Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.

Electronic Modulation and Surface Reconstruction of Cactus-Like CoB_2O_4@FeOOH Heterojunction for Synergistically Triggering Oxygen Evolution Reaction

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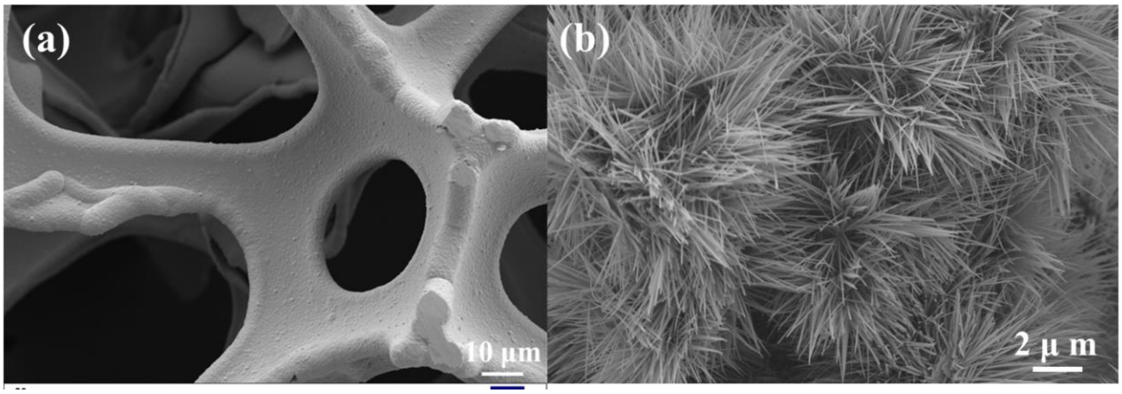

Figure S1 SEM images of (a) NF and (b) Co(OH)F/NF.

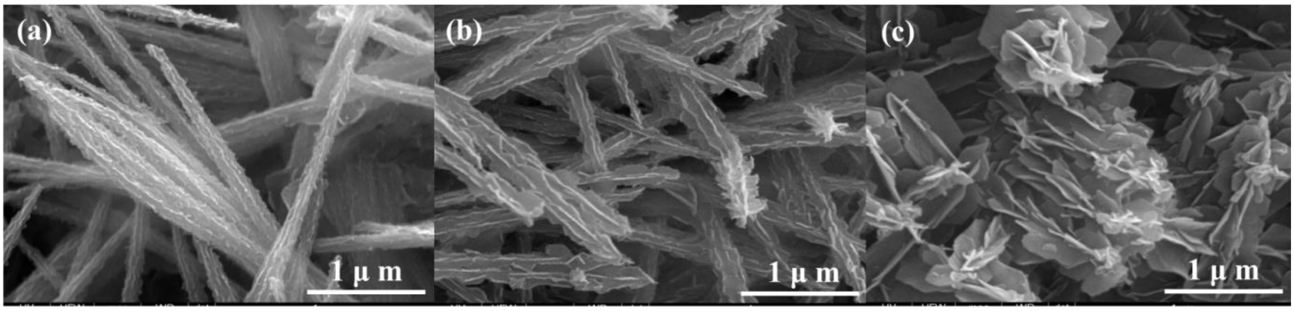

Figure S2 SEM images of the CoB_2O_4@FeOOH/NF with various electrosynthesis time ((a) 60 s, (b) 180 s and (c) 300 s).

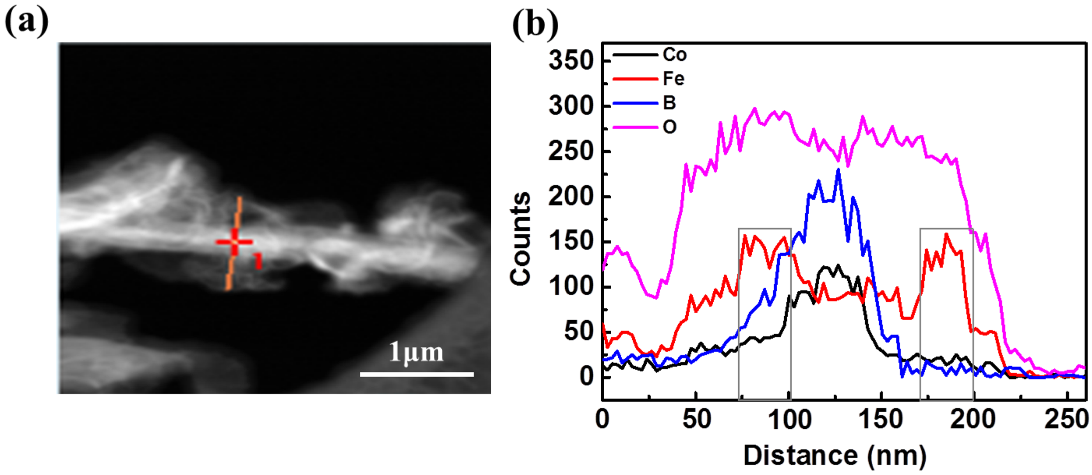

Figure S3 (a) and (b) elemental line scanning images of CoB_2O_4@FeOOH/NF.

