Electronic Supplementary Material (ESI) for Dalton Transactions.
This journal is © The Royal Society of Chemistry 2016

Supporting Information for:

Core-Shell $Cd_{0.2}Zn_{0.8}S$@BiOX (X = Cl, Br, I) Microspheres: A Family of Hetero-Structured Catalysts with Adjustable Bandgaps, Enhanced Stability and Photocatalytic Performance under Visible Light Irradiation

Yannan Zhou,[a,b] Ting Wen,[a,b] BinbinChang,[a,b] Baocheng Yang*[a,b] and Yonggang Wang*[c]

[a]Institute of Nanostructured Functional Materials, Huanghe Science and Technology College, Zhengzhou, Henan 450006, China.

[b]Henan Provincial Key Laboratory of Nano-composite and Applications, Zhengzhou 450006, Henan Province, China.

[c]High Pressure Science and Engineering Center, University of Nevada Las Vegas, Nevada 89154, United States.

***Emails:** baochengyang@hhstu.infmm.cn (B. Yang); yyggwang@gmail.com (Y. Wang).

Figures caption:

Fig.S1 SEM images of pristine Bi*OX* (a:BiOCl, b: BiOBr, and c: BiOI).

Fig.S2 EDX results of CZS and CZS@Bi*OX* (a: CZS, b: CZS@BiOCl, c: CZS@BiOBr, and d: CZS@BiOI) samples.

Fig.S3 TEM images of Bi*OX* (a: BiOCl, b: BiOBr, and c: BiOI). Scale bar: 500 nm.

Fig.S4 TEM images of 1:1 CZS@Bi*OX*: CZS@BiOCl (a), CZS@BiOBr (b), CZS@BiOI (c); 1:5 CZS@Bi*OX*: CZS@BiOCl (d), CZS@BiOBr (e), CZS@BiOI (f). Scale bar: 500 nm.

Fig.S5 PL spectra of CZS, Bi*OX* and CZS@Bi*OX* (*X* = Cl, Br, I).

Fig.S6 Decomposition pathway for RhB under light irradiation.

Fig.S7 Photocatalytic degradation of RhB on blank, CZS and Bi*OX* (*X* = Cl, Br, I) under visible-light irradiation.

Table S1 Comparison of the morphologies and photocatalytic activities of Bi*OX* (*X* = Cl, Br, I) between current synthesis method and previous reports.

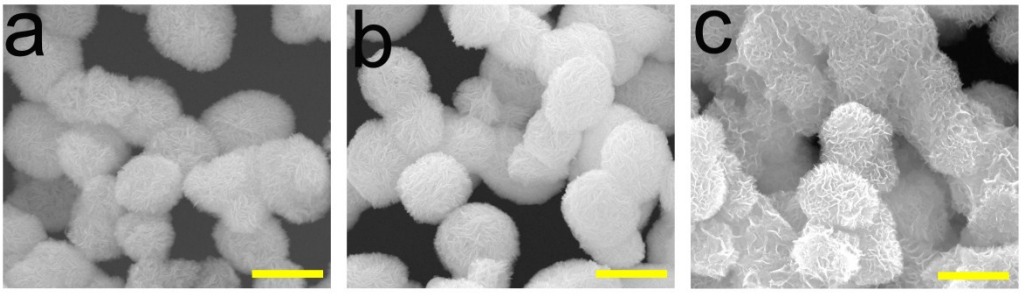

Fig.S1 SEM images of pristine Bi*OX* (a: BiOCl, b: BiOBr, and c: BiOI). Scale bar: 1 μm.

