Electronic Supplementary Information (ESI)

For

Fast and real-time acetone gas sensor using hybrid $ZnFe_2O_4$/ZnO hollow spheres

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Experiment Section

Fabrication of gas sensor. The typical fabrication of side-heated gas sensor was described as follows: the sample was put into an agate mortar and ground with a pestle for 30 min at least. Then, some deionized water was dropped in it and another 30 min for grinding were necessary. Then the mixed paste was dipped and pasted onto an alumina tube with 4 mm long, which was attached with four Pt wires and two Au electrodes. Then a small Ni-Cr alloy coil was inserted into the tube as a heater. The testable gas sensor was obtained after connecting the as-fabricated device with outside electronics by welding.

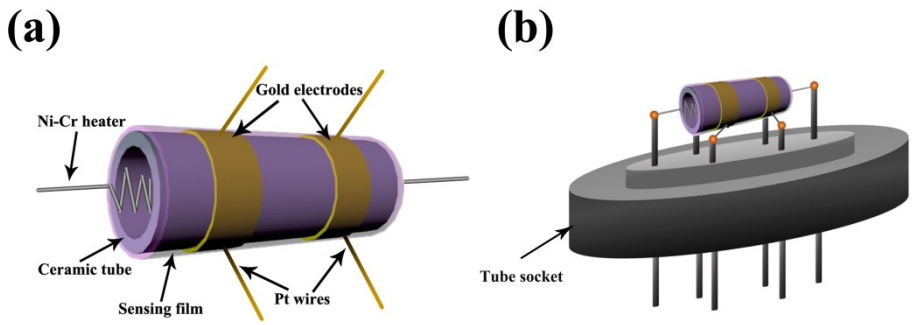

Figure S1. (a) Typical image of the ceramic tube and (b) the structure schematic image of the sensor based on hybrid $ZnFe_2O_4$/ZnO hollow sphere.

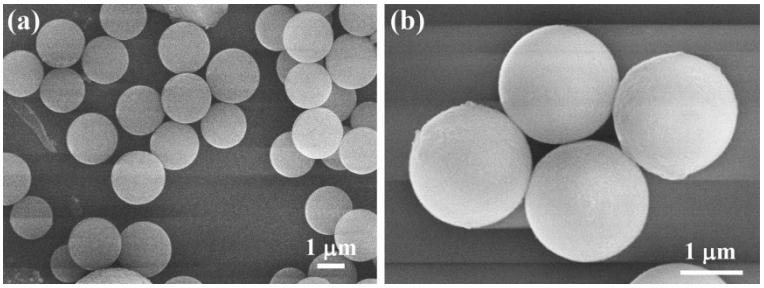

Figure S2. SEM (a) and enlarged SEM (b) images of carbon spheres synthesized through hydrothermal.

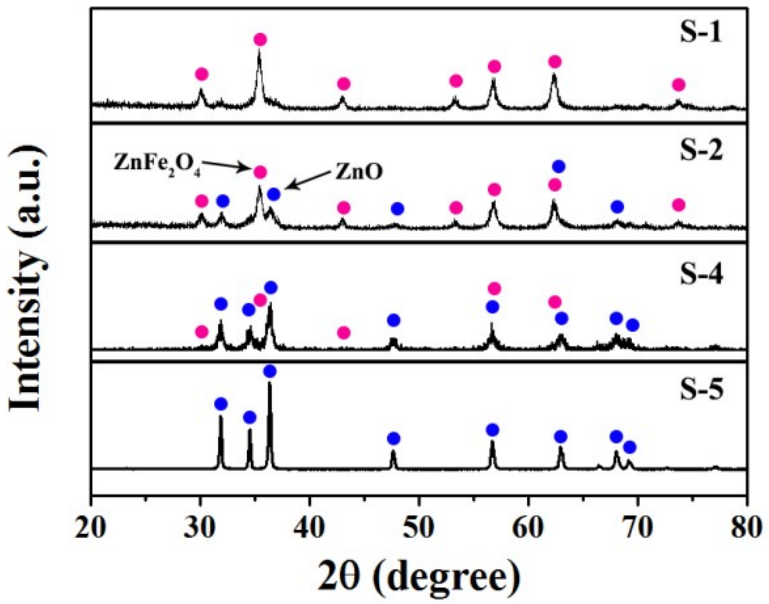

Figure S3. X-ray diffraction patterns of $ZnFe_2O_4$- or ZnO-based hollow spheres with different ratios.

