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Spiderweb-inspired all-weather CoS quantum dots confined in N-doped carbon for boosted sulfate radical evolution

*Jie Ding[a], Ying-Bo Zhu[a], Yu-Long Ma[*a], Yong-Gang Sun[*a], Lei Wang[a], Li-Qiong Wang[a], Yuan-Yuan Li[a], Wen-Xin Ji[a], Zhi-Jun Yu[b]*

[a] State Key Laboratory of High-efficiency Coal Utilization and Green Chemical Engineering. College of Chemistry and Chemical Engineering, Ningxia University, Yinchuan 750021, China.

[b] School of Environment, Tsinghua University, Beijing 10084, China.

Corresponding author:

Yu-Long Ma

State Key Laboratory of High-efficiency Utilization of Coal and Green Chemical Engineering, College of Chemistry and Chemical Engineering, Ningxia University

Helanshan Rd. 539, Yinchuan 750021, China

E-mail: yulongma796@sohu.com (Yu-Long Ma)

Yong-Gang Sun

State Key Laboratory of High-efficiency Utilization of Coal and Green Chemical Engineering, College of Chemistry and Chemical Engineering, Ningxia University

Helanshan Rd. 539, Yinchuan 750021, China

E-mail: cassyg2015@163.com (Yong-Gang Sun)

Experimental details

Sulphur was purchased from Sigma-Aldrich (99.99%). Other chemical reagents were purchased from Aladdin Chemical Reagent Co., Ltd., and were used without further purification.

Preparation of ZIF-67@CNTs: The ZIF-67@CNTs were prepared via a typical hydrothermal method. First, 50 mg acid treatment of CNTs (Aladdin, >90%) dispersed in 50 mL N,N-dimethylformamide (DMF, Aladdin, 98%) with continuous stirring for 1 h. Second, 0.1 mol $Co(NO_3)_2 \cdot 6H_2O$ (Aladdin, 99%) was dissolved in the above dispersion with continuous stirring for 20 min. Third, 0.01 mol 2-methylimidazole (Aladdin, 99%) was added into the above solution and stirring for another 40 min. Then, the mixture was transferred to a Teflon-lined autoclave and maintained at 60 °C for 20 h. Finally, the obtained product was centrifuged with deionized water and ethanol for several times. The collected powder was dried at 80 °C overnight. ZIF-67 without CNTs as a control.

Preparation of CoS@CNTs: To get the CoS@CNTs, the obtained ZIF-67@CNTs and Sulphur were placed in a sealed ampoule bottle with weight ratio of 1:2. And then the materials were heated to 500 °C for 2 h in tubular furnace with a temperature increase rate of 2 °C min^{-1} under argon atmosphere. After cooling to room temperature naturally, the final product was washed with deionized water and ethanol several times, respectively, and then dried in drying oven at 80 °C.

Preparation of CoS@CNTs with LPP: Dissolve the LPP material into the acetonitrile solution under magnetic stirring for 30 min. Next, a certain proportion of

catalyst slowly injected to the solution, and the resulting dispersion was stirred for 4 h for complete hydrolysis at 60 °C.

Catalytic activity test: BPA was selected as a target pollutant to evaluate the catalytic activity of catalytic, as it is a ubiquitous pollutant and an important intermediate in industrial processes. The degradation experiments were carried out in a batch mode using a threenecked flask (250 mL) at room temperature. In a typical experiment, catalytic was dispersed in BPA solution (50 mg/L, 150 mL) for 2 min. Then the degradation reaction was initiated by adding PMS under magnetic stirring. At predetermined time intervals, samples were withdrawn and filtered through 0.22 μm membrane filters to remove suspended MOFs. Meanwhile, an aliquot of 1 M isopropyl alcohol was immediately added to quench the reaction, and then the concentration of BPA was analyzed. After reaction, CoS@CNTs was separated by filtration, washed with water and methanol, and then reused in a new reaction after being dried at 60 °C.

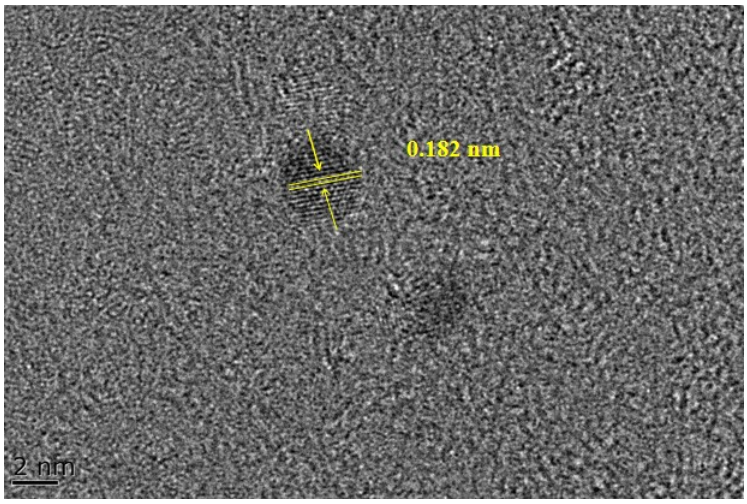


Figure S1 The HR-TEM image of CoS quantum dot nanoclusters.

