Supplementary Materials

Zinc-Mediated Template Synthesis of Hierarchical Porous N-Doped Carbon Electrocatalysts for Efficient Oxygen Reduction

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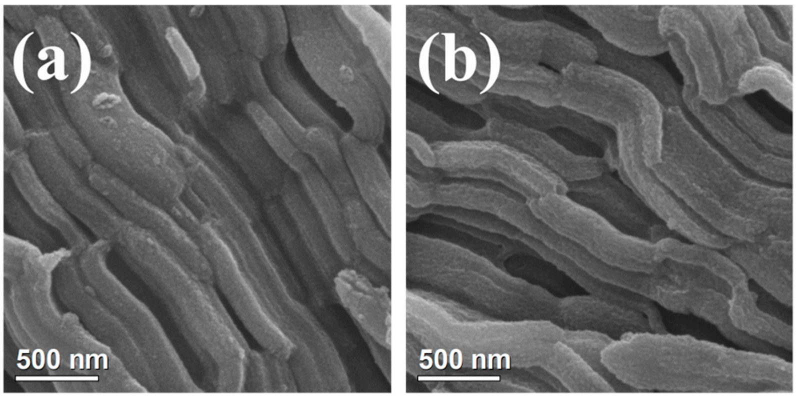


Figure S1 SEM images: (a) NC-0.4-S; (b) NC-0.6-S

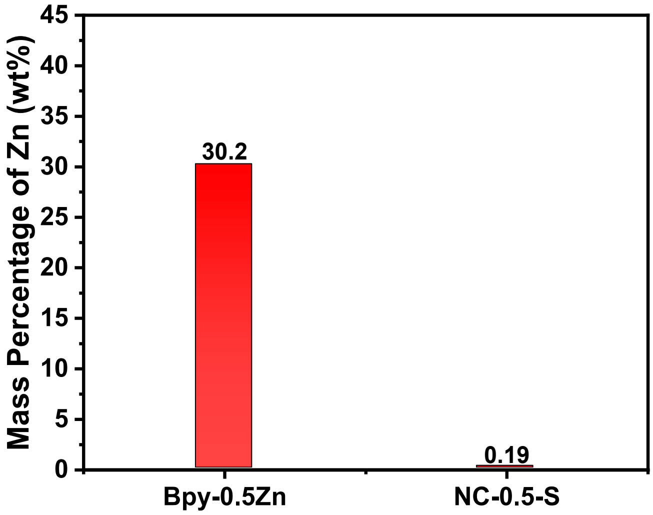


Figure S2 ICP-AES results for Bpy-0.5Zn and NC-0.5-S

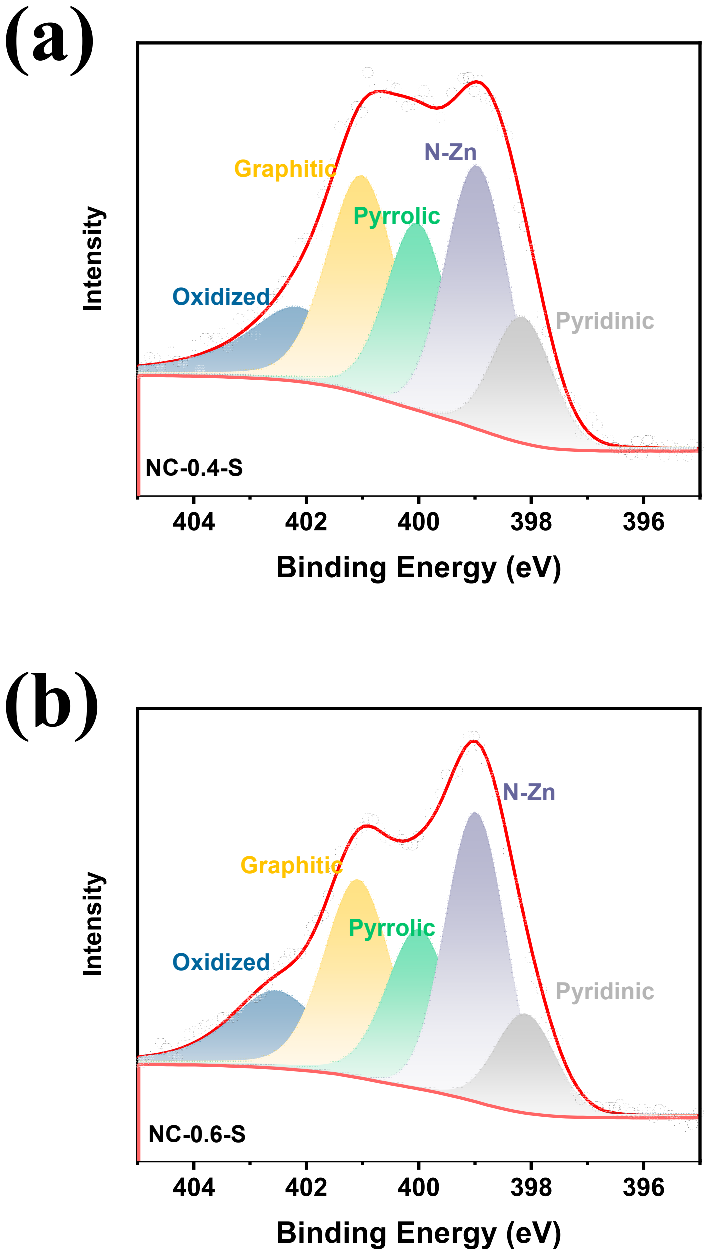
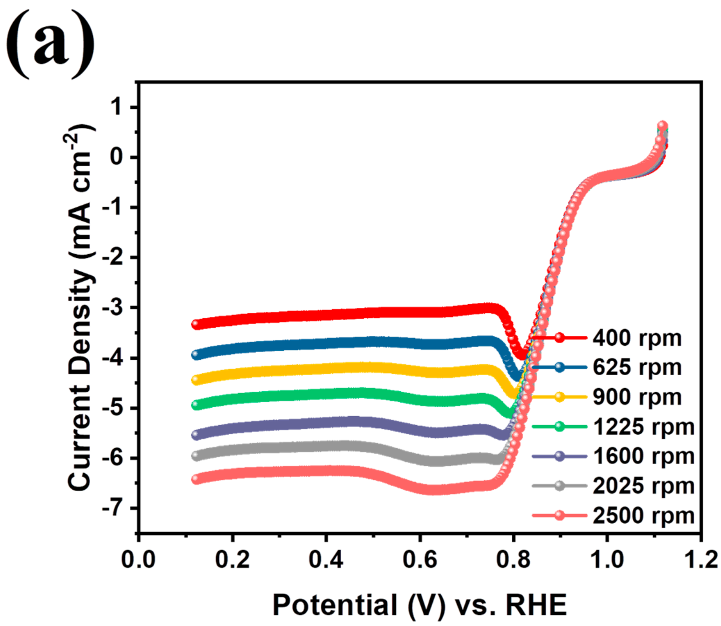


