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:

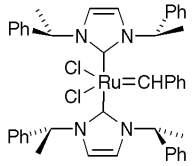
Stephen Brand, John Christopher, Emma Guthrie, Philip Kocienski, Louise Lea, Russell McDonald, Graeme McAllister and Robert Narquizian of Glasgow University.

The journals regularly covered by the abstractors are:

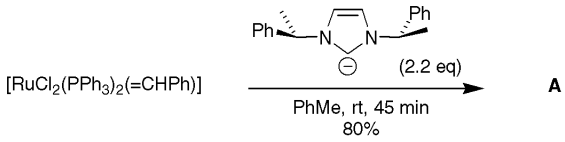
Angewandte Chemie International Edition
Bulletin of the Chemical Society of Japan
Chemical Communications
Chemistry A European Journal
Chemistry Letters
European Journal of Organic Chemistry
Helvetica Chimica Acta
Heterocycles
Journal of the American Chemical Society
Journal of Organic Chemistry
Organometallics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

Metathesis Catalyst ***Catalyst***

A new class of ruthenium catalysts for olefin metathesis is reported. The catalysts are air-stable and exhibit remarkable activity with high resistance to functional groups.



A



Catalyst **A** and 4 similar catalysts are prepared as above and applied to ring opening metathesis polymerisation of cyclooctene (yields 87-97%) and ring closing metathesis of 1,7-octadiene (yield >98%).

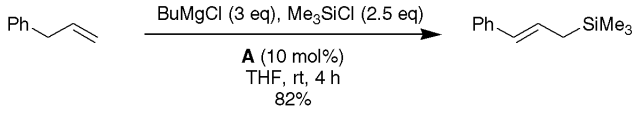
T. Weskamp, W. C. Schattenmann, M. Spiegler W. A. Herrmann *Angew. Chem. Int. Ed.* **1998**, *37*, 2490.

Bis(cyclopentadienyl)zirconium Dichloride ***Catalyst***

Zirconocene catalysed silylation of alkenes with chlorosilanes, silylsulfides, silylselenides and silyltellurides is reported. The reaction proceeds in the presence of a Grignard reagent to give alkenylsilanes and/or allylsilanes.

Cp_2ZrCl_2

A

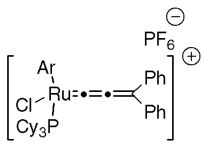


9 examples (yields 22-91%).

J. Terao, K. Torii, K. Saito, N. Kambe, A. Baba, N. Sonoda *Angew. Chem. Int. Ed.* **1998**, *37*, 2653.

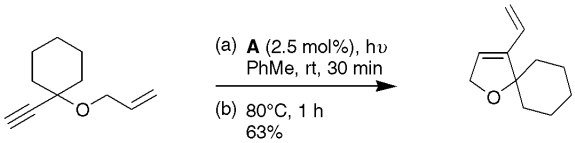
Metathesis Catalyst ***Catalyst***

The ruthenium(II)-allenylidene salt **A** acts as an olefin metathesis catalyst precursor for the ene-yne cyclisation of mixed propargylic allyl ethers. Initial photochemical irradiation efficiently promotes the catalytic activity.



A

Ar = *p*-cymene

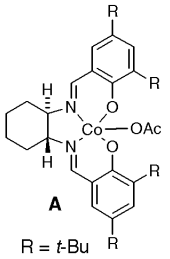


7 examples (yields 41-84%).

M. Picquet, C. Bruneau, P. H. Dixneuf *Chem. Commun.* **1998**, 2249.

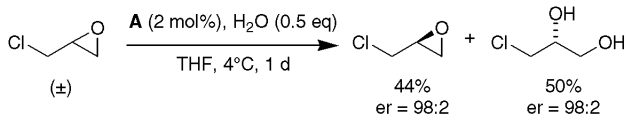
(*R,R*)-*N,N'*-Bis(3,5-di-*tert*-butyl-salicylidene)-1,2-cyclohexanediaminocobalt(II) — *Catalyst*

The title catalyst promotes the hydrolytic kinetic resolution of epichlorohydrin and glycidol derivatives.



A

R = *t*-Bu

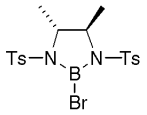


6 examples (yields 19-93%, %ee > 95%).

