Synthesis Alerts is a monthly feature to help readers of Synthesis keep abreast of new reagents, catalysts, ligands, chiral auxiliaries, and protecting groups which have appeared in the recent literature. Emphasis is placed on new developments but established reagents, catalysts etc are also covered if they are used in novel and useful reactions. In each abstract, a specific example of a transformation is given in a concise format designed to aid visual retrieval of information.

Synthesis Alerts is a personal selection by:

Robert Chow, John Christopher, Emma Guthrie, Philip Kocienski, Alexander Kuhl, Catherine McCusker, and Robert Narquizian of Glasgow University.

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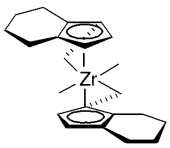
Bulletin of the Chemical Society of Japan
Chemical Communications
Chemistry A European Journal
Chemistry Letters
Collection Czechoslovak Chemical Communications
European Journal of Organic Chemistry
Helvetica Chimica Acta
Heterocycles
Journal of the American Chemical Society
Journal of Organic Chemistry
Organic Letters
Organometallics
Perkin Transactions 1
Synlett
Synthesis
Tetrahedron
Tetrahedron Asymmetry and Tetrahedron Letters

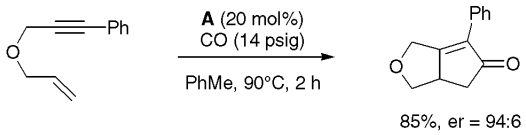
Article Identifier:
1437-210X,E;1999,0,12,2151,2158,ftx,en;X01299SS.pdf

(*S,S*)-Ethylenebistetrahydroindenyldimethylzirconium — ***Catalyst***

A mediates the enantioselective Pauson-Khand type cyclisation of 1,6-enynes.



A



13 examples (yields 70-94%, %ee = 47-96%).

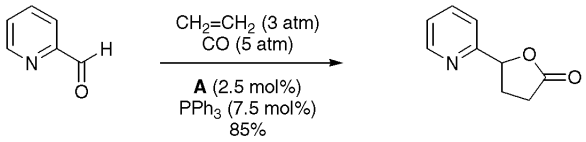
F. A. Hicks, S. L. Buchwald *J. Am. Chem. Soc.* **1999**, *121*, 7026.

Triruthenium dodecacarbonyl — ***Catalyst***

A mediates the [2+2+1]-cycloaddition of carbon monoxide, ethene and a variety of ketones or aldehydes, yielding γ-butyrolactones.

$Ru_3(CO)_{12}$

A

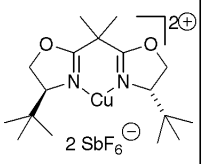


8 examples (yields 28-98%).

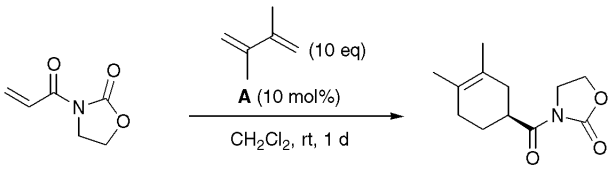
N. Chatani, M. Tobisu, T. Asaumi, Y. Fukumoto, S. Murai *J. Am. Chem. Soc.* **1999**, *121*, 7160.

C_2-Symmetric Copper(II) Complex — ***Catalyst***

A mediates the enantioselective Diels-Alder reaction between 3-propenoyl-2-oxazolidine and a range of substituted dienes. Pyridinyl analogs of **A** also catalyse Diels-Alder cycloaddition with acrolein and acrylate dienophiles.



A



78%, er = 83:17

10 examples (yields 59-95%, %ee = 59-97%).

D. A. Evans, D. M. Barnes, J. S. Johnson, T. Lectka, P. von Matt, S. J. Miller, R. D. Norcross, E. A. Shaughnessy, K. R. Campos *J. Am. Chem. Soc.* **1999**, *121*, 7582.

