Supporting Information

Facile Synthesis of Tetrapod-Shaped Ag_3PO_4 Microcrystals with an Increased Percentage of Exposed {110} Facets and Highly Efficient Photocatalytic Properties

*Hua Wang,[a] Liang He,[a] Lihua Wang,[b] Pengfei Hu,[a] Lin Guo,[*a] Xiaodong Han[b] and Jinghong Li[*c]*

[a]School of Chemistry and Environment, Beihang University, Beijing, 100191, China

[b]Institute of Microstructure and Properties of Advanced Materials, Beijing University of Technology, Beijing, 100022, China

[c]Department of Chemistry, Beijing Key Laboratory for Microanalytical Methods and Instrumentation, Lab. of Bioorganic Phosphorus Chemistry & Chemical Biology, Tsinghua University, Beijing, 100084, China

Corresponding author. E-mail: guolin@buaa.edu.cn; jhli@mail.tsinghua.edu.cn

EXPERIMENT

Preparation of Ag_3PO_4 Tetrapods. The silver-ammino ($[Ag(NH_3)_2]^+$) complex were used as the Ag^+ source, and typically, $AgNO_3$ (100 mg) was dissolved in 6 mL deionized water, then 168 μL concentrated ammonia aqueous solution ($NH_3 \cdot H_2O$, mass fraction 25%-28%) was added to form a transparent solution. The Ag_3PO_4 tetrapods were prepared using a facile precipitation reaction by the direct mixture of the above ($[Ag(NH_3)_2]^+$) complex with Na_2HPO_4 (5 g) aqueous solution at 60 °C. After continuous stirring for 1 h, the products were collected by centrifugation and washed several times

with distilled water, and then dried at room temperature in vacuum overnight. Some control experiments were carried out using the same process by simply adjusting the amount of added $NH_3 \cdot H_2O$ with the concrete amount of 5 g Na_2HPO_4, and adjusting the amount of added Na_2HPO_4 with the concrete amount of 168 μL $NH_3 \cdot H_2O$. The growth process was also investigated by replacing Na_2HPO_4 with other sources of PO_4^{3-}, such as NaH_2PO_4, H_3PO_4 and Na_3PO_4. Moreover, the irregular Ag_3PO_4 particles were prepared by a direct precipitation reaction with $AgNO_3$ and Na_2HPO_4 aqueous solutions without $NH_3 \cdot H_2O$ as coordination agent. The N-doped TiO_2 photocatalyst was prepared by nitridation of commercially available P25 powder under NH_3 flow (flow rate of 350 mL min^{-1}) at 500 °C for 10 h.

Characterization. The morphology test of the samples was carried out on a FEI Quanta 400 scanning electron microscope (FEI Company, Oregun, USA). The X-ray diffraction (XRD) spectra of the samples were recorded by a Rigaku Dmax 2200 X-ray diffractometer with Cu Kα radiation (λ=1.5416 Å). Diffuse reflectance absorption spectra of Ag_3PO_4-based photocatalyst were recorded in the range from 200 to 800 nm using a Hitachi U-3010 spectroscopy with $BaSO_4$ as reference. Brunauer–Emmett–Teller (BET) nitrogen adsorption–desorption (NOVA 2200e, Quanthachrome, USA).

Photocatalytic Experiment. Photocatalytic activities of the Ag_3PO_4-based photocatalyst were evaluated by degradation of MO dyes under a 300 W Xe lamp with UV cutoff filter (providing visible light with λ≥400 nm). MO solution (100 mL, 2×10^{-5} mol· L^{-1}) containing 0.1 g Ag_3PO_4-based photocatalysts or N-doped TiO_2 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.

