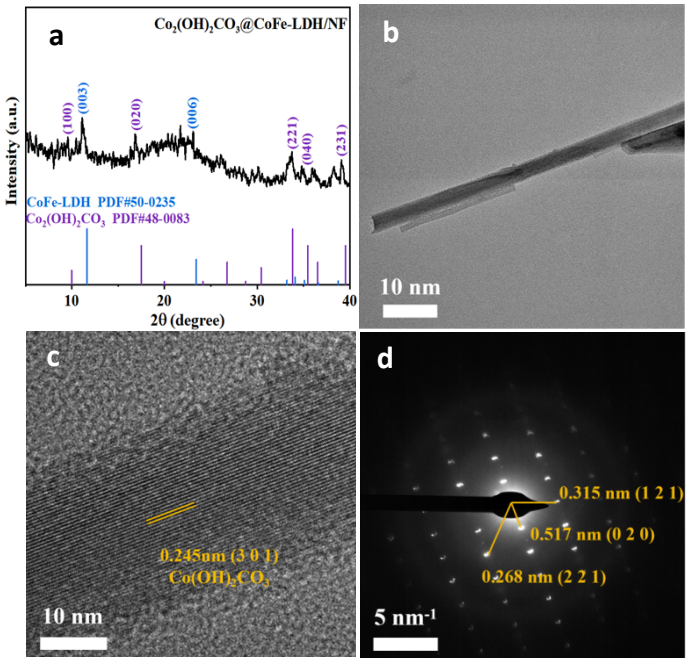
Appendix A Supplementary data

Construction of a $Co_2(OH)_2CO_3$@CoFe-LDH heterostructure on Ni foam with tunable interfacial properties for electrochemical applications

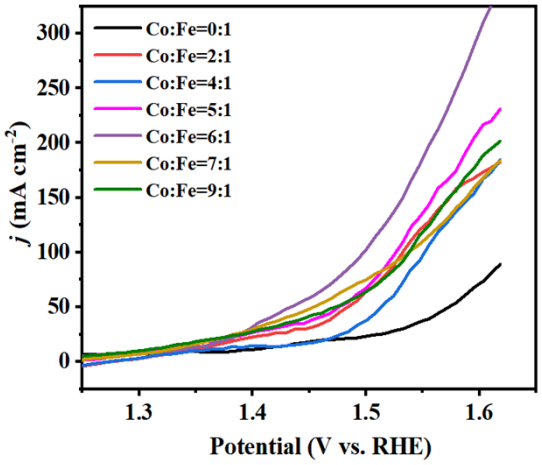
Qi Chen,[a] Hongwei Duan,[a] Yan Song, Yaning Guo,*[a] Hongge Zhang,[a] Feng Zhang,[a] Xiaobin Hu,[a] and Yinfeng Han*[a]

College of Chemistry and Material Engineering, Engineering Research Center of Advanced Ferroelectric Functional Materials, Baoji University of Arts and Sciences, Baoji, Shaanxi, China

*Corresponding authors
E-mail: ggyn1997@163.com
E-mail address: hhanyinfeng@126.com



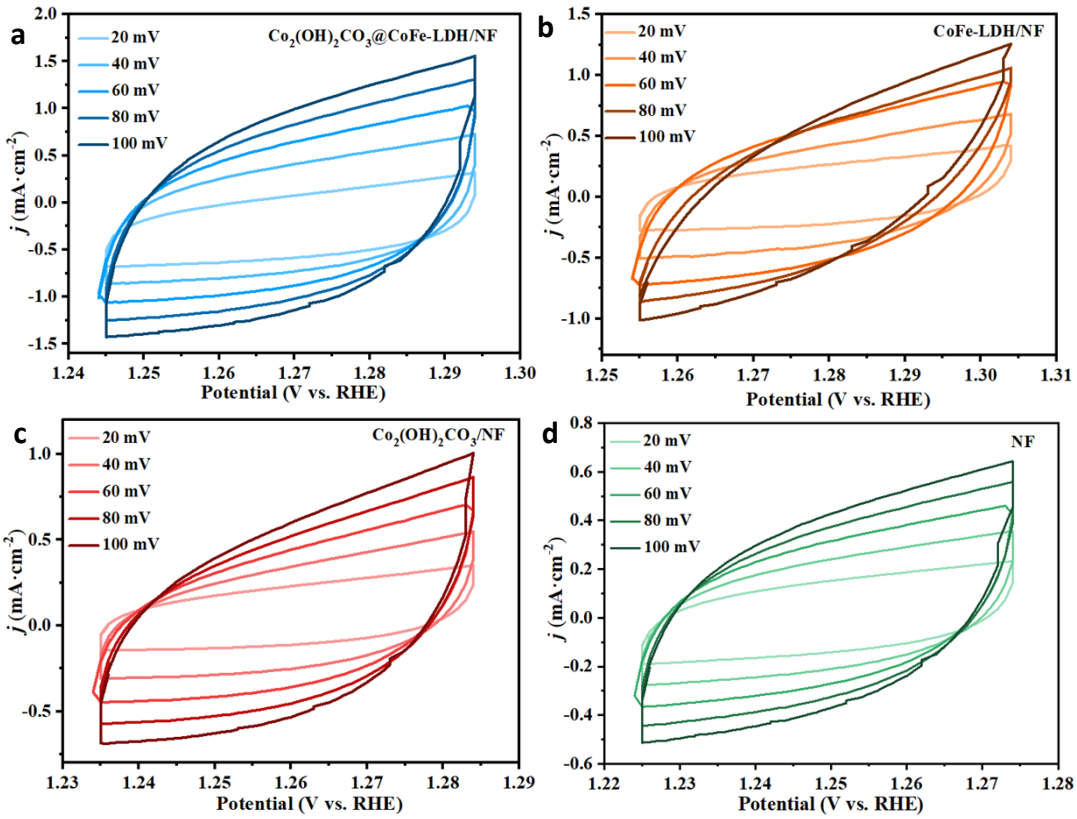
Supplementary Fig. 1. (a) XRD patterns of $Co_2(OH)_2CO_3$@CoFe-LDH/NF ; (b) TEM image; (c) HRTEM image and (d)SAED pattern of the nanoneedle-dominated region.



