Supplementary content

Facile synthesis of ZnO/SnO_2 hybrids for highly selective and sensitive detection of formaldehyde

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Synthesis of ZnO nanosheets (NSs): 0.75 g of $ZnSO_4$ was dissolved in 20 ml of DI water. Next 10 ml of NaOH solution (1.8 M) was dropped into the above solution under vigorous stirring for 30 min. Then, the above solution was transferred into Telon-lined autoclave and matained at 120^{o}C for 12 h. Then, white precipitate was washed with DI water and absolute alcohol by centrifugation, dried at 100^{o}C for a night.

Synthesis of SnO_2 nanoparticles (NPs): 0.35 g of $SnCl_4{\cdot}5H_2O$ was dissplved in 25 ml of DI water under vigorous stirring. Then, 0.24 g of NaOH was added into the above

solution under stirring for 30 min. Then, the above solution was transferred into Telon-lined autoclave and matained at 170°C for 24 h. Then, The precipitate was rinsed with DI water and anhydrous alcohol and dried at 60°C for a night. Finally, as-obtained samples were annealing at 500°C for 3 h.

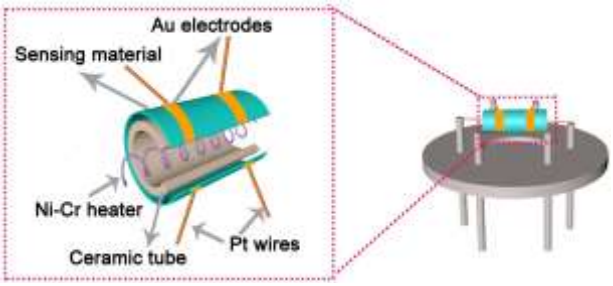

Fig. S1. The schematic diagram of the gas sensor.

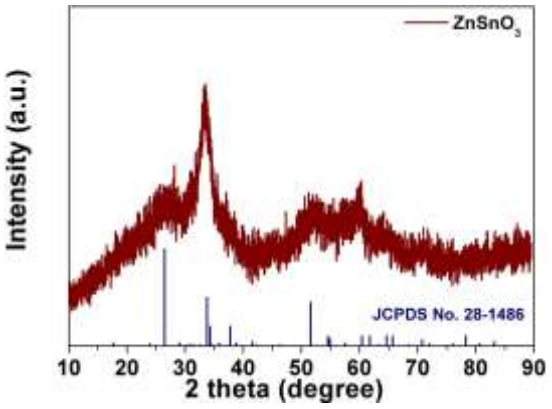

Fig. S2. XRD pattern of $ZnSnO_3$ nanosheets precursor.

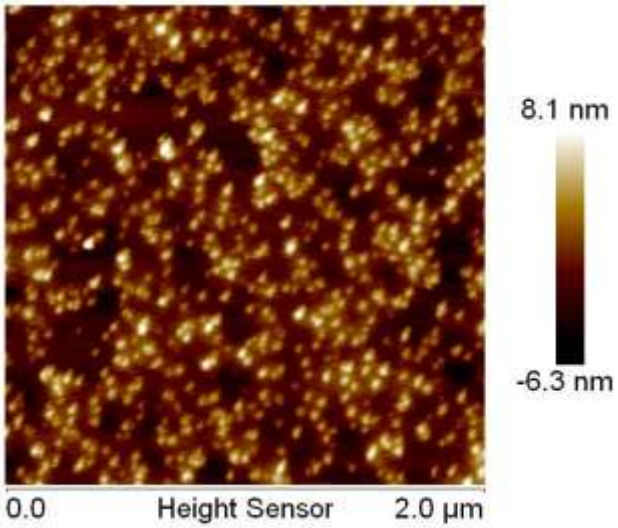

Fig. S3. AFM image of the nanosheets.

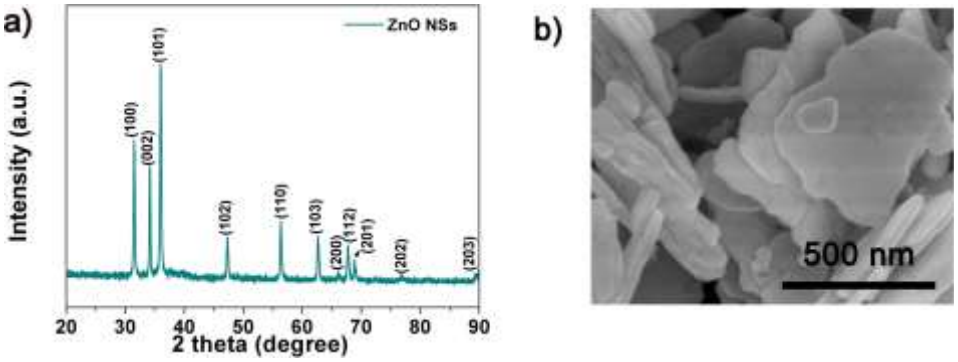

Fig. S4. (a) XRD pattern and (b) SEM image of ZnO nanosheets.

