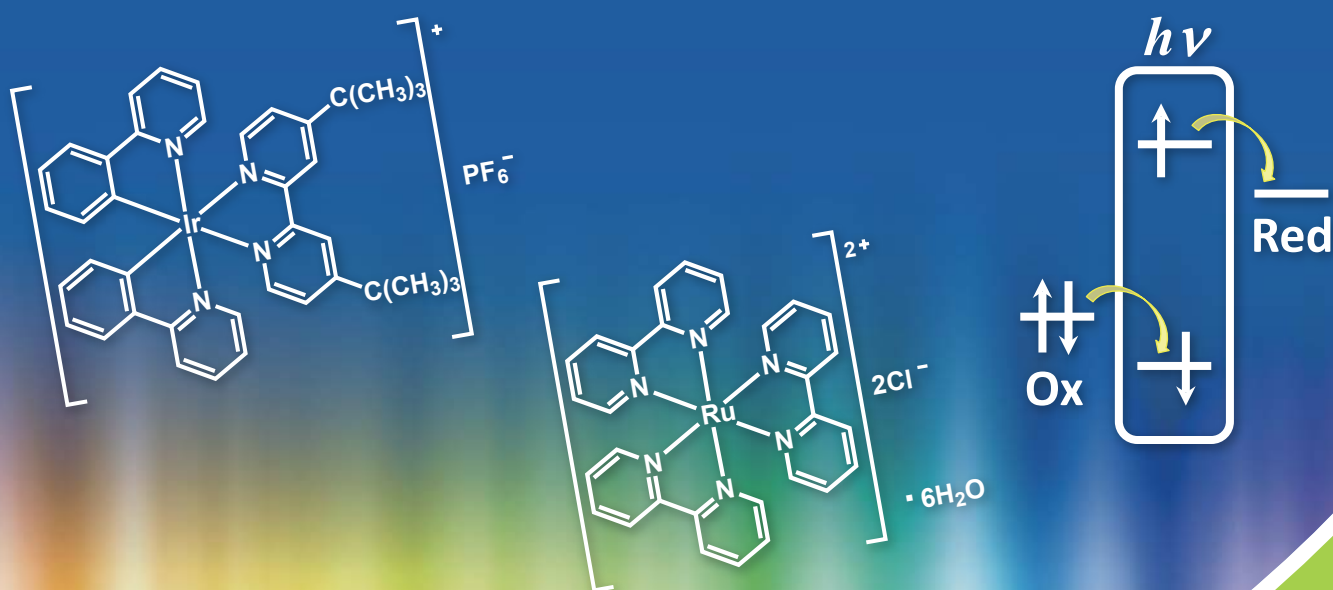


# Visible Light Photoredox Catalysts



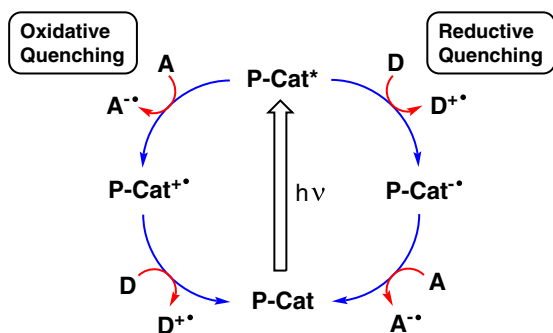
Metal Complex Catalysts

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.<sup>1)</sup> 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.

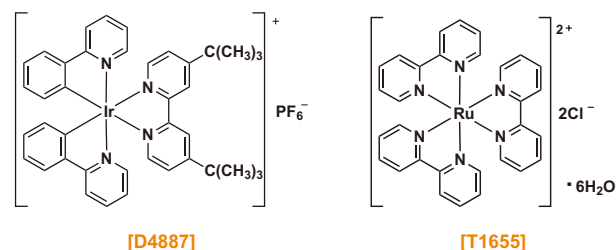


Photoredox catalysis by oxidative and reductive pathways

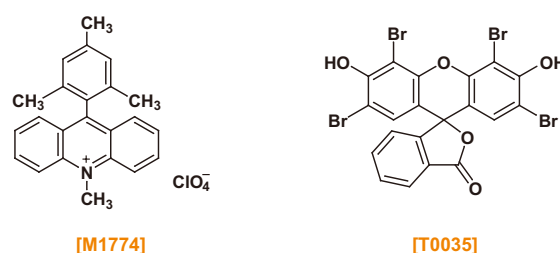
The formation of radical species normally requires a photoirradiation, redox reactions, and thermal activation by supplying high energy. The research field of photocatalysis developed transition metal complex catalysts and organic catalysts to form radical species under mild conditions, such as irradiating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

