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Supporting Information

Self-standing 2D/2D Co_3O_4@FeOOH Nanosheet Arrays as Promising Catalyst for Oxygen Evolution Reaction

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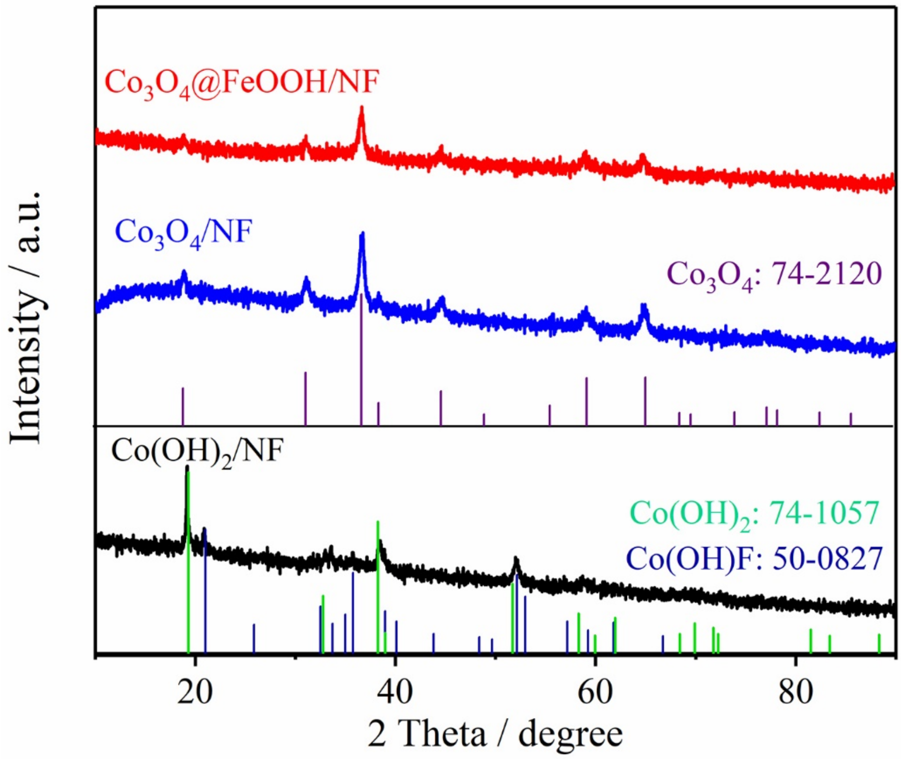


Figure S1. XRD pattern of $Co(OH)_2$ nanosheet arrays (black line), Co_3O_4 nanosheet arrays (blue line) and Co_3O_4@FeOOH nanosheet arrays (red line)

