Supplementary Information

Construction of three dimensional S, N co-doped ZIF-67 derivative assisted by PEDOT nanowires and its application in rechargeable Zn-air batteries

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Supplementary Figures

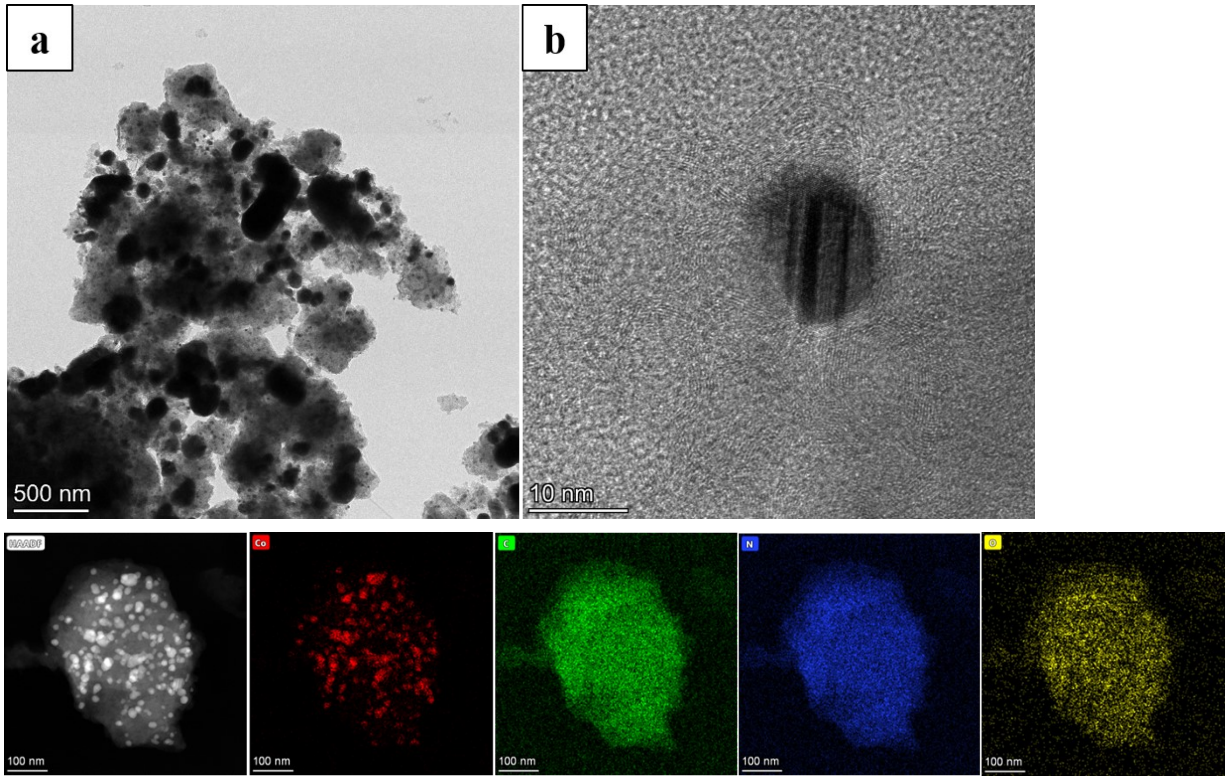

Fig. S1. TEM images (a, b) and elemental color mapping of the Co/C@N sample.

