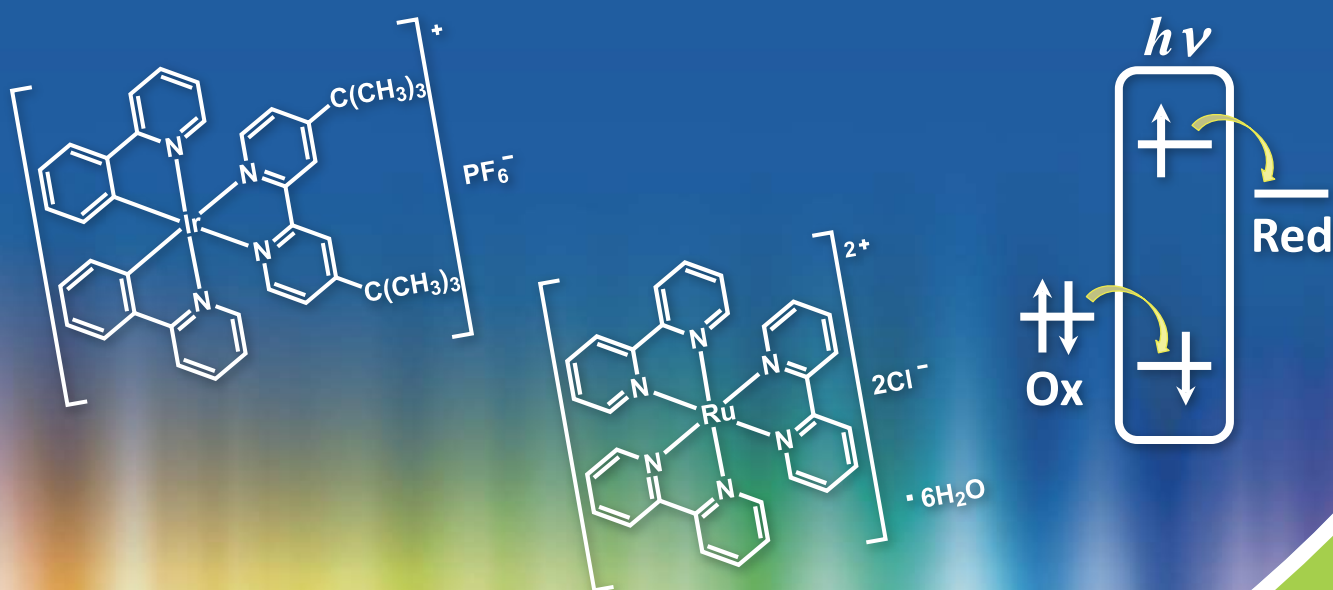


Visible Light Photoredox Catalysts



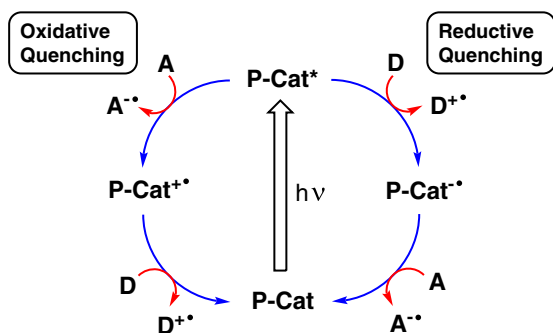
Metal Complex Catalysts

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.

