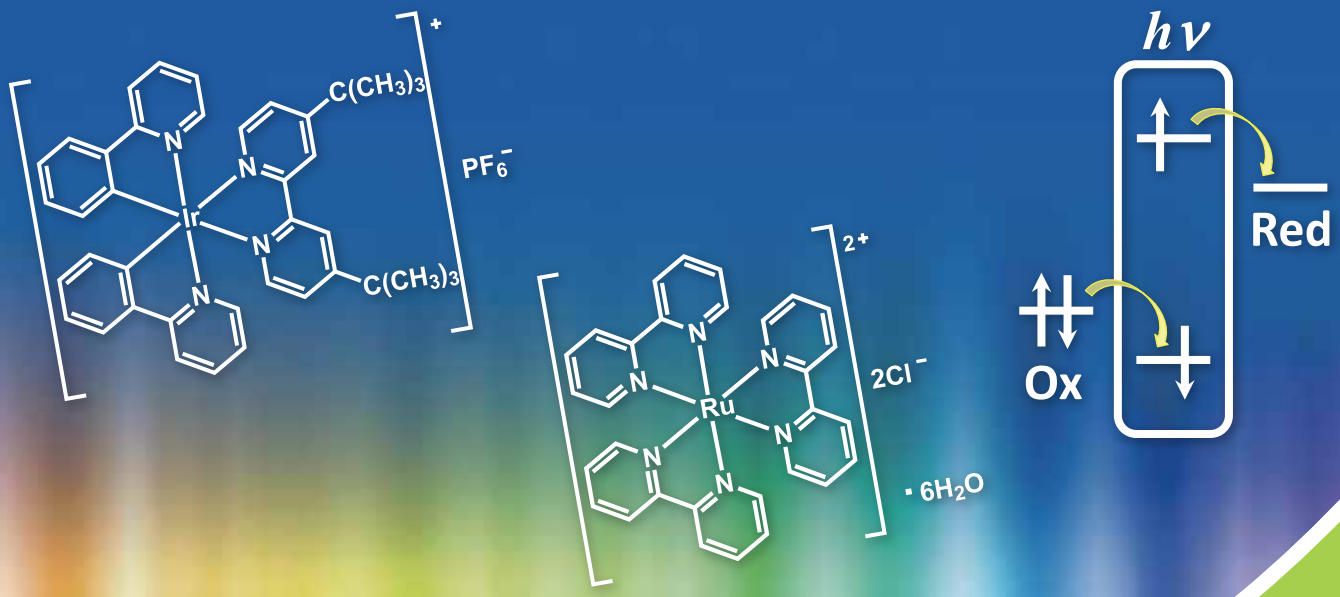
CHEMISTRY MATERIALS

Visible Light Photoredox Catalysts



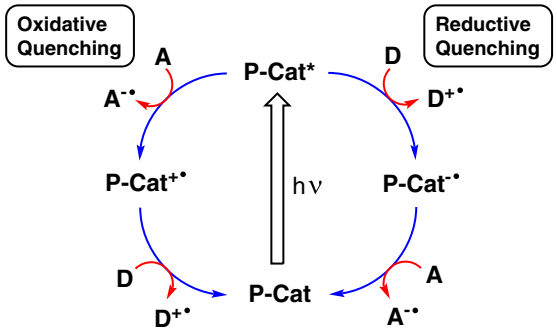
Metal Complex Catalysts

Organic Catalysts

Visible Light Photoredox Catalysts

A photoreaction undergoes a particular molecular conversion to form a product that is not obtained by a thermal reaction. Recently, visible light induced photoreactions were intensively developed. A photoreaction under visible light does not require high energy UV light and the reactions occur under mild conditions to avoid forming unexpected by-products.

A photocatalyst working for both one-electron oxidation and reduction under visible light irradiation, the so-called 'visible light photoredox catalyst', receives much attention, because there is possibility for use as a solar energy source.[1] A reaction mediated by a photoredox catalyst particularly works simply, whereas a thermal reaction under coexistence of oxidizing and reducing reagents is normally hard to make work. The reaction cycle using a photoredox catalyst involves both oxidative and reductive pathways, thus it shows a 'redox-neutral' mechanism overall.