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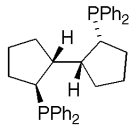
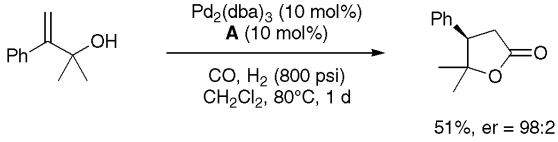
[(2*R*,2′*R*)-Bis(diphenylphosphanyl)](1*R*,1′*R*)-dicyclopentane — *Catalyst*

A mediates the enantioselective cyclocarbonylation of allylic alcohols.



A

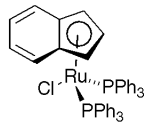


20 examples (yields 39-97%, %ee = 49-98%).

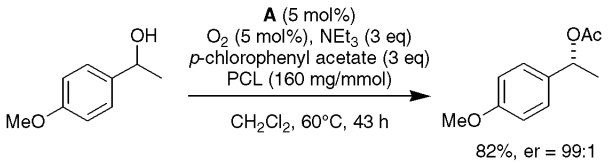
P. Cao, X. Zhang *J. Am. Chem. Soc.* **1999**, *121*, 7708.

Bistriphenylphosphine-(η^5-indenyl)-ruthenium(I) Chloride — *Catalyst*

The title reagent catalyses the racemisation of secondary alcohols. The Ru-catalysed racemisation is coupled with enzymatic acetylation, resulting in dynamic kinetic resolution and the production of chiral acetates in good yields with high enantioselectivities.



A

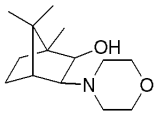


5 examples (yields 60-98%, %ee = 92-99%) are reported.

J. H. Koh, H. M. Jung, M.-J. Kim, J. Park *Tetrahedron Lett.* **1999**, *40*, 6281.

3-*exo*-Morpholinoisoborneol (MIB) — *Catalyst*

The crystalline, air-stable title reagent catalyses the enantioselective addition of organozinc reagents to heteroaromatic and branched aliphatic aldehydes.



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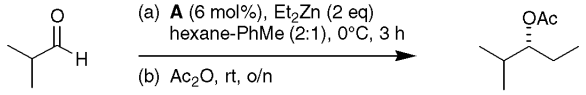


94%, er = 99:1

10 examples (yields 62-98%, %ee = 91-99%).

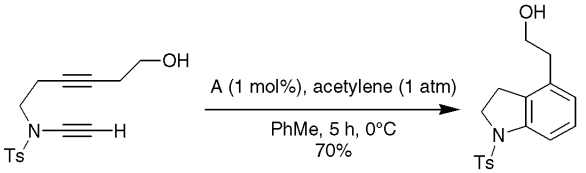
W. A. Nugent *Chem. Commun.* **1999**, 1369.

Tris(triphenylphosphane)rhodium(I) Chloride — *Catalyst*

The title compound catalyses the formation of multifunctionalised indolines *via* [2+2+2] cycloadditions.

$[RhCl(PPh_3)_3]$

A

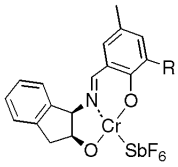


19 examples (yields 43-95%).

B. Witulski, T. Stengel *Angew. Chem. Int. Ed.* **1999**, *38*, 2426.

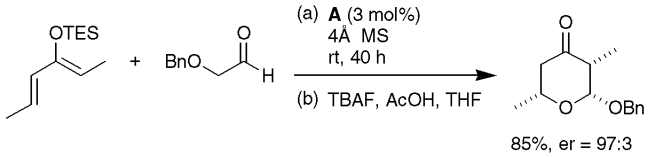
Chiral Chromium(III) Catalyst — *Catalyst*

The title compound catalyses enantio- and diastereoselective hetero-Diels-Alder reactions between aliphatic or aromatic aldehydes and a variety of substituted dienes.



A

R =



85%, er = 97:3

8 examples catalysed by **A** (yields 72-97%, %de(endo) > 95%, %ee = 90->99%) and 3 examples catalysed by a chloride derivative of **A** (yields 50-91%, %de(endo) > 95%, %ee = 91->99%) are described.

A. G. Dossetter, T. F. Jamison, E. N. Jacobsen *Angew. Chem. Int. Ed.* **1999**, *38*, 2398.

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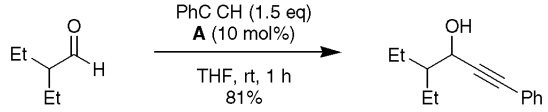
Cesium Hydroxide — *Catalyst*

A catalyses the alkynylation of aliphatic aldehydes and ketones to give the corresponding propargylic alcohols and alkenylation of nitriles to give the corresponding vinyl nitriles.