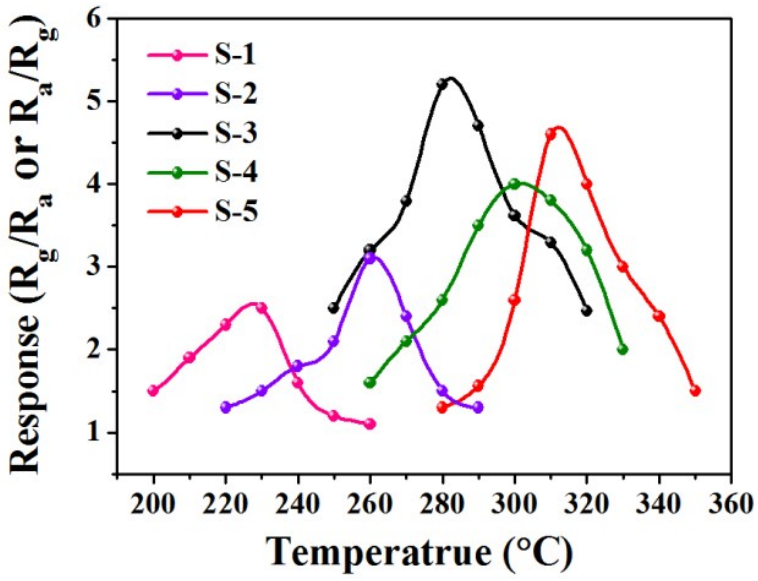

Figure S4. Responses of five $ZnFe_2O_4$- or ZnO-based sensors with different molar ratios, pure $ZnFe_2O_4$ and ZnO at different operating temperatures towards 50 ppm of acetone, respectively.

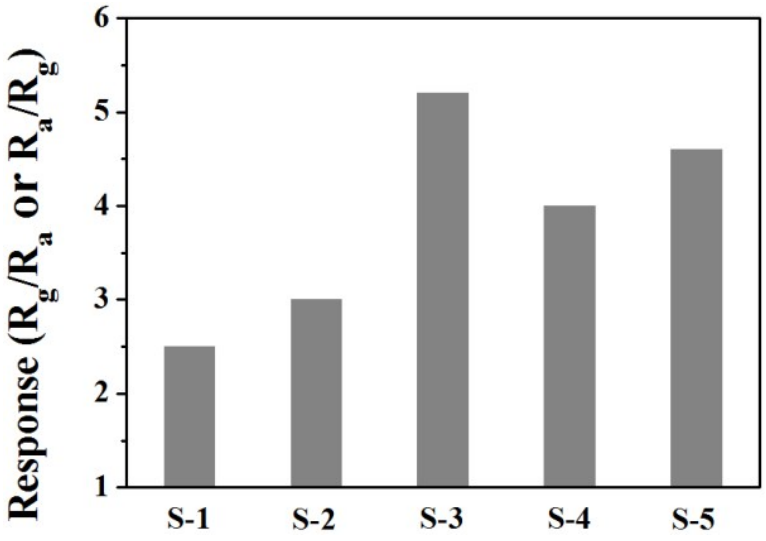

Figure S5. Response of hybrid $ZnFe_2O_4$/ZnO-based sensors with different ratios towards 50 ppm acetone at the optimum temperature.

