# TADF 有機分子を光増感剤 Mn(I)錯体を触媒として用いた $CO_2$ 還元光触媒反応

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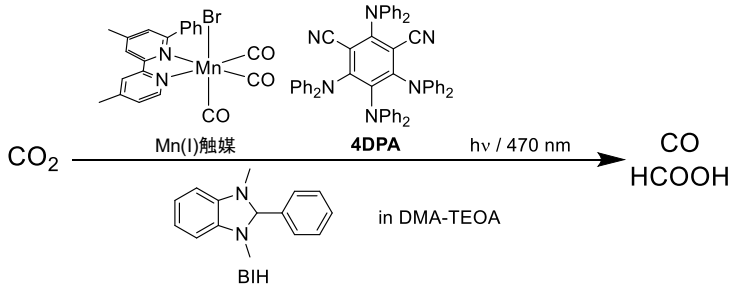
Photocatalytic $CO_2$ reduction using TADF organic molecules as photosensitizers and a Mn(I) complex as a catalyst.([1]*School of Science, Tokyo Institute of Technology*, [2]*Dipartimento di Chimica Ciamician, Universita' di Bologna*, [3]*Graduate school of Advanced Science and Engineering, Hiroshima University*) ○Rei Inoue,[1] Elena Bassan,[2] Francesco Calogero,[2] Simone Potenti,[2] Andrea Gualandi,[2] Pier Giorgio Cozzi,[2] Paola Ceroni,[2] Yusuke Tamaki,[1] Osamu Ishitani[1,3]

Photocatalytic $CO_2$ reduction using metal complexes have attracted much attention. In most of the reported researches, rare metals such as Ru(II) are used as a central metal ion of photosensitizers to drive photochemical electron transfer from an electron donor to a catalyst. For developing photosensitizers composed of only abundant elements, in this study, we focus on organic molecules that exhibit thermally activated delayed fluorescence (TADF) with long excitation lifetimes[1], and developed photocatalytic $CO_2$ reduction systems One of the TADF molecules, namely **4DPA**, with strong absorption of visible light and long excitation lifetime worked as a good photosensitizer in the visible light driven photocatalytic system for $CO_2$ reduction giving CO and HCOOH as main products in combination with a Mn(I) catalyst. ($TON_{CO+HCOOH} > 650$, $\Phi_{CO+HCOOH} = 22.8\%$)

*Keywords : photocatalytic $CO_2$ reduction; TADF; Organic photosensitizer; Mn(I) complex*

近年、金属錯体を用いた $CO_2$ 還元光触媒反応が盛んに研究されているが、多くの系では、光吸収により電子移動を駆動する光増感剤に Ru などの希少金属を用いている。

本研究では、可視光を吸収し、長い励起寿命を有する熱活性遅延蛍光(TADF)分子に着目し[1]、これを光増感剤に用いた $CO_2$ 還元光触媒反応系の開発を試みた。いくつかの TADF 分子を用いて光触媒反応を行い、下式に構造を示す **4DPA** が光増感剤として優れていることを見出した。**4DPA** は 510 nm までの可視光を吸収し、72 μs の励起寿命を示した。**4DPA** を下式に示す Mn(I)触媒及び還元剤 BIH と組み合わせて 470 nm の可視光を照射することで、$CO_2$ が CO と HCOOH へと光触媒的に高効率で還元された ($TON_{CO+HCOOH} > 650$、$\Phi_{CO+HCOOH} = 22.8\%$)。




1) H. Uoyama, C. Adachi, *et al.*, *Nature*, **2012**, *492*, 234-238.

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