$CsOH{\bullet}H_2O$

A



18 examples of alkynylation of aldehydes and ketones (yields 66-96%) and 3 examples of alkenylation of nitriles (yields 78-83%, *Z*:*E* ≥ 85:15) are reported.

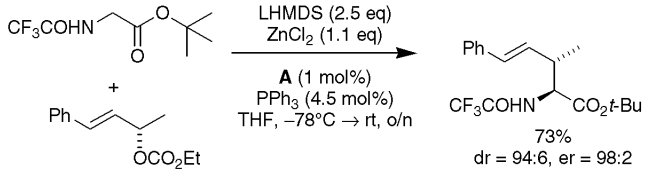
D. Tzalis, P. Knochel *Angew. Chem. Int. Ed.* **1999**, *38*, 1463.

Bis[allyl Palladium(II) Chloride] — *Catalyst*

The title compound catalyses the enantioselective allylation of glycine esters utilising a chelated glycine ester enolate and chiral allyl esters as key building blocks.

$[\{allylPdCl\}_2]$

A



2 examples (yields 67-73%, %de = 83-91%, %ee = 96%).

U. Kazmaier, F. L. Zumpe *Angew. Chem. Int. Ed.* **1999**, *38*, 1468.

Copper(I) Iodide / Bis(triphenylphosphine)palladium(II) Chloride — *Catalyst*

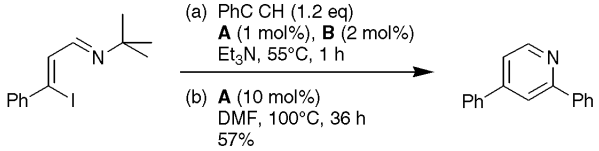
Isoquinolines and pyridines are prepared by coupling and cyclization of terminal acetylenes mediated by the title reagent pair.

CuI

A

$PdCl_2(PPh_3)_2$

B

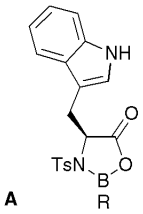


8 examples (yields 55-91%) are described.

K. R. Roesch, R. C. Larock *Org. Lett.* **1999**, *1*, 553.

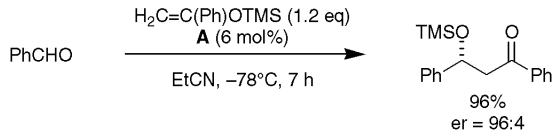
(*S*)-4-(Indol-3-ylmethyl)-*B*-3,5-di(trifluoromethyl)phenyl-oxazaborolidin-5-one — *Catalyst*

The title catalyst is utilised in the Mukaiyama aldol reaction of aldehydes with silyl enol ethers. **A** is reported to be much more active than Corey's original catalyst.



A

R = 3,5-$(CF_3)_2C_6H_3$

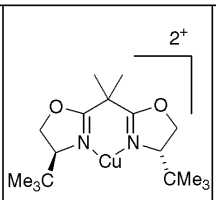


3 examples (yields 96-99%, %de > 99%, %ee = 89->99%) are reported.

K. Ishihara, S. Kondo, H. Yamamoto *Synlett* **1999**, 1283.

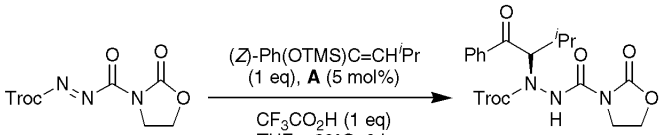
C_2-Symmetric Copper(II) Complex — *Catalyst*

A catalyses the enantioselective amination of enol silanes with azodicarboxylate derivatives.



2 OTf^-

A



Troc = $OC(O)CH_2CCl_3$

27 examples (yields 0, 51-96%, %ee = 21, 84-99%).

