

Supporting Information

Transformation of hollow ZnFe-ZIF-8 nanocrystals into hollow ZnFe-N/C electrocatalyst for oxygen reduction reaction

Pengyao Yu^a, Sheng Liu^d, Yuchen Cui^a, Kun Sun^a, Ling Zhang^a, Hailing Guo^{*a}, Yongming Chai^a,
Chenguang Liu^a, Lili Fan^c, Ge Yang^a, Chunzheng Wang^a, Svetlana Mintova^{a,b}

^a State Key Laboratory of Heavy Oil Processing, Key Laboratory of Catalysis, China National Petroleum Corp. (CNPC) China University of Petroleum (East China), Qingdao 266555, People's Republic of China.

^b Normandie Université, Laboratoire Catalyse et Spectrochimie (LCS), ENSICAEN, CNRS, 6 boulevard du Marechal Juin, 14050 Caen, France

^c School of Materials Science and Engineering, College of Science, China University of Petroleum (East China), Qingdao 266580, China

^d WISDRI Engineering and Technology Co. Ltd, Wuhan 430000, China

* Corresponding author: Prof. Hailing Guo, Fax: +86 0532 86981787, Tel: +86 0532 86984688

and e-mail: guohl@upc.edu.cn

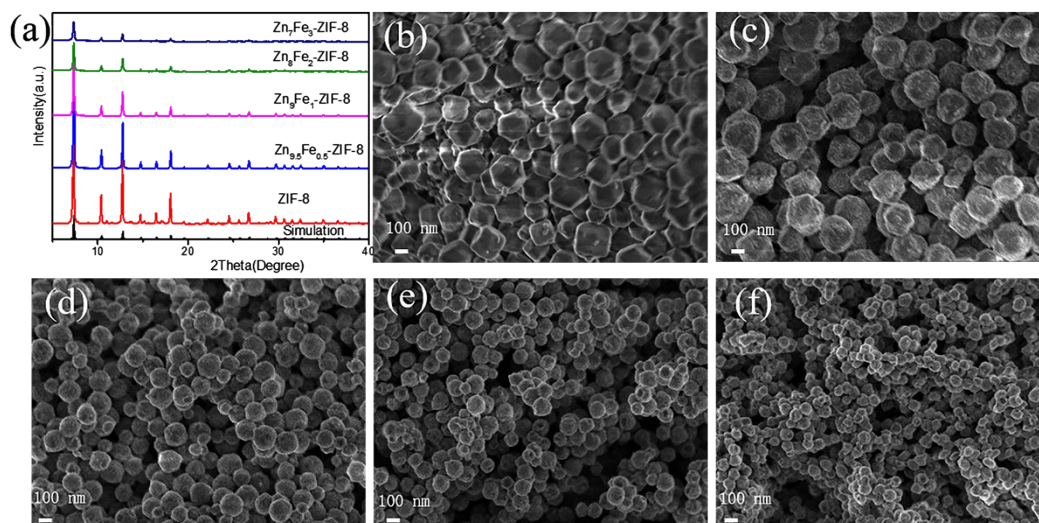


Figure S1. XRD patterns of (a) ZIF-8, ZnFe-ZIF-8-1, ZnFe-ZIF-8-2, ZnFe-ZIF-8-3 and ZnFe-ZIF-8-4 samples; SEM images of (b) ZIF-8, (c) ZnFe-ZIF-8-1, (d) ZnFe-ZIF-8-2, (e) ZnFe-ZIF-8-3, and (f) ZnFe-ZIF-8-4 samples.

