**Supporting Information for**

# Facile synthesis of novel $Ag_3PO_4$ tetrapods and the {110} facets-dominated photocatalytic activity

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## Experimental Section

***Chemicals:*** All chemicals used were analytic grade reagents without further purification; silver nitrate ($AgNO_3$), 85% phosphoric acid (85% $H_3PO_4$), urea ($CO(NH_2)_2$), titanium dioxide ($TiO_2$) were purchased from Shanghai Reagents Company (Shanghai, China).

***Synthesis of $Ag_3PO_4$ tetrapods:*** In a typical procedure, 3 mmol of 85% $H_3PO_4$ was dissolved in 80 mL of deionized water and 2.5 mmol of $AgNO_3$ was added under stirring. Then, 37.5 mmol of urea were put into above solution. The resulting precursor was transferred into a Teflon-lined stainless steel autoclave and maintained at 80□ for 24 h. After cooling to room temperature, the yellow precipitation was collected and washed with deionized water several times, and dried overnight at 60□.

***Synthesis of irregular $Ag_3PO_4$:*** The irregular $Ag_3PO_4$ particles were synthesized as previously reported.[1] Typically, appropriate amounts of raw powders of $Na_2HPO_4$ and $AgNO_3$ were thoroughly ground until the initial white changed to yellow. The SEM images and XRD pattern of irregular $Ag_3PO_4$ were showed in Fig. S1B.

***Synthesis of N-$TiO_2$:*** Nitrogen doping was conducted as described previously.[2] P25 (0.5 g) was suspended in ethanol (5 mL). Then, urea (1 g) was dissolved in 2.5 mL ethanol and 0.5 mL $H_2O$ was added into the suspension. The mixture was stirred and heated to completely evaporate the solvent, followed by calcination in air at 400 $^oC$ for 4 h.

***Photocatalytic reactions:*** Photocatalytic activities of the samples were evaluated by the photocatalytic decomposition of rhodamine B (RhB). Typically, 0.1 g of powders were put into a solution of RhB dye (100 ml, 8 mg/L), which was irradiated with a 300W Xe arc lamp equipped with an ultraviolet cutoff filter to provide visible light with $\lambda \geq 420$ nm.

***Characterizations:*** Scanning electron microscope (SEM) images of the samples were obtained on a Hitachi SU-1510 operated at 120kV. The samples were coated with 5-nm-thick gold layer before observation. The phase compositions of the samples were determined by X-ray diffractometer (Rigaku D/max-2550VB): using graphite monochromatized Cu K□ radiation ($\lambda$= 0.154 nm), operating at 40 kV and 50mA. The XRD patterns were scanned in the range of 20-80° (2□) at a scanning rate of 5°$min^{-1}$. Nitrogen adsorption-desorption isotherms were collected at 77 K using the NOVOE 4000 adsorption apparatus.

**Reference**

(1) Z. Yi, J. Ye, N. Kikugawa, T. Kako, S. Ouyang, H. S. Williams, H. Yang, J. Cao, W. Luo, Z. Li, Y. Liu and R. L. Withers, *Nat. Mater.*, 2010, **9**, 559.

(2) D. Mitoraj and H. Kisch, *Angew. Chem., Int. Ed.*, 2008, **47**, 9975.