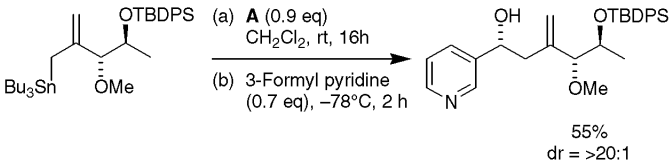
M. E. Furrow, S. E. Schaus, E. N. Jacobsen *J. Org. Chem.* **1998**, *63*, 6776.

(*R,R*)-1,3-Di(*p*-toluenesulfonyl)-2-bromo-4,5-dimethyldiazaborolidine — *Catalyst*

The title catalyst mediates the enantioselective addition of highly functionalised allyl stannanes to aldehydes.



A



9 examples using **A**, or its enantiomer (yields 55-99%, dr = 1:1 to 20:1) are described.

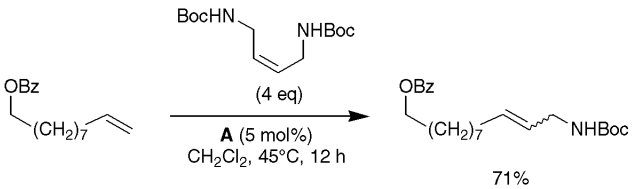
D. R. Williams, D. A. Brooks, K. G. Meyer, M. P. Clark *Tetrahedron Lett.* **1998**, *39*, 7251.

[Bis(tricyclohexylphosphine)benzylidene]ruthenium Dichloride — *Catalyst*

The title catalyst mediates the cross-metathesis of terminal olefins with symmetrical disubstituted olefins.

$Cl_2(PCy_3)_2Ru{=}CHPh$

A



14 examples (yields 28-95%, 2.2:1 ≤ *E*:*Z* ≤ 10:1) are described.

D. J. O'Leary, H. E. Blackwell, R. A. Washenfelder, R. H. Grubbs *Tetrahedron Lett.* **1998**, *39*, 7427.

Methyltri-*n*-octylammonium Hydrogensulfate / Sodium Tungstate(VI) — *Catalyst*

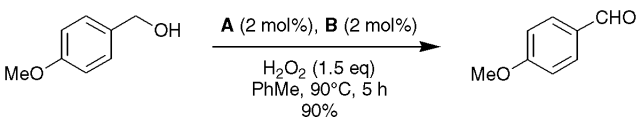
The title reagent pair mediates the oxidation of benzylic alcohols to the corresponding aldehyde or acid, with hydrogen peroxide.

$Me(^nOct)_3NHSO_4$

A

Na_2WO_4

B



8 examples of oxidation to aldehydes (yields 59-91%) and 6 examples of oxidation to carboxylic acids (yields 1, 80-91%) are described.

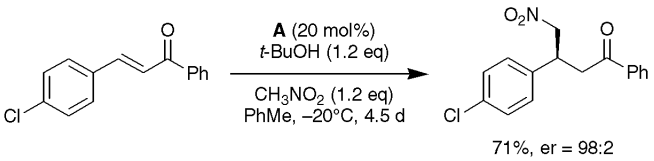
K. Sato, J. Takagi, M. Aoki, R. Noyori *Tetrahedron Lett.* **1998**, *39*, 7549.

Potassium Lanthanum(III) *tris*-((*R*)-binapthoxide) — *Catalyst*

The title catalyst mediates the asymmetric Michael addition of nitromethane to chalcones.

$K_3La[(R)\text{-BINOL}]_3$

A

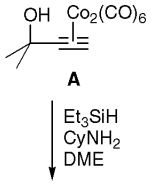


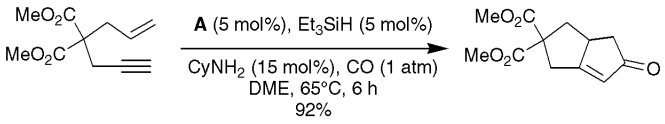
2 examples (yields 71, 85%, %ee 95, 93%) are described.

