

# Supporting Information

## Facile synthesis of AgBr nanocubes for a highly efficient visible light photocatalyst

Hua Wang, Yang Li, Chen Li, Liang He, Lin Guo\*

School of Chemistry and Environment, Beihang University, Beijing 100191, China

*Corresponding author. E-mail: [guolin@buaa.edu.cn](mailto:guolin@buaa.edu.cn)*

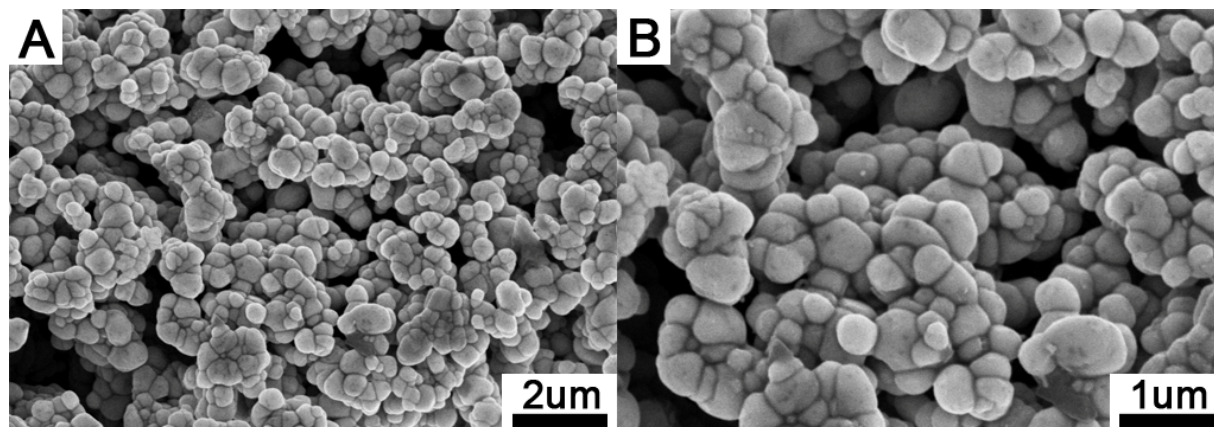
### EXPERIMENT

**Preparation of AgBr nanocubes.** The AgBr nanocubes were prepared using precipitation reaction with the aid of organic solvent pyridine. Typically, 5 mL pyridine was added to 12 mL ethylene glycol (EG) solution of AgNO<sub>3</sub> (57 mg), and the mixture solution was kept at 60 °C for 30 min under intensive magnetic stirring. After pyridine molecules sufficiently coordinating with silver ions, 6 mL of EG solution of NaBr (1036 mg) and PVP (37 mg, average MW 58000, K29-32, Acros) was dropwise added to the above solution under intensive stirring, and the color of the solution turned grey immediately with the solution addition. After the solution was kept for another 30 min at 60 °C for a precipitation process, the temperature was elevated to 90 °C and kept for 1 h to improve the crystalline quality of AgBr, and products were collected by centrifugation and washed with distilled water 3 times and with absolute ethanol twice, and then dried overnight at 60 °C under vacuum condition.

