Electronic Supplementary Material (ESI) for Nanoscale.
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In situ Evolution of Highly-dispersed Amorphous CoO_x Cluster for Oxygen Evolution Reaction

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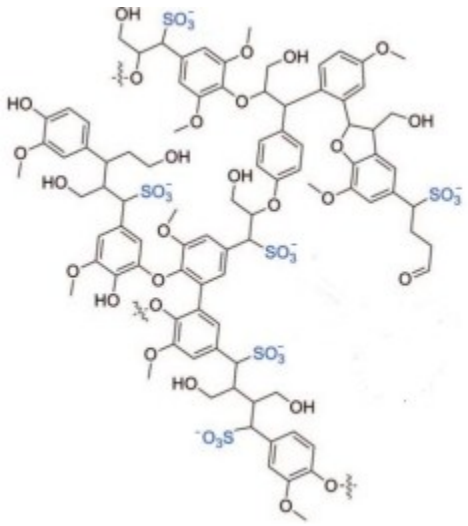

Figure S1. Model structural features characteristic of the LS.[s1]

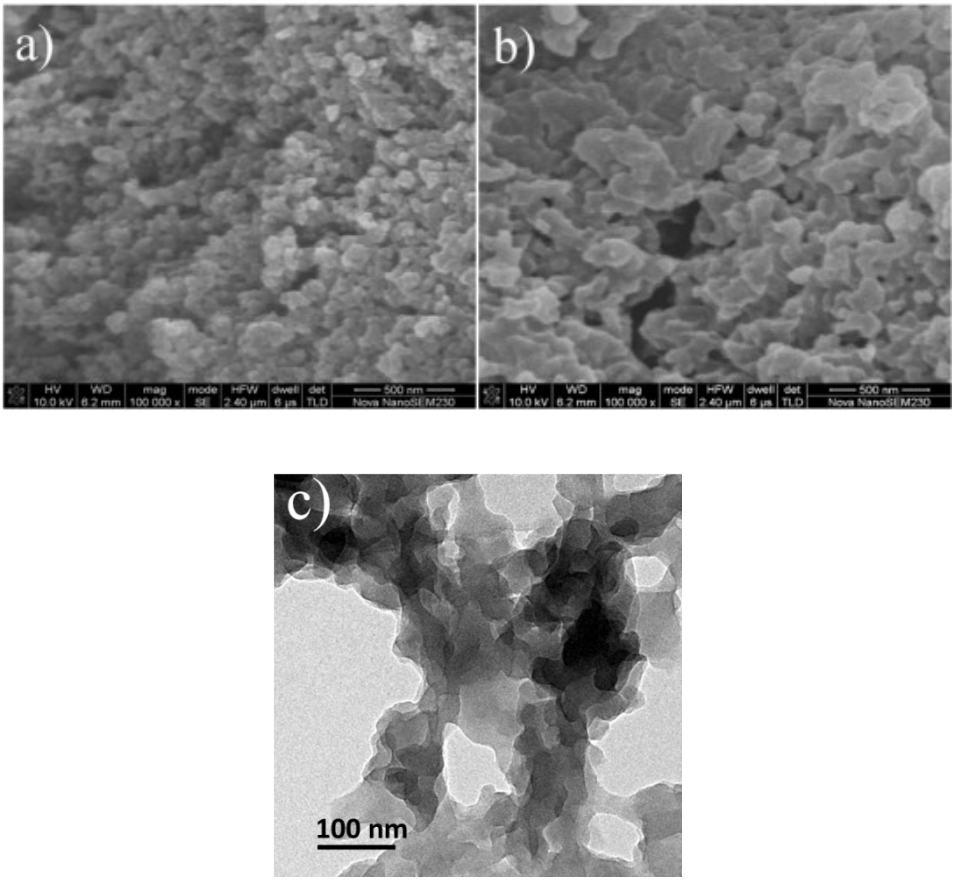

Figure S2. SEM images of (a) LS-Co, (b) LS-Co-air, and (c) TEM images of LS-Co.