K. Funabashi, Y. Saida, M. Kanai, T. Arai, H. Sasai, M. Shibasaki *Tetrahedron Lett.* **1998**, *39*, 7557.

Hexacarbonyldicobalt 2-methyl-3-butyn-2-ol complex — *Catalyst*

The title pro-catalyst mediates the thermal catalytic Pauson-Khand reaction upon decomplexation with triethylsilane.





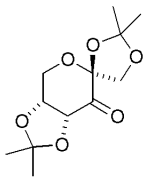
8 examples (yields 77-95%) are described.

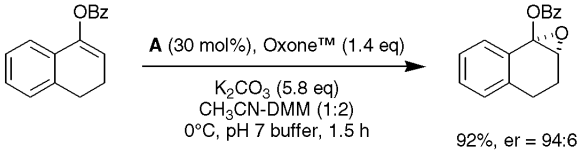
DME = 1,2-dimethoxyethane

D. B. Belanger, T. Livinghouse *Tetrahedron Lett.* **1998**, *39*, 7641.

Epoxidation Catalyst — *Catalyst*

The title catalyst mediates the enantioselective oxidation of silyl enol ethers and enol esters using Oxone™.





10 examples (yields 46-92%, %ee 74–95%) are described.

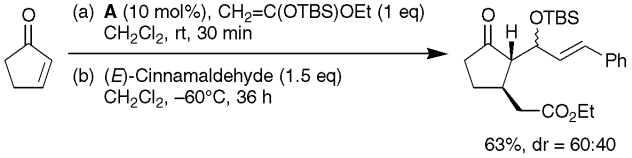
Y. Zhu, Y. Tu, H. Yu, Y. Shi *Tetrahedron Lett.* **1998**, *39*, 7819.

Samarium Diiodide - THF complex — *Catalyst*

A mediates the tandem Mukaiyama Michael-aldol reactions of cyclopenten-2-one and cyclohexen-2-one.

SmI_2•$(THF)_2$

A

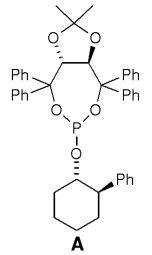


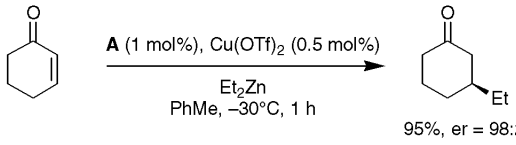
8 examples (yields 63-77%, %de = 18–96%) are described.

N. Giuseppone, Y. Courtaux, J. Collin *Tetrahedron Lett.* **1998**, *39*, 7845.

(–)-TADDOL — *Catalyst*

Catalyst **A**, derived from TADDOL, mediates the enantioselective conjugate addition of diethylzinc to a variety of enones.





2 examples of asymmetric induction using **A** (yields 20, 95%, %ee 0, 96%) are described. Comparison is made with the use of other TADDOL phosphite catalysts.

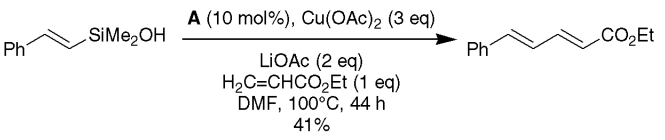
A. Alexakis, J. Vastra, J. Burton, C. Benhaim, P. Mangeney *Tetrahedron Lett.* **1998**, *39*, 7869.

Palladium(II) acetate — *Catalyst*

The title catalyst mediates the arylation of electron-deficient olefins with aryldimethyl silanols.

$Pd(OAc)_2$

A



9 examples (yields 34-69%) are described.

K. Hirabayashi, Y. Nishihara, A. Mori, T. Hiyama *Tetrahedron Lett.* **1998**, *39*, 7893.

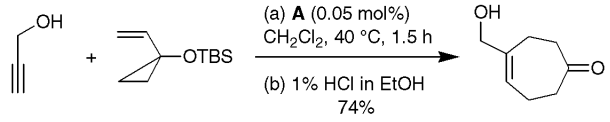
$[Rh(CO)_2Cl]_2$ — *Catalyst*

The title compound catalyses the intermolecular [5+2] cycloaddition of alkynes to 1-ethenyl-1-siloxycyclopropanes. The reaction corresponds to a homologous Diels-Alder reaction.