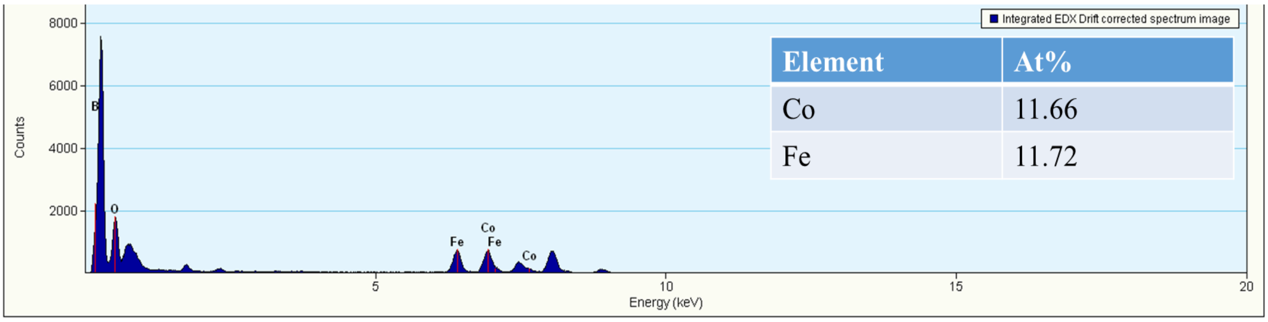

Figure S4 TEM-EDS spectrum of CoB_2O_4@FeOOH/NF.

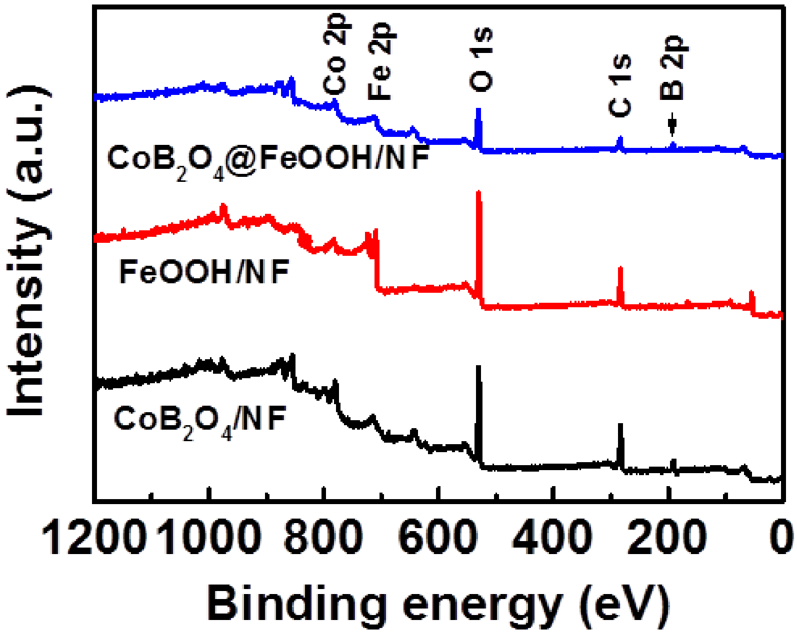

Figure S5 The survey XPS spectra of CoB_2O_4 /NF, FeOOH/NF and CoB_2O_4@FeOOH/NF.

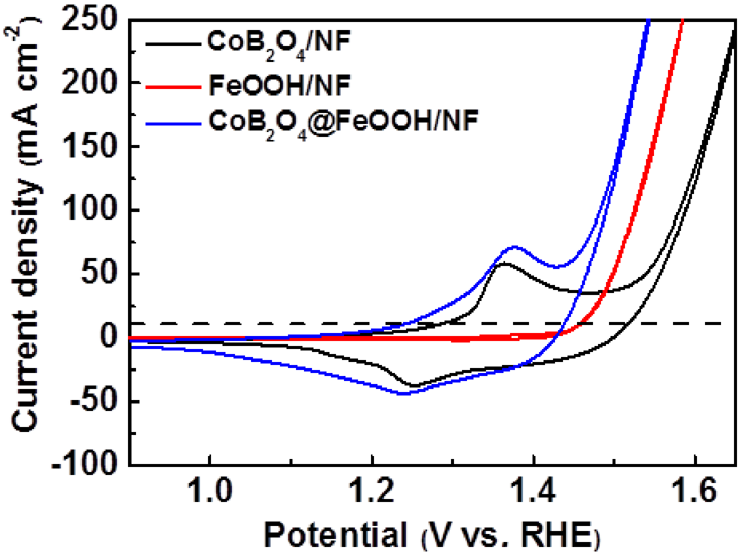

Figure S6 CV cures of CoB_2O_4 /NF, FeOOH/NF and CoB_2O_4@FeOOH/NF.