Figure S3 N1s spectra: (a) NC-0.4-S; (b) NC-0.6-S



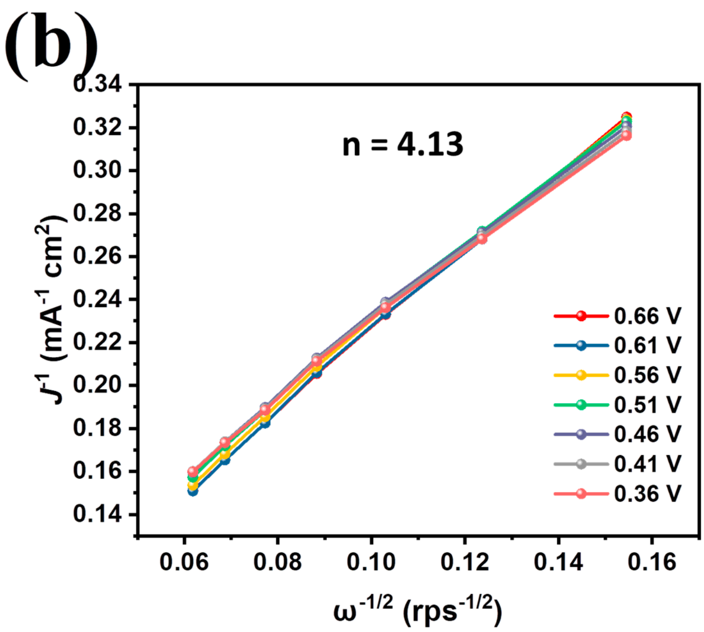


Figure S4 (a) LSV curves under different rotating rates of NC-0.5-S; (b) Koutecky-Levich (K-L) plots and calculated electron transfer number (n).

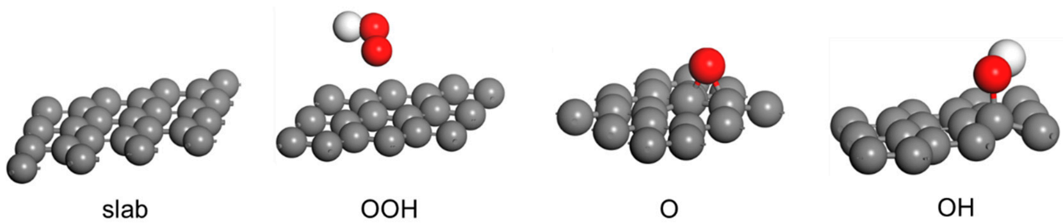


Figure S5 Optimized structures of C1 and the intermediate species adsorbed on it.

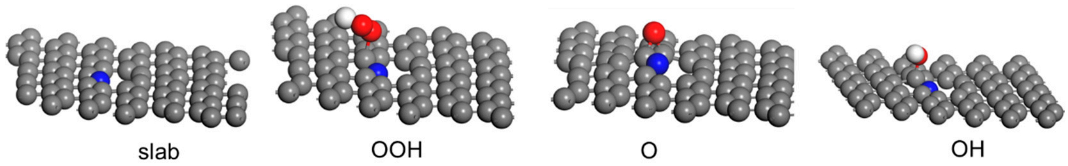


Figure S6 Optimized structures of C2 and the intermediate species adsorbed on it.

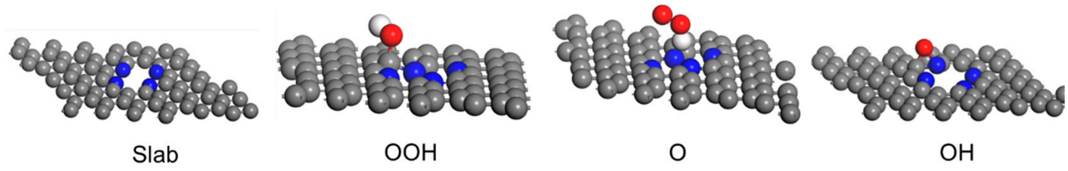


Figure S7 Optimized structures of C3 and the intermediate species adsorbed on it.

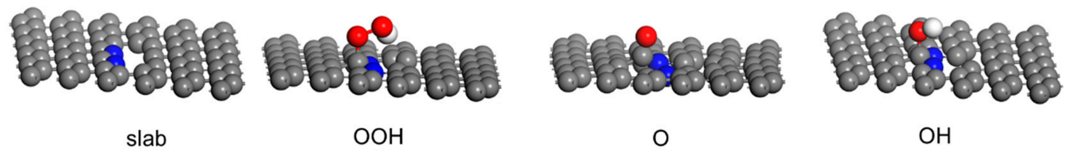


Figure S8 Optimized structures of C4 and the intermediate species adsorbed on it.

