Electronic Supplementary Material (ESI) for Sustainable Energy & Fuels.

FeS encapsulated hierarchical porous S, N-dual-doped carbon for oxygen reduction reaction facilitation in Zn-air battery

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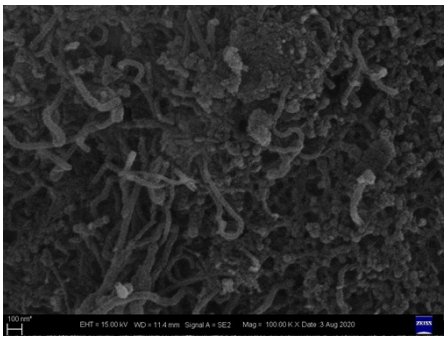

Fig. S1 The SEM image of Fe NPs/SNC.

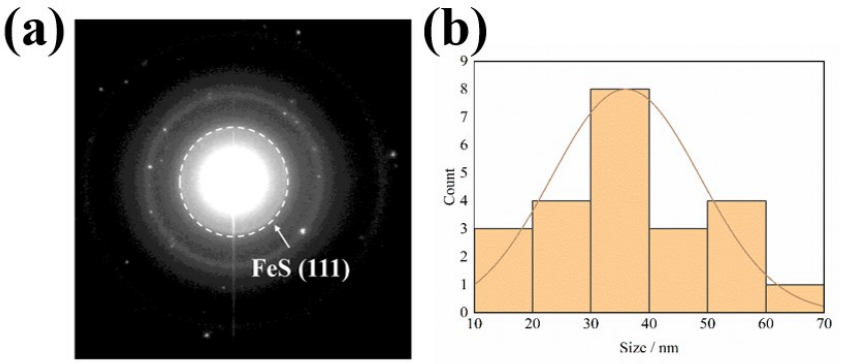

Fig. S2 (a) The SAED pattern of Fe-S, N-C-950. (b) the size distribution of FeS nanoparticles.

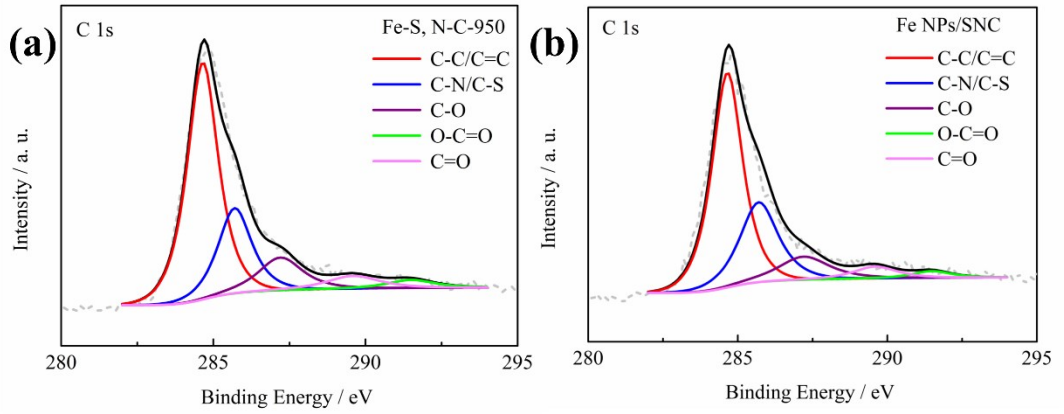

Fig. S3 (a) High resolution spectra of C 1s of Fe-S, N-C-950. (b) High resolution spectra of C 1s of Fe NPs/SNC.

