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Lingbo Xiao, Rongbin Lin, Jin Wang, Cao Cui, Jingyun Wang, Zhengquan Li

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# A Novel Hollow-Hierarchical Structured $\text{Bi}_2\text{WO}_6$ with Enhanced Photocatalytic Activity for $\text{CO}_2$ Photoreduction

Lingbo Xiao, Rongbin Lin, Jin Wang\*, Cao Cui, Jingyun Wang, and Zhengquan Li\*

Key Laboratory of the Ministry of Education for Advanced Catalysis Materials, Zhejiang Normal University, Jinhua, Zhejiang 321004, P. R. China

E-mail: [zqli@zjnu.edu.cn](mailto:zqli@zjnu.edu.cn); [wangjin@zjnu.edu.cn](mailto:wangjin@zjnu.edu.cn). Tel & Fax: +86 579 82281128

**Abstract:** Converting  $\text{CO}_2$  into high-valued chemicals with sunlight is regarded as a promising way to solve the impending energy and environmental crisis. Development of efficient photocatalysts with suitable energy band gap, high stability and favorable structure is thus of very importance. Herein, a novel hierarchical  $\text{Bi}_2\text{WO}_6$  photocatalyst assembled by  $\text{Bi}_2\text{WO}_6$  nanosheets with a hollow and rod-shaped appearance has been developed *via* a facile hydrothermal process. Interestingly, we found that the hydrolysis of  $\text{Bi}(\text{NO}_3)_3$  in water can produce solid  $\text{Bi}_6\text{O}_5(\text{OH})_3(\text{NO}_3)_5 \cdot 3\text{H}_2\text{O}$  microrods which can be transformed to hollow-hierarchical  $\text{Bi}_2\text{WO}_6$  nanosheets by virtue of the Kirkendall effect. The developed  $\text{Bi}_2\text{WO}_6$  nanosheets exhibit a 58 times higher specific surface area than that of bulk  $\text{Bi}_2\text{WO}_6$  and a remarkable enhancement in electrochemical performance such as photocurrent and charge transfer. As a result, the hollow-hierarchical structured  $\text{Bi}_2\text{WO}_6$  photocatalysts achieve a high  $\text{CH}_4$  yield of  $2.6 \mu\text{mol g}^{-1} \text{h}^{-1}$ , 8 times higher than that of bulk  $\text{Bi}_2\text{WO}_6$ . Moreover, the developed photocatalysts exhibit a high stability during the recycling experiments. This work may present a new strategy to attain hierarchical structured photocatalysts with high activity and stability toward  $\text{CO}_2$  reduction.

**Keywords:** photocatalysts;  $\text{Bi}_2\text{WO}_6$ ;  $\text{CO}_2$  photoreduction; hierarchical structure.

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