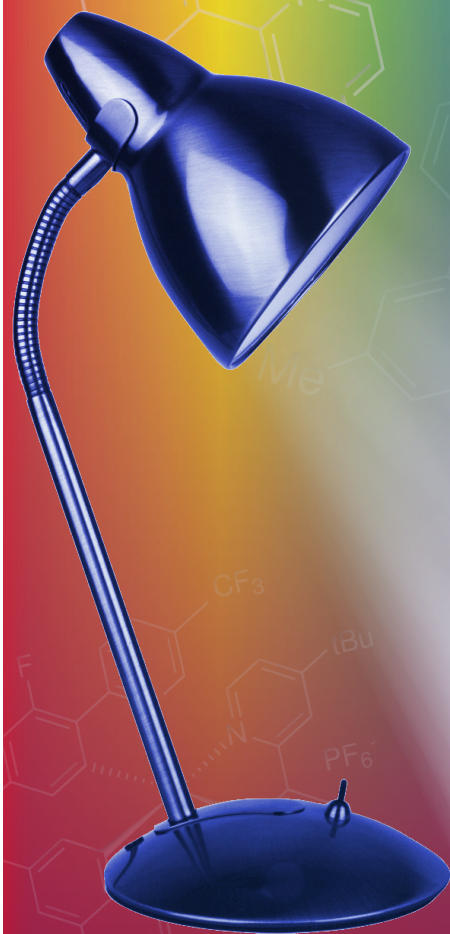
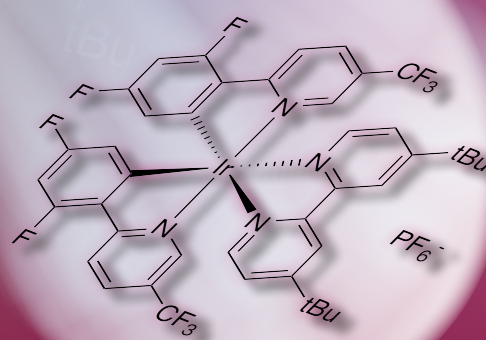
Photocatalysts





STREM

Photocatalysts

Strem Chemicals has been providing fine chemicals for research and commercial production for over fifty years. In this booklet you will find our selection of photocatalysts, related kits for screening purposes, as well as ligands and precursors for photocatalyst synthesis. There have been interesting developments in photocatalysis in the past few decades. Many of these novel compounds have been applied to solar cell research, light emitting diode manufacturing (LED) and initiators for free radical polymerizations. Specifically, cyclometallated ruthenium and iridium complexes are the most prominent. Recently, these compounds have been successfully applied to catalytic transformations. These catalysts can also be utilized in challenging organic transformations in both bench-top and commercial scales.

At Strem, we also offer a wide variety of ligands, nanomaterials and CVD/ALD precursors. Most of our products are of high purity, typically at 99%, while some are as high as 99.9999% metals purity. We continually seek to provide new technologies from around the globe and add to our product line. We have licensing agreements with industry and academia, which allow easier access to these patent-protected products for our customers. We look forward to continued growth in order to best serve our customers' needs with the quality and service they can trust from Strem.

As part of our ongoing commitment to quality, we have achieved ISO 9001 certification for the Quality Management System (QMS) at our corporate headquarters in Newburyport, Massachusetts.

In addition, custom synthesis services are provided on a contract basis. For pharmaceutical applications, manufacturing is conducted under current Good Manufacturing Practices (cGMP) in FDA inspected kilo-lab suites. Complete documentation is available, including validation and stability studies. Active Drug Master Files (DMF's) are maintained in North America and Europe.

***

Our other booklets, which focus on applications and product classes, are available in print per request and also on our website. Below is a list of current booklet titles that are available. Please also check our Product Resources section online to find additional literature offerings, such as the Strem Chemiker, our technical publication, and product literature sheets.

- Biocatalysts
- Buchwald Ligands and Precatalysts
- Carbon-Base Nanomaterials & Elemental Forms
- Catalysts & Ligands Manufactured Under License of Takasago Patent
- Gold Elements & Compounds
- Heterogeneous Catalysts
- High Purity Chiral Reagents
- Kits
- Materials for Energy Applications
- Metal Catalysts for Organic Synthesis
- Metathesis Catalysts
- MOCVD, CVD & ALD Precursors
- MOFs and Ligands for MOF Synthesis
- Nanomaterials
- New Products
- Other Ligands
- Phosphorous Ligands and Compounds
- Photocatalysts
- PURATREM: High Purity Inorganics

Ephraim S. Honig, Ph.D., M.B.A
Chief Executive Officer

ISO 9001 CERTIFIED

Photocatalyst 07/18

Glossary of Terms

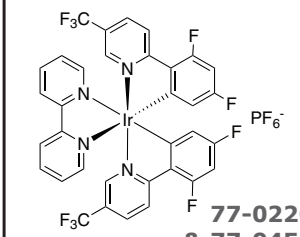
$[\alpha]_D$	.....	Specific rotation
AAS	.....	Atomic Absorption Standard
ACS	.....	Conforms to American Chemical Society specifications
air sensitive	.....	Product may chemically react with atmospheric oxygen or carbon dioxide at ambient conditions. Handle and store under an inert atmosphere of nitrogen or argon.
amp	.....	Ampouled
b.p.	.....	Boiling point in °C at 760mm, unless otherwise noted
d.	.....	Density
dec.	.....	Decomposes
elec. gr.	.....	Electronic Grade, suitable for electronic applications
f.p.	.....	Flash point in °F
gran.	.....	Granular
heat sensitive	.....	Product may chemically degrade if stored for prolonged periods of time at ambient temperatures or higher. Store at 5°C or lower.
hydrate	.....	Unspecified water content which may vary slightly from lot to lot
hygroscopic	.....	Product may absorb water if exposed to the atmosphere for prolonged periods of time (dependent on humidity and temperature). Handle and store under an inert atmosphere of nitrogen or argon.
light sensitive	.....	Product may chemically degrade if exposed to light
liq.	.....	Liquid
m.p.	.....	Melting point in °C
moisture sensitive	.....	Product may chemically react with water. Handle and store under an inert atmosphere of nitrogen or argon.
NMR grade		Suitable as a Nuclear Magnetic Resonance reference standard
optical grade	.....	For optical applications
pwdr.	.....	Powder
primary standard	.....	Used to prepare reference standards and standardize volumetric solutions
PURATREM	.....	Product has a minimum purity of 99.99% (metals basis)
purified	.....	A grade higher than technical, often used where there are no official standards
P. Vol.	.....	Pore volume
pyrophoric	.....	Product may spontaneously ignite if exposed to air at ambient conditions
reagent	.....	High purity material, generally used in the laboratory for detecting, measuring, examining or analyzing other substances
REO	.....	Rare Earth Oxides. Purity of a specific rare-earth metal expressed as a percentage of total rare-earths oxides.
SA	.....	Surface area
store cold	.....	Product should be stored at -18°C or 4°C, unless otherwise noted (see product details)
subl.	.....	Sublimes
superconductor grade	.....	A high purity, analyzed grade, suitable for preparing superconductors
tech. gr.	.....	Technical grade for general industrial use
TLC	.....	Suitable for Thin Layer Chromotography
v.p.	.....	Vapor pressure mm of Hg
xtl.	.....	Crystalline

About Purity

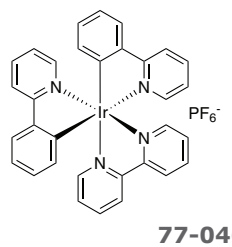
Chemical purity	.....	is reported after the chemical name, e.g. Ruthenium carbonyl, 99%
Metals purity	.....	is reported in parentheses with the respective element, e.g. Gallium (III) bromide, anhydrous, granular (99.999%-Ga) PURATREM where 100% minus the metal purity is equal to the maximum allowable percentage of trace metal impurity

Photocatalysts - Quick Reference

Iridium Photocatalysts



77-0220 & 77-0453



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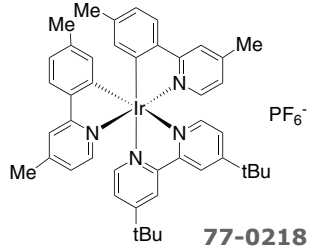

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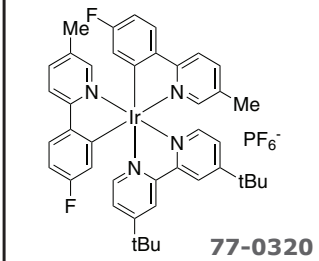

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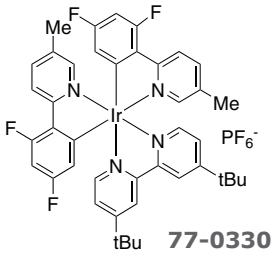

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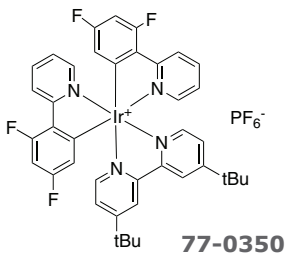

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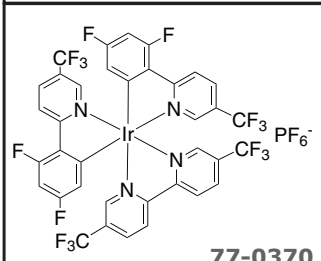

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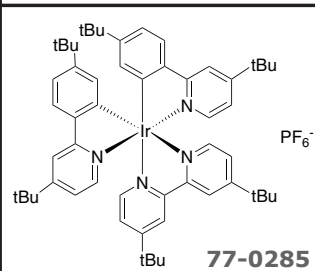