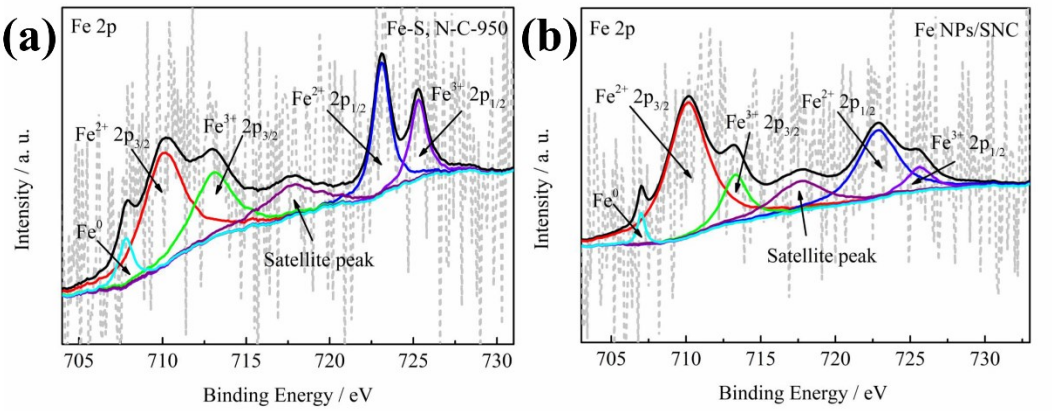

Fig. S4 (a) High resolution spectra of Fe 2p of Fe-S, N-C-950. (b) High resolution spectra of Fe 2p of Fe NPs/SNC.

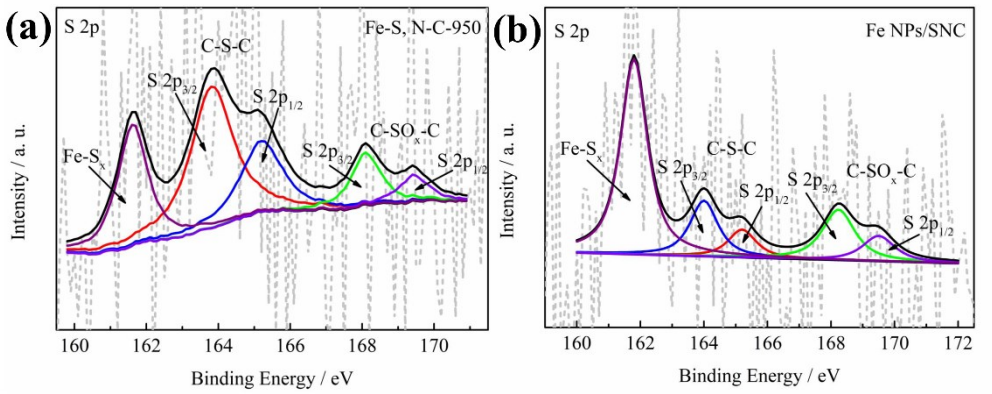

Fig. S5 (a) High resolution spectra of S 2p of Fe-S, N-C-950. (b) High resolution spectra of S 2p of Fe NPs/SNC.

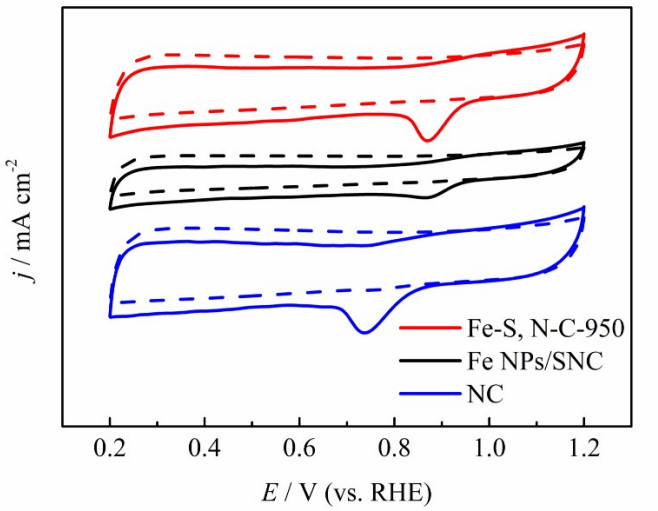

Fig. S6 Cyclic voltammograms (CV) of the prepared catalysts at a scan rate of 50 mv s^{-1} in 0.1 M KOH.

