

水溶性レニウム錯体の還元的疎水化を利用した人工脂質膜におけるCO₂光還元反応系の開発

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Development of CO₂ Photoreduction System on Lipid Membranes Based on Reductive Hydrophobization of a Water-Soluble Rhenium Complex (¹*Graduate School of Arts and Sciences, The University of Tokyo*) ○Morihiro Jo, Shin-ya Takizawa, Hiroshi Masai, Tomohiro Iwai, Jun Terao

We recently reported a visible light-driven CO₂ reduction system in water using lipid membranes as a reaction field.¹⁾ In order to further improve the reaction efficiency, electron transfer process from a photosensitizer to a catalyst embedded in the membrane should be taken into account. However, a conventional method, by which both the photosensitizer and catalyst are randomly incorporated into the membrane, has difficulty in maximizing the efficiency of electron transfer between them. Thus, we adopted a new strategy to control their spatial position, in which the photosensitizer (**Ir**) was immobilized on the membrane surface whereas water-soluble Re catalyst precursor **1** was dissolved in the outer aqueous phase (**Fig. 1**). In this system, hydrophobic Re catalyst **2**, generated via photoreduction of **1** with **Ir** and subsequent Hoffman-type elimination,²⁾ was expected to be trapped near the Ir photosensitizer. In fact, the amount of CO generated from this system was higher than that from the conventional system.

Keywords : CO₂ Photoreduction; Lipid Membrane; Photosensitizer; Rhenium Complex; Photoinduced Electron Transfer

最近我々は、人工脂質膜を反応場とした水中での可視光駆動 CO₂ 還元反応を報告した¹⁾。この反応をさらに高効率化するためには、光増感剤と触媒間の円滑な電子移動が重要であるが、光増感剤と触媒が膜に無秩序に導入される従来の手法ではそれが困難であった。そこで我々は今回、光増感剤と触媒の近接化を目的として、膜上に固定された Ir 光増感剤が、外水相にある第四級アンモニウム塩含有 Re 触媒前駆体 **1** を還元的に疎水化して生じた **2** を光増感剤近傍に捕捉する方法を着想した (図 1)²⁾。実際に、本手法による CO₂ 光還元反応系の CO 発生量は、触媒を膜に予め取り込ませる従来法と比較して増加した。

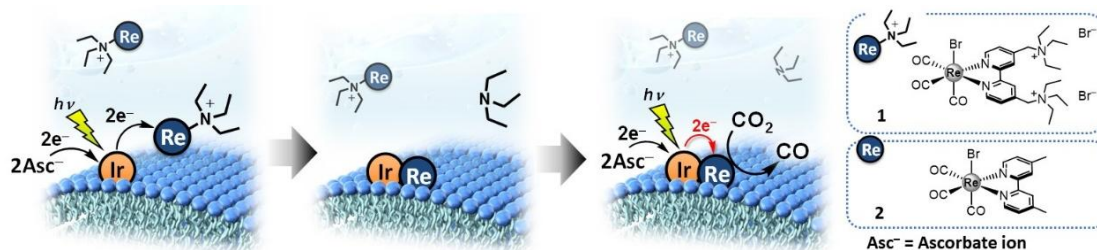


Figure 1. 本研究で目指す反応系の構築戦略

- 1) S. Takizawa, S. Murata, J. Terao *et al.* *J. Am. Chem. Soc.* **2023**, *145*, 15049.
- 2) 第四級アンモニウム塩含有 Re 触媒の還元に伴う Hoffman 型脱離の例: V. S. Thoi *et al.* *Inorg. Chem.* **2021**, *60*, 13011.