylidenetriphenyl-
 phosphorane
 Methoxymethylenetriphenyl-
 phosphorane
 Methoxymethyltriphenylphosphonium
 iodide
 3-Methyl-2-butenylidenetriphenyl-
 phosphorane
 Methylenetriphenylphosphorane
 1-Methylthiovinyl(triphenyl)-
 phosphonium chloride
 Methyltriphenylphosphonium bromide

Methyltriphenylphosphonium
 permanganate
 2-Oxo-3-(triphenylphosphoranylidene)-
 propyllithium
 Phenacyltriphenylphosphonium bromide
 Phenoxymethylenetriphenylphosphorane
 N-Phenylketeniminyl(triphenyl)-
 phosphorane
 (3-Phenyl-2-propenyl)triphenyl-
 phosphonium chloride
 1-Phenylthiocyclopropyltriphenyl-
 phosphonium tetrafluoroborate
 2-Propenyltriphenylphosphonium
 bromide
 β -Trimethylsilylethylidenetriphenyl-
 phosphorane
 Trimethylsilylmethylenetriphenyl-
 phosphorane
 Trimethylsilylmethylenetriphenyl-
 phosphorane
 2-Trimethylstannylethylidenetriphenyl-
 phosphorane
 Triphenyl(1-phenylthiovinyl)-
 phosphonium iodide
 Triphenylphosphoranylideneoxalace-
 tonitrile
 Triphenylpropargylphosphonium
 bromide
 Triphenyl(trimethylsilylmethyl)-
 phosphonium trifluoromethane-
 sulfonate
 Vinyltriphenylphosphonium bromide
 Wittig reaction

WITTIG-HORNER REAGENTS

Alkyldiphenylphosphine oxides
 Allyldiphenylphosphine
 Allyldiphenylphosphine oxide
 P-Allyl-N,N,N',N'-tetramethyl-
 phosphonic diamide
 Bis(diethoxyphosphinyl)methane
 1,3-Bis(dimethoxyphosphinyl)-2-
 propanone
 Bis(2,2,2-trifluoroethyl) methoxy-
 carbonylmethylphosphonate
 Cyanomethyldiphenylphosphine oxide
 Dibenzyloxymethylphosphonate
 Dibutyl tetrahydropyranyloxymethyl-
 phosphonate
 (Diethoxymethyl)diphenylphosphine
 oxide
 Diethoxyphosphinylacetic acid,

anhydride with trifluoroacetic acid
(Diethoxyphosphinyl)difluoromethyl-
lithium
2-(Diethoxyphosphinyl)propionic acid
2-(Diethoxyphosphinyl)propionic acid,
anhydride with trichloroacetic acid
2-(Diethoxyphosphinyl)propionitrile
Diethyl allylthiomethylphosphonate
Diethyl benzoylphosphonate
Diethyl N-benzylideneaminomethyl-
phosphonate
Diethyl benzylphosphonate
Diethyl *t*-butoxy(cyano)methyl-
phosphonate
Diethyl carboxychloromethyl-
phosphonate
Diethyl carboxymethylphosphonate
Diethyl chloromethylphosphonate
Diethyl cyanomethylphosphonate
Diethyl β -(cyclohexylimino)-
ethylphosphonate
Diethyl (diazomethyl)phosphonate
Diethyl dibromomethylphosphonate
Diethyl dichlorolithiomethyl-
phosphonate
Diethyl dichloromethylphosphonate
Diethyl 2,2-diethoxyethylphosphonate
Diethyl difluoromethylphosphonate
Diethyl difluorotrimethylsilylmethyl-
phosphonate
Diethyl (1,3-dithian-2-yl)phosphonate
Diethyl ethylthiomethylphosphonate
Diethyl formylmethylphosphonate
Diethyl isocyanomethylphosphonate
Diethyl lithio-N-benzylideneamino-
methylphosphonate
Diethyl lithiomorpholinomethyl-
phosphonate
Diethyl methoxyethoxymethyl-
phosphonate
Diethyl methoxymethylphosphonate
Diethyl methylsulfinylmethyl-
phosphonate
Diethyl methylsulfonylethylmethyl-
phosphonate
Diethyl (1-methylthio)ethylphosphonate
Diethyl methylthiomethylphosphonate
Diethyl morpholinomethylphosphonate
Diethyl 2-oxobutylphosphonate
Diethyl (2-oxopropyl)phosphonate
Diethyl phenylsulfinylmethyl-