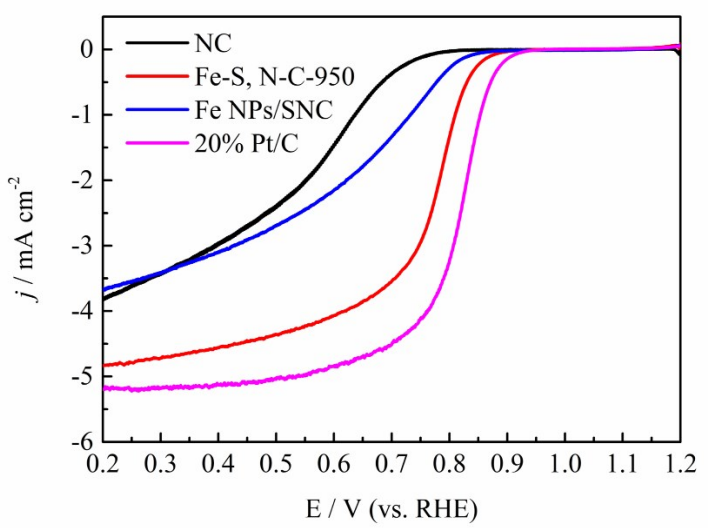

Fig. S7 ORR polarization LSV curves of NC, Fe-S, N-C-950, Fe NPs/SNC and 20% Pt/C in 0.1 M $HClO_4$; rotation rate of 1600 rpm, scan rate of 10 mVs^{-1}.

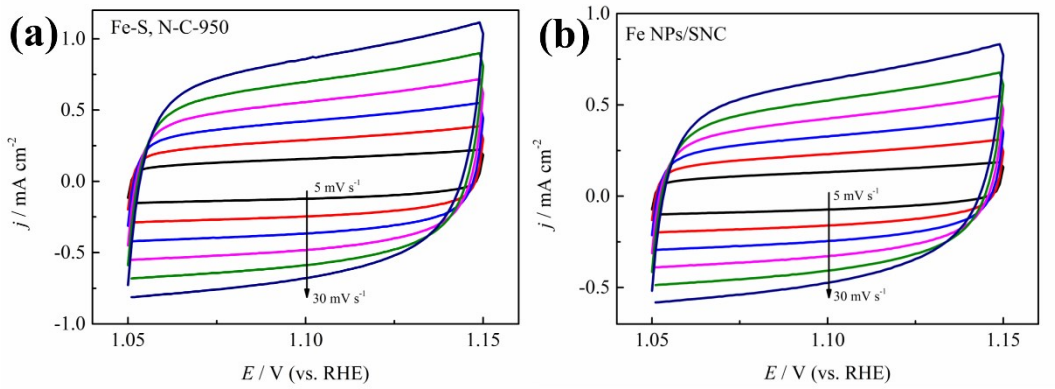

Fig. S8 CV curves for (a) Fe-S, N-C-950 and (b) Fe NPs/SNC at various scan rates.

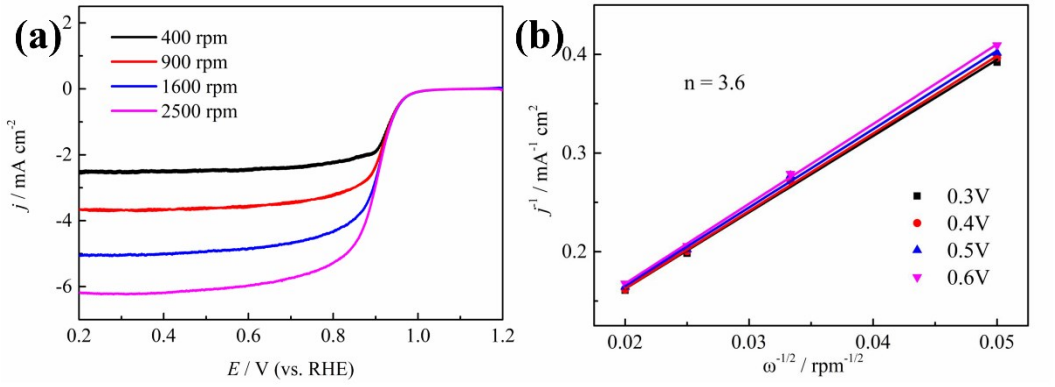

Fig. S9 (a) LSV curves of Fe-S, N-C-950 for rotation speeds from 400 to 2500 rpm. (b) Fitted K–L plots at different potentials.

