

## Supporting Information

### **N,S co-doped Co<sub>3</sub>O<sub>4</sub> core-shell nanospheres with high peroxidase activity for fast colorimetric detection of catechol**

**Xiangwei Liu, Xiaoyan Cao, Shuang Zhao, Zhenxue Liu\*, Guang Lu\* and Qingyun Liu\***

College of Chemical and Biological Engineering, Shandong University of Science and Technology, Qingdao, People's Republic of China

\* Corresponding Author

E-mail: [qyliu@sdust.edu.cn](mailto:qyliu@sdust.edu.cn)

Tel.: +86 0532 86057757

### **Synthesis of N,S co-doped $\text{Co}_3\text{O}_4$ (N,S- $\text{Co}_3\text{O}_4$ )**

In a typical procedure, 0.11 g of  $\text{Co}(\text{NO}_3)_2 \cdot 6\text{H}_2\text{O}$  was dissolved into a mixture solution of glycerol (8 mL) and isopropanol (40 mL), after stirring vigorously for 40 min, the as-prepared solution was then transferred to 100 mL of Teflon-lined stainless-steel autoclave and kept at 180 °C for 6 h. After cooling to room temperature naturally, the precipitates were separated by centrifugation, washed with ethanol five times, and then dried in an oven at 80 °C for 12 h. The collected product was assigned as the precursor A.

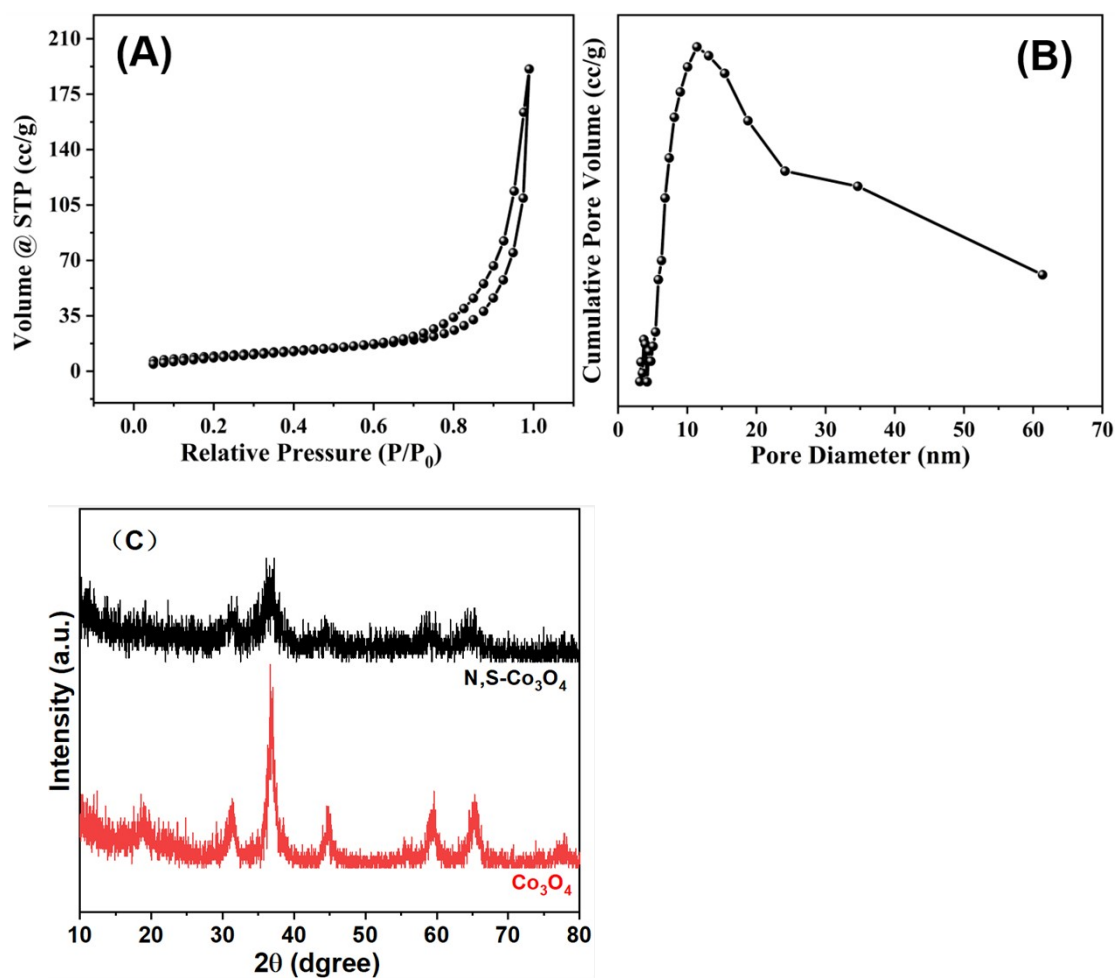
50 mg precursor A was dissolved into 20 mL of ethanol followed with ammonia solution (3mL, 15 wt%), after stirring for 30 min until the solution was evenly dispersed, the as-prepared solution was then transferred to 50 mL of Teflon-lined stainless-steel autoclave and kept at 160 °C for 1 h. The black precipitates were separated by centrifugation, washed five times with ethanol and dried at 60 °C for 12 h. The collected product is the precursor B.