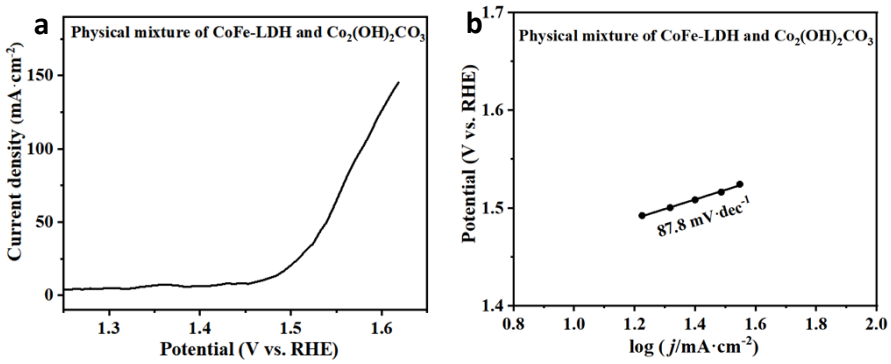
Supplementary Fig. 2 LSV curves of synthetic catalysts with different metal ion ratios.

Supplementary Table 1. The overpotentials required to achieve a current density of 50 mA·cm^{-2} for samples with different metal ion ratios

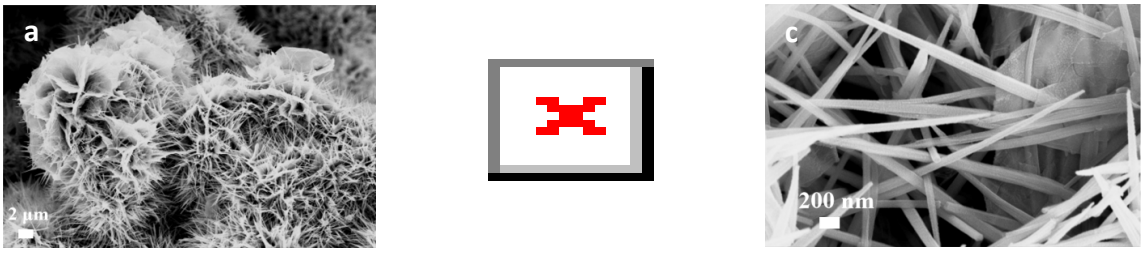
Co^{2+}: Fe^{3+} metal ion ratios	0:1	2:1	4:1	5:1	6:1	7:1	9:1
Overpotential (mV)	343	254.1	283.7	244.6	203.5	224.5	241.1



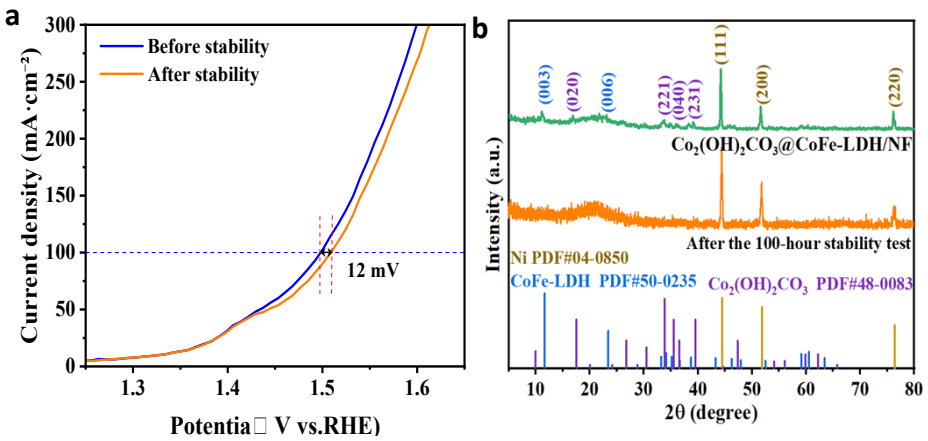
Supplementary Fig. 3 Cyclic voltammograms at different scan rates for (a) $Co_2(OH)_2CO_3$@CoFe-LDH/NF, (b) CoFe-LDH/NF, (c) $Co_2(OH)_2CO_3$/NF, and (d) NF.



