

Controllable Synthesis and Photocatalytic Degradation to Organic Pollutants of Heterogeneous Cu₂O-Au-TiO₂ Nanocomposite

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Cu₂O is a promising high efficiency photocatalyst which exhibits good visible light photocatalytic degradation to organic pollutants. A novel heterostructure Cu₂O-based nanocomposite was synthesized to suppress photogenerated charge recombination rate and photocorrosion of Cu₂O to enhance photocatalytic performance. A sandwich-like Cu₂O-Au-TiO₂ heterostructure was recommended in this project. The controllable synthesis was implemented as follows: first, 26-faced Cu₂O nanoparticles with smooth surfaces were prepared using a modified hydrothermal method. Then, Cu₂O nanoparticles were decorated with Au nanoparticles in HAuCl₄ solution. Cu₂O-Au nanocomposite was filled into Tetra-n-butyl titanate solution in an oil bath, the solution was stirred at 60°C for 15min. A sandwich-like Cu₂O-Au-TiO₂ heterostructure was obtained after centrifuged twice more in anhydrous ethanol and ultrapure water. Morphologies and microstructures of three nanomaterials were characterized using SEM and TEM. Photocatalytic degradation efficiency to organics of three nanomaterials was tested under xenon lamp, and methyl orange solution and Rhodamine B solution were used to simulate organic pollutants. All samples were analyzed with an ultraviolet-visible spectrophotometer. Experiment results of five different conditions showed that the average efficiency of Cu₂O-Au nanocomposite was 6.45 times of Cu₂O nanomaterial, and the average efficiency of Cu₂O-Au-TiO₂ nanocomposite was 11.8 times of Cu₂O nanomaterial. It follows that sandwich-like Cu₂O-Au-TiO₂ heterostructure can greatly enhance photocatalytic performance of Cu₂O. The enhancement comes from the synergistic effect of LSPR and Schottky barriers of the sandwich-like Cu₂O-Au-TiO₂ heterostructure.

Awards Won:

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