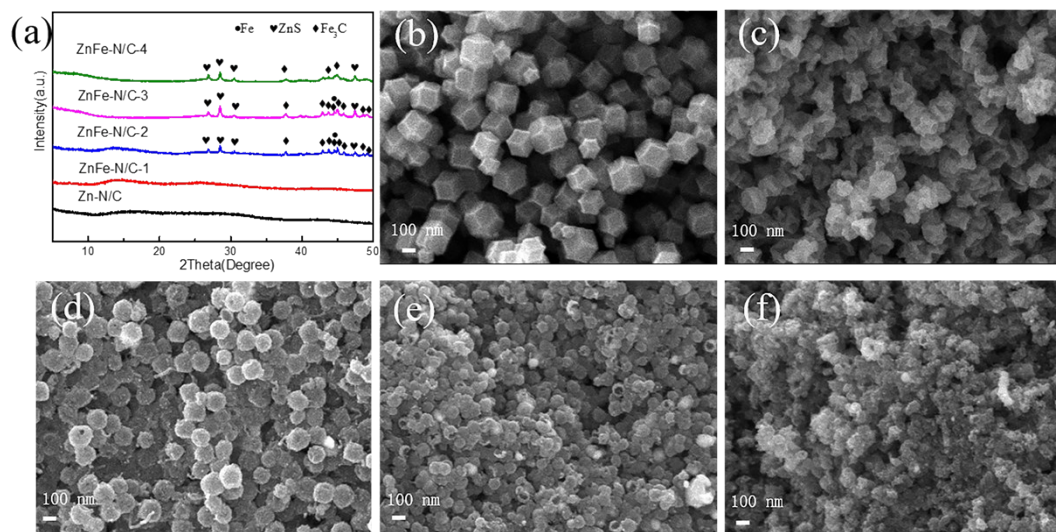


Figure S2. XRD patterns of (a) Zn-N/C, ZnFe-N/C-1, ZnFe-N/C-2, ZnFe-N/C-3 and ZnFe-N/C-4 samples; SEM iamges of (b) Zn-N/C, (c) ZnFe-N/C-1, (d) ZnFe-N/C-2, (e) ZnFe-N/C-3, and (f) ZnFe-N/C-4 samples.

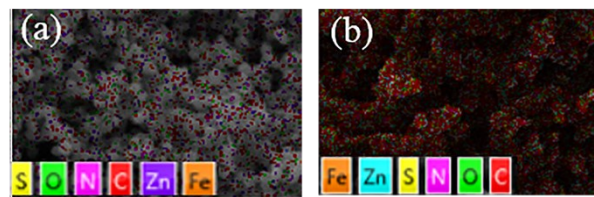


Figure S3. EDS mapping of (a) ZnFe-ZIF-8-3 and (b) ZnFe-N/C-3 samples.

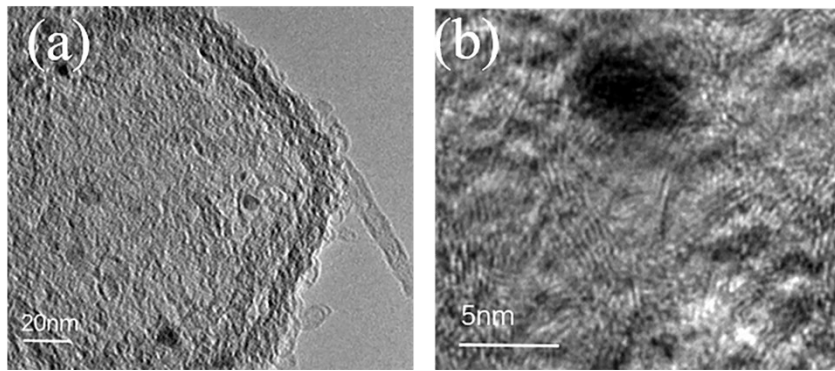


Figure S4. TEM images of H₂SO₄-leached-ZnFe-N/C-3 samples under different resolutions.

