Supporting Information

One-pot Synthesis of Fe_3O_4 Nanoprisms with Controlled Electrochemical Properties

Yao Zeng,[a] Rui Hao,[a] Bengang Xing,[b] Yanglong Hou,*[a] and Zhichuan Xu*[c]

[a] Department of Advanced Materials and Nanotechnology, College of Engineering, Peking University, *E-mail: hou@pku.edu.cn*

[b] School of Physical and Mathematical Sciences, Nanyang Technological University, SPMS-04-01, 21 Nanyang Link, Singapore 637371

[c] Department of Mechanical Engineering, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139 , USA, *xuzc@mit.edu*

Experimental

Chemicals and Materials. Hexane, absolute ethanol, toluene and oleic acid (Beijing Chemicals, AP), Iron (III) acetylacetonate ($Fe(acac)_3$) (Beijing Yili Fine Chemical), OAm (70%, Aldrich Chemical Company) and 1-octadecane (90%, Alfa Aesar Company) were used.

Synthesis of Fe_3O_4 nanoprisms. The solvothermal reactions were carried out in a stainless-steel autoclave with a Teflon-liner (25 mL in total capacity) under pressure. In a typical procedure, 1 mmol $Fe(acac)_3$ (about 0.353 g) and 5.0 mL OAm were added into the autoclave, and the autoclave was filled with toluene up to 80% of the total volume. Under vigorous stirring, a red solution was formed. The autoclave was kept at 200 ^oC for 24h. After natural cooling, the product was precipitated by adding 20 mL absolute ethanol and washed with absolute ethanol and hexane. The final product was dispersed in hexane.

Characterization. The samples were studied by transmission electron microscopy (TEM, JEOL JEM 200CX, 160 kV), high-resolution transmission electron microscope (HRTEM, FEI TECNAI F30, 300 kV), field-emission scanning electronic microscopy (SEM, JEOL JSM-7600F, 10 kV), X-ray powder diffraction (XRD, Rigaku D/MAX-2000, Cu Kα) and X-ray Photoelectron Spectroscopy (XPS, Kratos Axis Ultra). CVs were done with a CHI 760c electrochemical workstation (CHI, USA) with a conventional three-electrode electrochemical cell. Working electrode can be prepared after Fe_3O_4 nanoprisms were coated on a glassy carbon electrode drying off. Ternary electrode system consisted of Ag/AgCl as reference electrode, Pt as assistance electrode, and Fe_3O_4 as the aim electrode.

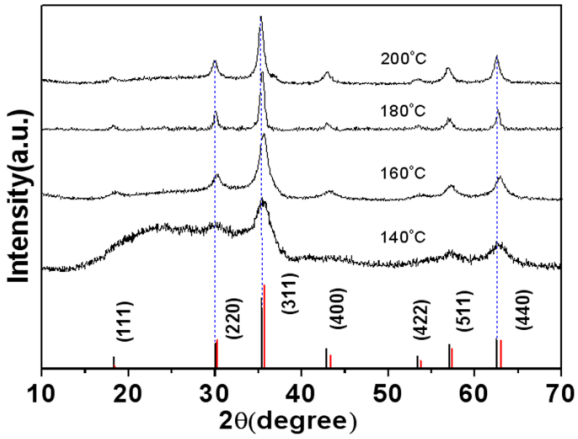

Fig. S1 XRD patterns of as-synthesized nanoprisms at 140, 160, 180, 200 °C , JCPDS card NO. 39-1346 (red, γ-Fe_2O_3, maghemite) and NO. 65-3107 (black, Fe_3O_4, magnetite)

