Supporting Information for

Fabrication of Ag_3PO_4/PAN composite nanofibers for photocatalytic applications

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Experimental Section

1. Materials

PAN (M_w=150000) was purchased from J&K Scientific Ltd, and ACS grade DMF was purchased from Sinopharm Chemical ReagentCo. Ltd. $AgNO_3$ and NaH_2PO_4 were also purchased from Sinopharm Chemical ReagentCo. Ltd, which were used to prepare Ag_3PO_4 nanoparticles.

2. Synthesis of Ag_3PO_4 nanoparticles

The Ag_3PO_4 nanoparticles were prepared by a simple precipitation reaction. In a typical synthesis, $AgNO_3$ (0.2 g) was solved in aqueous solution. Ammonia aqueous solution (0.1 M) was added with drop by drop to the above solution to form a transparent solution. Then the massive NaH_2PO_4 slowly dissolved in the solution of silver ammonia. After reaction for half an hour, the precursor Ag_3PO_4 particles were isolated by centrifugation and dried.

2. Fabrication of the Ag_3PO_4/PAN nanofibers

In a typical process, the Ag_3PO_4/PAN composite nanofibers were prepared by dissolving 0.5 g polyacrylonitrile (PAN) in 4.5 g N,N-Dimethyl formamide (DMF) to get a PAN solution of 10 wt %, and then 0.5 g Ag_3PO_4 particles was added to the as-prepared PAN/DMF solution to form a well-dispersed viscous solution after magnetically stirred for 30 min and then sonicated for 1 h. Subsequently, the mixture was loaded into a plastic syringe equipped with a metallic needle which was connected to a high-voltage generator that was capable of produce DC voltages from 0 to 50 kV. The liquids were fed at a constant rate of 1 mL/h through a syringe pumps. A sheet of grounded aluminum foil was placed 10 cm under the syringe as the collector. All experiments were conducted at room temperature and atmosphere pressure.

3. Photocatalytic Reactions

In a typical test, the sample (0.4 g, the mass ratio of Ag_3PO_4: PAN was 5:5) was mixed with an aqueous solution of RhB dye (100 mL, 8 mg/L). The reaction system was irradiated with a 300 W Xe arc lamp equipped with an ultraviolet cutoff filter to provide visible light with $\lambda \geq 420$ nm. The degradation of RhB dye was monitored by UV/Vis spectroscopy. Before the spectroscopy measurement, this photocatalyst was removed from the photocatalytic reaction systems by a dialyzer (Millipore, Millex-LH 0.45 μm).

4. Characterizations

The morphologies were observed by a field-emission scanning electron microscope (FE-SEM, JSM 6701F) operated at an accelerating voltage of 5 kV. The X-ray diffraction (XRD) measurements were performed on a X' pert PRO diffractometer using Cu Kα radiation (40 kV). The XRD patterns were recorded from 10° to 90° with a scanning rate of 0.067°/ s. The TEM images and composition of the products were characterized on a transmission electron microscope (JEM-1200 EX). The infrared spectra were obtained on a TENSOR27 FT-IR spectrometer using the KBr disk method. UV/Vis absorption spectra were taken at room temperature on a UV-2550 (Shimadzu) spectrometer.