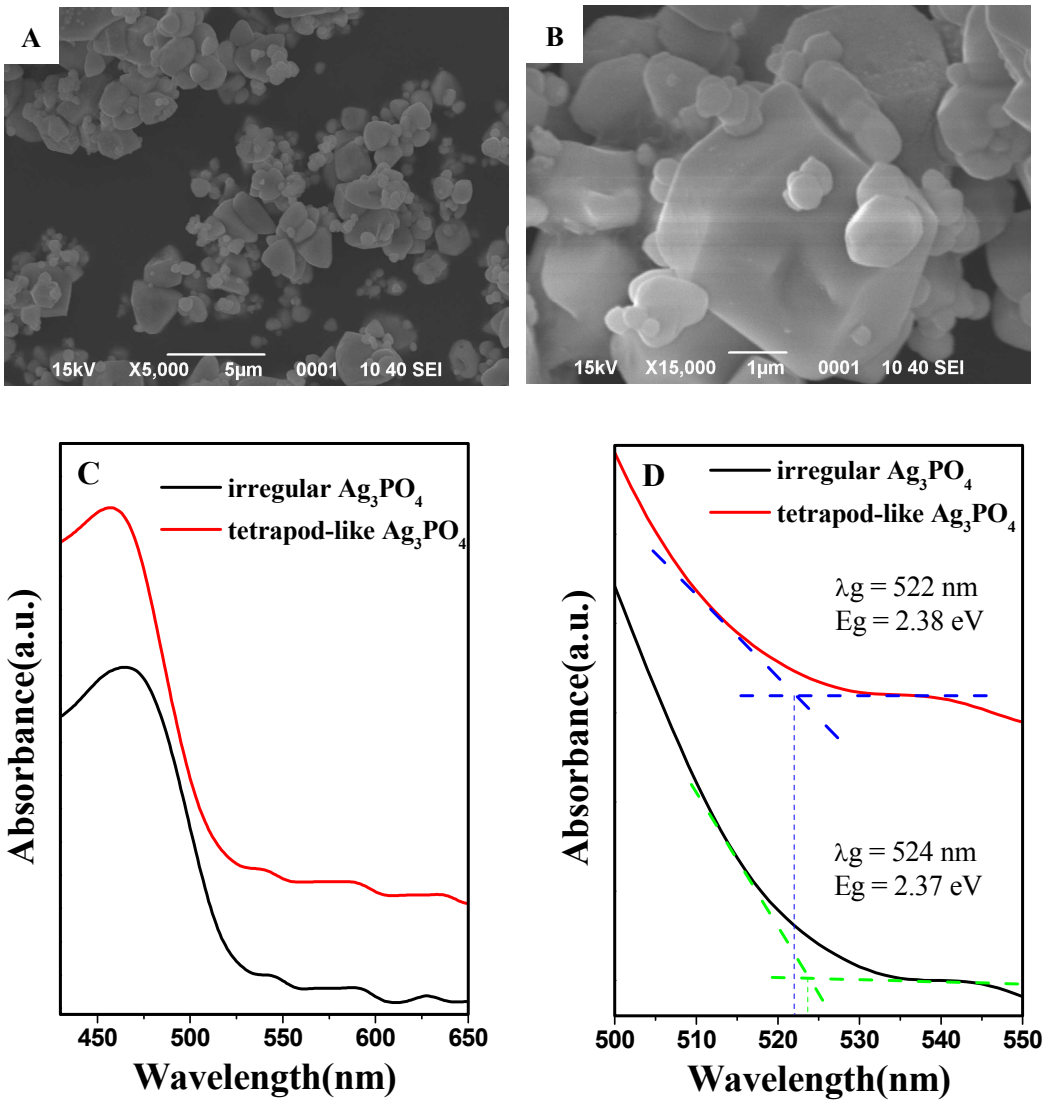


**Fig. S1** (A, B) SEM images of irregular $Ag_3PO_4$; (C,D) UV-visible spectra of T-$Ag_3PO_4$ and irregular $Ag_3PO_4$.

