

## Facile Synthesis of Heterostructured Bi<sub>2</sub>S<sub>3</sub>-WS<sub>2</sub> Photocatalysts for Photodegradation of Organic Dye

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**Abstract :** In this paper, we report a facile synthetic strategy of randomly disturbed Bi<sub>2</sub>S<sub>3</sub> nanorods on WS<sub>2</sub> 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 Bi<sub>2</sub>S<sub>3</sub>/WS<sub>2</sub> with a large scale (>95%). The structural features, composition, and morphology were characterized by XRD, SEM-EDX, TEM, HRTEM, XPS, UV-vis spectroscopy, N<sub>2</sub> adsorption-desorption, and TG-DTA measurements. The heterostructured Bi<sub>2</sub>S<sub>3</sub>/WS<sub>2</sub> 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 Bi<sub>2</sub>S<sub>3</sub>/WS<sub>2</sub> photocatalyst. Due to their marked synergistic effects, the supported Bi<sub>2</sub>S<sub>3</sub> nanorods on WS<sub>2</sub> nanosheet heterostructures exhibit significant visible-light photocatalytic activity and stability for the degradation of RhB. A possible reaction mechanism is proposed for the Bi<sub>2</sub>S<sub>3</sub>/WS<sub>2</sub> composite.

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

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