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Electronic Supplementary Information

Fe-induced electronic optimization of mesoporous Co-Ni oxide nanosheets as an efficient binder-free electrode for oxygen evolution reaction

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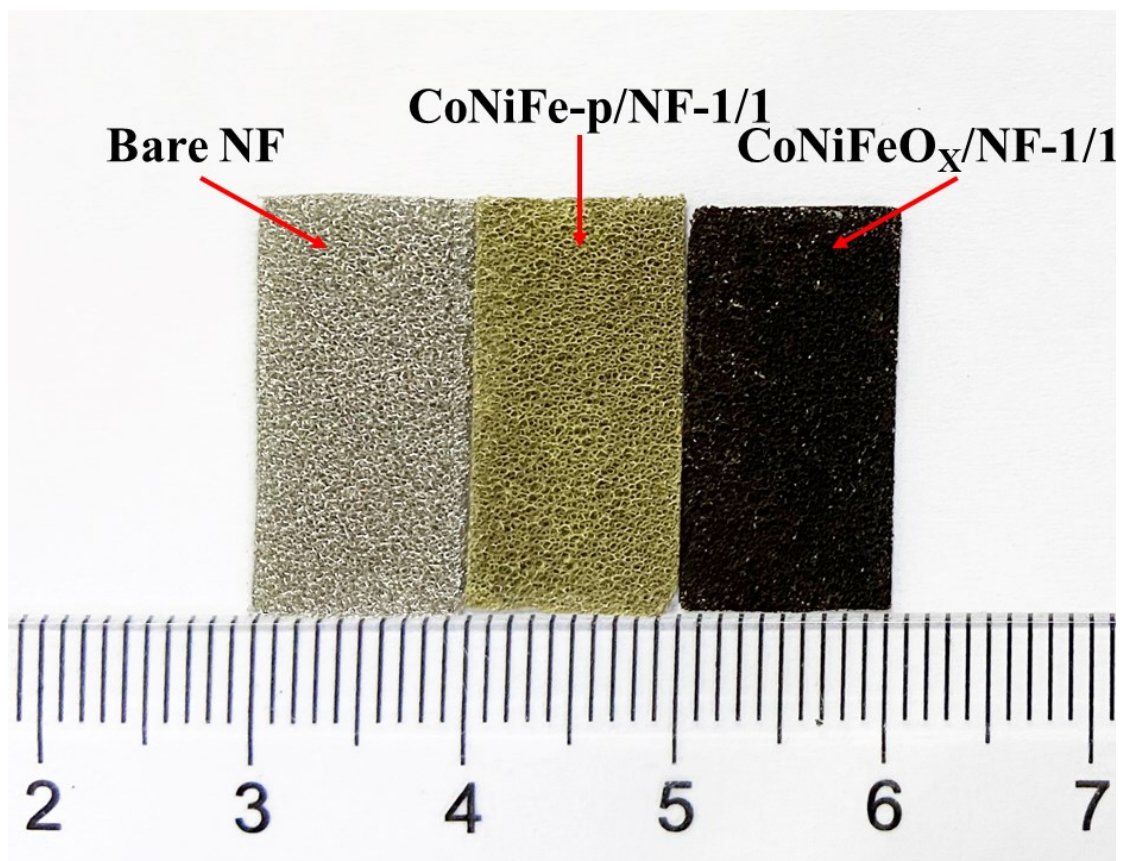


Figure S1. Optical image of bare NF (L), CoNiFe precursor/NF-1/1 (M) and CoNiFeO_x/NF-1/1 (R).

