Supplementary Materials

$Fe_3O_4/Fe_2O_3/Fe$ nanoparticles anchored on N-doped hierarchically porous carbon nanospheres as high-efficiency ORR electrocatalysts for rechargeable Zn-air batteries

*Yali Wang [a], Ruihui Gan[a], Hao Liu [a], Mahmut Dirican [b], Chengbiao Wei [a], Chang Ma [a, b, *], Jingli Shi [a,*] , Xiangwu Zhang [b]*

[a] Tianjin Municipal Key Lab of Advanced Fiber and Energy Storage Technology, Tiangong University, Tianjin 300387, P. R. China.

[b] Fiber and Polymer Science Program, Department of Textile Engineering, Chemistry and Science, Wilson College of Textiles, North Carolina State University, Raleigh, North Carolina 27695-8301, United States

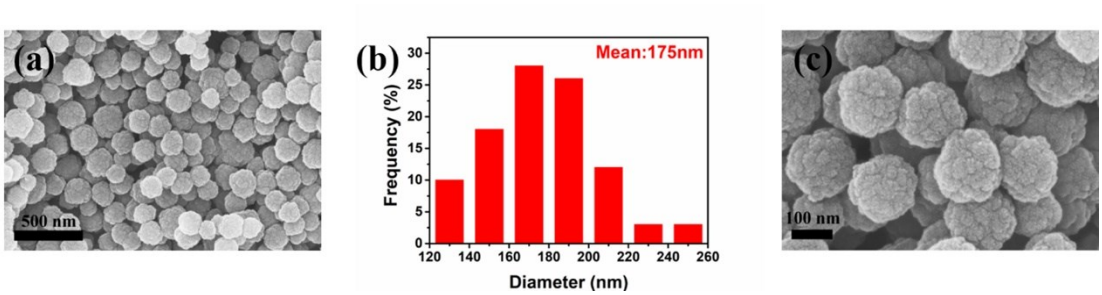

Figure S1. SEM images of the Fe-CNSs-C sample.

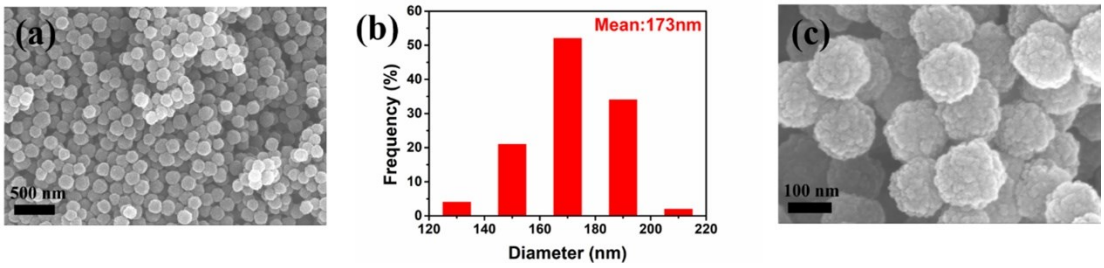

Figure S2. SEM images of CNSs-N sample.

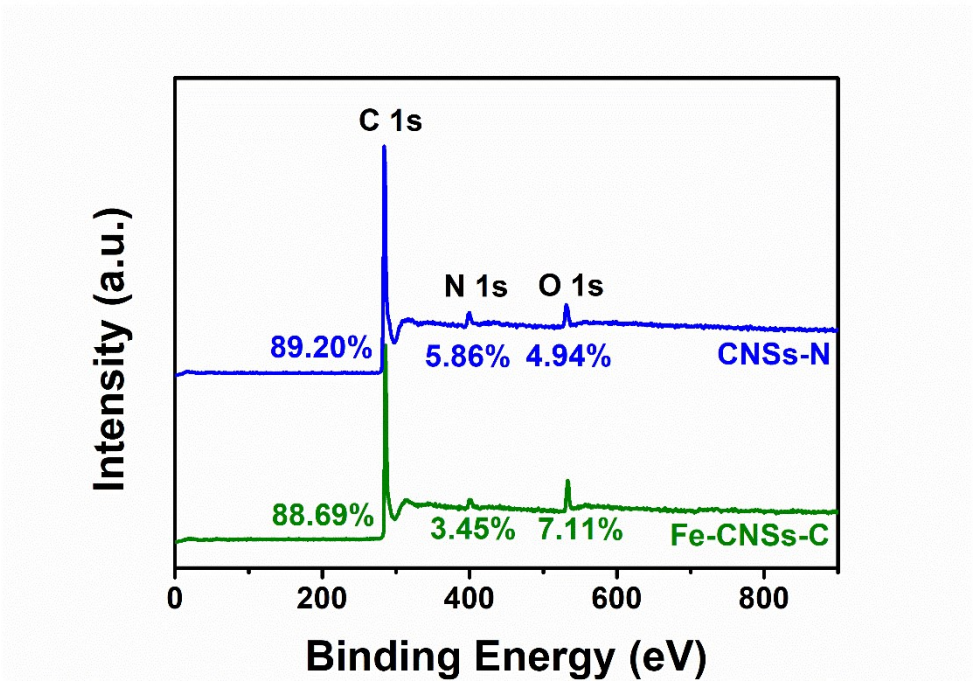

Figure S3. Survey spectra of CNSs-N and Fe-CNSs-C.

