Electronic Supplementary Material (ESI) for Dalton Transactions.

Supplementary Information

Self-supported wire-in-plate NiFeS/CoS nanohybrids with hierarchical structure for efficient overall water splitting

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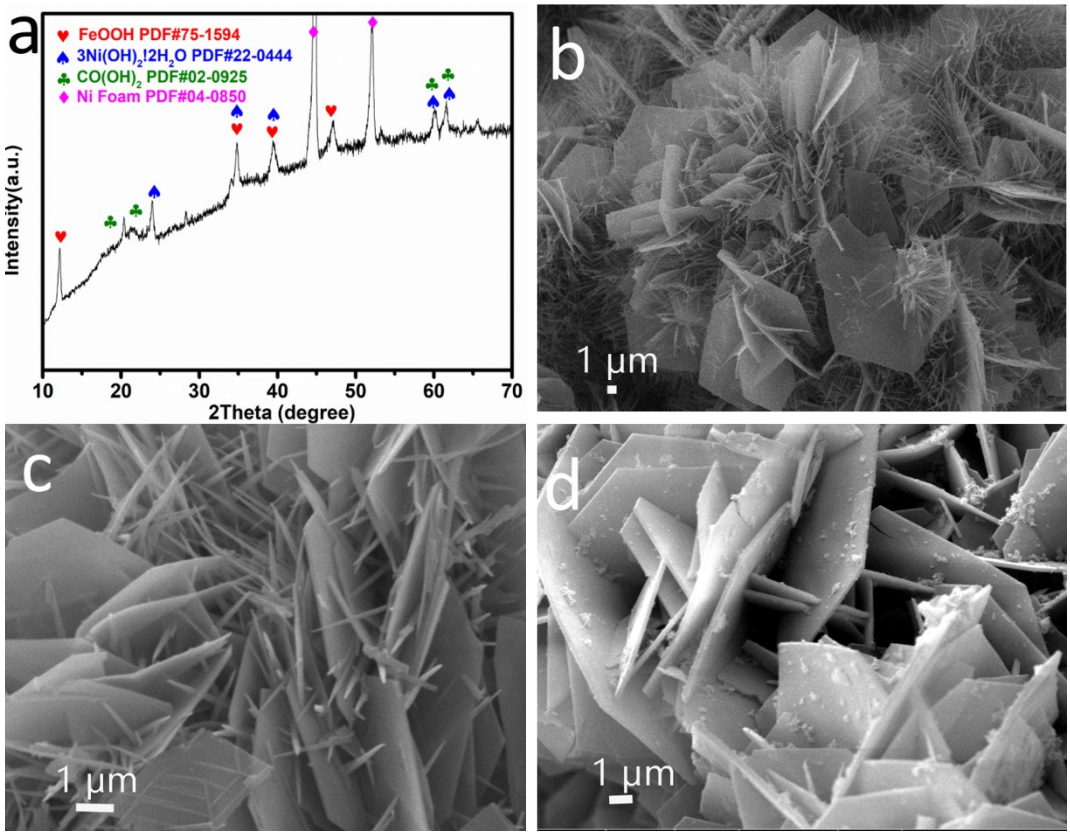


Fig. S1 (a) The XRD pattern of NiFe LDHs/$Co(OH)_2$; (b) and (c) SEM images of NiFe LDHs/$Co(OH)_2$; (d) SEM image of NiFe LDHs.