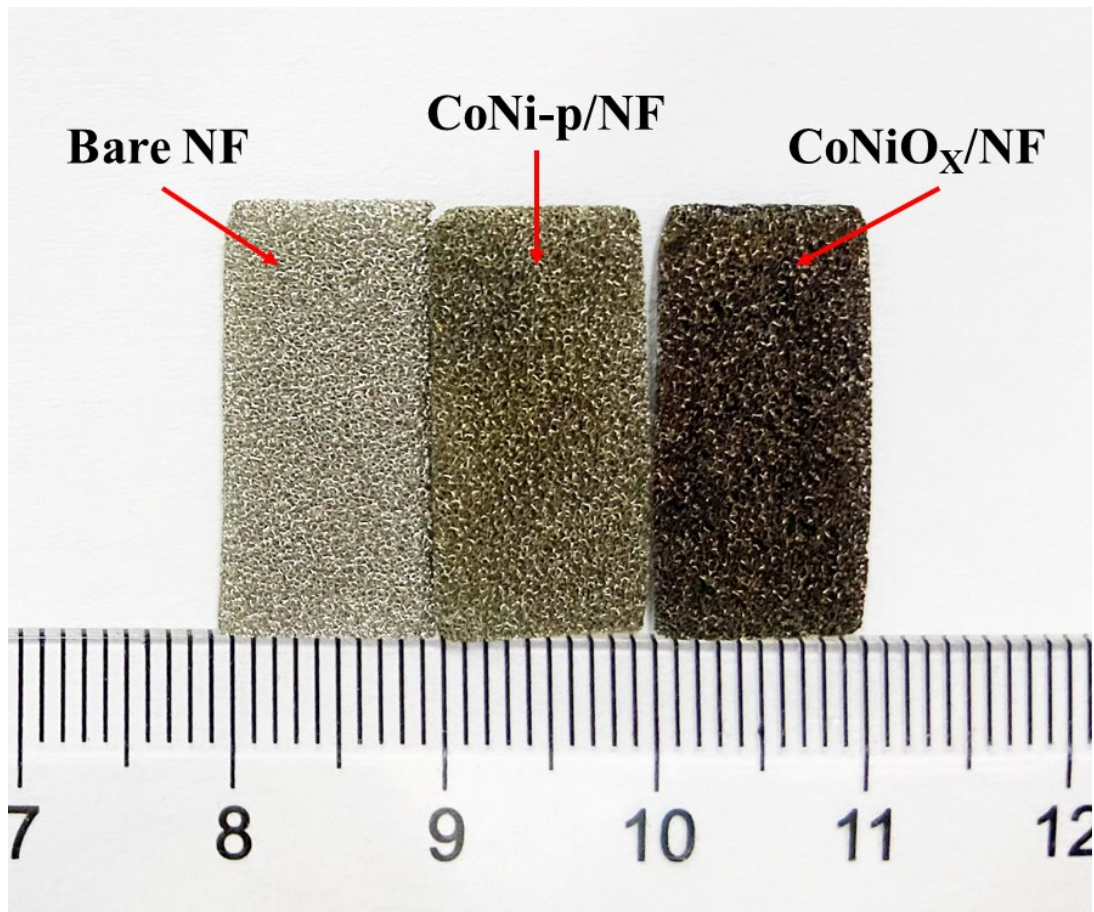


Figure S2. Optical image of bare NF (L), CoNi-p/NF (M) and CoNiO_x/NF (R).

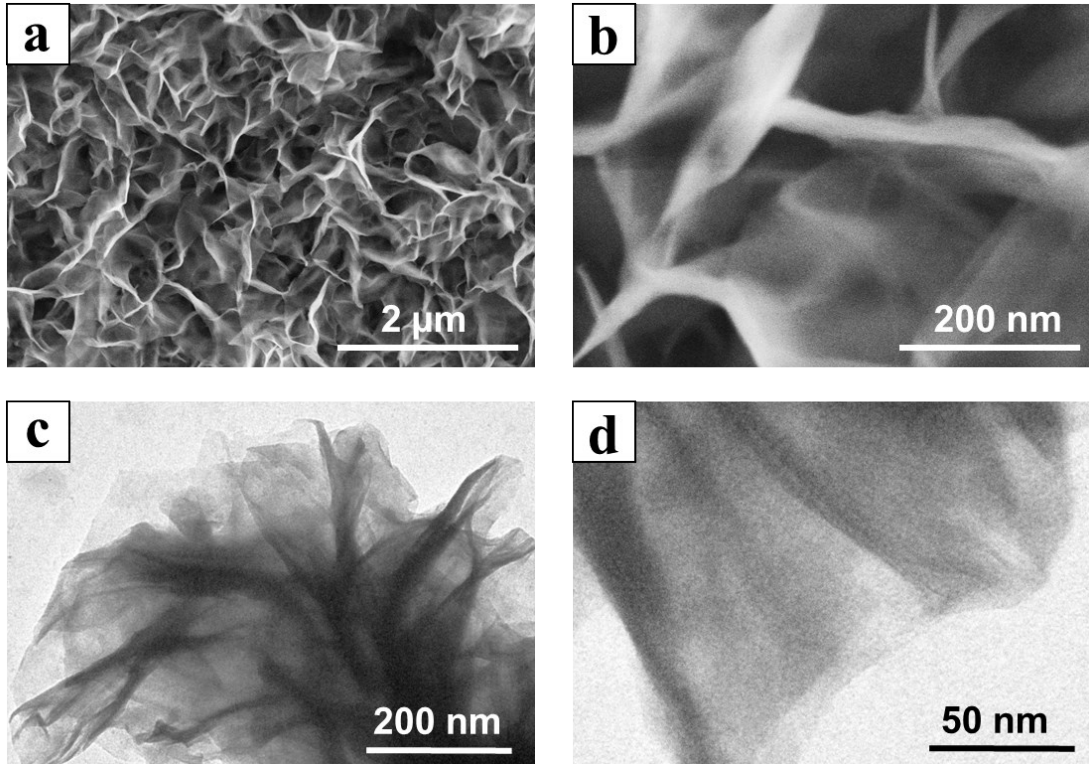


Figure S3. (a-b) SEM and (c-d) TEM images of CoNiFe-p/NF-1/1 nanosheets (scraped from Ni foam) at different magnifications.