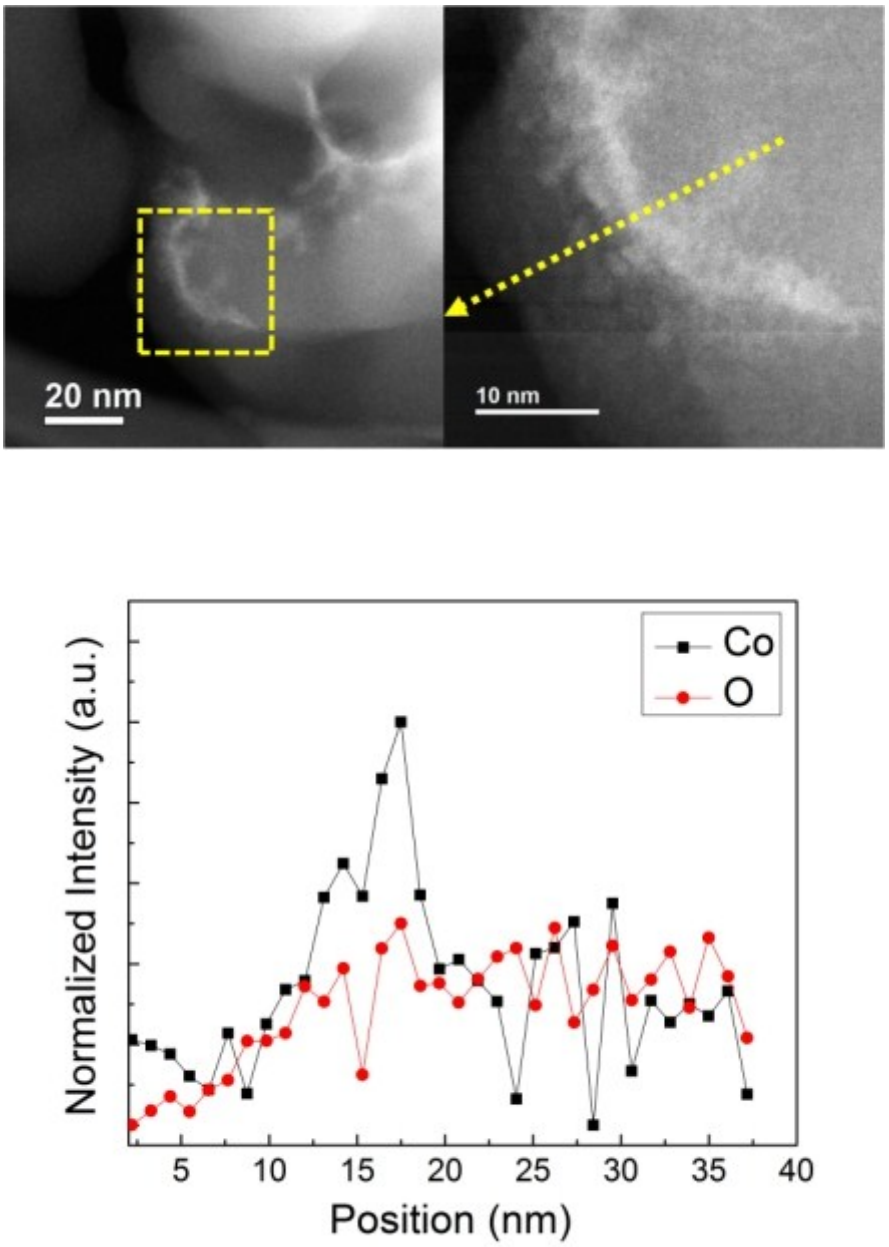

Figure S3. (EELS line scan of LS-CoO_x (indicated by the dashed line in yellow). (a) overall HAADF-STEM image. (b) HAADF-STEM image showing the scanning line. (c) the line scan profiles of Co and O respectively.