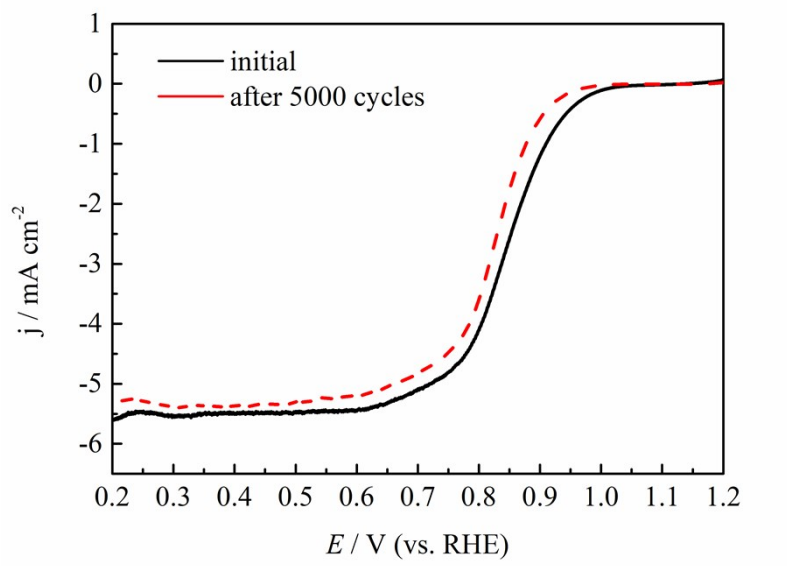

Fig. S10 ORR polarization curves of Pt/C before and after 5000 cycles in 0.1 M KOH.

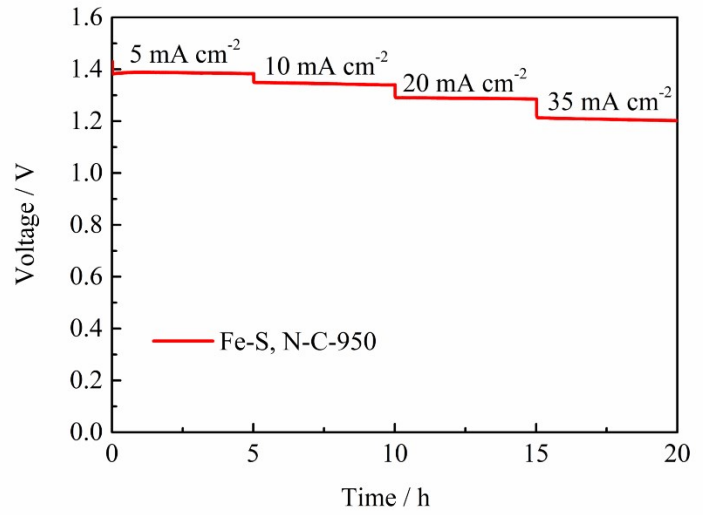

Fig. S11. Discharge curves of primary Zn–air batteries using Fe-S, N-C-950 as ORR catalyst.

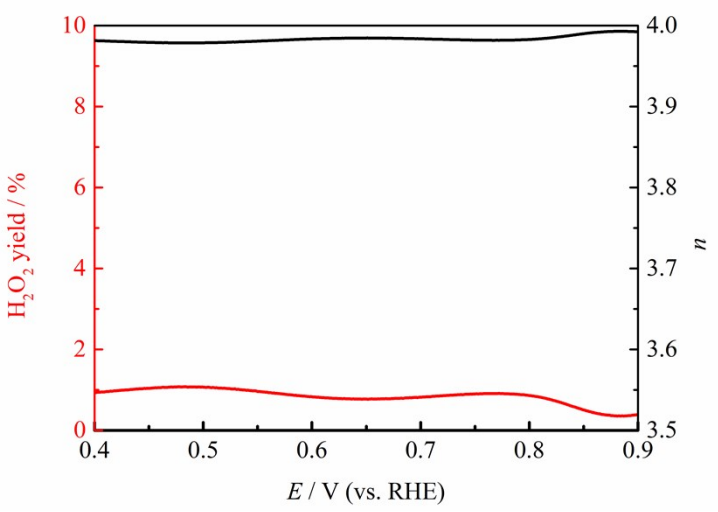

Fig. S12 H_2O_2 yield and electron transfer number (n) for 20% Pt/C.