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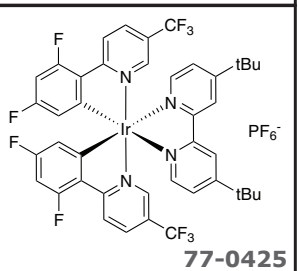

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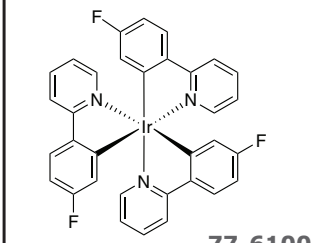

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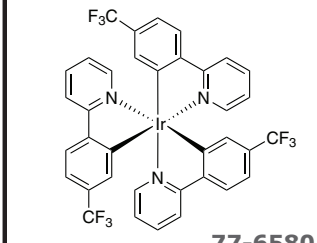

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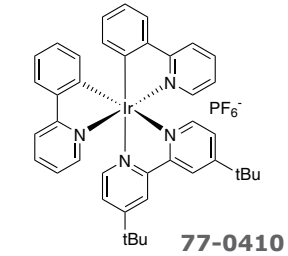

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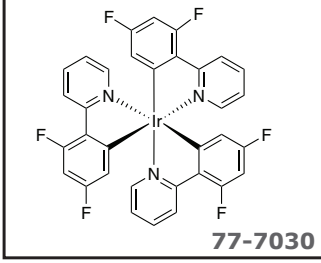

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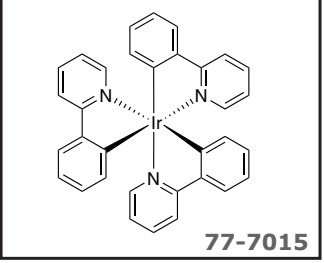
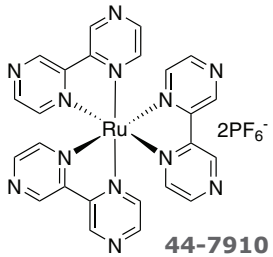


77-7015

Photocatalysts - Quick Reference

Ruthenium Photocatalysts



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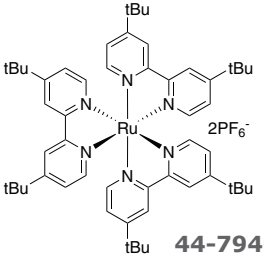

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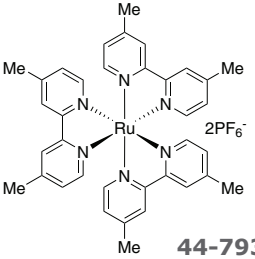

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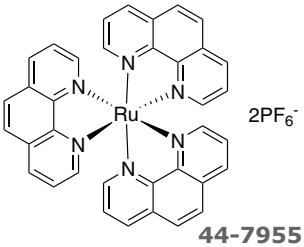

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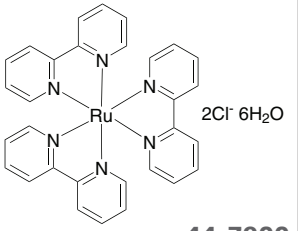

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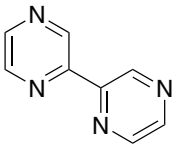
Ligands for Photocatalyst Synthesis



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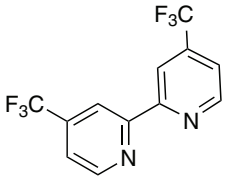

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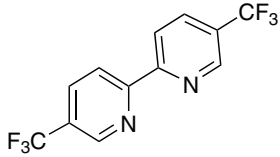

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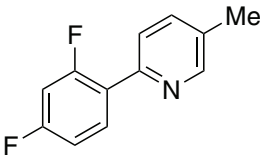

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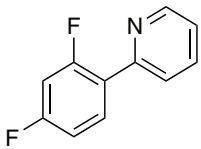

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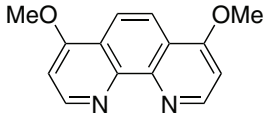

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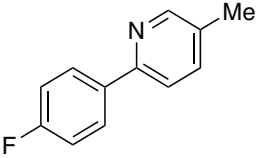

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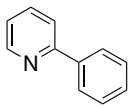

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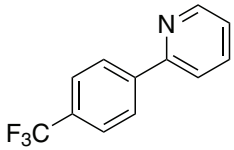
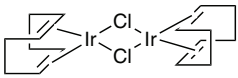


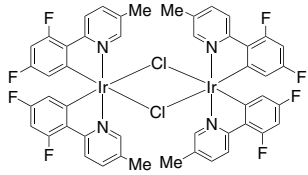
07-2625

Photocatalysts - Quick Reference

Precursors for Photocatalyst Synthesis



77-0400



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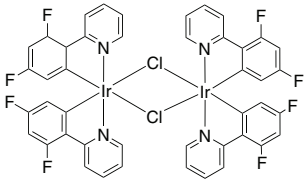

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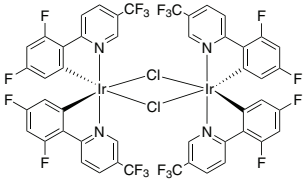

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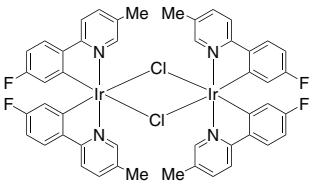

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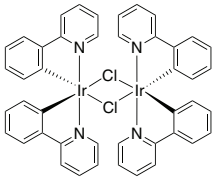


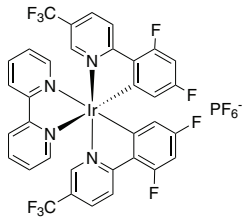
77-0455

IRIDIUM (Compounds)

77-0220

NEW

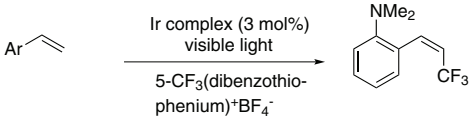
(2,2'-Bipyridine)bis[3,5-difluoro-2-[5-(trifluoromethyl)-2-pyridinyl-kN][phenyl-kC] iridium(III) hexafluorophosphate, 95%
(1092775-62-6)
$C_{34}H_{18}F_{16}IrN_4P$; FW: 1009.70; yellow pwdr.
air sensitive
Note: Photocatalyst



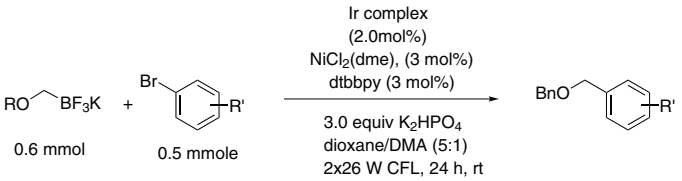
50mg
250mg

Technical Notes:

1. Photocatalyst used for the chemo-, regio, and stereoselective trifluoromethylation of styrene.
2. Photoredox catalyst used in cross-coupling: Ir/Ni dual catalysts for the synthesis of benzylic ethers.
3. Iridium complex used for catalytic olefin hydroamidation enabled by proton-coupled electron transfer.
4. Catalyst used for visible light photoredox cross-coupling of acyl chlorides with potassium alkoxymethyltrifluoroborates.
5. Iridium catalyst used in the photoredox/nickel dual catalytic cross-coupling of secondary alkyl β-trifluoroboratoketones and –esters with aryl bromides.
6. Photocatalyst used in the cross-coupling of trifluoroalkylboranes.



Tech. Note (1)
Ref. (1)



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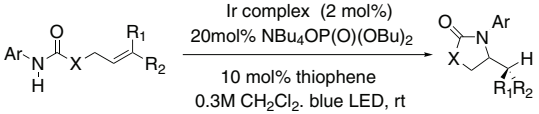

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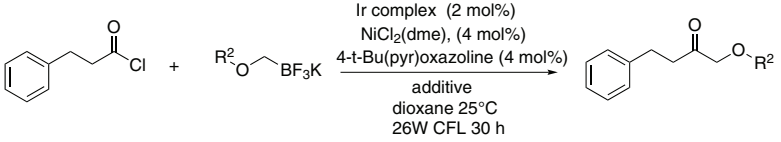

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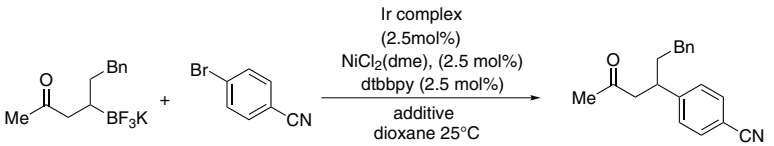
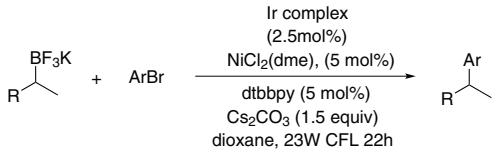


Tech. Note (5)
Ref. (5)

IRIDIUM (Compounds)

77-0220 **(2,2'-Bipyridine)bis[3,5-difluoro-2-[5-(trifluoromethyl)-2-pyridinyl-kN][phenyl-kC] iridium(III) hexafluorophosphate, 95%** *(1092775-62-6)*
(continued)



Tech. Note (6)
Ref. (6)

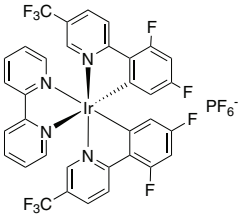
References:

1. *J. Org. Chem.*, **2014**, *79*, 10446.
2. *Org. Lett.*, **2015**, *17*, 3294.
3. *J. Am. Chem. Soc.*, **2015**, *137*, 13495.
4. *Org. Lett.*, **2016**, *18*, 732.
5. *Org. Lett.*, **2016**, *18*, 2994.
6. *Org. Lett.*, **2016**, *18*, 5760.