40 mg of precursor B and 100 mg of sulfur powders were put at two separate positions in a porcelain boat with sulfur powders at the upstream side of the tube furnace. Then, the samples were annealed at 300 °C for 2 h with a rising rate of 1 °C $\cdot$ min<sup>-1</sup> under a flow of nitrogen gas (in which process the evaporation of sulfur powder and its reaction with the oxide precursor was happened). Finally, N,S- $\text{Co}_3\text{O}_4$  was obtained after cooling to ambient temperature under nitrogen atmosphere.

### **FI-IR data**

The two bands at 1643.84 and 3774.05 cm<sup>-1</sup> appear in all spectra, related to the

hydroxyl group (-OH) of the absorbed water molecules and its vibrations.<sup>1,2</sup> The band around  $500\text{ cm}^{-1}$  and between  $600 \sim 700\text{ cm}^{-1}$  corresponds to the stretching band of Co-O in the system,<sup>3,4</sup> which are further confirmed by the appearance of the new vibrations at  $410\text{-}430\text{ cm}^{-1}$  (Co-O) and  $450\text{-}470\text{ cm}^{-1}$  (Co-N), respectively.<sup>5</sup> The band of  $1048\text{ cm}^{-1}$  is related to the coordination of Co and the generation of Co-O-S and Co-S relations.<sup>6</sup>



**Fig. S1** (A) N<sub>2</sub> adsorption-desorption isotherm and (B) pore size distribution determined by BJH method for N,S-Co<sub>3</sub>O<sub>4</sub> microspheres. (C) XRD images of Co<sub>3</sub>O<sub>4</sub> and N,S-Co<sub>3</sub>O<sub>4</sub>, respectively.

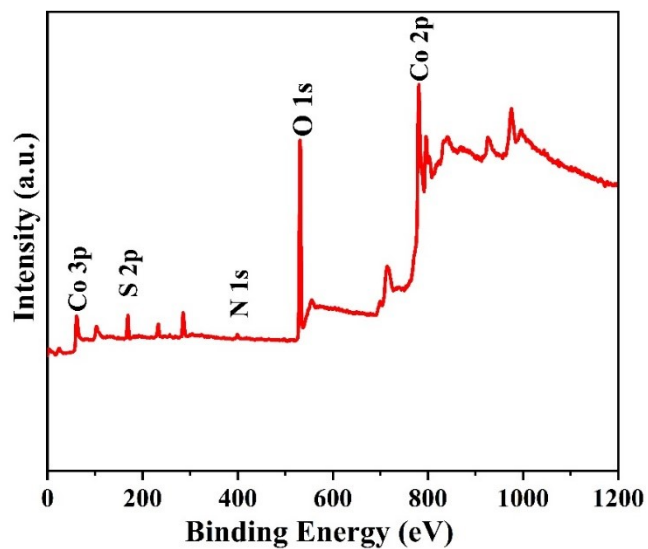


Fig. S2 XPS survey spectrum of N, S-Co<sub>3</sub>O<sub>4</sub>.