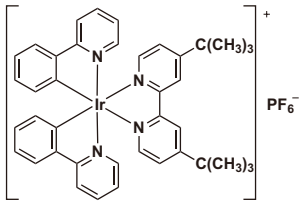


Photoredox catalysis by oxidative and reductive pathways

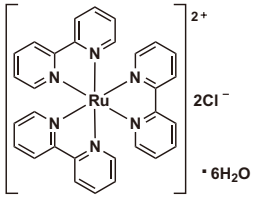
The formation of radical species normally requires a photoirradiation, redox reactions, and thermal activation by supplying high energy. The research field of photocatalysis developed transition metal complex catalysts and organic catalysts to form radical species under mild conditions, such as irradiating with visible light.

Some ruthenium(II) polypyridyl complexes and iridium(III) phenylpyridyl complexes work as photoredox catalysts under irradiation of visible light.[2] These transition metal complexes are useful photocatalysts, because they can form a long-lived triplet-excited state under photoirradiation. A chemical modification of the coordinating ligands controls the redox potentials of the transition metal complexes.[3] Metal-free organic catalysts have also been developed. Some acridinium compounds with a donor-acceptor structure can be photoredox catalysts, because the excited state exhibits a long-lived charge separation by irradiating with visible light.[4] In addition, one reported that eosin and xanthene dyes are photoredox catalysts as well.[5]

Transition metal Photoredox catalysts

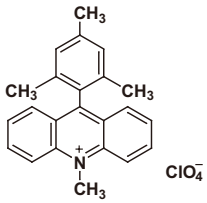


[D4887]

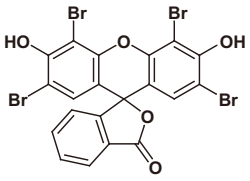


[T1655]

Transition metal-free photoredox catalysts



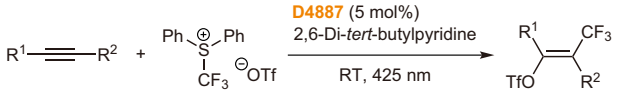
[M1774]



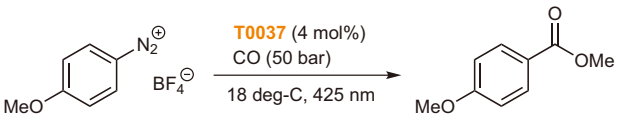
[T0035]

●Reaction examples mediated by visible light photoredox catalysts

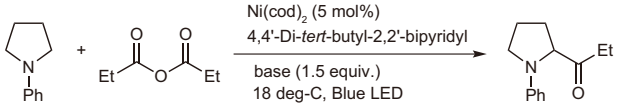
(1) Trifluoromethylation[6]



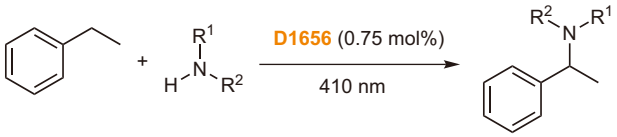
(2) Carbonylation[7]



(3) Direct acylation to C-H bond[8]



(4) Direct amination to C-H bond[9]



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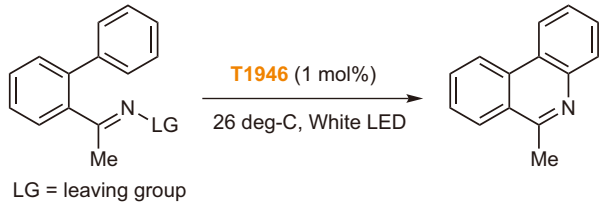
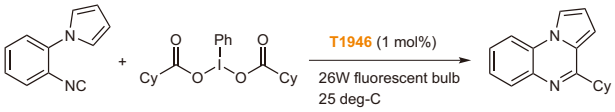
(5) Formation of iminyl radical[10)]



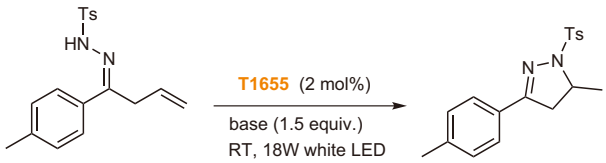
LG = leaving group

(6) Synthesis of quinoxaline derivative[11)]



(7) Formation of oxazole by [3 + 2] cycloaddition[12)]

