Electronic Supplementary Information for

Facile synthesis of novel α-Ag_3VO_4 nanostructures with enhanced photocatalytic activity

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Experimental procedure

Synthesis of α-Ag_3VO_4 nanostructures:

In a typical experiment, 5 mL of *n*-butylamine (*n*-BA) (0.1 mM) was dropped into 100 mL of $AgNO_3$ aqueous solution (5 mM), then, the color of the solution was transmitted from transparent to dark brown. After the mixture was stirred for 12 h at the room temperature, 5 mL of Na_3VO_4 aqueous solution (0.033 M) was added into the above solution and yellow precipitation was formed. The sample was washed by deionized water and absolute ethyl alcohol alternatively and dried at 70 ^oC at air atmosphere. Then, α-Ag_3VO_4 nanostars were obtained. Varying the amounts of *n*-BA and Na_3VO_4 while other conditions are kept constant, the α-Ag_3VO_4 with flowers structure can be fabricated. As a contrast photocatalyst, the nanoparticles were obtained from precipitating using $AgNO_3$ and Na_3VO_4 aqueous solution directly.

Photocatalytic activity measurement

In photocatalytic testing, 0.1 g of samples was dispersed in 100 mL of rhodamine B (RhB) aqueous solution (1×10^{-5} M) in a glass reactor. The mixture was stirred for 30 min in the dark to achieve absorption equilibrium and then irradiated with a Xe arc lamp (300W) equipped with an ultraviolet cutoff filter (420 nm) to obtain visible light. The degradation solution of RhB was separated by centrifugation every 20 min for absorbance spectra collection with a UV/Vis spectroscopy and the degradation curve was started from the light turned on.

Reuse of the photocatalyst:

Recycle experiment on photocatalytic decomposing of RhB was designed to examine the recycling property of as-prepared photocatalysts. After finishing a cycle, the catalyst powders were separated from the reaction solution by centrifugation. After washing and drying, repetitive photocatalytic reactions began and the detail process was as same as the first cycle. The recycle

experiment was carried out for three cycles.

Characterization

X-ray diffraction (XRD) patterns of the samples were recorded on a Bruker D8 Focus diffractometer (CuKα radiation, λ=1.5418 Å, 40 kV), field emission scanning electron microscopy (FESEM) measurement was performed by JSM-6700F instrument operated at an accelerating voltage of 10 kV, transmission electron microscope (TEM) and high-resolution transmission electron microscope (HRTEM) and using Tecnai G2 instrument at an accelerating voltage of 200 kV, UV-Vis spectra were recorded on a Cary 5000 spectrometer.

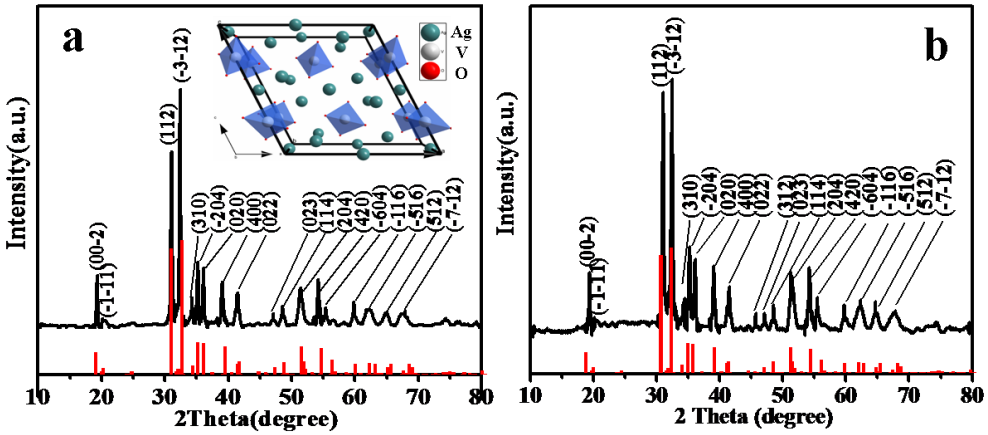

Figure S1 XRD patterns of (a) α-Ag_3VO_4 nanostars, (b) α-Ag_3VO_4 nanoflowers and standard pattern (red), the insert in a is the schematic illustration of the unit cell of monoclinic α-Ag_3VO_4 structure.