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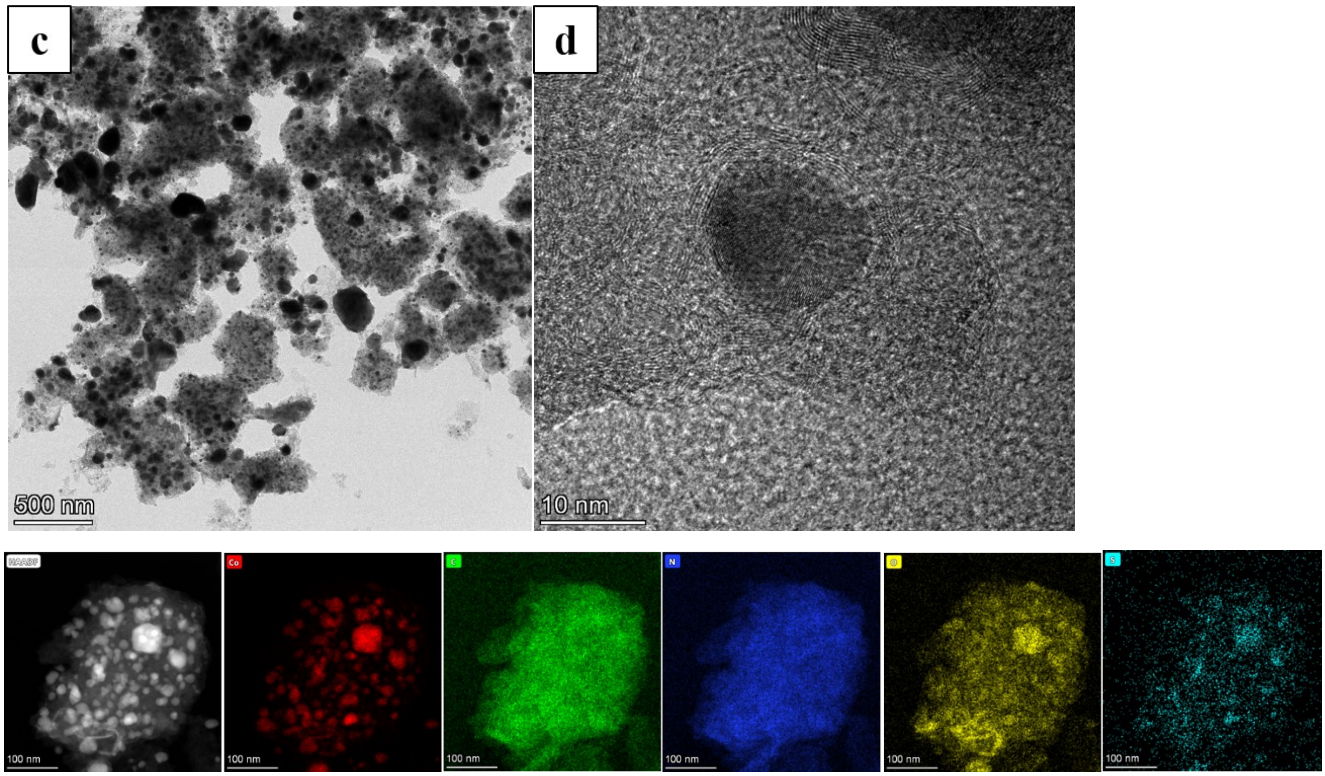

Fig. S2. TEM images (c, d) and elemental color mapping of the Co/C@NS sample.

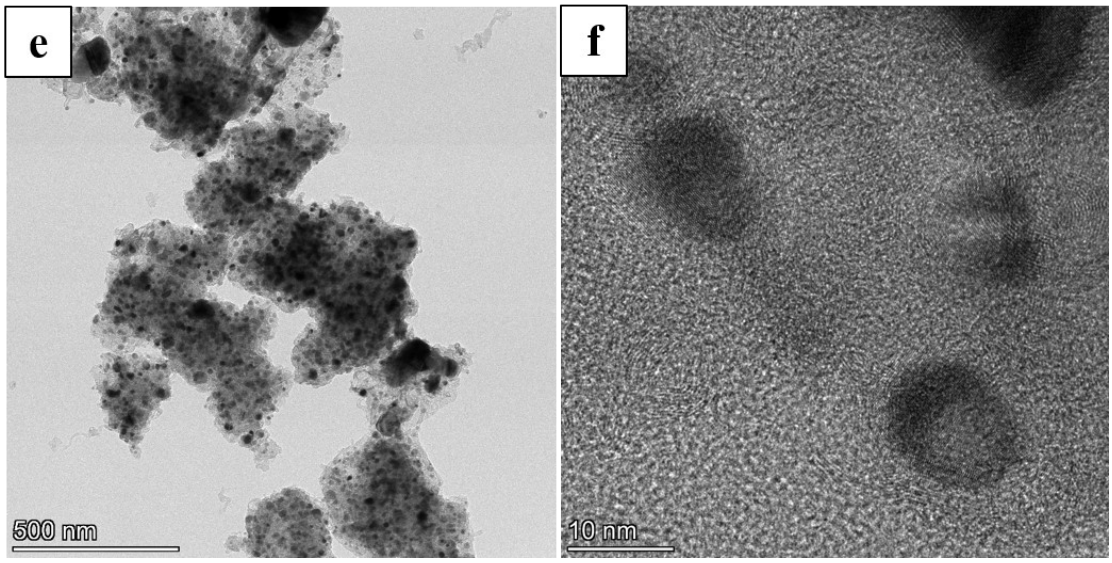

Fig. S3.TEM images for Co/C@NS NWs (e, f) catalysts.