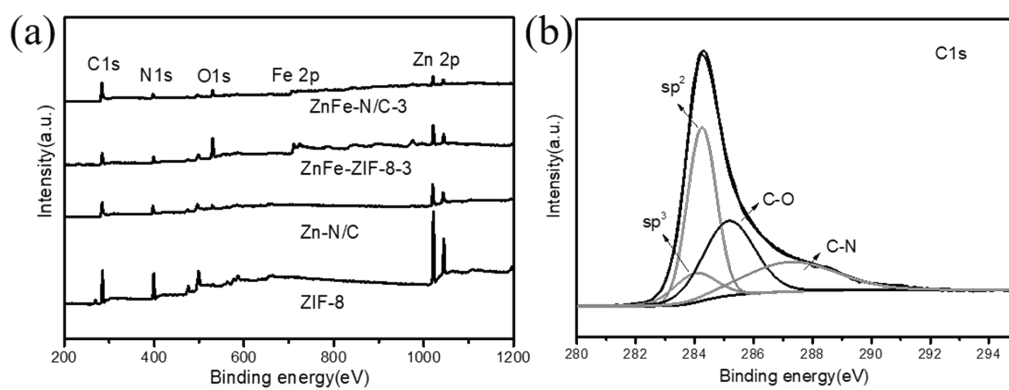


Figure S5. (a) Full XPS spectra of ZIF-8, Zn-N/C, ZnFe-ZIF-8-3 and ZnFe-N/C-3 samples; (b) C 1s XPS spectrum of ZnFe-N/C-3.

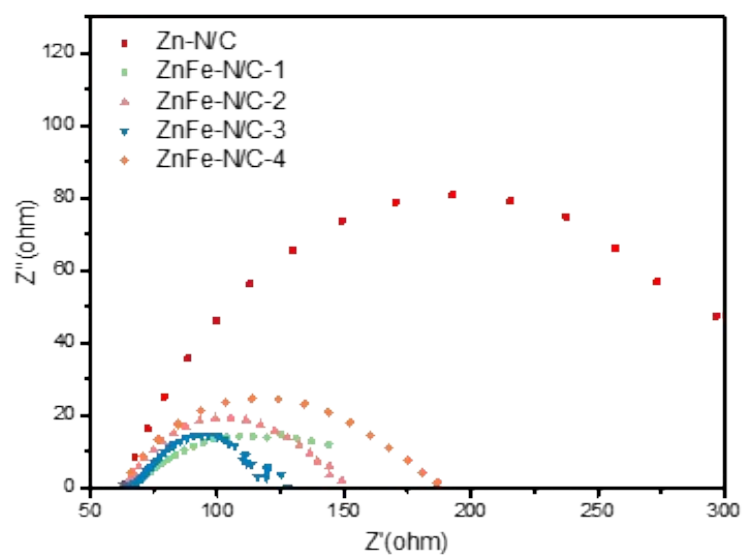


Figure S6. Nyquist plots of Zn-N/C, ZnFe-N/C-1, ZnFe-N/C-2, ZnFe-N/C-3, ZnFe-N/C-4.

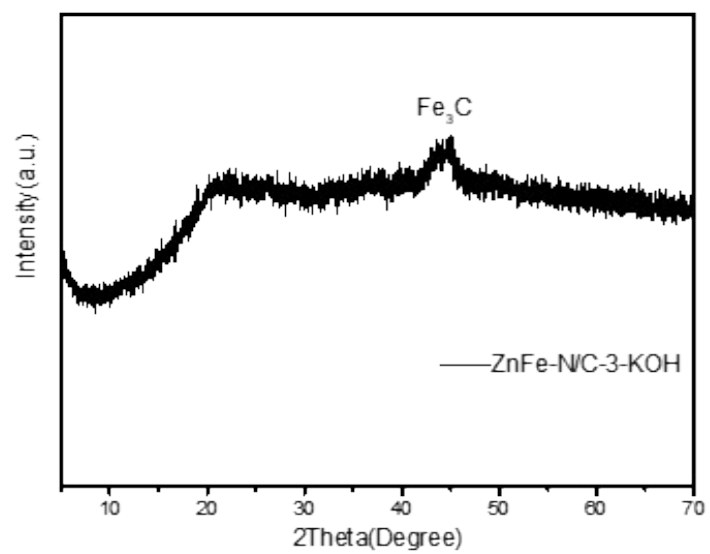


Figure S7. XRD pattern of ZnFe-N/C-3-KOH sample.