77-0453 **(2,2'-Bipyridine)bis[3,5-difluoro-2-[5-trifluoromethyl-2-pyridinyl-kN)phenyl-kC] iridium(III) hexafluorophosphate, 99%** *(1092775-62-6)*

NEW

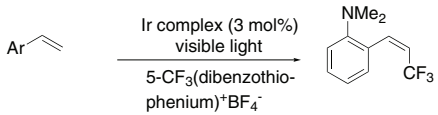
$[Ir(C_{10}H_8N_2)(C_{12}H_5F_5N)_2]$ PF_6; FW: 1009.70; yellow pwdr.
Note: Photocatalyst



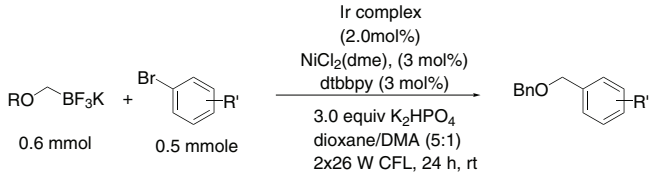
50mg
250mg

Technical Notes:

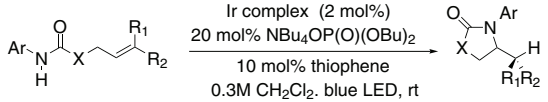
1. Catalyst used for the chemo-, regio, and stereoselective trifluoromethylation of styrene.
2. Photoredox catalyst used in cross-coupling: Ir/Ni dual catalysts for the synthesis of benzylic ethers.
3. Iridium complex used for catalytic olefin hydroamidation enabled by proton-coupled electron transfer.
4. Catalyst used for visible light photoredox cross-coupling of acyl chlorides with potassium alkoxymethyltrifluoroborates.
5. Iridium catalyst used in the photoredox/nickel dual catalytic cross-coupling of secondary alkyl β-trifluoroboratoketones and –esters with aryl bromides.
6. Photocatalyst used in the cross-coupling of trifluoroalkylboranes.



Tech. Note (1)
Ref. (1)



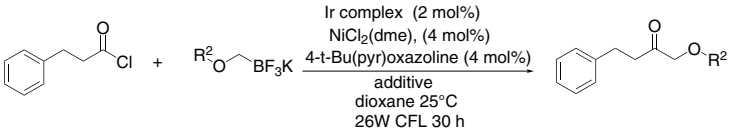
Tech. Note (2)
Ref. (2)



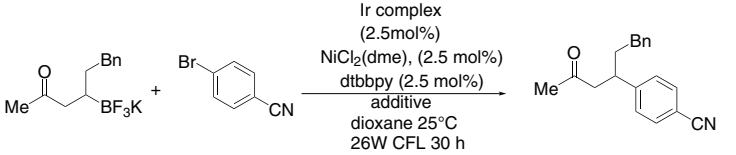
Tech. Note (3)
Ref. (3)

IRIDIUM (Compounds)

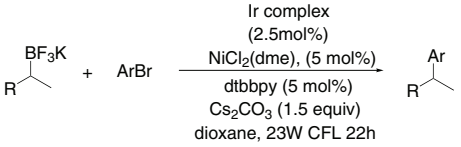
77-0453 **(2,2'-Bipyridine)bis[3,5-difluoro-2-[5-trifluoromethyl-2-pyridinyl-kN)phenyl-kC]iridium(III) hexafluorophosphate, 99%** *(1092775-62-6)*
(continued)



Tech. Note (4)
Ref. (4)



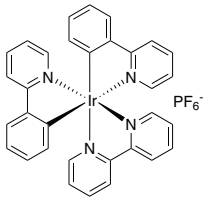
Tech. Note (5)
Ref. (5)



Tech. Note (6)
Ref. (6)

References:
1. *J. Org. Chem.*, **2014**, *79,* 10446.
2. *Org. Lett.*, **2015**, *17*, 3294.
3. *J. Am. Chem. Soc.*, **2015**, *137*, 13495.
4. *Org. Lett.,* **2016**, *18*, 732.
5. *Org. Lett.*, **2016**, *18*, 2994.
6. *Org. Lett.*, **2016**, *18*, 5760.

77-0465 **(2,2'-Bipyridine)bis[2-pyridinyl-kN)phenyl-kC] iridium(III) hexafluorophosphate, 99%**
NEW
(106294-60-4)
$[Ir(C_{10}H_8N_2)(C_{11}H_8N)_2]PF_6$; FW: 801.74;
yellow pwdr.
Note: Photocatalyst



100mg
500mg

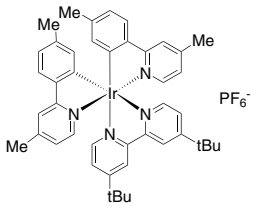
Technical Notes:
1. Catalyst used in the visible-light, photoredox-catalyzed synthesis of nitrones.
2. Catalyst used in light-mediated, direct arylation of arenes and heteroarenes.
3. Photoredox catalyst used in C-P bond formation reactions.

References:
1. *Org. Lett.,* **2014**, *16*, 2872.
2. *Chem. Lett.,* **2013**, *42*, 1203.
3. *Chem. Comm.,* **2011**, *47*, 8679.

IRIDIUM (Compounds)

77-0218 NEW

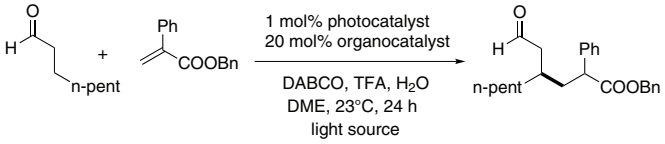
4,4'-Bis(t-butyl-2,2'-bipyridine]bis[5-methyl-2-(4-methyl-2-pyridinyl-kN)phenyl-kC]iridium hexafluorophosphate, 95% *(1607469-49-7)*
$C_{44}H_{48}F_6IrN_4P$; FW: 970.06; yellow pwdr.
air sensitive
Note: Photocatalyst



50mg
250mg

Technical Note:

1. Catalyst used for the direct β-alkylation of aldehydes via photoredox organocatalysis.



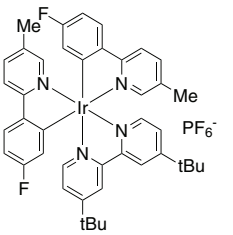
Tech. Note (1)
Ref. (1)

References:

1. *J. Am. Chem. Soc.*, **2014**, *136*, 6858.

77-0320 NEW

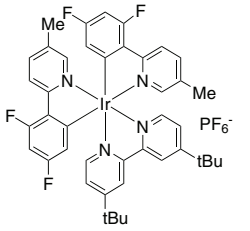
[4,4'-Bis(1,1-dimethylethyl)-2,2'-bipyridine-κN,κN] bis[5-fluoro-2-(5-methyl-2-pyridinyl-κN)phenyl-κC] iridium hexafluorophosphate, 98% *(808142-88-3)*
$C_{42}H_{42}F_8IrN_4P$; FW: 977.98; yellow solid
air sensitive
Note: Photocatalyst



50mg
250mg

77-0330 NEW

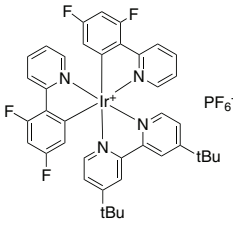
[4,4'-Bis(1,1-dimethylethyl)-2,2'-bipyridine-κN,κN] bis[3,5-difluoro-2-(5-methyl-2-pyridinyl)phenyl] iridium hexafluorophosphate, 98% *(1335047-34-1)*
$C_{42}H_{40}F_{10}IrN_4P$; FW: 1013.96; yellow solid
air sensitive
Note: Photocatalyst



100mg
500mg

77-0350 NEW

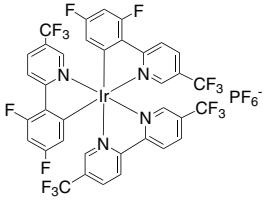
[4,4'-Bis(1,1-dimethylethyl)-2,2'-bipyridine-κN,κN] bis[3,5-difluoro-2-(2-pyridinyl-κN)phenyl-κC]iridium hexafluorophosphate, 97% *(1072067-44-7)*
$C_{40}H_{36}F_{10}IrN_4P$; FW: 985.92; Yellow pwdr.
air sensitive
Note: Photocatalyst



100mg
500mg

77-0370 NEW

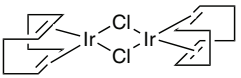
[5,5'-Bis(trifluoromethyl)-2,2'-bipyridine-κN,κN] bis[3,5-difluoro-2-[5-(trifluoromethyl)-2-pyridinyl-κN]phenyl]iridium hexafluorophosphate, 98% *(1973375-72-2)*
$C_{36}H_{16}F_{22}IrN_4P$; FW: 1145.69; yellow solid
air sensitive
Note: Photocatalyst



50mg
250mg

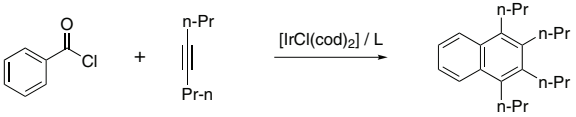
IRIDIUM (Compounds)

77-0400 **Chloro-1,5-cyclooctadiene iridium(I) dimer, 99%** 500mg
(12112-67-3) 2g
$[IrCl(C_8H_{12})]_2$; FW: 671.71; red to orange pwdr.; m.p. 190° dec. 10g
Note: Precursor for Photocatalyst Synthesis

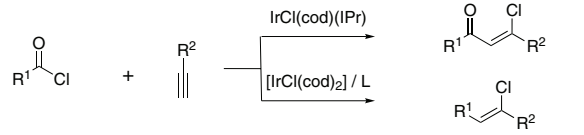


Technical Notes:

