“POMbranes” – Incorporation of Catalytically Active Polyoxometalates into Integral Asymmetric Block Copolymer Membranes

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This project focuses on immobilizing catalytically active components within nanostructured block copolymer membranes for light-driven catalysis under flow conditions. We aim to facilitate light-driven water oxidation (WOC) and hydrogen evolution reactions (HER) using various catalyst and sensitizer combinations. Effective immobilization in POMbranes is achieved through strategies like electrostatic immobilization, covalent linkage, and their combinations.

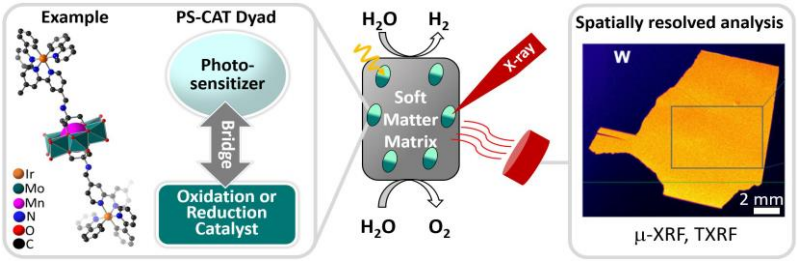

Figure 1. Left: Embedding of photosensitizers and catalysts; Centre: Functional block copolymer matrices; Right: In-situ characterization of “POMbranes” for reactivity and stability.

We initially relied on electrostatic immobilization, resulting in POMbranes capable of oxidation reactions and hydrogen evolution reactions (HER) under flow conditions [1]. Additionally, we demonstrated that water oxidation catalysis (WOC) is achievable [2] using a CoW POM (CAT) and $[Ru(bpy)_3]^{2+}$ as the sensitizer (PS). However, many examples show partial leakage of CAT/PS or degradation, as observed through time-resolved X-ray spectroscopy.

To address these challenges, we are developing reversible immobilization methods for suitable CAT building blocks alongside covalent linkage of various sensitizers. We provide a framework for immobilizing molecular building blocks within stimuli-responsive soft matter. Within the CRC 234 “CataLight”, we collaborate on projects examining changes in CAT/PS molecules during heterogenization using theoretical and spectroscopic approaches, integrating our findings into photo-flow reactors.

References

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