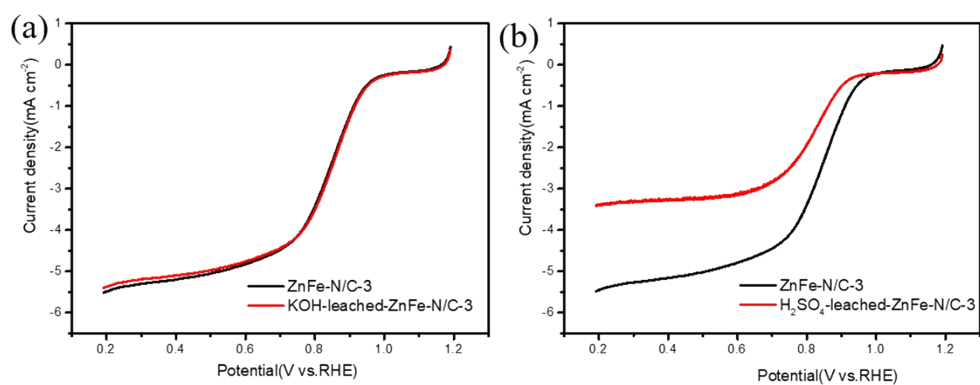


Figure S8. ORR polarization curves of as-prepared and KOH-leached (a), H₂SO₄-leached (b) ZnFe-N/C-3 measured in 0.1M KOH.

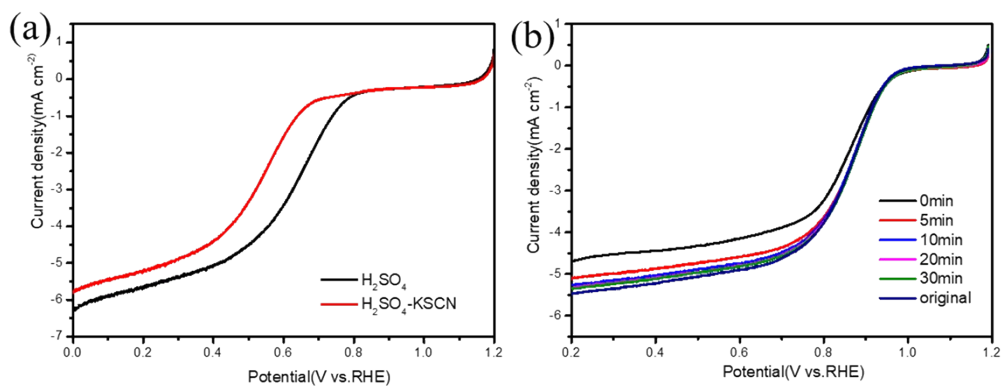


Figure S9. (a) ORR polarization curves of ZnFe-N/C-3 catalyst in O_2 -saturated 0.5M H_2SO_4 with or without 0.01M KSCN. (b) Time-dependent ORR polarization curves of SCN^- poisoned ZnFe-N/C-3 measured in 0.1M KOH.

Table S1. Elemental analysis (wt%) dates of ZnFe-ZIF-8-3 and ZnFe-N/C-3 obtained from ICP.

Element	ICP(wt %)	
	ZnFe-ZIF-8-3	ZnFe-N/C-3
Fe	2.6	19.2
Zn	12.6	6.4

Table S2. Properties of samples obtained from N₂ sorption measurements.

Sample	S _{BET} (m ² /g)	S _{micro} (m ² /g)	S _{external} (m ² /g)	Volume(cm ³ /g)
ZIF-8	2036	1987	48	0.9
ZnFe-ZIF-8-3	853	784	68	0.6
Zn-N/C	52	0	52	0.16
ZnFe-N/C-3	176	0.87	175	1