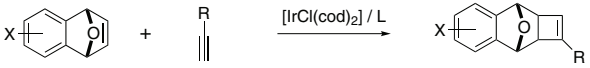
1. Precursor to catalysts for the asymmetric hydrogenation of tri- and tetrasubstituted olefins.
2. Precursor to catalyst for enantioselective reduction of imines.
3. Precursor to catalyst for allylic alkylation.
4. Precursor to catalyst for allylic amination and etherification.
5. Precursor to catalyst for the reaction of aroyl chlorides with internal alkynes to produce substituted naphthalenes and anthracenes.
6. Ir-catalyzed addition of acid chlorides to terminal alkynes.
7. Intramolecular hydroamination of unactivated alkenes with secondary alkyl- and arylamines.
8. Enantioselective [2+2] cycloaddition.
9. Silyl-directed, Ir-catalyzed ortho-borylation of arenes.
10. Ir-catalyzed cross-coupling of styrene derivatives with allylic carbonates.
11. Transfer hydrogenative C-C coupling



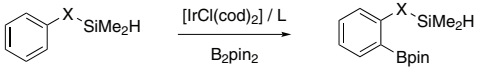
Tech. Note (5)
Ref. (5)



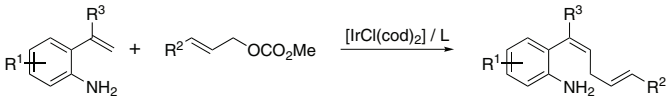
Tech. Note (6)
Ref. (6)



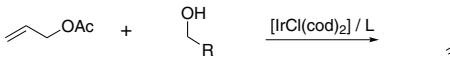
Tech. Note (8)
Ref. (8)



Tech. Note (9)
Ref. (9)



Tech. Note (10)
Ref. (10)



Tech. Note (11)
Ref. (11)

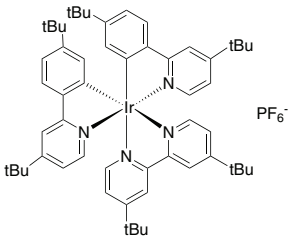
References:

1. *Angew. Chem. Int. Ed.,* **1998**, *37*, 2897
2. *J. Am. Chem. Soc.,* **1999**, *121*, 6421
3. *J. Am. Chem. Soc.,* **1998**, *120*, 8647
4. *J. Am. Chem. Soc.,* **2003**, *125*, 14272
5. *J. Am. Chem. Soc.,* **2002**, *124*, 12680
6. *J. Am. Chem. Soc.,* **2009**, *131*, 6668
7. *J. Am. Chem. Soc.,* **2010**, *132*, 413
8. *Org. Lett.,* **2010**, *12*, 304
9. *J. Am. Chem. Soc.,* **2008**, *130*, 7534
10. *J. Am. Chem. Soc.,* **2009**, *131*, 8346
11. *(a) J. Am. Chem. Soc.,* **2008**, *130*, 6340, *(b) Angew, Chem, Int, Ed,* **2009**, *48*, 6313

IRIDIUM (Compounds)

77-0285 NEW

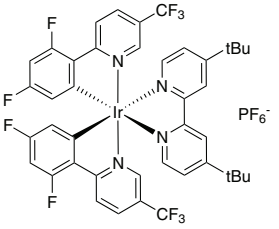
[4,4'-Di-t-butyl-2,2'-bipyridine][bis[5-(t-butyl)-2-[4-(t-butyl)-2-pyridinyl-kN] phenyl-kC]iridium(III) hexafluorophosphate, 95% *(808142-80-5)*
$C_{56}H_{72}F_6IrN_4P$; FW: 1138.38; yellow pwdr.
air sensitive
Note: Photocatalyst



50mg
250mg

77-0425 NEW

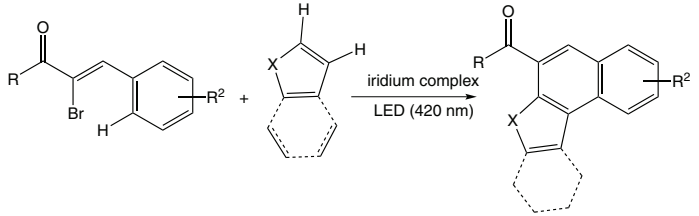
(4,4'-Di-t-butyl-2,2'-bipyridine)bis[3,5-difluoro-2-[5-trifluoromethyl-2-pyridinyl-kN) phenyl-kC]iridium(III) hexafluorophosphate, 99% *(870987-63-6)*
$[Ir(C_{18}H_{24}N_2)(C_{12}H_5F_5N)_2]^+PF_6^-$; FW: 1121.91; yellow xtl.
Note: Photocatalyst



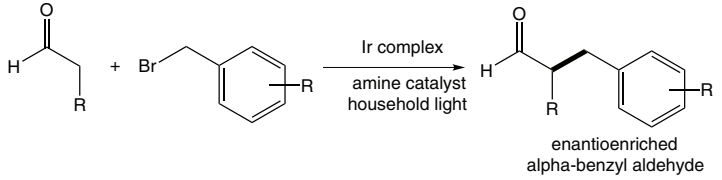
50mg
250mg
1g

Technical Notes:

1. Visible light photoredox-catalyzed cascade cyclizations of α-bromochalcones or α-bromocinnamates with heteroarenes.
2. Enantioselective α-benzylation of aldehydes via photoredox organocatalysis..



Tech. Note (1)
Ref. (1)



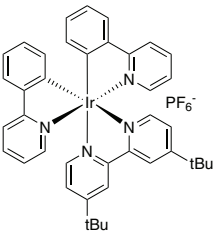
Tech. Note (2)
Ref. (2)

References:

1. *Adv. Synth. Cat.,* **2014**, *356*, 557
2. *J. Amer. Chem. Soc.,* **2010**, *132*, 13600

77-0410 NEW

(4,4'-Di-t-butyl-2,2'-bipyridine)bis[2-(2-pyridinyl-kN)phenyl-kC]iridium(III) hexafluorophosphate, 99% *(676525-77-2)*
$[Ir(C_{18}H_{24}N_2)(C_{11}H_8N)_2]^+PF_6^-$; FW: 913.95; yellow xtl.
Note: Photocatalyst



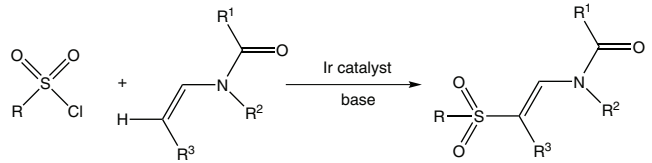
100mg
500mg

Technical Notes:

1. This Iridium catalyst is used in the synthesis of β-amidovinyl sulfones via visible-light photoredox catalysis.
2. Numerous uses of this photoredox catalyst are reported (see Ref. 2).

IRIDIUM (Compounds)

77-0410 ***(continued)*** **(4,4'-Di-t-butyl-2,2'-bipyridine)bis[2-(2-pyridinyl-kN)phenyl-kC]iridium(III) hexafluorophosphate, 99%** *(676525-77-2)*



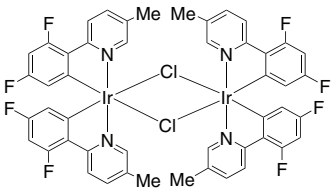
Tech. Note (1)
Ref. (1)

References:

1. *Adv. Synth. Cat.,* **2013**, *355*, 809
2. *Chem. Rev.,* **2013**, *113*, 5322, review

77-0345 NEW

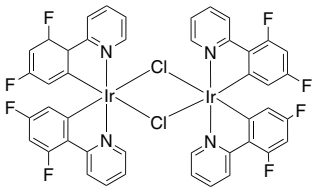
Di-μ-chlorotetrakis[3,5-difluoro-2-(5-methyl-2-pyridinyl-κN)phenyl-κC] diiridium, 98% *(1335047-33-0)*
$C_{48}H_{32}Cl_2F_8Ir_2N_4$; FW: 1272.11; yellow solid
Note: Precursor for Photocatalyst Synthesis



250mg
1g

77-0365 NEW

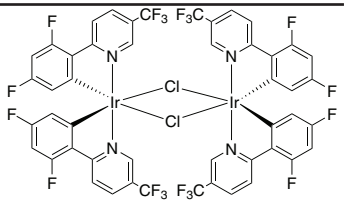
Di-μ-chlorotetrakis[3,5-difluoro-2-(2-pyridinyl-κN)phenyl-κC]diiridium, 98% *(562824-27-5)*
$C_{44}H_{24}Cl_2F_8Ir_2N_4$; FW: 1216.05 ; yellow solid
air sensitive
Note: Precursor for Photocatalyst Synthesis



250mg
1g

77-0468 NEW

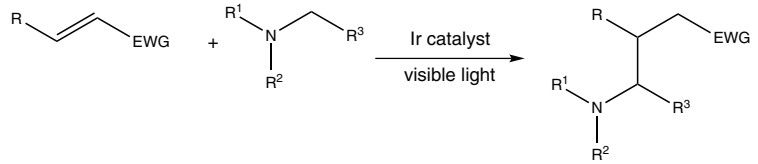
Di-μ-chlorotetrakis[3,5-difluoro-2-[5-trifluoromethyl-2-pyridinyl-kN)phenyl-kC] diiridium(III), 99% *(870987-64-7)*
$C_{48}H_{20}Cl_2F_{20}Ir_2N_4$; FW: 1488.01; yellow xtl.
Note: Precursor for Photocatalyst Synthesis



50mg
250mg

Technical Note:

1. Addition to electron–deficient alkenes using a photoredox catalyst.



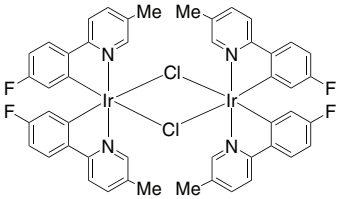
Tech. Note (1)
Ref. (1)

References:

1. *J. Am. Chem. Soc.*, **2012**, *134*, 3338.