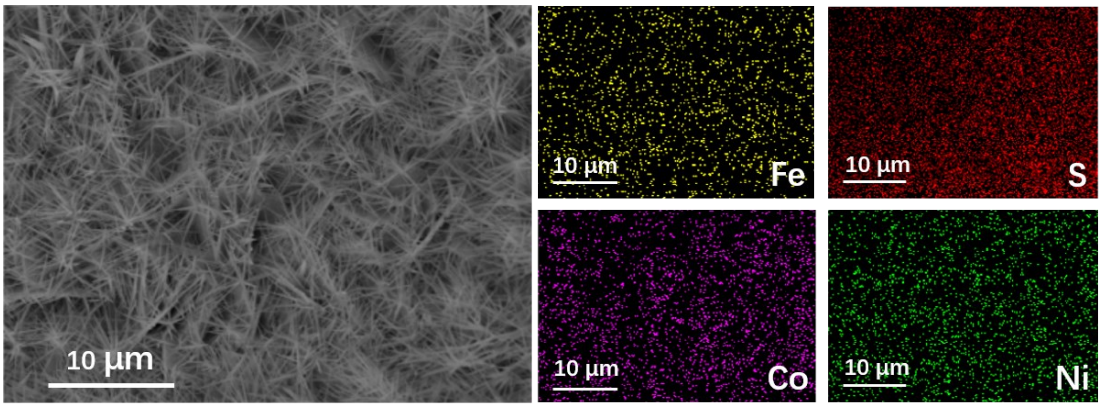
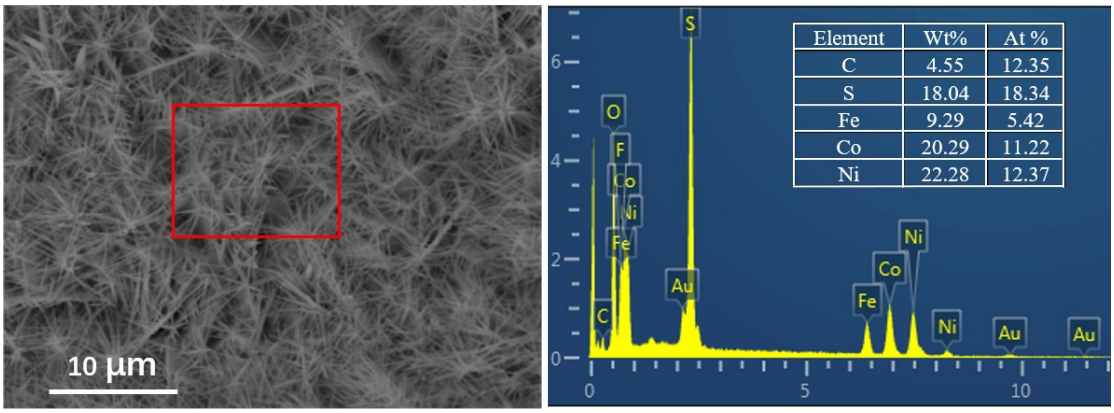


Fig. S2 The mapping spectrum of NiFeS/CoS.



Element	Wt%	At %
C	4.55	12.35
S	18.04	18.34
Fe	9.29	5.42
Co	20.29	11.22
Ni	22.28	12.37

Fig. S3 The EDX spectrum of NiFeS/CoS.

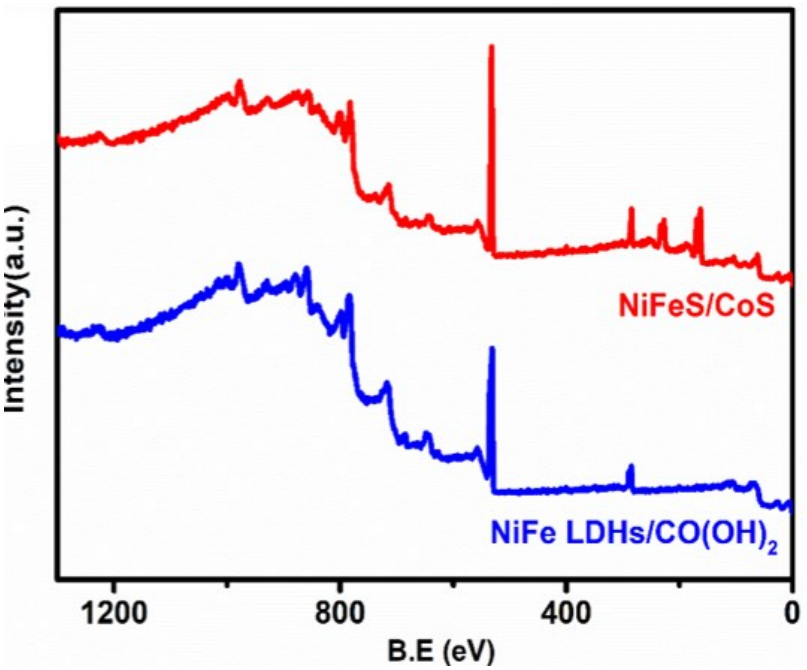


Fig. S4 XPS survey spectra of NiFeS/CoS and NiFe LDHs/$Co(OH)_2$.