Additional Figures and Discussions

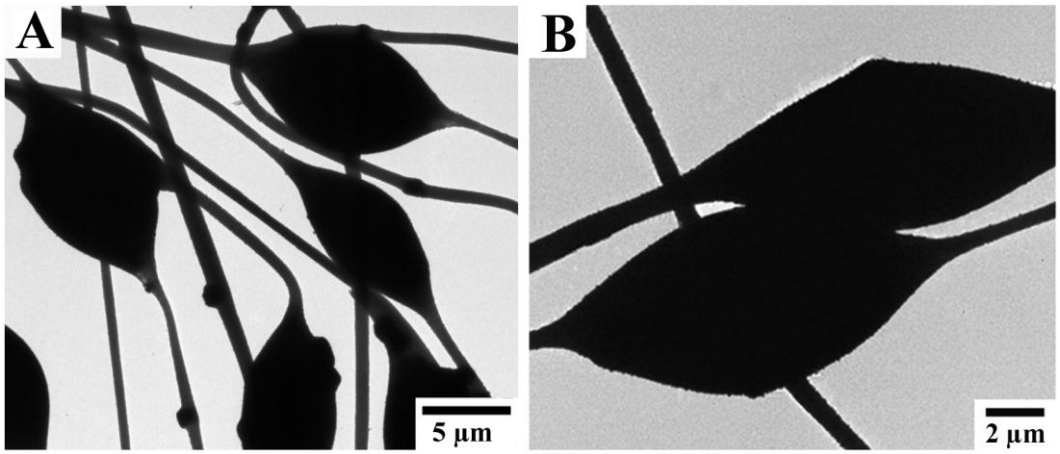

Fig. S1. TEM image of Ag_3PO_4/PAN composite nanofibers with different voltage: (A, B) 15 kV. Ag_3PO_4:PAN=5:5, work distance 10 cm.

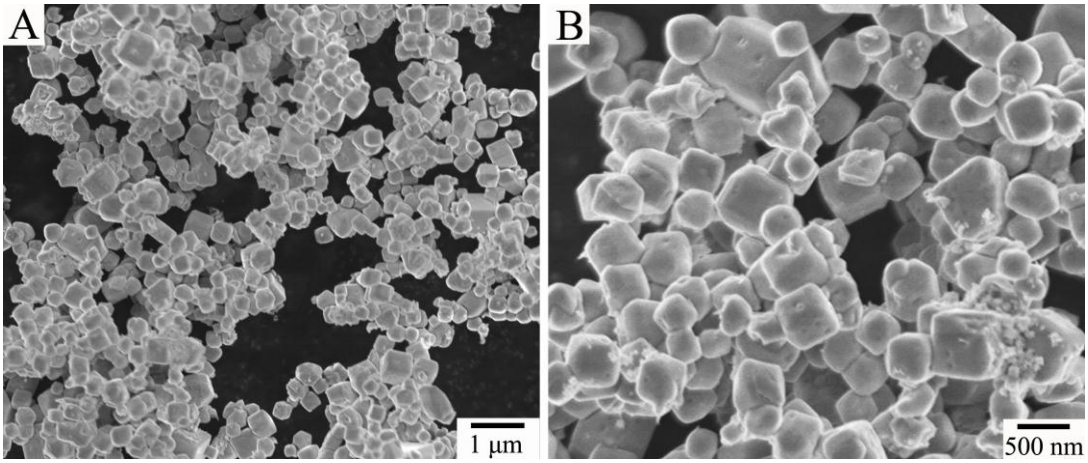

Fig. S2. SEM images of Ag_3PO_4 particles synthesized by reacting the $[Ag(NH_3)_2]^+$ complex with Na_2HPO_4 at room temperature

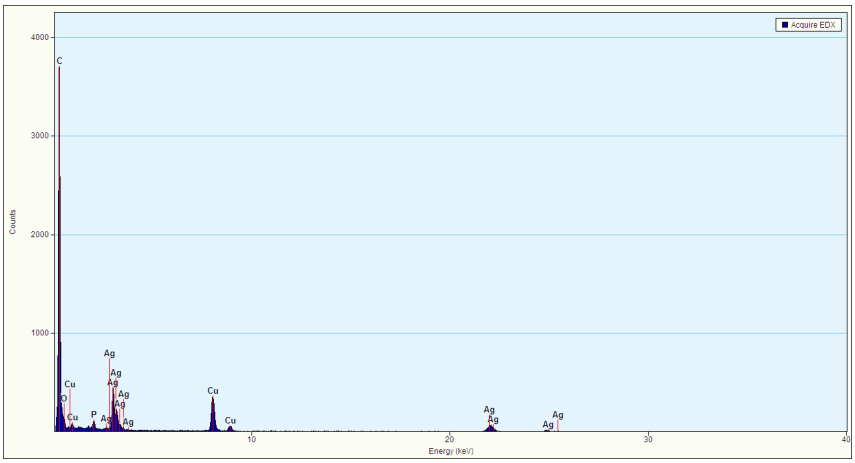

Fig. S3. EDS spectra of the as-synthesized Ag_3PO_4/PAN necklace-like nanofibers.