77-0335 NEW

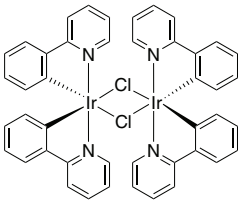
Di-μ-chlorotetrakis[5-fluoro-2-(5-methyl-2-pyridinyl-κN)phenyl-κC]diiridium, 98% *(808142-89-4)*
$C_{48}H_{36}Cl_2F_4Ir_2N_4$; FW: 1200.15; yellow solid
Note: Precursor for Photocatalyst Synthesis



250mg
1g

IRIDIUM (Compounds)

77-0455 **Di-μ-chlorotetrakis[2-(2-pyridinyl-kN) phenyl-kC]diiridium(III), 99%** *(603109-48-4)*
$C_{44}H_{32}Cl_2Ir_2N_4$; FW: 1072.09; yellow-green xtl.
Note: Precursor for Photocatalyst Synthesis



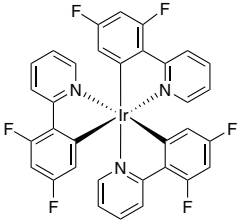
250mg
1g

Technical Note:

1. Iridium complex is a photoredox catalyst having numerous uses in electroluminescent materials and devices, organic light-emitting diodes, display devices and chemosensors.

96-7780 **Iridium Photocatalyst Kit**
See page 19

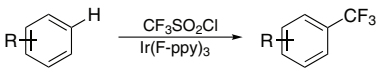
77-7030 **Tris[2-(2,4-difluorophenyl)pyridine] iridium(III), 95%** *(387859-70-3)*
NEW
$C_{33}H_{18}F_6IrN_3$; FW: 762.72; yellow pwdr.
air sensitive
Note: Photocatalyst



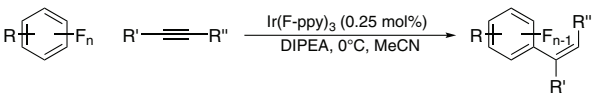
50mg
250mg

Technical Notes:

1. Photoredox catalysis for trifluoromethylation of arenes and heteroarenes.
2. Photocatalyst for C–F alkenylation coupling reactions between perfluoroarenes and alkynes.



Tech. Note (1)
Ref. (1)

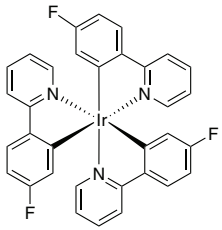


Tech. Note (2)
Ref. (2)

References:

1. *Nature*, **2011**, *480*, 224.
2. *Chem. Sci.,* **2016**, *7*, 6796.

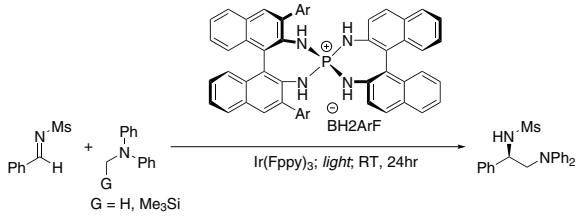
77-6100 **Tris[5-fluoro-2-(2-pyridinyl-kN)phenyl-kC] iridium(III), 95%** *(370878-69-6)*
NEW
$C_{33}H_{21}F_3IrN_3$; FW: 708.75; yellow pwdr.
air sensitive
Note: Photocatalyst



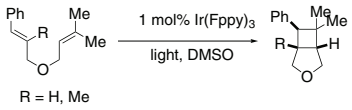
50mg
250mg

Technical Notes:

1. Photosensitizer for the enantioselective coupling reaction between (N-arylamino)methanes and (N-methanesulfonyl)-aldimines catalyzed by P-Spiro chiral (arylamino)phosphonium catalyst.
2. Photocatalyst for [2+2] styrene cycloadditions.
3. Photocatalyst for azoylation of trimethoxybenzene by via C−H functionalization.



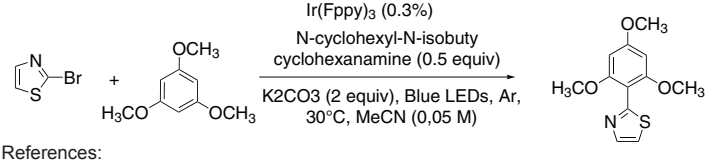
Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)

IRIDIUM (Compounds)

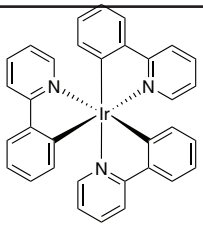
77-6100 **Tris[5-fluoro-2-(2-pyridinyl-kN)phenyl-kC]iridium(III), 95%** *(370878-69-6)*
(continued)



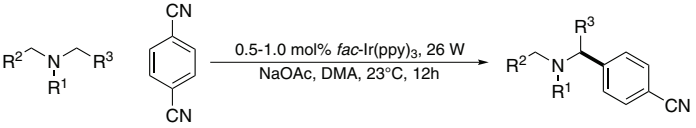
Tech. Note (3)
Ref. (3)

References:
1. *J. Org. Chem.,* **2016**, *81*, 6953.
2. *Chem. Sci.,* **2016**, *7*, 6796.
3. *Org. Lett.,* **2016**, *18*, 3996.

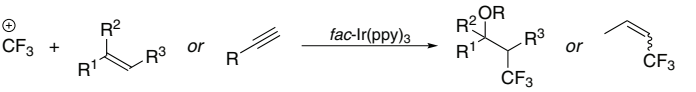
77-7015 **Tris(2-phenylpyridinato-C2,N)iridium(III), 95%** 50mg
NEW *(94928-86-8)* 250mg
$C_{33}H_{24}IrN_3$; yellow pwdr.
air sensitive
Note: Photocatalyst



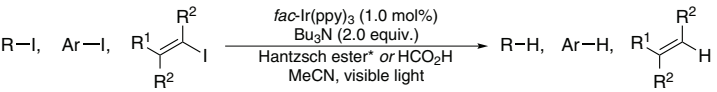
Technical Notes:
1. Photocatalyst for α-amino C–H arylation of cyano(hetero)arenes by tertiary amines
2. Photocatalyst for trifluoromethylation of alkenes and alkynes
3. Photocatalyst for reduction of alkyl, alkenyl, aryl iodides (a) and intramolecular reductive cyclizations (d)
4. Photocatalyst for organocatalyst assisted direct arylation of allylic sp^3 C–H bonds
5. Photocatalyst for the generation multifluorinated biaryls via functionalization of the C−F bond of a perfluoroarene and C−H bond of the other arene in the presence of amines
6. Photocatalyst for visible-light photoredox arylation of thiols with various aryl halides



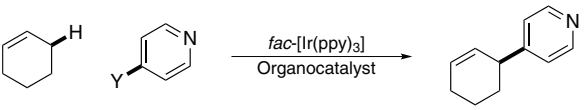
Tech. Note (1)
Ref. (1)



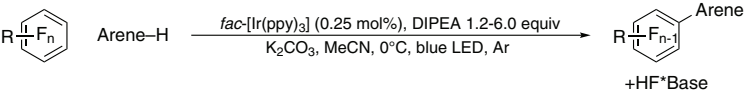
Tech. Note (2)
Ref. (2,3)



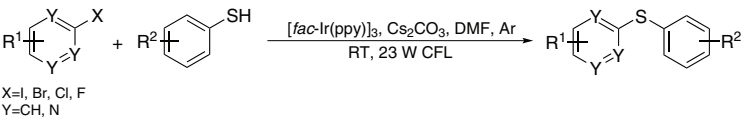
Tech. Note (3)
Ref. (4)



Tech. Note (4)
Ref. (5)



Tech. Note (5)
Ref. (6)



Tech. Note (6)
Ref. (7)

IRIDIUM (Compounds)

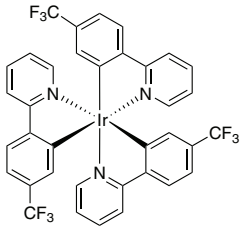
77-7015 **Tris(2-phenylpyridinato-C2,N)iridium(III), 95%** *(94928-86-8)*
(continued)

References:

1. *Science* **2011**, *334*, 1114
2. *Angew. Chem. Int. Ed.* **2012**, *51*, 9567
3. *Angew. Chem. Int. Ed.* **2014**, *53*, 539
4. *Nat. Chem.* **2012**, *4*, 854
5. *Nature* **2015** *519*, 74
6. *J. Am. Chem. Soc.* **2016**, *138*, 2520
7. *Angew. Chem. Int. Ed.* **2017**, *56*, 874

77-6580 NEW

Tris[(2-(2-pyridinyl-kN)-5-(trifluoromethyl) phenyl-kC]iridium(III), 95% *(500295-52-3)*
$C_{36}H_{21}F_9IrN_3$; FW: 858.78; yellow solid
air sensitive
Note: Photocatalyst

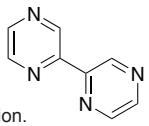


50mg
250mg

NITROGEN (Compounds)

07-0750 NEW

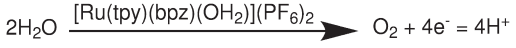
2,2'-Bipyrazine, 95% *(10199-00-5)*
$C_8H_6N_4$; FW: 158.16; light-brown solid
air sensitive
Note: Ligand for Photocatalyst Synthesis



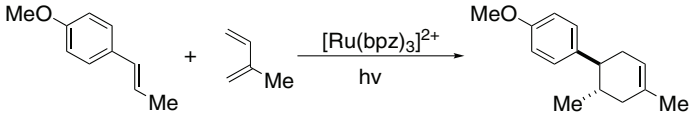
250mg
1g

Technical Notes:

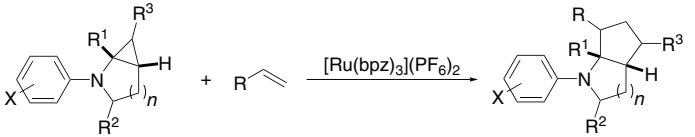
1. Ligand for the ruthenium- promoted catalytic water oxidation reaction.
2. Ligand for the ruthenium promoted photocatalytic Diels-Alder cycloaddition.
3. Ligand for the ruthenium photocatalyzed intermolecular [3+2] cycloaddition of cyclopropylamines with olefins.
4. Ligand for the ruthenium mediated photocatalytic reaction for the preparation of N-arylindoles.
5. Endoperoxide synthesis by photocatalytic aerobic [2+2+2] cycloadditions.
6. $[Ru(bpz)_3](PF_6)_2$ catalyzed anti-Markovnikov hydrothiolation of olefins with a variety of thiols.
7. $[Ru(bpz)_3](PF_6)_2$ catalyzed [3+2] photooxygenation of aryl cyclopropanes.
8. $[Ru(bpz)_3](PF_6)_2$ catalyzed intermolecular [3 + 2] annulation of cyclopropylanilines with alkynes.



