Electronic Supplementary Material (ESI) for Nanoscale.

Designed Formation through Metal Organic Frameworks Route of $ZnO/ZnCo_2O_4$ Hollow Core-shell Nanocages with Enhanced Gas Sensing Properties

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Experimental Section

Synthesis of $ZnCo_2O_4$ shells

The $ZnCo_2O_4$ shells were synthesized according to a previous report with a modification. Typically, 0.04g of ZIF-8/Co−Zn hydroxides precursor was first dispersed in a mixed solvent consisting of 20 mL ethanol and refluxed at 90 °C for 1 h, during which the ZIF-8 cores can be completely removed. Then, the as-obtained Co−Zn hydroxides shells were annealed in air at 450 °C for 3 h with a ramp rate of 1 °C min^{-1} to generate the $ZnCo_2O_4$ shells.

Supplementary Figures

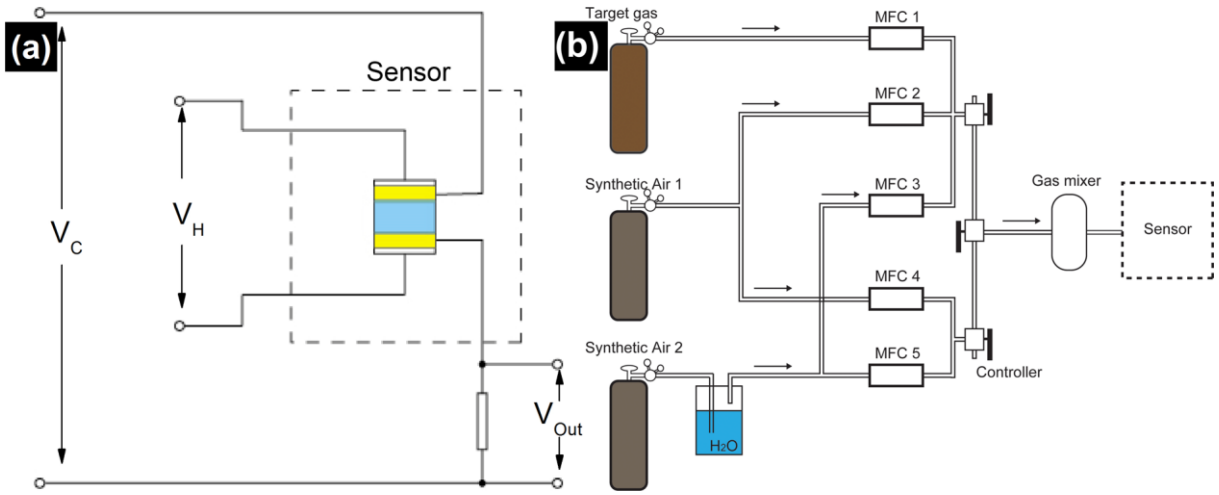

Fig. S1 The schematic illustration of (a) gas sensing analysis system and (b) gas mixing line equipment.

