

## Supporting Information

# **SnO<sub>2</sub>/α-Fe<sub>2</sub>O<sub>3</sub> Nanoheterostructure with Novel Architecture: Structural Characteristics and Photocatalytic Property**

Ju Xu, Feng Huang, Yunlong Yu, Anping Yang, Yuansheng Wang\*

State Key Laboratory of Structural Chemistry, Fujian Institute of Research on the Structure of Matter, Chinese Academy of Sciences; Graduate University of Chinese Academy of Sciences, Fuzhou, China

### Nitrogen-sorption analyses

Nitrogen-sorption analyses were performed to measure BET surface areas of the α-Fe<sub>2</sub>O<sub>3</sub> precursors and SnO<sub>2</sub>/α-Fe<sub>2</sub>O<sub>3</sub> nanoheterostructures, as exhibited in Figure S1. BET surface area of the α-Fe<sub>2</sub>O<sub>3</sub> nanoprisms is determined to be 60 m<sup>2</sup>/g. Such large surface area benefits to the formation of the heterostructures from the precursors. After the hetero-epitaxial growth of SnO<sub>2</sub>, the hollowed α-Fe<sub>2</sub>O<sub>3</sub> nanoprisms are filled with the SnO<sub>2</sub> nanorods, as a result BET surface area reduces to 16 m<sup>2</sup>/g.

---

\* Corresponding author. Tel: +86-591-8370-5402; fax: +86-591-8370-5402.

*E-mail address:* yswang@fjirsm.ac.cn (Y. S. Wang).

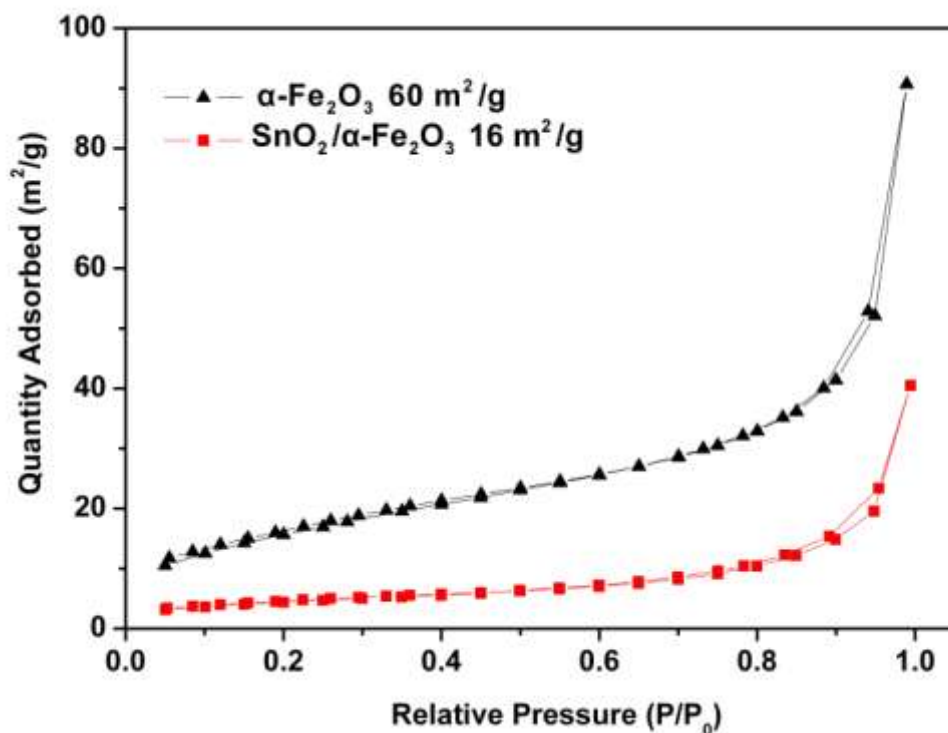
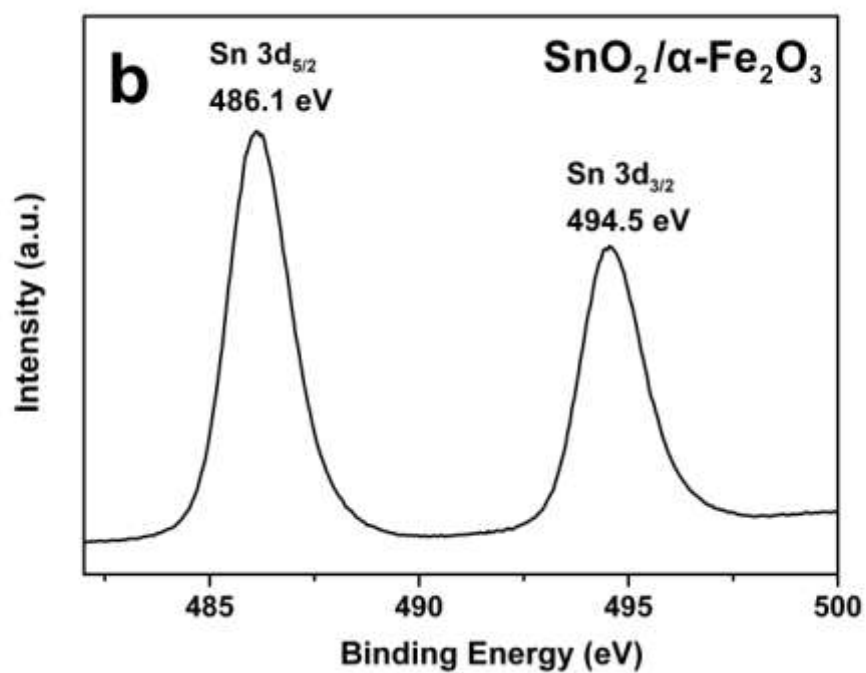
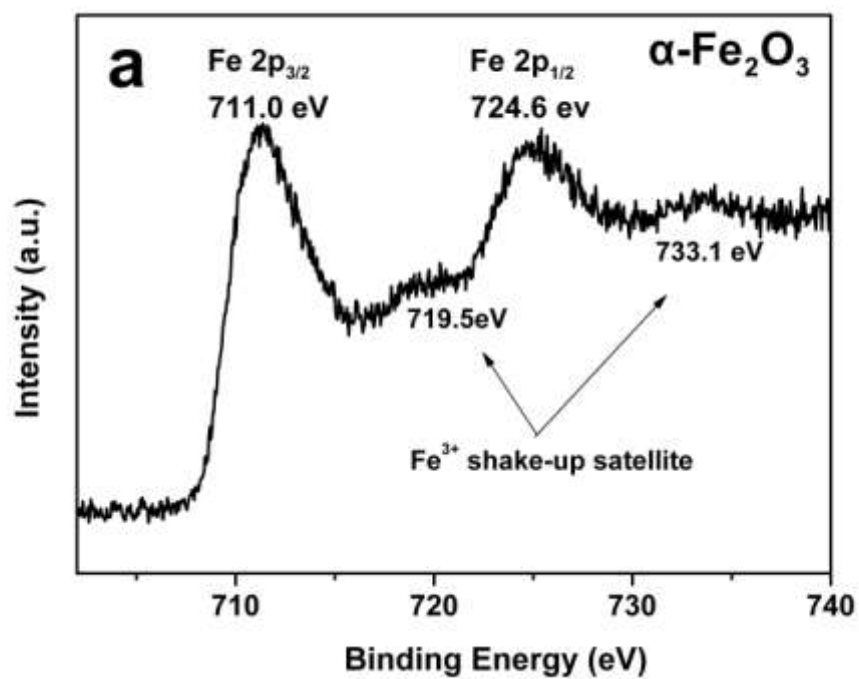