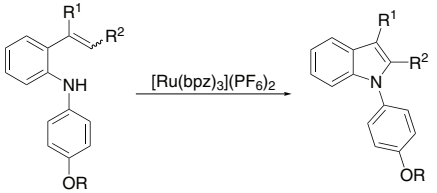
Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)



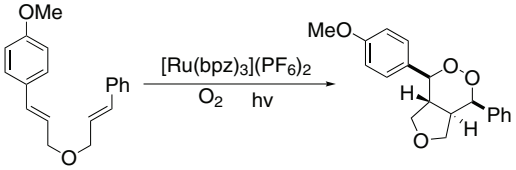
Tech. Note (3)
Ref. (3)



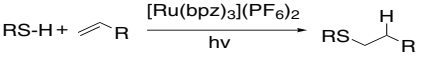
Tech. Note (4)
Ref. (4)

NITROGEN (Compounds)

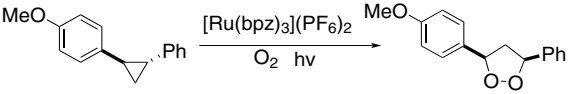
07-0750 **2,2'-Bipyrazine, 95%** *(10199-00-5)*
(continued)



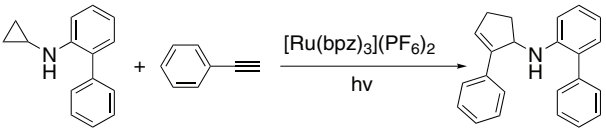
Tech. Note (5)
Ref. (5)



Tech. Note (6)
Ref. (6)



Tech. Note (7)
Ref. (7)

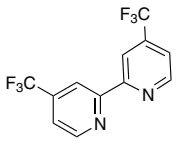


Tech. Note (8)
Ref. (8)

References:

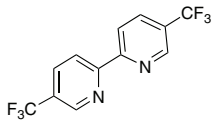
1. *J. Am. Chem. Soc.*, **2008**, *130,* 16462.
2. *J. Am. Chem. Soc.*, **2011**, *133,* 19350.
3. *Angew. Chem. Int. Ed.,.*, **2012**, *51,* 222.
4. *Angew. Chem. Int. Ed.,.*, **2012**, *51,* 9562.
5. *Org. Lett.,.*, **2012**, *14,* 1640.
6. *J. Org. Chem.,.*, **2013**, *78,* 2046.
7. *Tetrahedron*, **2014**, *70*, 4270.
8. *Beilstein J. Org. Chem.,* , **2014**, *10*, 975.

07-1425 NEW
4,4'-Bis(trifluoromethyl)-2,2'-bipyridine, min. 95%
(142946-79-0)
$C_{12}H_6F_6N_2$; FW: 292.17; off-white to light yellow pwdr.
air sensitive
Note: Ligand for Photocatalyst Synthesis



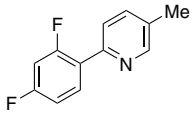
1g
5g

07-1430 NEW
5,5'-Bis(trifluoromethyl)-2,2'-bipyridine, min 97%
(142946-80-3)
$C_{12}H_6F_6N_2$; FW: 292.17; White pwdr.
air sensitive
Note: Ligand for Photocatalyst Synthesis



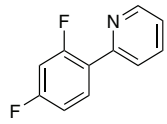
1g
5g

07-1280 NEW
2-(2,4-Difluorophenyl)-5-methylpyridine, 95%
(583052-21-5)
$C_{12}H_9F_2N$; FW: 205.20; white solid
air sensitive
Note: Ligand for Photocatalyst Synthesis



500mg
2g

07-1420 NEW
2-(2,4-Difluorophenyl)pyridine, min. 97% *(391604-55-0)*
$C_{11}H_7F_2N$; FW: 191.17; white solid
air sensitive
Note: Ligand for Photocatalyst Synthesis

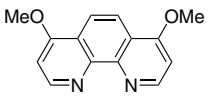


1g
5g

NITROGEN (Compounds)

07-1923 NEW HAZ

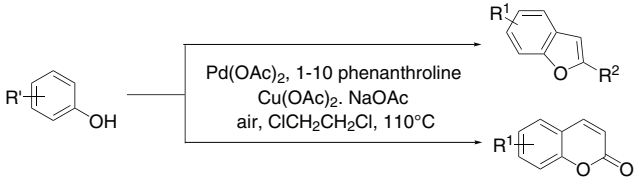
4,7-Dimethoxy-1,10-phenanthroline, 98% *(92149-07-0)*
$C_{14}H_{10}N_2O_2$; FW: 238.24; white to off-white pwdr.;
m.p. 210-212°; d. 1.25
air sensitive
Note: Ligand for Photocatalyst Synthesis



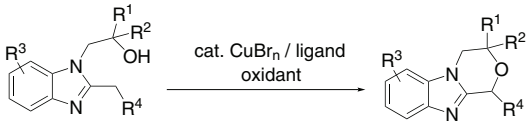
250mg
1g

Technical Notes:

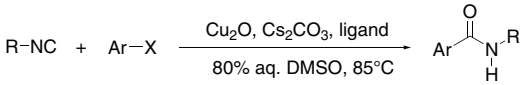
1. Palladium-catalyzed synthesis of benzofurans and coumarins from phenols and olefins.
2. Copper-catalyzed benzylic C(sp3)-H alkoxylation of heterocyclic compounds.
3. Synthesis of amides via copper-catalyzed amidation of aryl halides using isocyanides.
4. Iridium-catalyzed silylation of aryl C-H bonds.
5. Palladium-catalyzed intramolecular cyclization of nitroalkenes: synthesis of thienopyrroles.
6. A Copper-catalyzed N-alkynylation route to 2-substitued N-alkynyl pyrroles and their cyclization into pyrrolo[2,1-c]oxazin-1-ones



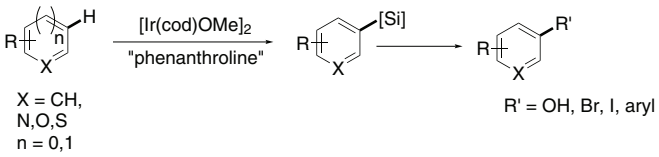
Tech. Note (1)
Ref. (1)



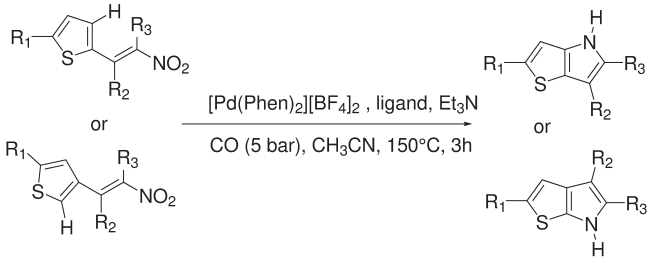
Tech. Note (2)
Ref. (2)



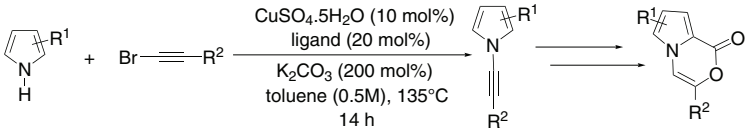
Tech. Note (3)
Ref. (3)



Tech. Note (4)
Ref. (4)



Tech. Note (5)
Ref. (5)



Tech. Note (6)
Ref. (6)

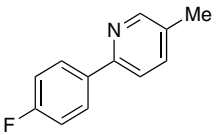
NITROGEN (Compounds)

07-1923 **4,7-Dimethoxy-1,10-phenanthroline, 98%** *(92149-07-0)*
(continued)

References:

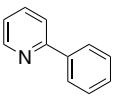
1. *Angew. Chem. Int. Ed.*, **2013**, *52*, 12669.
2. *Organic & Biomolecular Chemistry,* **2014**, *12*, 2528.
3. *Tetrahedron Letts.*, **2014**, *55*, 4981.
4. *J. Am. Chem. Soc.*, **2015**, *137*, 592.
5. *European Journal of Organic Chemistry*, **2017**, *2017(14)*, 1902.
6. *Synthesis,* **2017**, *49*, 2544.

