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ORIGINAL PAPER

Visible-light-driven photocatalytic degradation of rhodamine B by Ag_2CO_3/Bi_2WO_6 nanocomposites

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Abstract

0–10 wt% Ag_2CO_3/Bi_2WO_6 nanosamples were prepared by hydrothermal method combined with solution precipitation–deposition method. The as-prepared samples were characterized by X-ray diffraction, scanning electron microscopy, transmission electron microscopy and UV–visible spectroscopy. They certified that spherical Ag_2CO_3 nanoparticles supported on orthorhombic Bi_2WO_6 nanoplates. Their photocatalytic activities were investigated through photodegradation of rhodamine B (RhB) under visible-light irradiation. In this research, 10 wt% Ag_2CO_3/Bi_2WO_6 nanocomposites show the highest performance for photodegradation of RhB induced by visible radiation.

Keywords Ag_2CO_3/Bi_2WO_6 · Photocatalyst · Heterojunction

Introduction

Semiconductor-based photocatalysts have received much attention due to their potential in solving energy and environmental problems by generated species with strong oxidative properties to convert organic compounds into CO_2 and H_2O [1, 2]. Among the semiconductor-based photocatalysts, Bi_2WO_6 with energy band gap of 2.70 eV shows an outstanding photocatalysis for water-splitting and photodegradation of organic pollutants under visible radiation ranging of < 460 nm wavelength [3, 4]. The photocatalyst is able to generate hydroxyl radicals in aqueous aerated solution without the formation of superoxide anion radicals [3]. For example, hierarchical Bi_2WO_6 with clew-like, clew-like and flower-like, flower-like, dish-like with crisscross, dish-like with incomplete crisscross, and dish-like products was successfully prepared by a simple hydrothermal method by Shang et al. [5]. The clew-like Bi_2WO_6 exhibited enhanced photocatalytic activity for degrading of rhodamine B (RhB) due to its larger specific surface area and pore diameter. Selvi et al. succeeded in synthesizing of Bi_2WO_6 nanoplates by hydrothermal method [6]. The nanoplates show photocatalytic activity of 84% degradation of methylene blue (MB) under visible light within 120 min due to their hierarchical structure, crystallite size and narrow band gap. In contrast, the photocatalytic activity of Bi_2WO_6 is low because of the high recombination rate of photo-induced electron–hole pairs that play the role in inhibiting the driven activity of the material [7, 8].

To increase the photocatalytic performance of Bi_2WO_6, double-charge transfer of two different semiconductors is created by forming heterojunction between the two semiconductors and to promote the separation and transfer of photo-induced electron–hole pairs of photocatalytic composites [9, 10]. Among Ag-doped photocatalyst, Ag_2CO_3 with narrow band gap of 2.46 eV has excellent photocatalytic properties

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