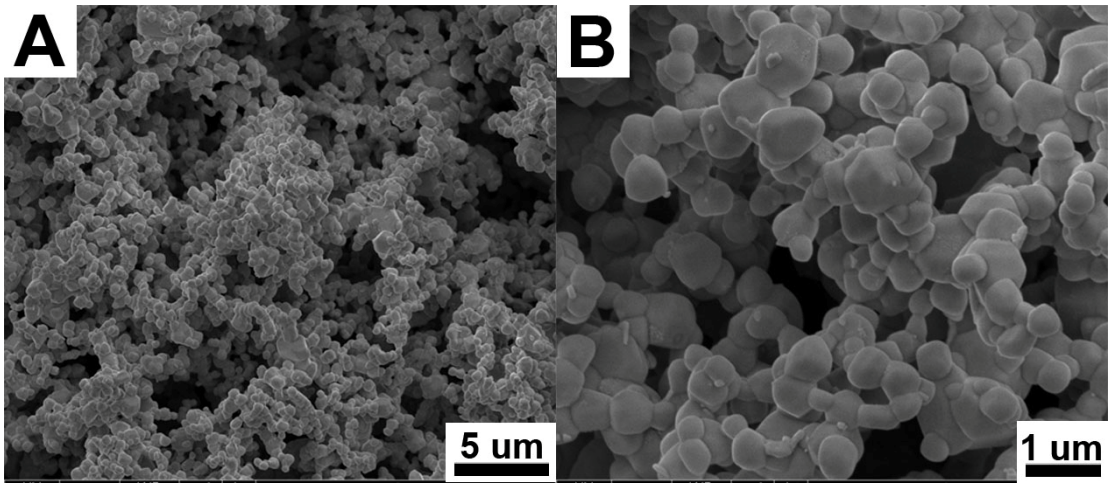

Fig. S1. SEM images of irregular Ag_3PO_4 particles at low (A) and high (B) magnifications.

