Supporting Information

for

Acetates-induced controllable synthesis of hematite polyhedra enclosed by high-activity facets for enhanced photocatalytic performance

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Experimental Details

1. Materials. All of the chemical reagents, such as $FeCl_3 \cdot 6H_2O$, NH_4Ac, KAc, NaAc and absolute EtOH were of analytic grade from Sinopharm Chemical Reagent Co.,Ltd and used without further purification.

2. Synthesis of α-Fe_2O_3 truncated bipyramids, nanopseudocubes and hexagonal nanoplates. All of these three kinds of hematite polyhedra were synthesized *via* a facile hydrothermal method. In a typical route for α-Fe_2O_3 truncated bipyramids, $FeCl_3 \cdot 6H_2O$ (0.54g) and KAc (1.91g) were dissolved in the system of EtOH-H_2O (20:1, v/v) mixed solvent under continuous stirring to form orange solution. Then the

mixture was transferred to a 40ml Teflon-lined stainless steel autoclave and kept at 180°C for 24h. After cooled to room temperature, the product was collected by high-speed centrifugation, washed with water and EtOH for several times and dried at 60°C for 4h. The morphology evolution of α-Fe_2O_3 polyhedra was readily tailored by tuning the species of acetates. For preparing α-Fe_2O_3 nanopseudocubes, KAc source was substituted by equivalent stoichiometric NH_4Ac while keeping other synthetic parameters unchanged. And for α-Fe_2O_3 nanoplates, a similar method reported previously,[1] using NaAc as acetate source, was adopted.

3. Characterization. The phase composition information of the as-prepared products was determined by X-ray diffraction (XRD) analysis on a D/max2550 VB+ diffractometer with CuKα radiation (λ=0.15405 nm). The morphology of the products was evaluated by using FEI Helios Nanolab 600i scanning electron microscopy (SEM). Transmission electron microscopy (TEM) image, high-resolution TEM (HRTEM) and the selected area electron diffraction (SAED) patterns were recorded on a Tecnai G2 F20 transmission electron microscope.

4. Photodegradation of RhB. The photocatalytic performance of all the products with different facets exposed were characterized toward photodegradation of RhB under Xe light irradiation. The absorbance of aqueous RhB was collected with a UV-vis spectroradiometer (Shimadzu UV-2600). Typically, the products (30mg) were dispersed in 150ml RhB solution with 0.7ml H_2O_2 (≥28wt%). The adsorption-desorption equilibrium of RhB on the surface of the photocatalysts was facilitated under magnetic stirring in the dark for 40min. Then a Xe light (250W) was 15 cm above the liquid level and used to irradiate the mixture cooled by circulating water cooling system (6±0.1°C). After specific intervals, the dispersion was centrifuged and the upper was measured of the absorbance at 550nm.

References

1 L.Q. Chen, X.F. Yang, J. Chen, J. Liu, H. Wu, H.Q. Zhan, C.L. Liang, M.M. Wu, Inorg. Chem. 2010, 49, 8411.

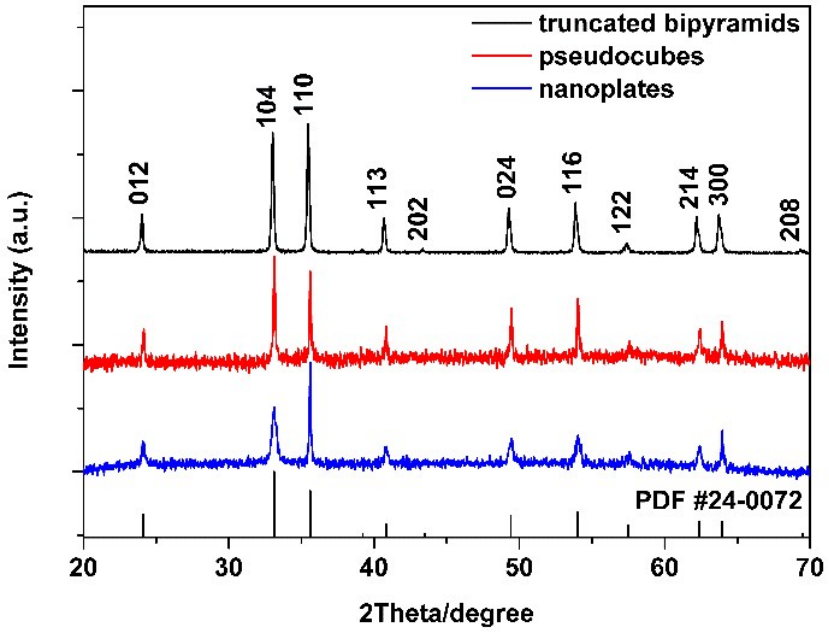

Figure S1. XRD patterns of α-Fe_2O_3 truncated bipyramids (black line), pseudocubes (red line) and nanoplates (blue line).

Table S1 Photocatalytic properties of α-Fe_2O_3 truncated bipyramids, pseudocubes and nanoplates.

Morphology	**Dominant facets**	**Bandgap (eV)**	**Rate constants k [* 10^{-2} min^{-1}]**
truncated bipyramids	{101}/{001}	2.10	10.51
pseudocubes	{012}	2.16	4.84
nanoplates	{001}	2.17	3.42

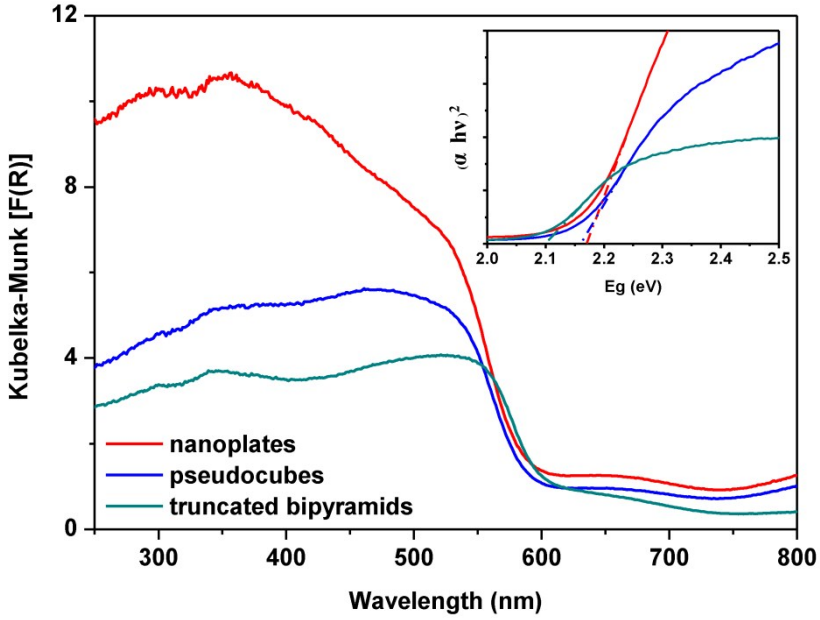

Figure S2. UV-vis diffuse reflectance spectra of the as-prepared α-Fe_2O_3 polyhedra with enclosed by specific facets. The inset is the calculation diagram of the bandgaps, which is determined to be 2.10, 2.16 and 2.17 eV for α-Fe_2O_3 truncated bipyramids, pseudocubes and nanoplates, respectively.