P. A. Wender, H. Rieck and M. Fuji *J. Am. Chem. Soc.* **1998**, *120*, 10976.

$[Rh(CO)_2Cl]_2$

A

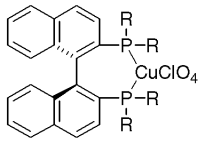


13 examples; 65-93% yield. Electron rich, electron poor, conjugated, internal and terminal alkynes, even ethyne itself, provide cycloadducts. Only one siloxycyclopropane was used in this study.

(*R*)-Tol-BINAP•$CuClO_4$ — *Catalyst*

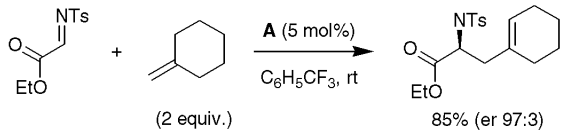
A copper(I) catalyst prepared from (R)- or (S)-Tol-BINAP catalyses the enantioselective ene reaction of α-imino esters.

W. J. Drury, D. Ferraris, C. Cox, B. Young and T. Lectka *J. Am. Chem. Soc.* **1998**, *120*, 11006.



R = 4-MeC_6H_4

A

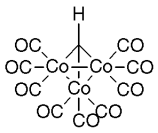


7 examples; 85-94% yield, 85-99% ee

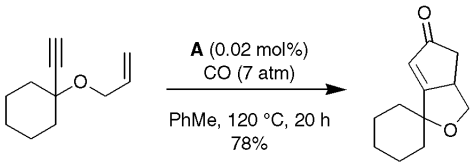
Methylidynetricobalt Nonacarbonyl — *Catalyst*

The stable cluster **A** catalyses the Pauson-Khand reaction.

T. Sugihara and M. Yamaguchi *J. Am. Chem. Soc.* **1998**, *120*, 10782.



A

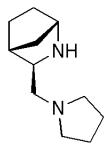


16 examples; O (1 case), 23, 78-98% yields. The case that failed involved a trisubstituted alkene. Both intramolecular and intermolecular examples.

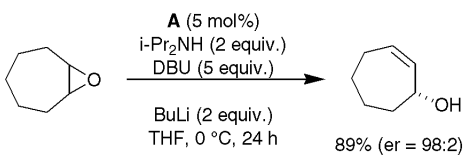
3-Pyrrolidin-1-ylmethyl-2-azabicyclo[2.2.1]heptane — *Catalyst*

The lithium amide bases prepared from **A** (and its enantiomer) are highly efficient catalysts for the asymmetric base-mediated rearrangement of symmetrical epoxides to allylic alcohols.

M. J. Södergren and P. G. Andersson *J. Am. Chem. Soc.* **1998**, *120*, 10760.



A



5 examples including 2-cyclopenten-1-ol (67%, 48% ee); 2-cyclohexen-1-ol (85%, 93% ee), 2-cycloocten-1-ol (81%, 78% ee). These are the highest levels of asymmetric epoxide deprotonation reported to date.

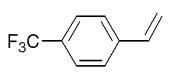
Nickel(II) Acetylacetonate / 4-(trifluoromethyl)styrene — *Catalyst*

The title reagent pair catalyses the cross coupling of arylzinc reagents with primary alkyl iodides.

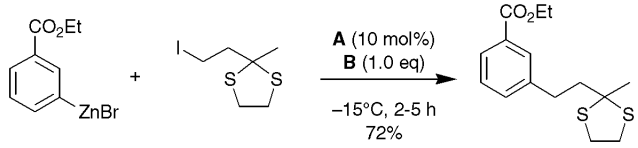
R. Giovannini and P. Knochel *J. Am. Chem. Soc.* **1998**, *120*, 11186.

$Ni(acac)_2$

A



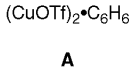
B



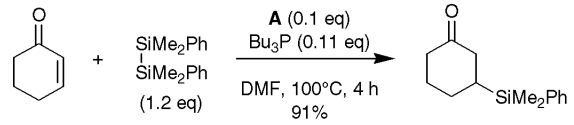
12 examples; yields 71-80%. The functionalised arylzinc bromides can be prepared by treatment of the iodoarene with isopropylmagnesium bromide in THF at –40°C for 30 min to give the arylmagnesium halide followed by transmetallation with zinc bromide.