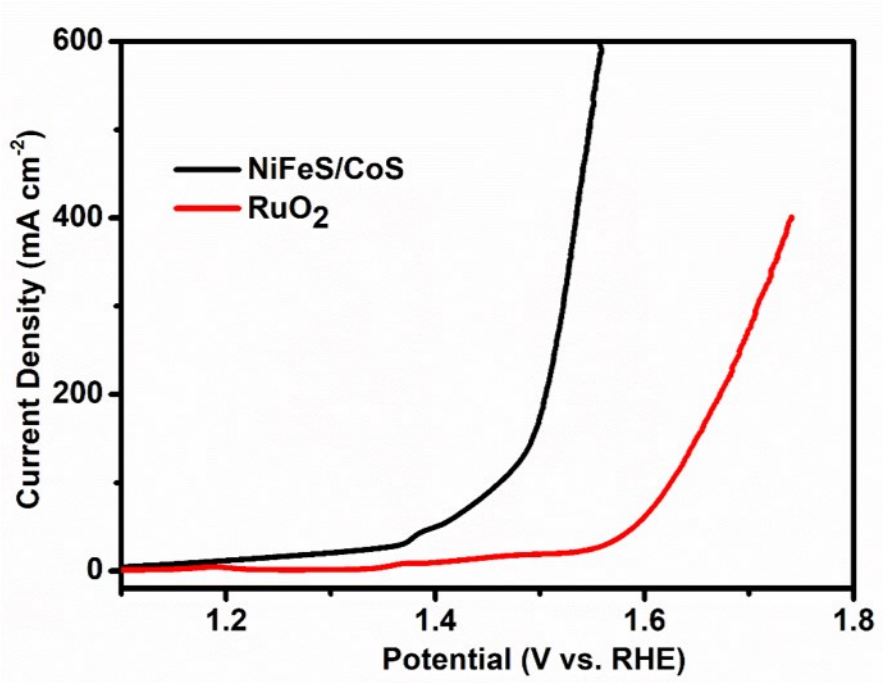


Fig. S5 Polarization curves of NiFeS/CoS and RuO_2 in OER.

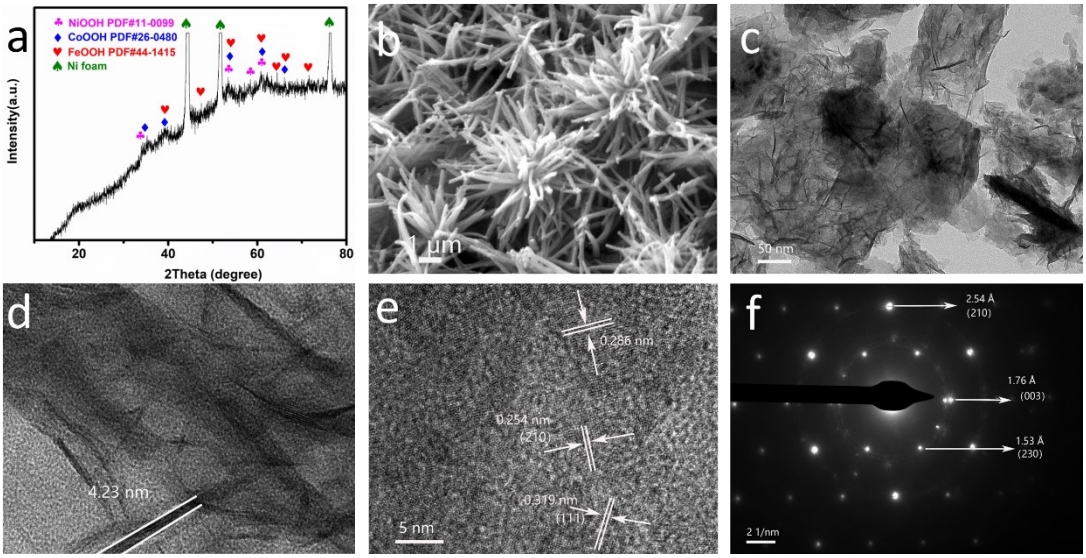


Fig. S6 (a) XRD pattern；(b) SEM image; (c) and (d) TEM images; (e) HR-TEM image and (f) SAED pattern of NiFeS/CoS after OER.