phosphonate
Diethyl phenylthiomethylphosphonate
Diethyl 1-phenyl-1-trimethylsilyloxy-
methylphosphonate
Diethyl [(2-tetrahydropyranyloxy)-
methyl]phosphonate
Diethyl trichloromethylphosphonate
Diethyl trimethylsilyloxycarbonyl-
methylphosphonate
Diethyl 1-trimethylsilyloxyethyl-
phosphonate
Diisopropyl methylphosphonate
(Dimethoxyphosphinyl)methyl lithium
R-(-)-(Dimethoxyphosphinyl)methyl
p-tolyl sulfoxide
N,N'-Dimethyl-2-allyl-1,3,2-
diazaphospholidine 2-oxide
Dimethyl bis(methylthio)methyl-
phosphonate
Dimethyl 3-bromo-2-ethoxypropenyl-
phosphonate
Dimethyl diazomethylphosphonate
Dimethyl methylphosphonate
Diphenylmethoxymethylphosphine
Diphenyl 2-(N-piperidinyl)ethyl-
phosphine oxide
Ethyl 4-diethoxyphosphinylcrotonate
Ethyl 4-diethoxyphosphinyl-3-
oxobutanoate
Ethyl 4-diphenylphosphinyl-3-
oxobutanoate
P-Ethyl-N,N,N',N'-tetramethyl-
phosphonic diamide
P-Isopropyl-N,N,N',N'-tetramethyl-
phosphonic diamide
1-Methoxycarbonylethyl(diphenyl)-
phosphine oxide
1-Methoxyethyldiphenylphosphine oxide
Methoxymethyl(diphenyl)phosphine
oxide
Methyl bis(trifluoroethoxy)-
phosphinylacetate
Methyl 2-bis(2,2,2-trifluoroethoxy)-
phosphinylpropionate
Methyl 4-diethoxyphosphinylcrotonate
N-Morpholinomethyldiphenylphosphine
oxide
Pentamethylphosphonic diamide
Phosphonamides, chiral
Tetraethyl dimethylaminomethyl-
enediphosphonate

WITTIG-HORNER REAGENTS*(Continued)*

Tetraethyl phosphonosuccinate
 Triethyl phosphonoacetate
 Triethyl phosphonoiodoacetate
 Triethyl α -phosphonopropionate
 Trimethyl phosphonoacetate
 Trimethylphosphonoglycolate

YLIDES (EXCLUDING WITTIG REAGENTS)

Acetylmethylene(triphenyl)arsorane
 Dibutyltelluronium
 carboethoxymethylide
 2,5-Dichlorothiophenium bismethoxy-
 carbonylmethylide
 (N,N-Diethylamino)methyloxo-
 sulfonium methylide
 (N,N-Dimethylamino)methyloxo-
 sulfonium methylide
 (Dimethylamino)phenyloxo-
 sulfonium methylide
 Dimethyl(phenyl)selenonium methyl
 sulfate
 Dimethylselenonium methylide