Copper(I) Triflate — *Catalyst*

The title reagent catalyses the conjugate silylsilylation of enones. On acidic hydrolysis of the enolsilane intermediate, β-silyl ketones are formed. A Si-Cu reagent is involved.



A

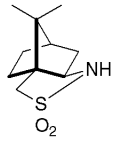


11 examples involving cyclic and acyclic enones; yields 35-100%.

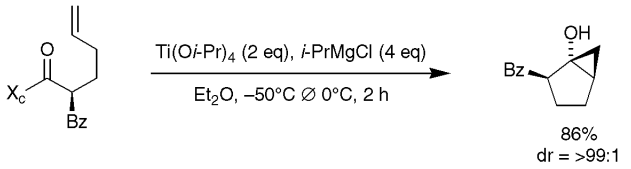
H. Ito, T. Ishizuka, J. Tateiwa, M. Sonoda, A. Hosomi *J. Am. Chem. Soc.* **1998**, *120*, 11196.

(1*S*)-(–)-2,10-Camphorsultam — *Chiral Auxiliary*

The cyclisation of unsaturated acylsulfonamides derived from auxiliary **A** with the titanium complex [Ti(O*i*-Pr)$_2$(η^2-propene)] (generated *in situ*) affords bicyclic cyclopropanols in high diastereoselectivity.



A

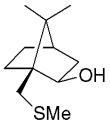


7 examples (yields 56-87%, %de = 84->98%).

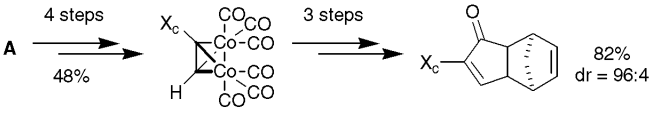
R. Mizojiri, H. Urabe, F. Sato *Angew. Chem. Int. Ed.* **1998**, *37*, 2666.

(2*R*)-10-(Methylthio)isoborneol — *Chiral Auxiliary*

The title chiral auxiliary is utilised in a highly diastereoselective intermolecular Pauson-Khand reaction. A unique advantage is the possibility of performing the normally difficult first dissociative step in a facile stereocontrolled manner and in the absence of a reacting olefin.



A

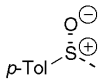


3 examples of intermolecular Pauson-Khand reactions (yields 70-95%, %de = 84-92%).

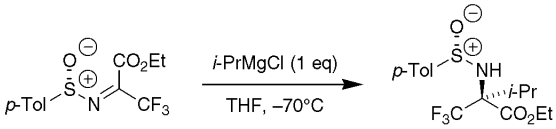
X. Verdaguer, J. Vázquez, G. Fuster, V. Bernardes-Génisson, A. E. Greene, A. Moyano, M. A. Pericàs, A. Riera *J. Org. Chem.* **1998**, *63*, 7037.

(*S*)-*p*-Toluenesulfinyl Auxiliary — *Chiral Auxiliary*

The title auxiliary mediates the diastereoselective addition of Grignard reagents to its sulfinimine derivatives.



A

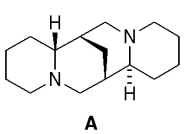


7 examples (yields 52-72%, %de 40–>96%) are described. Adducts can be converted to the corresponding α-trifluoromethyl amino acids by treatment with TFA followed by saponification.

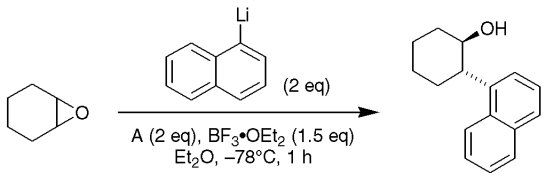
P. Bravo, M. Crucianelli, B. Vergani, M. Zanda *Tetrahedron Lett.* **1894**, *39*, 7771.

(–)-Sparteine — *Ligand*

Aryl lithium reagents, complexed with **A**, react enantioselectively with cyclic *meso* epoxides, to afford chiral aryl cyclanols.



A

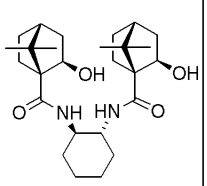


10 examples (yields 80-97%, %ee 15-87).