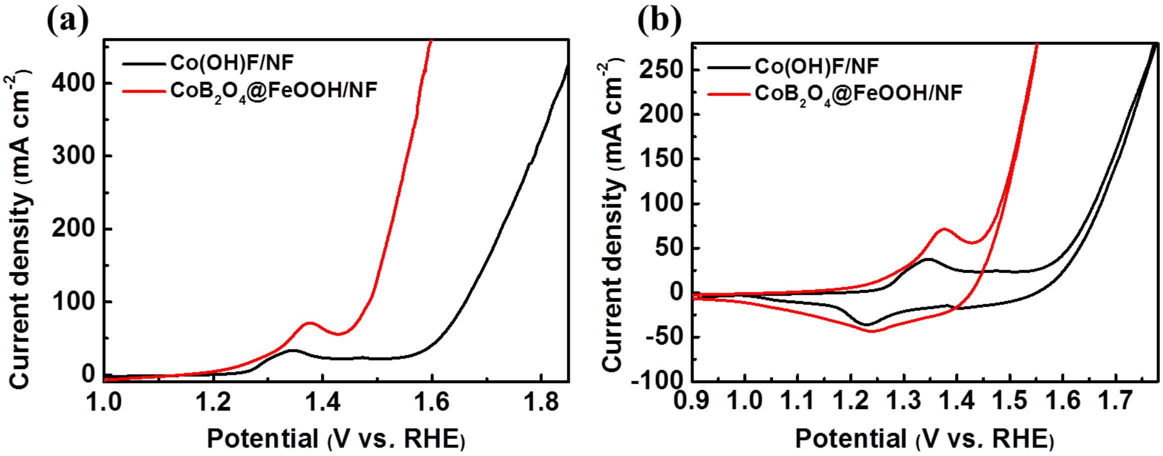

Figure S7 (a) LSV curves and (b) CV curves of Co(OH)F/NF and CoB_2O_4@FeOOH/NF.

Table S1 Comparison of OER activities for reported catalysts

Catalysts	Substrate	η_{10} (mV)	η_{100} (mV)	Stability	Ref
CoB_2O_4@FeOOH/NF	**Ni Foam**	**205**	**260**	**100 h**	**This work**
FeOOH/Cr-$NiCo_2O_4$/NF	Ni Foam	217	268	20 h	[1]
FeOOH(Se)/IF	Iron foam	287	364	15 h	[2]
CoP/FeOOH	-	290	-	20 h	[3]
NiV-LDH@FeOOH/NF	Ni Foam	-	297	20 h	[4]
Co@Co-Bi/Ti	Ti mesh	329	373	20000s	[5]
Co-Fe-Bi/NF	Ni Foam	307	-	40 h	[6]
CC@CoO@FeOOH-NWAs	Carbon Cloth	255	-	20 h	[7]
Co-B@Co-Bi	-	291	-	25 h	[8]
FeOOH@$NiCo_2O_4$	-	203	259	10 h	[9]
FeOOH/Co/FeOOHHNTAs-NF	Ni Foam	239	305	50 h	[10]