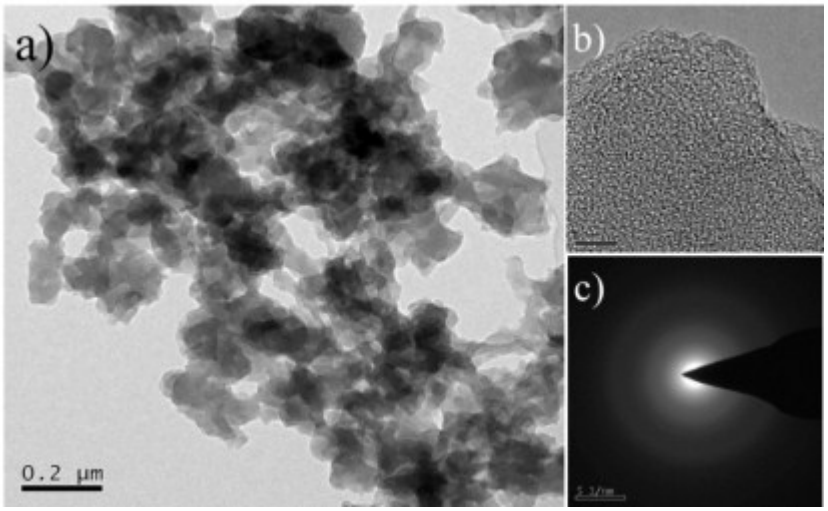

Figure S4. (a) TEM image, (b) HRTEM image, and (c) corresponding SAED pattern of LS-Co.

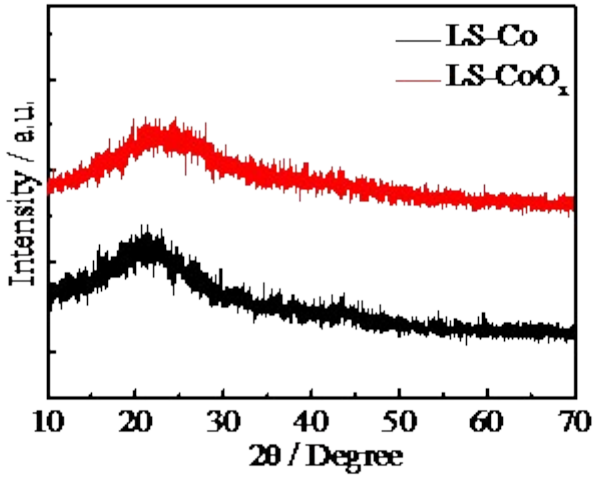

Figure S5. XRD patterns of (a) LS-Co and (b) LS-CoO_x.