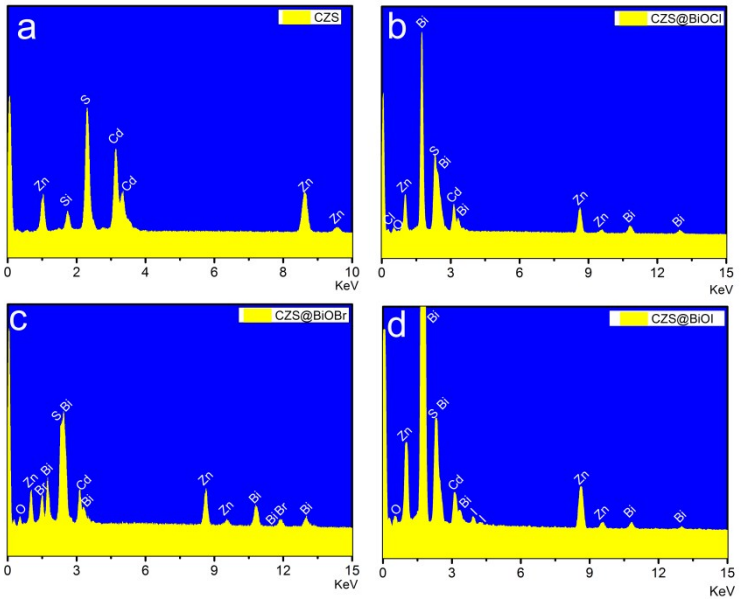

Fig.S2 EDX results of CZS and CZS@Bi*OX* (a: CZS, b: CZS@BiOCl, c: CZS@BiOBr, and d: CZS@BiOI) samples.

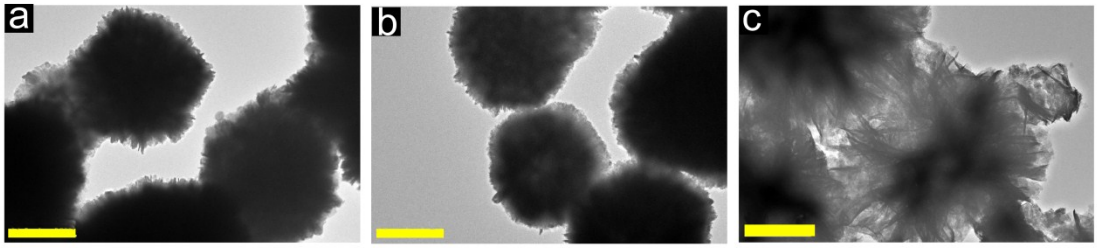

Fig.S3 TEM images of Bi*OX* (a: BiOCl, b: BiOBr, and c: BiOI). Scale bar: 500 nm.

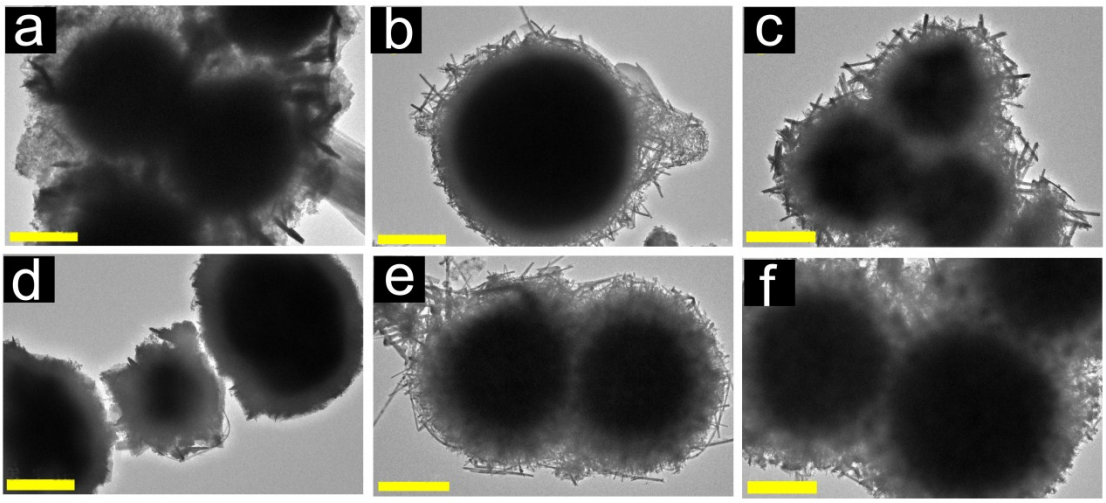

Fig.S4 TEM images of 1:1 CZS@BiO*X*: CZS@BiOCl (a),CZS@BiOBr (b), CZS@BiOI (c); 1:5 CZS@BiO*X*: CZS@BiOCl (d), CZS@BiOBr (e), CZS@BiOI (f). Scale bar: 500 nm.