07-1410 NEW
2-(4-Fluorophenyl)-5-methylpyridine, min. 97% *(85237-65-6)*
$C_{12}H_{10}FN$; FW: 187.07; Off white pwdr.
air sensitive
Note: Ligand for Photocatalyst Synthesis



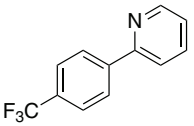
1g
5g

07-1780 NEW
2-Phenylpyridine, 95% *(1008-89-5)*
$C_{11}H_9N$; FW: 155.20; amber liquid; b.p. 268-270º; f.p. 230º; d. 1.086
air sensitive
Note: Ligand for Photocatalyst Synthesis



1g

07-2625 NEW
2-[4-(Trifluoromethyl)phenyl]pyridine, 95% *(203065-88-7)*
$C_{12}H_8F_3N$; FW: 223.19; white to yellow solid
air sensitive
Note: Ligand for Photocatalyst Synthesis

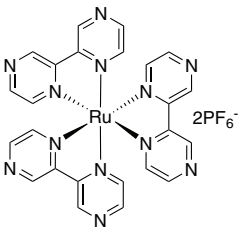


1g

RUTHENIUM (Compounds)

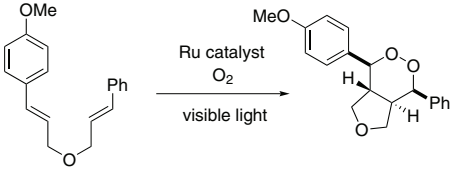
96-4450 **Ruthenium Photocatalyst Kit**
See page 21

44-7910 NEW
Tris(2,2'-bipyrazine)ruthenium(II) hexafluorophosphate, 95% *(80907-56-8)*
$C_{24}H_{18}F_{12}N_{12}P_2Ru$; FW: 865.48; red pwdr.
air sensitive
Note: Photocatalyst.



50mg
250mg

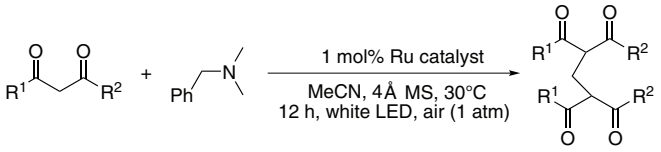
Technical Notes:
1. Endoperoxide synthesis by photocatalytic aerobic [2+2+2] cycloadditions.
2. Aerobic oxidation of a tertiary aliphatic amine under visible-light photocatalysis. Facile synthesis of methylene-bridged bis-1,3-dicarbonyl compounds.
3. Hydrophosphinylation of unactivated alkenes with secondary phosphine oxides under visible-light photocatalysis.
4. [3+2] Photooxygenation of aryl cyclopropanes via visible light photocatalysis.
5. Photocatalytic synthesis of dihydrobenzofurans by oxidative cycloaddition of phenols.



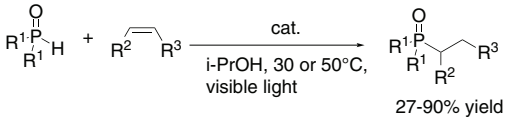
Tech. Note (1)
Ref. (1)

RUTHENIUM (Compounds)

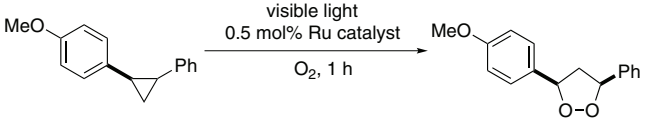
44-7910 **Tris(2,2'-bipyrazine)ruthenium(II) hexafluorophosphate, 95%** *(80907-56-8)*
(continued)



Tech. Note (2)
Ref. (2)



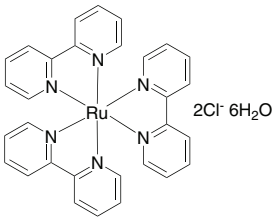
Tech. Note (3)
Ref. (3)



Tech. Note (4)
Ref. (4)

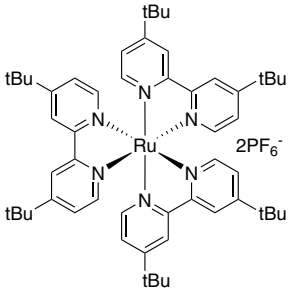
References:
1. *Org. Lett.*, **2012**, *14*, 1640.
2. *Chemistry – An Asian Journal*, **2012**, *7*, 2764.
3. *Green Chemistry*, **2013**, *15*, 1844.
4. *Advanced Synthesis & Catalysis*, **2014**, *356*, 2831.
5. *J. Am. Chem. Soc.*, **2015**, *137*, 5654.

44-7900 **Tris(2,2'-bipyridyl)ruthenium(II) chloride hexahydrate, min. 98%** *(50525-27-4)*
$Ru(C_{10}H_8N_2)_3Cl_2{\cdot}6H_2O$; FW: 640.54 (748.63); orange to red xtl.
Note: Photocatalyst



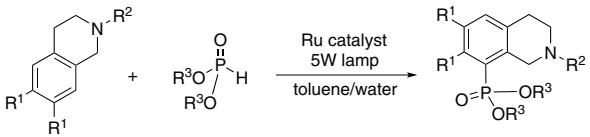
250mg
1g
5g

44-7940 **NEW**
Tris[4,4'-bis(t-butyl)-2,2'-bipyridine] ruthenium(II) hexafluorophosphate, 95% *(75777-87-6)*
$C_{54}H_{72}F_{12}N_6RuP_2$; FW: 1196.19; red pwdr.
air sensitive
Note: Photocatalyst.



50mg
250mg

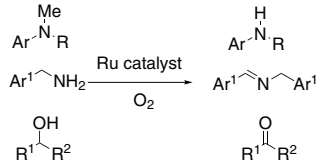
Technical Notes:
1. Photoredox catalysed C-P bond formation reactions – visible light mediated oxidative phosphonylations of amines.
2. Aerobic oxidation of a tertiary aliphatic amine under visible-light photocatalysis: facile synthesis of methylene-bridged bis-dicarbonyl compounds.
3. Photoredox catalysis as an efficient tool for the aerobic oxidation of amines and alcohols.
4. Visible-light induced, direct synthesis of polysubstituted furans from cyclopropyl ketones.



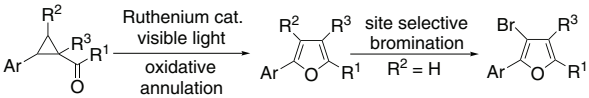
Tech. Note (1)
Ref. (1)

RUTHENIUM (Compounds)

44-7940 **Tris[4,4'-bis(t-butyl)-2,2'-bipyridine]ruthenium(II) hexafluorophosphate, 95%** *(75777-87-6)*
(continued)



Tech. Note (2)
Ref. (2)



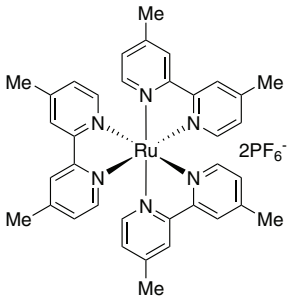
Tech. Note (3)
Ref. (3)

References:

1. *Chem. Commun.*, **2011**, *47*, 8679.
2. *Chemistry – An Asian Journal*, **2012,** *7*, 2764.
3. ACS Catalysis, **2012**, *2,* 2810.
4. *J. Org. Chem.*, **2016**, *81*, 7008.

44-7930 **NEW**

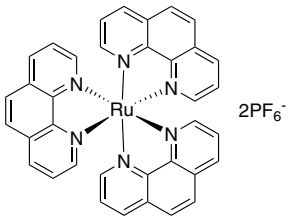
Tris(4,4'-dimethyl-2,2'-bipyridine) ruthenium(II) hexafluorophosphate, 95%, DMBPY *(83605-44-1)*
$C_{36}H_{36}F_{12}N_6RuP_2$; FW: 943.71; red pwdr.
air sensitive
Note: Photocatalyst.



50mg
250mg

44-7955 **NEW**

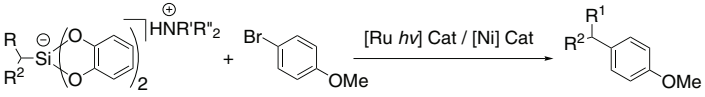
Tris(1,10-phenanthroline)ruthenium(II) hexafluorophosphate, 95% *(60804-75-3)*
$C_{36}H_{24}F_{12}N_6RuP_2$; FW: 931.62; red pwdr.
air sensitive
Note: Photocatalyst



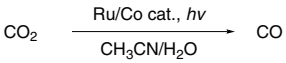
50mg
250mg

Technical Notes:

1. Photoredox catalyst for nickel assisted cross-coupling reactions of ammonium alkylsilicates with aryl bromides
2. A photosensitizer for cobalt catalyzed visible-light driven CO_2 - Reduction to CO in CH_3CN/H_2O Solution



Tech. Note (1)
Ref. (1)



Tech. Note (2)
Ref. (2)

References:

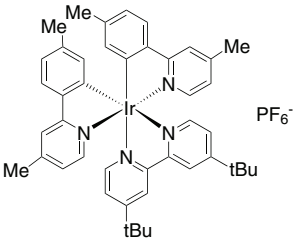
1. *J. Am. Chem. Soc.*, **2016**, *138*, 475.
2. *Angew. Chem. Int. Ed.*, **2017**, *56*, 738.