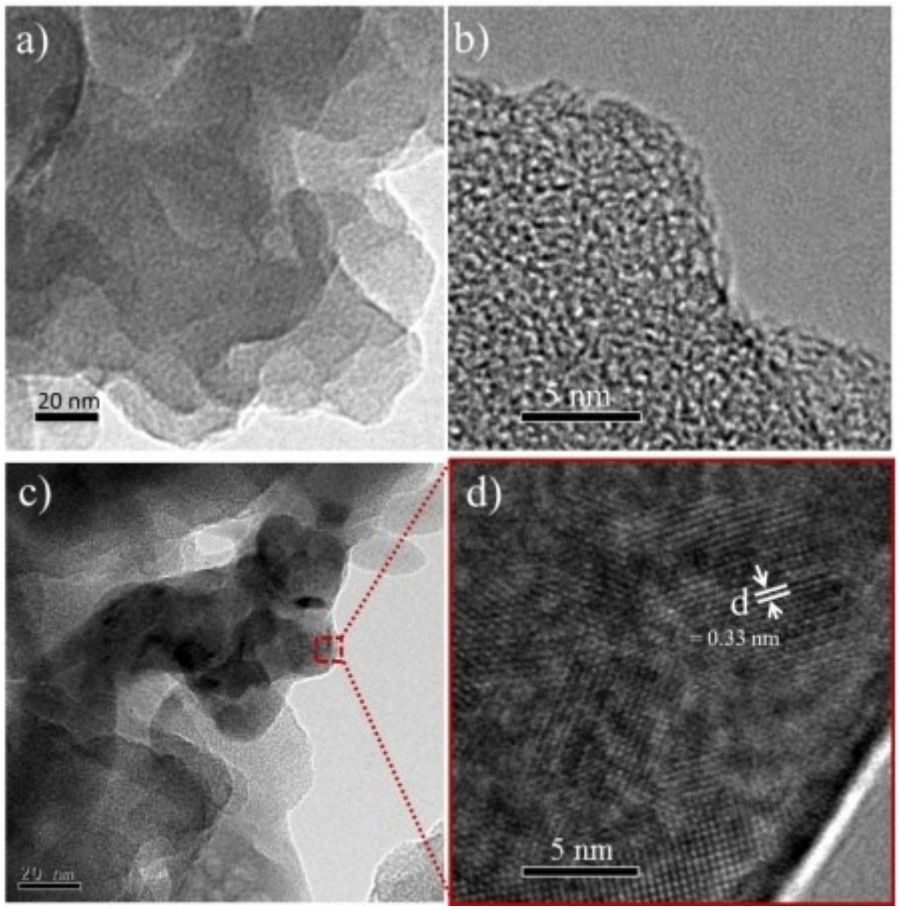

Figure S6. TEM images of (a) LS-Co-N_2, and (c) LS-Co-O_2, and corresponding HRTEM images of (b) LS-Co-N_2, and (d) LS-Co-O_2.