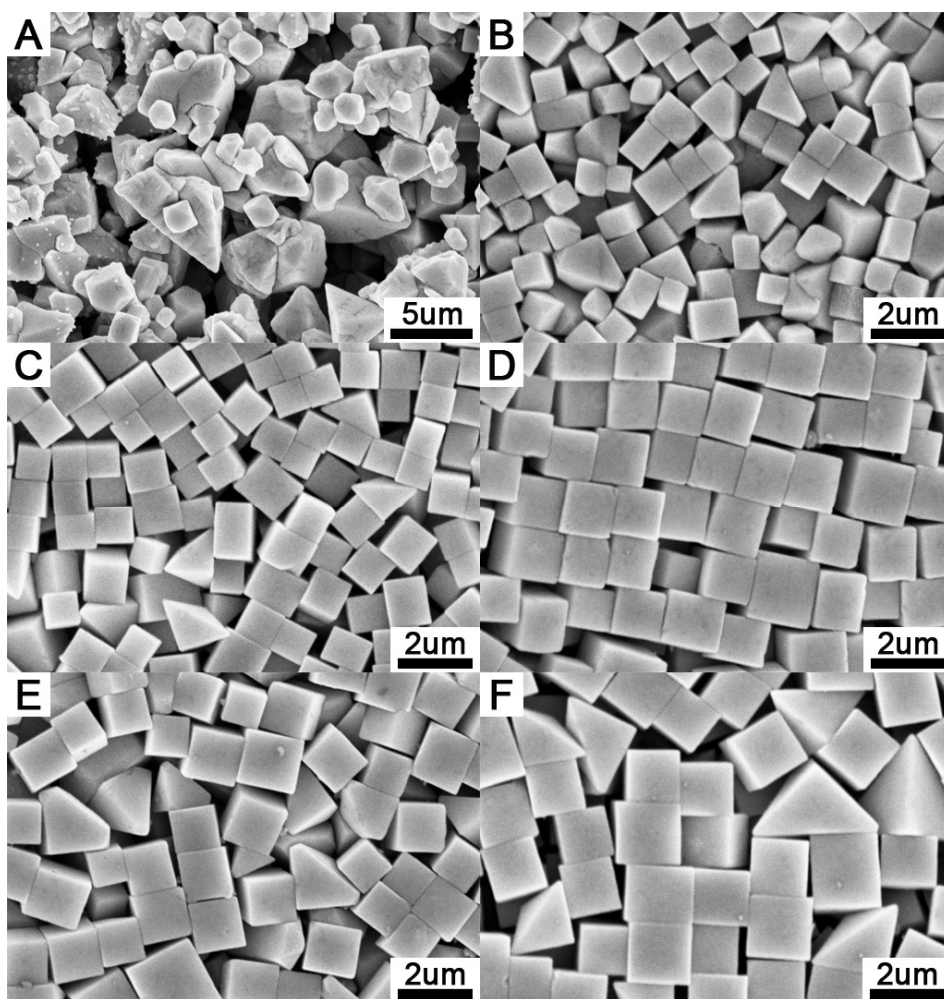
The irregular AgBr particles were prepared by a direct precipitation reaction with AgNO<sub>3</sub> and NaBr aqueous solutions at room temperature. For comparison, Ag<sub>3</sub>PO<sub>4</sub>, as a new type of highly efficient photocatalysts, was prepared by a direct precipitation reaction. In a typical synthesis, 0.340 g of AgNO<sub>3</sub> was completely dissolved in distilled water in a flask at 60 °C under magnetic stirring. Then, 30 mL of Na<sub>3</sub>PO<sub>4</sub> (Na<sub>3</sub>PO<sub>4</sub>·12H<sub>2</sub>O, 0.253 g) aqueous solution was dropwise added, and the color of the solution turned yellow immediately. After continuous stirring for 30 min, the products were collected by centrifugation and washed several times with distilled water, and then dried at 60 °C in vacuum overnight.

**Characterization.** The morphology test of the samples was carried out on a FEI Quanta 400 scanning electron microscope (FEI Company, Oregon, USA). TEM investigations were carried out by a JEOL 3100 microscope with an weak beam current of  $\sim 60 \mu\text{A}$ . The as-prepared sample was dispersed in ethanol and dropped onto a carbon film supported on a copper grid. The X-ray diffraction (XRD) spectra of the samples were recorded by a Rigaku Dmax 2200 X-ray diffractometer with Cu  $K\alpha$  radiation ( $\lambda=1.5416 \text{ \AA}$ ). Diffuse reflectance absorption spectra of AgBr-based photocatalyst were recorded in the range from 300 to 800 nm using a Hitachi U-3010 spectroscopy with  $\text{BaSO}_4$  as reference. Brunauer–Emmett–Teller (BET) nitrogen adsorption–desorption (NOVA 2200e, Quantachrome, USA). XPS spectra were measured on a Perkin-Elmer model PHI 5600 XPS system with a resolution of 0.3-0.5 eV from a monochromatic aluminum anode X-ray source.

