Electronic Supplementary Material (ESI) for RSC Advances.

Supporting information

MOF-derived hierarchical $ZnO/ZnFe_2O_4$ hollow cubes for enhanced acetone gas-sensing performance

Xiang Ma,[ab] Xinyuan Zhou, [ab] Yan Gong, [ab] Ning Han, [a] Haidi Liu [a] and Yunfa Chen *[a]

[a] State Key Laboratory of Multiphase Complex System, Institute of Process Engineering, Chinese Academy of Sciences, Beijing, 100190, China.

[b] University of Chinese Academy of Sciences, No. 19A Yuquan Road, Beijing, 100049, China.

Materials synthesis

Synthesis of singular ZnO sample

Typically, 1.1 g $Zn(NO_3)_2 \cdot 6H_2O$ was dissolved in 5 mL water, 0.498 g ammonium bicarbonate was dissolved in 5 mL water. After that, the nitrate solution was slowly added into ammonium bicarbonate solution under stirring for 30 min. White precipitates was observed and aged for 1 h. The products was collected by centrifugation and washing with water three times, then dried at 80 °C overnight. The as-synthesized basic zinc carbonate was calcined at 500 °C for 2 h in a muffle furnace with a heating rate of 1 °C min^{-1} to get singular ZnO nanoparticles.

Synthesis of singular $ZnFe_2O_4$ sample

Typically, 0.297 g of $Zn(NO_3)_2 \cdot 6H_2O$ and 0.483 g of $Fe(NO_3)_3 \cdot 9H_2O$ were dissolved into a 40 mL ethanol-ethylene glycol (EG) mixed solution (the volume ratio of ethanol and EG is 1:9) under continuous stirring. The homogeneous solution was transferred into a 50 mL Teflon-lined stainless steel autoclave, which was then tightly sealed and maintained at 180 °C for 24 h in an oven. The products was collected by centrifugation and washed with water and ethanol alternately, then dried at 80 °C overnight. The as-synthesized products was calcined at 500 °C for 2 h in a muffle furnace with a heating rate of 1 °C min^{-1} to get singular $ZnFe_2O_4$ nanoparticles.

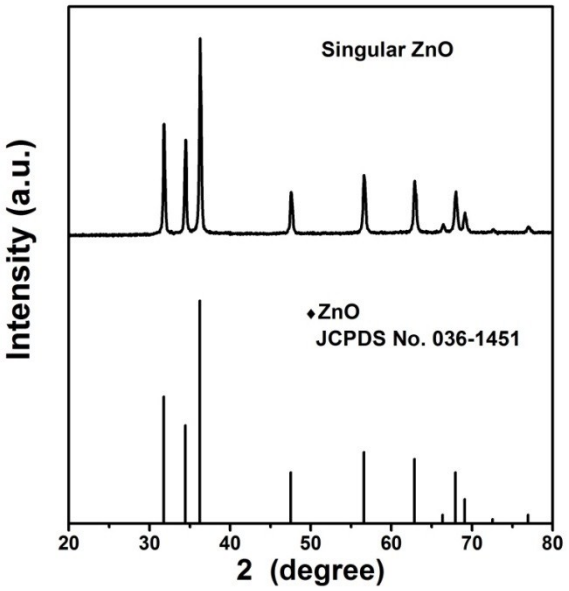

Fig. S1 XRD patterns of singular ZnO.

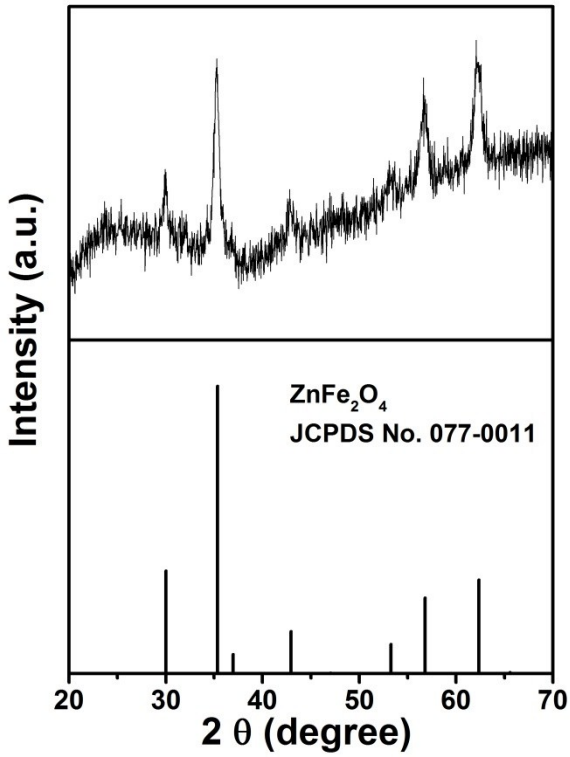

Fig. S2 XRD patterns of singular $ZnFe_2O_4$.