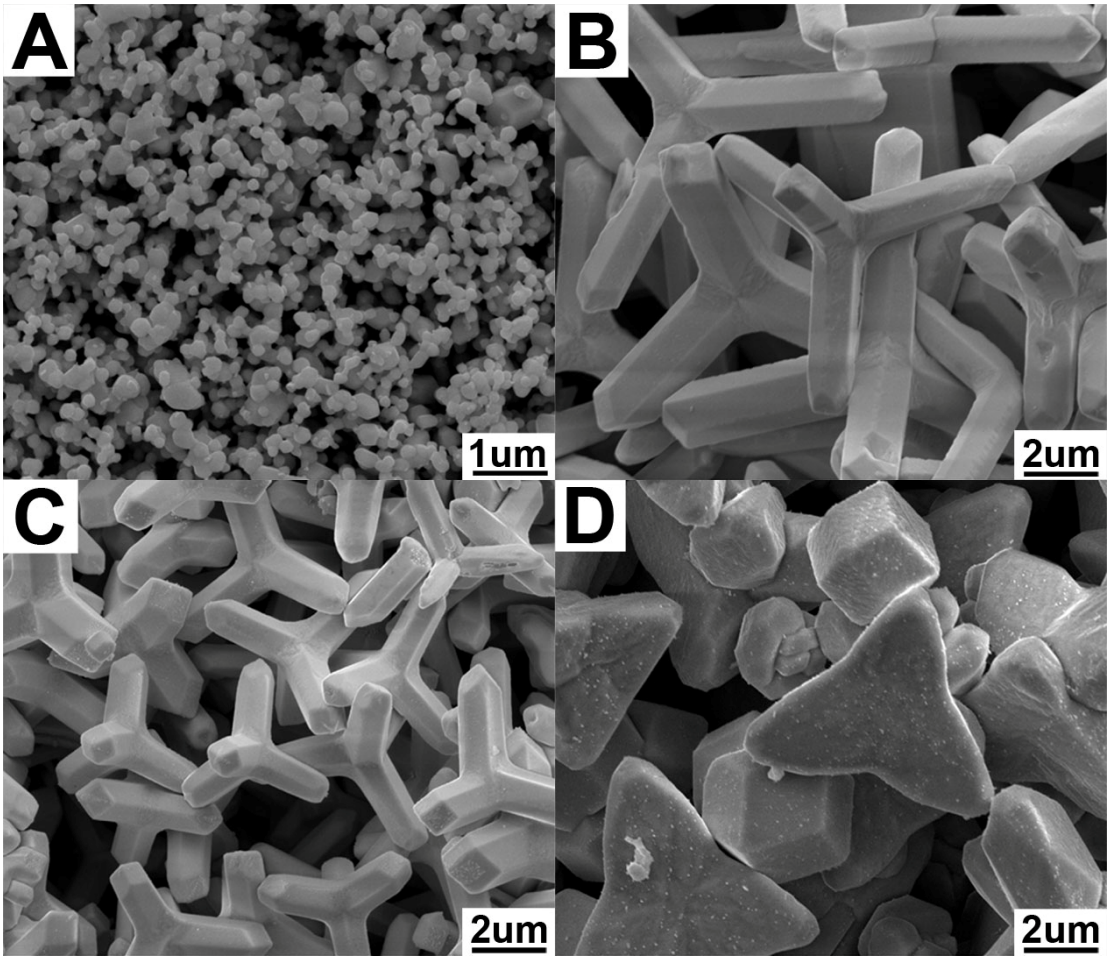

Fig. S2. SEM images of as-prepared Ag_3PO_4 nanoparticles produced with the different amount of added $NH_3 \cdot H_2O$. (A)64 μL (B) 138 μL , (C) 168 μL, (D) 198 μL.

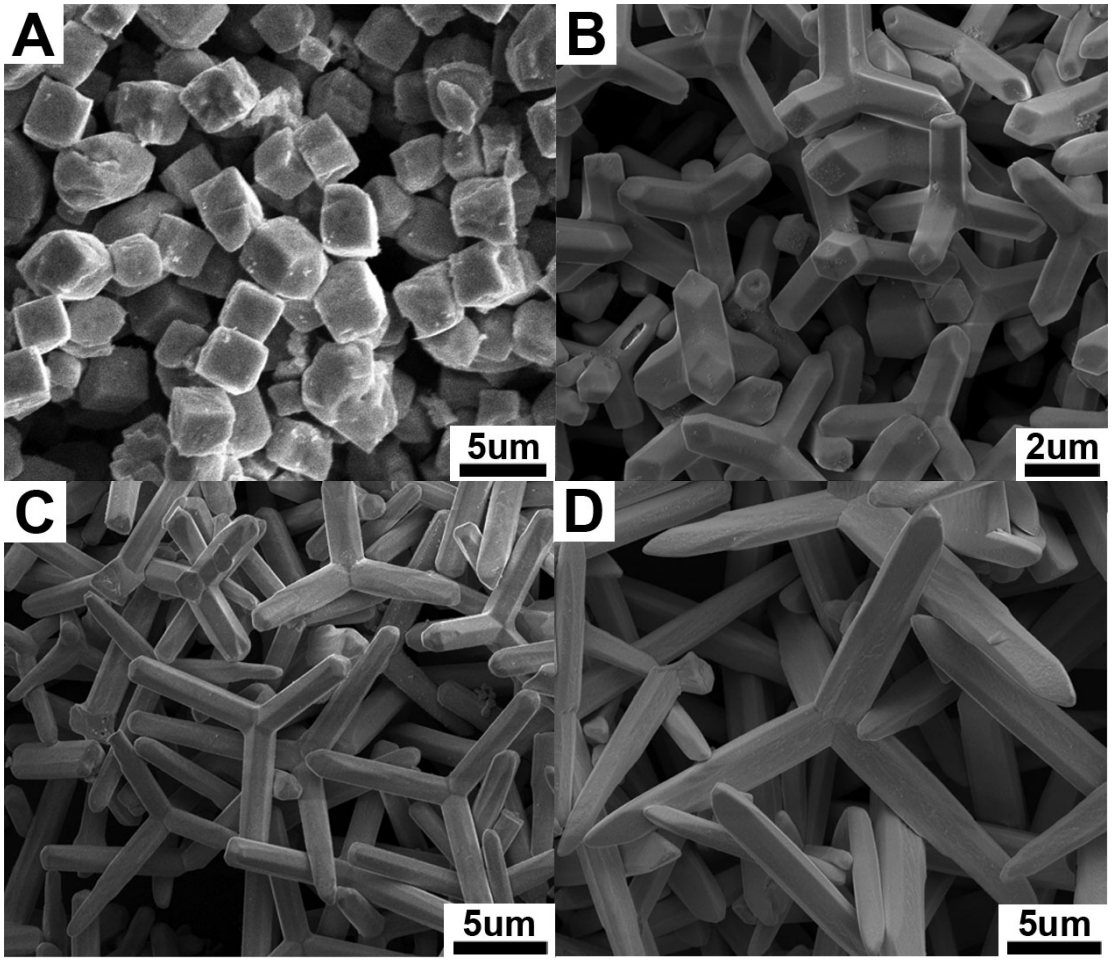

Fig. S3. SEM images of as-prepared Ag_3PO_4 nanoparticles produced with the different amount of added Na_2HPO_4. (A) 3 g, (B) 5 g, (C) 6 g, (D) 7.5 g.