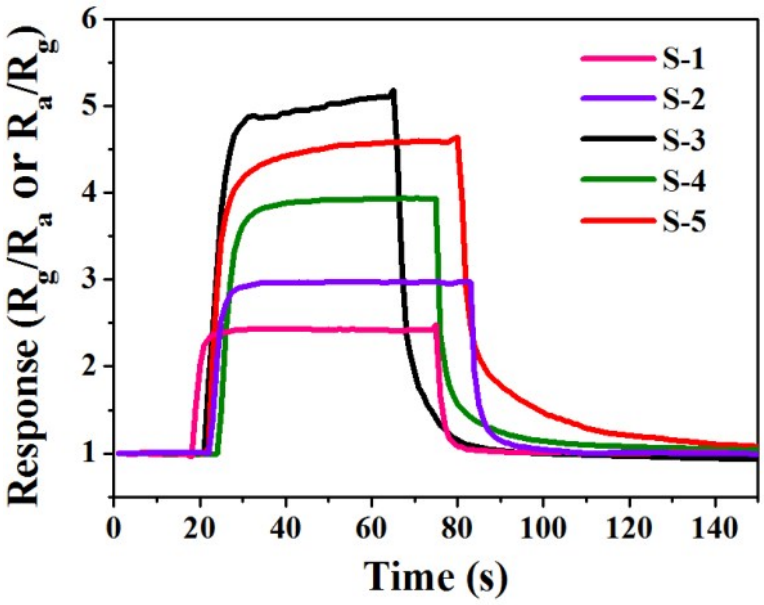

Figure S6. One cycle of response transient of the $ZnFe_2O_4$/ZnO -based sensor with different ratios to 50 ppm acetone at the optimum temperature.

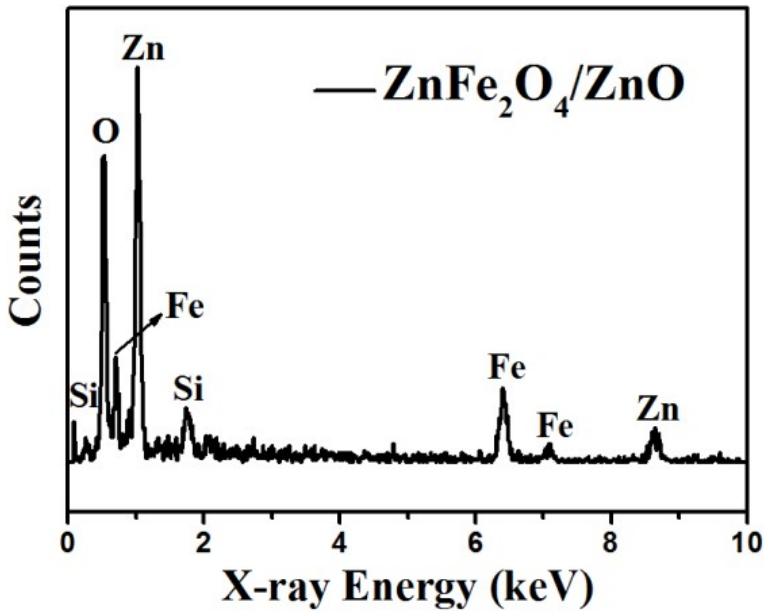

Figure S7. EDS spot scanning pattern of hybrid $ZnFe_2O_4$/ZnO hollow spheres.

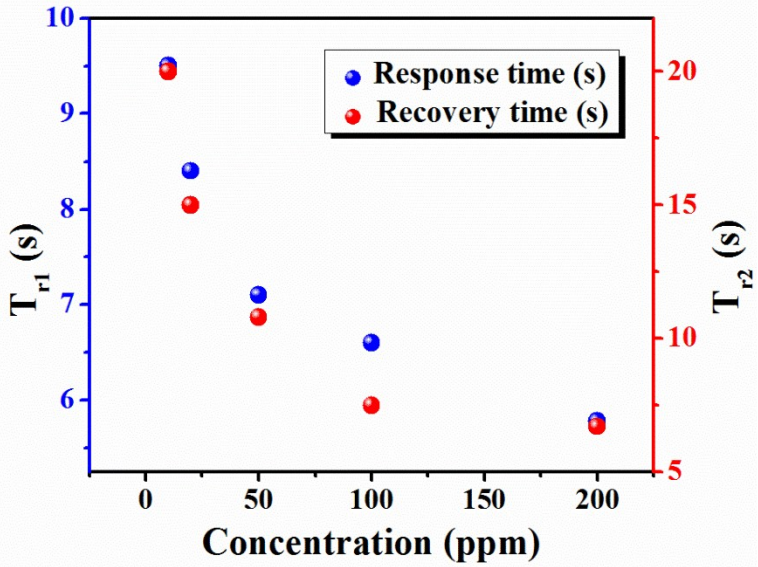

Figure S8. Response time and recovery time of hybrid $ZnFe_2O_4$/ZnO hollow spheres-based sensor to 10-200 ppm acetone.