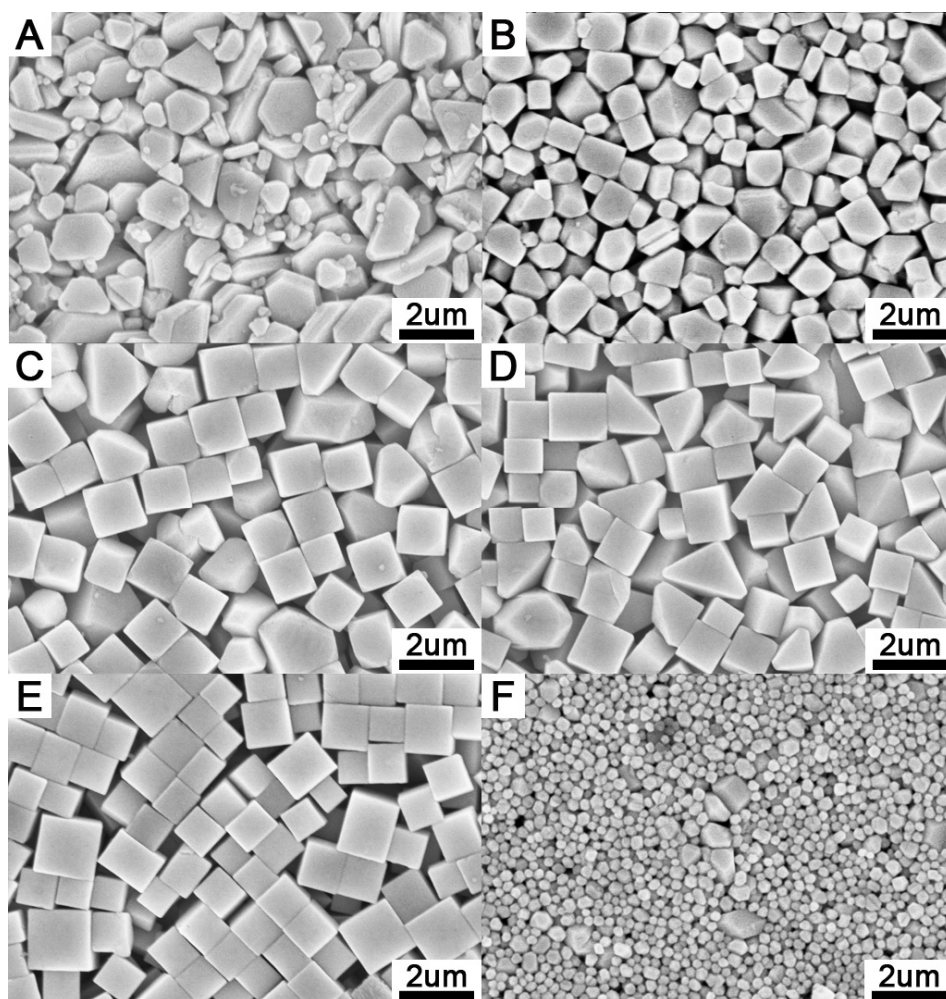
**Photocatalytic Experiment.** Photocatalytic activities of the AgBr-based photocatalyst were evaluated by degradation of MO dyes under a 300 W Xe lamp with UV cutoff filter (providing visible light with  $\lambda \geq 400 \text{ nm}$ ). MO solution (100 mL,  $10^{-4} \text{ mol} \cdot \text{L}^{-1}$ ) containing 0.1 g of the AgBr/Ag-based photocatalysts was placed in a 200 mL cylindrical quartz vessel. Before the light was turned on, the solution was stirred in the dark for 30 min to ensure an adsorption/desorption equilibrium between the catalysts and organic dyes.



