**Supporting Information for**

# Hierarchical Ag/$Bi_2MoO_6$ hollow nanoboxes with high photocatalytic performance

**Ying Ma,[a,*] Yulong Jia,[a,*] Yinhe Lin,[a] Wenbing Shi[a]**

[a] School of Chemistry and Chemical Engineering, Yangtze Normal University
Chongqing, 408000 (China)
Email: yma2017@126.com

## Experimental section

The $Ag_3PO_4$ nanocubes were obtained by a simple co-precipitation method using silver-ammino complex as precursor. To get silver-ammino complex, ammonia aqueous solution (0.1 M) was added into the $AgNO_3$ (0.2 g) aqueous solution (30 mL) to form a transparent solution. Subsequently, $Na_2HPO_4$ aqueous solution (0.167 g, 0.15 M) was dropped into the above solution. Finally, olivine powder was obtained by filtration and washing with deionized water and ethanol. In order to grow $Bi_2MoO_6$ nanosheets, 0.21 g $Bi(NO_3)_3$•$5H_2O$ and 0.27 g $(NH_4)_6Mo_7O_{24}$•$4H_2O$ were separately dissolved in 5 mL ethylene, forming the homogeneous solution. Then, $(NH_4)_6Mo_7O_{24}$ solution was added dropwise into the $Bi(NO_3)_3$ solution. With stirred for 10 min, the precursor solution was added with 25 mL ethanol and poured into a 80 mL Teflon-lined stainless steel autoclave, which was heated at 160 ºC for 12 h. After cooling down to room temperature, the obtained samples were collected and dried in vacuum for 4 h. In order to reveal the growth process of samples, the hydrothermal reaction was controlled at 4 h, 8 h, 12 h and 16 h, respectively. In addition, Ag nanoparticles were obtained by the same procedure except adding of precursors for $Bi_2MoO_6$. For comparison, the microbox was prepared as referred to [1].

## Characterizations

The morphologies of samples can be characterized by scanning electron microscopy (SEM) (JSM-6701, JEOL) and transmission electron microscopy (TEM) (FEI Tecnai TF20). X-ray diffraction (XRD) patterns of samples can be investigated by Rigaku RINT-2000 instrument using Cu Kα radiation at 40 kV. Moreover, the UV-vis absorption spectra were measured on the UV-2550 (Shimadzu) spectrometer. The valence states of elements were characterized by Thermo ESCALAB 250 Xi system at room temperature using Al Kα with monochromic radiation.

## Photocatalytic reactions

The photocatalytic activity of samples was evaluated by the $CO_2$ production produced by decomposition of 2-propanol in gas phase. More specifically, the photocatalyst (200 mg) was dispersed on a glass dish (4 $cm^{-2}$), which was located in a Tedlar bag with a volume of 125 mL mixed air (79% $N_2$, 21% $O_2$, <0.1 ppm of $CO_2$, 500 ppm of 2-propanol). Adsorption-desorption equilibrium can be reached by leaving the photocatalytic system in dark for 1 h. After that, the samples were irradiated by visible light with 100 mW $cm^{-2}$, which was obtained by a Xenon lamp equipped with a Yellow-44 filter. In addition, the $CO_2$ evolution was measured by gas chromatography (Agilent/Inficon 3000 Micro GC) with a PLOT U column and OV-1 column.

## Additional Figures and Discussions

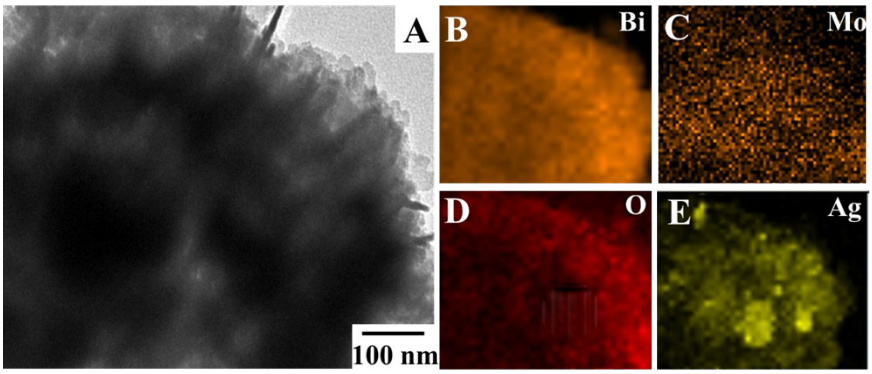


**Fig. S1.** Mapping images of (B) Bi (C) Mo (D) O and (E) Ag based on the TEM image (A) of samples.

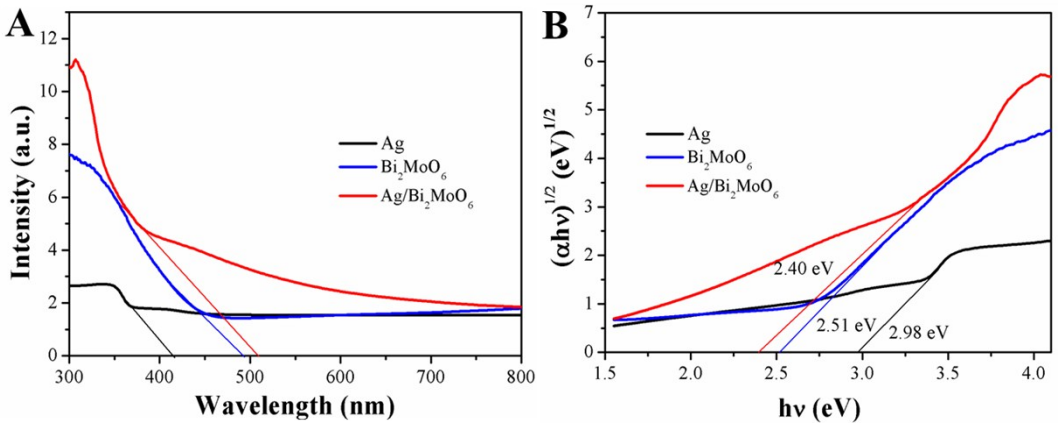


**Fig. S2.** (A) UV-vis diffuse reflectance spectra and (B) absorption edge of Ag nanoparticles, $Bi_2MoO_6$ microbox and $Ag/Bi_2MoO_6$ nanobox.

## Reference

1 Y.L. Jia, Y. Ma, J.Z. Tang, W.B. Shi, *Dalton Trans.*, 2018, **47**, 5542.