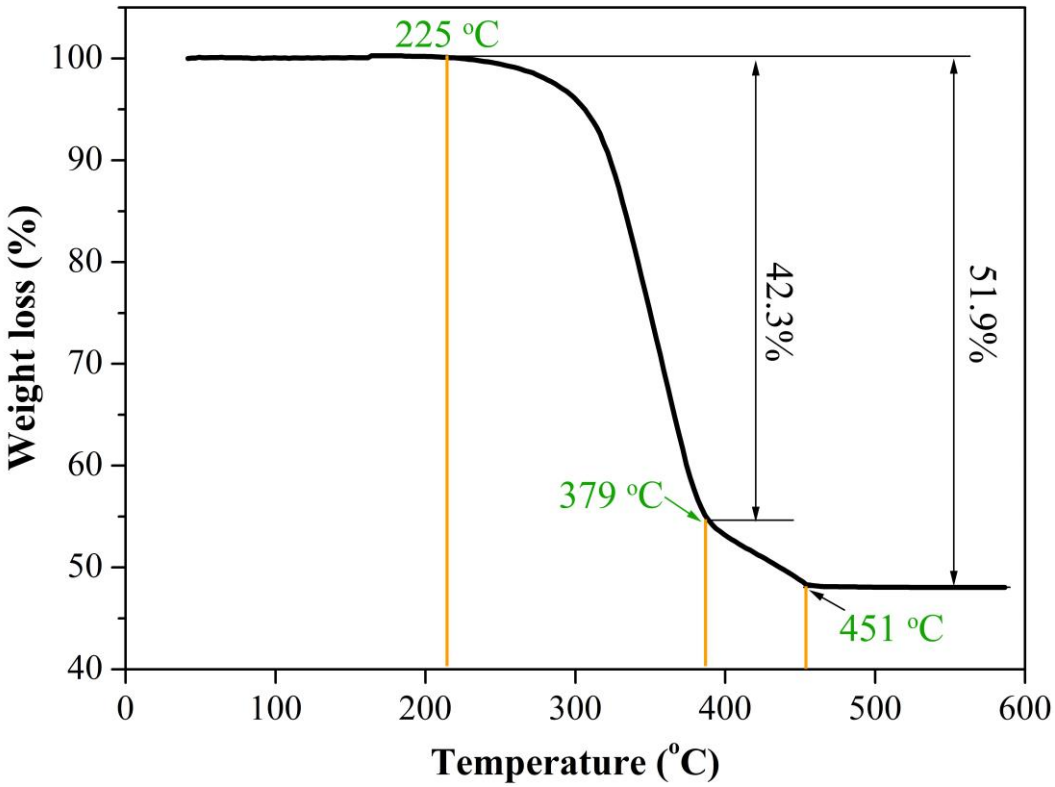

Fig. S2 TG curves of ZIF-8/Zn-Co hydroxides precursor

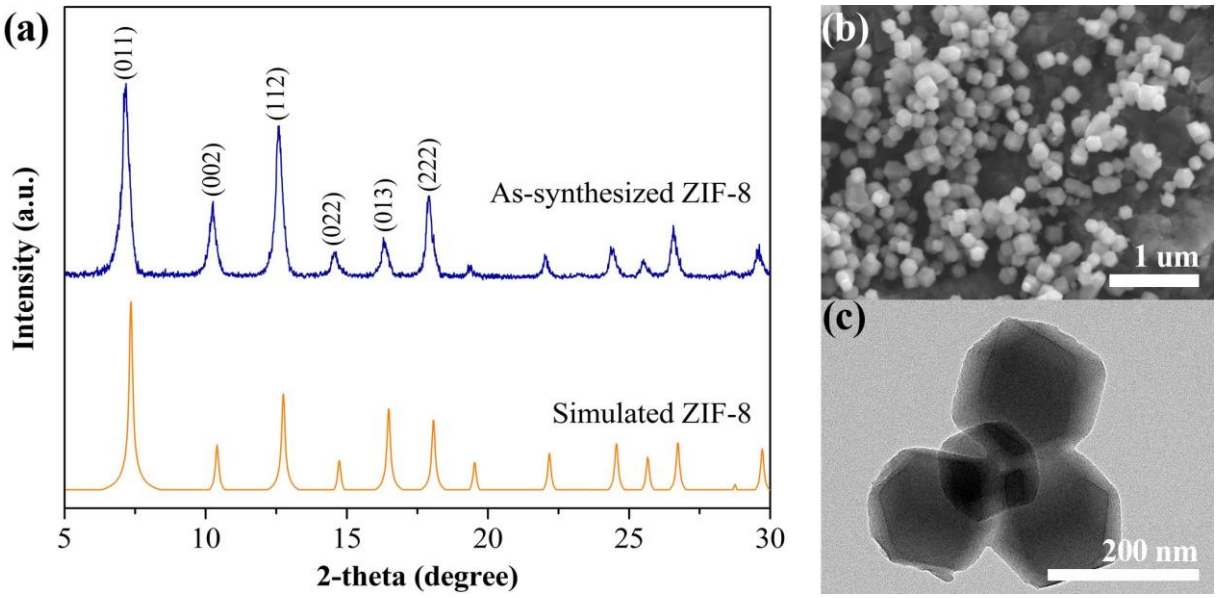

Fig. S3 XRD pattern, SEM images and TEM images of ZIF-8.