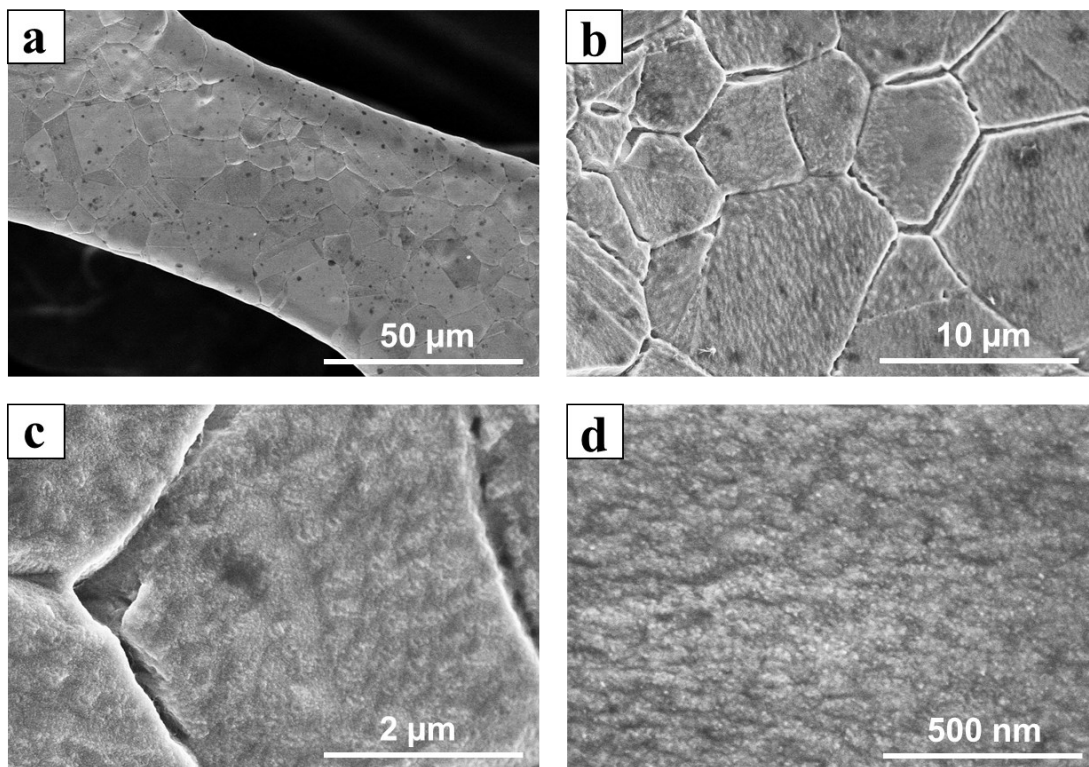


Figure S4. SEM images of CoNiO_x/NF at different magnifications.