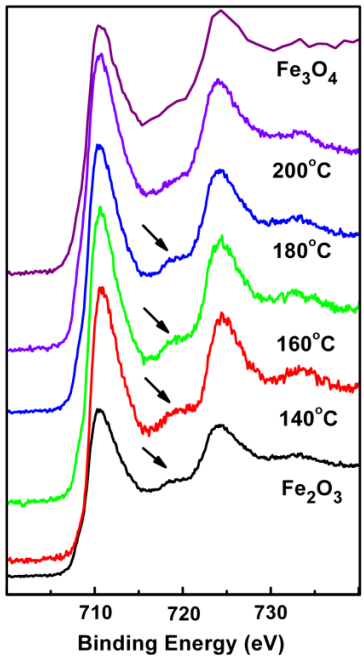

Fig. S2 XPS measurements of as-synthesized nanoprisms at 140 °C, 160 °C, 180 °C, 200 °C, and standard spectra of Fe_3O_4 and γ-Fe_2O_3, the satellite peak is ~718 eV (indicated by an arrow).

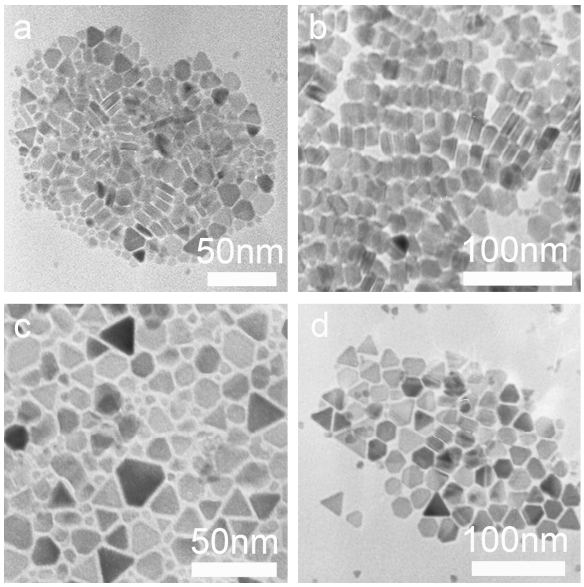

Fig. S3 TEM images of Fe_3O_4 nanoprisms synthesized at (a) 140 ^oC, (b) 160 ^oC, (c) 180 ^oC, (d) 200 ^oC

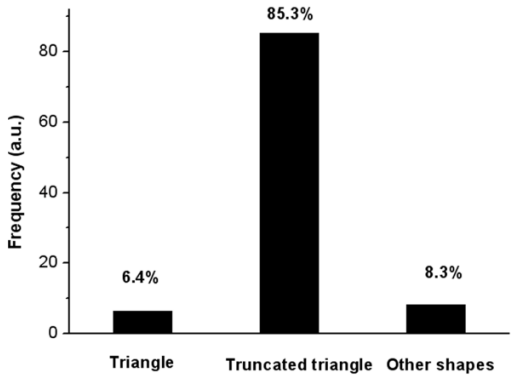

Fig. S4 Shape histogram of Fe_3O_4 nanoprisms

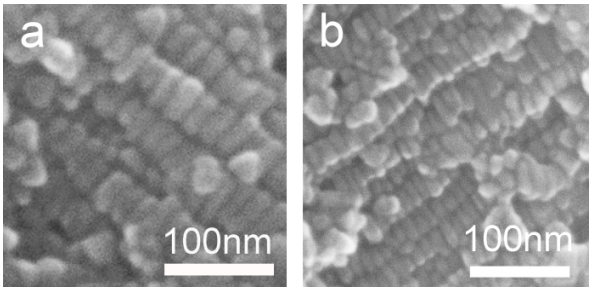

Fig. S5 SEM images of (a) nanoprism and (b) self-assembled multilayer.