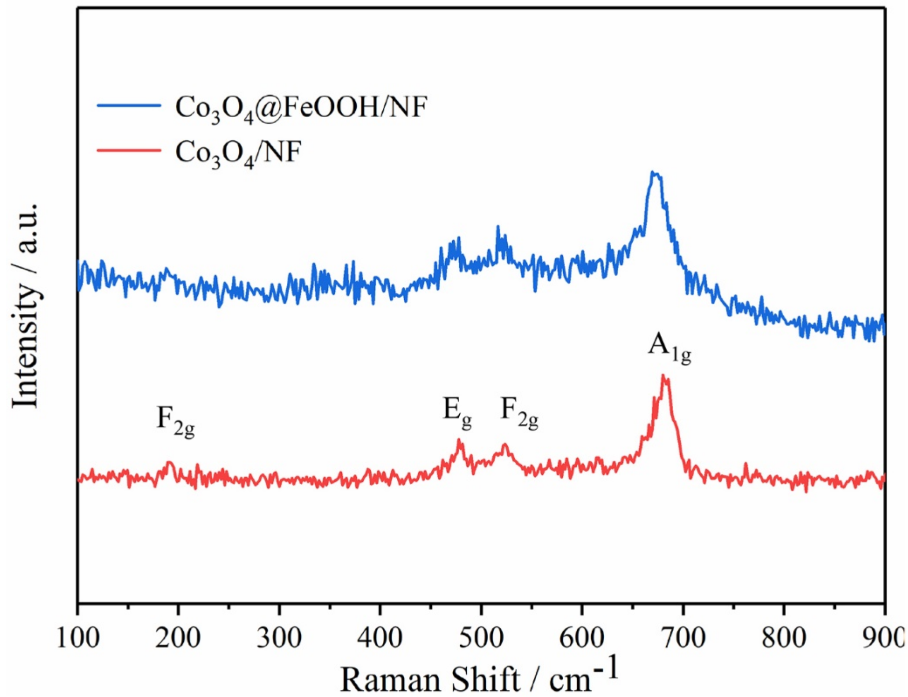


Figure S2. Raman spectra of Co_3O_4 /NF (red line) and Co_3O_4@FeOOH/NF (blue line)

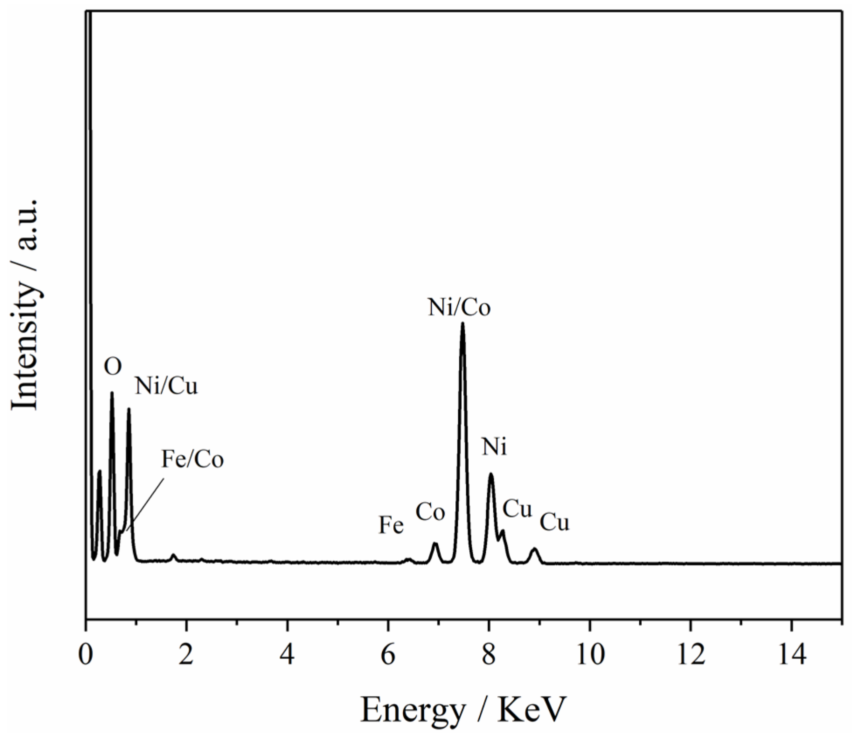


Figure S3. EDX spectrum of Co_3O_4@FeOOH nanosheets.