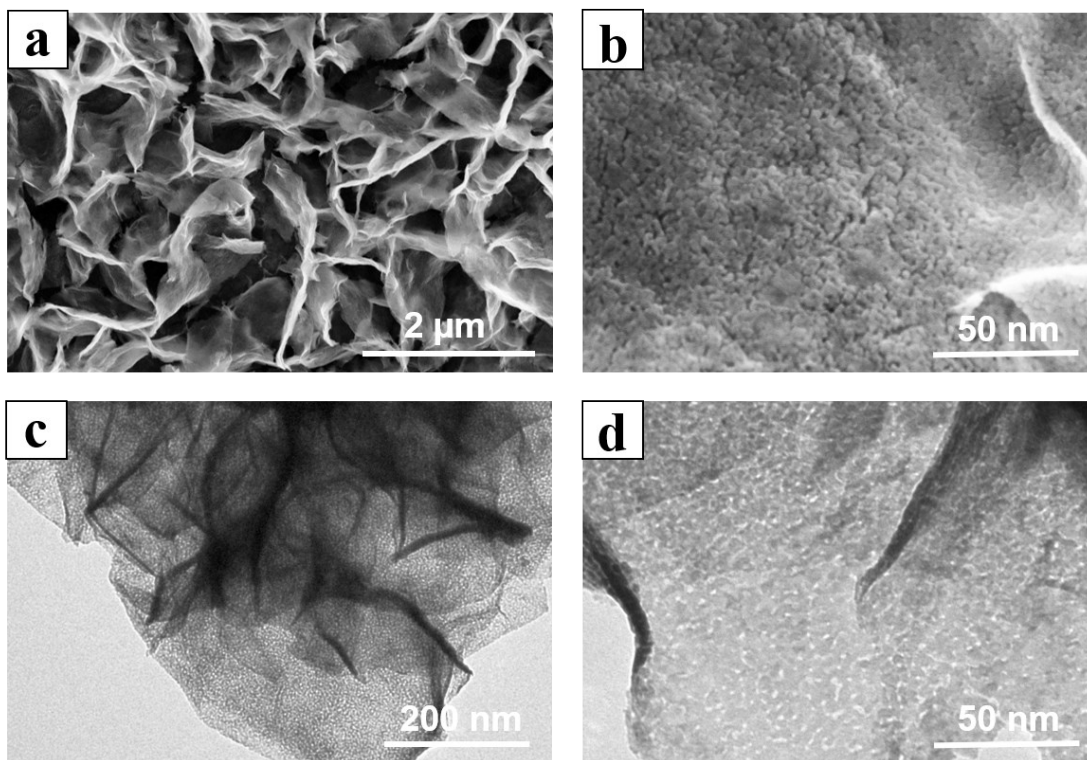


Figure S5. (a-b) SEM and (c-d) TEM images of CoNiFeO_x/NF-2/1 nanosheets (scraped from Ni foam) at different magnifications.

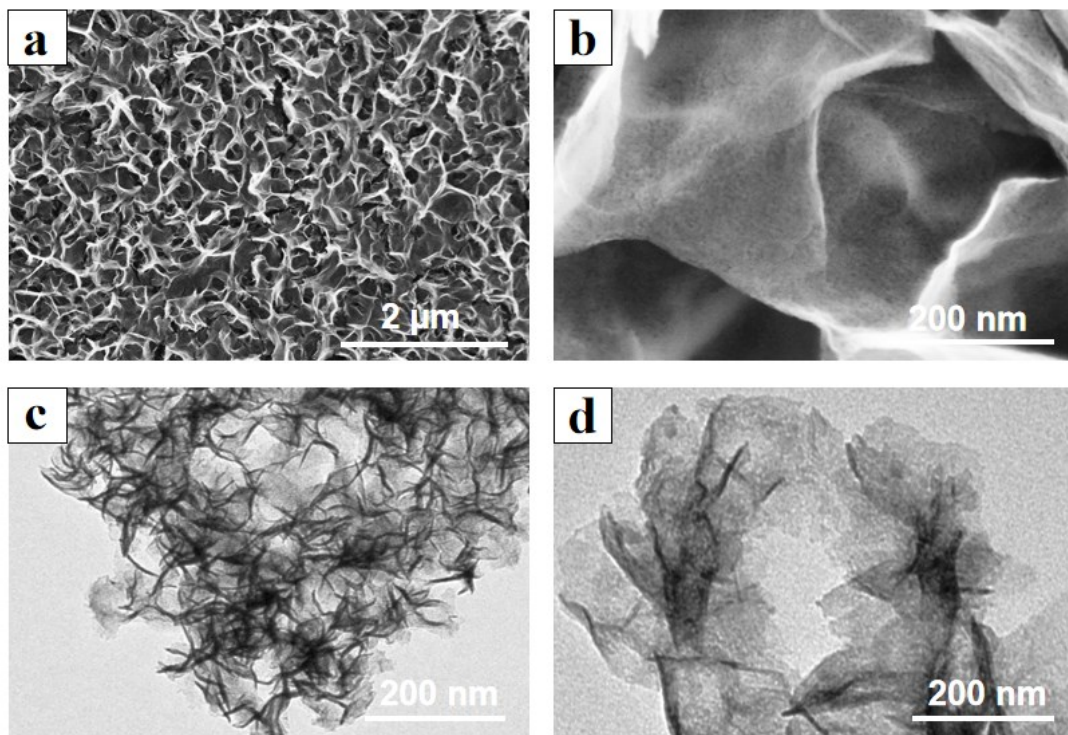


Figure S6. (a-b) SEM and (c-d) TEM images of CoNiFeO_x/NF-1/2 nanosheets (scraped from Ni foam) at different magnifications.