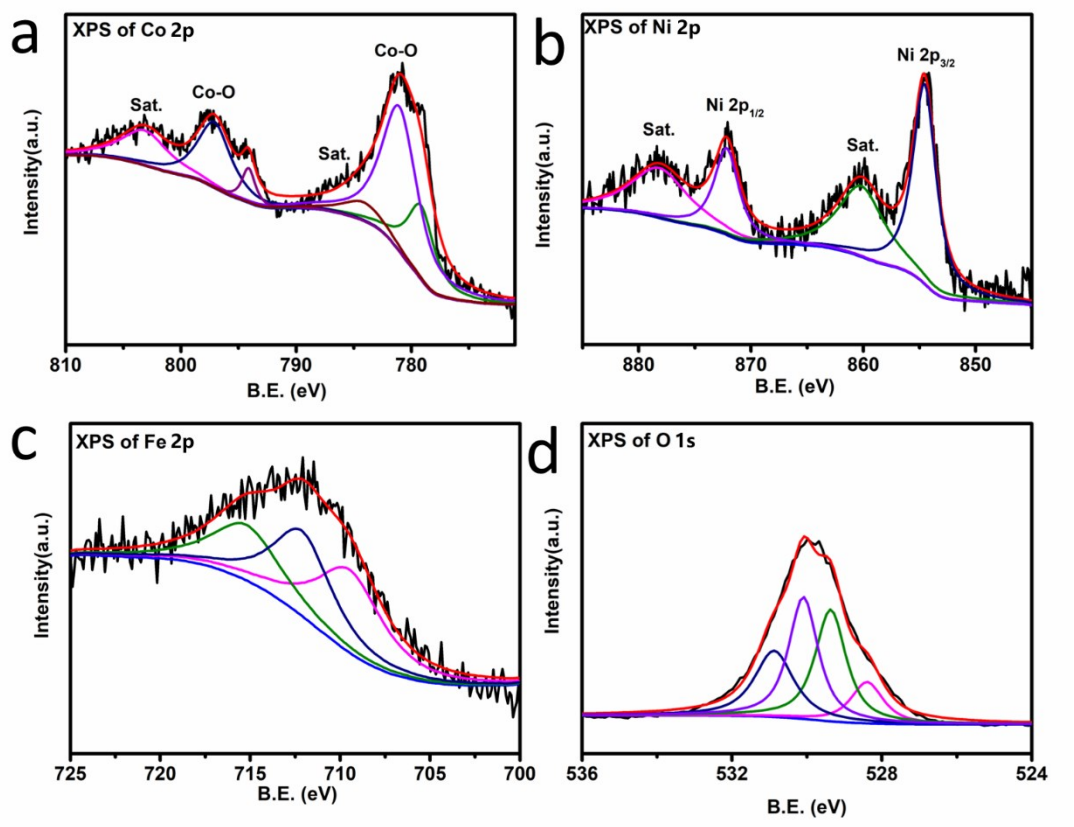


Fig. S7 The XPS spectra of (a) Co 2p, (b) Ni 2p, (c) Fe 2p, (d) O 1s for NiFeS/CoS after OER.

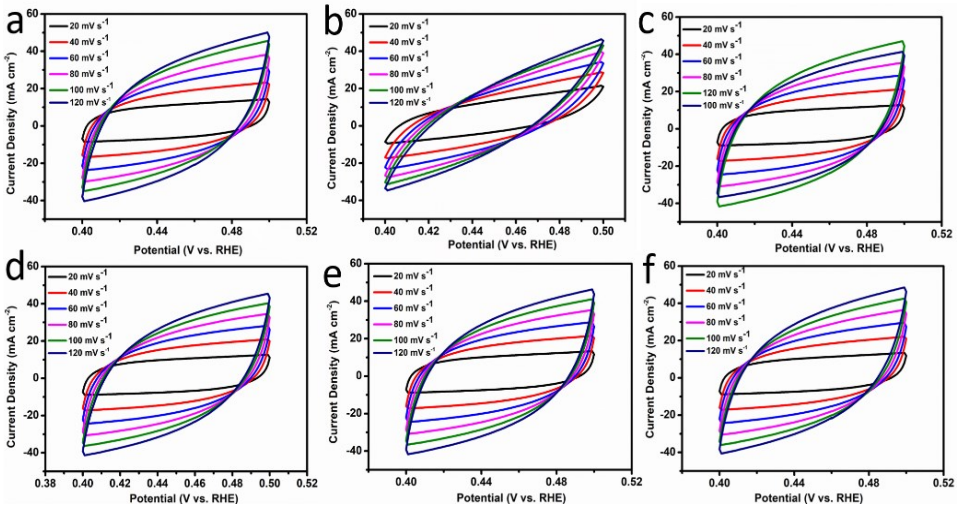


Fig. S8 CV curves of (a) NiFeS/CoS, (b) NiFe LDHs/$Co(OH)_2$, (c) NiFeS, (d) NiFe LDHs, (e) CoS, (f) $Co(OH)_2$.