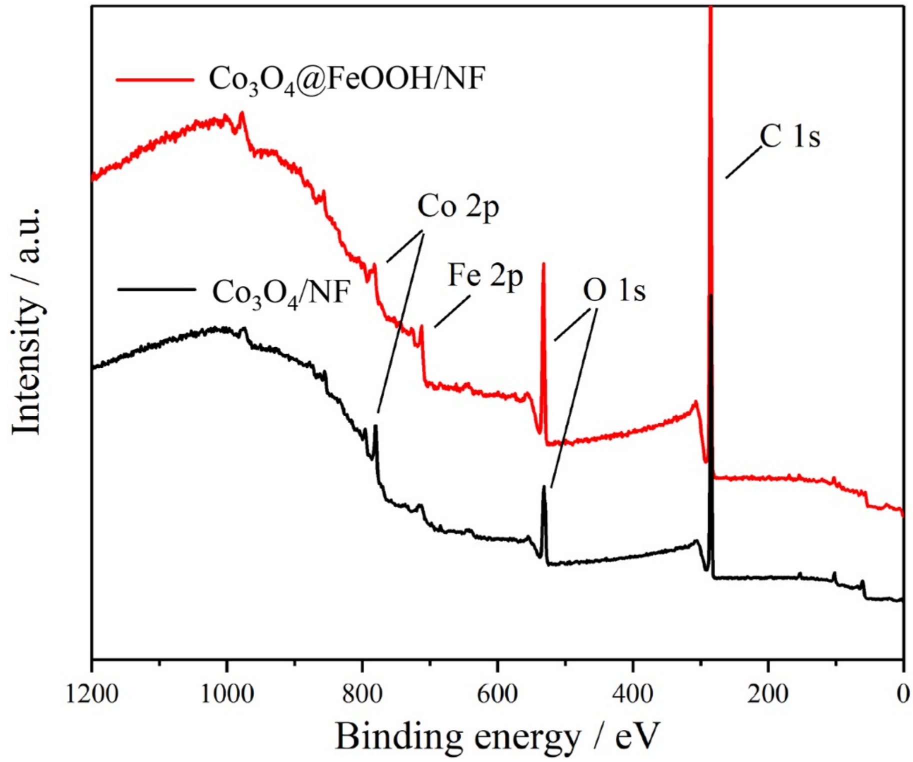


Figure S4. Survey XPS spectra of Co_3O_4@FeOOH/NF (red) and Co_3O_4/NF (black)

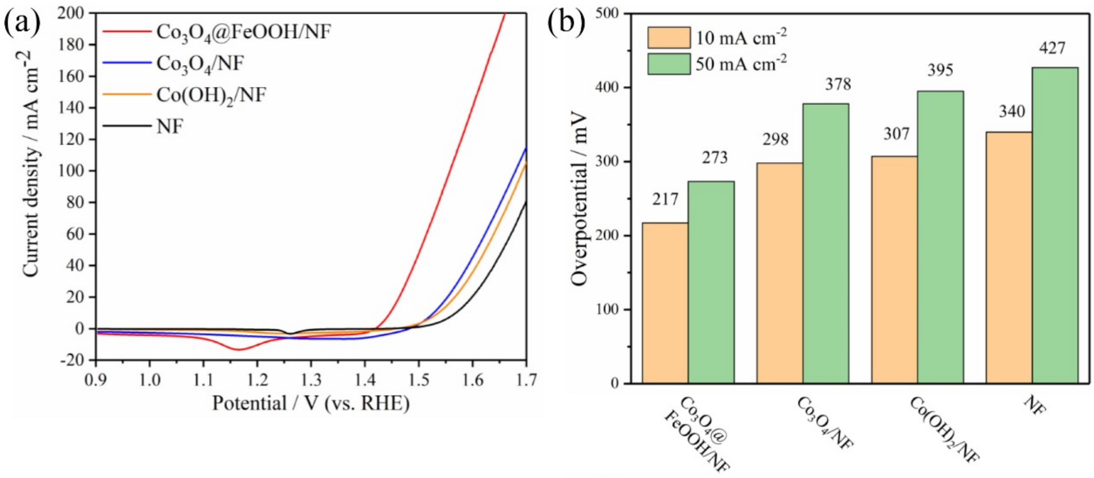


Figure S5. (a) polarization curves of Co_3O_4@FeOOH/NF, Co_3O_4/NF $Co(OH)_2$/NF and NF without iR compensation; (b) bar graph of overpotentials derived from polarization curves.

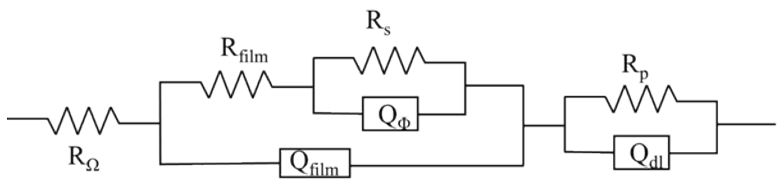


Figure S6. The equivalent circuit used for modeling the measured electrochemical response. R_Ω represents solution resistance; Q_{film} and R_{film} are represented as the dielectric property and resistance of catalyst film, respectively. Q_d is related to double layered capacitance and $Q_\Phi$models the relaxation of the charge associated with the adsorbed intermediate. R_s and R_p are related with the kinetics of the interfacial charge transfer reaction. When resistance of oxide film is negligible compared with solution resistance, this equivalent circuit is equal to that of the conventional model of R(RQ) . Note that, as the electrodes in our work featuring porous nature, constant phase element (CPE) was selected instead of capacitance element that was chosen in the literature reference.

