

Improvement of formation quantum yields of one-electron reduced species of Re(I)-complex photosensitizers and its utilization

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Redox photocatalytic reactions using redox photosensitizers are utilized in various research fields. Quantum yields of the photochemical formation of one-electron reduced species (OERS) of the photosensitizers (Φ_{OERS}), which is an initiation process of the photocatalytic redox reactions, potentially affects the quantum yields of the overall redox photocatalytic reactions. We previously demonstrated that Φ_{OERS} of some Re(I)-complex photosensitizers (Fig. 1) using 1,3-dimethyl-2-phenyl-2,3-dihydro-1H-benzo[d]imidazole (BIH) or triethanolamine (TEOA) as reductants were much higher compared to the Ru(II)- and Os(II)-complex photosensitizers.¹⁻³ However, Φ_{OERS} were suppressed by addition of both BIH and TEOA that has been frequently used as additives for photocatalytic CO₂ reduction.

In this presentation, we clarify how TEOA affects the formation process of OERS of the Re(I)-complexes. Transient absorption spectra were measured of the Re(I) complexes in reaction solutions including BIH and/or TEOA for tracing OERS formation processes on ns and μs time scales. The result indicates that TEOA promotes back electron transfer process from OERS to one-electron oxidized species of BIH and decrease Φ_{OERS} .

We will also discuss about relationships between the efficiencies of the OERS formation and the photocatalytic reaction for CO₂ reduction, and effects of TEOA to the photocatalytic reactions.

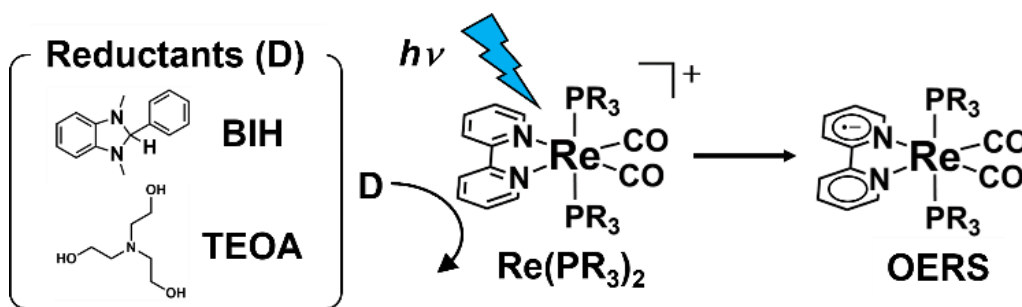


Figure 1. Photochemical reduction of Re(I)-complex

[References]

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