D. A. Evans, D. S. Johnson *Org. Lett.* **1999**, *1*, 595.

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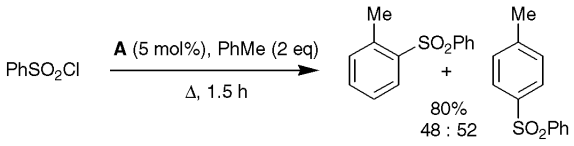
Bismuth(III) Trifluoromethanesulfonate — *Catalyst*

The title compound catalyses the sulfonylation of arenes.

$Bi(OTf)_3$

A

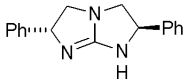


23 examples (yields 35-90%).

S. Répichet, C. Le Roux, P. Hernandez, J. Dubac, J.-R. Desmurs *J. Org. Chem.* **1999**, *64*, 6479.

(3*R*,7*R*)-3,7-Diphenyl-1,4,6-triazabicyclo[3.3.0]oct-4-ene — *Catalyst*

The title compound catalyses the enantioselective Strecker synthesis of chiral α-amino nitriles from *N*-benzhydryl imines.



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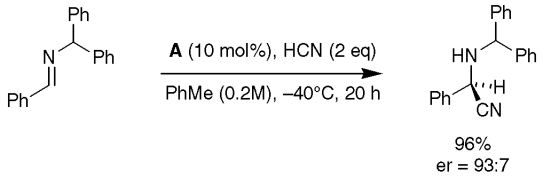
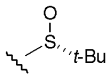


10 examples (yields 80-99%, %ee = 50-88%).

E. J. Corey, M. J. Grogan *Org. Lett.* **1999**, *1*, 157.

(*S*)-*tert*-Butyl Methyl Sulfoxide — *Chiral Auxiliary*

A serves as a chiral auxiliary in the enantioselective Pauson-Khand reaction of 1,6-enynes. The auxiliary is quantitatively removed upon treatment with activated zinc and NH_4Cl.



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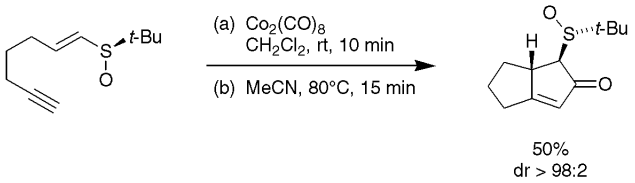
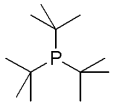


7 examples (yields 30-65%, %de = 94-99%).

J. Adrio, C. Carreyero *J. Am. Chem. Soc.* **1999**, *121*, 7411.

Tri-*tert*-butylphosphane — *Ligand*

A general method for the Stille cross-coupling of organostannanes with a range of aryl halides, utilising **A** to enhance the reactivity of the palladium catalyst and CsF to enhance the reactivity of the stannane is described.



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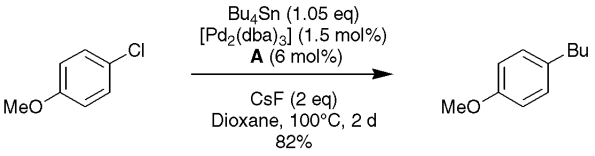
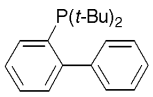


9 examples (yields 61-98%) are reported.

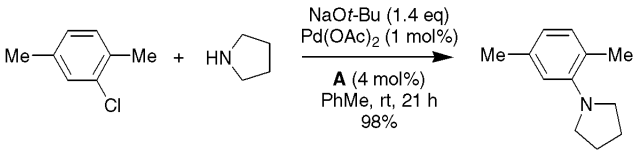
A. F. Littke, G. C. Fu *Angew. Chem. Int. Ed.* **1999**, *38*, 2411.

2-(Di-*tert*-butylphosphanyl)biphenyl — *Ligand*

A is reported to be a highly active catalyst for the room-temperature amination and Suzuki coupling of aryl chlorides.



A



19 examples (yields 81-100%) using **A** or a derivative are described.

