Supporting Information

a Solvothermal Transformation from α-Fe$_2$O$_3$ Nanocrystals to Fe$_3$O$_4$ Polyhedrons

Liqiao Chen,[a,b]* Qingfeng Xiong,[c] Wenlin Li,[c] Junpeng Li,[c] and Xuan Yu[a]

[a] Innovation & Application Institute, Zhejiang Ocean University, Zhoushan 316022, P. R. China; [b] State Key Laboratory of Optoelectronic Materials and Technologies, School of Chemistry and Chemical Engineering, Sun Yat-Sen University, Guangzhou 510275, P. R. China; [c] State Key Laboratory of Advanced Technologies for Comprehensive Utilization of Platinum Metals, Kunming Institute of Precious Metal, Kunming 650106, P. R. China.

E-mail: chenlq118@126.com; Tel: +86 580 2262589

Experimental Section

Preparations. Iron trichloride (FeCl$_3$·6H$_2$O, Guangdong Guanghua Chemical Co.), hydrated hydrazine (N$_2$H$_4$·H$_2$O (85%), Sinopharm Chemical Reagent Co.,Ltd), then Sodium hydroxide (NaOH, Guangzhou Chemical Reagent Factory), sodium acetate (CH$_3$COONa, Guangdong Guanghua Chemical Co.) and ethanol (Tianjin Fuyu Chemical Co.) were analytical grade and used as raw materials without further purification.

The preparations of α-Fe$_2$O$_3$ precursors: 0.109 g of FeCl$_3$·6H$_2$O (0.04 mmol) was dissolved under vigorously magnetic stirring in ethanol (4.0 mL) and 1.0 mL of water (0.28 mL of water was added for the synthesis of α-Fe$_2$O$_3$ nanoplates). Until completely dissolved, 0.32 g of sodium acetate was added while stirring. The mixture was sealed in a Teflon-lined stainless steel autoclave (25 mL) and maintained at 180 ℃ for 12 h for solvothermal crystallization.
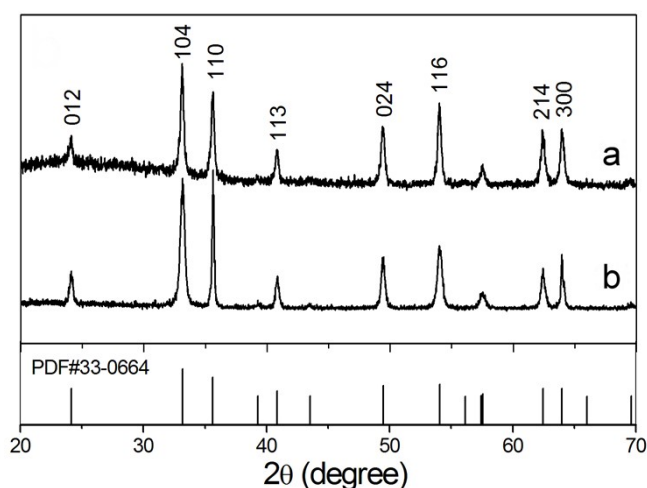

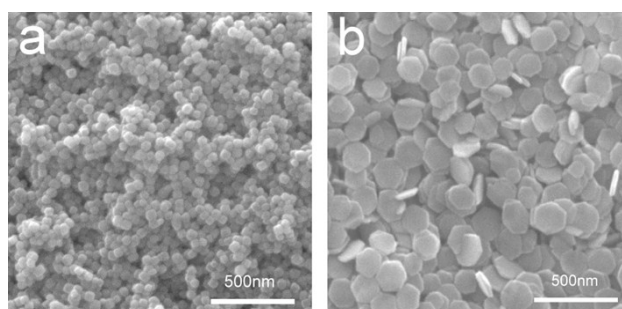Figure S1. pXRDs of α-Fe$_2$O$_3$ precursor, (a) nanoparticles, (b) nanoplates.

Figure S2. SEM images of α-Fe$_2$O$_3$ precursor, (a) nanoparticles, (b) nanoplates.

The synthesis of the typical Fe$_3$O$_4$ polyhedrons: The above processed samples transfered to a Teflon-lined stainless steel autoclave (25 mL), sealed after adding 4.0 mL of N$_2$H$_4$·H$_2$O and 2.0 mL H$_2$O, and maintained solvothermal processing at 220 ℃ for 24 h. Following natural cooling to ambient temperature, the resulting solid products were washed with distilled water and alcohol several times, respectively, and finally dried in a desiccator at 60 ℃ for ca. 10 h for characterization. To study the growth process of this route, the samples were

collected from the bottom of autoclave at regular intervals, and the resulting solid products were washed with distilled water and absolute ethanol by centrifugation for several times, and the as obtained products were dried at 60 ℃, then randomly sampled for pXRD, SEM and TEM characterization.

Characterization: The products were characterized by powder X-ray diffraction (XRD), and scanning electron microscopy (SEM). XRD patterns were recorded with a Rigaku D/MAX 2200 VPC diffractometer using Cu KR radiation (λ= 0.15045 nm) and a graphite monochromator. SEM images were taken with a FEI Quanta 400 Thermal FE environmental scanning electron microscope. Samples were supported in glass plates and gold-coated prior to the SEM analysis. X-ray photoelectron spectra (XPS) were recorded on an ESCALAB 250 spectrometer to characterize the particles surfaces with its energy analyzer working in the pass energy mode at 20 eV and an Al $_{K\alpha}$ line applied as the excitation source. TEM images were prepared on a JEM-2010HR transmission electron microscope operated at an accelerating voltage of 200 kV. TEM samples were prepared by dispersing the powders on holey carbon film supported on copper grids. The magnetic properties of the samples were measured at 300 K on a Quantum Design MPMS XL-7 SQUID magnetometer.