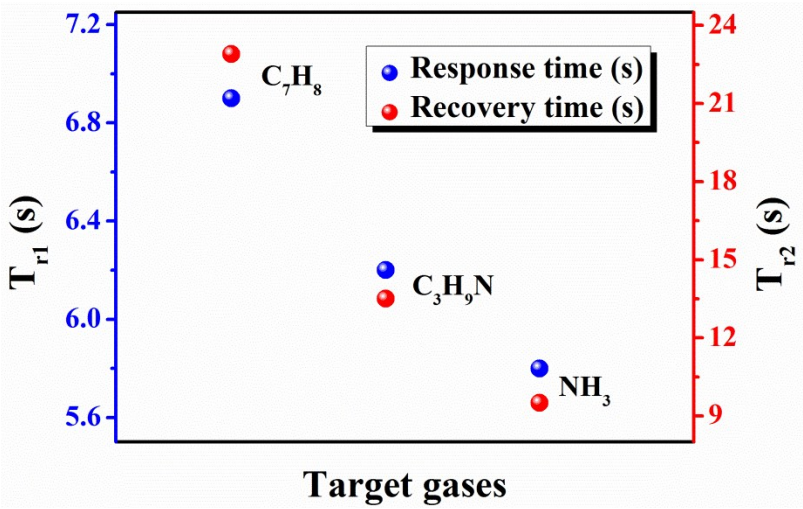

Figure S9. Response and recovery time towards 50 ppm C_7H_8, C_3H_9N and NH_3 at 280 °C of the sensor based on hybrid $ZnFe_2O_4$/ZnO hollow spheres.

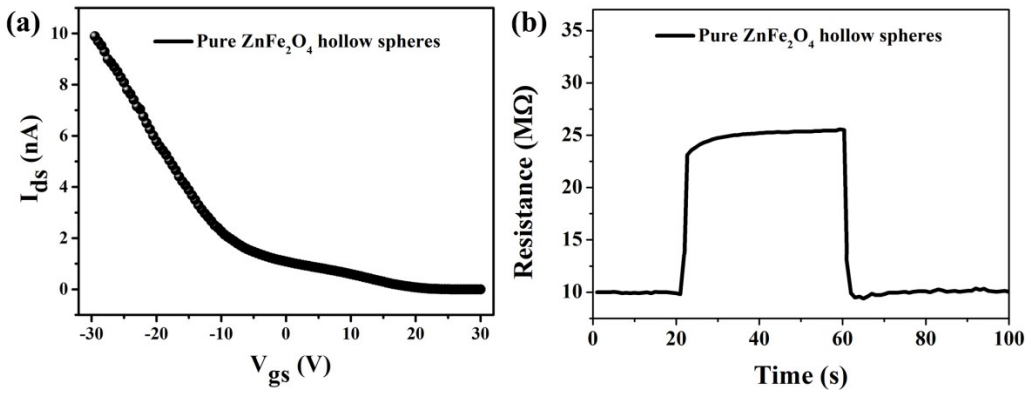

Figure S10. (a) Gating effect of the $ZnFe_2O_4$-based device and (b) resistance transient of the sensor based on pure $ZnFe_2O_4$ hollow spheres-based sensor to 50 ppm acetone at the optimum temperature.

Table S1 Detailed Experimental Parameters for the Preparation of Five ZnO- or $ZnFe_2O_4$- Samples.

Sample No.	Starting regents	Molar ratio of Zn to Fe	Final product
S-1	$Zn(NO)_3 \bullet 6H_2O$ and $Fe(NO)_3 \bullet 9H_2O$	10:1	$ZnFe_2O_4$
S-2	$Zn(NO)_3 \bullet 6H_2O$ and $Fe(NO)_3 \bullet 9H_2O$	12:1	$ZnFe_2O_4$/ZnO
S-3	$Zn(NO)_3 \bullet 6H_2O$ and $Fe(NO)_3 \bullet 9H_2O$	15:1	$ZnFe_2O_4$/ZnO
S-4	$Zn(NO)_3 \bullet 6H_2O$ and $Fe(NO)_3 \bullet 9H_2O$	20:1	$ZnFe_2O_4$/ZnO
S-5	$Zn(NO)_3 \bullet 6H_2O$ and $Fe(NO)_3 \bullet 9H_2O$	1:0	ZnO