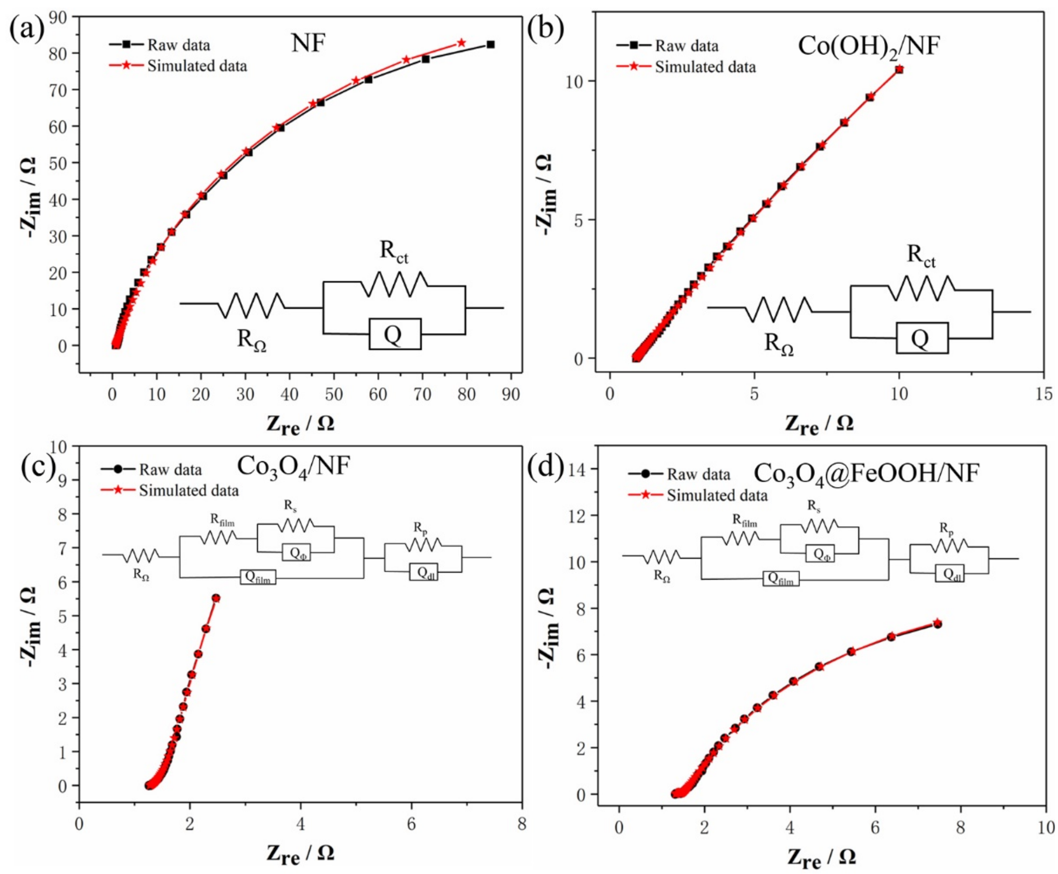
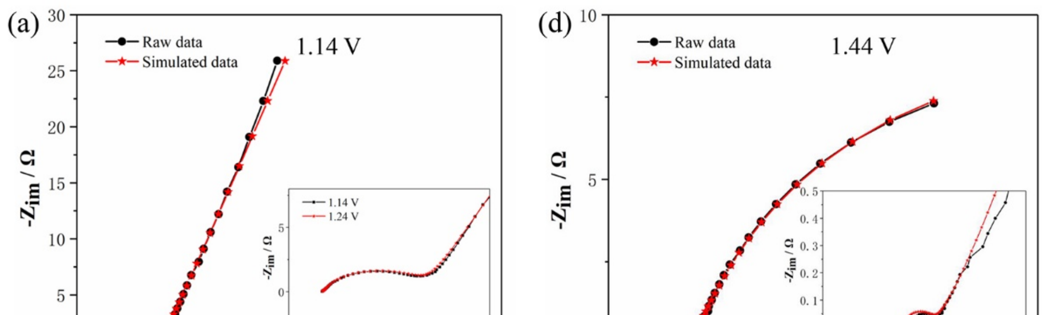