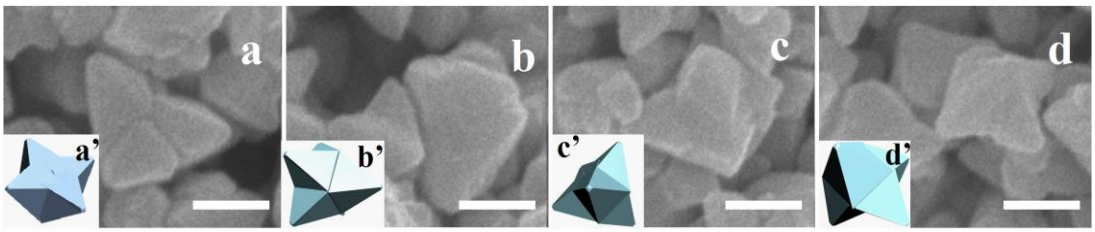

Figure S2 SEM images of nanostars with different directions (a, b, c, d). The inserts show three-dimensional shape simulated images (a', b', c', d'). Scale bar (a, b, c, d, e), 0.2 μm.

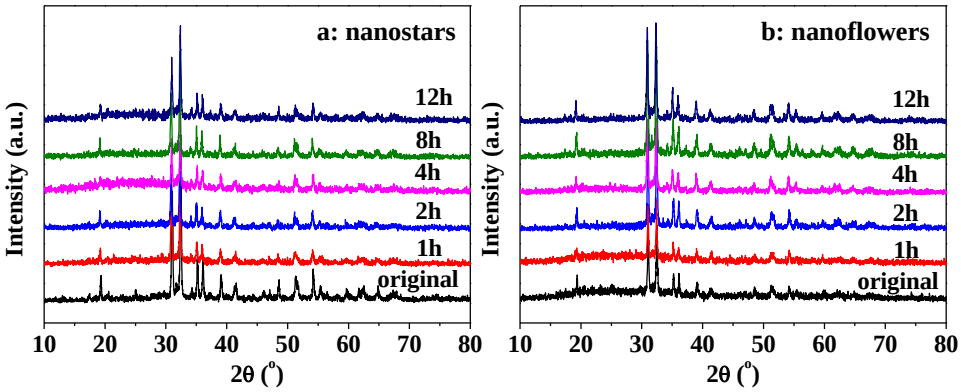

Figure S3 XRD patterns of α-Ag_3VO_4 nanostars and α-Ag_3VO_4 nanoflowers and the samples under visible light irradiation 1h, 2h, 4h, 8h and 12h. (a) α-Ag_3VO_4 nanostars and (b) α-Ag_3VO_4 nanoflowers. The experimental procedures were same like the photocatalytic activity measurement except replacing RhB with deionized water. With the light irradiation time increasing, the XRD patterns of the samples have little changed, which are indicated the good light stabilities of both α-Ag_3VO_4 nanostars and α-Ag_3VO_4 nanoflowers.

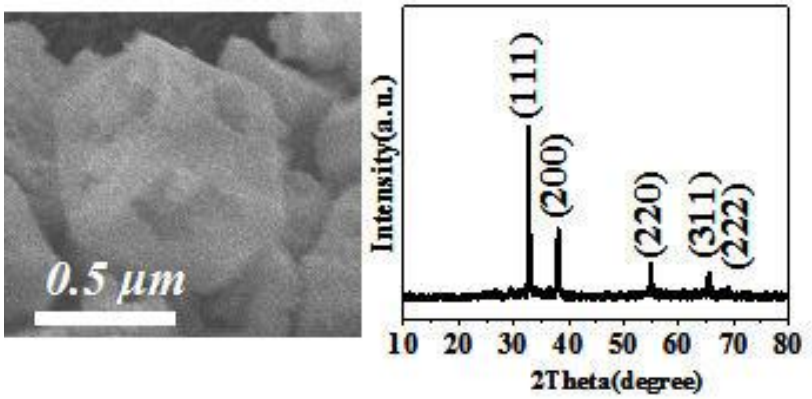

Figure S4 SEM image and XRD pattern of Ag_2O.