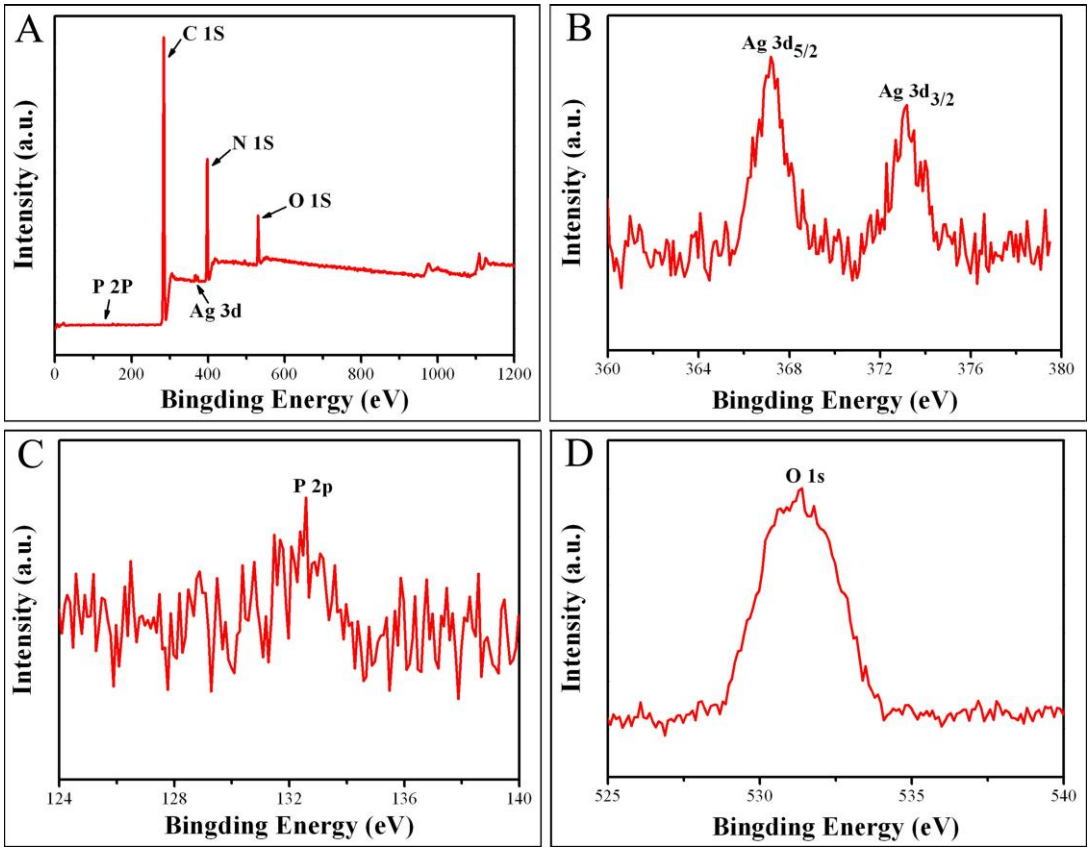

Fig. S4. XPS spectra of (A)Ag_3PO_4/PAN necklace-like nanofibers, (B) Ag 3d, (C) P 2p, (D) O 1s.

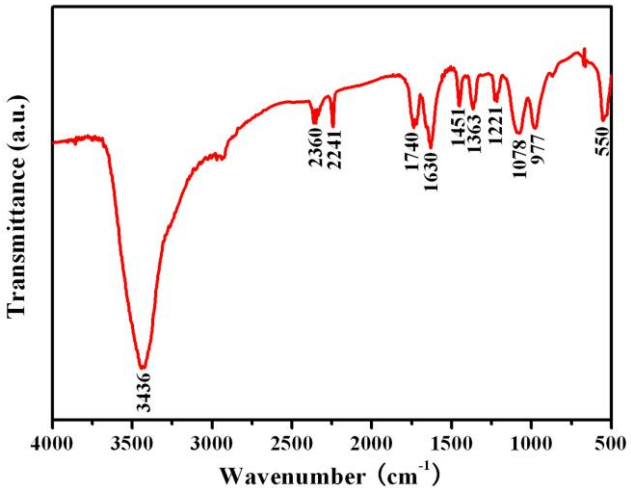

Fig. S5. FTIR spectra of Ag_3PO_4/PAN necklace-like nanofibers.