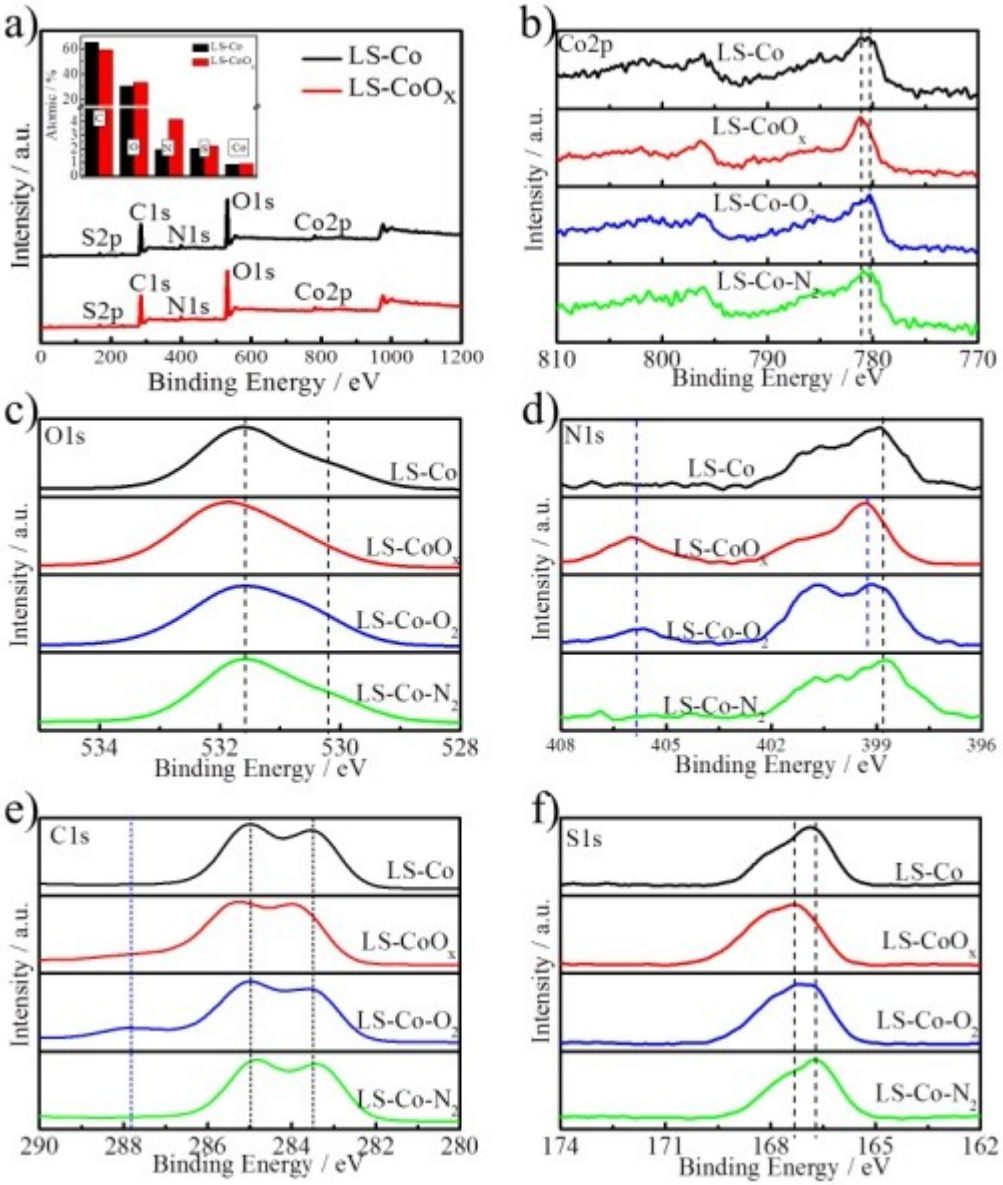

Figure S7. (a) Co2p, (b) O1s, (c) N1s, (d) S1s, (e) C1s spectra of LS-Co treated by N_2 DBD-plasma.

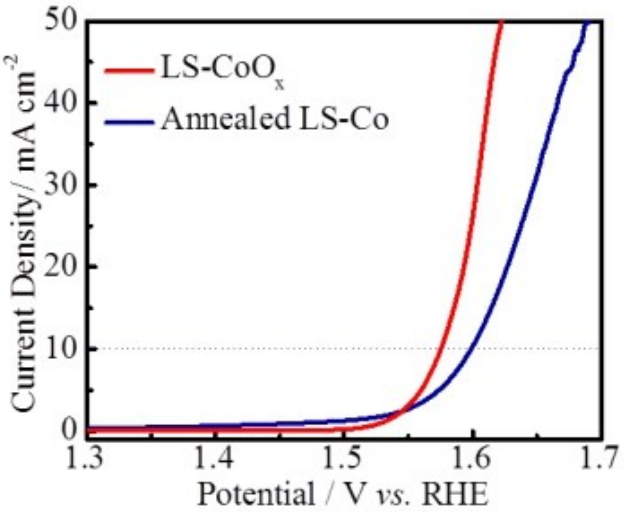

Figure S8. LSV polarization curves of the annealed LS-Co and LS-CoO_x electrocatalysts.

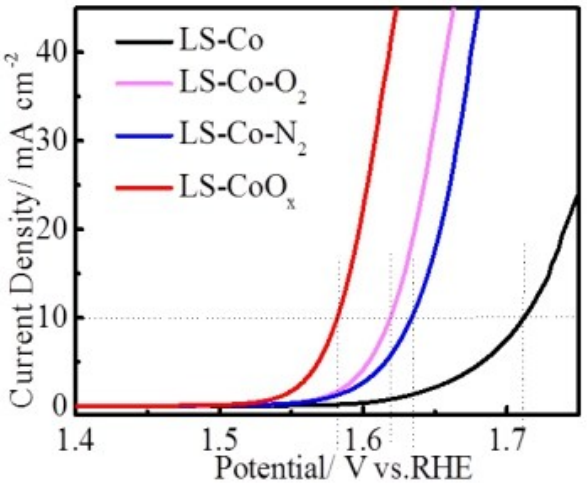

Figure S9. LSV polarization curves of the LS-Co, , LS-Co-O_2, LS-Co-N_2, and LS-CoO_x.

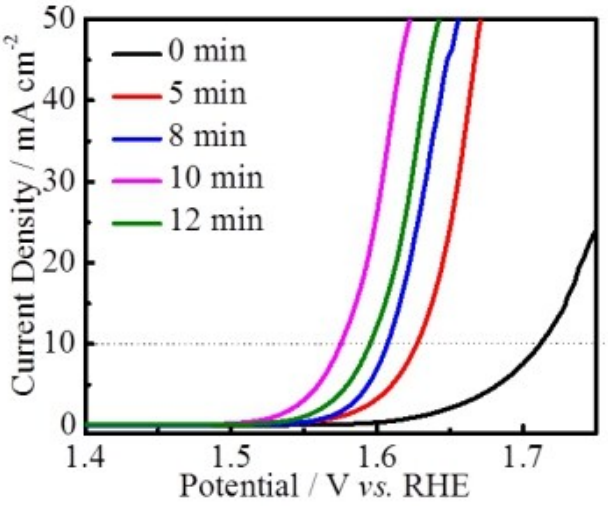

Figure S10. LSV polarization curves of the LS-Co electrocatalysts modified by air DBD plasma with different time.