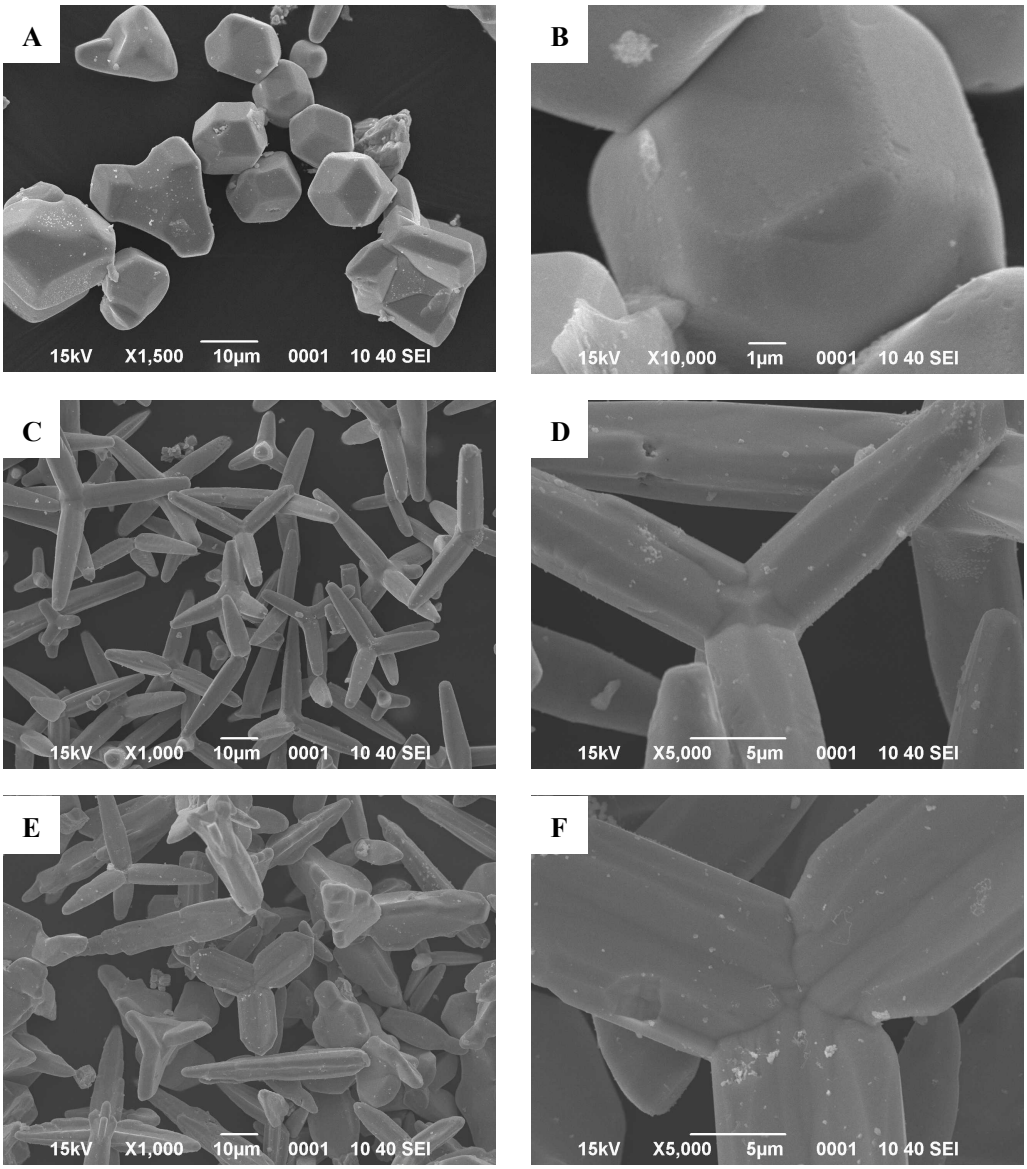


**Fig. S2** SEM images of $Ag_3PO_4$ microcrystals synthesized at different molar ratios of urea to $AgNO_3$: (A, B) 10; (C, D) 15; (E, F) 20.

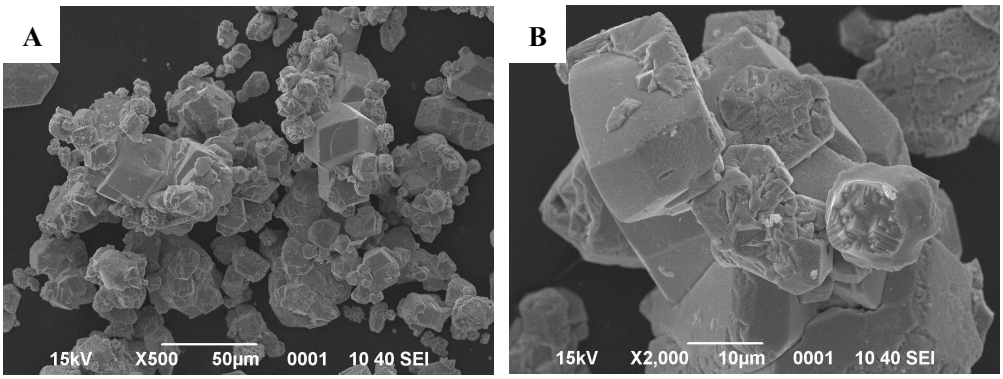


**Fig. S3** SEM images of $Ag_3PO_4$ microcrystals synthesized via an open refluxing system.

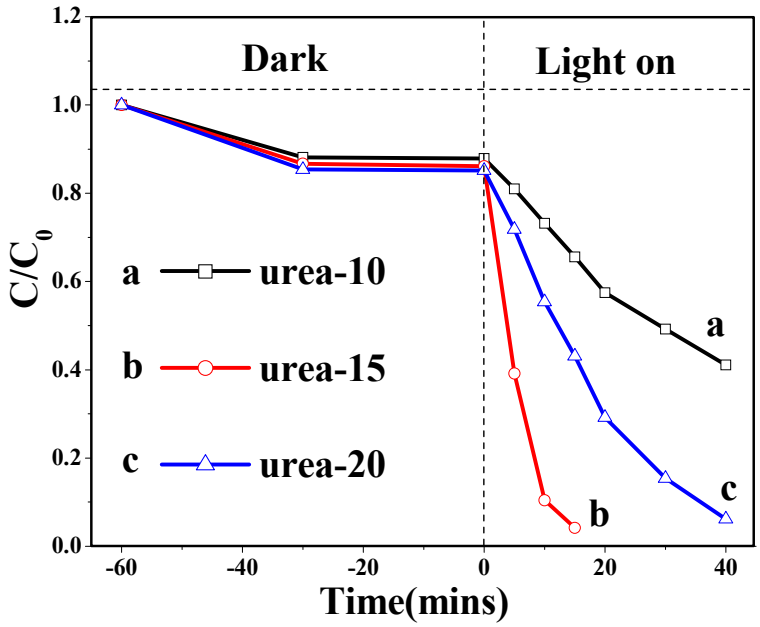


**Fig. S4** Photocatalytic activities of $Ag_3PO_4$ synthesized at different molar ratios of urea to $AgNO_3$: (a) 10, (b) 15, (c) 20.

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**Table S1** The textural properties of the polyhedrons and tetrapods.

| Samples | Surface areas ($m^2/g$) | Pore volume ($cm^3/g$) | Pore Diameter (nm) |
|---|---|---|---|
| Polyhedrons | 29.851 | 0.023 | 3.113 |
| Tetrapods | 37.952 | 0.030 | 3.112 |

Surface area, calculated by the Brunauer–Emmett–Teller method; Pore sizes, calculated by the Barret–Joyner–Halender method.