FTIR analysis of the as-prepared Ag_3PO_4/PAN necklace-like nanofibers

The infrared spectra of the Ag_3PO_4/PAN necklace-like nanofibers has been investigated and shown in Fig. S5. It can be clearly seen that the Ag_3PO_4 displays the characteristic absorption peaks of the P-O stretching vibrations at 1078 cm^{-1} and 550 cm^{-1}, respectively [1]. The vibrations characteristic of CN nitrile group is observed at 2241 cm^{-1}, and the characteristic bands at 1451 cm^{-1}, 1363 cm^{-1} and 1221 cm^{-1} are assigned to the aliphatic CH group vibrations [2]. In addition, the bands at 3436 cm^{-1} and 1630 cm^{-1} are attributed to OH strectching vibrations of the H_2O molecules, the peak at 2360 cm^{-1} can be attributed to CO_2 peak presented in air. Besides, the C-C bands is appeared around 977cm^{-1} [3], and the peak at 1740 cm^{-1} should correspond to the C=O peak for methyl acrylate comonomer.[4]

Reference

[1]. M. Thomas, S. K. Ghosh and K. C. George, *Mater. Lett.*, 2002, 56, 386.

[2]. W. Zhang, J. Liu and G. Wu. *Carbon*, 2003, 41, 2805.

[3]. S. Bloembergen, D. Holden, G. Hamer, T. Bluhm and R. Marchessault. *Macromolecules*, 1986, 19, 2865.

[4]. S. Juthawan, J. Sujinda, N. Manit, M. Chidchanok and S. Pitt. *Polym. Int.*, 2006, 825.

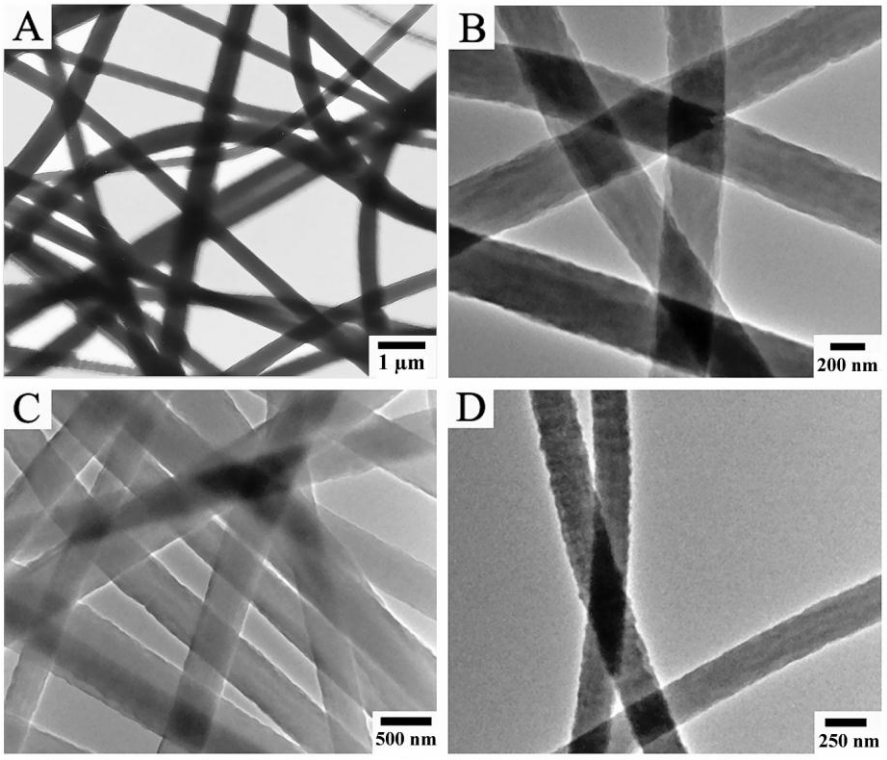

Fig. S6. TEM image of Ag_3PO_4/PAN composite nanofibers with different voltage: (A, B) 20 kV, (C) 25 kV, (D) 30 kV. Ag_3PO_4:PAN=5:5, work distance 10 cm.