J. P. Wolfe, S. L. Buchwald *Angew. Chem. Int. Ed.* **1999**, *38*, 2413.

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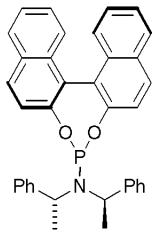
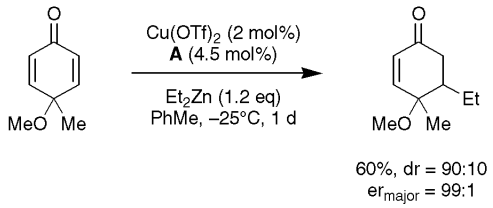
Chiral Phosphoramidite Ligand — *Ligand*

The title ligand is utilised in the copper(II) catalysed enantioselective conjugate addition of dialkylzinc reagents to 4,4-disubstituted cyclohexadienones.



A

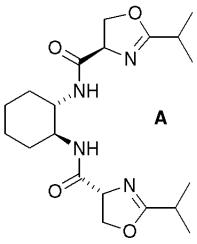


10 examples (yields 59-76%, %de = 0, 80-98%, %ee = 85-99%) are described.

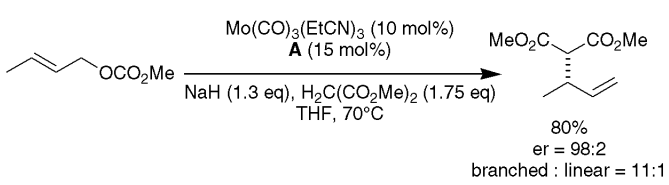
R. Imbos, M. H. G. Brilman, M. Pineschi, B. L. Feringa *Org. Lett.* **1999**, *1*, 623.

N,N′-Bis-{(4*R*)-[2-*iso*-propyloxazoline]carboxamide}-(1*S*,2*S*)-cyclohexane — *Ligand*

The title ligand mediates highly enantioselective molybdenum-catalysed allylic alkylation of 1- and 3-monosubstituted allylic substrates.



A



5 examples (yields 60-85%, 5:1 ≤ branched : linear ≤ 49:1, %ee = 74-99%).

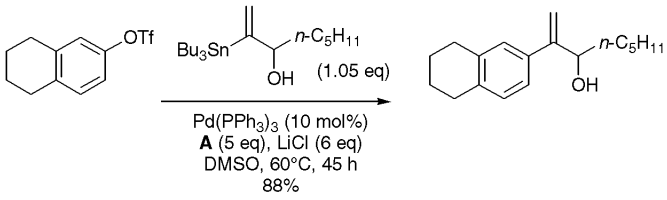
F. Glorius, A. Pfaltz *Org. Lett.* **1999**, *1*, 141.

Copper(I) Chloride — *Reagent*

Application of **A** in Stille-couplings prevents *cine*-substitution and gives rise to α-methylene hydroxyalkylarenes in high yield, when vinylstannanes and phenol triflates are utilized.

CuCl

A

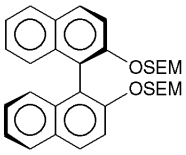


5 examples (yields 87-94%).

X. Han, B. M. Stoltz, E. J. Corey *J. Am. Chem. Soc.* **1999**, *121*, 7600.

(*R*)-2,2′-Bis[2-(trimethylsilyl)ethoxymethyl]-1,1′-binapthyl / Tin Tetrachloride — *Reagent*

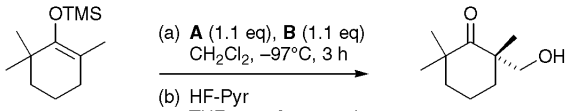
The enantioselective hydroxymethylation of silyl enol ethers with the title reagent pair is reported.



A

$SnCl_4$

B

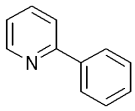


7 examples (yields 57-91%, %ee = 64-86%).

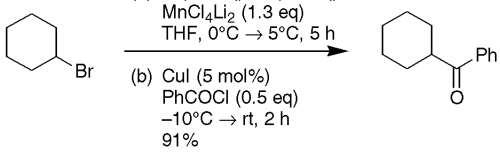
K. Ishihara, H. Nakamura, H. Yamamoto *J. Am. Chem. Soc.* **1999**, *121*, 7720.

2-Phenylpyridine — *Reagent*

The title reagent is used to produce activated manganese metal for the preparation of organomanganese reagents from organic halides.



A



19 examples (yields 56-93%) are reported.