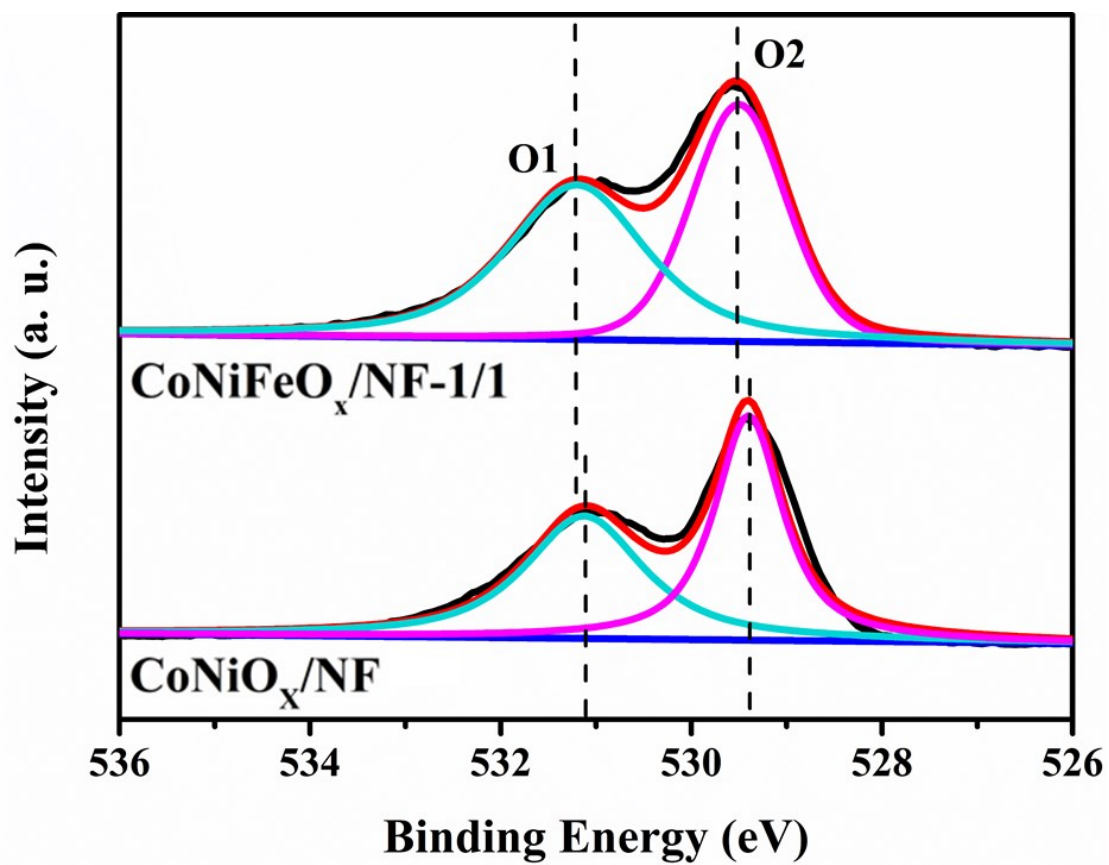


Figure S7. O 1s XPS spectras of CoNiFeO_x/NF-1/1 and CoNiO_x/NF.

Table S1 XPS survey scans for atomic ratio of metal (Ni, Co and Fe)

Catalysts	Ni (atomic %)	Co (atomic %)	Fe (atomic %)
CoNiFeO _x /NF-1/1	14.5	8.1	12.8
CoNiO _x /NF	20.5	5.6	-

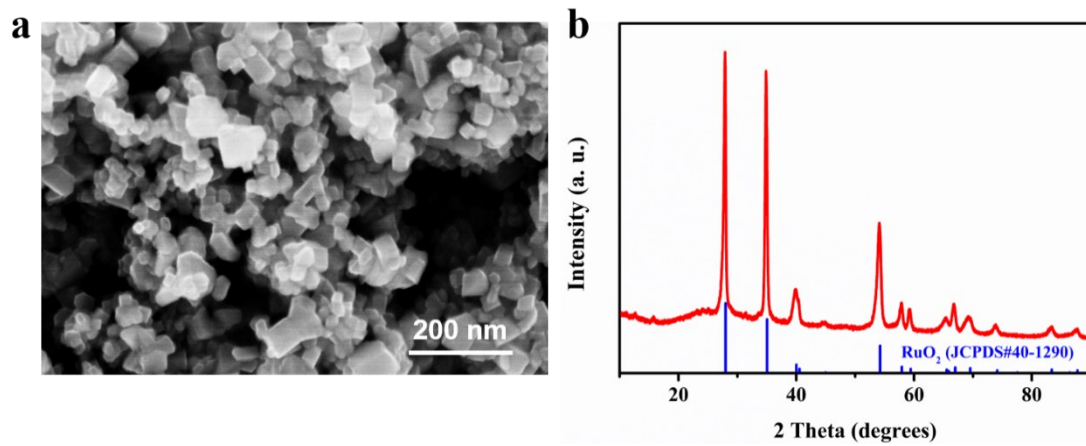


Figure S8. (a) SEM image and (b) XRD pattern of commercial RuO₂.