Figure S1. Nitrogen-sorption curves and BET surface areas of  $\alpha$ -Fe<sub>2</sub>O<sub>3</sub> nanoprism precursors and SnO<sub>2</sub>/ $\alpha$ -Fe<sub>2</sub>O<sub>3</sub> nanoheterostructures.

## XPS analyses

High-resolution XPS measurements were performed to study the valence and electronic structure of Fe and Sn in the prepared materials. For the  $\alpha$ -Fe<sub>2</sub>O<sub>3</sub> nanoprism precursors, the Fe 2p peaks locate at 724.6 eV (2p<sub>1/2</sub>) and 711.0 eV (2p<sub>3/2</sub>), besides, there are two satellite peaks at 733.1 eV and 719.5 eV, as shown in Figure S2a, which is characteristic of Fe<sup>3+</sup> in Fe<sub>2</sub>O<sub>3</sub>.<sup>1</sup> For the SnO<sub>2</sub>/ $\alpha$ -Fe<sub>2</sub>O<sub>3</sub> nanoheterostructures, two peaks at 494.5 eV (3d<sub>3/2</sub>) and 486.1 eV (3d<sub>5/2</sub>) are observed (Figure S2b), ascribing to Sn 3d of Sn<sup>4+</sup>. The signals of Sn 3p and Fe 2p overlap in the range of 700~740 eV. By multiplet peaks fitting, the Sn 3p<sub>3/2</sub>, Fe 2p<sub>1/2</sub>, Fe 2p<sub>3/2</sub>, and two satellite peaks of Fe<sup>3+</sup> are separated, as exhibited in Figure S2c. Evidently, the Fe valence still remains 3+. However, all the Fe 2p peaks shift slightly (0.4 eV) towards the low-energy side, which should be attributed to the subtle modification of the Fe electronic structure induced by the formation of the SnO<sub>2</sub>/Fe<sub>2</sub>O<sub>3</sub> hetero-interfaces.<sup>2-3</sup>