G. Cahiez, A. Martin, T. Delacroix *Tetrahedron Lett.* **1999**, *40*, 6407.

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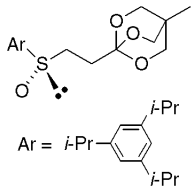
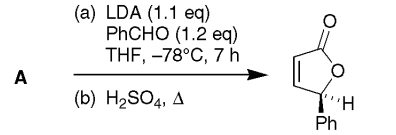
(*S*)-2-{4-Methyl-2,6,7-trioxabicyclo[2.2.2]octyl}ethyl 2,4,6-Triisopropylphenyl Sulfoxide

Reagent

The title reagent is used for the convergent asymmetric synthesis of γ-butenolides from aldehydes. Reactions with ketones are less stereoselective.



A



79%, er = 96:4

4 examples with aldehydes (yields 78-82%, %ee = 85-94%) and 2 examples with ketones (yields 65-95%, %ee = 29-32%) are reported.

M. Renard, L. Ghosez *Tetrahedron Lett.* **1999**, *40*, 6237.

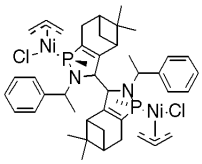
Liquid or Supercritical CO_2

Reagent

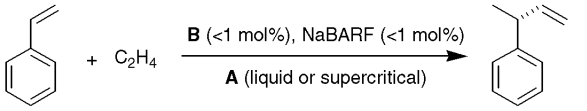
A is used as a solvent for the regio-, chemo- and enantioselective nickel-catalysed hydrovinylation of styrenes.

CO_2
(liquid or supercritical)

A



B



>99%, er = 96:4

BARF = tetrakis[3,5-bis(trifluoromethyl)phenyl]borate

3 examples (yields >99%, %ee = 81-92%).

A. Wegner, W. Leitner *Chem. Commun.* **1999**, 1583.

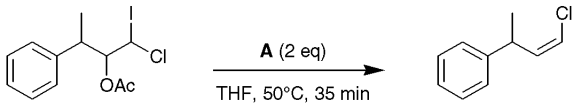
Samarium(II) Iodide

Reagent

The title reagent effects 1,2 elimination of *O*-acetylated 1,1-dihaloalkan-2-ols to give (*Z*)-vinyl halides with high diastereoselectivity.

SmI_2

A



95%
Z:*E* = 90:10

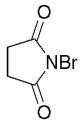
14 examples (yields 54-93%, 72:28 ≤ *Z*:*E* ≤ 94:6) are described.

J. M. Concellón, P. L. Bernad, J. A. Pérez-Andrés *Angew. Chem. Int. Ed.* **1999**, *38*, 2384.

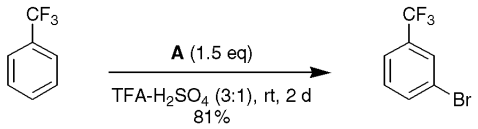
N-Bromosuccinimide (NBS)

Reagent

Treatment of deactivated aromatic compounds with **A** in trifluoroacetic acid (TFA) with the addition of sulfuric acid yields the corresponding monobromoaromatic compounds.



A



9 examples (yields 45-91%) are reported.

J. Duan, L. H. Zhang, W. R. Dolbier Jr. *Synlett* **1999**, 1245.

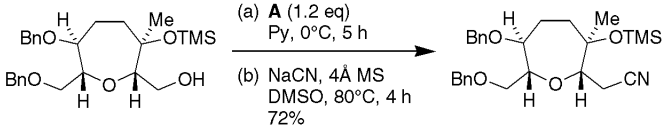
Chloromethylsulfonyl Chloride

Reagent

Chloromethanesulfonates formed from alcohols using the title reagent serve as efficient leaving groups in carbon-carbon bond rearrangements and conversions of alcohols into azides and nitriles.

$ClCH_2SO_2Cl$

A



11 examples (yields 34-95%).