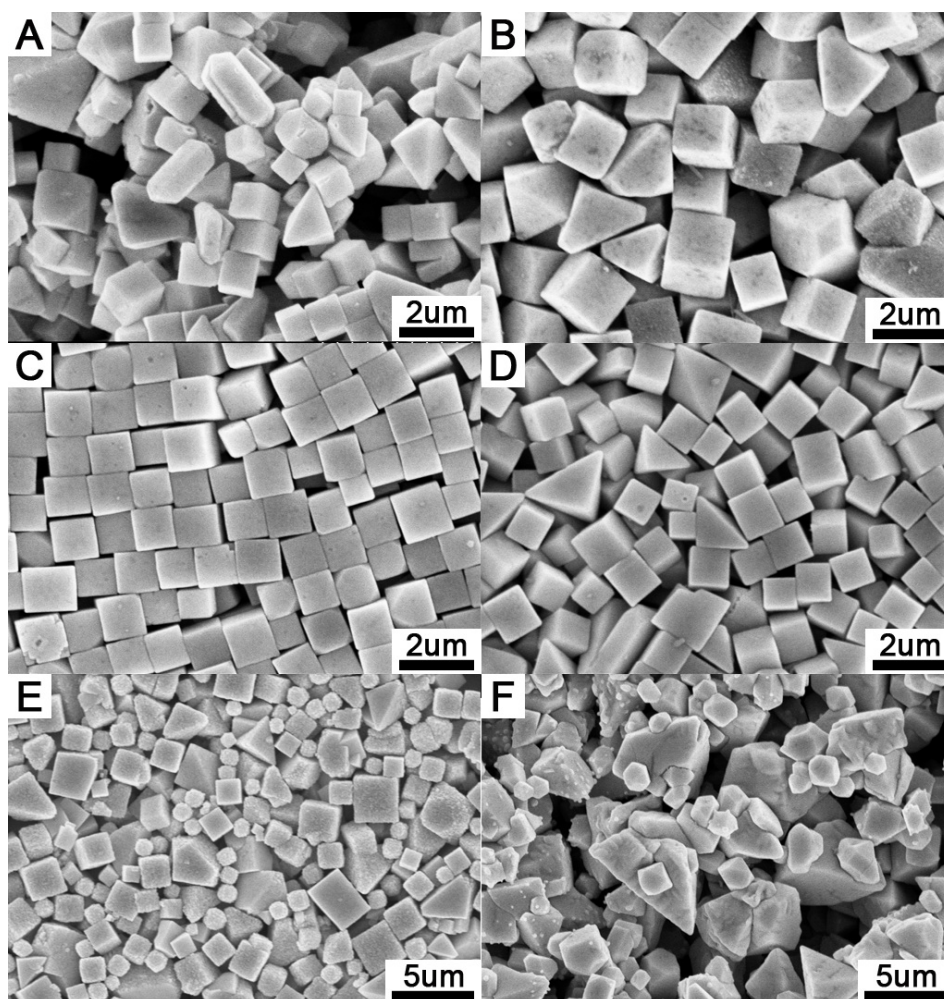
**Fig. S1.** SEM images of irregular particles at low (A) and high (B) magnifications.



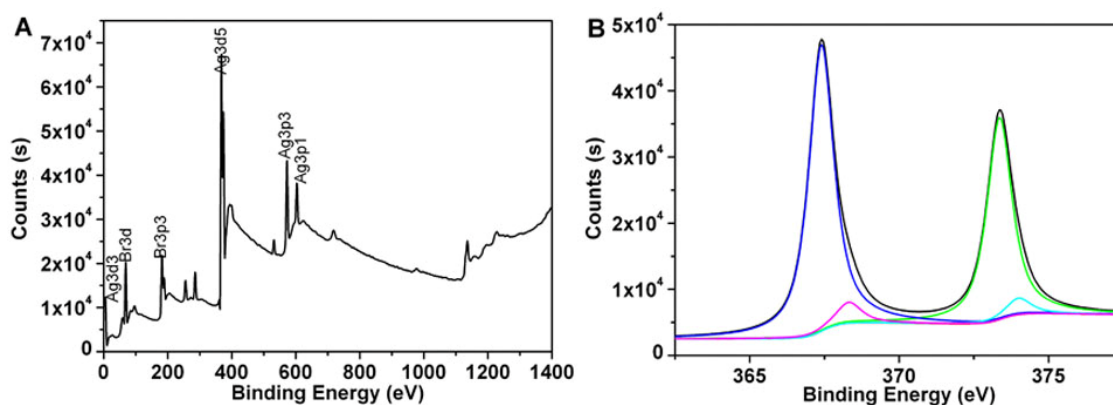
**Fig. S2.** SEM images of as-prepared AgBr nanoparticles produced with the different amount of added PVP. (A) 0 mg, (B) 18.5 mg, (C) 37 mg, (D) 74 mg, (E) 185 mg and (F) 370 mg.



