Experimental

Synthesis of a-Fe_2O_3 nanochains

All the chemicals were of analytical grade and used without further purification. In a typical synthesis, 0.27 g of $FeCl_3 \cdot 6H_2O$ was introduced into 10 g ammounium acetate and 3 mL of acetate acid. Then, the above mixture was transferred into a 20 mL Teflon-lined stainless-steel autoclave. The autoclave was maintained at 150 °C for 20 h, and then cooled to room temperature naturally. The red solid was separated by centrifugation, washed with absolute alcohol and distilled water for several times, and dried by vacuum.

To study the effect of acetate acid, we also replaced the acetate acid with the amount of distilled water, ammounia (w, 28%), or nothing, separately.

Characterization

The X-ray diffraction (XRD) patterns of the products were recorded with Rigaku D/max Diffraction System using a Cu Kα source (λ = 0.15406 nm). The high-resolution transmission electron microscopy (HR-TEM) images were taken on a JEOL 2010 high-resolution transmission electron microscope performed at 200 kV. The specimen of HR-TEM measurement was prepared via spreading a droplet of ethanol suspension onto a copper grid, coated with a thin layer of amorphous carbon film, and allowed to dry in air. Nitrogen adsorption–desorption isotherms were obtained on an ASAP 2020 nitrogen adsorption apparatus. The Brunauer–Emmett–Teller (BET) specific surface areas (S_{BET}) were calculated using the BET equation. Desorption isotherm was used to determine the pore size distribution using the Barret–Joyner–Halender (BJH) method.

Fabrication and analysis of gas sensor

The gas sensor was fabricated as follows: A proper amount of a-Fe_2O_3 nanochains was grinded with several drops of water in an agate mortar to form a slurry. Then, the slurry was coated onto an alumina tube with a diameter of 1mm and length of 4mm, positioned with two Au electrodes and four Pt wires on each end of the tube. A Ni-Cr alloy filament was put through the tube and used as a heater by tuning the heating voltage. Gas sensing tests were performed on a static test system (HW-30A, HanWei Electronics Co., Ltd., Henan Province, China) using air as the reference and diluting gas at a relative humidity (RH) of 38%. The sensor was placed in a transparent testing chamber with a volume of 15 L and aged for several days before analysis. Target gas such as H_2S gas was injected into the testing chamber by a microsyringe. The sensor signal voltage (V_{out}) was collected by a computer at a constant test voltage of 5V. The sensor response is defined as the ratio S = Rg/Ra, where Rg and Ra are the electrical resistance of the sensor in test gas and in air, respectively. The response and recovery time is defined as the time for sensor to reach 90% of its maximum response and falls to 10% of its maximum response, respectively.

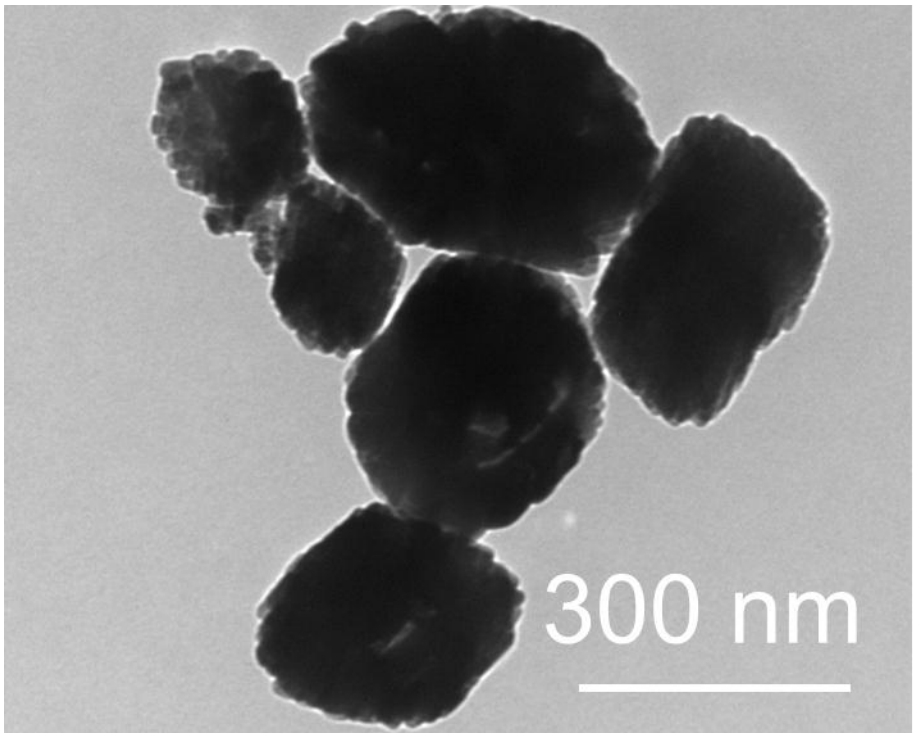

Fig. S1 TEM image of the a-Fe_2O_3 sample without acetate acid while other condition kept the same.