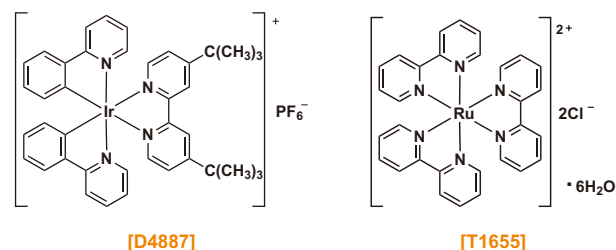


Photoredox catalysis by oxidative and reductive pathways

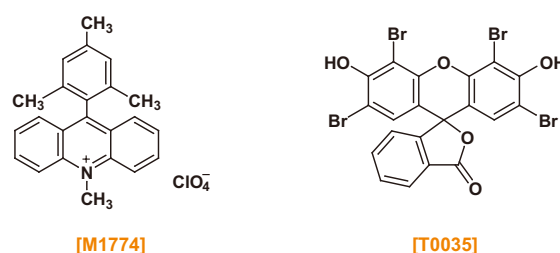
The formation of radical species normally requires a photoirradiation, redox reactions, and thermal activation by supplying high energy. The research field of photocatalysis developed transition metal complex catalysts and organic catalysts to form radical species under mild conditions, such as irradiating 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 xanthenes dyes are photoredox catalysts as well.⁵⁾

Transition metal Photoredox catalysts

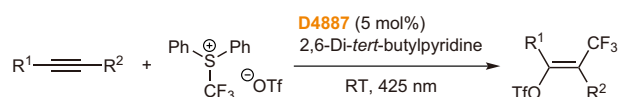


Transition metal-free photoredox catalysts

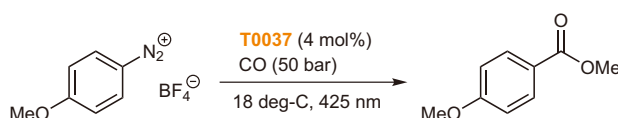


Reaction examples mediated by visible light photoredox catalysts

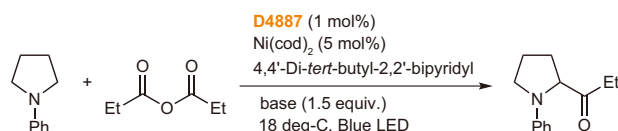
(1) Trifluoromethylation⁶⁾



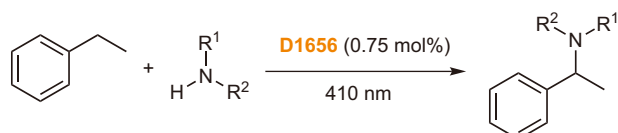
(2) Carbonylation⁷⁾

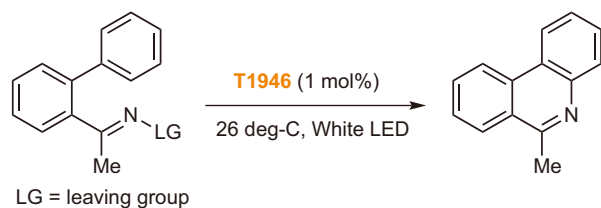
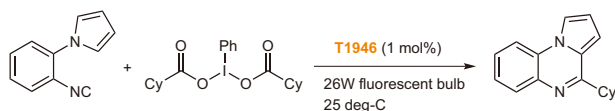
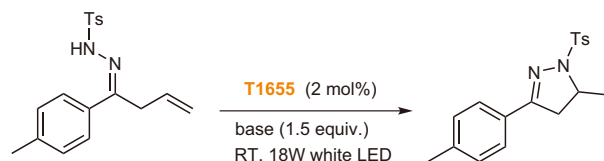


(3) Direct acylation to C-H bond⁸⁾



(4) Direct amination to C-H bond⁹⁾

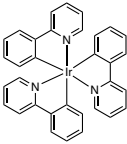
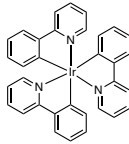
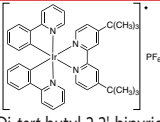
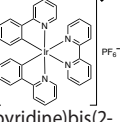
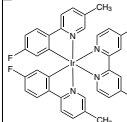
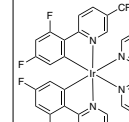
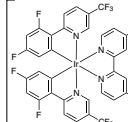
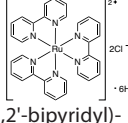
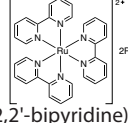
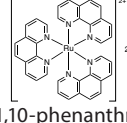
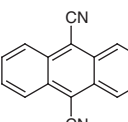
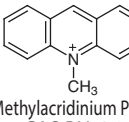
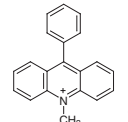
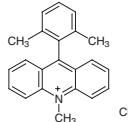
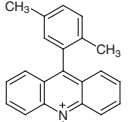
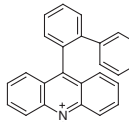
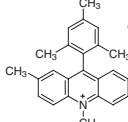
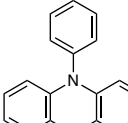
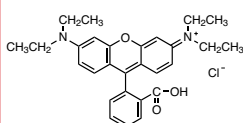
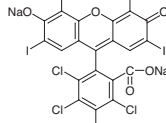
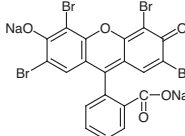
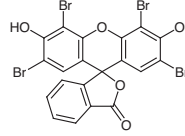