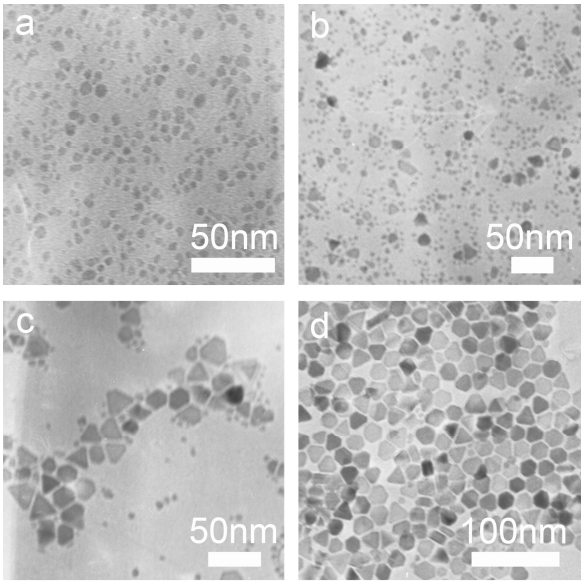

Fig. S6 TEM images of Fe_3O_4 nanoprisms synthesized after 1 h, 6 h, 10 h and 24 h at 200 ^oC

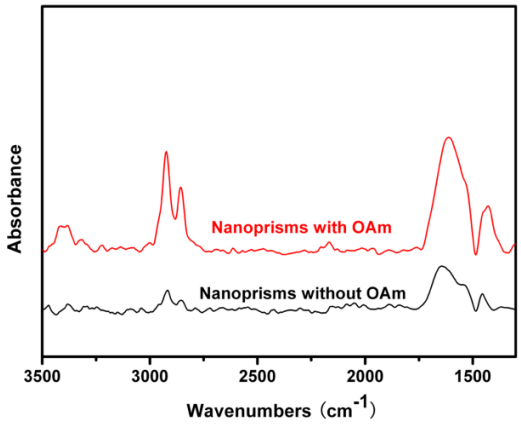

Fig. S7 FTIR spectra of nanoprisms with OAm and nanoprisms without OAm

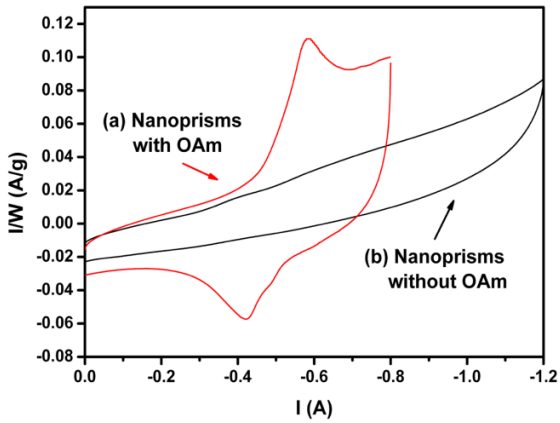

Fig. S8 Cyclic voltammograms of electrodes made of (a) Fe_3O_4 nanoprisms with OAm; (b) Fe_3O_4 nanoprisms without OAm in 1M NaCl

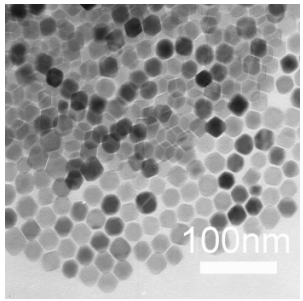

Fig. S9 TEM images of Fe_3O_4 nanooctahedrons

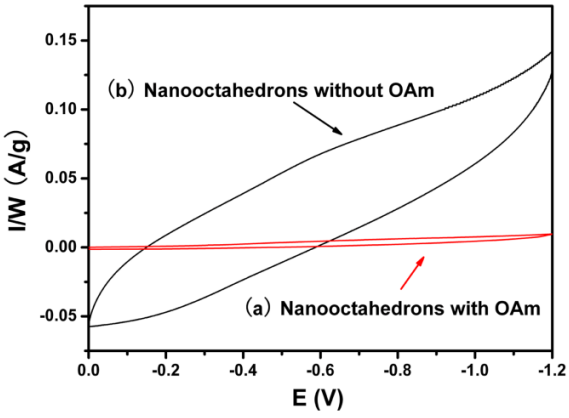

Fig. S10 Cyclic voltammograms of electrodes made of (a) Fe_3O_4 nanooctahedrons with OAm; (b) Fe_3O_4 nanooctahedrons without OAm in 1M Na_2SO_3