Electronic Supplementary Material (ESI) for RSC Advances.

Supporting Information

Fe^{3+} Facilitating the Response of NiO towards H_2S

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Supporting Information

Experimental

All the chemicals were of analytical grade and used without further purification.

Synthesis of the Fe_2O_3 loaded NiO nanoplates

The synthesis of Fe_2O_3 loaded NiO nanoplates is involved with two steps: 1) the synthesis of NiO nanoplates. The synthesis of NiO nanoplates was based on our previous work.[1] Typically, the hydrothermally proceeded $Ni(OH)_2$ could be obtained from the reaction system with 1.45 g $Ni(NO_3)_3 \cdot 6H_2O$, 3 ml n-butylamine and 12 ml distilled water at 180 ^oC for 12 h, and then the as-obtained $Ni(OH)_2$ nanoplates can be converted to NiO nanoplates through annealing process at 320 ^oC for 4 h with the heating rate of 5 ^oC /min; 2) 0.2 g of the as-synthesized NiO nanoplates was immersed in 10 ml of 1 mol/l $Fe(NO_3)_3 \cdot 9H_2O$ for 2 h, and then the resulting precipitate was collected by centrifugation, and heated at 100 ℃ for 2 h and 250 ^oC for 4 h in air with a heating rate of 5 ^oC /min in a muffle furnace, and cooled to room temperature naturally.

Characterization

The morphology and structural characteristics were observed using X-ray diffraction (XRD, Rigaku D/max 2500 diffractometer), scanning electron microscopy (SEM, Hitachi S4800) and transmission electron microscope (TEM; JEOL 2010 with an accelerating voltage of 200 kV).

Gas sensing measurements

The fabrication and testing principles of the gas sensor are similar to that described in our previous reports.[2] Firstly, the gas-sensing samples were mixed with terpineol to form a paste and then coated onto the outside surface of an alumina tube with a diameter of 1 mm and a length of 5 mm. A platinum coil through the tube was employed as a heater to control the operating temperature. To improve their stability and repeatability, the gas sensors were

aged at 300 ºC for 10 h in air. Here, the sensing properties of the sensors were measured by a NS-4003 series gas-sensing measurement system (China Zhong-Ke Micro-nano IOT, Internet of Things, Ltd.). The relative humidity (RH) is about 45%. The response and recovery times were defined as the time required for a change of the resistance to reach 90 % of the equilibrium value after injecting and that for removing the detected gas, respectively. When air and ppm-level target gas were flowed through the sensor element, the corresponding steady-state resistances of the sensor in air (R_{air}) and in the air–gas mixture (R_{gas}) were recorded, respectively. The as-fabricated Fe_2O_3 loaded NiO or NiO sensor gas response (S) for reducing gases (H_2S, CH_4, SO_2 or CO) is defined as the ratio of R_{gas}/R_{air}.

References

1 J. M. Ma, J. Q. Yang, L. F. Jiao, Y. H. Mao, T. H. Wang, X. C. Duan, J. B. Lian and W. J. Zheng, *CrystEngComm*, 2012,**14**, 453-459.

2 J. W. Deng, J. M. Ma, L. Mei, Y. J. Tang, Y. J. Chen, T. Lv, Z. Xu and T. H. Wang, *J. Mater. Chem. A*, 2013, **1**, 12400-12403.

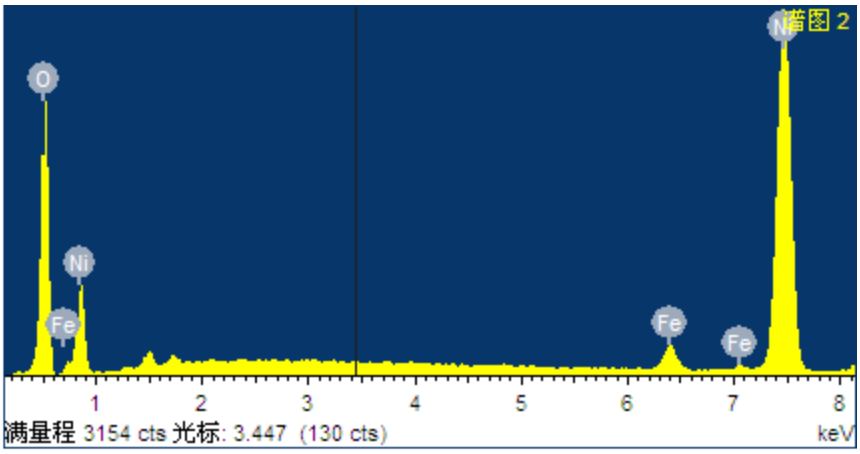

Fig. S1 EDX spectrum of Fe_2O_3-loaded NiO nanoplates.