(5) Formation of iminyl radical¹⁰⁾(6) Synthesis of quinoxaline derivative¹¹⁾(7) Formation of oxazole by [3 + 2] cycloaddition¹²⁾(8) Formation of hydrazonyl radical¹³⁾

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Metal Complex Catalysts

B4944 200mg		T3716 200mg 1g		T1946 200mg		D4887 200mg	
							
<p>(2,2'-Bipyridine)bis[2-(2,4-difluorophenyl)pyridine]-iridium(III) Hexafluorophosphate CAS RN: 864163-80-4</p>		<p>$\text{Ir}(\text{ppy})_3$ CAS RN: 94928-86-6</p>		<p>$\text{Ir}(\text{ppy})_3$ (purified by sublimation) CAS RN: 94928-86-6</p>		<p>(4,4-Di-tert-butyl-2,2'-bipyridine)-bis[(2-pyridinyl)phenyl]iridium(III) Hexafluorophosphate CAS RN: 676525-77-2</p>	
B4893 200mg		B6258 200mg 1g		B6161 200mg 1g		D5817 200mg 1g	
							
<p>(2,2'-Bipyridine)bis[2-phenylpyridinato]iridium(III) Hexafluorophosphate CAS RN: 106294-60-4</p>		<p>$[\text{Ir}(p\text{-F}(\text{Me})\text{ppy})_2\text{-(4,4'-dtbbpy)}]\text{PF}_6$ CAS RN: 808142-88-3</p>		<p>$\text{Ir}[\text{dF}(\text{CF}_3)\text{ppy}]_2(\text{bpy})\text{PF}_6$ CAS RN: 1092775-62-6</p>		<p>$[\text{Ir}[\text{dF}(\text{CF}_3)\text{ppy}]_2(\text{dtbbpy})]\text{PF}_6$ CAS RN: 870987-63-6</p>	
T1655 1g 5g		T3435 1g		T3208 200mg 1g			
							
<p>Tris(2,2'-bipyridyl)-ruthenium(II) Chloride Hexahydrate CAS RN: 50525-27-4</p>		<p>Tris(2,2'-bipyridine)-ruthenium(II) Bis(hexafluorophosphate) CAS RN: 60804-74-2</p>		<p>Tris(1,10-phenanthroline)-ruthenium(II) Bis(hexafluorophosphate) CAS RN: 60804-75-3</p>			
M1774 1g 5g		D1656 1g 5g		M1787 250mg 1g		M1775 1g 5g	
							
<p>9,10-Dicyanoanthracene CAS RN: 1217-45-4</p>		<p>10-Methylacridinium Perchlorate CAS RN: 26456-05-3</p>		<p>10-Methyl-9-phenylacridinium Perchlorate CAS RN: 36519-61-6</p>			
D3429 1g		D3428 1g 5g		B2897 1g 5g		M2072 1g	
							
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P2470 1g 5g		R0040 25g 250g		R0041 25g		T0037 25g	
							
<p>10-Phenylphenothiazine CAS RN: 7152-42-3</p>		<p>Rhodamine B CAS RN: 81-88-9</p>		<p>Rose Bengal CAS RN: 632-69-9</p>		<p>Eosine CAS RN: 17372-87-1</p>	
		T0035 25g					
							
		<p>Eosin Y CAS RN: 15086-94-9</p>					

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