(8) Formation of hydrazonyl radical[13)]



References

1) Review: Y. Xi, H. Yi, A. Lei, *Org. Biomol. Chem.* **2013**, *11*, 2387.
2) K. Zeitler, *Angew. Chem. Int. Ed.* **2009**, *48*, 9785.
3) Review: J. W. Tucker, C. R. J. Stephenson, *J. Org. Chem.* **2012**, *77*, 1617.
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6) R. Tomita, T. Koike, M. Akita, *Angew. Chem. Int. Ed.* **2015**, *54*, 12923.
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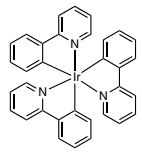
13) X.-Q. Hu, J.-R. Chen, Q. Wei, F.-L. Liu, Q.-H. Deng, A. M. Beauchemin, W.-J. Xiao, *Angew. Chem. Int. Ed.* **2014**, *53*, 12163.

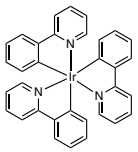
Metal Complex Catalysts

T3716 200mg 1g



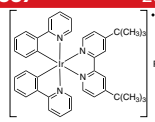
$Ir(ppy)_3$
CAS RN: 94928-86-6

T1946 200mg



$Ir(ppy)_3$ (purified by sublimation)
CAS RN: 94928-86-6

D4887 200mg



(4,4'-Di-*tert*-butyl-2,2'-bipyridine)-bis[(2-pyridinyl)phenyl]iridium(III) Hexafluorophosphate
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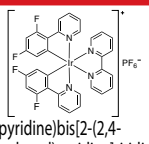
B4944 200mg



(2,2'-Bipyridine)bis[2-(2,4-difluorophenyl)pyridine]-iridium(III) Hexafluorophosphate
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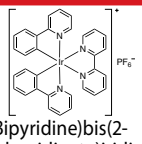
B4893 200mg



(2,2'-Bipyridine)bis(2-phenylpyridinato)iridium(III) Hexafluorophosphate
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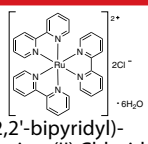
T1655 1g 5g



Tris(2,2'-bipyridyl)-ruthenium(II) Chloride Hexahydrate
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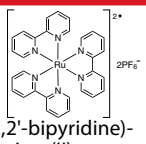
T3435 1g



Tris(2,2'-bipyridine)-ruthenium(II) Bis(hexafluorophosphate)
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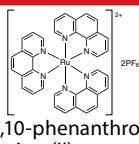
T3208 200mg 1g



Tris(1,10-phenanthroline)-ruthenium(II) Bis(hexafluorophosphate)
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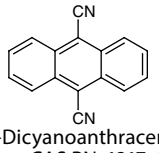
Organic Catalysts

D1656 1g 5g



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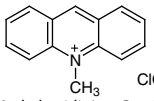

10-Methylacridinium Perchlorate
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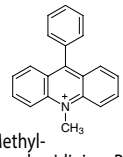
M1775 1g 5g



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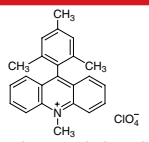
M1774 1g 5g



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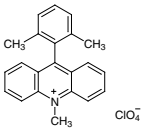
D3429 1g



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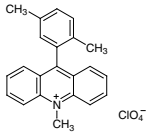
D3428 1g 5g



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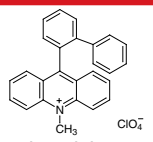

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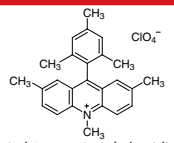
M2072 1g



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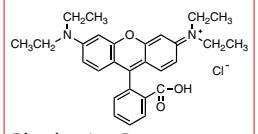
R0040 25g 250g



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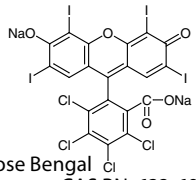
R0041 25g



Rose Bengal
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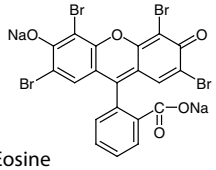
T0037 25g



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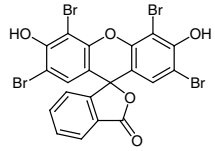

Eosin Y
CAS RN: 15086-94-9

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