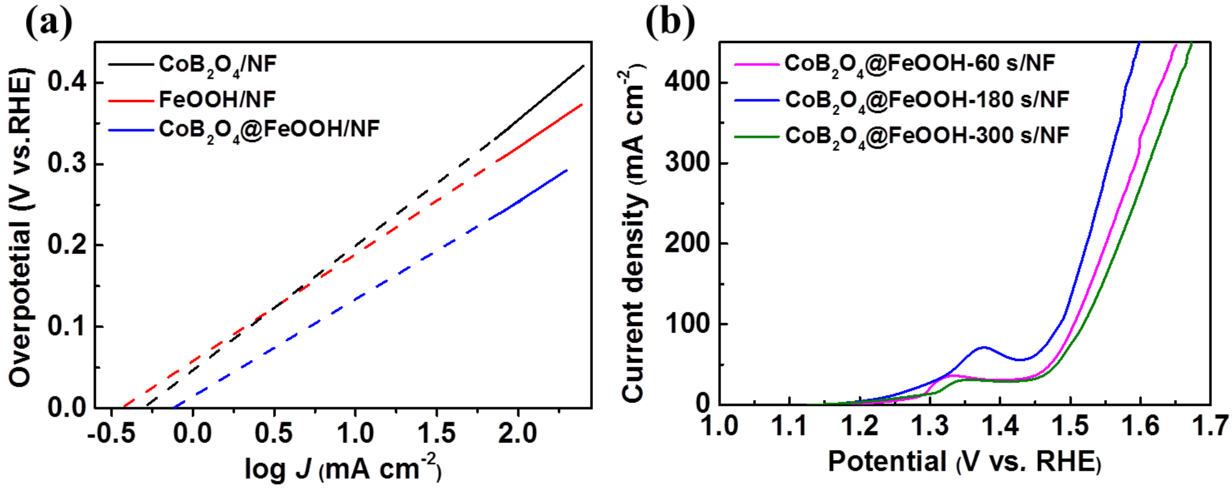

Figure S8 (a) The exchange current density of CoB_2O_4 /NF, FeOOH/NF and CoB_2O_4@FeOOH/NF, (b) LSV cures of catalysts with different electrosynthesis time for CoB_2O_4@FeOOH/NF-60, CoB_2O_4@FeOOH/NF-180, CoB_2O_4@FeOOH/NF-300.

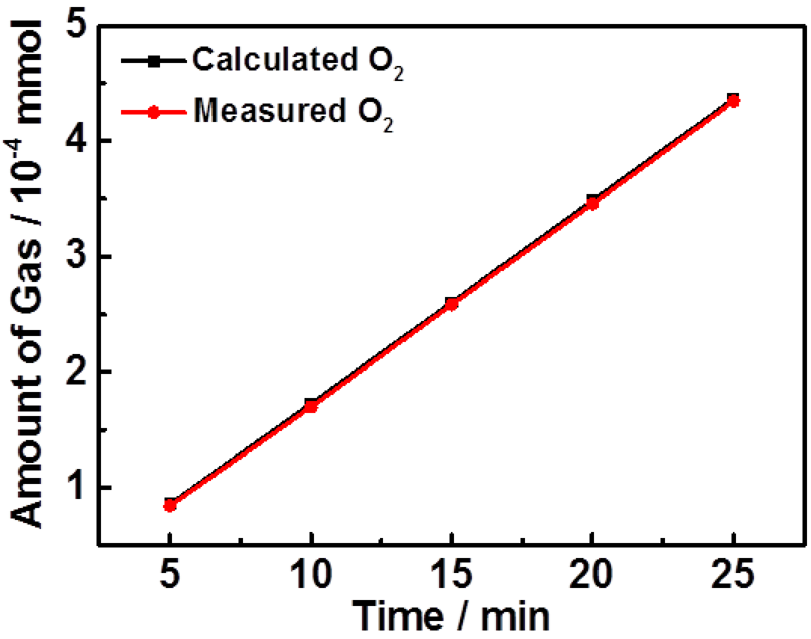

Figure S9 Faradaic efficiency of the CoB_2O_4@FeOOH/NF catalyst for O_2 evolution.

