

## Supplementary Information

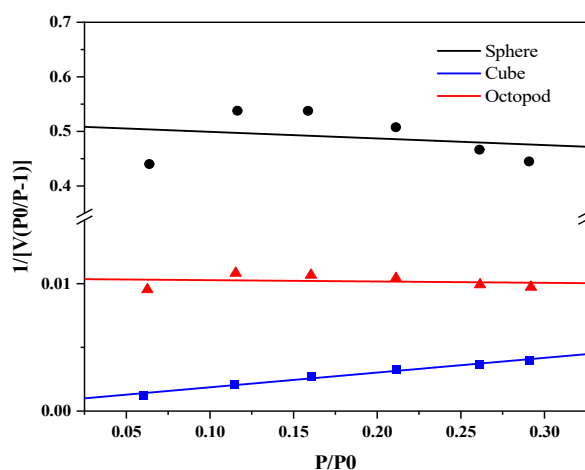
### Enhanced visible light photocatalytic activity of the octopod

#### Ag<sub>3</sub>PO<sub>4</sub> microcrystals with high index crystal faces

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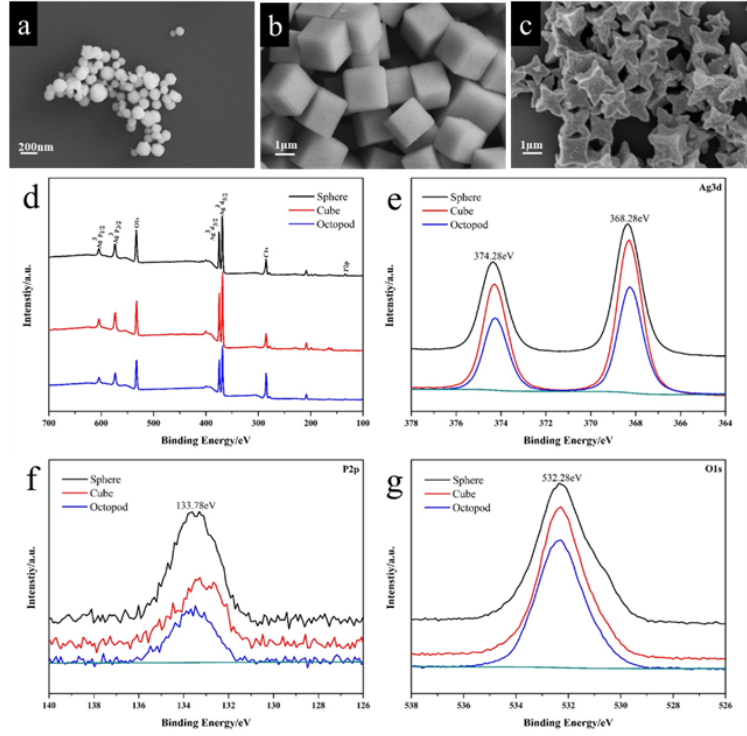
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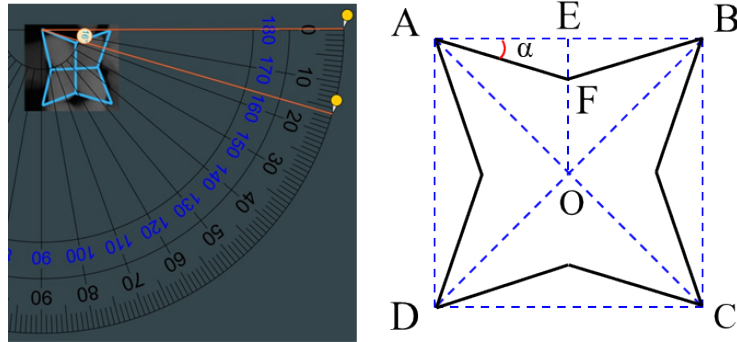


**Fig. S1** Specific surface area calculation of Ag<sub>3</sub>PO<sub>4</sub> with three different morphologies.

Calculate as the formula  $(P/P0)/[V(1-P/P0)] = (C-1)/(Vm \cdot C) \cdot P/P0 + 1/(Vm \cdot C)$ ,  $P$ : pressure of the adsorbed gas at equilibrium at adsorption temperature;  $P0$ : saturated steam pressure;  $V$ : the total volume of adsorbed gas when the equilibrium pressure is  $P$ ;  $Vm$ : the volume of gas required when the catalyst surface is covered with the first full layer;  $C$ : the constant related to adsorption.



**Fig. S2** SEM images and corresponding XPS spectra of three different morphologies of  $\text{Ag}_3\text{PO}_4$  after photocatalysis, (a) sphere, (b) cube and (c) octopod; (d) XPS spectra of  $\text{Ag}_3\text{PO}_4$ . High-resolution XPS spectra of Ag 3d (e), P 2p (f), and O 1s (g) from  $\text{Ag}_3\text{PO}_4$ .



**Fig. S3** Crystal orientation of octopod shaped  $\text{Ag}_3\text{PO}_4$ .

Facet AF = (cd0);  
 $AB = BC = AD = CD = a$ ;  
 $\angle FAB = \alpha$ ;  $AE = BE = a/2$ ;  
 $\tan \alpha = EF/AE$ ;  $EF = (a \cdot \tan \alpha)/2$ ;  
 $c = AD/EF = 2/\tan \alpha$ ;  $d = AB/AE = 2$ ;  
 Facet AF =  $(2/\tan \alpha \ 2 \ 0)$ .

The angle  $\alpha$  was measured about  $16^\circ$ , and the crystal plane exposed of the octopod shaped  $\text{Ag}_3\text{PO}_4$  particles is calculated as  $(2/\tan \alpha \ 2 \ 0)$ , and the result of  $2/\tan 16^\circ$  is 6.97. As a result, the crystal index of octopod  $\text{Ag}_3\text{PO}_4$  is obtained as (720).