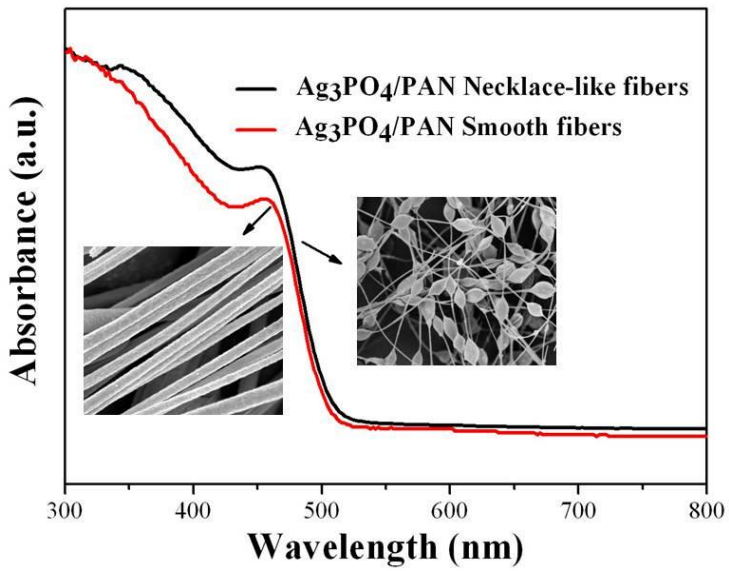

Fig. S7. The ultraviolet-visible diffusive absorption spectrums of Ag_3PO_4/PAN electrospun mats: the neck-lace like nanofibers and the smooth nanofibers

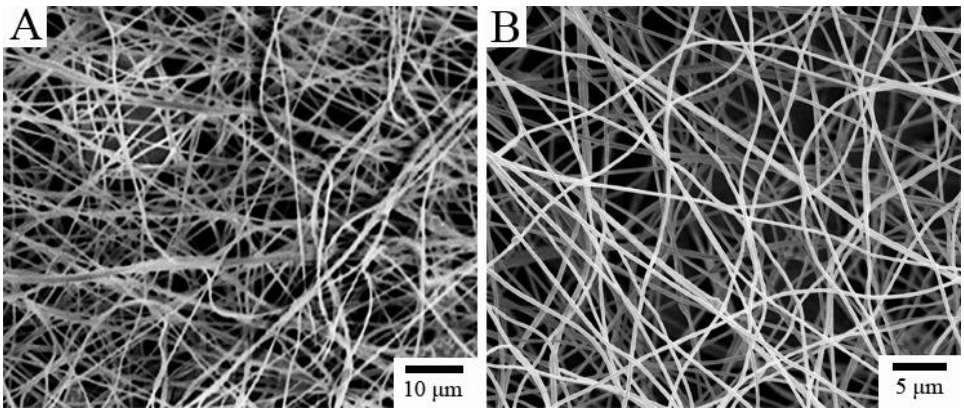

Fig. S8. SEM images of the Ag_3PO_4/PAN nanofibers with different magnifications. PAN 12 wt %, Voltage 15 kV, work distance 10 cm.

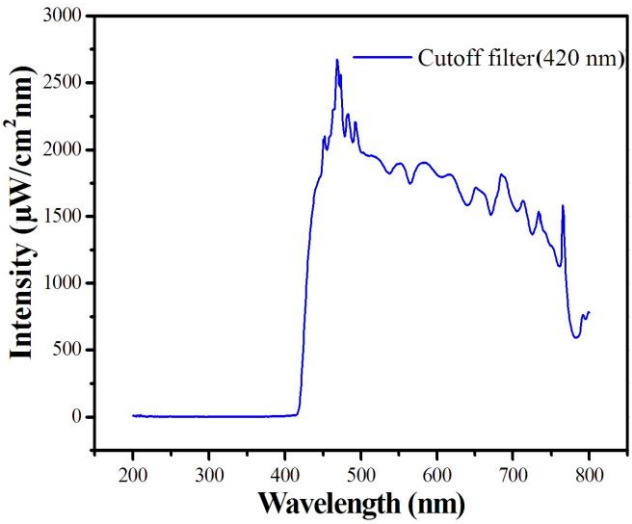

Fig. S9. The intensity and wavelength distribution of the irradiation light employed in the organic decomposition experiments. Integral intensities were measured under the actual experimental conditions.