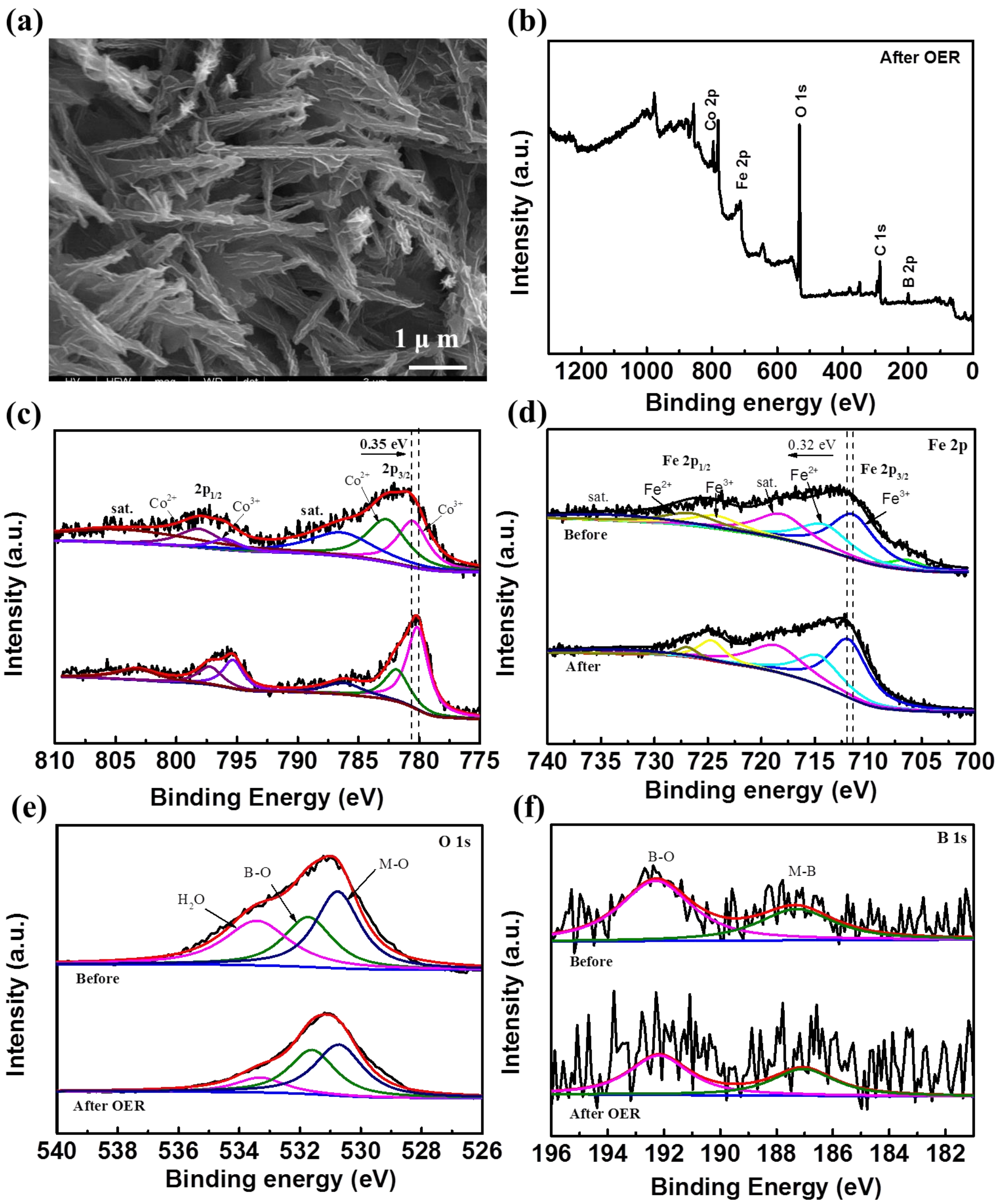

Figure S10 (a) SEM image of CoB_2O_4@FeOOH/NF after durability test. (b) The survey XPS of CoB_2O_4@FeOOH/NF after durability test. Comparison of XPS spectra of (c) Co 2p, (d) Fe 2p, (e) O 1s and (f) B 1s before and after OER durability test.

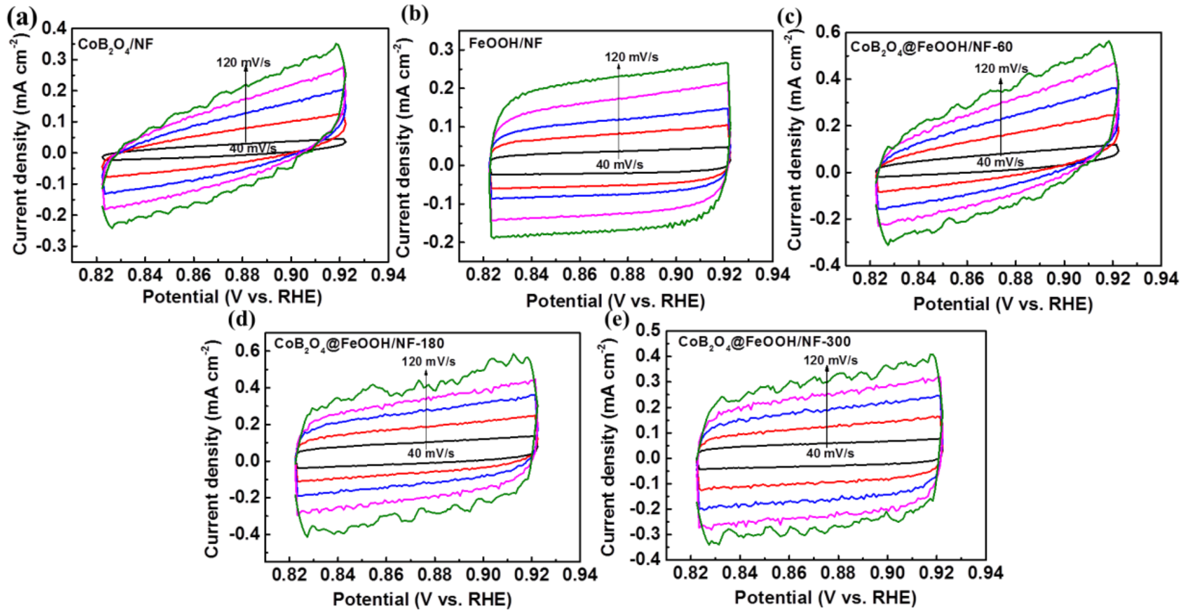

Figure S11 CV curves of CoB_2O_4 /NF, FeOOH/NF and CoB_2O_4@FeOOH/NF recorded from 0.8224 to 0.9224 V (vs. RHE) at different scan rates (40, 60, 80, 100, 120 mV s^{-1}).