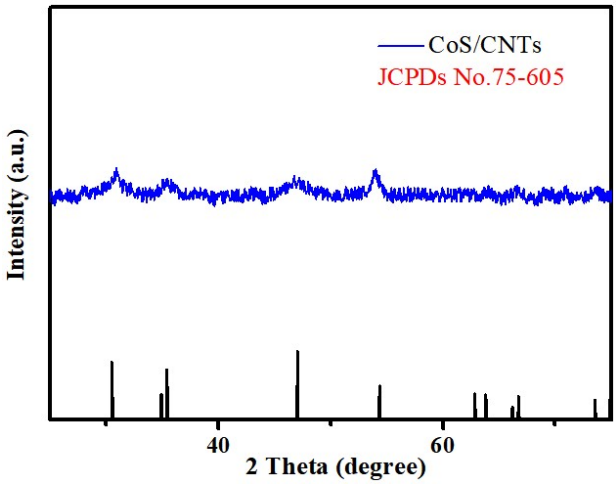


Figure S2 XRD pattern of CoS/CNTs.

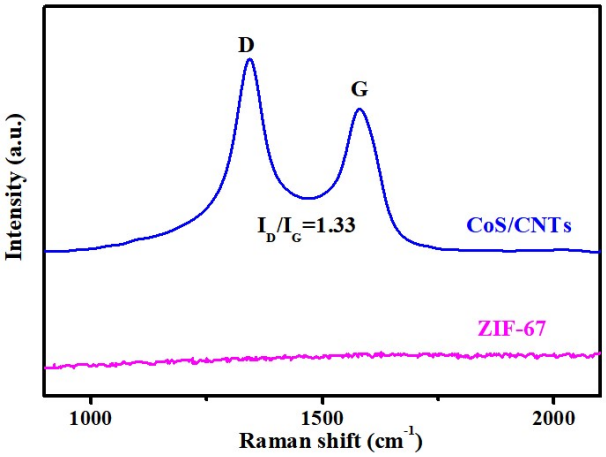


Figure S3 Raman spectra of CoS/CNTs.

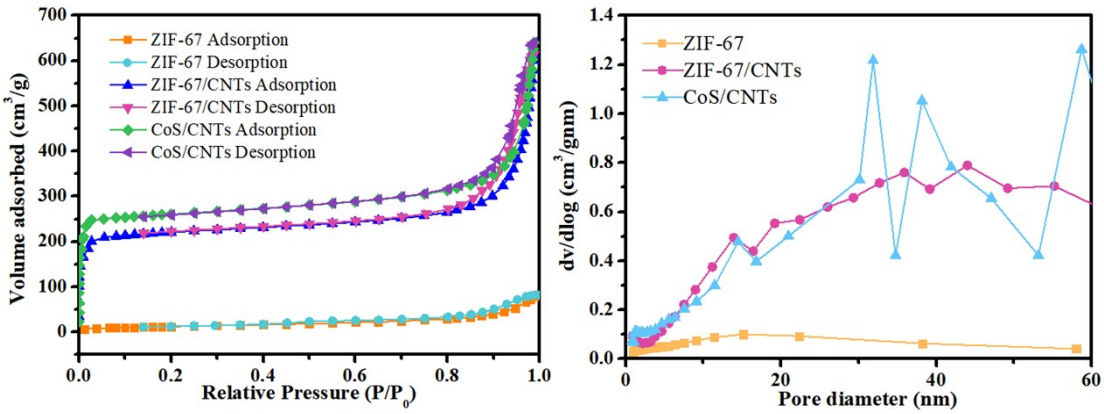


Figure S4 BET results.

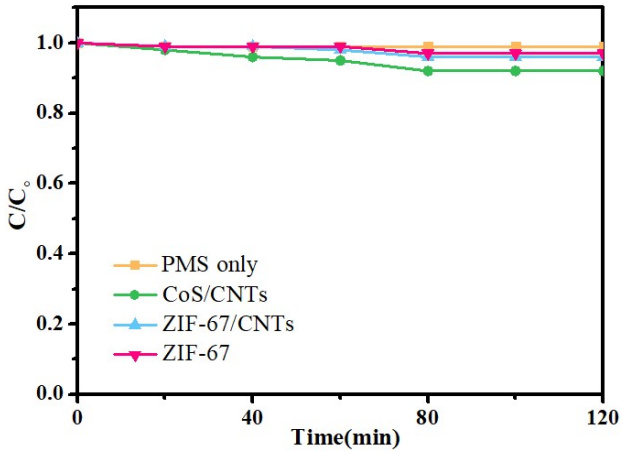


Figure S5 Adsorption performance of different catalysts.

