Supporting Information

Novel $Fe_{2.55}Sb_2$ Alloy Nanoparticles incorporated in N-doped Carbon as Bifunctional Oxygen Electrocatalyst for Rechargeable Zn-Air Battery

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To be published in New Journal of Chemistry

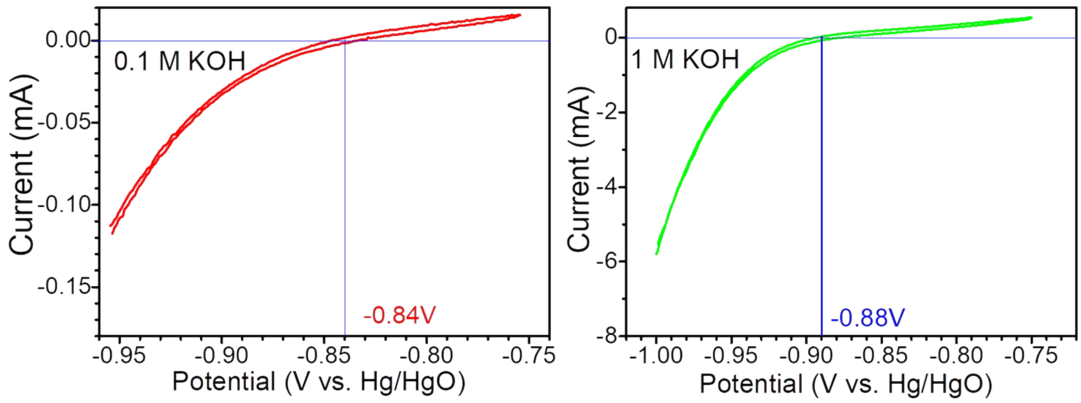

Fig. S1. Calibration of Hg/HgO reference electrode with respect to reversible hydrogen electrode (RHE).

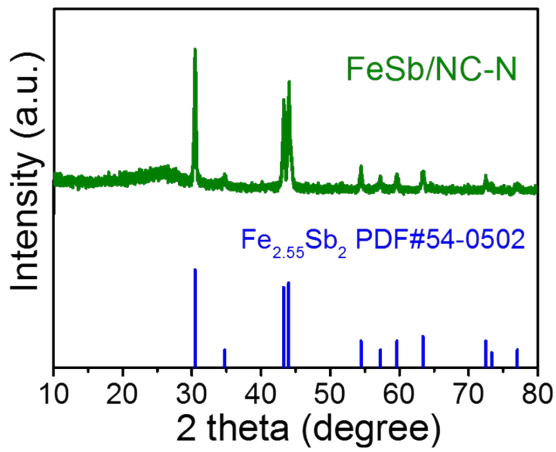

Fig. S2. XRD pattern of FeSb/NC-N catalyst.

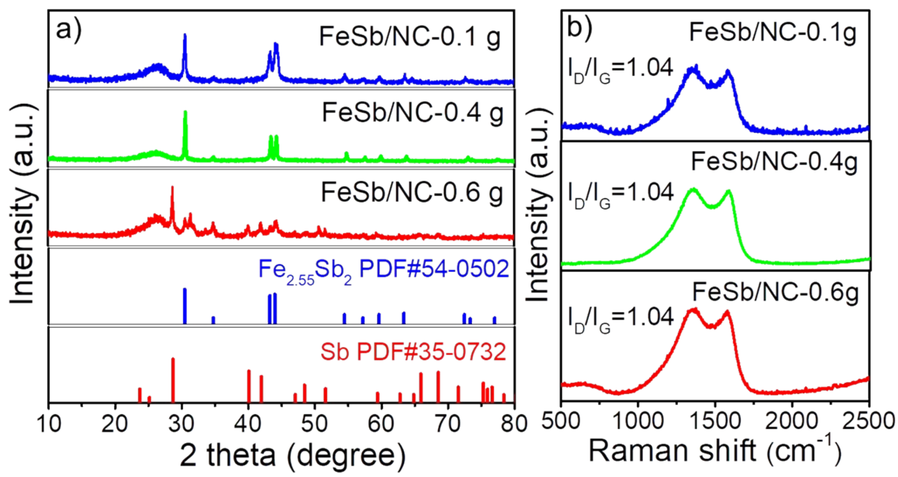

Fig. S3. a) XRD patterns and b) Raman spectra of FeSb/NC with different feeding amount of $SbCl_3$.