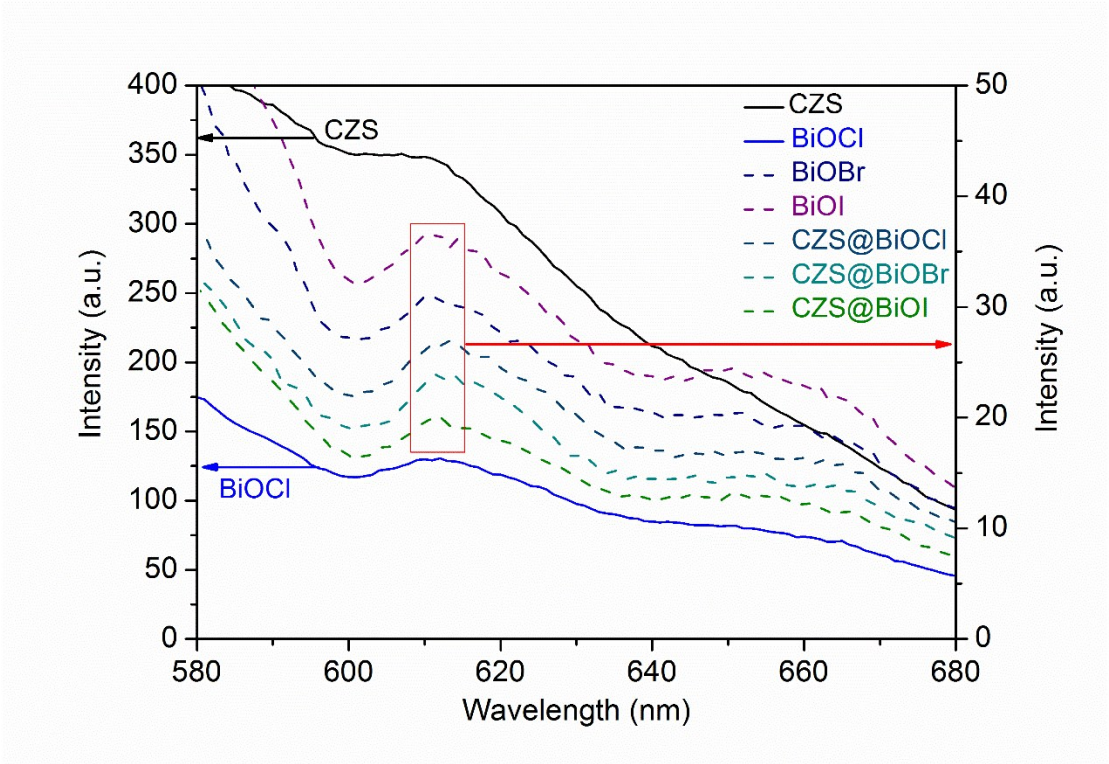

Fig.S5 PL spectra of CZS, BiO*X* and CZS@BiO*X* (*X* = Cl, Br, I).

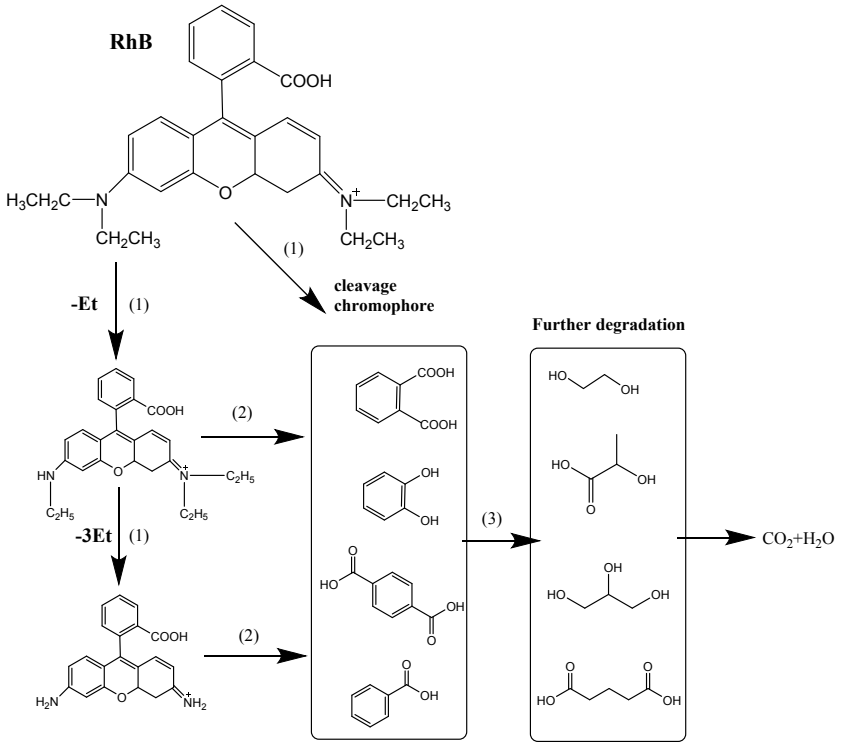

Fig.S6 Decomposition pathway for RhB under light irradiation.