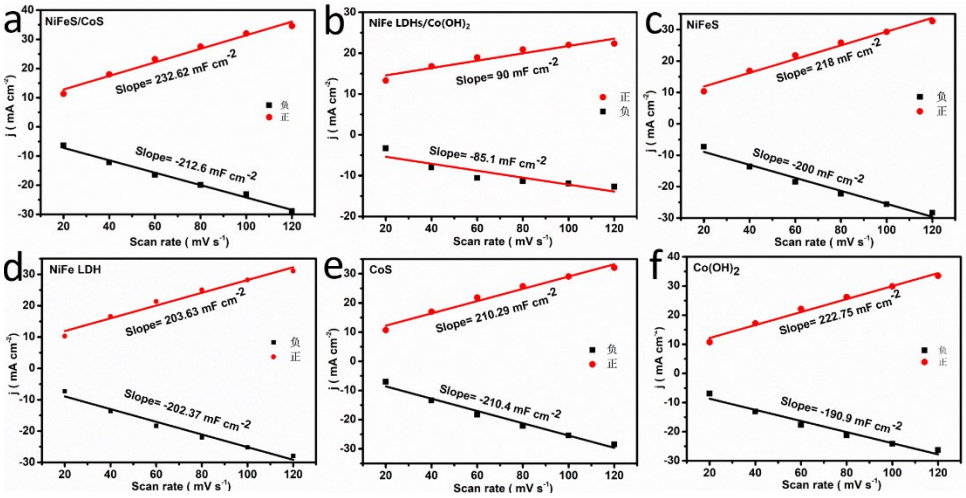


Fig. S9 The double-layer capacitances of (a) NiFeS/CoS, (b) NiFe LDHs/$Co(OH)_2$, (c) NiFeS, (d) NiFe LDHs, (e) CoS, (f) $Co(OH)_2$.

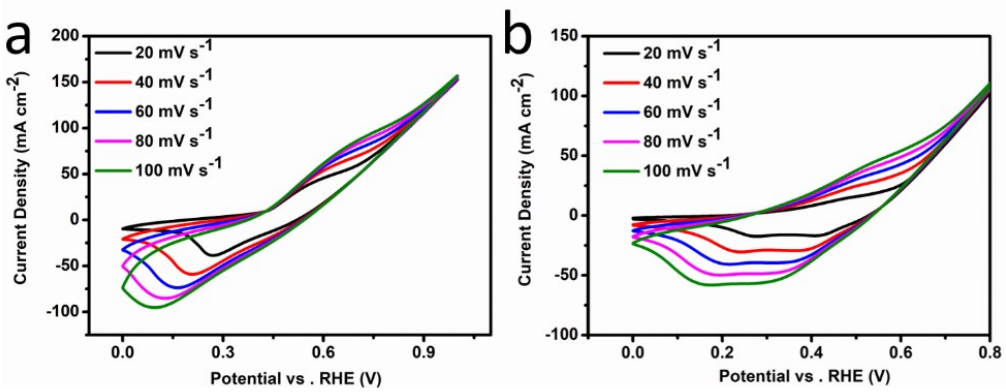


Fig. S10 CV curves at the different scan rates for (a) NiFeS/CoS, (b) NiFe LDHs/$Co(OH)_2$.

