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Supporting Information

Boosting the primary Zn-air battery oxygen reduction performance with mesopore-dominated semi-tubular doped-carbon nanostructures

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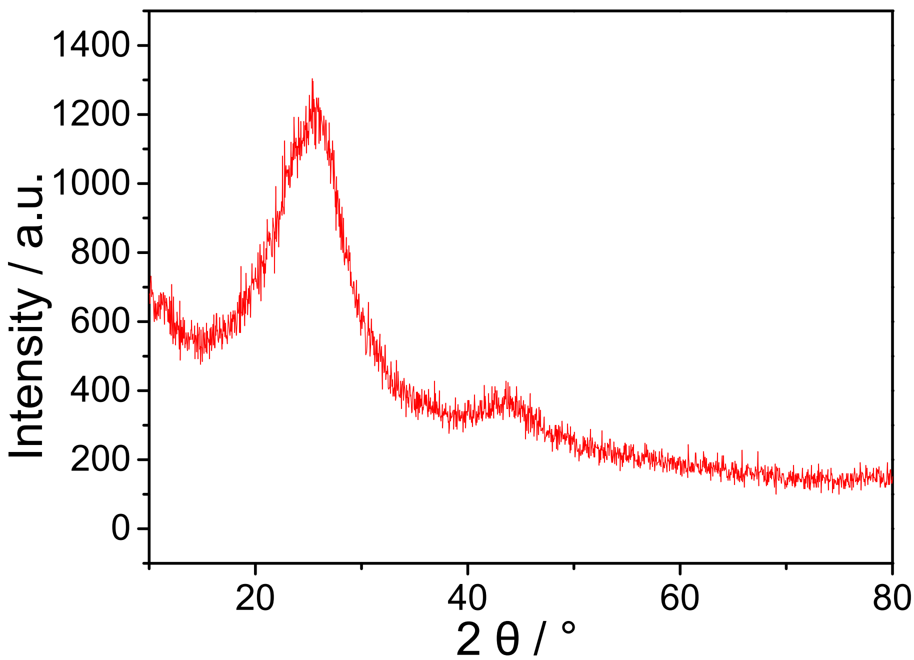

Fig. 1S. XRD image of Hemin@HN-800Zn.

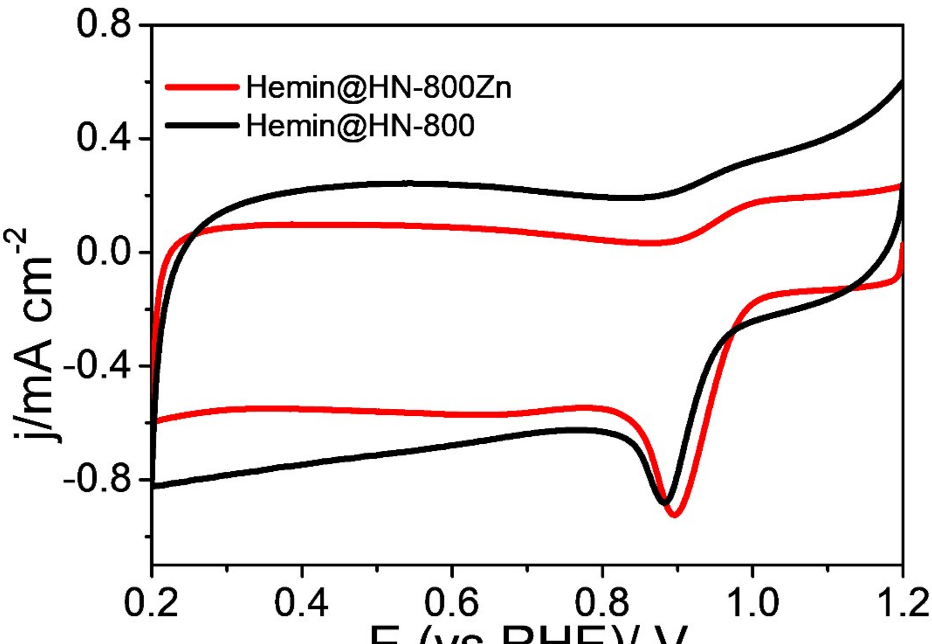

Fig. 2S. CV curves of Hemin@HN-800 and Hemin@HN-800Zn.