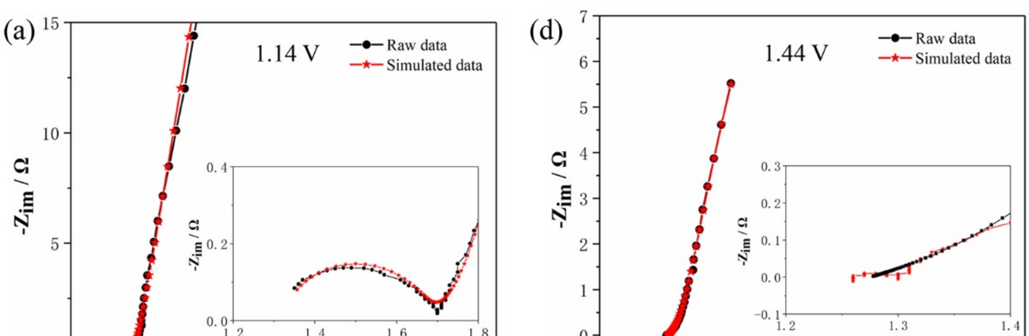
Figure S7. Equivalent circuit simulation results of NF (a), $Co(OH)_2$/NF (b), Co_3O_4/NF (c) and Co_3O_4@FeOOH/NF (d).

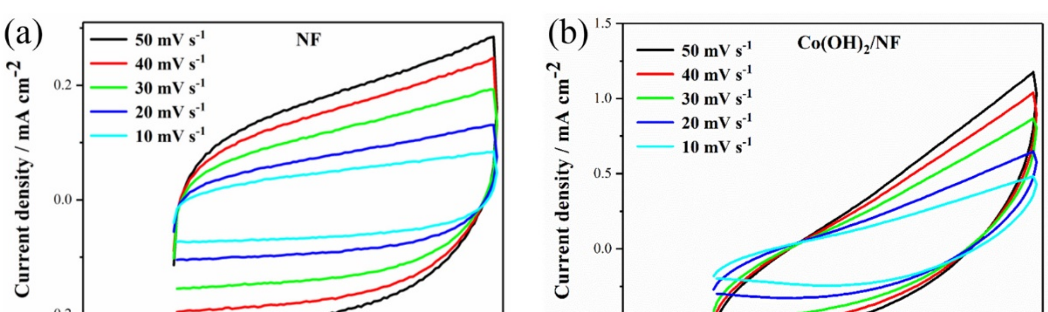
Table S1. Optimum values of circuit elements for NF, $Co(OH)_2$/NF, Co_3O_4/NF and

Co_3O_4@FeOOH/NF by fitting the impedance data of Figure S11

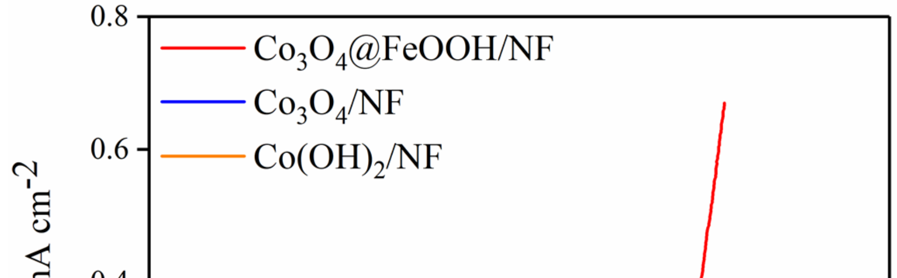
Electrode name	Element value			
NF	$R_{\Omega} = 0.829\ \Omega$	$R_{ct} = 233.3\ \Omega$		
$Co(OH)_2$/NF	$R_{\Omega} = 0.905$	$R_{ct} = 146.8$		
Co_3O_4/NF	$R_{\Omega} = 1.27$	$R_{film} = 0.31$	$R_S = 1.31$	$R_S = 76.59$
Co_3O_4@FeOOH/NF	$R_{\Omega} = 1.32$	$R_{film} = 0.73$	$R_S = 0.12$	$R_S = 18.76$