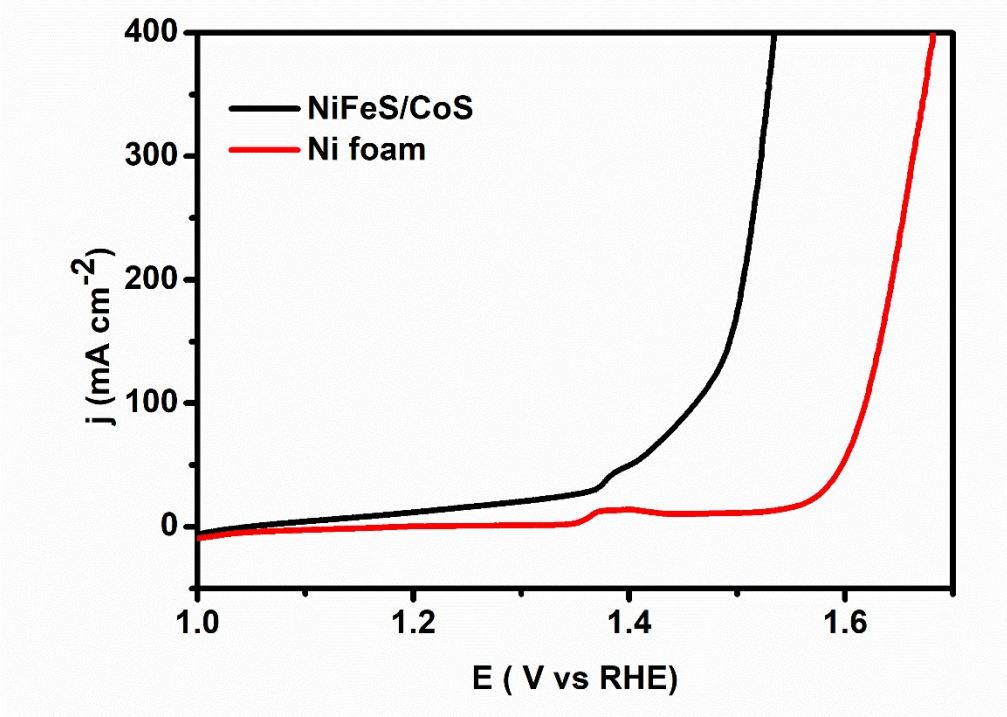


Fig. S11 Polarization curves of NiFeS/CoS and Ni foam in OER.

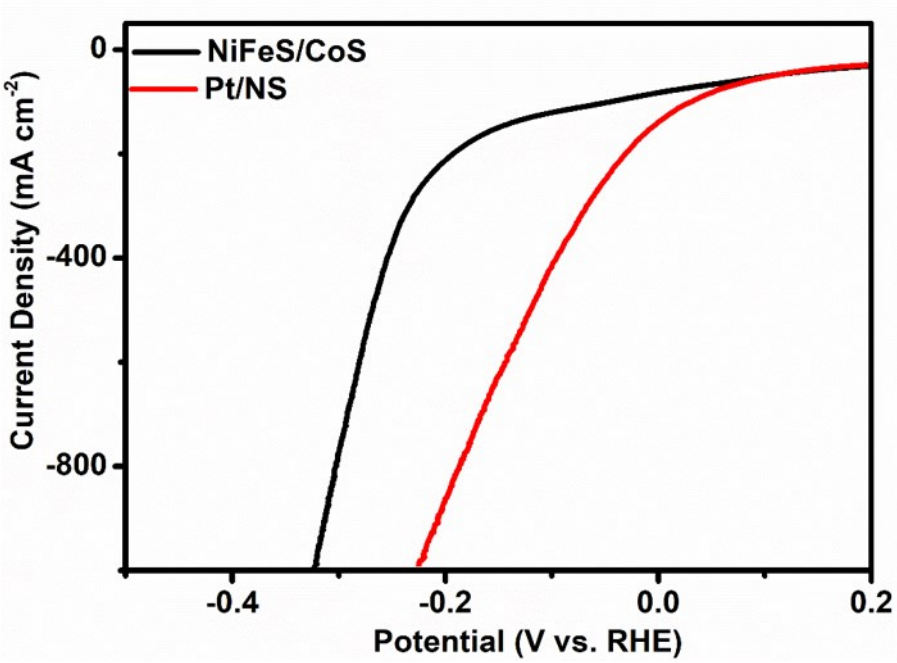


Fig. S12 Polarization curves of NiFeS/CoS and Pt/NS in HER.

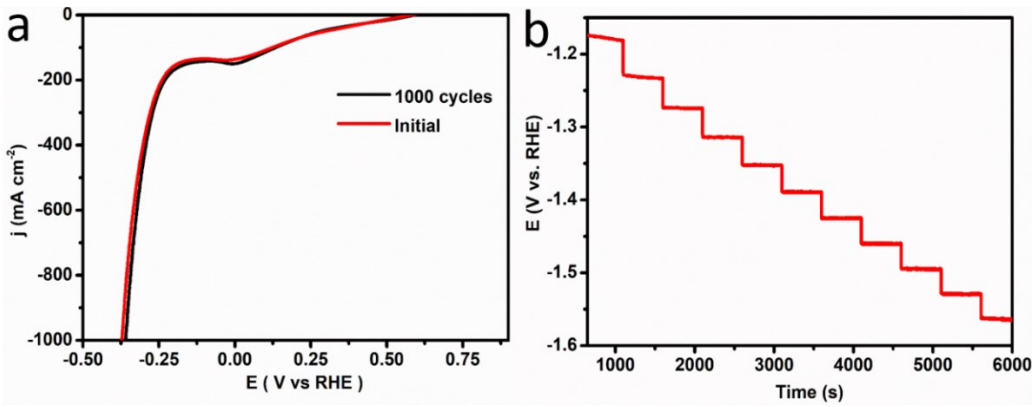


Fig. S13 (a) LSV curves before and after 1000 cycles for HER; (b) the Multi-step chronopotentiometric plot of NiFeS/CoS in HER.