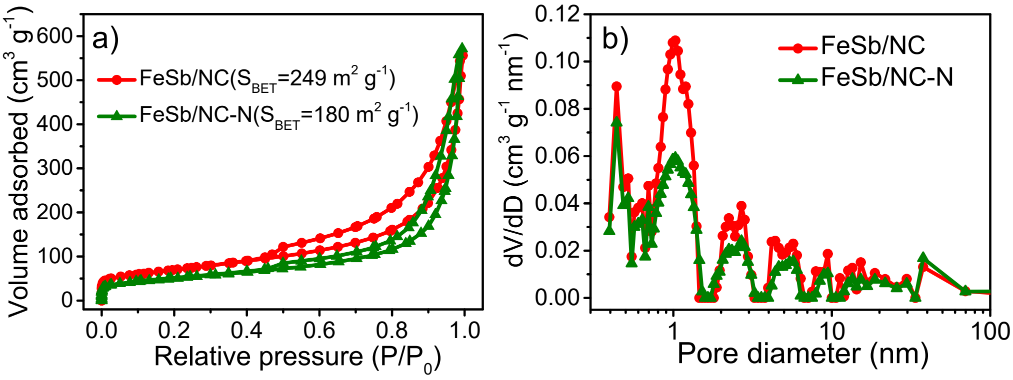

Fig. S4. a) N_2 adsorption-desorption isotherms and b) the corresponding pore size distribution curves of FeSb/NC and FeSb/NC-N catalysts.

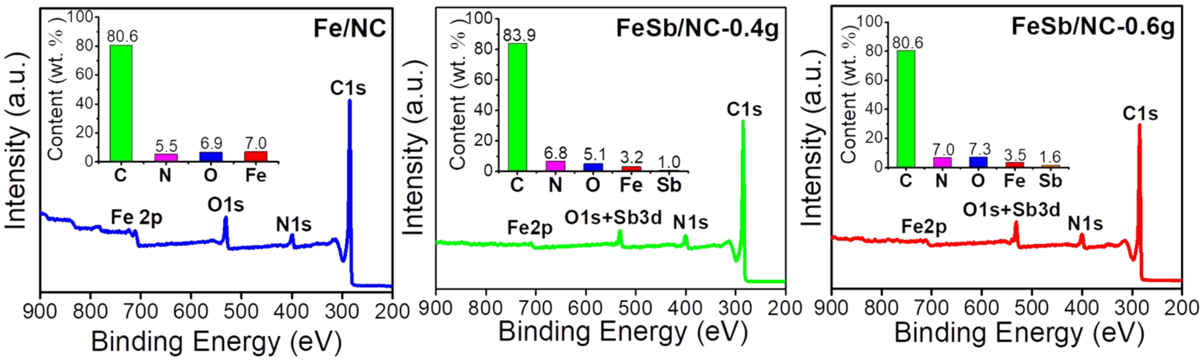

Fig. S5. The XPS survey spectra and the corresponding elemental contents of Fe/NC, FeSb/NC-0.4g and FeSb/NC-0.6g.

