Cocatalyst Engineering for Efficient Photocatalysis

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Abstract: Photocatalysis relies fundamentally on surface-mediated redox reactions, where the strategic integration of cocatalysts with photocatalysts plays a pivotal role. Despite its importance, achieving precise control over cocatalyst engineering for enhanced photocatalytic efficiency remains a critical challenge. This study systematically addresses three key aspects: (1) Identification of critical parameters governing cocatalyst design, emphasizing particle size minimization, spatial homogeneity, and interfacial intimacy with photocatalysts; (2) Demonstration of advanced cocatalyst strategies that synergistically enhance Z-scheme overall water splitting systems and enable single-step fabrication of optimized heterojunction architectures; (3) Introduction of an innovative ice-templating synthesis platform enabling atomic-scale precision in cocatalyst fabrication, with tunable coordination environments and programmable morphologies spanning single-atom sites, cluster assemblies, and nanostructured particles. Through comprehensive structural-property correlation studies, we establish that these rationally designed cocatalyst engineering approaches significantly boost photocatalytic performance across multiple reaction platforms. The developed methodologies provide generalized design principles for advancing next-generation photocatalytic systems.

References:

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