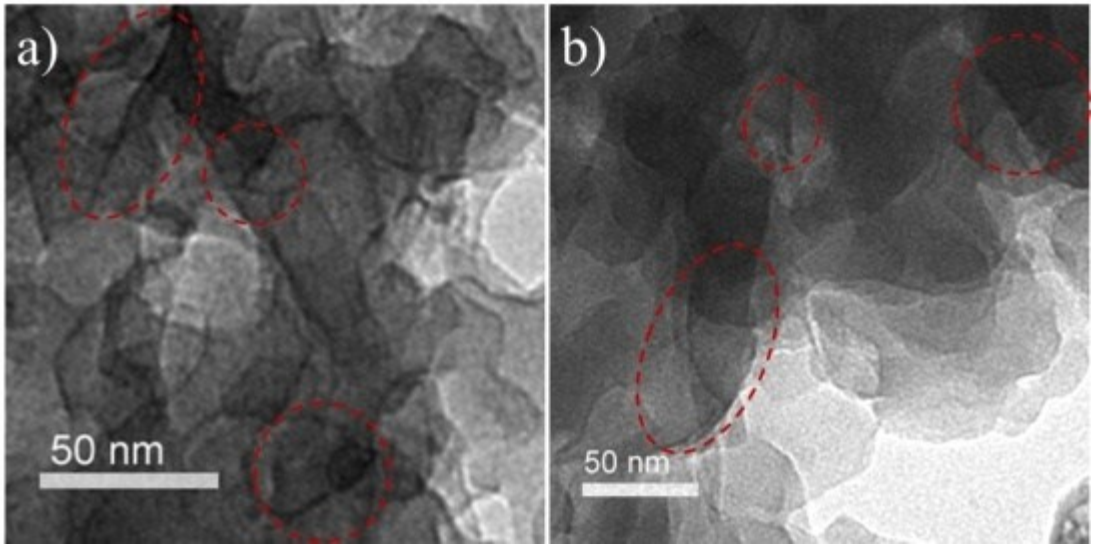

Figure S11. TEM images of LS-CoO_x and after 2000 cycles.