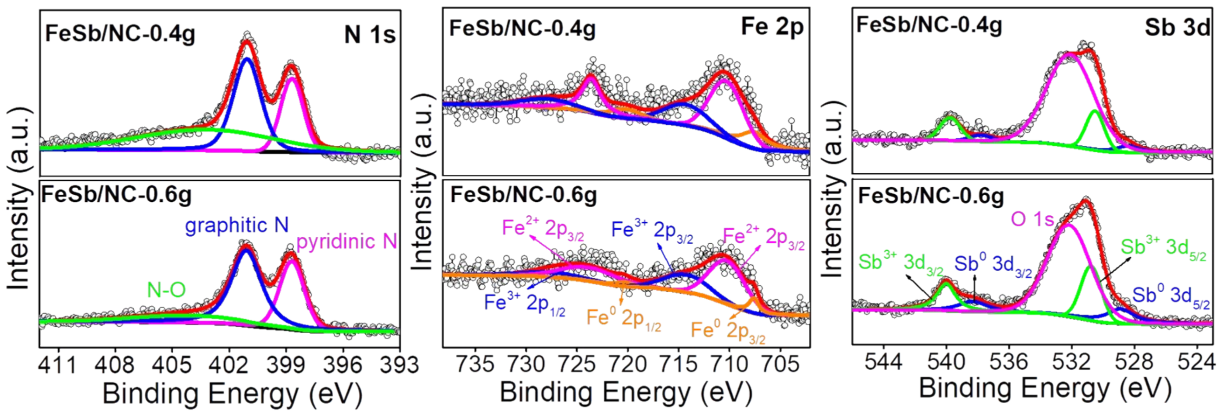

Fig. S6. High-resolution N 1s, Fe 2p and Sb 3d spectra of FeSb/NC-0.4g and FeSb/NC-0.6g.

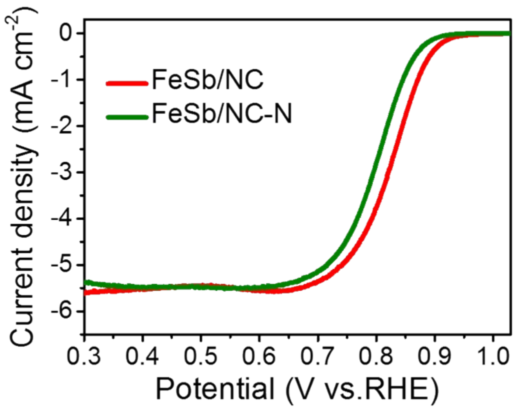

Fig. S7. LSV curves for ORR of FeSb/NC and FeSb/NC-N catalysts.