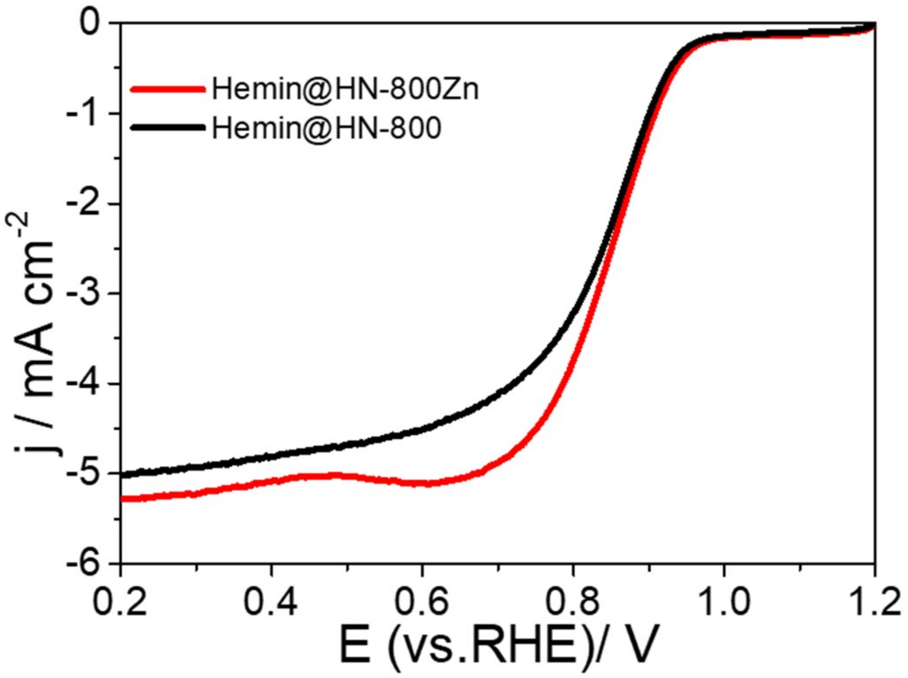

Fig. 3S. LSV curves of Hemin@HN-800 and Hemin@HN-800Zn.

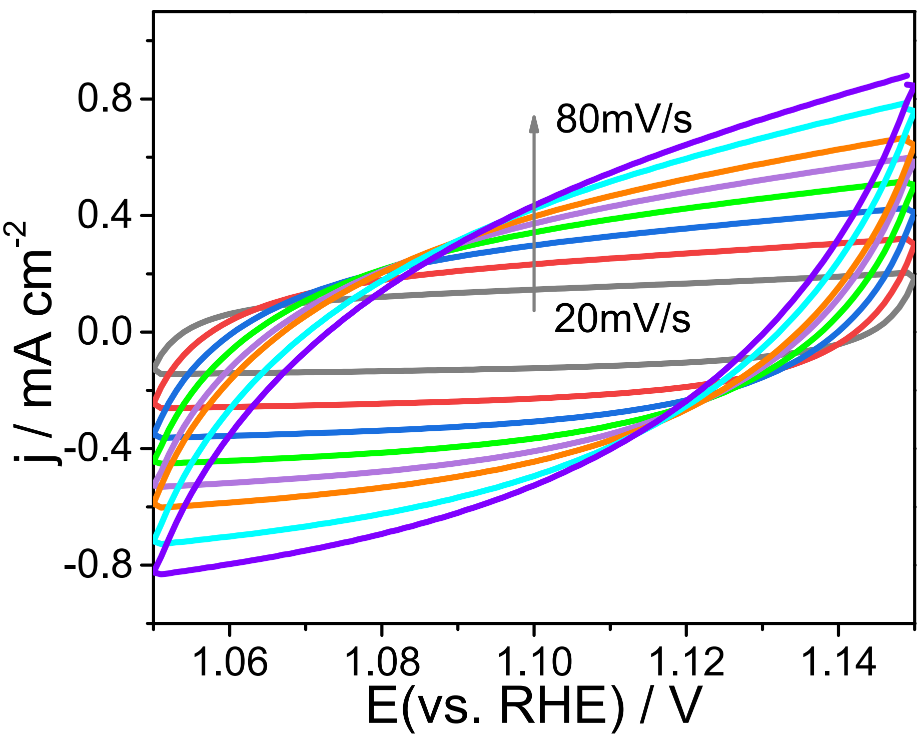

Fig. 4S. CV curves of Hemin@HN-700Zn tested at different scan rates.