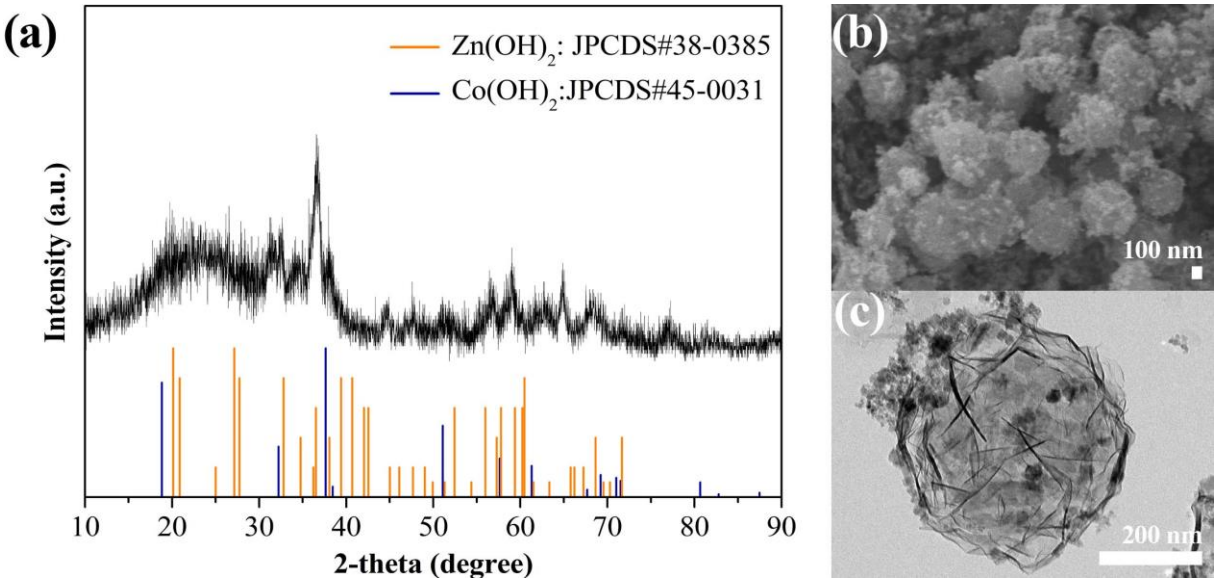

Fig. S4 SEM images and TEM images of Zn-Co hydroxide shells.

The following equations may describe the reaction process of $Co(OH)_2$ and $Zn(OH)_2$:[1]

$Co(NO_3)_2 \cdot 6H_2O \rightarrow Co^{2+} + 2NO_3^- + 6H_2O$ (1)

$H_2O \rightarrow OH^- + H^+$ (2)

$Co^{2+} + 2OH^- \rightarrow Co(OH)_2 \downarrow$ (3)

$Zn^{2+} + 2OH^- \rightarrow Zn(OH)_2 \downarrow$ (4)