Dimethylsulfonium
 ethoxycarbonylmethylide
 Dimethylsulfonium methylide
 Dimethylsulfoxonium methylide
 Dimethyl(tetrahydro-2-oxo-3-furanyl)-
 sulfonium tetrafluoroborate
 Diphenylsulfonium cyclopropylide
 Diphenylsulfonium isopropylide
 Diphenylsulfonium methylide
 Ethyl (dimethylsulfuranylidine)acetate
 N-Imino-N,N-dimethyl-2-hydroxy-
 propanaminium ylide
 Isopropylidenediphenylsulfurane
 Lauryldimethylsulfonium chloride
 2-Methylcyclopentenone-3-dimethyl-
 sulfoxonium methylide
 Methyl(phenyl)selenoniomethanide
 (2-Oxo-2-phenylethylide)dimethyl-
 selenonium ylide
 Phenacylidenedimethylsulfurane
 Trimethylsilylmethylene
 dimethylsulfurane
 Triphenylarsonium cinnamylide
 Triphenylarsonium ethylide

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 Benzyl(2-hydroxyethyl)dimethylammonium hydroxide, **6**, 220
 3-Benzyl-5-(2-hydroxyethyl)-4-methyl-1,3-thiazolium chloride, **6**, 38, 289; **7**, 16; **10**, 27
 N-Benzylhydroxylamine, **9**, 42; **12**, 13
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 N-Benzylideneaniline, **12**, 194
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 3-(2-Benzylloxyacetyl)thiazolidine-2-thione, **12**, 491
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 Benzyltriethylammonium chloride (TEBA), **3**, 19; **4**, 27; **5**, 26; **6**, 41, 566; **7**, 18, 78, 239, 353; **8**, 248, 388; **9**, 357; **10**, 293, 305
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- BINAP [*see* (R)-(+)- and (S)-(-)-2,2'-Bis-(diphenylphosphine)-1,1'-binaphthyl]
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- 4-Biphenylcarbonyl chloride, **4**, 376; **7**, 282
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- Bis(acetonitrile)chloronitropalladium(II), **10**, 30; **11**, 45
- Bis(acetonitrile)dichloropalladium(II), **7**, 21; **8**, 39; **9**, 44, 456; **10**, 30; **11**, 46; **12**, 50
- Bis(acetylacetonate)oxovanadium (*see* Vanadyl acetylacetonate)
- Bis(acetylacetonate)palladium(II) (*see* Palladium(II) acetylacetonate)
- Bis(acrylonitrile)nickel(0), **3**, 20; **6**, 45; **11**, 48
- 2,3-Bis(azidomethyl)-1,3-butadiene, **5**, 33
- Bis(benzonitrile)dibromopalladium(II), **11**, 80
- Bis(benzonitrile)dichloropalladium(II), **1**, 56; **4**, 129; **5**, 31, 502, 574; **6**, 45; **7**, 95, 277, 371; **9**, 44; **10**, 31; **11**, 48; **12**, 51