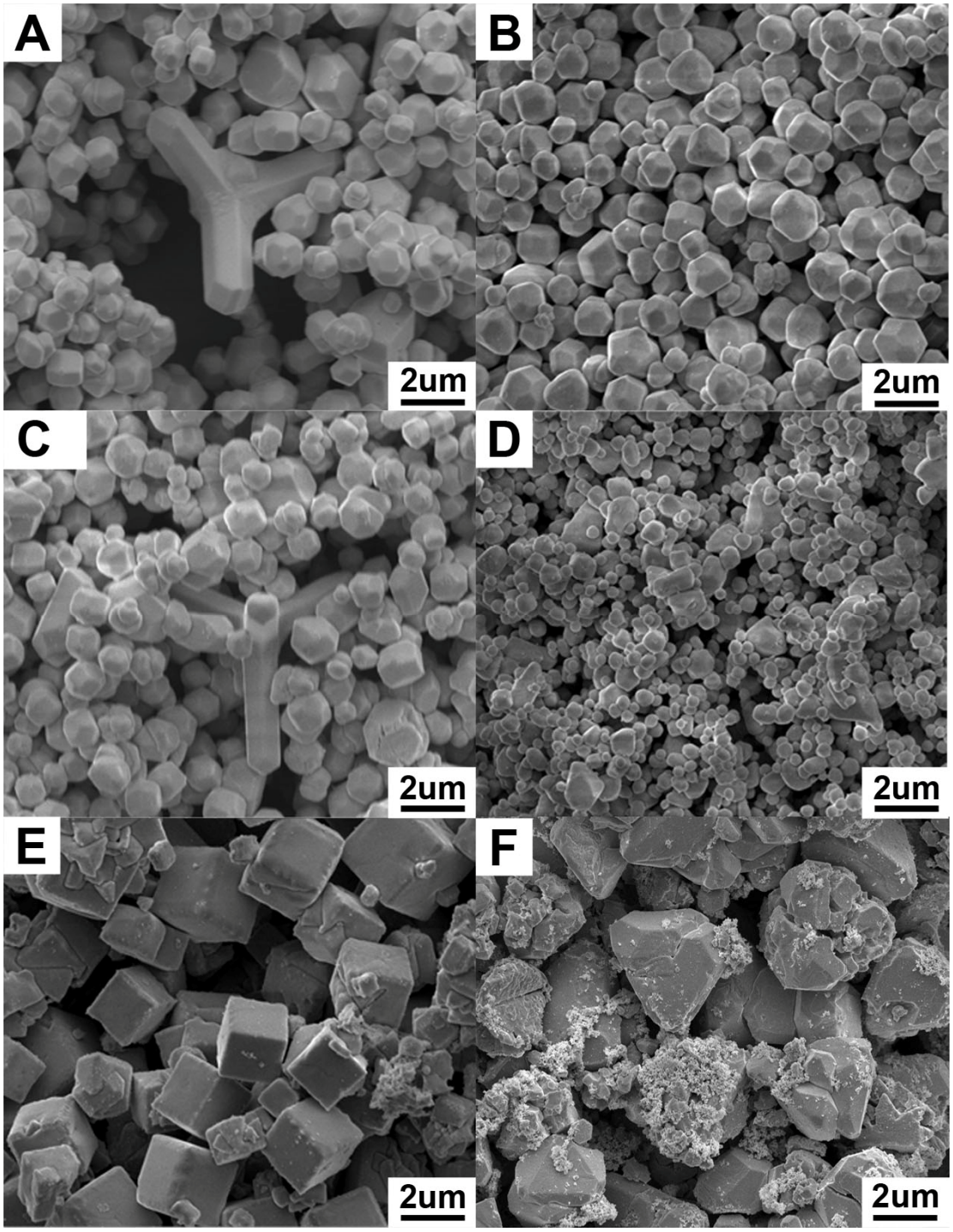

Fig. S4. SEM images of as-prepared Ag_3PO_4 nanoparticles produced by replacing Na_2HPO_4 with other sources of PO_4^{3-}, such as NaH_2PO_4 (A,B), H_3PO_4 (C,D) and Na_3PO_4 (E,F).