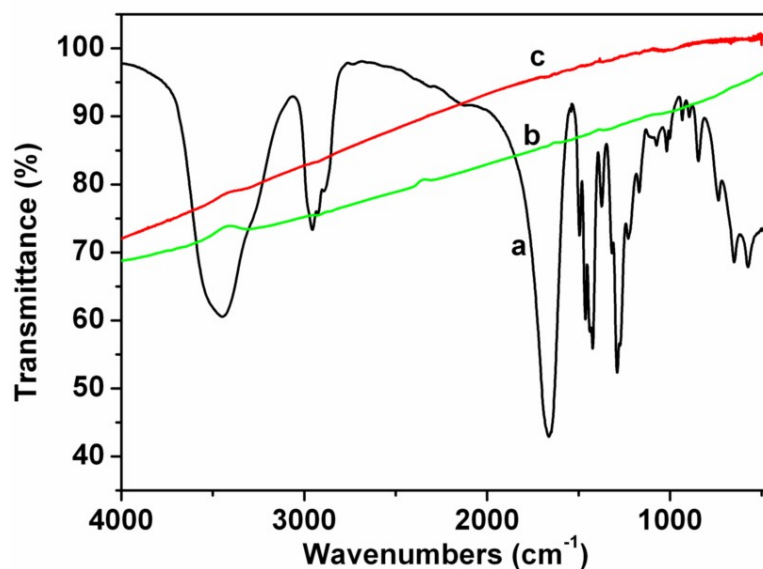
**Fig. S3.** SEM images of as-prepared AgBr nanoparticles produced with the different amount of added pyridine. (A) 0 mL, (B) 1 mL, (C) 2.5 mL, (D) 3.5 mL, (E) 5 mL and (F) 6 mL.



**Fig. S4.** SEM images of as-prepared AgBr nanoparticles produced with the different reaction time. (A) 0 h, (B) 0.5 h, (C) 1 h, (D) 3 h, (E) 6 h and (F) 12 h.



**Fig.S5.** The overview and Ag 3d XPS spectra of as-prepared AgBr nanocubes.



**Fig. S6.** The FTIR spectra of PVP (a), as-prepared irregular AgBr particles (b) and AgBr nanoplates (c).

Fig. S6 shows the FTIR spectrum of pure PVP (a), as-prepared irregular AgBr particles (b) and AgBr nanocubes (c). From curve a, it can be seen that the peaks at about 1288, 1428, 1663, 2959 cm<sup>-1</sup> correspond to the peaks of C-N, C=C, C=O and C-H, respectively. (C. X. Song, G. H. Gu, Y. S. Lin, H. Wang, Y. Guo, X. Fu and Z. S. Hu, *Materials Research Bulletin*, 2003, **38**, 917; J. Bai, Y. X. Li, C. Q. Zhang, X. F. Liang and Q. B. Yang, *Colloids and Surfaces A: physicochem, Eng. Aspects*, 2008, **329**, 165; D. F. Zhang, H. Zhang, L. Guo, K. Zheng, X. D. Han and Z. Zhang, *J. Mater. Chem.*, 2009, **19**, 5220.) The peak at 3444 cm<sup>-1</sup> is believed to be associated with the stretching vibrations of hydrogen-bonded surface water molecules and hydroxyl groups, originating from the surface adsorbed H<sub>2</sub>O. (Y. L. Hsin, K. C. Hwang and C. T. Yeh, *J. Am. Chem. Soc.*, 2007, **129**, 9999.) AgBr, which is transparent in the infrared region, has no vibration peaks within the wavenumber range from 450 to 4000 cm<sup>-1</sup>, as shown in the curve b of irregular AgBr particles, and the light absorption is due to the grain boundary effects. (T. J. Bridges, J. S. Hasiak, and A. R. Strnad, *Optics Letters*, 1980, **5**, 80; B. Lendl and B. Mizaikoff, *Optical Fibers for Mid-Infrared Spectrometry, Handbook of Vibrational Spectroscopy*, 2006; E. Rave, K. Roodenko, and A. Katzir, *Appl. Phys. Lett.*, 2003, **83**, 1912; V.A. Burrows. *Solid State Electron.*, 1992, **35**, 231.) Meanwhile, no vibration peaks from PVP can be found in curve c, which suggests that the PVP has been completely removed from the as-prepared AgBr nanocubes.