- Bis(benzonitrile)dichloroplatinum(II), **11**, 49
- Bis(benzonitrile)palladium(II) chloride [*see* Bis(benzonitrile)dichloropalladium(II)]
- Bis(benzoyloxy)borane, **10**, 32
- Bis(benzyltriethylammonium) dichromate, **11**, 50
- Bis[1,2-bis(diphenylphosphine)ethane]-palladium(0), **9**, 344; **10**, 32; **11**, 508; **12**, 473
- Bis[1,3-bis(diphenylphosphine)propane]-chlororhodium(I), **12**, 111
- Bis(α-bromobenzyl)phenylphosphine oxide, **4**, 116
- N,N-Bis(bromomagnesio)anilide, **4**, 33
- 1,4-Bis(bromomagnesio)butane, **1**, 415
- 1,5-Bis(bromomagnesio)pentane, **9**, 355
- 2,3-Bis(bromomethyl)-1,3-butadiene, **5**, 32
- Bis(*t*-butoxycarbonyl)amine, **1**, 210
- 1,3-Bis(*t*-butyldimethylsilyloxy)-2-aza-1,3-diene, **11**, 50
- Bis(N-*t*-butylsalicylaldiminato)copper(II), **12**, 52
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- Bis(3-carboxy-4-nitrophenyl) disulfide, **1**, 351
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- Bis(chlorodimethylsilyl)ethane, **10**, 140; **12**, 179
- 1,4-Bis(chloromethoxy)butane, **6**, 105; **7**, 22
- Bis(chloromethyl) ether, **5**, 34
- Bis(chloromethyl) sulfoxide, **7**, 380
- μ-Bis(cyanotrihydroborato)tetrakis-(triphenylphosphine)dicopper(I), **10**, 33
- Bis(1,5-cyclooctadiene)nickel(0), **4**, 33; **5**, 34; **6**, 45; **7**, 428; **9**, 45; **10**, 33; **11**, 51; **12**, 52
- Bis(1,5-cyclooctadiene)nickel(0)-(-)-Benzylmethylphenylphosphine, **4**, 35
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- Bis(cyclopentadienyl)(diiodozinc)-μ-methylenetitanium, **12**, 506
- Bis(cyclopentadienyl)diiodozirconium, **12**, 53
- Bis(cyclopentadienyl)isoprenезirconium, **11**, 174
- Bis(cyclopentadienyl)methyltitanium, **8**, 40
- Bis(cyclopentadienyl)niobium trihydride, **6**, 47
- Bis(cyclopentadienyl)titanacyclobutanes, **12**, 54, 110
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- Bis(cyclopentadienyl)titanium dichloride [*see* Dichlorobis(cyclopentadienyl)titanium]
- Bis(cyclopentadienyl)trihydridoniobium, **6**, 47
- Bis(cyclopentadienyl)(η³-1-trimethylsilylallyl)titanium, **11**, 174
- Bis(dialkylamino)alanes-Dichlorobis-(cyclopentadienyl)titanium, **9**, 46
- Bis(1-diazo-2-ethoxy-2-oxoethyl)mercury, **6**, 190
- Bis(dibenzylideneacetone)palladium(0), **9**, 46, 344; **10**, 34; **11**, 53; **12**, 56, 575
- Bis(dibutylacetoxytin) oxide, **4**, 393