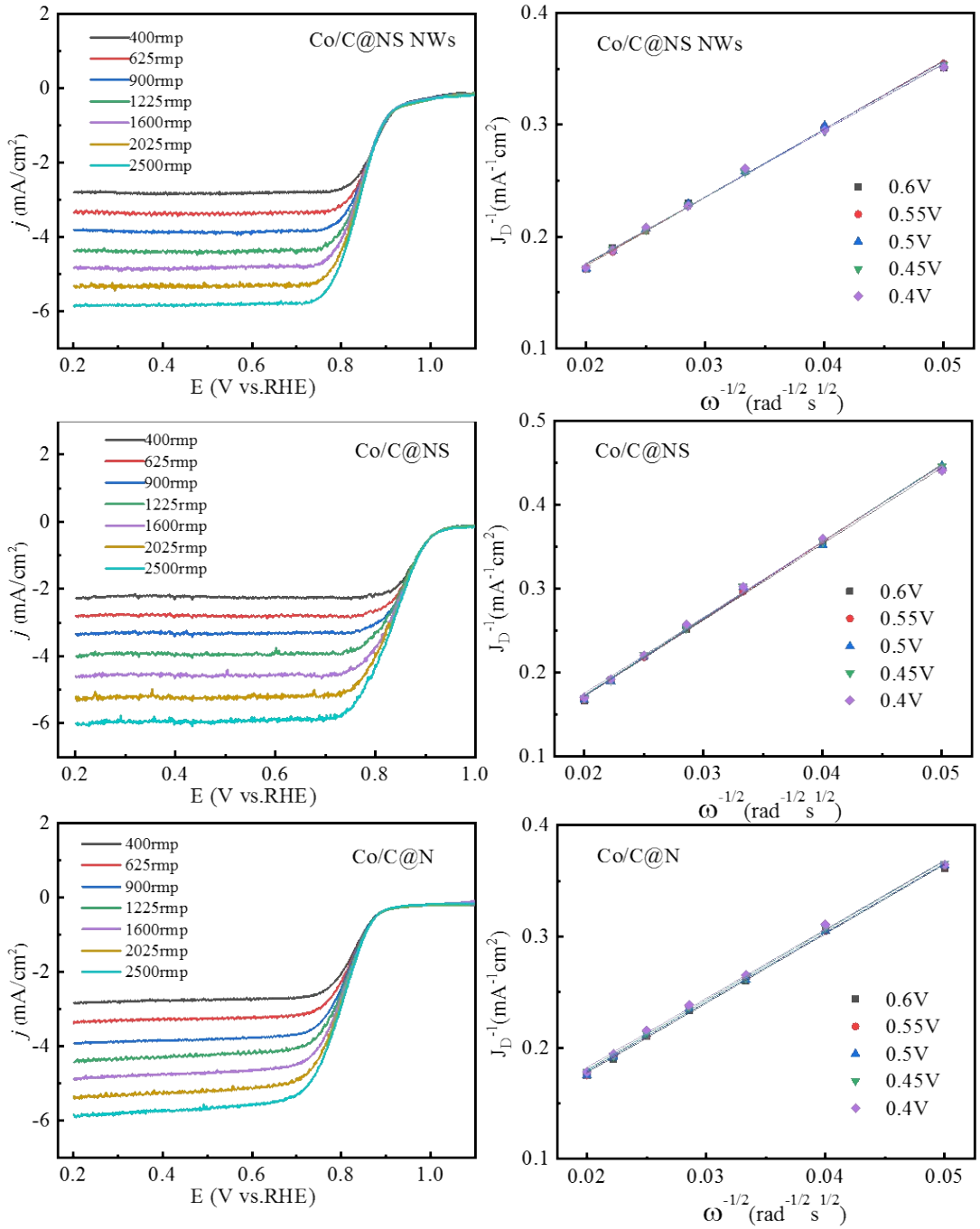

Fig. S4. RRDE curves of various catalysts at different rotation rates from 400 to 2500 rpm and the corresponding Koutecky-Levich (K-L) plots (j^{-1} vs. $\omega^{-1/2}$) of various catalysts between 0.40 V and 0.60 V.