(a)
1.14 V
Raw data
Simulated data
-Zim / Ω
(d)
1.44 V
Raw data
Simulated data
-Zim / Ω



(a)
NF
50 mV s-1
40 mV s-1
30 mV s-1
20 mV s-1
10 mV s-1
Current density / mA cm-2
0.2
0.0
(b)
Co(OH)2/NF
50 mV s-1
40 mV s-1
30 mV s-1
20 mV s-1
10 mV s-1
Current density / mA cm-2
1.5
1.0
0.5
0.0


0.8
0.6
0.4
Co3O4@FeOOH/NF
Co3O4/NF
Co(OH)2/NF
mA cm-2

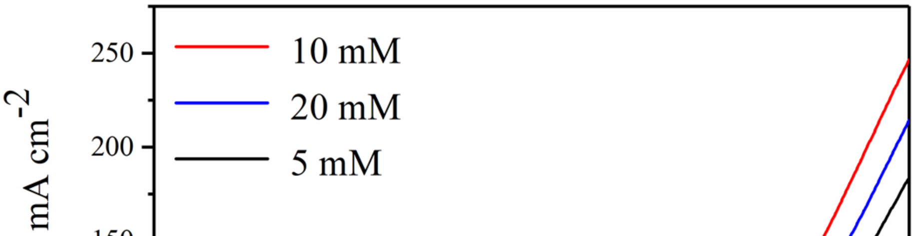

10 mM
20 mM
5 mM
250
200
mA cm-2

Figure S12. polarization curves of Co_3O_4@FeOOH/NF obtained under 5 mM (black line), 10 mM (red line) and 20 mM (blue line) $(NH_4)_2Fe(SO_4)_2$ solution.

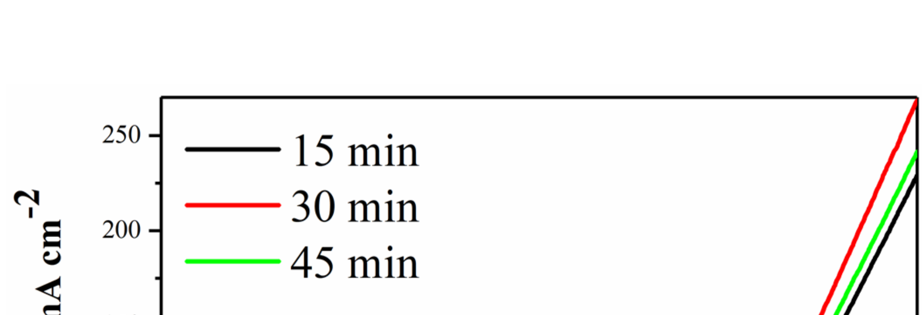
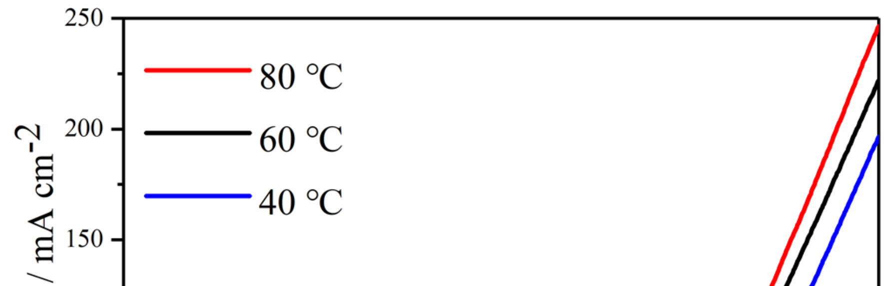
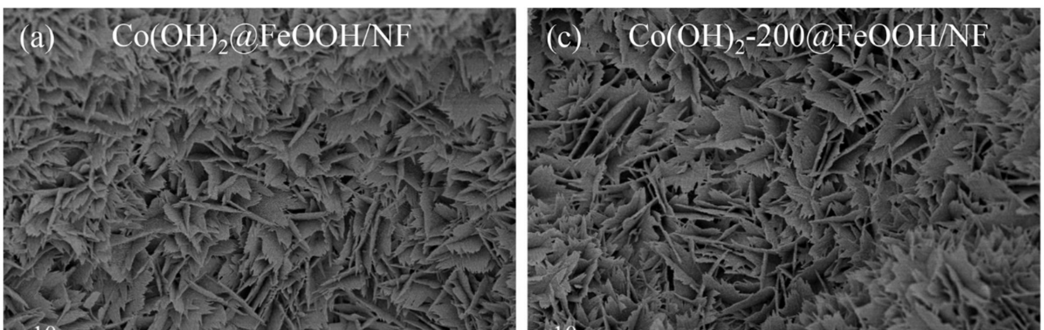