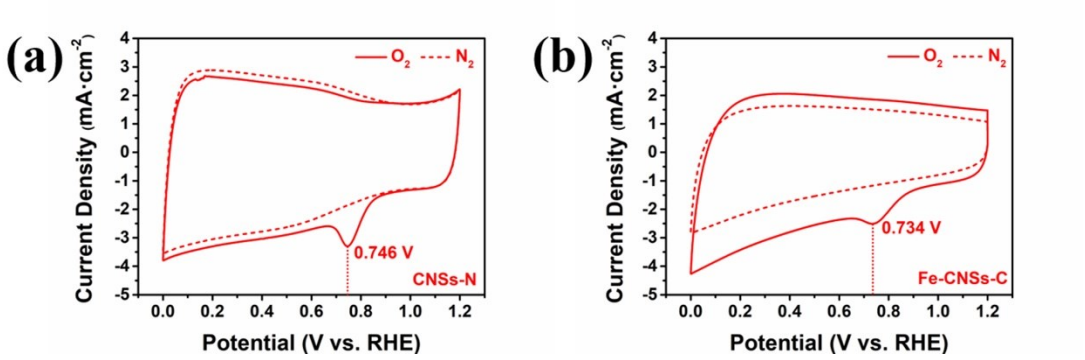

Figure S4. CVs of CNSs-N and Fe-CNSs-C.

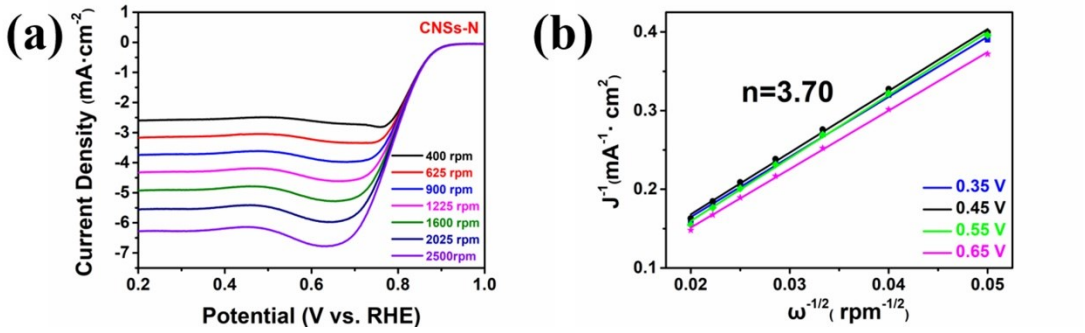

Figure S5. (a) LSV curves of CNSs-N at a scan rate of 10 mV·s^{-1} and various rotating rates from 400 to 2500 rpm. (b) K-L plots of CNSs-N derived from LSV curves at various potentials.

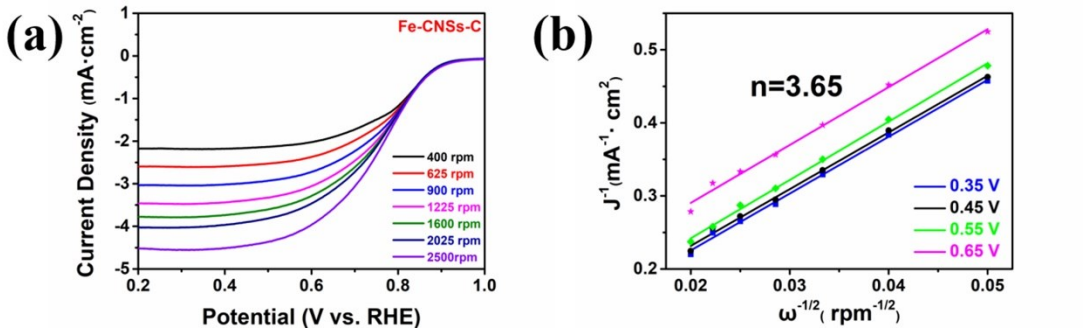

Figure S6. (a) LSV curves of Fe-CNSs-C at a scan rate of 10 mV·s^{-1} and various rotating rates from 400 to 2500 rpm. (b) K-L plots of Fe-CNSs-C derived from LSV curves at various potentials.

Table S1. The electrocatalytic performances of Fe-CNSs-N, Fe-CNSs-C, CNSs-N and Pt/C for oxygen reduction reaction in alkaline electrolytes.

Catalyst	E_{onset} (V vs RHE)	$E_{1/2}$ (V vs RHE)	J_K (mA·cm^{-2})
Pt/C	0.947	0.828	5.52
Fe-CNSs-N	0.948	0.835	5.17
Fe-CNSs-C	0.937	0.765	3.81
CNSs-N	0.910	0.809	4.79

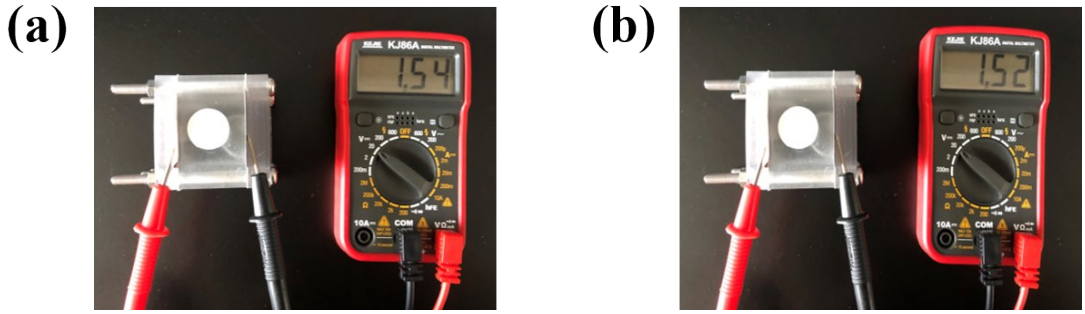

Figure S7. The photographs of the open-circuit voltage of the Zn-air batteries using Fe-CNSs-N (a) and commercial Pt/C (b) as air electrodes measured by multimeter.