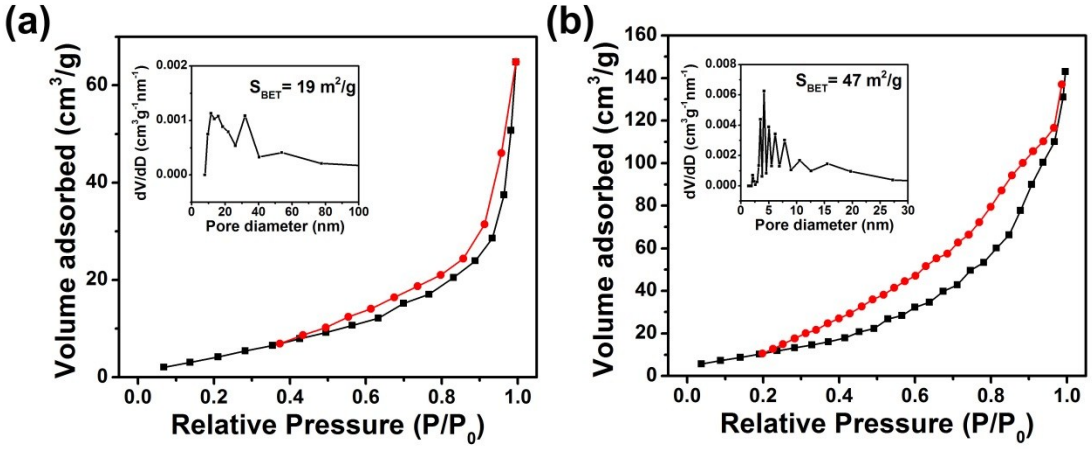

Fig. S3 N_2 adsorption-desorption isotherm of the (a) singular ZnO and (b) singular $ZnFe_2O_4$ (the inset is the corresponding BJH pore size distribution).

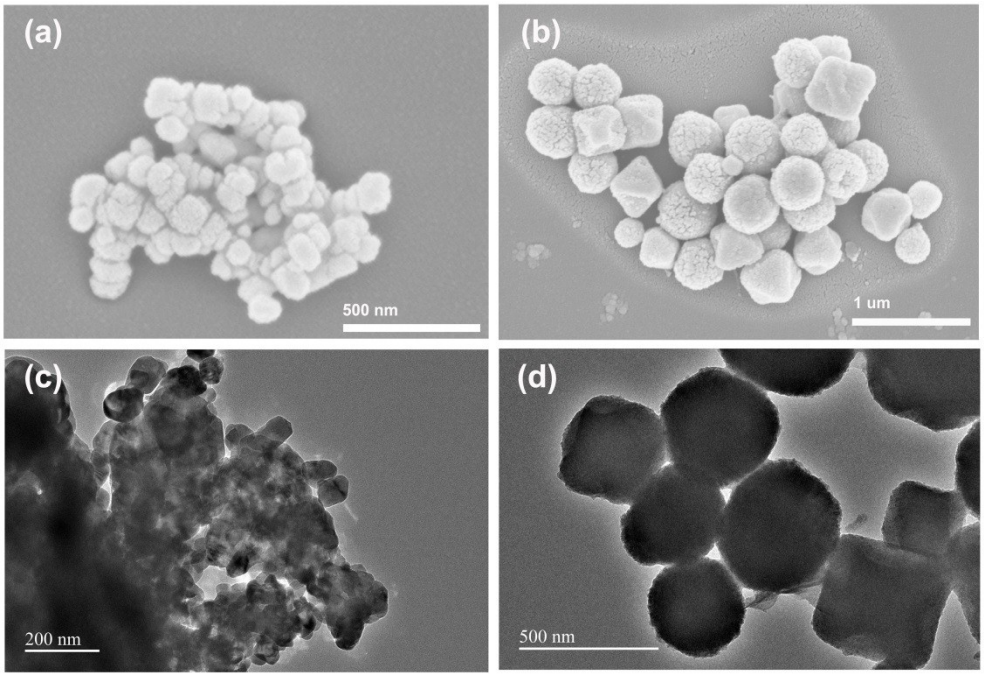

Fig.S4 SEM images of (a) singular ZnO and (b) singular $ZnFe_2O_4$; TEM images of (c) singular ZnO and (d) singular $ZnFe_2O_4$.

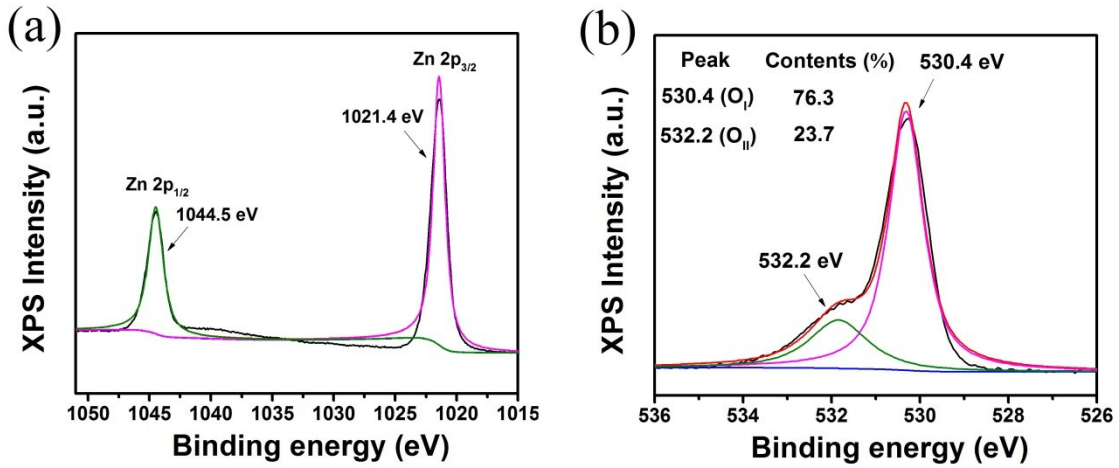

Fig. S5 XPS spectra of (a) Zn 2p spectra; (b) O 1S spectra of singular ZnO sample. (O_I: lattice oxygen; O_{II}: surface adsorbed oxygen)

It should be pointed out that the fitting peak at binding energy of 533.1 eV which is ascribed to the adsorbed OH groups and molecular water of singular ZnO is not found.