

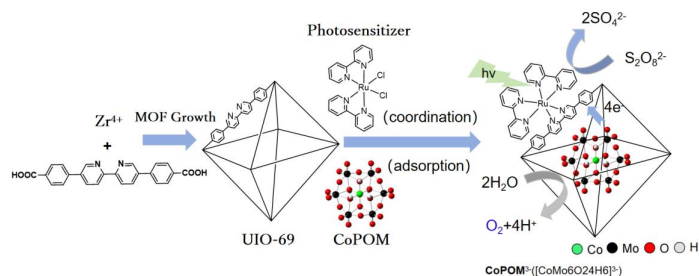
Immobilization of Cobalt Polyoxometalates in Crystalline UiO-69@Ru(bpy)₂ for High-Performance Water Oxidation Photocatalysis

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Keywords: MOF; POMs; Photocatalysis; Water Oxidation;

In the transition from fossil fuels to renewable energy sources, solar energy conversion technology has garnered significant attention in recent years. This is primarily due to the potential of hydrogen produced via photocatalytic water splitting and carbonaceous fuels generated from carbon dioxide, both of which are considered promising candidates for renewable energy. However, water oxidation catalysts (WOCs) remain a key bottleneck in this process. To address this challenge, designing multifunctional photocatalysts with porous structures and structural stability—combining catalysis, light capture, and porosity—has become an attractive research direction. Metal-organic frameworks (MOFs) offer an ideal platform for this purpose due to their porosity and the functional tunability of their organic linkers. With their tunable structure, high surface area, abundant active sites, and exceptional stability, MOFs are considered a promising material for catalytic applications.¹

Cobalt polymolybdate (CoPOM), which has been shown to be an efficient and highly stable water oxidation catalyst (WOC)^[2], was utilized as the molecular WOC in the photocatalytic system we constructed. First, we synthesized the precursor linker and then grew the MOF crystal of UiO-69 under hydrothermal conditions. Next, Ru(bpy)₂Cl₂, serving as the photosensitizer, was coordinated with UiO-69 to form the Ru(bpy)₂/UiO-69 complex. Finally, CoPOM was immobilized within the MOF through electrostatic adsorption to create the target structure, Ru(bpy)₂/UiO-69@CoPOM. Electrochemical tests have shown that the system can effectively promote photocatalytic water oxidation, providing a new design direction for the design of water oxidation catalysts.



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