Electronic Supporting Information

Three-dimensional hierarchical Co_3O_4 nano/micro-architecture: synthesis and ethanol sensing properties

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Experimental procedure

Synthesis of Co_3O_4 cubes and nanoparticles. In typical synthesis procedure, 1mmol $Co(NO_3)_2 \cdot 6H_2O$ and some NaCl were completely dissolved in ethylene-glycol (65ml) to form a transparent solution. Brief, 4 mmol NH_4F were added to solution above and dissolved completely. After ultrasonic and stirred treatments, the final solution was transferred to a Teflon-lined stainless autoclave, which was heated 180°C for 8h in air flow electric oven. After cooling down, the product was washed by distilled water and ethanol several times prior to being dried at 60°C for 10h. Finally, the final cubic sample was collected after the calcination process at 500°C for the gas sensing test further. Those nanoparticles were prepared by the similar process above just changing the solvent (only 70mL ethanol) and the alkaline source (urea).

Table. S1 Gas responses to ethanol of the sensors in the recent study and those reported in the literature.

Materials	Structure	Ethanol conc.(ppm)	T (°C)	Sensitivity	Reference
ZnO/Co_3O_4	pyramidal-like	500	400	~10	S1
α-Fe_2O_3	Yolk-shell	100	240	~13	S2
SnO_2/α-Fe_2O_3	Hollow spheres	10	250	~15	S3
ZnO	Brush-like	50	265	~10	S4
Co-doped ZnO	nanowires	5	450	~5	S5
Zn-doped SnO_2	Sphere-like	100	213	~14.4	S6
ZnO	Hollow spheres	50	420	~8.5	S7
NiO/SnO_2	Nanofibers	100	330	~3.5	S8
$ZnFe_2O_4$	nanoparticles	100	200	~6	S9
Co_3O_4	Lamellar cubes	50	170	~5.1	This work
Co_3O_4	Needle-shaped	50	170	~13.4	This work

Conc., concentration; T, the optimal working temperature

Table. S2 ICP-MS analysis data of S1 before/after sensing reaction.

Elements / No.	Co	
	Before (c_1)	**After (c_2)**
1	11.27	11.26
2	11. 20	11.22
3	11.23	11.23
Average	11.33	11.37
Δ *Con.*$_{(C2-C1)}$	+0.04	

***Con.*, ppm level**

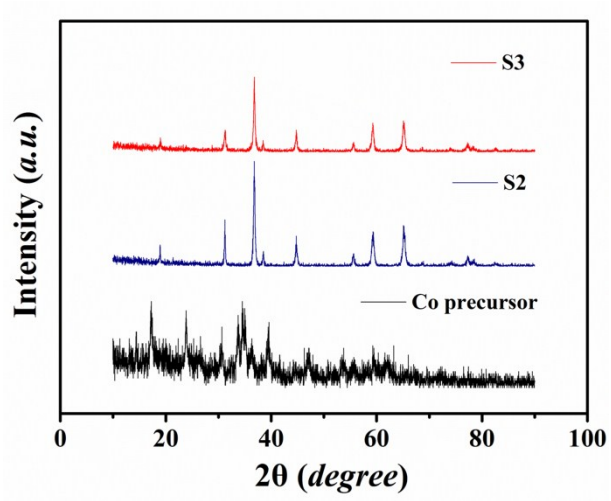

Fig. S1 XRD patterns of precursor of S1, Co_3O_4 cubes (S2) and Co_3O_4 nanoparticles (S3).

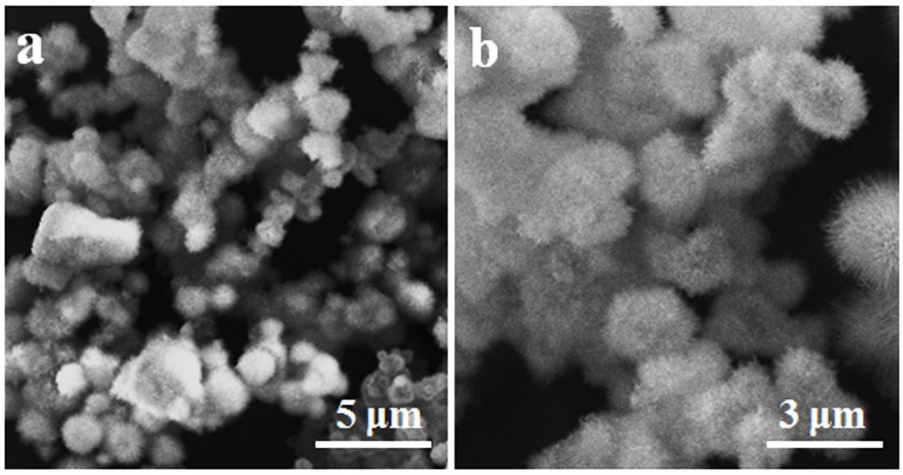

Fig. S2 The SEM images of S1 at different magnifications.

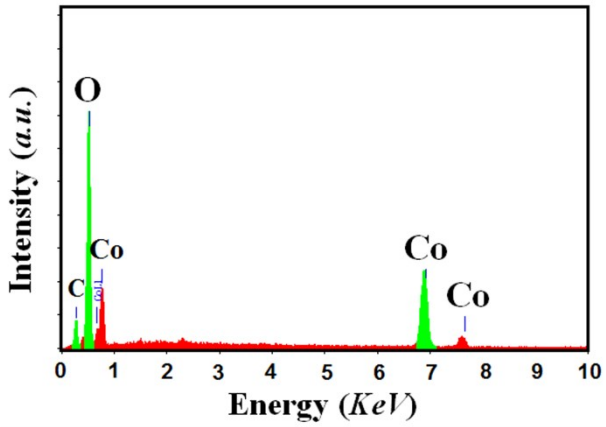

Fig. S3 The EDS analysis spectrums of Co_3O_4 needle-shaped microspheres (S1).

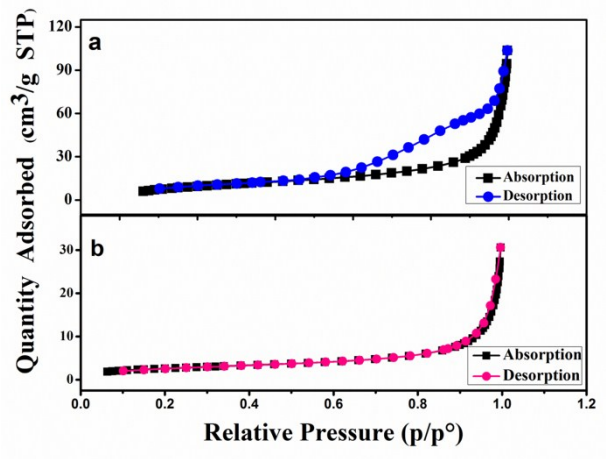

Fig. S4 The BET data of control groups: (a) S2 and (b) S3.

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