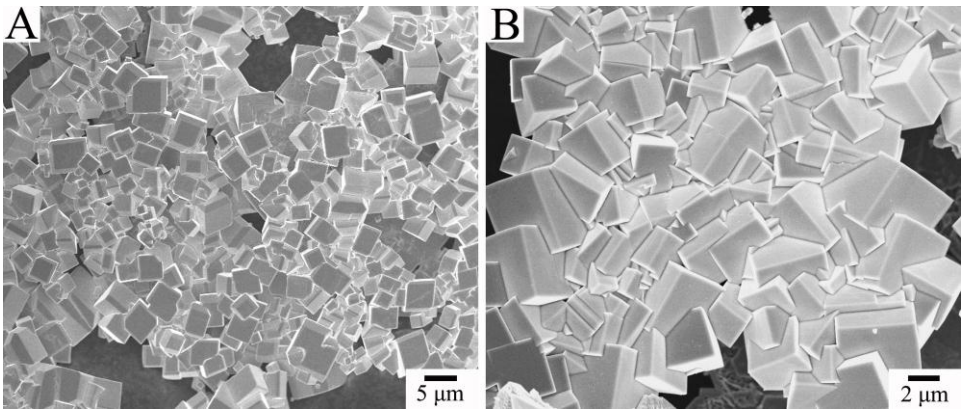

Fig. S10. (A,B) SEM images of the cubic Ag_3PO_4 crystals with different magnifications.

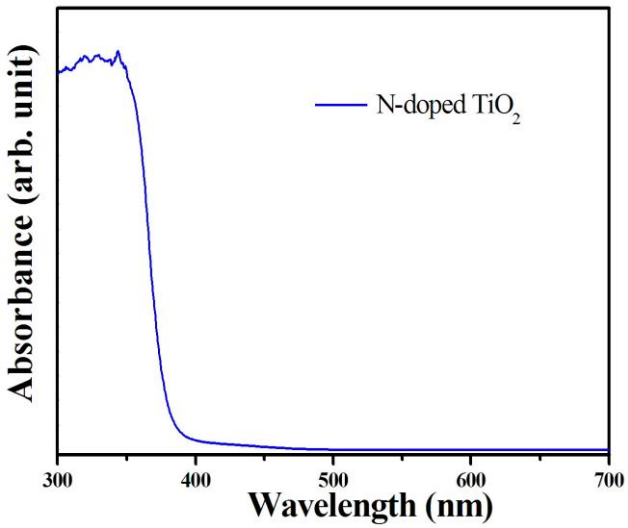

Fig. S11. The ultraviolet–visible diffusive reflectance spectrums of N-doped TiO_2.

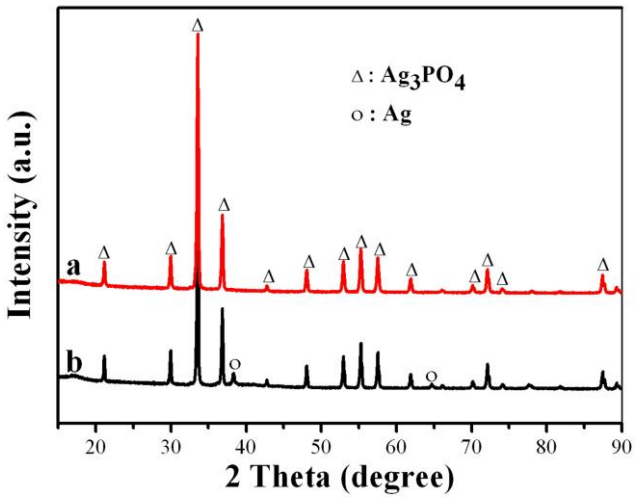

Fig. S12. XRD patterns of Ag_3PO_4/PAN Necklace-like nanofibers: (a) before the photodegradation experiment, (b) after the photodegradation experiment.