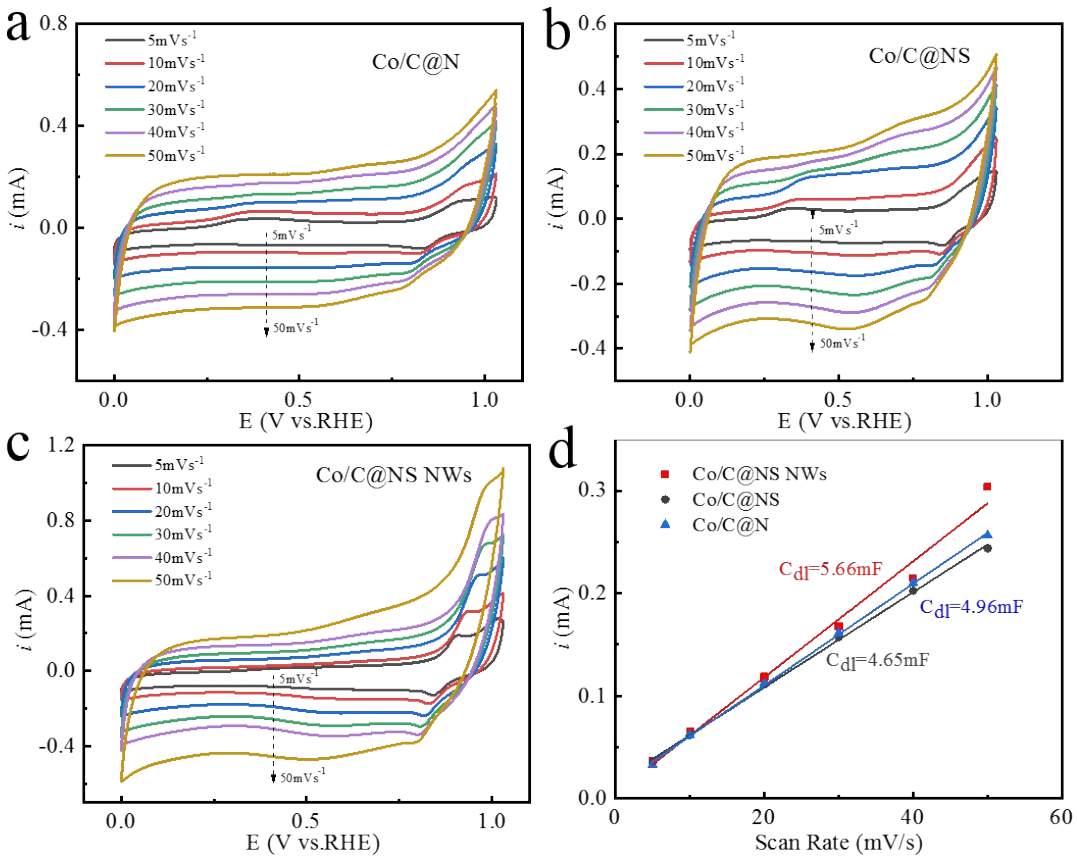

Fig. S5. (a -c) CV graphs of various catalysts measured at different scan rate from 5 to 50 mV s^{-1}. (d) Plots of the current versus the scan rate for Co/ C@N, Co/ C@NS and Co/ C@NS NWs.