Some ruthenium(II) polypyridyl complexes and iridium(III) phenylpyridyl complexes work as photoredox catalysts under irradiation of visible light.<sup>2)</sup> 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.<sup>3)</sup> 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.<sup>4)</sup> In addition, one reported that eosin and xanthenes dyes are photoredox catalysts as well.<sup>5)</sup>

## Transition metal Photoredox catalysts



## Transition metal-free photoredox catalysts

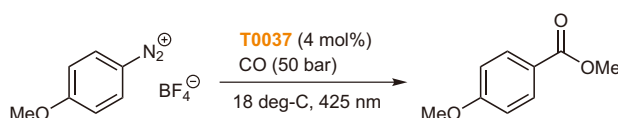


## Reaction examples mediated by visible light photoredox catalysts

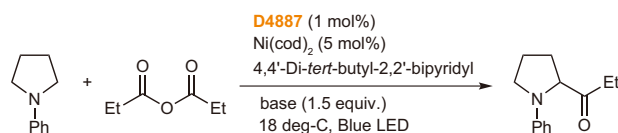
### (1) Trifluoromethylation<sup>6)</sup>



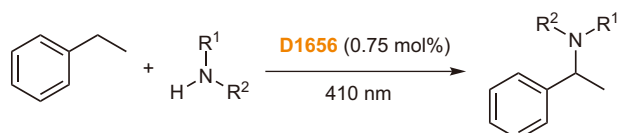
### (2) Carbonylation<sup>7)</sup>

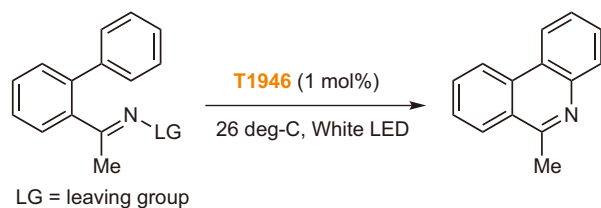
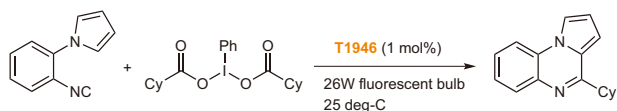
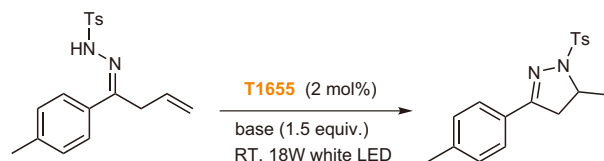


### (3) Direct acylation to C-H bond<sup>8)</sup>



### (4) Direct amination to C-H bond<sup>9)</sup>

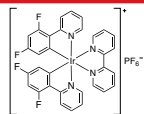
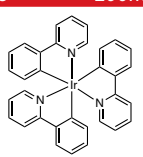
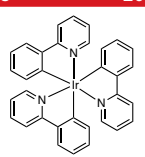
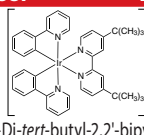
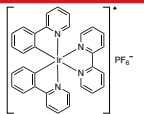
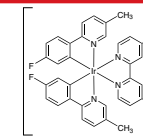
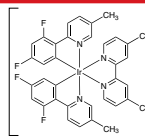
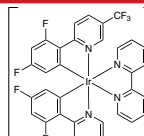
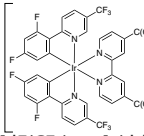
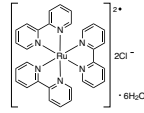
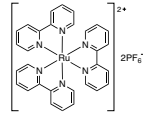
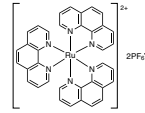
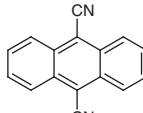
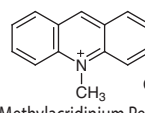
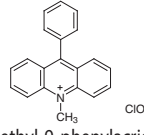
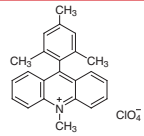
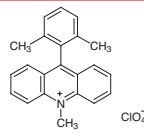
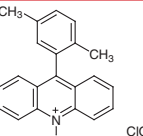
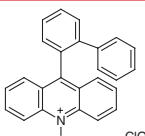
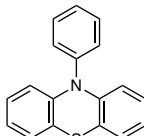
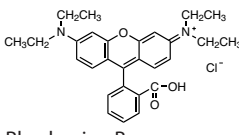
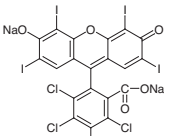
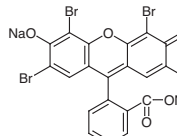
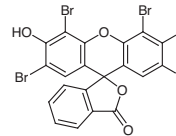
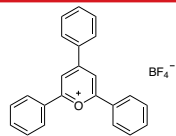