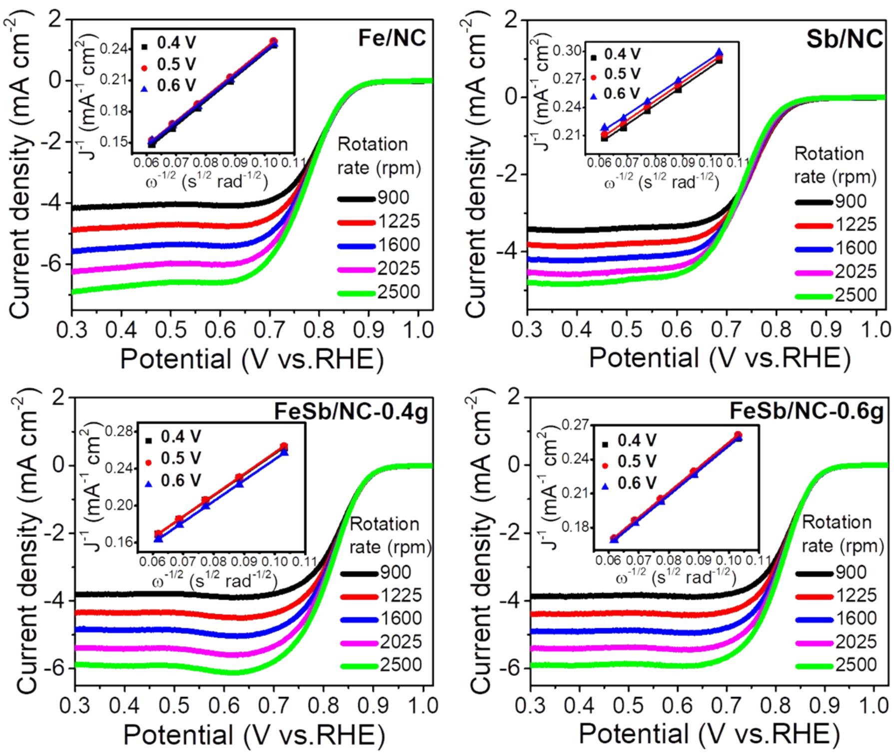

Fig. S8. LSV curves of Fe/NC, Sb/NC, FeSb/NC-0.4g and FeSb/NC-0.6g catalysts measured at different rotation rates and the corresponding K-L plots.

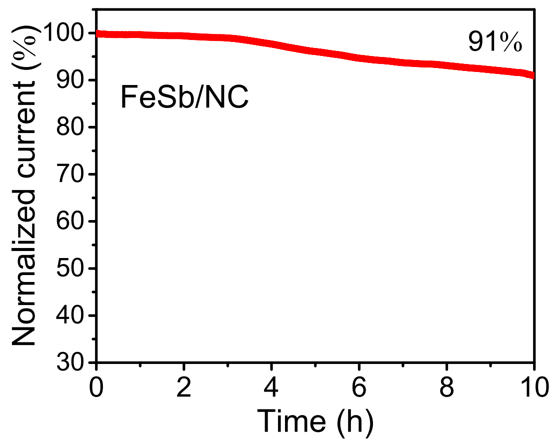

Fig. S9. ORR durability test of FeSb/NC performed on carbon paper.

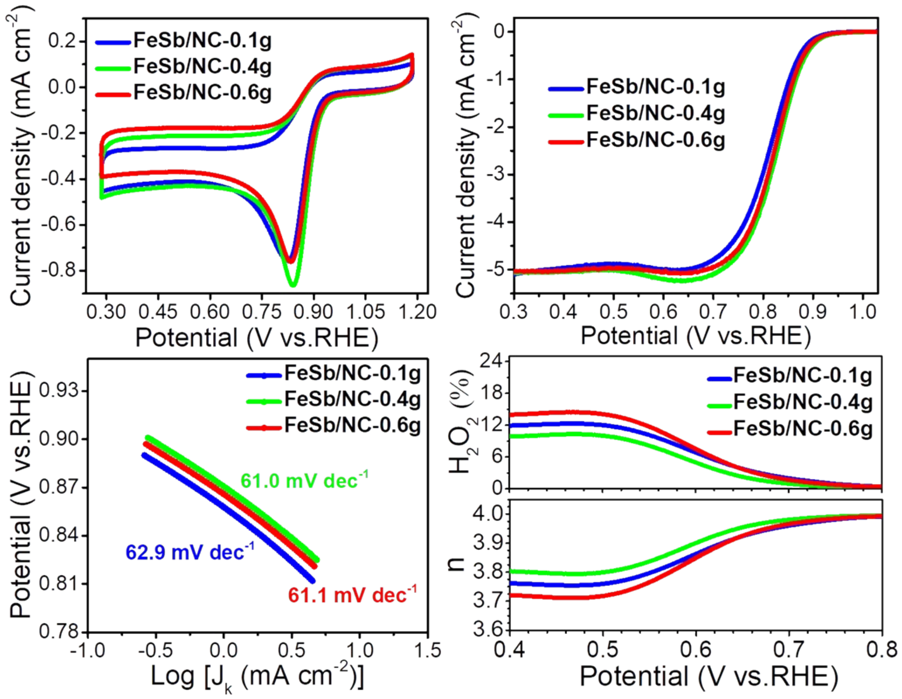

Fig. S10. ORR performance of FeSb/NC with different feeding amount of $SbCl_3$.