KITS - Iridium Photocatalyst Kit

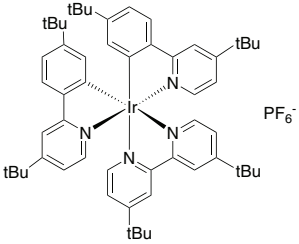
96-7780 **Iridium Photocatalyst Kit**

NEW

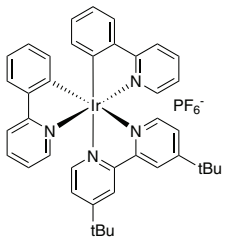
Components also available for individual sale.
Contains the following:



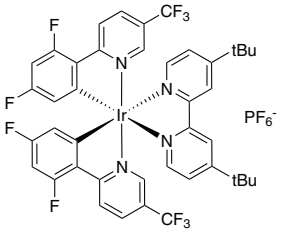
77-0218 50mg



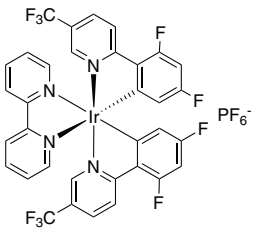
77-0285 50mg



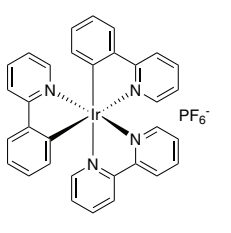
77-0410 100mg



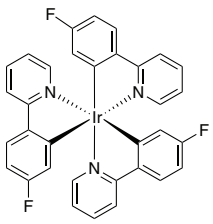
77-0425 50mg



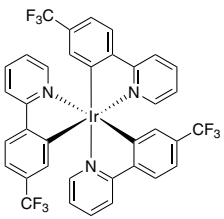
77-0453 50mg



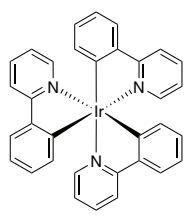
77-0465 100mg



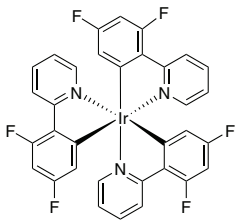
77-6100 50mg



77-6580 50mg



77-7015 50mg



77-7030 50mg

KITS - Iridium Photocatalyst Kit

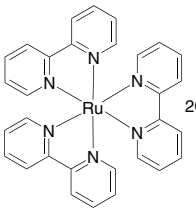
77-0218	4,4'-Bis(t-butyl-2,2'-bipyridine]bis[5-methyl-2-(4-methyl-2-pyridinyl-kN)phenyl-kC]iridium hexafluorophosphate, 95% *(1607469-49-7)*	50mg	See page 7
77-0285	[4,4'-Di-t-butyl-2,2'-bipyridine][bis[5-(t-butyl)-2-[4-(t-butyl)-2-pyridinyl-kN]phenyl-kC]iridium(III) hexafluorophosphate, 95% *(808142-80-5)*	50mg	See page 9
77-0410	(4,4'-Di-t-butyl-2,2'-bipyridine)bis[2-(2-pyridinyl-kN)phenyl-kC] iridium(III) hexafluorophosphate, 99% *(676525-77-2)*	100mg	See page 9
77-0425	(4,4'-Di-t-butyl-2,2'-bipyridine)bis[3,5-difluoro-2-[5-trifluoromethyl-2-pyridinyl-kN)phenyl-kC]iridium(III) hexafluorophosphate, 99% *(870987-63-6)*	50mg	See page 9
77-0453	(2,2'-Bipyridine)bis[3,5-difluoro-2-[5-trifluoromethyl-2-pyridinyl-kN)phenyl-kC]iridium(III) hexafluorophosphate, 99% *(1092775-62-6)*	50mg	See page 5
77-0465	(2,2'-Bipyridine)bis[2-pyridinyl-kN)phenyl-kC]iridium(III) hexafluorophosphate, 99% *(106294-60-4)*	100mg	See page 6
77-6100	Tris[5-fluoro-2-(2-pyridinyl-kN)phenyl-kC]iridium(III), 95% *(370878-69-6)*	50mg	See page 11
77-6580	Tris[(2-(2-pyridinyl-kN)-5-(trifluoromethyl)phenyl-kC] iridium(III), 95% *(500295-52-3)*	50mg	See page 13
77-7015	Tris(2-phenylpyridinato-C2,N)iridium(III), 95% *(94928-86-8)*	50mg	See page 12
77-7030	Tris[2-(2,4-difluorophenyl)pyridine]iridium(III), 95% *(387859-70-3)*	50mg	See page 11

KITS - Ruthenium Photocatalyst Kit

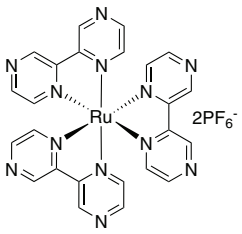
96-4450 **Ruthenium Photocatalyst Kit**

NEW

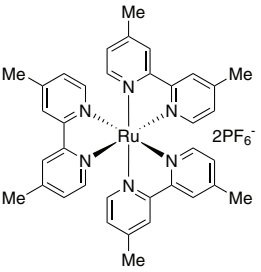
Components also available for individual sale.
Contains the following:



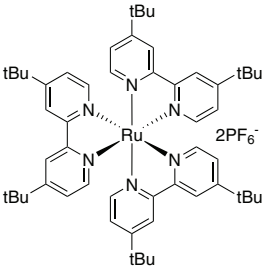
44-7900 250mg



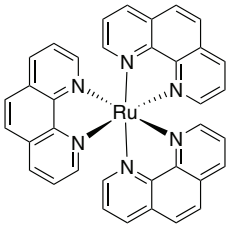
44-7910 50mg



44-7930 50mg



44-7940 50mg



44-7955 50mg

44-7900	Tris(2,2'-bipyridyl)ruthenium(II) chloride hexahydrate, min. 98% *(50525-27-4)*	250mg	See page 17
44-7910	Tris(2,2'-bipyrazine)ruthenium(II) hexafluorophosphate, 95% *(80907-56-8)*	50mg	See page 16
44-7930	Tris(4,4'-dimethyl-2,2'-bipyridine)ruthenium(II) hexafluorophosphate, 95%, DMBPY *(83605-44-1)*	50mg	See page 18
44-7940	Tris[4,4'-bis(t-butyl)-2,2'-bipyridine]ruthenium(II) hexafluorophosphate, 95% *(75777-87-6)*	50mg	See page 17
44-7955	Tris(1,10-phenanthroline)ruthenium(II) hexafluorophosphate, 95% *(60804-75-3)*	50mg	See page 18

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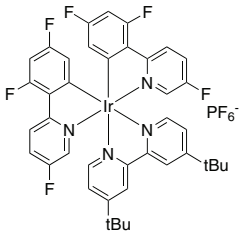
77-0340

NEW

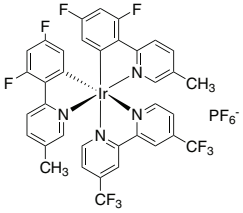
[4,4'-Bis(1,1-dimethylethyl)-2,2'-bipyridine]bis[3,5-difluoro-2-(5-fluoro-2-pyridinyl)phenyl]iridium hexafluorophosphate *(2042201-18-1)*
$C_{40}H_{34}F_{12}IrN_4P$; FW: 1021.89
air sensitive
Note: Photocatalyst



77-0380

NEW

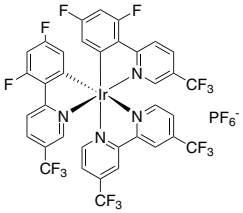
4,4'-Bis(trifluoromethyl)-2,2'-bipyridinebis[3,5-difluoro-2-[5-methyl-2-pyridinyl)phenyl] iridium(III) hexafluorophosphate
$C_{36}H_{22}F_{16}IrN_4P$; FW: 1037.77
air sensitive
Note: Photocatalyst



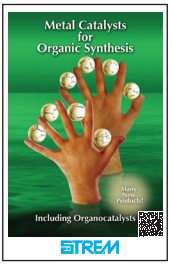
77-0360

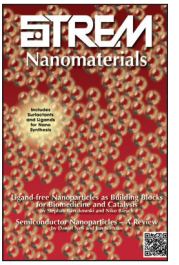
NEW

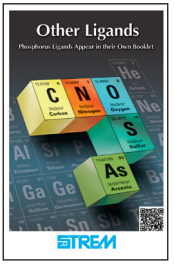
4,4'-Bis(trifluoromethyl)-2,2'-bipyridinebis[3,5-difluoro-2-[5-trifluoromethyl-2-pyridinyl)phenyl] iridium(III) hexafluorophosphate *(2030437-90-0)*
$C_{36}H_{16}F_{22}IrN_4P$; FW: 1145.69
air sensitive
Note: Photocatalyst

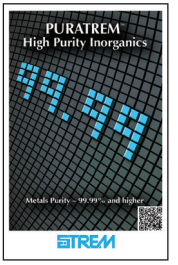


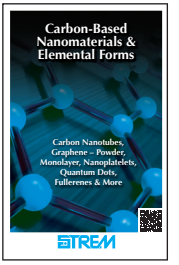
Available Booklets

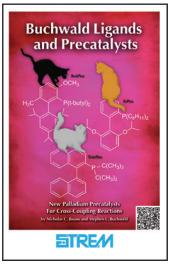


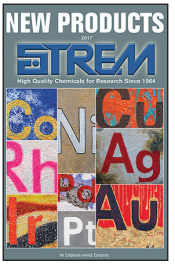


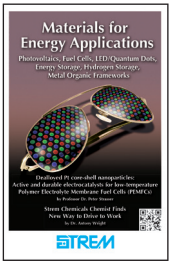


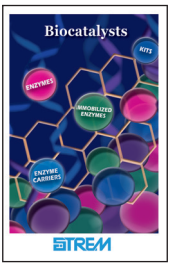


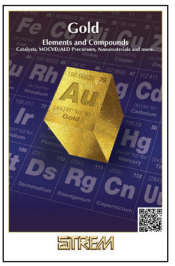


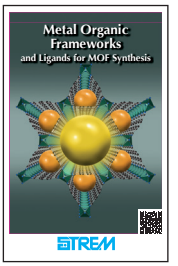












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