T. Shimizu, T. Ohzeki, K. Hiramoto, N. Hori, T. Nakata *Synthesis* **1999**, 1373.

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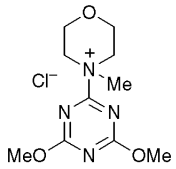
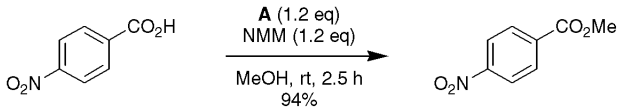
4-(4,6-Dimethoxy-1,3,5-triazin-2-yl)-4-methyl-morpholinium Chloride (DMTMM) — *Reagent*

Reaction of carboxylic acids with **A** in methanol, ethanol or isopropanol in the presence of *N*-methylmorpholine (NMM) affords the corresponding esters.



A



10 examples (yields 34, 64-99%).

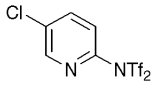
M. Kunishima, J. Morita, C. Kawachi, F. Iwasaki, K. Terao, S. Tani *Synlett* **1999**, 1255.

Potassium Bis(trimethylsilyl)amide / 2-[*N*,*N*-Bis(trifluoromethylsulfonyl)amino]-5-chloropyridine — *Reagent*

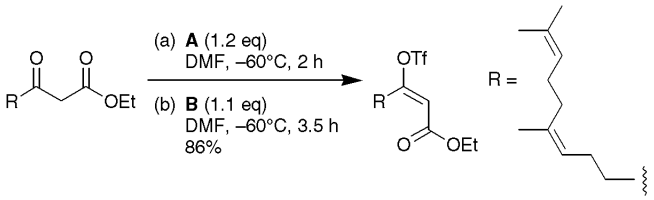
The title reagent pair is utilised in the stereocontrolled triflation of β-keto esters. The reaction is solvent dependent: use of THF yields *E* triflates, whereas DMF results in the corresponding *Z* isomers.

$(Me_3Si)_2NK$

A



B

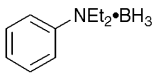


4 examples (yields 60-86%, ≥ 90% selectivity).

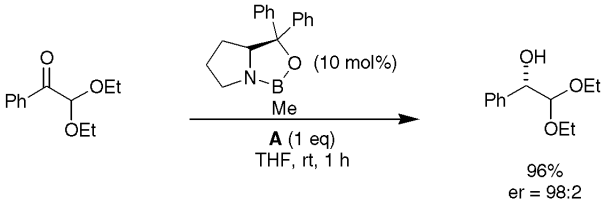
Y. Shao, J. T. Eummer, R. A. Gibbs *Org. Lett.* **1999**, *1*, 627

N,*N*-Diethylaniline-Borane Complex — *Reagent*

Synthesis of chiral α-hydroxy acetals by oxazaborolidine-catalyzed asymmetric reduction of α-keto acetals using **A** as the hydride source is reported.



A



13 examples (yields 65-98%, %ee = 30->99%).

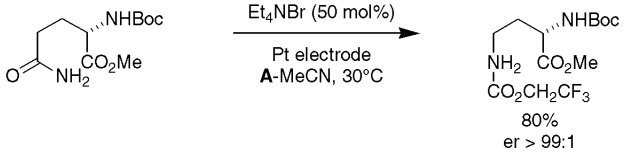
B. T. Cho, Y. S. Chun *J. Chem. Soc., Perkin Trans. 1* **1999**, 2095.

Trifluoroethanol (TFE) — *Reagent*

The electrochemical Hofmann rearrangement of N^2-protected glutamine esters using a mixed TFE-MeCN solvent system is described. **A** may play an important role in controlling the basicity caused by electrochemically generated bases.

CF_3CH_2OH

A

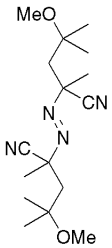


2 examples (yields 75-80%, %ee > 99%) are described.

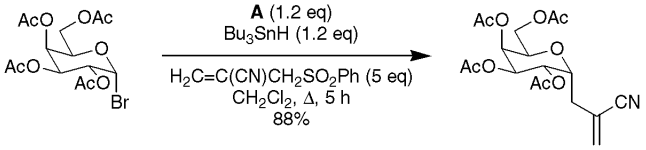
Y. Matsumura, Y. Satoh, K. Shirai, O. Onomura, T. Maki *J. Chem. Soc., Perkin Trans. 1* **1999**, 2057.

2,2′-Azobis(2,4-dimethyl-4-methoxyvaleronitrile) — *Reagent*

Efficient synthesis of α-*C*-glycosides through a radical reaction using **A** as an initiator under mild conditions is reported.