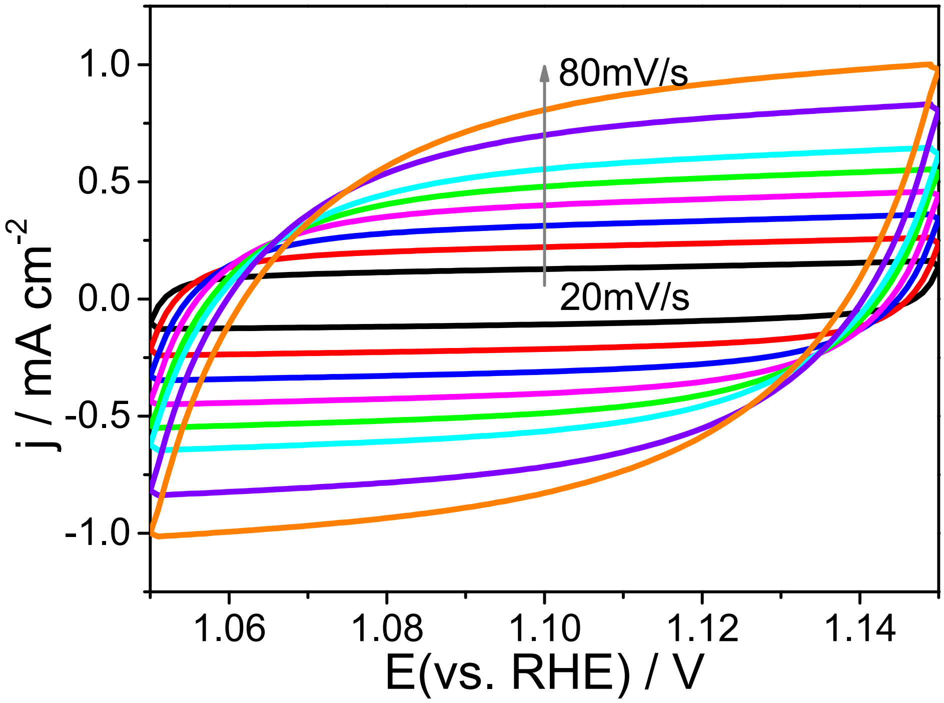

Fig. 5S. CV curves of Hemin@HN-900Zn tested at different scan rates.

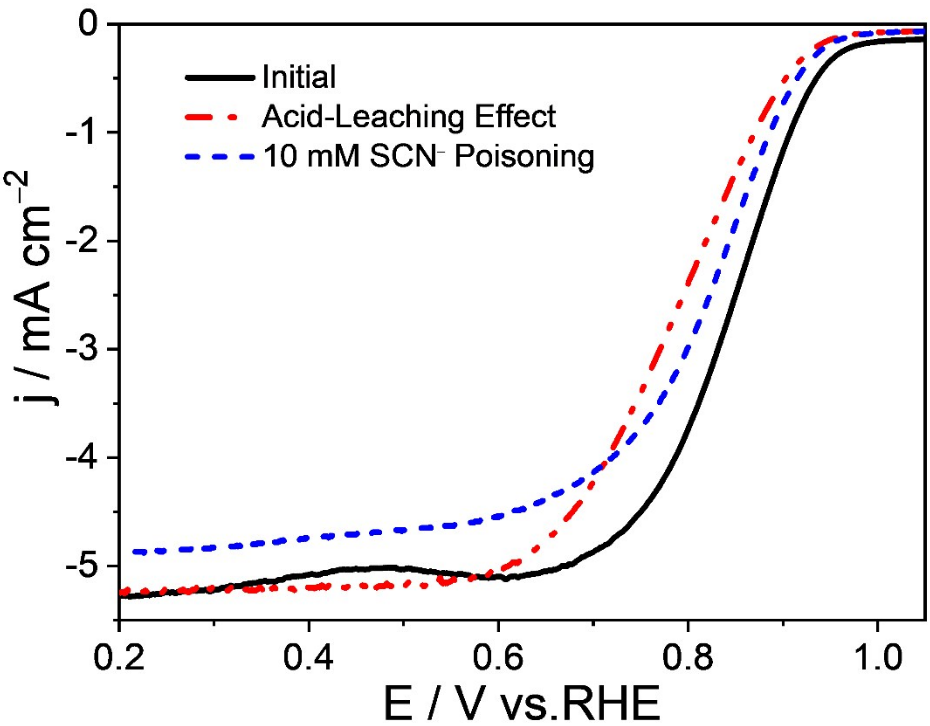

Fig. 6S. The LSV curves of Hemin@HN-800Zn catalyst in O_2-saturated KOH *versus* O_2-saturated KOH containing 10 mM SCN^-.

