Supporting Information

High-Efficiently Visible-Light-Responsive Photocatalysts: Ag$_3$PO$_4$ Tetrahedral Microcrystals with Exposed {111} Facets of High Surface Energy

Binjie Zheng, Xue Wang, Chang Liu, Kai Tan*, Zhaoxiong Xie*, Lansun Zheng

State Key Laboratory for Physical Chemistry of Solid Surfaces & Department of Chemistry, College of Chemistry and Chemical Engineering, Xiamen University, Xiamen 361005, China.

AUTHOR EMAIL ADDRESS: zxxie@xmu.edu.cn, ktan@xmu.edu.cn

**Fig. S1** The histogram of particle size distributions of the Ag$_3$PO$_4$ tetrahedral microcrystals.

**Fig. S2** A series of high-magnification SEM images and corresponding models of the tetrahedral Ag$_3$PO$_4$ in different orientations.
**Fig. S3** (a) Typical low-magnification TEM image and (b) the corresponding SAED pattern of a tetrahedral Ag$_3$PO$_4$ sub-microcrystal viewed along the [111] direction. The TEM image agrees well with the schematic model of an ideal tetrahedron enclosed by {111} facets viewed along the [111] direction (inset in Fig. S3a), indicating that the surface of Ag$_3$PO$_4$ sub-microcrystal consists of {111} facets.

**Fig. S4** The SEM images of Ag$_3$PO$_4$ sub-microcrystals with different morphologies: (a) rhombic dodecahedrons; (b) cubes.

**Fig. S5** XRD patterns of Ag$_3$PO$_4$ rhombic dodecahedrons and cubes.
**Fig. S6** Zeta potentials of Ag₃PO₄ with difference morphologies.

**Fig. S7** Pseudo first-order reaction kinetics of (a) MB, (b) MO and (c) RhB degradation over Ag₃PO₄ tetrahedra (■), rhombic dodecahedra (●) and cubes (▲).
**Fig. S8** The adsorption properties of MB over Ag$_3$PO$_4$ tetrahedra, rhombic dodecahedra and cubes under dark conditions.

**Fig. S9** The adsorption properties of MO over Ag$_3$PO$_4$ tetrahedra, rhombic dodecahedra and cubes under dark conditions.

**Fig. S10** The adsorption properties of RhB over Ag$_3$PO$_4$ tetrahedra, rhombic dodecahedra and cubes under dark conditions.