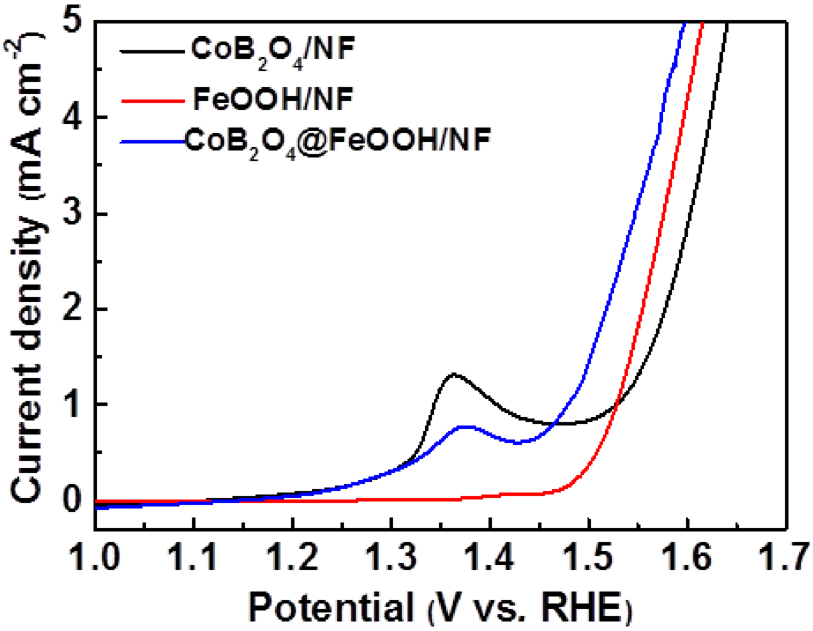

Figure S12 OER polarization curves standardized by ECSA of CoB_2O_4/NF, FeOOH/NF and CoB_2O_4@FeOOH/NF.