(5) Formation of iminyl radical<sup>10)</sup>(6) Synthesis of quinoxaline derivative<sup>11)</sup>(7) Formation of oxazole by [3 + 2] cycloaddition<sup>12)</sup>(8) Formation of hydrazonyl radical<sup>13)</sup>

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## Metal Complex Catalysts

<p><b>B4944</b> 200mg</p>  <p>(2,2'-Bipyridine)bis[2-(2,4-difluorophenyl)pyridine]iridium(III) Hexafluorophosphate CAS RN: 864163-80-4</p>		<p><b>T3716</b> 200mg 1g</p>  <p>Ir(ppy)<sub>3</sub> CAS RN: 94928-86-6</p>		<p><b>T1946</b> 200mg</p>  <p>Ir(ppy)<sub>3</sub> (purified by sublimation) CAS RN: 94928-86-6</p>		<p><b>D4887</b> 200mg</p>  <p>(4,4'-Di-tert-butyl-2,2'-bipyridine)-bis[(2-pyridinyl)phenyl]iridium(III) Hexafluorophosphate CAS RN: 676525-77-2</p>			
		<p><b>B4893</b> 200mg</p>  <p>(2,2'-Bipyridine)bis(2-phenylpyridinato)iridium(III) Hexafluorophosphate CAS RN: 106294-60-4</p>		<p><b>B6258</b> 200mg 1g</p>  <p>[Ir(p-F(Me)ppy)<sub>2</sub>-(4,4'-dtbbpy)]PF<sub>6</sub> CAS RN: 808142-88-3</p>		<p><b>B6254</b> 200mg 1g</p>  <p>[Ir(dF(Me)ppy)<sub>2</sub>-(dtbbpy)]PF<sub>6</sub> CAS RN: 1335047-34-1</p>		<p><b>B6161</b> 200mg 1g</p>  <p>[Ir(dF(CF<sub>3</sub>)ppy)<sub>2</sub>(bpy)]PF<sub>6</sub> CAS RN: 1092775-62-6</p>	
<p><b>D5817</b> 200mg 1g</p>  <p>[Ir(dF(CF<sub>3</sub>)ppy)<sub>2</sub>(dtbbpy)]PF<sub>6</sub> CAS RN: 870987-63-6</p>		<p><b>T1655</b> 1g 5g</p>  <p>Tris(2,2'-bipyridyl)ruthenium(II) Chloride Hexahydrate CAS RN: 50525-27-4</p>		<p><b>T3435</b> 1g</p>  <p>Tris(2,2'-bipyridine)ruthenium(II) Bis(hexafluorophosphate) CAS RN: 60804-74-2</p>		<p><b>T3208</b> 200mg 1g</p>  <p>Tris(1,10-phenanthroline)ruthenium(II) Bis(hexafluorophosphate) CAS RN: 60804-75-3</p>			
<h2>Organic Catalysts</h2>		<p><b>D1656</b> 1g 5g</p>  <p>9,10-Dicyanoanthracene CAS RN: 1217-45-4</p>		<p><b>M1787</b> 250mg 1g</p>  <p>10-Methylacridinium Perchlorate CAS RN: 26456-05-3</p>		<p><b>M1775</b> 1g 5g</p>  <p>10-Methyl-9-phenylacridinium Perchlorate CAS RN: 36519-61-6</p>			
		<p><b>M1774</b> 1g 5g</p>  <p>9-Mesityl-10-methylacridinium Perchlorate CAS RN: 674783-97-2</p>		<p><b>D3429</b> 1g</p>  <p>9-(2,6-Dimethylphenyl)-10-methylacridinium Perchlorate CAS RN: 1276539-32-2</p>		<p><b>D3428</b> 1g 5g</p>  <p>9-(2,5-Dimethylphenyl)-10-methylacridinium Perchlorate</p>		<p><b>B2897</b> 1g 5g</p>  <p>9-(2-Biphenyl)-10-methylacridinium Perchlorate</p>	
<p><b>P2470</b> 1g 5g</p>  <p>10-Phenylphenothiazine CAS RN: 7152-42-3</p>		<p><b>R0040</b> 25g 250g</p>  <p>Rhodamine B CAS RN: 81-88-9</p>		<p><b>R0041</b> 25g</p>  <p>Rose Bengal CAS RN: 632-69-9</p>		<p><b>T0037</b> 25g</p>  <p>Eosine CAS RN: 17372-87-1</p>		<p><b>T0035</b> 25g</p>  <p>Eosin Y CAS RN: 15086-94-9</p>	
<p><b>T3968</b> 1g</p>  <p>2,4,6-Triphenylpyrylium Tetrafluoroborate CAS RN: 448-61-3</p>									

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