Figure S13. polarization curves of Co_3O_4@FeOOH/NF obtained with the reaction time of 15 min (black line), 30 min (red line) and 45 min (green line).




(a)
Co(OH)2@FeOOH/NF
(c)
Co(OH)2-200@FeOOH/NF

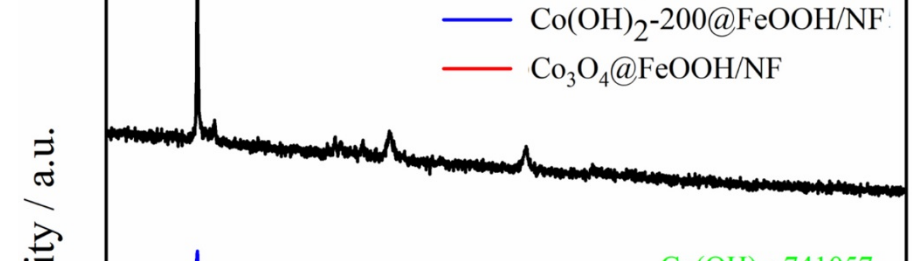

Co(OH)2@FeOOH/NF
Co(OH)2-200@FeOOH/NF
Co3O4@FeOOH/NF

Table S1. Comparison of the OER performance of **Sample 1** with the recently reported cobalt based catalysts.

Electrocataylst	electrolyte	j mA	η_j mV	Tafel slop	Durability h	Ref.

		cm^{-2}		$mV\ dec^{-1}$		
Co_3O_4@FeOOH/NF	1.0 M KOH	10 50 100	209 235 253	48.9	24	This work
FeOOH(Se)/IF	1.0 M KOH	10 100	287 364	54	15	J. Am. Chem. Soc. 2019, 141, 7005−7013
S-FeOOH/CC	1.0 M KOH	10 50 100	244 287 308	59	100	Adv. Funct. Mater. 2022, 32, 2112674
FeOOH/Ni_3N	1.0 M KOH	10	244	65	50	Appl. Catal. B: Environmental 269 (2020) 118600
CoP/FeOOH	1.0 M KOH	10	250	56.6	20	Chem. Eng. J 428 (2022) 131130
Fe_3O_4/Co_3S_4	1.0 M KOH	10	270	56	24	J Mater Chem A, 2017, 5(19): 9210-6
NiCoP/C@FeOOH	1.0 M KOH	10 50	271 321	69	14	Nanoscale, 2019, 11(42): 19959-68.
γ-FeOOH/NF-6M	1.0 M KOH	10 100	286 316	51	24	Adv. Mater. 2021, 33, 2005587
$CoSe_2$@FeOOH NAs/CC	1.0 M KOH	10	253	69	20	Adv. Mater. Interfaces 2020, 2001310
Ni_3S_2@MoS_2/FeOOH	1.0 M KOH	10	234	49	50	Appl. Catal. B: Environmental 244 (2019) 1004–1012
CoFeO@N/S-rGO	1.0 M KOH	10 100	248 400	40	100	J. Mater. Chem. A, 2018, 6, 15728–15737
3-CoFeW	1.0 M KOH	10	192	36	30	J. Am. Chem. Soc. 2019, 141, 1, 232–239
CeO_2/Co_3O_4	1.0 M KOH	10	265	68.1	20	ACS Catal. 2019, 9, 6484−6490