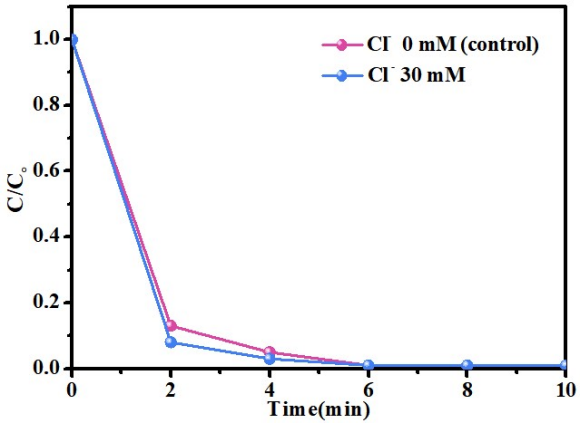


Figure S6 Effect of Cl^- on BPA degradation.

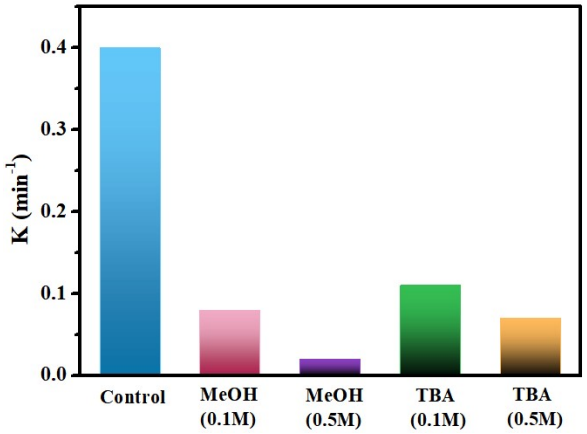


Figure S7 Reaction rate constant of catalysts.

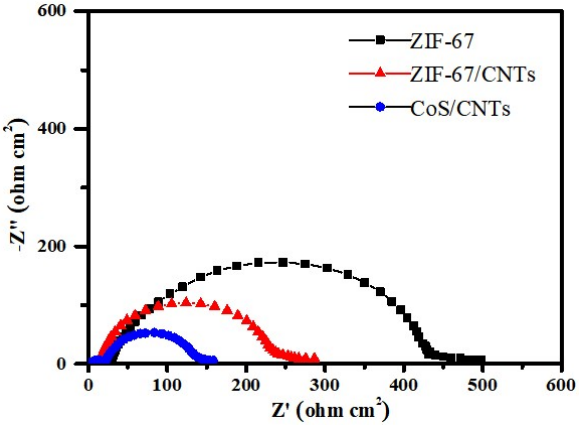
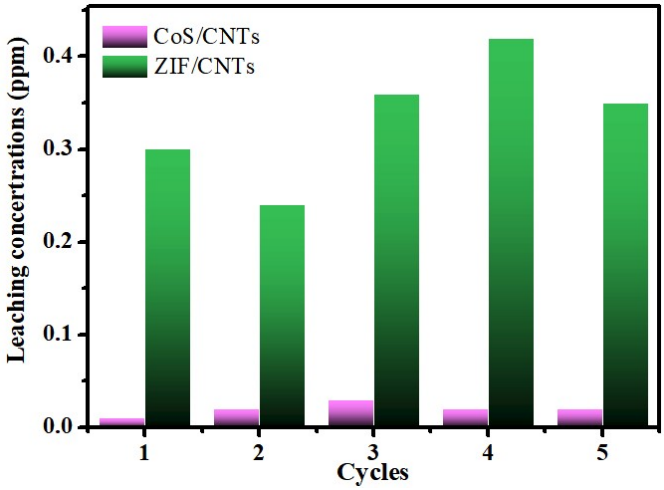


Figure S8 Nyquist EIS plot of catalysts.



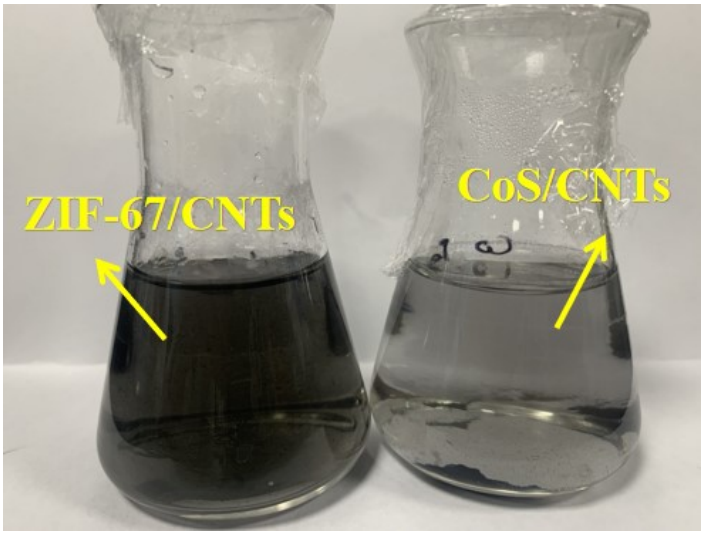


Figure S9 The diagram of metal dissolution.