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Improvement of visible light photocatalytic activity over flower-like BiOCl/BiOBr microspheres synthesized by reactable ionic liquids

Jing Zhang[a], Jiexiang Xia[a], Sheng Yin[a], Huaming Li[a,*], Hui Xu[b], Minqiang He[a], Liying Huang[a], Qi Zhang[a]

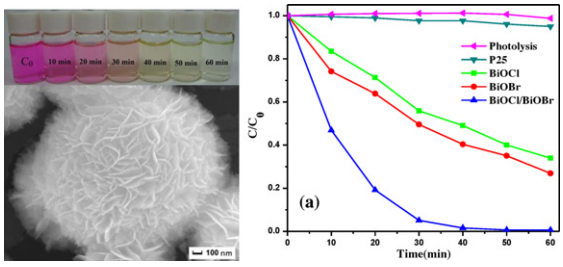
[a] School of Chemistry and Chemical Engineering, Jiangsu University, 301 Xuefu Road, Zhenjiang 212013, PR China
[b] School of the Environment, Jiangsu University, 301 Xuefu Road, Zhenjiang 212013, PR China

HIGHLIGHTS

- Flower-like BiOCl/BiOBr microspheres have been synthesized in the presence of ionic liquids [C_{16}mim]Cl and [C_{16}mim]Br.
- Ionic liquid played the role of solvent, reactant and template at the same time.
- The BiOCl/BiOBr materials showed the higher photocatalytic activities of rhodamine B than single BiOCl and BiOBr crystal.

GRAPHICAL ABSTRACT

In this paper, we developed a facile reactable ionic liquids (RILs) synthesis of BiOCl/BiOBr flower-like microspheres by an EG-assisted solvothermal process. The DRS analysis and high photocurrent suggested that BiOCl/BiOBr possessed absorbtion under visible light and was a benefit for the efficient generation and separation of the electron–hole pairs. Additionally, we evaluated the photocatalytic activities of BiOCl/BiOBr on the degradation of RhB under visible light irradiation and found that the obtained BiOCl/BiOBr materials exhibited higher photocatalytic activity than single BiOCl and BiOBr. A possible photocatalytic mechanism based on the relative band positions of BiOCl and BiOBr had been proposed.



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ABSTRACT

BiOCl/BiOBr uniform flower-like composite photocatalysts had been successfully synthesized through a one-pot ethylene glycol (EG)-assisted solvothermal process in the presence of 1-hexadecyl-3-methylimidazolium chloride ([C_{16}mim]Cl) and 1-hexadecyl-3-methylimidazolium bromide ([C_{16}mim]Br) reactable ionic liquids. Their structures, morphology, and optical properties were characterized by X-ray diffraction (XRD), X-ray photoelectron spectroscopy (XPS), scanning electron microscopy (SEM), energy-dispersive X-ray spectroscopy (EDS) and UV–vis diffuse reflectance spectroscopy (DRS). The DRS analysis and high photocurrent suggested that BiOCl/BiOBr possessed absorption under visible light and was a benefit for the efficient generation and separation of the electron–hole pairs. Photocatalytic activity experiment proved that BiOCl/BiOBr composites exhibited higher photocatalytic activity than single BiOCl and BiOBr for the degradation of rhodamine B (RhB) under visible light ($\lambda > 400$ nm). A possible photocatalytic mechanism based on the relative band positions of BiOCl and BiOBr had been proposed.

1. Introduction

Since the discovery of the photocatalytic splitting of water on TiO_2 photochemical electrodes by Fujishima and Honda in 1972 [1], semiconductor photocatalysis has been regarded as one of the most promising technologies in terms of solar energy conversion and photodegradation of organic pollutants [2–6]. As a traditional

* Corresponding author. Tel.: +86 511 88791108; fax: +86 511 88791108.
E-mail address: lihm@ujs.edu.cn (H. Li).

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