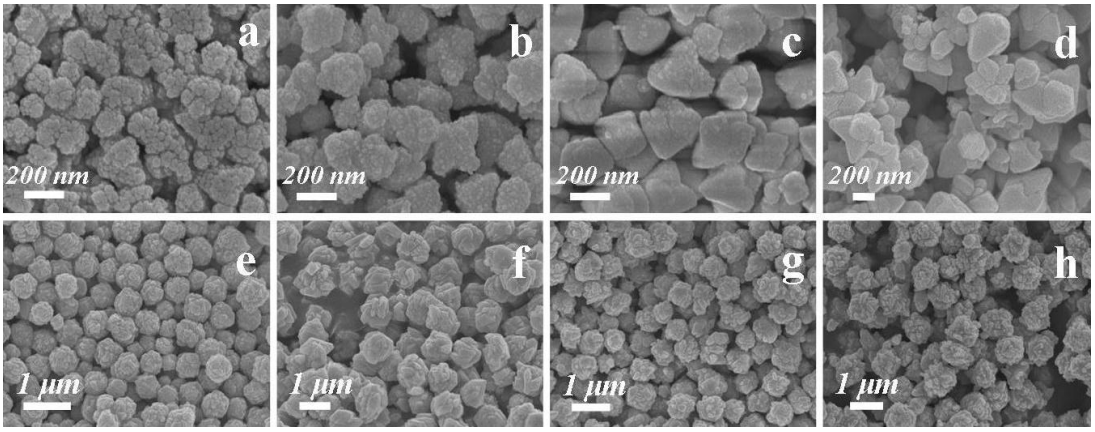

Figure S5 SEM images of samples (nanostars: a-d, nanoflowers: e-h) obtained with different amount of Na_3VO_4 (0.033 M): 2 mL (a, e), 6 mL (b, f), 10 mL (c, g), 12 mL (d, h).

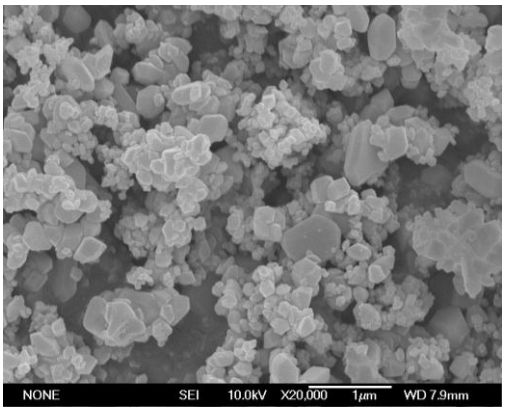

Figure S6 SEM image of α-Ag_3VO_4 nanoparticles

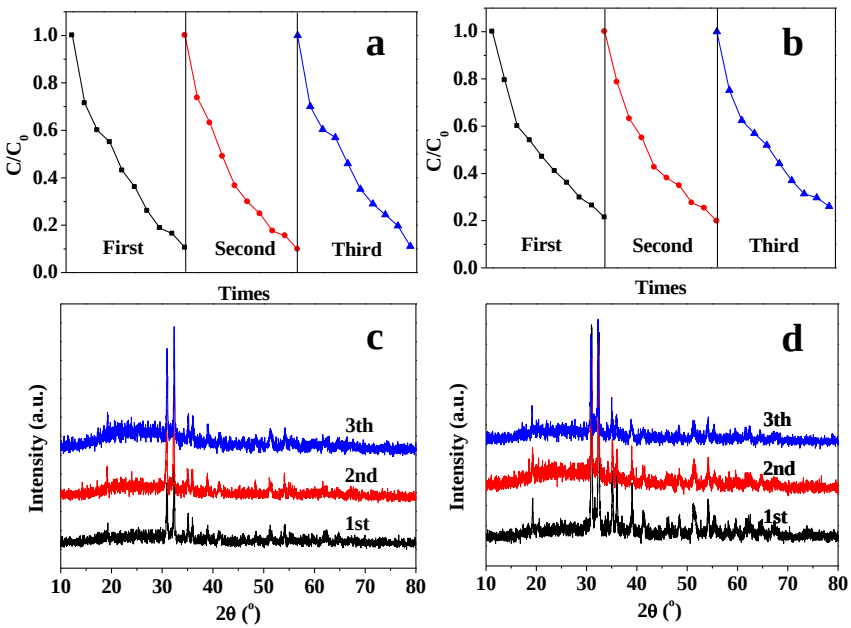

Figure S7 Degradation curves of RhB over as-prepared α-Ag_3VO_4 reusing three times, (a) α-Ag_3VO_4 nanostars and (b) α-Ag_3VO_4 nanoflowers and XRD patterns of the photocatalysts after reusing, (c) α-Ag_3VO_4 nanostars and (d) α-Ag_3VO_4 nanoflowers.