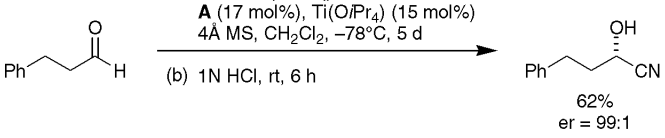
A. Alexakis, E. Vrancken, P. Mangeney *Synlett* **1998**, 1165.

Chiral *trans*-1,2-Diamide — *Ligand*

A chiral Ti(IV) complex formed from the title ligand catalyses the enantioselective addition of trimethylsilyl cyanide to aldehydes.



A

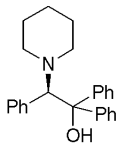


9 examples (yields 51-96%, %ee 87-98%) are reported.

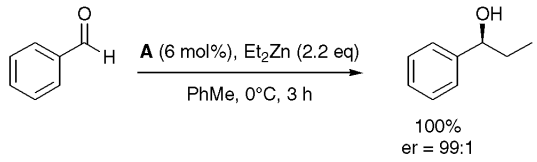
C.-D. Hwang, D.-R. Hwang, B.-J. Uang *J. Org. Chem.* **1998**, *63*, 6762.

(*R*)-2-Piperidino-1,1,2-triphenylethanol — *Ligand*

The title ligand mediates the catalytic enantioselective addition of diethylzinc to α-substituted aldehydes.



A

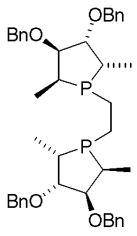


20 examples of addition to aliphatic and aromatic aldehydes (yields 88-100%, %ee 92->99 %).

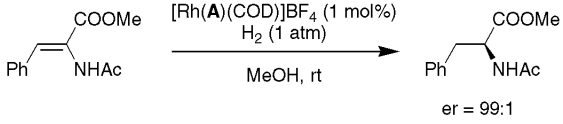
L. Solà, K. S. Reddy, A. Vidal-Ferran, A. Moyano, M. A. Pericàs, A. Riera, A. Alvarez-Larena, J.-F. Piniella *J. Org. Chem* **1998**, *63*, 7078.

1,2-Bis[(2*S*,3*S*,4*S*,5*S*)-3,4-bis(benzyloxy)-2,5-dimethylphospholanyl]ethane — *Ligand*

A rhodium(I) catalyst derived from the title ligand mediates the enantioselective hydrogenation of a range of functionalised olefins.



A



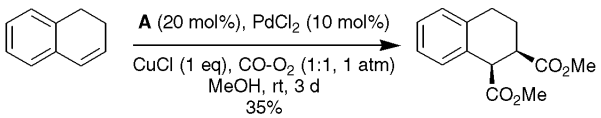
15 examples using **A** and three similar ligands are reported (%ee 93-99).

J. Holz, M. Quirmbach, U. Schmidt, D. Heller, R. Stürmer, A. Börner *J. Org. Chem.* **1998**, *63*, 8031.

Triphenylphosphine Sulfide — *Ligand*

The title ligand mediates the Palladium(II) catalysed *bis*-alkoxycarbonylation of olefins.

A

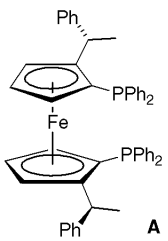


7 examples (yields 35-90%) are described. Chiral ligands related to **A** are applicable in an asymmetric variant of the above reaction (3 examples, %ee<30%).

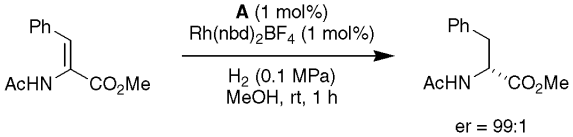
M. Hayashi, H. Takezaki, Y. Hashimoto, K. Takaoki, K. Saigo *Tetrahedron Lett.* **1998**, *39*, 7529.

(*R*)-(*S*)-Phenylethyl-FERRIPHOS — *Ligand*

The title catalyst mediates the enantioselective Rhodium-catalysed hydrogenation of (*Z*)-α-acetamidocinnamates.



A



5 examples (%ee 97.9–98.3%) are described. Enantioselectivity is comparable to that obtained using Rh(BINAP)$_2$.