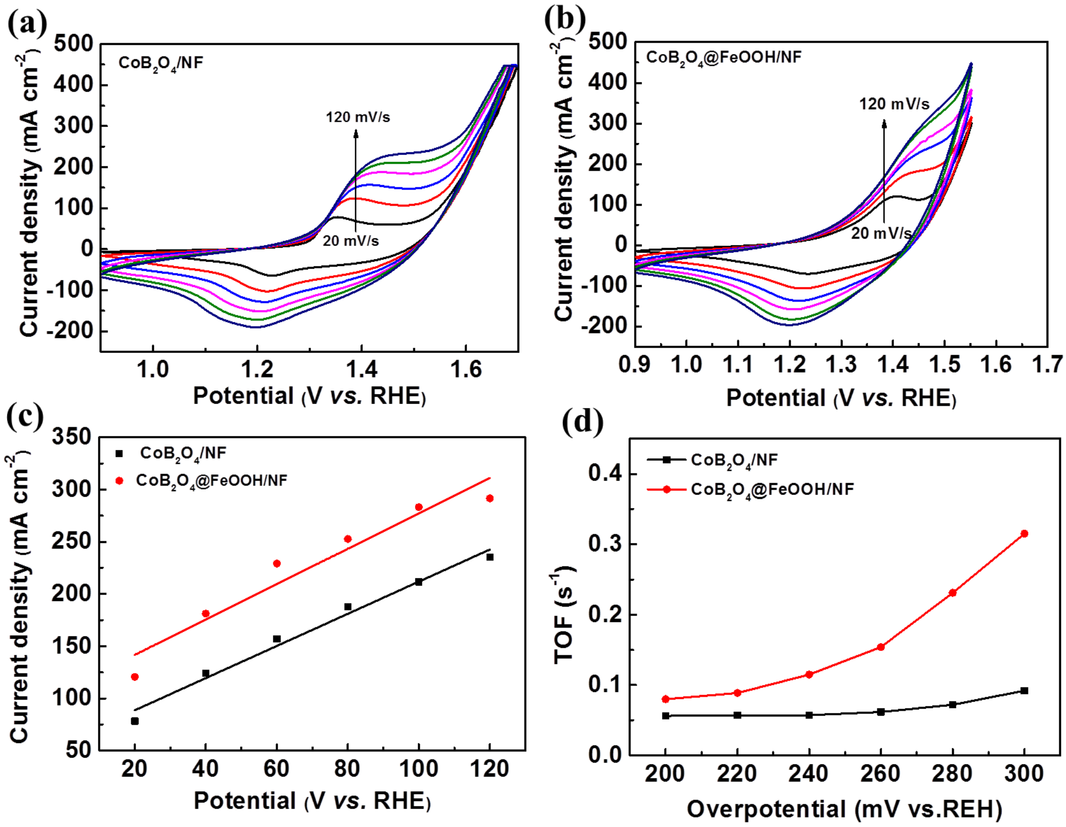

Figure S13 Cyclic voltammograms of (a) CoB_2O_4/NF and (b) CoB_2O_4@FeOOH/NF at various scan rates (c) Linear relationship of the peak current density for oxidation wave as a function of scan rate for CoB_2O_4/NF and CoB_2O_4@FeOOH/NF. (d) Plot of TOF for CoB_2O_4/NF and CoB_2O_4@FeOOH/NF

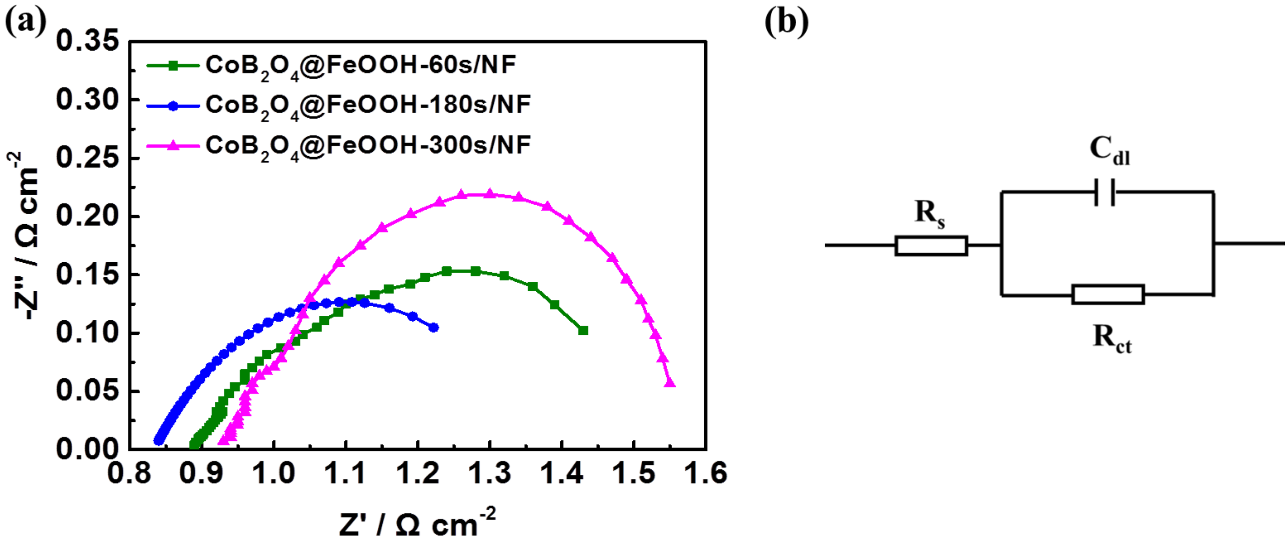

Figure S14 (a) Nyquist plots of CoB_2O_4@FeOOH/NF with different deposition times (60, 180 and 300 s) at potential of 1.5 V (vs. RHE), (b) A simplified Randles circuit by fitting the plots.

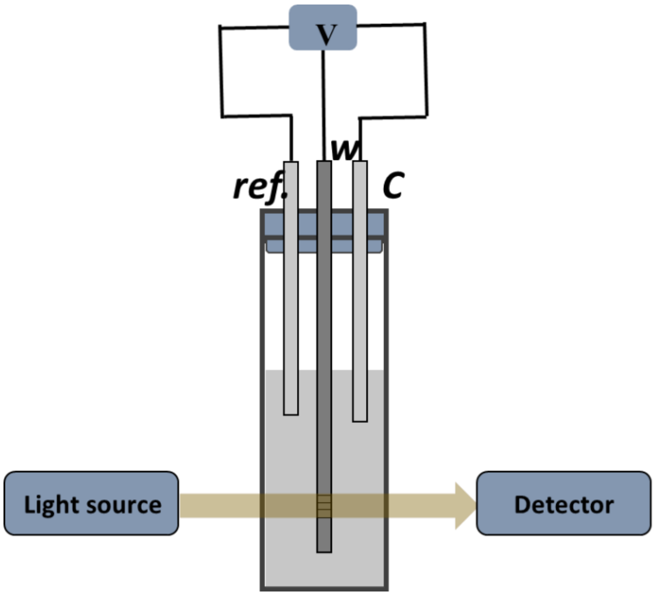

Figure S15 In-situ UV-vis experiment. W is working electrode, ref. is reference electrode and c is counter electrode.