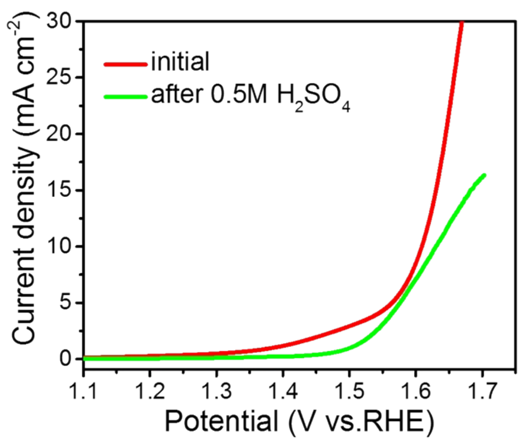

Fig. S11. OER LSV curves of FeSb/NC before and after acid leaching.

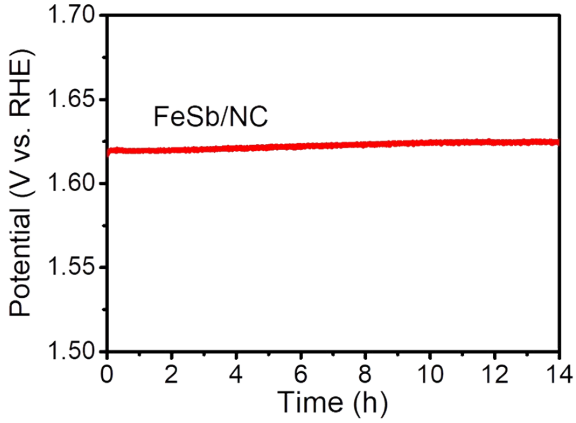

Fig. S12. Chronopotentiometric curve at a constant current density of 10 mA cm^{-2} for on FeSb/NC.

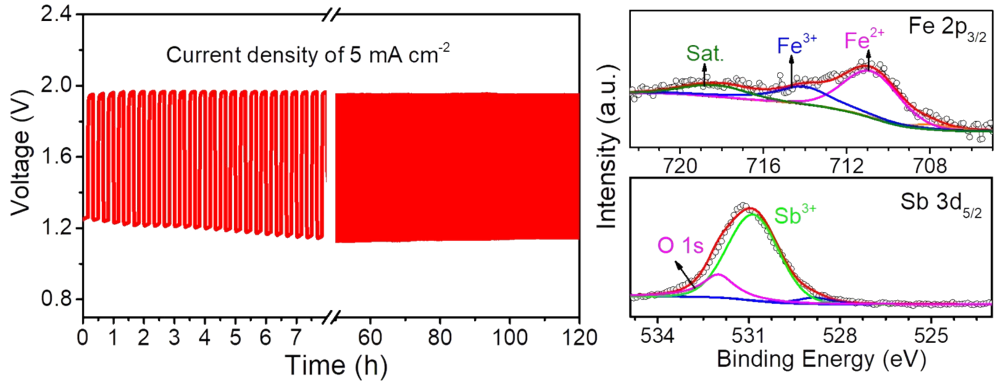

Fig. S13. High-resolution Fe $2p_{3/2}$ and Sb $3d_{5/2}$ spectra of FeSb/NC after 120 h of charge-discharge cycling test at 5mA cm^{-2} for 120 h.

Table S1 ORR parameters for for FeSb/NC-0.1g, FeSb/NC-0.4g, FeSb/NC-0.6g.

Samples	Peak potential (V vs. RHE)	E_{onset} (V vs. RHE)	$E_{1/2}$ (V vs. RHE)	J_L (mA cm^{-2})	Tafel slope (mV dec^{-1})
FeSb/NC-0.1g	0.82	0.89	0.81	5.00	62.9
FeSb/NC-0.4g	0.84	0.90	0.82	5.24	61.0
FeSb/NC-0.6g	0.83	0.90	0.82	5.07	61.1

Table S2 Comparison of Zn-air battery performance of the FeSb/NC catalyst with recently reported electrocatalysts.