Supplementary Fig. 4 (a) LSV curves and (b) the corresponding Tafel slope of the physical mixture of CoFe-LDH and $Co_2(OH)_2CO_3$.



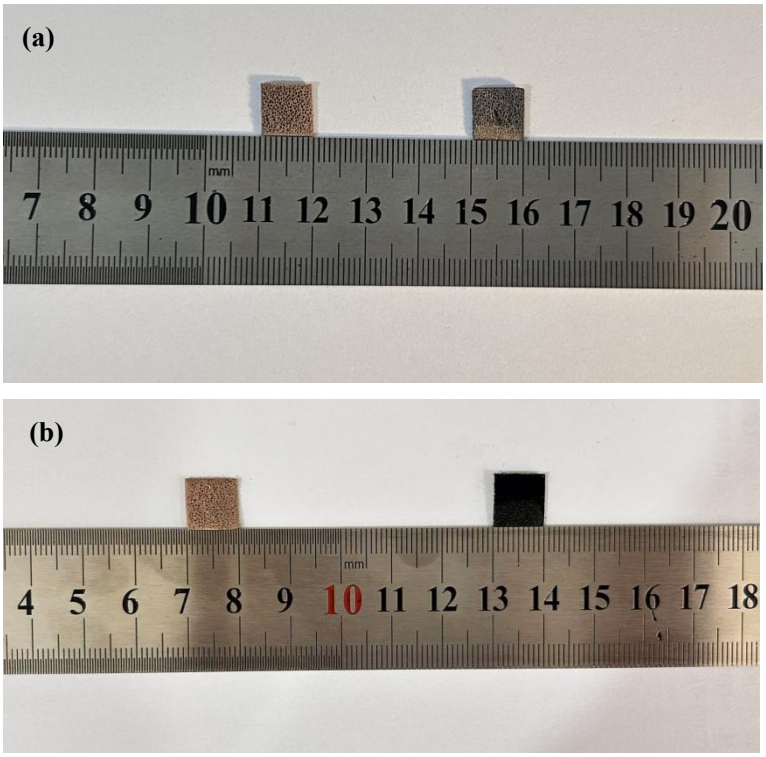
Supplementary Fig. 5 (a-c) SEM images of the catalyst at different magnifications after the durability test



Supplementary Fig. 6 comparison of (a) the LSV curves and (b) corresponding XRD patterns before and after the durability test.

Supplementary Table 2. Comparison of the OER performance of $Co_2(OH)_2CO_3$@CoFe-LDH with previously reported CoFe-LDH based electrocatalysts

Catalysts	η_{10} (mV)	η_{50} (mV)	η_{100} (mV)	Tafel slope ($mV \cdot dec^{-1}$)	Ref
Ru, Ir@CoFe-LDH/IF	-	-	256	49.3	[10]
$Ni_{0.85}Se$@CoFe LDH/NF nanosheet	223	-	280	-	[12]
CoFe-LDH@NiSe	127	285	-	37	[13]
Mo-$NiSe_x$/CoFe LDH	-	-	200	77.3	[14]
MoS_2/CoFe-LDH/NF nanosheet	224	255	278	57.91	[15]
CoFe LDH/MoS_2/Ni_3S_2/NF	228	277	-	54.66	[23]
Ni(OH)S@CoFe-LDH/NF	-	-	238	48.2	[24]
ZIF@CoFe-LDH NCs nanocage	-	278	-	50	[17]
CoFe-LDH@MnCo-CH nanosheet	250	276	290	50.0	[36]
CoFe LDH/$Co_2Fe_2O_4$ nanosheet	162	-	400	85.6	[39]
Co-LDH@ZIF-67 nanosheet	187	-	290	59	[31]
CoFe-LDH/GF nanowire	252	-	285	61	[51]
CoFe-LDH@MnCo-CH nanowire	250	-	-	50.0	[55]
CoFe-LDH	-	-	360	38.6	[34]
$Ce_{0.2}$CoFe-LDH	227	-	310	48.30	[40]
CoFe/a-NiFe LDH	-	-	265	38.8	[8]
$Co_2(OH)_2CO_3$@CoFe-LDH/NF	104	203.5	267.2	57.6	This work



Supplementary Fig. 7 (a) Digital photograph of $Co_2(OH)_2CO_3$@CoFe-LDH/NF unreacted samples and LSV reaction tests, (b) Digital photograph of $Co_2(OH)_2CO_3$@CoFe-LDH/NF unreacted samples and stability tests.