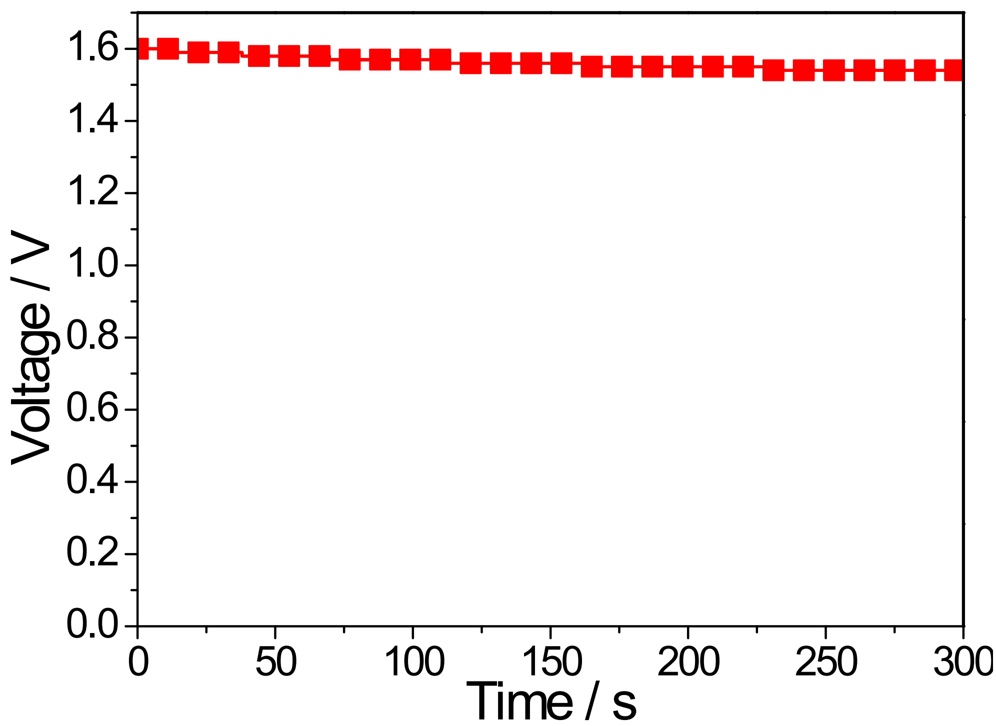

Fig. 7S. The open-circuit voltage of Zn-air battery using Hemin@HN-800Zn catalyst as a cathode.

Table 1S. Surface contents of C, N and O, fitted data of various nitrogen species, and corresponding ORR catalysis data in prepared carbon-based catalysts; Data derive from Fig. 4, Fig. 5 and Fig. 6.

Sample	C1s at. %	N1s at. %	O1s at. %	Pyridinic N %	Fe-N %	Graphitic N %	Pyridinic N^{+}-O^{-} %	E_p / V	E_{ORR} / V	$E_{1/2}$ / V	J @0.3V mA cm^{-2}	Average H_2O_2%	Average *n*
Hemin@HN-700Zn	82.12	7.98	9.9	17.2	23.6	35.1	24.1	0.86	0.92	0.78	4.44	6.20	3.88
Hemin@HN-800Zn	74.99	6.53	18.47	19.7	24.2	33.0	23.1	0.90	1.01	0.85	5.22	3.67	3.93
Hemin@HN-900Zn	90.79	2.44	6.77	8.1	25.1	40.2	26.6	0.84	0.89	0.76	4.11	6.34	3.87
Pt-C catalyst	---	---	---	---	---	---	---	0.90	1.04	0.85	5.16	4.4	3.91

Table 2S. Comparison of catalytic activity data of different catalysts.

Sample	E_{ORR} / V vs. RHE	$E_{1/2}$ / V vs. RHE	j_d / mA cm^{-2}	Reference
Fe-NC	0.96	0.87	5.82	Carbon 146 (2019) 671-679
HNCSs	0.92	0.82	5.48	Carbon 146 (2019) 248-256
DAC-N800	0.89	0.79	6.17	Carbon 146 (2019) 411-418
Fe-NHPC-8	0.99	0.85	5.40	Journal of Power Sources 448 (2020) 227443
FeNC-950	0.94	0.84	5.85	Journal of Power Sources 450 (2020) 227659
Co-NCF	0.91	0.83	5.74	Journal of Power Sources 450 (2020) 227577
Ni-GT-750-A	0.91	0.77	4.16	Journal of Colloid and Interface Science 571 (2020) 285-296
Co-N_x@CNF700	0.94	0.81	5.50	Nature communications, 2015, 6, 7343
CoFe/SN-C-25	0.91	0.84	6.96	Applied Catalysis B: Environmental 269 (2020) 118771
NMC-1	0.92	0.82	4.50	Nano Energy 62 (2019) 628-637
Hemin@HN-800Zn	1.01	0.85	5.22	This work