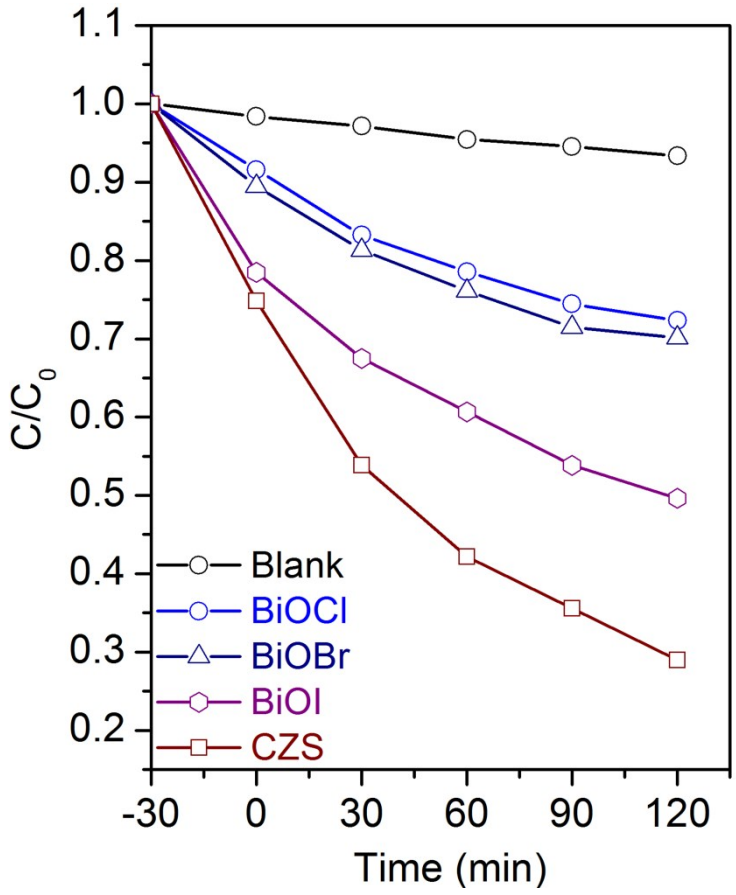

Fig.S7 Photocatalytic degradation of RhB on blank, CZS and BiO*X* (*X* = Cl, Br, I) under visible-light irradiation.

Table S1 Comparison of the morphologies and photocatalytic activities of BiO*X* (*X* = Cl, Br, I) between current synthesis method and previous reports.

Synthesis method	Morphology	S_{BET} (m^2/g)	Catalytic activity	*Ref*
Precipitation; Room temperature.	Plates	BiOCl:12.1 BiOBr: 14.3 BiOI: 13.4	BiOCl<BiOI<BiOBr	1
Solvothermal; Ethylene glycol; 150 °C.	Plates	BiOI: 6.72 BiOCl:15.99	BiOI<BiOCl	2
Solvothermal; Ethylene glycol; 160 °C.	Irregular spheres	BiOBr:12.03 BiOI:56.29	BiOBr<BiOI	3
Solvothermal; Ethylene glycol; 160 °C.	Porous spheres	BiOCl:30.35, BiOBr:43.82 BiOI:70.15	BiOCl<BiOBr<BiOI	This work

Reference:

1. L. Chen, R. Huang, M. Xiong, Q. Yuan, J. He, J. Jia, M. Yao, S. Luo, C. Au and S. Yin, Inorg. Chem., 2013, 52, 11118–11125.
2. T. Li, G. Chen, C. Zhou, Z. Shen, R. Jin and J. Sun, Dalton Trans., 2011, 40, 6751–6758.
3. Z. Jia, F. Wang, F. Xin and B. Zhang, Ind. Eng. Chem. Res., 2011, 50, 6688–6694.