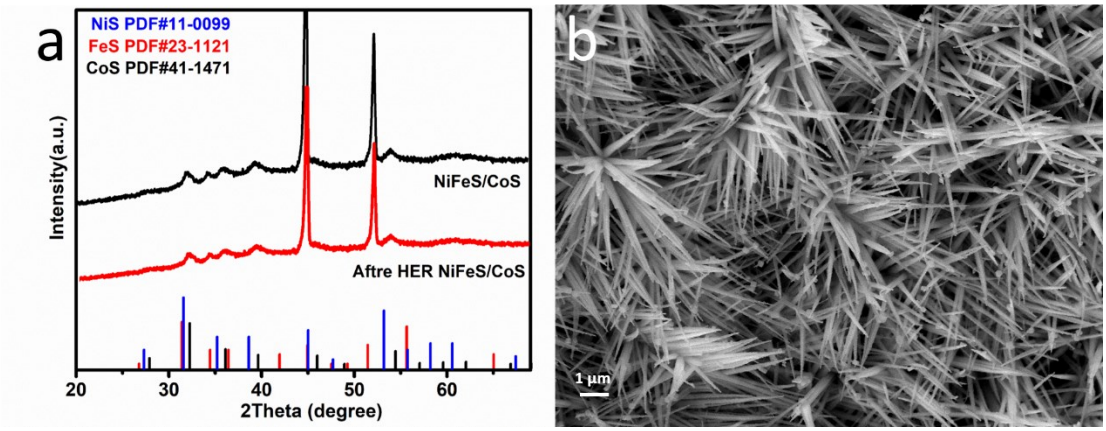


Fig. S14 (a) The XRD image; (b) the SEM image of NiFeS/CoS after HER.