- Bis(dicarbonylcyclopentadienyl)iron
[see Di- μ -carbonyldicarbonylbis-(cyclopentadienyl)diiron]
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- Bis(diethoxyphosphinyl)methyl(dimethyl)-amine (see Tetraethyl dimethylaminomethylenediphosphonate)
- Bis(diethylaluminum) sulfate, **9**, 46
- Bis(2,6-diethylphenyl)carbodiimide, **1**, 56
- Bis(diethylphosphono)methane, **6**, 191
- Bis(diisobutylaluminum) 1,2-ethane-dithiolate, **12**, 342
- Bis(diisopropylamino)aluminum hydride, **7**, 196
- 1,3-Bis(dimethoxyphosphinyl)-2-propanone, **10**, 35
- Bis(dimethylaluminum) 1,2-ethanedithiolate, **5**, 35
- Bis(dimethylaluminum) 1,3-propanedithiolate, **6**, 49
- 4,4'-Bis(dimethylamino)benzophenone (Michler's ketone), **2**, 285
- (S,S)-(+)-1,4-Bis(dimethylamino)-2,3-dimethoxybutane, **9**, 47
- Bis(dimethylamino)methane, **3**, 21; **7**, 359
- Bis(dimethylamino)methoxymethane [see also *t*-Butoxybis(dimethylamino)-methane], **10**, 34
- 1,8-Bis(dimethylamino)naphthalene (Proton sponge), **3**, 22; **4**, 35; **6**, 50, 59, 596; **7**, 372
- Bis(dimethylamino) phosphorochloridate, **4**, 480; **11**, 372
- Bis(dimethylamino) phosphorochloridite, **6**, 575
- Bis(3-dimethylaminopropyl)-phenylphosphine, **5**, 36; **10**, 34
- 1,4-Bis(dimethylamino)-1,1,4,4-tetramethyldisilylethylene, **12**, 476
- Bis(3,6-dimethyl)borepane, **4**, 35
- Bis(N,N-dimethylformamido)-oxodiperoxymolybdenum(VI), **9**, 48
- Bis(4,5-dimethyl-2-oxo-1,3,2-dioxaphospholenyl)oxide, **6**, 6, 218
- 1,3-Bis(dimethylphosphono)-2-propanone, **10**, 35
- Bis(2,4-dinitrophenyl) carbonate, **1**, 56; **2**, 29
- [Bis(1,3,2-dioxaborolan-2-yl)methyl]lithium, **6**, 328; **10**, 239
- α,γ -Bis(diphenylene)- β -phenylallyl, **1**, 57
- Bis(1,3-diphenyl-2-imidazolidinylidene), **7**, 22
- trans*-2,3-Bis(diphenylphosphine)bicyclo-[2.2.1]hept-5-ene (Norphos), **9**, 48; **10**, 36
- [*trans*-2,3-Bis(diphenylphosphine)bicyclo-[2.2.1]hept-5-ene]dichloronickel(II), **10**, 36
- (R)-(+)- and (S)-(-)-2,2'-Bis(diphenylphosphine)-1,1'-binaphthyl (BINAP), **10**, 36; **11**, 53; **12**, 56
- [2,2'-Bis(diphenylphosphine)-1,1'-binaphthyl](cyclooctadiene)rhodium(I) perchlorate, **11**, 54; **12**, 57
- [2,2'-Bis(diphenylphosphine)-1,1'-binaphthyl](norbornadiene)rhodium(I) perchlorate, **10**, 36
- 1,4-Bis(diphenylphosphine)butane (dppb), **12**, 473
- [1,4-Bis(diphenylphosphine)butane]-(1,5-cyclooctadiene)iridium(I) tetrafluoroborate, **12**, 427
- 1,4-[Bis(diphenylphosphine)butane]-(norbornadiene)rhodium(I) tetrafluoroborate, **12**, 426
- 1,2-Bis(diphenylphosphine)ethane (dppe, Diphos), **6**, 447; **9**, 451; **10**, 34, 389; **11**, 53, 81, 391; **12**, 16, 129, 473
- [1,2-Bis(diphenylphosphine)ethane]bis-(triphenylphosphine)palladium(0), **10**, 133
- [1,2-Bis(diphenylphosphine)ethane]-cyclohexyneplatinum(0), **5**, 171
- [1,2-Bis(diphenylphosphine)ethane]-(dichloro)nickel(II), **7**, 250; **9**, 147; **10**, 36; **12**, 146, 171
- [1,2-Bis(diphenylphosphine)ethane]-dichloropalladium(II), **6**, 447
- [1,2-Bis(diphenylphosphine)ethane]nickel(II) chloride [see [1,2-Bis(diphenylphosphine)ethane](dichloro)nickel(II)]
- Bis[2-(diphenylphosphine)ethyl]amine hydrochloride, **11**, 54
- 1,1'-Bis(diphenylphosphine)ferrocene (dppf), **10**, 37
- [1,1'-Bis(diphenylphosphine)ferrocene]-dichloronickel(II), **10**, 37; **12**, 172
- [1,1'-Bis(diphenylphosphine)ferrocene]-dichloropalladium(II), **9**, 147; **10**, 37; **12**, 46, 171
- (R)-1-(S)-1'-2-Bis(diphenylphosphine)-