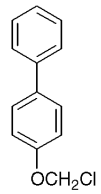
J. J. A. Perea, A. Börner, P. Knochel *Tetrahedron Lett.* **1998**, *39*, 8073.

1-(Chloromethoxy)-4-phenylbenzene

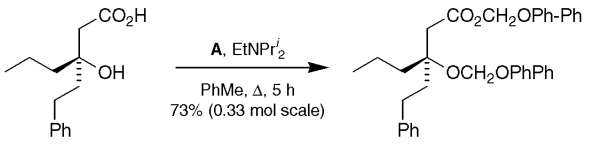
Protecting Group

The title reagent can be used to prepare [(*p*-phenylphenyl)oxy]methyl (POM) ethers which are more likely to be crystalline than alternatives such as MOM, MEM, SEM, or BOM ethers. A large scale synthesis of **A** is reported.

K. S. Fors, J. R. Gage, , R. F. Heier, R. C. Kelly, W. R. Petrault, N Wienienski *J. Org. Chem.* **1998**, *69*, 7348.



A



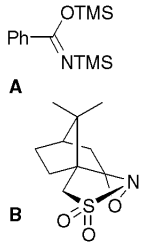
Only one example reported

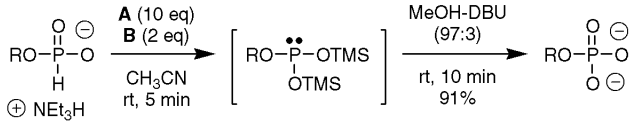
N,O-Bis(trimethylsilyl)benzamide / (+)-(10-Camphorsulfonyl)oxaziridine

Reagent

The title reagent pair mediates the oxidation of nucleoside-derived phosphonate monoesters to their phosphate esters, *via* the intermediacy of a *bis*trimethylsilyl phosphite.

T. Wada, A. Mochizuki, Y. Sato, M. Sekine *Tetrahedron Lett.* **1998**, *39*, 7123.





5 examples (yields 91-95%) are described.

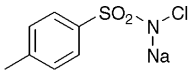
R = 5′-*O*-dimethoxytrityldeoxyadenosin-3′-yl

N-Chloro-*N*-sodio-*p*-toluenesulfonamide (Chloramine-T)

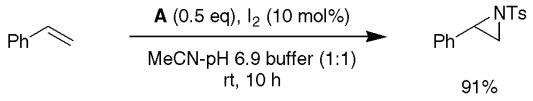
Reagent

A in the presence of catalytic iodine is utilised in the efficient aziridination of a range of aromatic and aliphatic olefins.

T. Ando, D. Kano, S. Minakata, I. Ryu, M. Komatsu *Tetrahedron* **1998**, *54*, 13485.



A



13 examples (yields 50-91%).

Benzyltriphenylphosphonium Peroxodisulfate

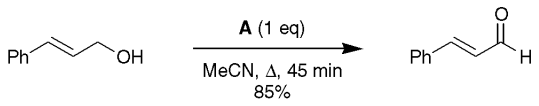
Reagent

Preparation of **A** and its use for the oxidation of a variety of organic compounds is reported.

I. Mohammadpoor-Baltork, A. R. Hajipour, H. Mohammadi *Bull. Chem. Soc. Jpn.* **1998**, *71*, 1649.

$(PhCH_2PPh_3)_2S_2O_8$

A



69 examples of the oxidation of alcohols and oximes to carbonyl compounds, thiols to disulfides, sulfides to sulfoxides and aromatic amines to azo compounds (yields 60-100%) are reported.

Borane-Tetrahydrofuran Complex

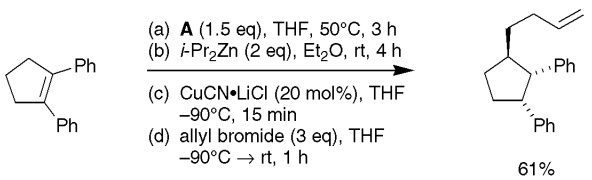
Reagent

1,2-Disubstituted cycloalkenes are hydroborated with **A** to provide tertiary alkylboranes.These undergo a stereoselective *syn* migration to the secondary alkylboranes which can be trapped by a variety of electrophiles.

