Copper Single Atom-diimine Catalytic centers immobilized on TiO_2 for water purification under-visible-light irradiation.

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Titanium dioxide (TiO_2) is the most investigated nanomaterial due to its excellent photocatalytic properties, non-toxicity, chemical stability and low cost. It exhibits a large band gap of ~3.2eV, which limits its absorption capacity in the UV light spectrum. To enhance the catalytic efficiency of TiO_2 for water purification, it is crucial to reduce its bandgap. This modification enables the material to effectively harness sunlight, including the visible light spectrum, thereby improving its photocatalytic performance. [1]

Single-atom catalysts (SACs) exhibit remarkable catalytic efficiency due to their unique electronic structure and maximum utilization of individual atoms, which improves selectivity and activity in various chemical processes. Cu-based SACs (Cu-SACs) can expose more accessible active sites which are utilized more efficiently. When combined with TiO_2 the photocatalytic performance is improved due to the transfer of electrons on the Cu SACs and the suppression of exciton recombination. [2,3].

In this study, we employed an innovative approach for the modification of the Cu SACs centers on TiO_2 by bonding them with various diamine ligands. A variety of analytical techniques were used for characterizing the generated TiO_2 oxide nanoparticles, including X-ray diffraction (XRD) and thermogravimetric analysis (TGA) to determine the crystal structure and composition. Optical properties were assessed using UV-DRS, while spectroscopic characterization were performed using IR-ATR and Raman techniques. The resulting Cu SAC:[diimines]/TiO_2 nanoparticles demonstrated high degradation efficiency under LED visible light for the removal of toxic dyes from water, such as Methylene Blue (MB) and Rhodamine B (RhB).

References:

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