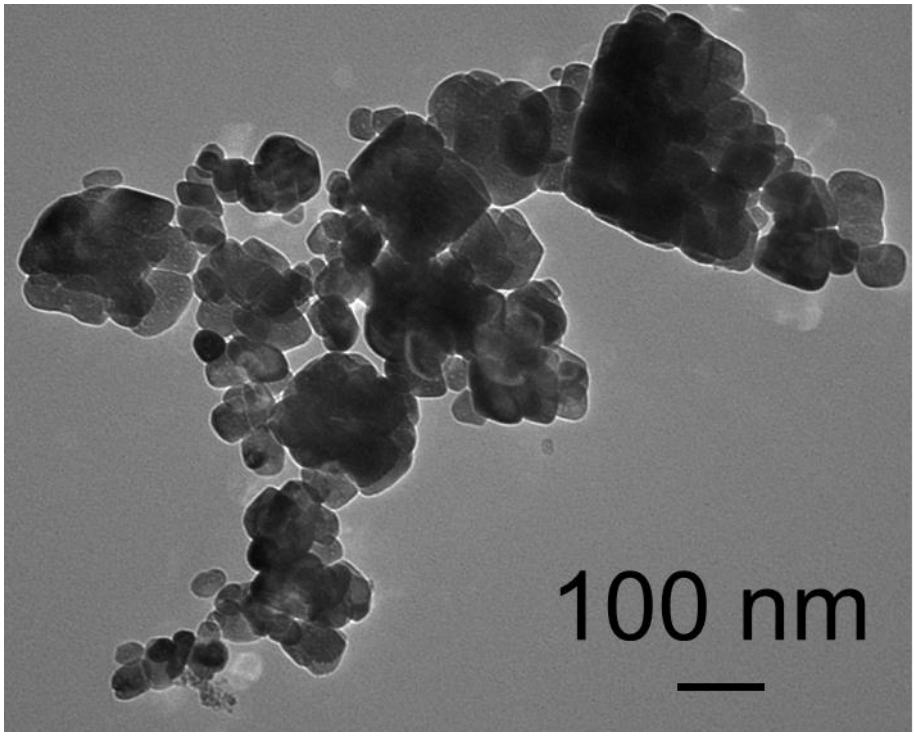

Fig. S2 TEM image of the a-Fe_2O_3 sample with 3 ml ammonia (w, 28%) while other condition kept the same.

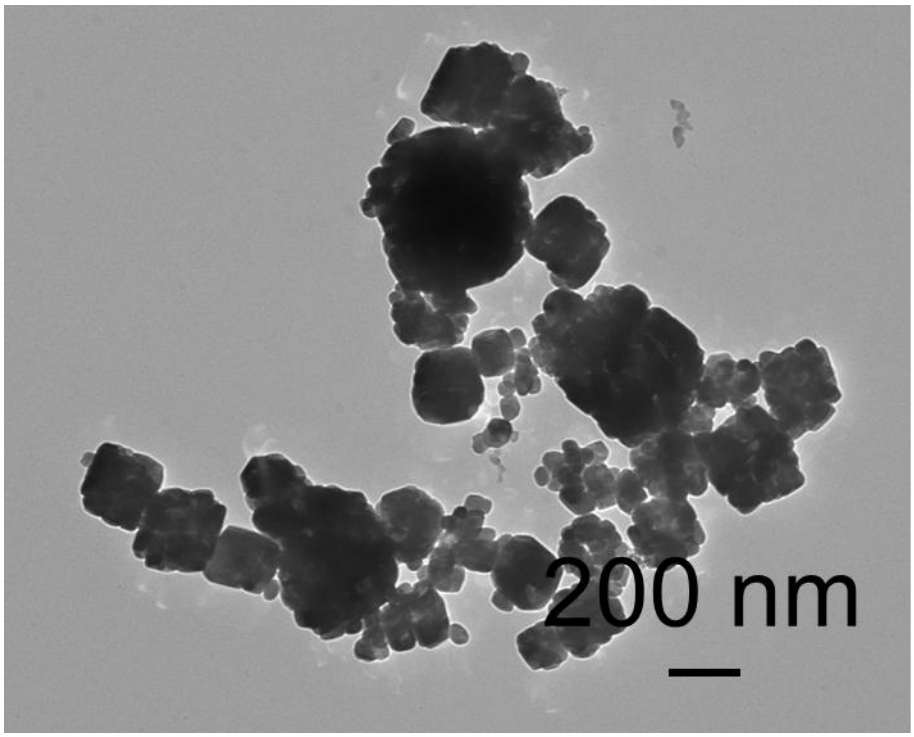

Fig. S3 TEM image of the a-Fe_2O_3 sample with 3 ml distilled water while other condition kept the same.