F. Lhermitte, P. Knochel *Angew. Chem. Int. Ed.* **1998**, *37*, 2460.

BH_3•THF

A



9 examples (yields 40-92%, %de = 98-100%).

Diethylzinc / Diiodomethane

Reagent

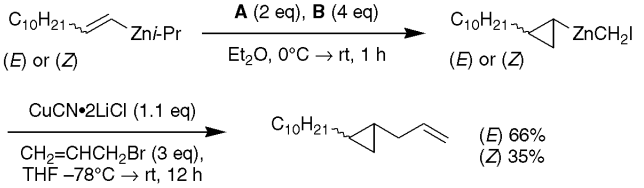
A one pot synthesis of cyclopropylzinc compounds from 1-alkenylzinc derivatives and their subsequent trapping with electrophiles is described.

Et_2Zn

A

CH_2I_2

B



3 examples (yields 35-66%). In addition, 3 examples of the formation of *trans* cyclopropane derivatives from 1-alkynes in a one pot procedure (yields 20-69%) are reported.

K. Yachi, H. Shinokubo, K. Oshima *Angew. Chem. Int. Ed.* **1998**, *37*, 2515.

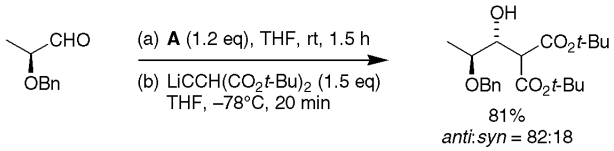
Zinc Chloride

Reagent

1,2-Asymmetric induction in the aldol addition reaction of malonate ester enolates to α-alkoxyaldehydes in the presence of **A** is reported.

$ZnCl_2$

A



8 examples exhibiting *anti* selectivity (yields 39-94%, 58:42 ≤ *anti*:*syn* ≤ 98:2) and 1 example of *syn* selectivity with a trityl protected aldehyde (yield 53%, *anti*:*syn* = 10:90) are reported.

S. Marumoto, H. Kogen, S. Naruto *Chem. Commun.* **1998**, 2253.

Phosphazene Base / Copper(I) Bromide

Reagent

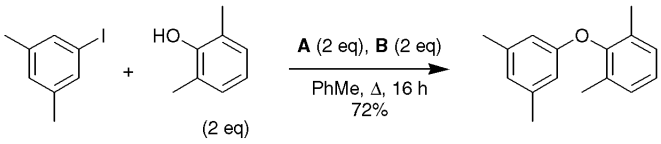
Phosphazene P_4-*t*-Bu base **A** in combination with Cu(I) salts promotes the Ullman reaction of electron-rich, electron-neutral and electron-poor aryl halides with a variety of phenols.

P_4-^{t}Bu

A

CuBr

B



9 examples (yields 56-81%).

C. Palomo, M. Oiarbide, R. López, E. Gómez-Bengoa *Chem. Commun.* **1998**, 2091.

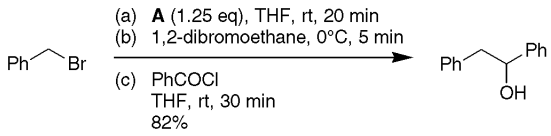
Highly active manganese

Reagent

A is used in the preparation of benzylic manganese halides and their coupling reactions.

Mn*

A



24 examples of coupling with aldehydes, ketones and acid chlorides (yields 0, 46-95%) are reported.

S.-H. Kim, R. D. Rieke *J. Org. Chem.* **1998**, *63*, 6766.

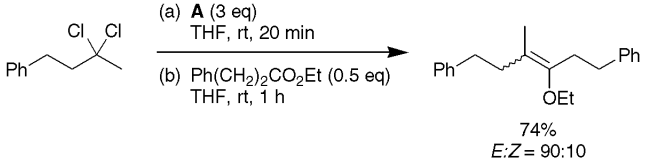
Bis(cyclopentadienyl)titanium bis(triethoxyphosphine)

Reagent

The preparation of highly substituted olefins by carbonyl olefination using the title reagent is reported.

$Cp_2Ti[P(OEt)_3]_2$

A



15 examples (yields 34-83%).

T. Takeda, R. Sasaki, T. Fujiwara *J. Org. Chem.* **1998**, *63*, 7286.