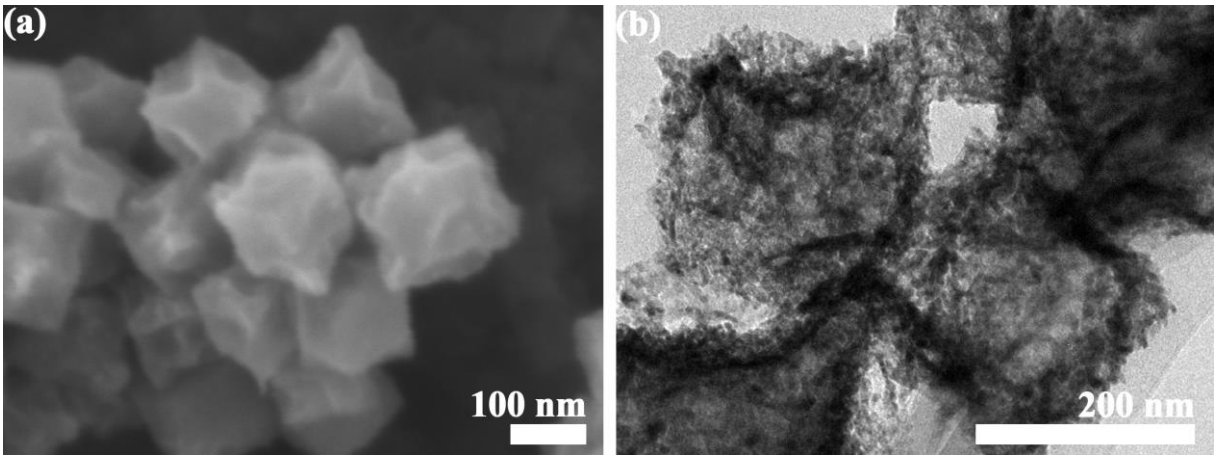

Fig. S5 SEM images and TEM images of ZnO. XRD pattern,

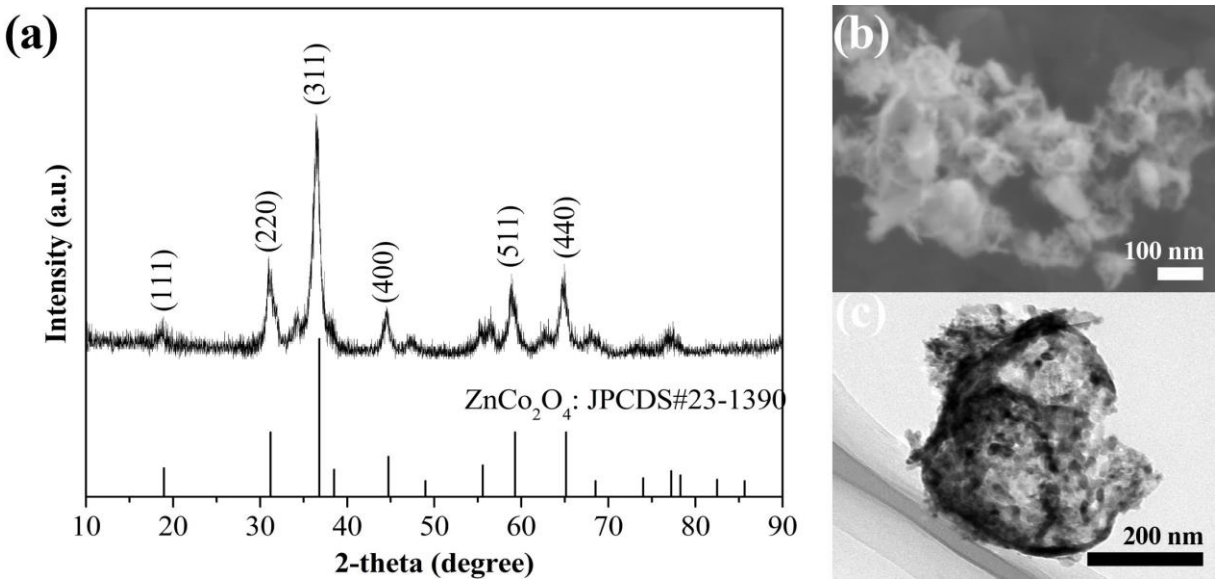

Fig. S6 XRD pattern, SEM images and TEM images of $ZnCo_2O_4$ shells.