- ferrocenylethanol, **11**, 237
- 1,3-Bis(diphenylphosphine)propane, **8**, 474
- [1,3-Bis(diphenylphosphine)propane]-dichloronickel(II), **6**, 50; **10**, 191; **11**, 167; **12**, 244
- [1,2-Bis(diphenylphosphine)propane]-(norbornadiene)rhodium perchlorate, **9**, 452
- Bis[2-(diphenylphosphinyl)ethyl]amine hydrochloride, **11**, 54
- Bis(2,2-dipyridyl)silver(II) peroxydisulfate, **6**, 51
- 1,2-Bis(1,3-dithian-2-yl)ethane, **6**, 493; **8**, 223
- Bis(ethenyl) sulfone (*see* Divinyl sulfone)
- Bis(ethyl diazoacetate)mercury, **6**, 190
- Bis(ethylenediamine)chromium(II) perchlorate, **3**, 58; **4**, 97
- Bis(ethylthio)acetic acid, **9**, 228; **10**, 38
- 2,2-Bis(ethylthio)propane, **10**, 373
- Bis(fluoroxy)difluoromethane, **4**, 36
- Bis(iodomethyl)zinc-Zinc iodide (*see* Simmons-Smith reagent)
- Bis(isopropylthio)boron bromide [*see* Bromobis(isopropylthio)boron]
- Bis(methoxycarbonyl)carbene, **8**, 159
- Bis(methoxycarbonyl)sulfodiimide, **12**, 57
- trans*-2,5-Bis(methoxymethoxymethyl)-pyrrolidine, **12**, 573
- 2,3-Bis(methoxymethyl)-1,3-butadiene, **5**, 33
- Bis(1-methoxy-2-methyl-1-propenyloxy)-dimethylsilane, **12**, 58
- trans*-2,5-Bis(methoxymethyl)pyrrolidine, **12**, 59
- 2,4-Bis(4-methoxyphenyl)-1,3-dithia-2,4-diphosphetane-2,4-disulfide (Lawesson's reagent), **8**, 327; **9**, 49; **10**, 39; **11**, 54; **12**, 59
- Bis(*p*-methoxyphenyl) telluroxide, **9**, 50; **11**, 55
- Bis[methoxy(thiocarbonyl)] disulfide, **10**, 39
- Bis(*o*-methylaminophenyl) disulfide, **9**, 305
- (*S,S*)- or (*R,R*)-*N,N'*-Bis(α -methylbenzyl)-sulfamide, **12**, 60
- Bis(3-methyl-2-butyl)borane (*see* Disiamylborane)
- Bis(*trans*-2-methylcyclohexyl)borane, **4**, 37
- Bis(methylcyclopentadienyl)titanium(II), **12**, 201
- Bis(*N*-methyl-*N*-nitroso)terephthalamide, **1**, 59, 191
- Bis(*N*-methylpiperazinyl)aluminum hydride, **6**, 52; **12**, 60
- 1,1-Bis(methylseleno)cyclobutane, **10**, 232
- 1,1-Bis(methylseleno)cyclopropane, **9**, 85
- 1,3-Bis(methylthio)allyllithium, **4**, 38; **6**, 53
- 1,2-Bis(methylthio)-1,3-butadiene, **10**, 40
- 2,4-Bis(methylthio)-2,4-dithioxo-cyclodiphosphathiane, **11**, 56
- Bis(methylthio)methane, **7**, 24
- Bis(methylthio)methylolithium, **7**, 24
- Bis(methylthio)(trimethylsilyl)methane, **6**, 53
- Bis(methylthio)(trimethylsilyl)methylolithium, **6**, 53
- Bis(methylthio)(trimethylstannyl)methane, **6**, 54
- Bis(methylthio)(trimethylstannyl)-methylolithium, **6**, 54
- Bismuth(III) acetate, **4**, 40
- Bismuth(III) chloride, **7**, 24
- Bismuth(III) oxide, **1**, 59
- Bismuth(III) oxide-Tin(IV) oxide, **6**, 55
- Bis(*p*-nitrophenethyl) phosphorochloridate, **11**, 56
- Bis(4-nitrophenyl) carbonate, **1**, 330
- Bis(*p*-nitrophenyl) hydrogen phosphate, **1**, 331; **2**, 29
- Bis(*o*-nitrophenyl) phenylphosphonate, **9**, 50; **10**, 41
- Bis(*p*-nitrophenyl) phenylphosphonate, **9**, 50
- 2,5-Bis[(*Z*)-(2-nitrophenylsulfenyl)-methylene]-3,6-dimethylene-7-oxabicyclo[2.2.1]heptane, **12**, 60
- Bis(norbornadiene)rhodium(I) perchlorate-(*R*)-1-(*S*)-1',2-Bis(diphenylphosphine)-ferrocenylethanol, **11**, 239
- N,N*-Bis(2-oxo-3-oxazolidinyl)phosphorodiamidic chloride, **10**, 41; **11**, 57
- Bis(2,4-pentanedionato)copper (*see* Copper(II) acetylacetonate)
- Bis(2,4-pentanedionato)nickel(II) (*see* Nickel(II) acetylacetonate)
- Bis(2,4-pentanedionato)palladium(II) [*see* Palladium(II) acetylacetonate]
- Bis-*o*-phenylene pyrophosphite, **1**, 60; **2**, 30
- 1,3-Bis(phenylseleno)propene, **11**, 59
- 1,3-Bis(phenylseleno)-3-trimethylsilyl-1-propene, **11**, 60
- Bis(phenylsulfenyl)methane, **6**, 191, 394
- 1,1-Bis(phenylsulfonyl)cyclopropane, **12**, 61
- (*Z*)-1,2-Bis(phenylsulfonyl)ethylene, **11**, 60
- Bis(phenylsulfonyl)methane, **9**, 457
- N,N*-Bis(phenylthio)benzenesulfenamide, **5**, 732