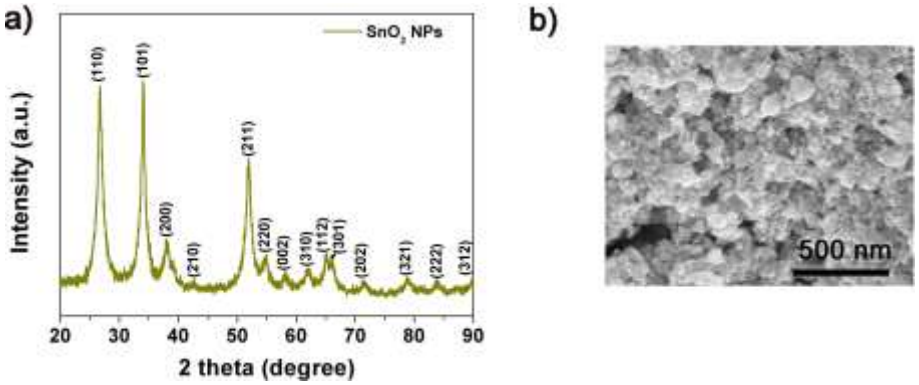

Fig. S5. (a) XRD patteren and (b) SEM image of SnO_2 nanoparticles.

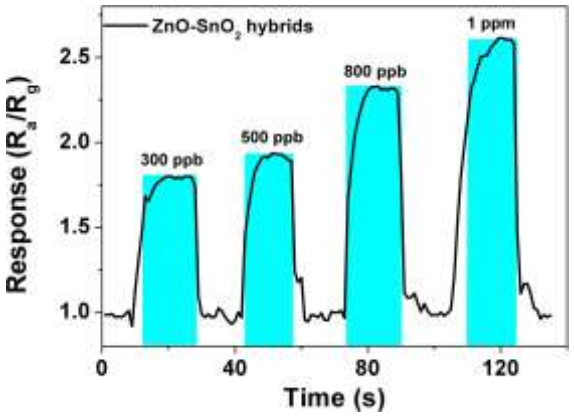

Fig. S6. Response curves of ZnO-SnO_2 hybrids to different concentration of HCHO at 200°C.

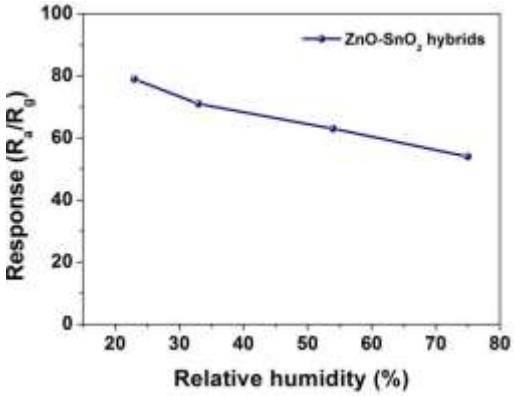

Fig. S7. The responses of ZnO-SnO_2 hybrids to 100 ppm formaldehyde at 200°C in different humidity environments.

When the resistances of the ZnO-SnO_2 sensor in the air is stable, the sensor is quickly put into the formaldehyde gas until the resistances become stable. The time of the ZnO-SnO_2 sensor placed in formaldehyde gas is about 6-8 s. The response/recovery time is defined as the time taken for achieving 90% of the total resistances change after the gas sensor is exposed to formaldehyde gas and air, respectively. The results

show the response time of the $ZnO\text{-}SnO_2$ sensor to 100 ppm formaldehyde at 200^oC is about 1 s. Then the $ZnO\text{-}SnO_2$ sensor is quickly taken out and placed in the air until the resistances of the $ZnO\text{-}SnO_2$ sensor changes back to the original values in the air. The time of the $ZnO\text{-}SnO_2$ sensor left in the air during the recovery period is about 16-18 s. The recovery time the $ZnO\text{-}SnO_2$ sensor to 100 ppm formaldehyde at 200^oC is about 9 s.