Cobalt nanoparticles embedded in N-doped carbon nanotubes on the reduced graphene oxide as efficient oxygen catalyst for Zn-air battery

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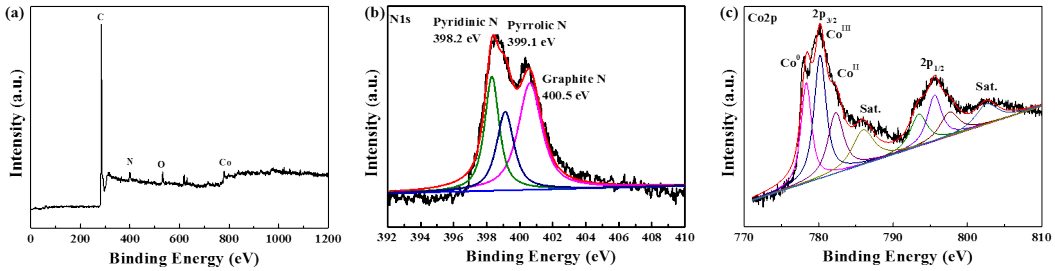

Fig. S1. (a) Survey XPS spectra and high-resolution. XPS spectra of N 1s (b) and Co 2p (c) in Co@N-CNT/rGO-0.1.

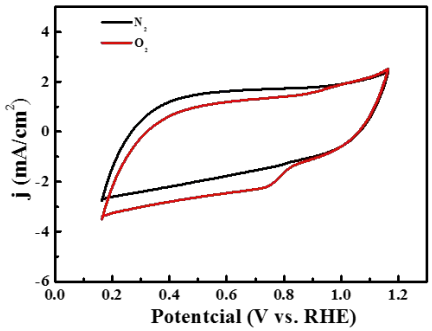

Fig. S2. CV curves of Co@N-CNT/rGO-0.1 in N_2- and O_2-saturated 0.1 M KOH solution.

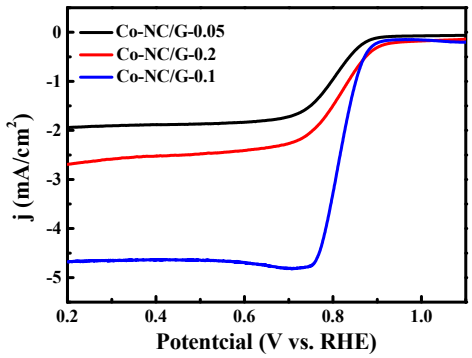

Fig. S3. LSV curves of Co@N-CNT/rGO-0.05, Co@N-CNT/rGO-0.2 and Co@N-CNT/rGO-0.1

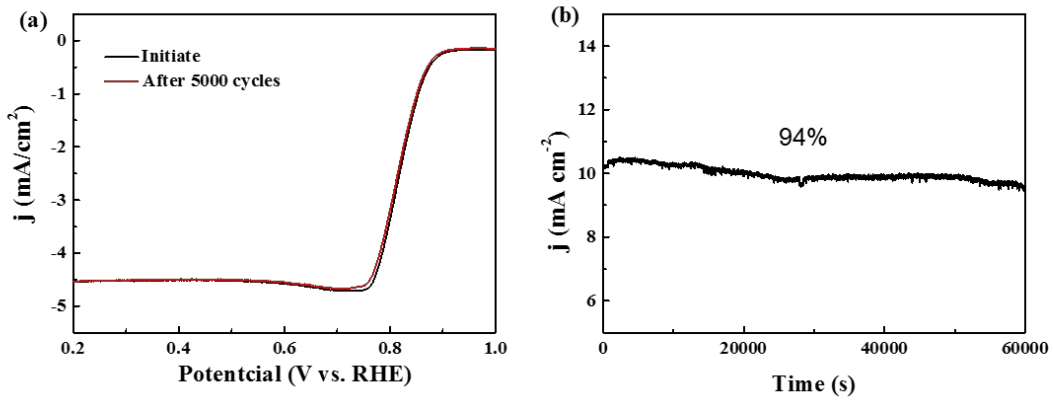

Fig. S4. (a) The ORR polarization curves of Co@N-CNT/rGO-0.1 at initial and after 5000 CV cycles. (b) The OER stability of Co@N-CNT/rGO-0.1 under a constant voltage of 1.68 V (vs RHE)

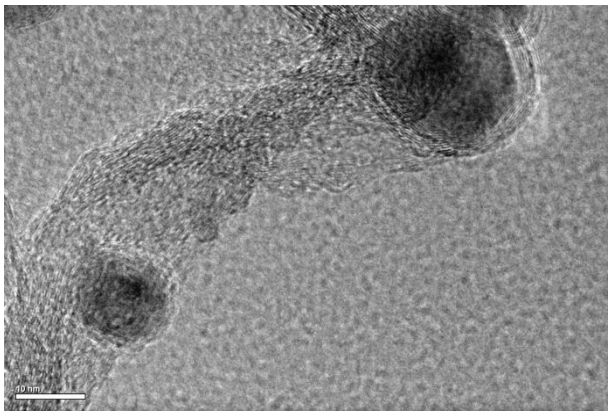

Fig. S5. The TEM image of Co@N-CNT/rGO-0.1 after long-term cycling test.

Table. S1. Comparison of the performances of Zn–air batteries with recently reported representative bifunctional electrocatalysts.

Catalysts	$\Delta E\ (V) = E_{j=10} - E_{1/2}$	Liquid Zn–air battery			References
		Charge/discharge voltage gap (V)	Current density (mA cm^{-2})	Cycling time (h)	
ZnCo-ZIF@GO	0.90	1.05	10	25	1
$ZnCo_2O_4$/N-CNT	0.78	0.84	10	5.3	2
MnO@Co–N/C	0.93	0.75	5	633	3
CoNi/BCF	0.80	0.95	10	30	4
NiCo2O4/CNTs	0.88	0.84	10	200	5
Co_9S_8/P@CS-1:2	/	0.9	5	350	6
Co-N-CNTs	0.81	0.80	5	10	7
Co@NCNT/rGO-0.1	**0.87**	**0.80**	**5**	**125**	**This work**

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