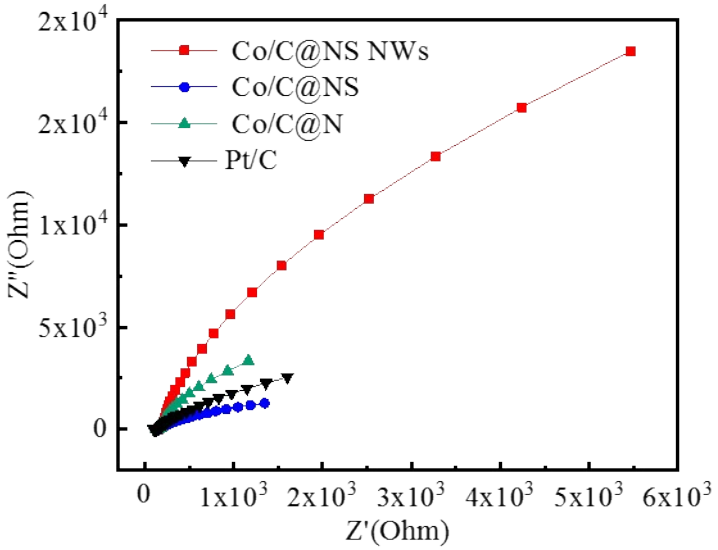

Fig. S6. EIS of various catalysts measured.

Supplementary table

Table S1. Comparison of the ORR/OER catalytic performances of Co/C@NS NWs with those of other reported works about ZIF-derived catalysts.

Sample	ORR				0ER	Ref.
	E_{onset} *vs.* RHE (V)	$E_{1/2}$ *vs.* RHE (V)	J_L (mA cm^{-2})	electron transfer number (n)	E (V) (J=10mA cm^{-2})	
Co/ C@NS NWs	**0.88**	**0.80**	**-4.8**	**3.86~3.94**	**1.4**	**this work**
Co/ C@NS	0.87	0.81	-4.5	3.92-3.99	1.44	this work
Co/ C@N	0.86	0.79	-4.3	3.9-3.99	1.5	this work
Pt/C	0.92	0.81	-6	3.94-3.99	1.81	this work
Ag NWs-ZIF67	0.903	0.852	-	3.85	1.546	[1]
ZIF-67	0.75	0.66	4.32	3.87	1.68	[2]
Zn-Co-ZIF/GO-920	0.914	0.807	6.23	3.97-4.0	-	[3]
ZIF-67@NPC-2(2:1)	0.890	0.82	-4.94	4.03	1.64	[2]
Co,N-PCL	0.863	0.822–0.846	4.64–5.22	3.97	-	[4]
P/Ni/Co/NC	0.872	0.775	5.02	-	-	[5]
Co-CNT	0.957	0.877	5.20	3.9	-	[6]
CS-HPCN1000-5	0.897	0.697	-3.75	3.9-4.0	-	[7]
CNT-900	0.934	0.819	4.98	3.99	-	[8]

Table S2. The performance of liquid rechargeable Zn-air batteries with various bifunctional electrocatalysts.

Sample	Open circuit potential (V)	Peak power density ($mW.cm^{-2}$)	Specific capacity at current density@J ($mAh.g^{-1}$)	Electrolyte	Oxygen source	Ref.
Co/C@NS NWs	1.46	129.3	800@10	6 M KOH	air	**This work**
Co_3O_4-x/NG	1.49	166	700.6@10	6 M KOH	air	[9]
Co-NCNT/Ng-900	1.4	174.4	795.0@10	6 M KOH	air	[9]
CoDNG900	1.45	207.47	669 @10	6 M KOH	air	[9]
FeCo-N-C-700	1.39	150	518@10	6 M KOH	air	[9]
Co@hNCTs-800	1.45	149	746 @10	6 M KOH	air	[9]
$NiCo_{2.148}O_4$ PNSs	1.46	83	700@10	6 M KOH	air	[9]
Co_4N@NC-2	1.48	74.3	769.4@5	6 M KOH	air	[9]
1-Pd/$Co(OH)_2$	1.4	-	766@10	6 M KOH	air	[9]
CoNC (1:4)	1.33	126	852@10	6 M KOH	air	[9]
Co-MOF-800	1.38	144	671.6@10	6 M KOH	air	[9]
Co-MOF/LC-0.5 + 20Pt/C	1.44	126	-	6 M KOH+0.2M $ZnCl_2$	air	[10]
MnO@Co-N/C	-	130.3	-	6M KOH+0.2 M $Zn(Ac)_2$	air	[11]
SNC	1.24	94.8	-	Alkaline electrolyte	air	[12]

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