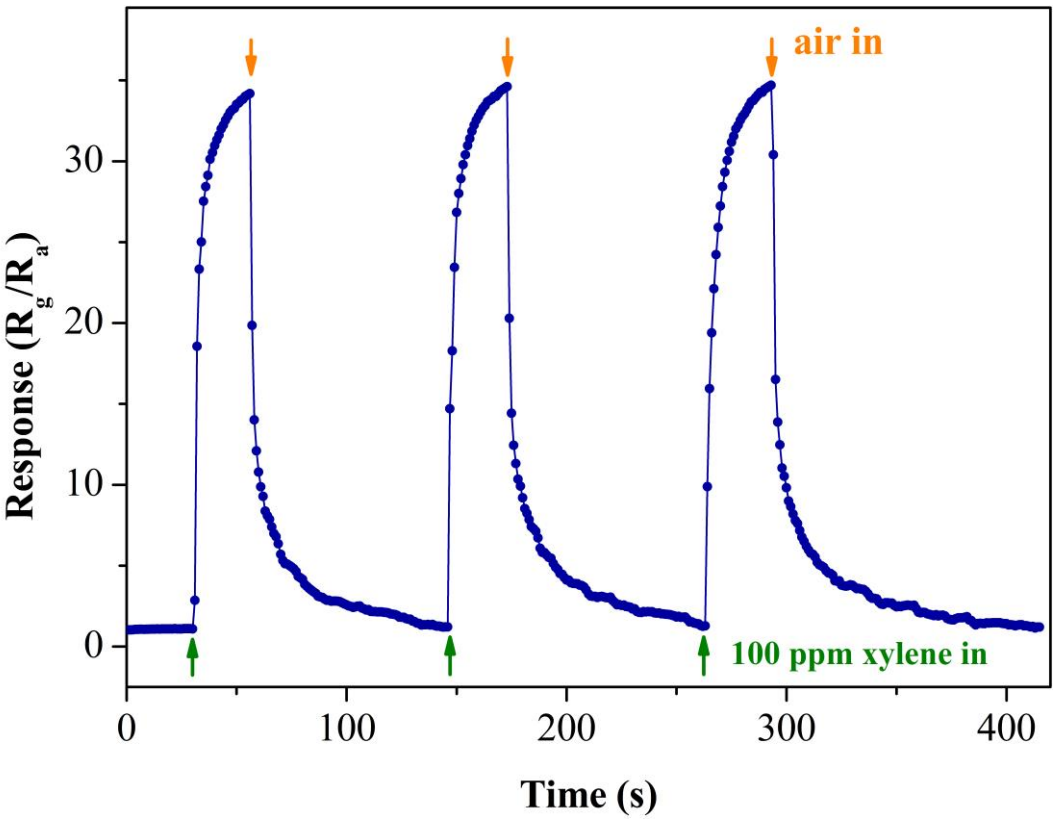

Fig. S7 The dynamic 3-cycles response measurements to 100 ppm xylene for $ZnO/ZnCo_2O_4$ HCSNCs at 320 ^{o}C.

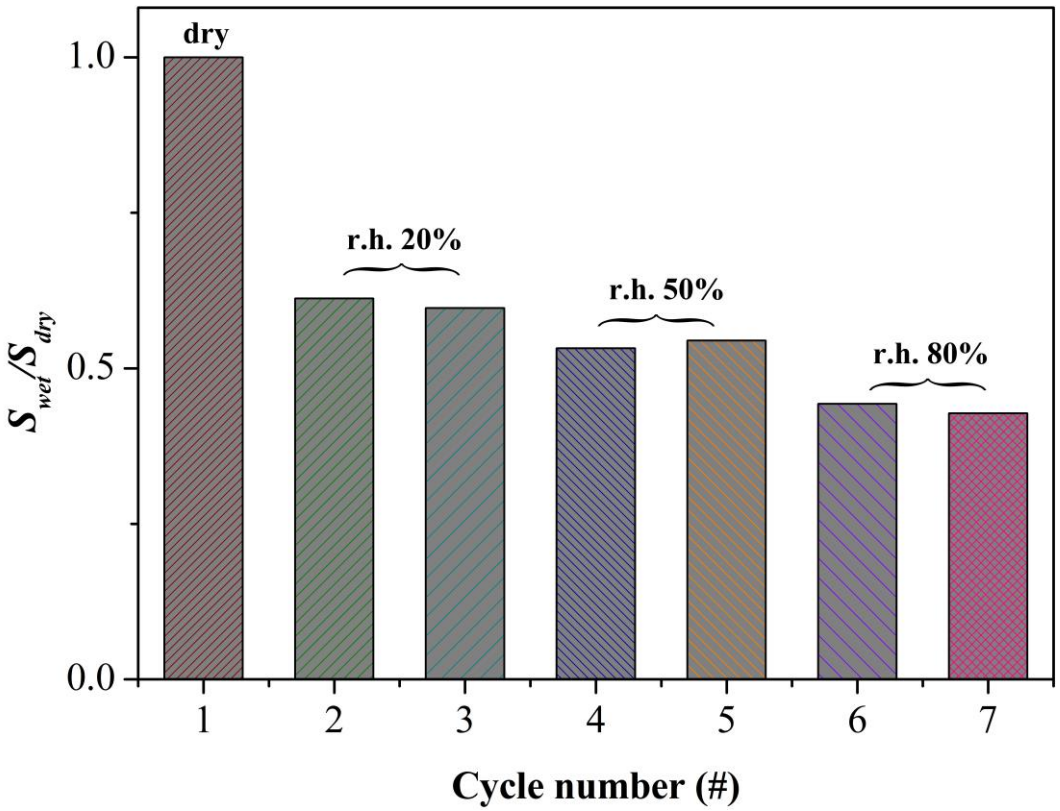

Fig. S8 The S_{wet}/S_{dry} of $ZnO/ZnCo_2O_4$ HCSNCs exposed to 100 ppm xylene in dry and humid conditions (r.h. 20%, 50%, and 80%).

Reference:

[1] Jiang Z, Li Z, Qin Z, et al. LDH nanocages synthesized with MOF templates and their high performance as supercapacitors. Nanoscale, 2013, 5(23): 11770-11775.