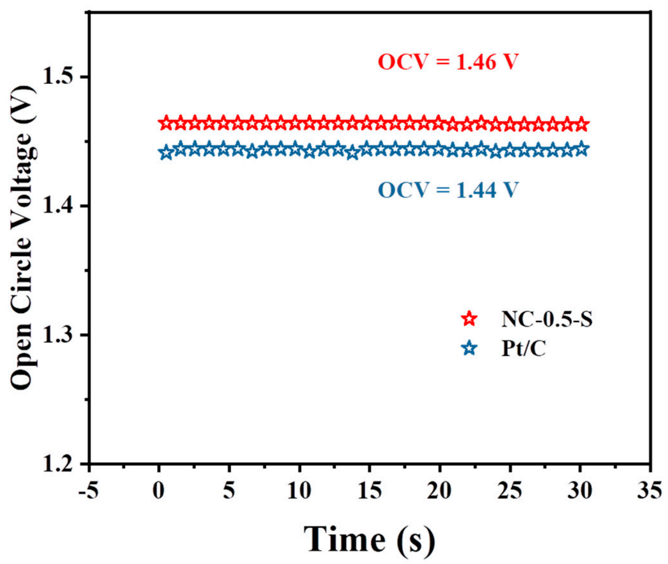


Figure S9 The open circle potentials for the ZABs using NC-0.5-S and Pt/C

Table S1 surface atomic compositions of various catalysts derived from the XPS results

	Bpy	**Bpy-0.5Zn**	**NC-0.5**	**NC-0-S**	**NC-0.4-S**	**NC-0.5-S**	**NC-0.6-S**
C1s	78.77	57.64	89.98	85.02	88.61	89.32	87.21
N1s	8.42	9.59	6.17	4.82	6.62	7.14	7.95
O1s	12.81	27.98	3.48	10.16	4.6	3.42	4.73
Zn2p	-	4.79	0.37	-	0.16	0.12	0.11

Table S2 The adsorption energies of intermediate species of ORR on different C sites.

	C1	**C2**	**C3**	**C4**
ΔG_{*OOH} / eV	5.31	4.78	4.69	1.0
ΔG_{*O} / eV	3.51	3.38	3.66	-2.51
ΔG_{*OH} / eV	3.07	2.81	2.57	-1.97

Table S3 comparison of NC-0.5-S and other catalysts for the zinc-air battery recently reported

No.	Catalyst	Half-wave potential (V vs. RHE)	Peak power density ($mW\ cm^{-2}$)	Specific capacity ($mAhg_{Zn}^{-1}$)	Reference
1	CoSA/N,S-HCS	0.85	1.5	173.1	[1]
2	FeCoMoS@NG	0.83	1.44	118	[2]
3	CuSA@HNCNx	0.91	1.51	212	[3]
4	CS-NFO@PNC-700	0.85	1.45	130	[4]
5	LDH-POF	0.8		185	[5]
6	VO-CMON@NCN	0.857	1.404	143.7	[6]
7	S-CFZ	0.82		178	[7]
8	CMO–U@CC	0.81	1.42	135	[8]
9	Vo-CoFe/CoFe2O4@NC	0.858	1.53	139.5	[9]
10	Co/ZnCo2O4@NC-CNT	0.9	1.47	305	[10]
11	NiFe/bNCNT	0.8	1.52	224	[11]
12	Co/CoS/Fe-HSNC	0.9		213	[12]
13	CoDNG900	0.864	1.45	205	[13]
14	FeNi–SAs@NC	0.907	1.54	260	[14]
15	Co3O4/Co@NCs	0.92	1.5	123.4	[15]
16	CoFe–Co@PNC	0.887	1.46	152.8	[16]
17	Co/N@CNTs@CNMF	0.86	1.52	133	[17]
18	Fe,Mn/N–C	0.928	1.4	160.8	[18]
19	FeNi/N-CPCF-950	0.89	1.478	160.6	[19]
20	BFC-FC-0.2	0.9	1.49	160	[20]
21	CoNi/Co–N@HNC	0.86	1.43	179.1	[21]
22	CoFe/Co@NCNT/NG	0.876	1.4	161	[22]
23	FeNiN-MWCNT	0.87	1.45	84.5	[23]
	NC-0.5-S	0.89	1.46	196.3	**Our work**

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