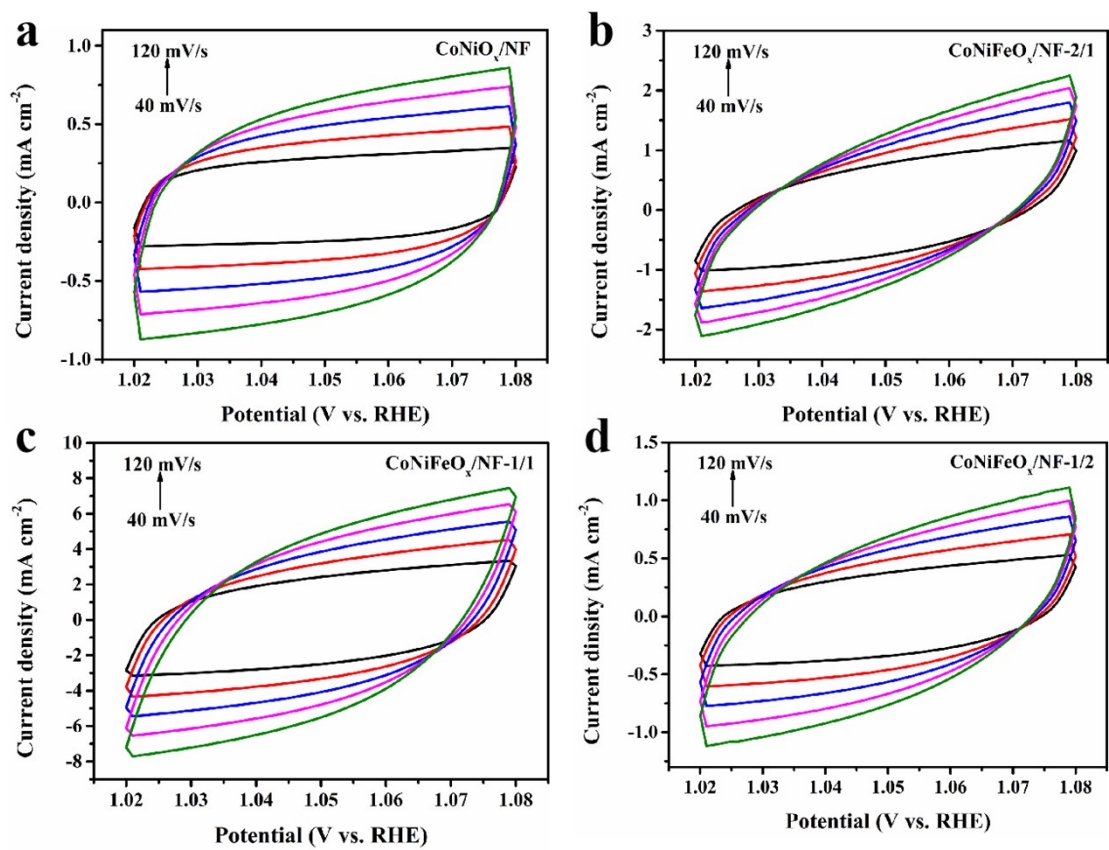


Figure S9 The cyclic voltammograms of (a) CoNiFeO_x/NF-1/1, (b) CoNiFeO_x/NF-2/1, (c) CoNiFeO_x/NF-1/2, and (d) CoNiO_x/NF from 40 to 120 mV/s at 1.05 V vs. RHE.