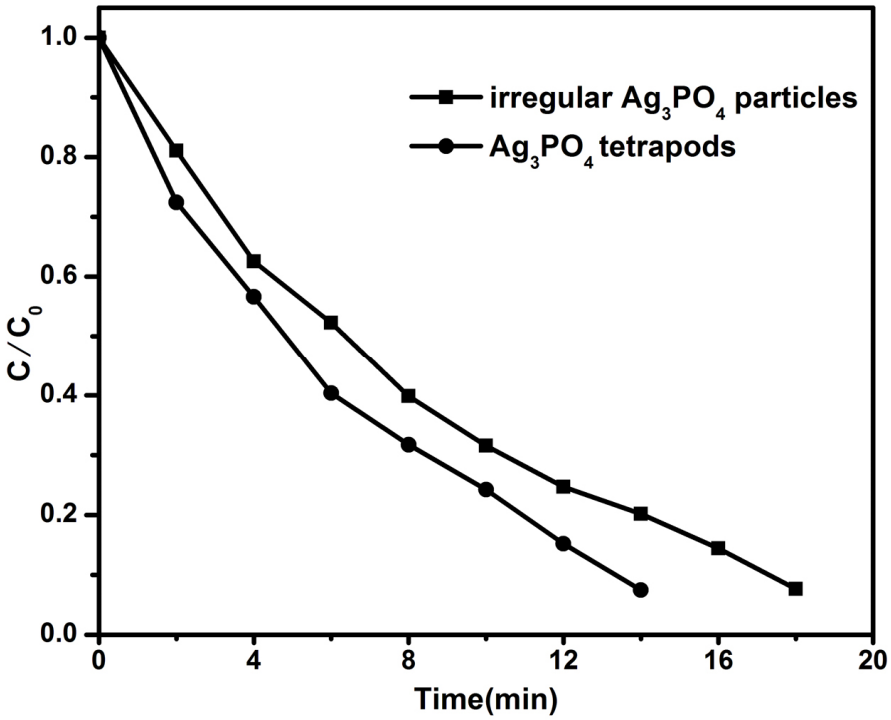

Fig. S5. Photodegradation of higher concentration MO dyes solution over as-prepared Ag_3PO_4 tetrapods and irregular Ag_3PO_4 particles.

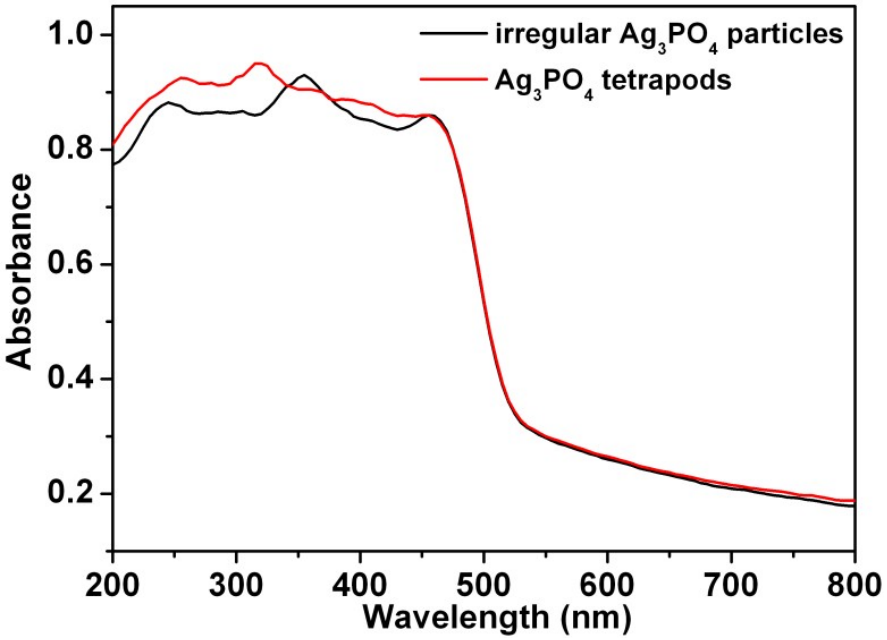

Fig. S6. Diffuse reflectance absorption spectra (DRS) of as-prepared Ag_3PO_4 tetrapods (a) and irregular particles (b).