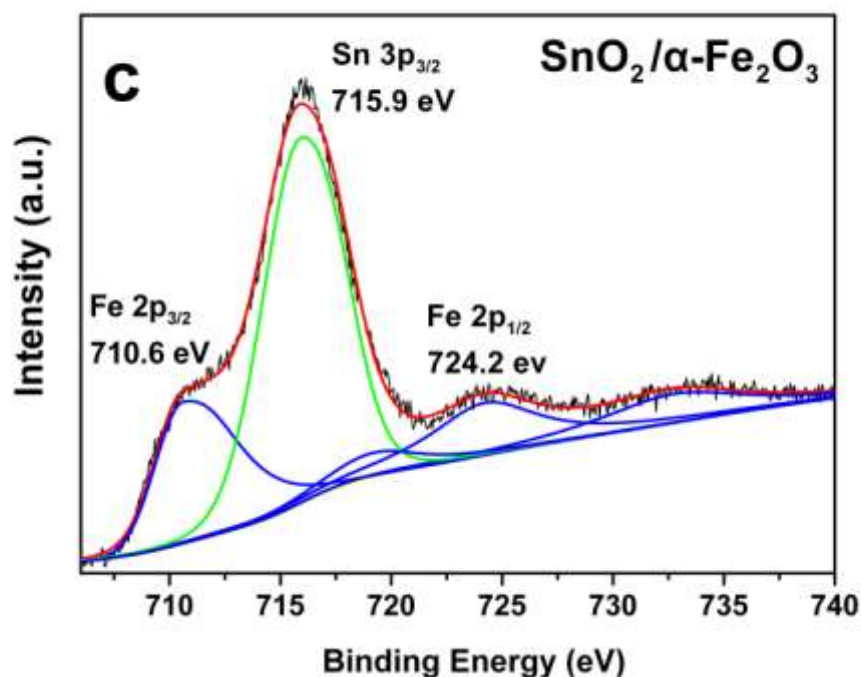


Figure S2. High-resolution XPS spectra of (a) Fe 2p of  $\alpha\text{-Fe}_2\text{O}_3$  precursors; (b) Sn 3d of  $\text{SnO}_2/\alpha\text{-Fe}_2\text{O}_3$  nanoheterostructures; (c) Fe 2p and Sn  $3p_{3/2}$  of  $\text{SnO}_2/\alpha\text{-Fe}_2\text{O}_3$  nanoheterostructures. Black curve represents the measured result, while red, blue and green ones the results of Lorentzian-Gaussian multipole fitting.

## EDS analyses

EDS spectra taken from the nanoprism precursor and the nanorod respectively in a nanoheterostructure are presented in Figure S3. Obviously, the nanoprism is pure  $\alpha\text{-Fe}_2\text{O}_3$  and the nanorod pure  $\text{SnO}_2$ , without any detectable impurity elements. The C and Cu signals are attributed to the grid used to support the TEM specimens.

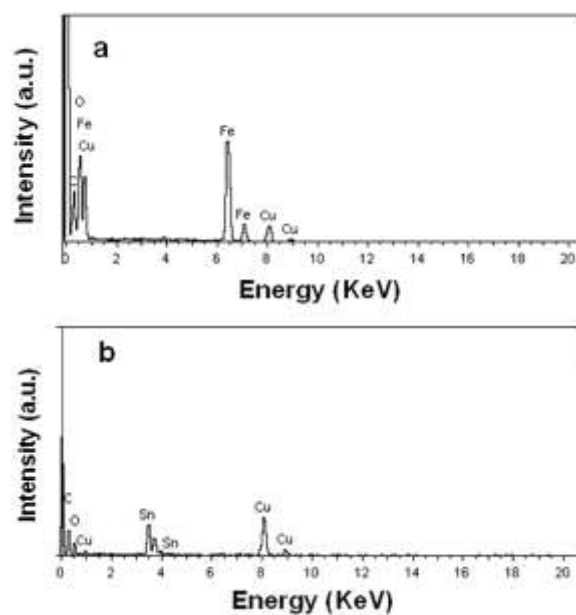


Figure S3. EDS spectra taken from (a)  $\alpha$ -Fe<sub>2</sub>O<sub>3</sub> nanoprism, and (b) SnO<sub>2</sub> nanorod of a SnO<sub>2</sub>/ $\alpha$ -Fe<sub>2</sub>O<sub>3</sub> nanoheterostructure; C and Cu signals are attributed to the grid used to support TEM specimens.

## Reference

- (1) X. L. Hu, J. C. Yu, J. M. Gong; Q. Li, G. S. Li, *Adv. Mater.*, **2007**, *19*, 2324-2329.
- (2) J. Zhang, X. H. Liu, L. W. Wang, T. L. Yang, X. Z. Guo, S. H. Wu, S. R. Wang, S. M. Zhang, *Nanotechnology*, **2011**, *22*, 185501.
- (3) Y. H. Zheng, L. R. Zheng, Y. Y. Zhan, X. Y. Lin, Q. Zheng, K. M. Wei, *Inorg. Chem.*, **2007**, *46*, 6980-6986.