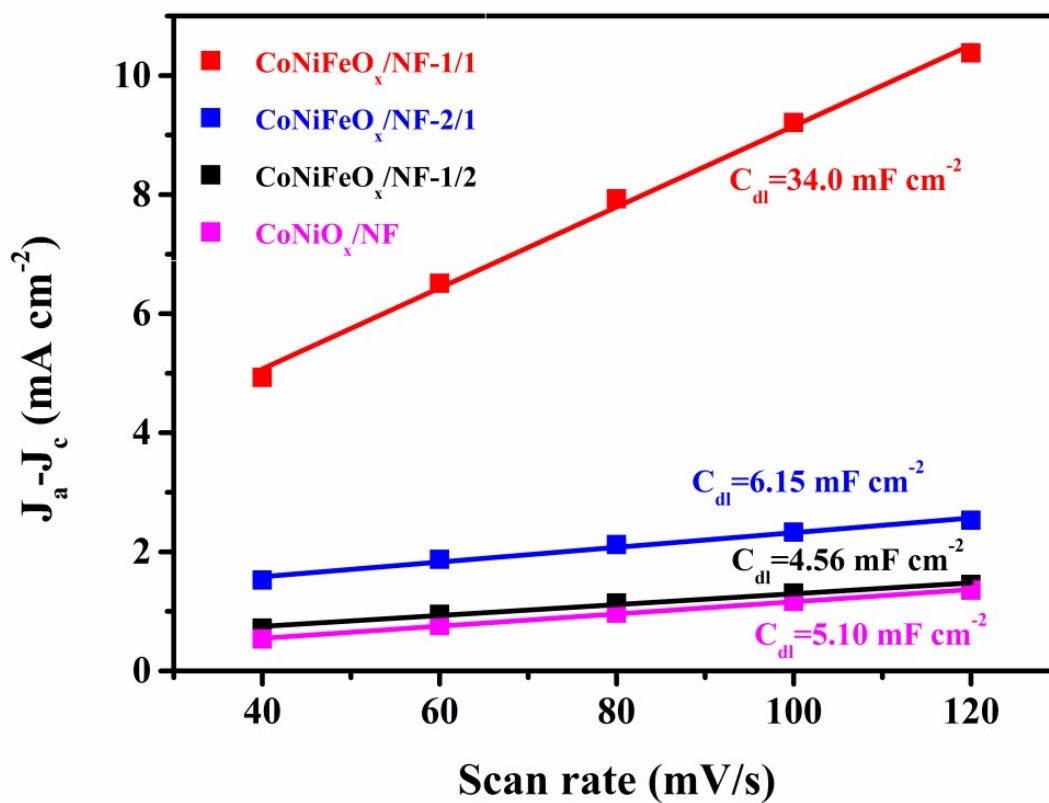


Figure S10 Capacitive current as a function of the scan rate for CoNiFeO_x/NF-1/1, CoNiFeO_x/NF-2/1, CoNiFeO_x/NF-1/2, and CoNiO_x/NF.

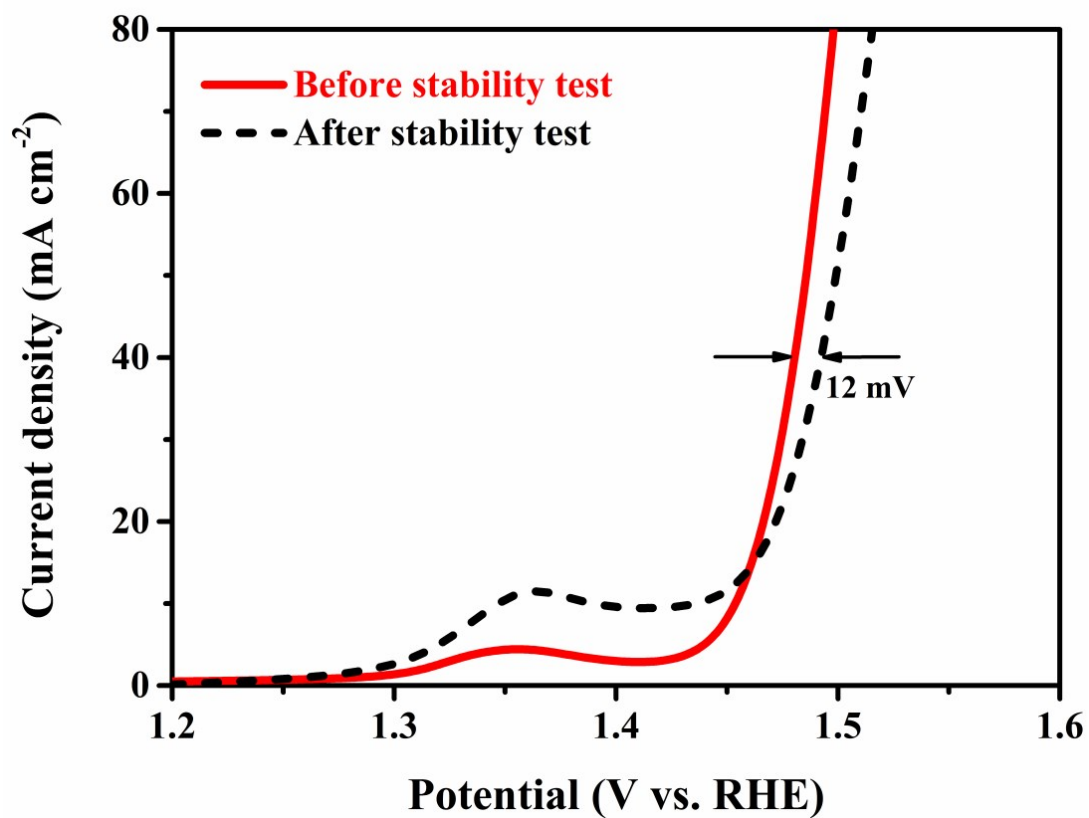


Figure S11. LSV curves of CoNiFeO_x/NF-1/1 before and after electrochemical durability testing for 250 h.