- 1,1-Bis(phenylthio)cyclopropane, **8**, 306
 Bis(phenylthio)methane, **6**, 131, 267; **7**, 25, 75; **8**, 126; **10**, 42; **11**, 303
 Bis(phenylthio)methylithium, **6**, 131, 267; **7**, 25; **8**, 126; **10**, 42
 1,3-Bis(phenylthio)propane, **10**, 231
 Bis(propenyl)mercury, **6**, 573
 Bis(*N*-propylsalicylideneaminato)cobalt(II), **11**, 61
 Bis(*N*-propylsalicylideneaminato)copper(II), **5**, 41
 Bis(pyridine)dimethylformamido-dichlororhodium borohydride, **4**, 40
 Bispyridinesilver permanganate, **11**, 61; **12**, 62
 Bis(3-salicylideneaminopropyl)amine-cobalt(II), **3**, 245
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 [Bis(salicylidene- γ -iminopropyl)]-methylaminocobalt(II), **11**, 138
 Bis(tetrabutylammonium) dichromate, **9**, 53; **10**, 42
 Bis(*p*-toluenesulfonato)zinc, **11**, 605
 Bis(*p*-toluenesulfonyl)seleniumdiimide, **7**, 316
 Bis(*N*-*p*-toluenesulfonyl)sulfodiimide, **7**, 317; **8**, 43
 1,2-Bis(β -tolylsulfonylethoxycarbonyl)-diazene, **6**, 55
 Bis(tribromomethyl)mercury, **2**, 30
 Bis(tributylphosphine)nickel dibromide [*see* Dibromobis(tributylphosphine)-nickel(II)]
trans-1,2-Bis(tributylstannyl)ethylene, **5**, 43; **6**, 56
 Bis(tributyltin) oxide, **6**, 56; **7**, 26; **8**, 43; **9**, 53; **11**, 62
 Bis(tributyltin) peroxide, **8**, 44
 Bis(tricaprylmethyl)ammonium nitrosodisulfonate, **10**, 42
 Bis(2,2,2-trichloro-1,1-dimethylethyl)phosphorochloridate, **11**, 62
 Bis(2,2,2-trichloroethyl) azodicarboxylate, **12**, 62
 Bis(2,2,2-trichloroethyl) phosphorochloridate, **2**, 187; **3**, 136
 Bis(trichloromethyl)mercury, **2**, 30
 Bis(tricyclohexyltin) selenide or sulfide—Boron trichloride, **11**, 63
 Bis(triethylphosphine)nickel(II) bromide, **5**, 42
 Bis(trifluoroacetoxy)borane, **8**, 45
 [Bis(trifluoroacetoxy)iodo]benzene [*see* Phenyliodine(III) bis(trifluoroacetate)]
 O,*N*-Bis(trifluoroacetyl)hydroxylamine, **1**, 60
 Bis(trifluoroacetyl) sulfate, **10**, 375
 Bis(2,2,2-trifluoroethoxy)triphenylphosphorane, **10**, 43
 Bis(2,2,2-trifluoroethyl) methoxycarbonylmethylphosphonate, **12**, 320
 Bis(trifluoromethyl)diazomethane, **1**, 561