A



10 examples (yields 36-88%).

K. Gotanda, M. Matsugi, M. Suemura, C. Ohira, A. Sano, M. Oka, Y. Kita *Tetrahedron* **1999**, *55*, 10315.

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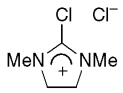
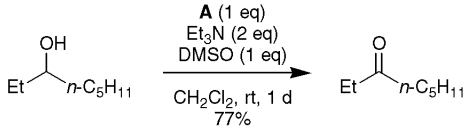
2-Chloro-1,3-dimethylimidazolinium Chloride — *Reagent*

A can act as a powerful dehydrating agent comparable to DCC and also has utility as a reagent for chlorination, oxidation, reduction, and rearrangement reactions.



A

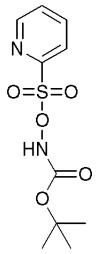


8 examples of the chlorination of alcohols and 1,3-diketones (yields 76-99%), 11 examples of the oxidation of alcohols (yields 47-92%), 4 examples of reduction of sulfoxides (yields 50-71%), and 16 examples of Lossen-type or Beckmann-like rearrangements (yields 57-93%) are reported.

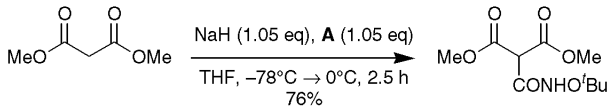
T. Isobe, T. Ishikawa *J. Org. Chem.* **1999**, *64*, 5832.

N-(*tert*-Butoxycarbonyl)-*O*-(2-pyridinylsulfonyl)hydroxylamine — *Reagent*

The title reagent reacts with soft enolates to yield *O*-*t*-butoxycarbonylamino derivatives rather than the expected Boc-protected amino acids.



A

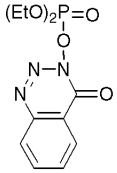


19 examples (yields 32-92%).

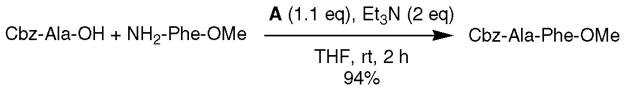
S. Hanessian, S. Johnstone *J. Org. Chem.* **1999**, *64*, 5896.

3-(Diethoxyphosphoryloxy)-1,2,3-benzotriazin-4(3*H*)-one (DEPBT) — *Reagent*

A is reported as a coupling reagent which mediates amide bond formation with high resistance to racemisation.



A

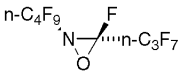


4 examples (yields 70-94%).

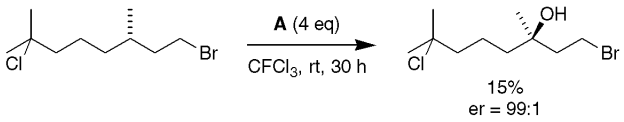
H. Li, X. Jiang, Y.-h. Ye, C. Fan, T. Romoff, M. Goodman *Org. Lett.* **1999**, *1*, 91.

Perfluoro-*cis*-2-*n*-butyl-3-*n*-propyloxaziridine — *Reagent*

The title compound mediates the enantiospecific oxyfunctionalisation of nonactivated hydrocarbon sites.



A

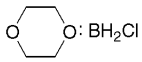


5 examples (yields 15-56%, %ee = 94-98%).

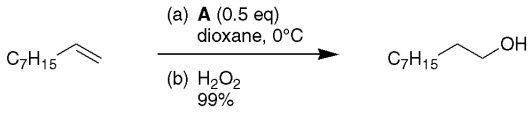
A. Arnone, S. Foletto, P. Metrangolo, M. Pregnolato, G. Resnati *Org. Lett.* **1999**, *1*, 281.

Dioxane-Monochloroborane — *Reagent*

The title compound is reported as a highly reactive hydroboration reagent.



A



11 examples of hydroboration and 6 examples of hydroboration-oxidation (yields ≥ 99%, 59:41 ≤ regioselectivity ≤ 100:0).

J. V. B. Kanth, H. C. Brown *Org. Lett.* **1999**, *1*, 315.

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