

Facile Synthesis of Heterostructured Bi₂S₃-WS₂ Photocatalysts for Photodegradation of Organic Dye

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Abstract : In this paper, we report a facile synthetic strategy of randomly disturbed Bi₂S₃ nanorods on WS₂ nanosheets, which are synthesized via a controlled hydrothermal method without surfactant under an inert atmosphere. We developed a simple hydrothermal method for the formation of heterostructured of Bi₂S₃/WS₂ with a large scale (>95%). The structural features, composition, and morphology were characterized by XRD, SEM-EDX, TEM, HRTEM, XPS, UV-vis spectroscopy, N₂ adsorption-desorption, and TG-DTA measurements. The heterostructured Bi₂S₃/WS₂ composite has significant photocatalytic efficiency toward the photodegradation of organic dye. The time-dependent UV-vis absorbance spectroscopy measurement was consistent with the enhanced photocatalytic degradation of rhodamine B (RhB) under visible light irradiation with the diminishing carrier recombination for the Bi₂S₃/WS₂ photocatalyst. Due to their marked synergistic effects, the supported Bi₂S₃ nanorods on WS₂ nanosheet heterostructures exhibit significant visible-light photocatalytic activity and stability for the degradation of RhB. A possible reaction mechanism is proposed for the Bi₂S₃/WS₂ composite.

Keywords : photocatalyst, heterostructures, transition metal disulfides, organic dye, nanorods

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