Catalysts	OCV (V)	Peak power density (mW cm^{-2})	Specific capacity (mA h g-1 Zn)	Cycling durability @J(mA cm^{-2})	Ref.
FeSb/NC	**1.46**	**175**	**751**	**887 h @5** **616 h @10**	**This work**
N-CoS_2 YSSs	1.41	81	744	165 h @10	[1]
$FeNi_3$@NC	1.39	139	756	30 h @5	[2]
Co@hNCTs-800	1.45	149	746	500 h @5	[3]
Zn-Ni_3FeN/NG	1.60	158	650	180 h @10	[4]
Fe-enriched-$FeNi_3$/NC	1.43	89	734	14 h @10	[5]
$CoSe_2$@NC	1.48	137	751	83 h @10	[6]
CoFe@NC/NC HNSs-700	1.49	184	774	50 h @5	[7]
Mn-RuO_2	1.55	181	812	2500 h @10	[8]
$Co_6Mo_6C_2$-Co@NC	1.38	45	760	300 h @10	[9]
CoFe/S-N-C	1.48	130	814	100 h @10	[10]
NiCo/NHCS-TUC-3	1.59	256	757	70 h @5	[11]
CS350-10Ar	1.36	135		120 h @5	[12]
Co/NGC-3		134	716	120 h @5	[13]
FeCo/Co_2P@NPCF	1.44	154		107 h @10	[14]
MnSAC		258	675	100 h @5	[15]
Co_9S_8@Co/Mn-S,N-PC	1.49	80		210 h @10	[16]
CoFe-NCNFs	1.52	116		110 h @5	[17]
Fe-NC SAC		180	786	160 cycles @20	[18]
FeCo/Se-CNT	1.54	173		70 h @5	[19]
$FeCu_{0.3}$-N/C	1.50	111	682	75 h @5	[20]
$NiFe_3$@NGHS-$NCNT_S$	1.51	127		166 h @10	[21]
f-FeCo-CNT	1.48	196	754	180 h @20	[22]
Catalysts	OCV (V)	Peak power density (mW cm^{-2})	Specific capacity (mA h g-1 Zn)	Cycling durability @J(mA cm^{-2})	Ref.

CoSb/NC-0.8	1.42	180		160 h @10	[23]
$CoSb_3$/NCL-30		211		60 h @10	[24]
S-$LaCoO_3$	1.47	92	747	100 h @2	[32]
LSCP-3	1.50	52	740	60 h @10	[33]
$Pb_2Ru_2O_{6.5}$		195		33 h @10	[34]
YRO	1.17	145		34 h @10	[35]

Table S3 Comparison of BI and SBI values of FeSb/NC catalyst with recently reported electrocatalysts.

Catalysts	ORR (V) @-3 mA/cm^2_{geo}	OER (V) @10 mA/cm^2_{geo}	BI (V)	SBI (uA/cm^2_{BET})	Ref.
FeSb/NC	**0.82**	**1.72**	**0.90**	**4.9**	**This work**
Co_9S_8/(N,S-doped carbon)	0.84	1.64	0.80	1.3	[25]
N-doped CNT framework	0.83	1.60	0.77	6.8	[26]
N,P-doped C foam	0.80	1.90	1.10	0.8	[27]
$Ba_{0.5}Sr_{0.5}Co_{0.8}Fe_{0.2}O_{3-\delta}$	0.74	1.58	0.84	2.7	[28]
α-MnO_2	0.76	1.72	0.96	14.7	[29]
$Co_xMn_{3-x}O_4$/C	0.82	1.80	0.98	92.6	[30]
$Pb_2Ru_2O_{7-x}$	0.74	1.43	0.69	274.0	[31]

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