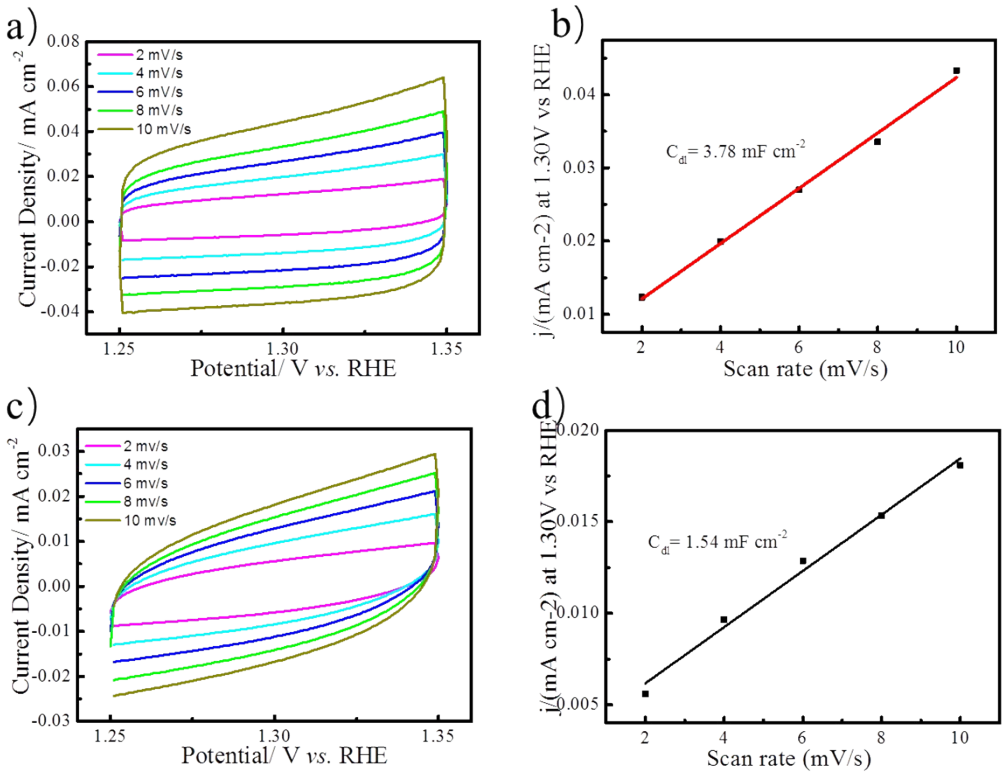

Figure S12. Electrochemical surface area (ECSA) tests in 1 M KOH. a) Cyclic voltammetry curves of LS-Co and c) LS-CoO_x with different scanning rates. The capacitive current measured at 1.30V vs RHE was plotted as a function of scan rate b) LS-Co and d) LS-CoO_x.

Table S1. Comparison of OER activity with recently reported Co-based Oxides catalyst

Catalysts	η @10 mA cm^{-2}	Electrolyte	Electrode	Tafel slope (mV dec-1)	Ref.
LS-CoOx	**345**	**1 M KOH**	GC	**32**	**This work**
	290	**1 M KOH**	**Ni-foam**	**/**	
Co_3O_4/N-rmGO	310	1 M KOH	GC	67	*Nat. Mater.* 2011, *10*, 78
$CoFeO_x$	270	1 M KOH	GC	/	*J. Am. Chem. Soc.*, 2016, *138,* 8946.
$Ni_{0.5}Co_{0.5}O_x$	355	1 M KOH	GC	35	*J. Am. Chem. Soc.* 2012, *134*, 17253.
Co_3O_4	530	1 M KOH	GC	60	*Chemical Science*, 2014, **5**, 3976
Co_3O_4	328	1 M KOH	Ni foam	/	*J Phys Chem C*, 2009, **113**,15068
CoO	330	0.1M KOH	CFP	70	*Nat Commun*, 2015, **6.**
$Co_3O_{4-\delta}$	390	1 M KOH	GC	/	*Angew Chem Int Edit*, 2015, **54**, 7399
$ZnCo_3O_{4-\delta}$	365	1 M KOH	GC	45	*Angew Chem Int Edit*, 2015, **54**, 7399
$NiCo_2O_{4-\delta}$	320	1 M KOH	GC	54	*Angew Chem Int Edit*, 2015, **54**, 7399
$Li_{1-x}CoO_2$	395	0.1M KOH	CFP	61	*Chem Mater*, 2014, **26**, 1889
$Li_{1-x}Co_{0.5}Fe_{0.5}O_2$	350	0.1M KOH	CFP	51	*Chem Mater*, 2014, **26**, 1889
Co_3O_4@CoO SC	430	1 M KOH	GC	89	*Nat. Commun.* **2015**, *6*, 8.
Amorphous Ni-Co Binary Oxide Nanoporous Layers	325	1 M KOH	GC	39	*ACS Nano* **2014**, *8*, 9518.
Au@Co_3O_4	378	1 M KOH	GC	60	*Adv. Mater.* **2014**, *26*, 3950.
Ni-Co oxides layers	325	1 M NaOH	GC	39	*ACS Nano* **2014**, *8*, 9518.
Co_3O_4/$NiCo_2O_4$	340	1 M KOH	GC	88	*J. Am. Chem. Soc.* **2015**, *137*, 5590.

Reference

[s1] J.Zakzeski, P.C.Bruijnincx, A.L.Jongerius, B.M.Weckhuysen, Chem. Rev., 2010, ***110*****,** 3552.