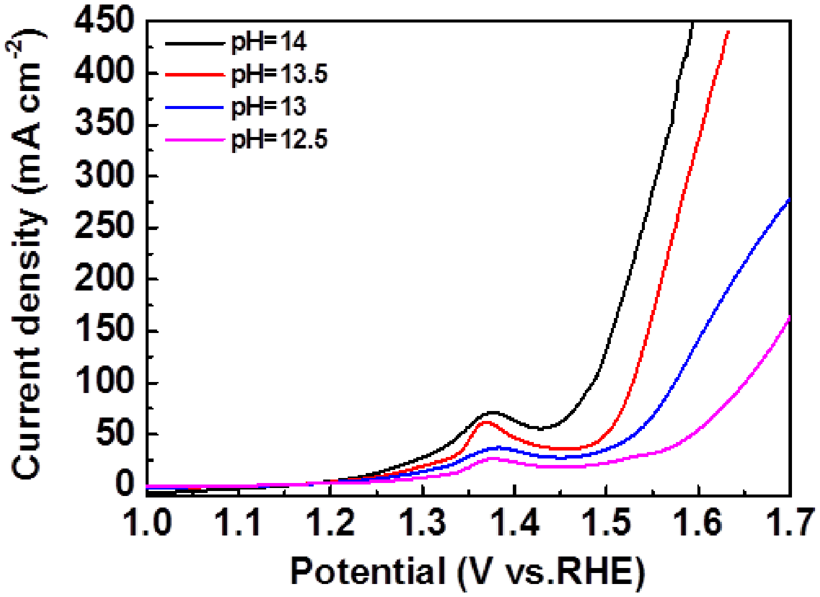

Fig. S16 LSV curves of CoB_2O_4@FeOOH/NF in a KOH solution with different PH range.

Table S2 Comparison of reported electrocatalysts for overall water splitting

Catalysts	Cell Voltages (V)		Stability (h)	Reference
	η_{50}	η_{100}		
CoB_2O_4@FeOOH/NF||Pt/C/NF	**1.537**	**1.576**	125@300 mA cm^{-2}	This work
NC/Ni_3Mo_3N/NF||$NiMoO_4\cdot xH_2O$/NF	1.58	1.71	50 h@500 mA cm^{-2}	[11]
$NiFe(OH)_x$@Ni_3S_2/MoS_2-CC|| Ni_3S_2/MoS_2-CC	-	1.71	48 h@20 mA cm^{-2}	[12]
NiFeCo LDH||NiFeCo phosphide	1.44	1.58	70 h@50 mA cm^{-2}	[13]
$Co_{1-x}Fe_x$-LDH||$Ni_{1-x}Fe_x$-LDH	1.59	1.88	24 h@25 mA cm^{-2}	[14]
FeOOH/Cr-$NiCo_2O_4$/NF|| FeOOH/Cr-$NiCo_2O_4$/NF	1.62	1.65	10 h@20 mA cm^{-2}	[1]
Ni_5P_4/NiP_2/NiFe LDH/NF|| Ni_5P_4/NiP_2/NF	1.60	1.68	50 h@50 mA cm^{-2}	[15]
NiFe LDH-NiSe/NF|| NiFe LDH-NiSe/NF	-	1.84	75 h@12 mA cm^{-2}	[16]
NiFe(OH)x/FeS/IF||MoNi4/MoO2/NF	-	1.68	70 h@300 mA cm^{-2}	[17]
Ni@NCNTs/NF-L||NiFe-L	1.52	2.1	10 h@100 mA cm^{-2}	[18]
$NiFe(OH)_x$/FeS/IF||$MoNi_4$/MoO_2/NF	1.50	1.68	70 h@300 mA cm^{-2}	[19]
NiFe LDH-MoS_x/INF||20%PtC/INF	-	1.72	20 h@100 mA cm^{-2}	[20]
$Co_5Mo_{1.0}O$ NSs@NF|| $Co_5Mo_{1.0}O$ NSs@NF	-	1.90	30 h@10 mA cm^{-2}	[21]
NiFe LDHs/$NiCo_2O_4$/NF|| NiFe LDHs/$NiCo_2O_4$/NF	1.81	1.95	24 h@15 mA cm^{-2}	[22]
NiFe-HD/pre-NF|| CoP/P-NiO/NF	-	1.62	85 h at 100 mA cm^{-2}	[23]

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