 Bis(trifluoromethyl)methylenetriphenylphosphorane, **9**, 54
 Bis(trifluoromethylthio)mercury, **7**, 391
 1,3-Bis(triisopropylsilyl)propyne, **11**, 63
 (2*R*,3*R*)-Bis(trimethylacetyl)tartaric acid, **9**, 204
 Bis(trimethylsilyl)acetamide (BSA), **1**, 61; **2**, 30; **3**, 23; **6**, 634; **9**, 234; **12**, 330, 473
 Bis(trimethylsilyl)acetylene, **5**, 44; **6**, 153; **7**, 8, 84, 94; **8**, 146; **9**, 142, 311; **10**, 126, 183; **11**, 162, 426; **12**, 162
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 1,4-Bis(trimethylsilyl)butadiene, **5**, 624
 1,4-Bis(trimethylsilyl)-2-butene, **7**, 8
 1,4-Bis(trimethylsilyl)-2-butyne, **11**, 64
 N,*O*-Bis(trimethylsilyl) carbamate, **7**, 28
 Bis(trimethylsilyldichloromethyl)mercury, **2**, 30
 Bistrimethylsilyl ether (*see* Hexamethyldisiloxane)
 1,1-Bis(trimethylsilyl)ethylene, **5**, 374
 Bis(trimethylsilyl)ethyne [*see* Bis(trimethylsilyl)acetylene]
 Bis(trimethylsilyl)formamide, **6**, 58
 O,*N*-Bis(trimethylsilyl)hydroxylamine, **6**, 58
 C,*O*-Bis(trimethylsilyl)ketene methyl ketal, **10**, 261
 Bis(trimethylsilyl) lithiomalonate, **9**, 55
 Bis(trimethylsilyl) malonate, **7**, 53; **9**, 55
 Bis(trimethylsilyl)mercury, **9**, 55
 Bis(trimethylsilyl)methane, **5**, 617; **7**, 396
 N,*N*-Bis(trimethylsilyl)methoxymethylamine, **12**, 62
 2,3-Bis(trimethylsilylmethyl)-1,3-butadiene, **11**, 64; **12**, 77
 Bis(trimethylsilylmethyl)mercury, **6**, 637
 Bis(trimethylsilyl) monoperoxsulfate, **9**, 56
 1,3-Bis(trimethylsilyloxy)-1,3-butadiene, **7**, 27; **9**, 56; **10**, 44
 2,3-Bis(trimethylsilyloxy)-1,3-butadiene, **4**, 436; **8**, 46

- 1,2-Bis(trimethylsilyloxy)cyclobutene, **10**, 45
1,3-Bis(trimethylsilyloxy)-1,3-cyclohexadiene, **8**, 46, 297
2,3-Bis(trimethylsilyloxy)-1,3-cyclohexadiene, **8**, 297
2,5-Bis(trimethylsilyloxy)furans, **10**, 45
1,3-Bis(trimethylsilyloxy)-1-methoxy-1,3-butadiene [*see* 1-Methoxy-1,3-bis(trimethylsilyloxy)-1,3-butadiene]
1,1-Bis(trimethylsilyloxy)-1-propene, **11**, 600
Bis(trimethylsilyl) peroxide, **11**, 67; **12**, 63
Bis(trimethylsilyl) peroxide–Vanadyl acetylacetonate, **12**, 63
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