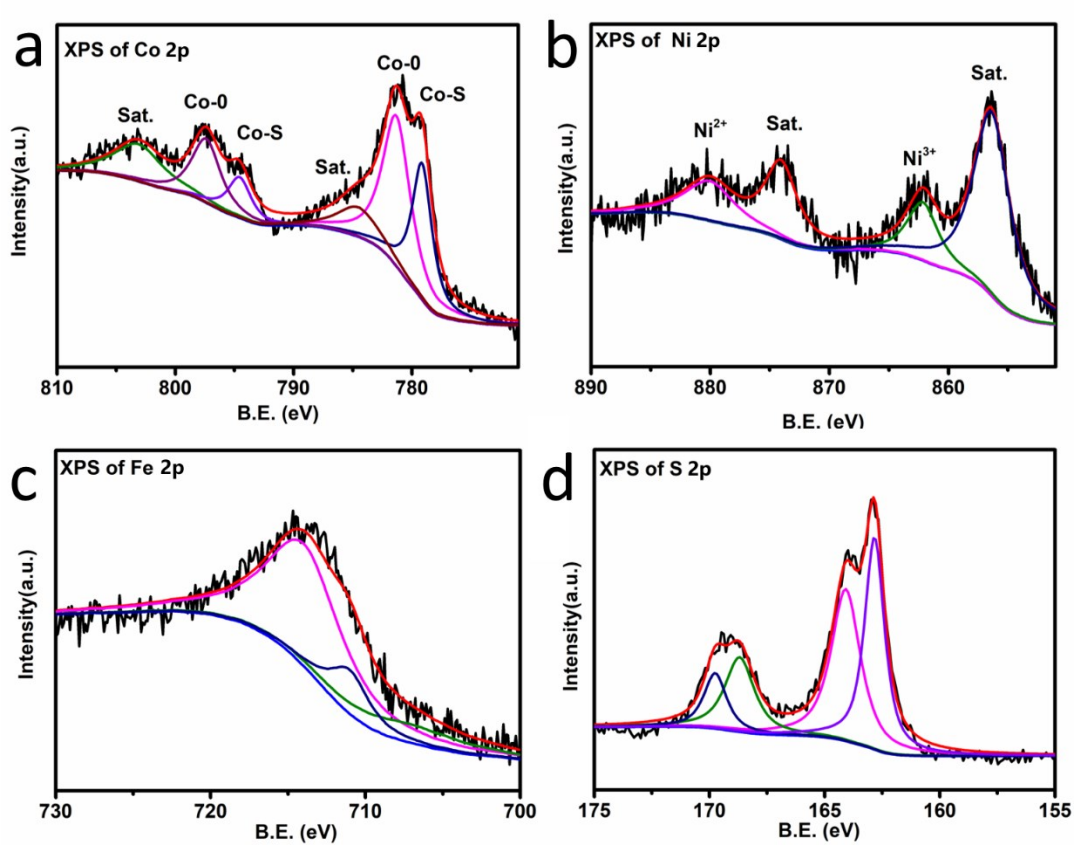


Fig. S15 The XPS spectra of (a) Co 2p, (b) Ni 2p, (c) Fe 2p, (d) S 2p for NiFeS/CoS after HER.

Table S1. Comparison of the OER performance for the obtained materials in this work with other state-of-the-art OER electrocatalysts.

Catalyst	Electrolyte	$\eta_{j=100}$ (mV)	$\eta_{j=10}$ (mV)	Tafel slope (mV dec^{-1})	Catalyst weight (mg cm^{-2})	Reference
NiFeS/CoS	1 M KOH	230	/	54.7	4.6	This work
S-NiCoFe LDH	1 M KOH	258	/	46	1.18	1
$Ni_{3.5}Co_{5.5}S_8$ NAHNs	1 M KOH	/	333	48.8	/	2
$Ni_{0.7}Fe_{0.3}S_2$	1 M KOH	287	198	56	3	3
Ni_3S_2-FeS-CoS/PNFCF	1 M KOH	≈160	90	76	/	4
Co_4Fe_2-LDHs/$CO(OH)_2$-NWs	1 M KOH	231	/	51	/	5
CoFeP-1.8	1 M KOH	242	/	53	3.14	6
Ni/NiS/NC	1 M KOH	/	337	45	0.92	7
Fe-Ni_3S_2/NF	1 M KOH	249	214	54	4-6	8
NiFe-LDH@NiFe-B_i/CC	1 M KOH	/	444	50	/	9
$Cu(OH)_2$@$CoCO_3(OH)_2 \cdot nH_2$	1 M KOH	≈270	/	78	15	10

Table S2. Comparison of the HER performance for the obtained materials in this work with other state-of-the-art HER electrocatalysts.

Catalyst	Electrolyte	Current density (mA cm^{-2})	Overpotential (mV)	Catalyst weight (mg cm^{-2})	Tafel slope (mV dec^{-1})	Reference
NiFeS/CoS	1 M KOH	150	150	4.6	42.4	This work
$(Ni_{0.33}Fe_{0.67})_2P$	1 M KOH	≈40	150	2	/	11
$Ni_{0.7}Fe_{0.3}S_2$	1 M KOH	≈10	150	3	109	3
$Ni_{0.75}Fe_{0.125}V_{0.125}$-LDHs	1 M KOH	≈40	150	/	62	12
$Fe_{17.5\%}$-Ni_3S_2/NF	1 M KOH	≈20	150	/	95	8
IFONFs-45	1 M KOH	≈60	150	/	31	13
$FeCoNiP_0S_1$	1 M KOH	≈180	150	/	99	14
Ni_3S_2-FeS-CoS/PNFCF	1 M KOH	≈45	150	/	68	15
NiFeSP/N	1 M KOH	≈65	150	4.2	82.6	16

Table S3. Comparison of the overall water splitting performance for the obtained materials in this work with other state-of-the-art bifunctional electrocatalysts.

Catalyst	Electrolyte	$\eta_{j=100}$ (mV)	double - layer capacitance ($mF\ cm^{-2}$)	Reference
NiFeS/CoS	1 M KOH	1.81	113.6	This work
CoFeP-x (x=1.8 and 2.4)	1 M KOH	1.62	23.0 and 27.82	6
NiMoN||NiMoN	1 M KOH	1.56	82.68	17
Ni_3FeN/r-GO || Ni_3FeN/r-GO	1 M KOH	1.65	15.9	18
Cu@NiFe LDH||Cu@NiFe LDH	1 M KOH	1.69	59.8	19
FeMnP/GNF||FeMnP/ GNF	1 M KOH	1.67	71	20
Ni_1Mo_1P NSs@MCNTs	1 M KOH	1.8	170	21
Fe17.5%-Ni_3S_2/NF	1 M KOH	1.70	206.5	8
$Ni_{0.7}Fe_{0.3}S_2$	1 M KOH	≈1.83	/	3

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