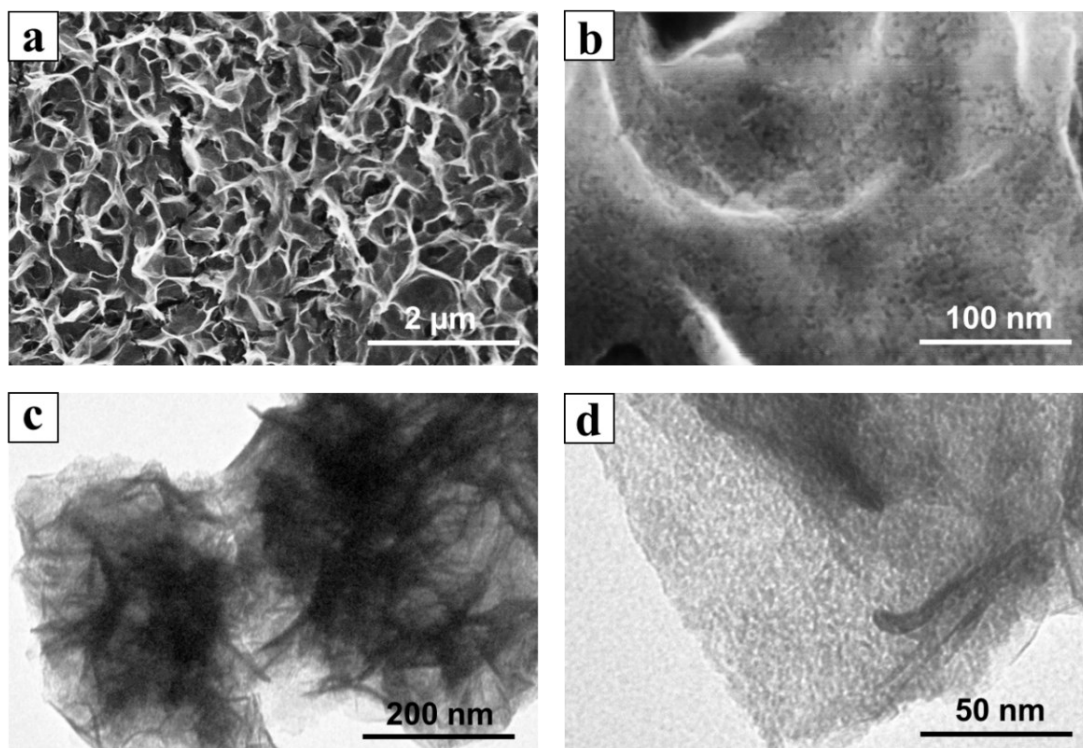


Figure S12. (a-b) SEM and (c-d) TEM images of CoNiFeO_x/NF-1/1 after electrochemical durability testing for 250 h.

Table S2 Comparisons of the electrocatalytic activities of recently reported OER catalysts

Catalysts	Overpotential(mV) @ a specific current density	Tafel slope (mV dec ⁻¹)	Stability	Refs
CoNiFeO_x/NF-1/1	221@10 mA cm⁻²	43.8	250 h@20 mA cm⁻²	This work
NiFe LDH	239@10 mA cm ⁻²	66.3	24 h@10 mA cm ⁻²	[2]
A-NiFe-LDH	241@10 mA cm ⁻²	55	10 h@10 mA cm ⁻²	[7]
Ni-Co-Fe oxide	279@10 mA cm ⁻²	61	24 h@1.53 V	[16]
CoFe hydroxide	260@10 mA cm ⁻²	48.7	25 h@10 mA cm ⁻²	[17]
Co-Fe-O	260@10 mA cm ⁻²	53	60000 s@1.49 V	[19]
CoFe-H	280@10 mA cm ⁻²	28	40 h@10 mA cm ⁻²	[21]
Fe ₂ -NiCoP	293@50 mA cm ⁻²	37.8	22 h@10 mA cm ⁻²	[23]
Co _{0.5} Fe _{0.5} OOH-NSUPs	220@20 mA cm ⁻²	38.2	200 h@40 mA cm ⁻²	[24]
FeCoOOH/CC	259@10 mA cm ⁻²	34.9	100 h@20 mA cm ⁻²	[25]
NiFe _x /NiFe ₂ O ₄ @NC	262@10 mA cm ⁻²	51.4	150 h@10 mA cm ⁻²	[26]
CoFe ₂ O ₄ /NF	266@10 mA cm ⁻²	53	24 h@10 mA cm ⁻²	[27]
Co _{0.75} Fe _{0.25} P	270@10 mA cm ⁻²	48.2	18 h@1.5 V	[29]
CoFe ₂ O ₄	342@10 mA cm ⁻²	57.1	15 h@1.57 V	[30]
CoOOH	245@10 mA cm ⁻²	53.9	250 h@10 mA cm ⁻²	[31]
Fe@Ni(OH) ₂ /NF	250@10 mA cm ⁻²	46	500 h@10 mA cm ⁻²	[35]
CoFe-LDH/NCO/NF	273@20 mA cm ⁻²	108	32 h@20 mA cm ⁻²	[36]
Fe-doped NiCoO ₂	302@10 mA cm ⁻²	42	10 h@1.53 V	[37]
NiFeCo-LDH/CF	249@10 mA cm ⁻²	42	20 h@1.48 V	[41]
2.5Fe-NiCoP/PBA HNCs	290@10 mA cm ⁻²	70	40 h@10 mA cm ⁻²	[42]
Fe _{0.4} Ni _{0.6} -alloy	261@50 mA cm ⁻²	67	80 h@250 mA cm ⁻²	[43]
Ni _{0.8} Fe _{0.2} /Co-H NAs/NF	231@10 mA cm ⁻²	32.9	135 h@10 mA cm ⁻²	[44]
CoNiFeO _x -NC	265@50 mA cm ⁻²	64.1	40 h@1.49 V	[45]