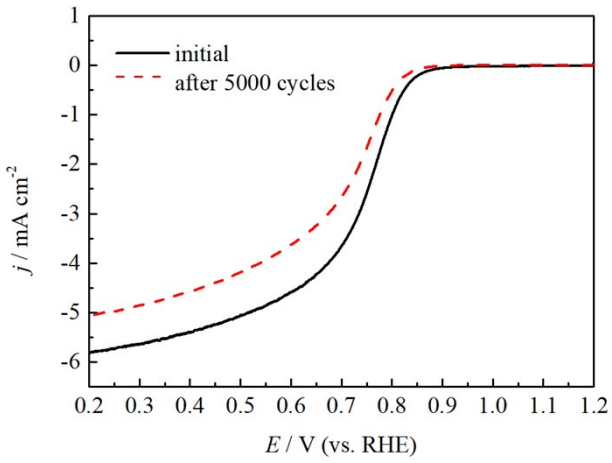

Fig. S13 ORR polarization curves of Fe-S, N-C-950 before and after 5000 cycles in 0.1 M $HClO_4$.

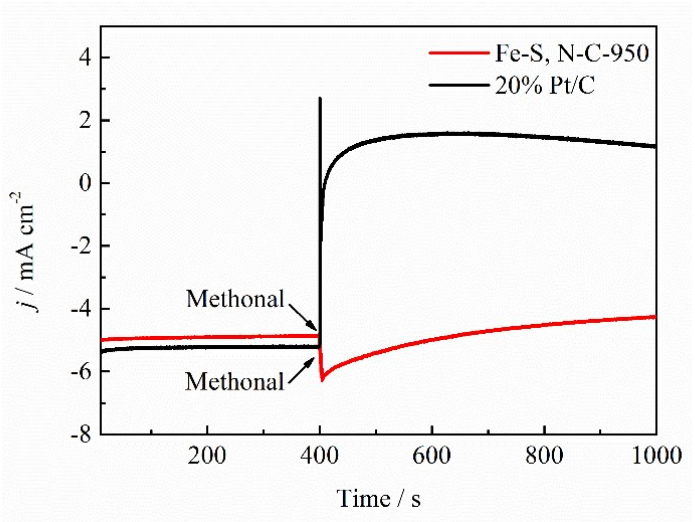

Fig. S14 Methanol tolerance tests for Fe-S, N-C-950 and 20% Pt/C in 0.1 M KOH at 0.7 V.

Table S1 Elemental composition of Fe-S, N-C-950 and Fe NPs/SNC calculated from XPS.

Atomic %	Fe-S, N-C-950	Fe NPs/SNC
C	92.75	90.01
N	3.32	4.37
O	3.19	3.94
S	0.19	0.57
Fe	0.55	1.11

Table S2 The Comparison of ORR performance of non-precious M−N/C catalysts from the recent literature and this work

Catalysts	**Electrolyte**	**Half-wave potential (V vs. RHE)**	**Reference**
Fe-S, N-C-950	0.1 M KOH	0.9	**This work**
Fe-N/C-155	0.1 M KOH	0.85	*J. Mater. Chem. A*, 2019, 7,16508.
Fe-N_x-C	0.1 M KOH	0.91	*Adv. Funct. Mater.*, 2019, 29, 1808872.
C-FeZIF-8@g-C_3N_4	0.1 M KOH	0.845	*Chem. Eng. J.*, 2020, 390, 124479.
Fe-N-C/N-OMC	0.1 M KOH	0.93	*Appl. Catal. B Environ*., 2021, 280, 119411.
Fe-N-C HNSs	0.1 M KOH	0.87	*Adv. Mater*, 2018, 31, 1806312.
Fe-SAC/NC	0.1 M KOH	0.84	*Nano Energy*, 2020, 72, 104670.
Cu SAC	0.1 M KOH	0.81	*J. Mater. Chem. A*, 2019, 7, 16690.
f-Mn-NC/CNT	0.1 M KOH	0.83	*Nanoscale*, 2019, 11, 15900.
Co@hNCTs-800	0.1 M KOH	0.887	*Nano Energy*, 2020, 71, 104592.
Fe-N-S CNN	0.1 M KOH	0.91	*Appl. Catal. B Environ*, 2019, 250, 143.
Fe-SAs/NSC	0.1 M KOH	0.87	*J. Am. Chem.*

			Soc., 2019, 141, 20118.
Fe-NSDC	0.1 M KOH	0.84	*Small*, 2019, 15, 1900307.
Fe-S, N-C	0.1 M KOH	0.83	*Electrocatalysis*, 2019, 10, 72.