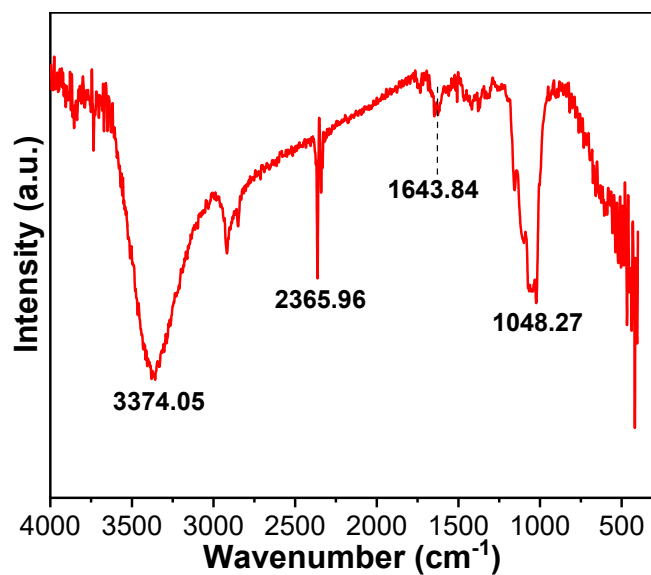
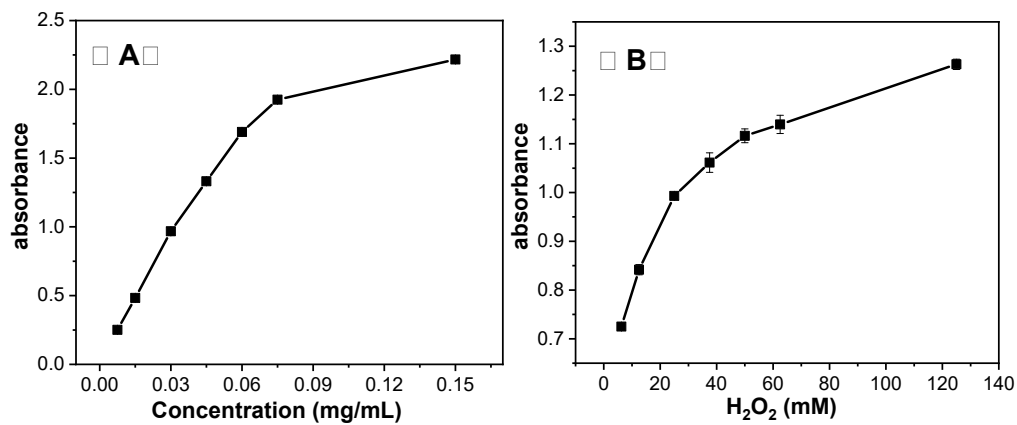
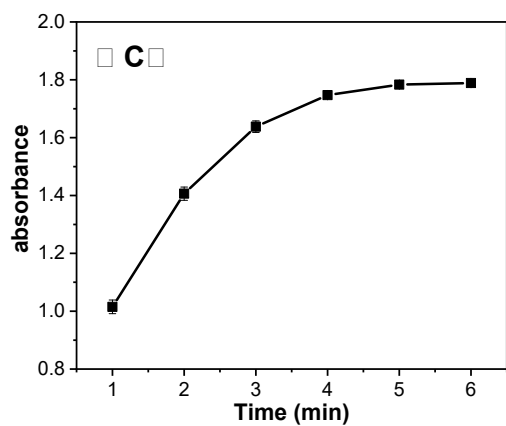
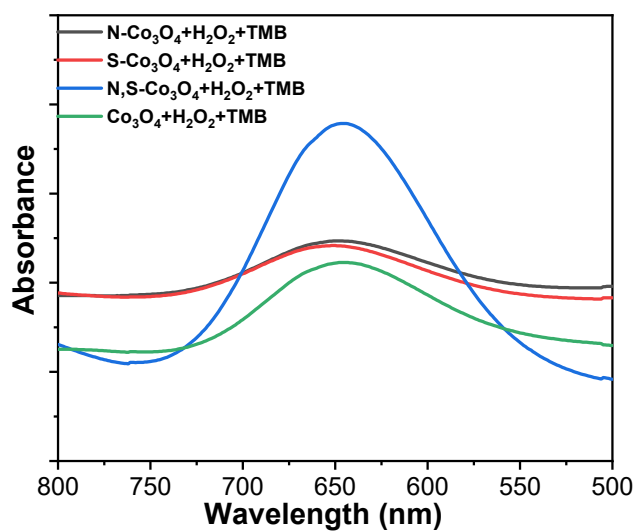


Fig. S3 FT-IR spectrum of N, S-Co<sub>3</sub>O<sub>4</sub>.





**Fig. S4** Influences of concentration (A),  $H_2O_2$  (B) and time (C) on the peroxidase-like activity of N,S- $Co_3O_4$ .



**Fig. S5** The comparison of the peroxidase-like activity of pure  $Co_3O_4$ , sole N-doped, sole S-doped and N,S-doped  $Co_3O_4$ , respectively.