Supporting Information

Ultra-durable high-performance CoMo-MCA/Fe-NWs/NF heterostructures for industrial-grade current density seawater splitting

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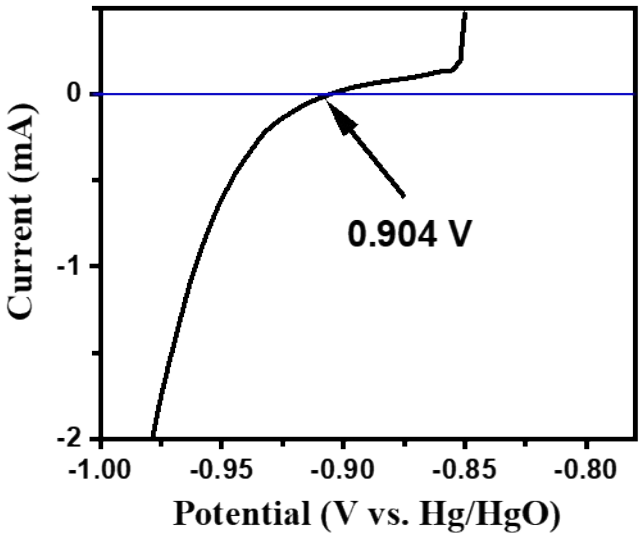

Fig. S1 Calibration of the Hg/HgO reference electrode. The Hg/HgO electrode is used as the reference for all electrochemical measurements in alkaline media. Calibration to the RHE is performed in a high-purity H2-saturated electrolyte with Pt wire as the working electrode in 1 M KOH. LSV is conducted at a scan rate of 1 mV s^{-1}, assuming the HER potential to be at 0 mA. Therefore, in 1 M KOH, E(RHE) = E(Hg/HgO) + 0.904 V.

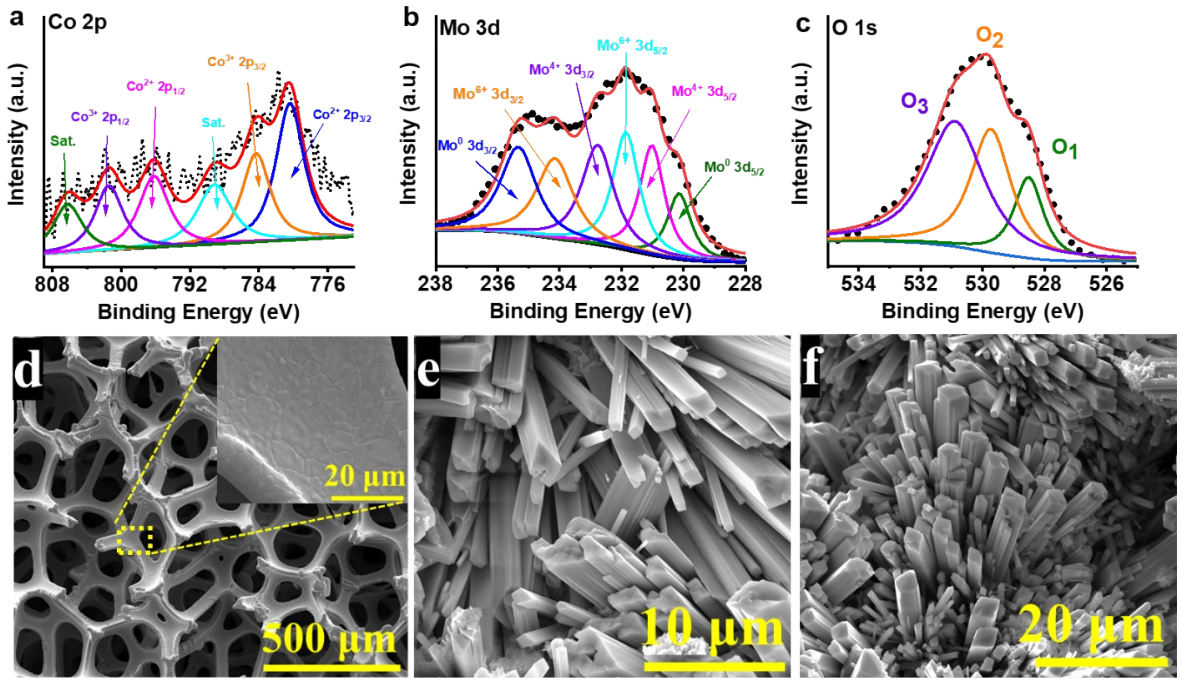

Fig. S2 Structural analysis of the synthesized CoMo-MCA/NF electrocatalysts: (a–c) High-resolution XPS spectra: Co 2p (a), Mo 3d (b), and O 1s (c). (d) FE-SEM images of bare NF. (e and f) FE-SEM images of CoMo-MCA/NF.

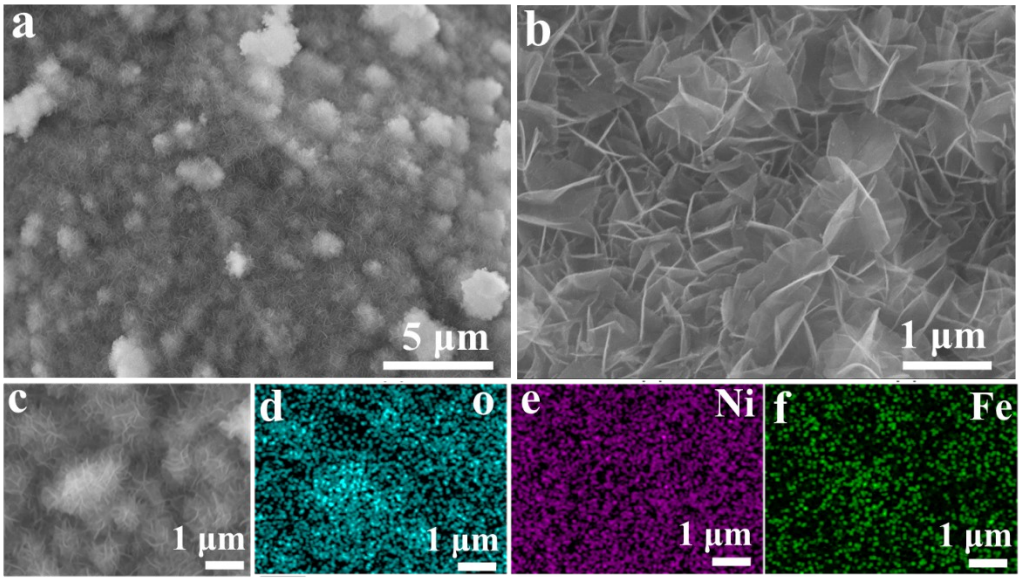

Fig. S3 Structural characterization of Fe-NS/NF. (a and b) FE-SEM images at different magnifications. (c–f) FE-SEM EDS elemental mapping.

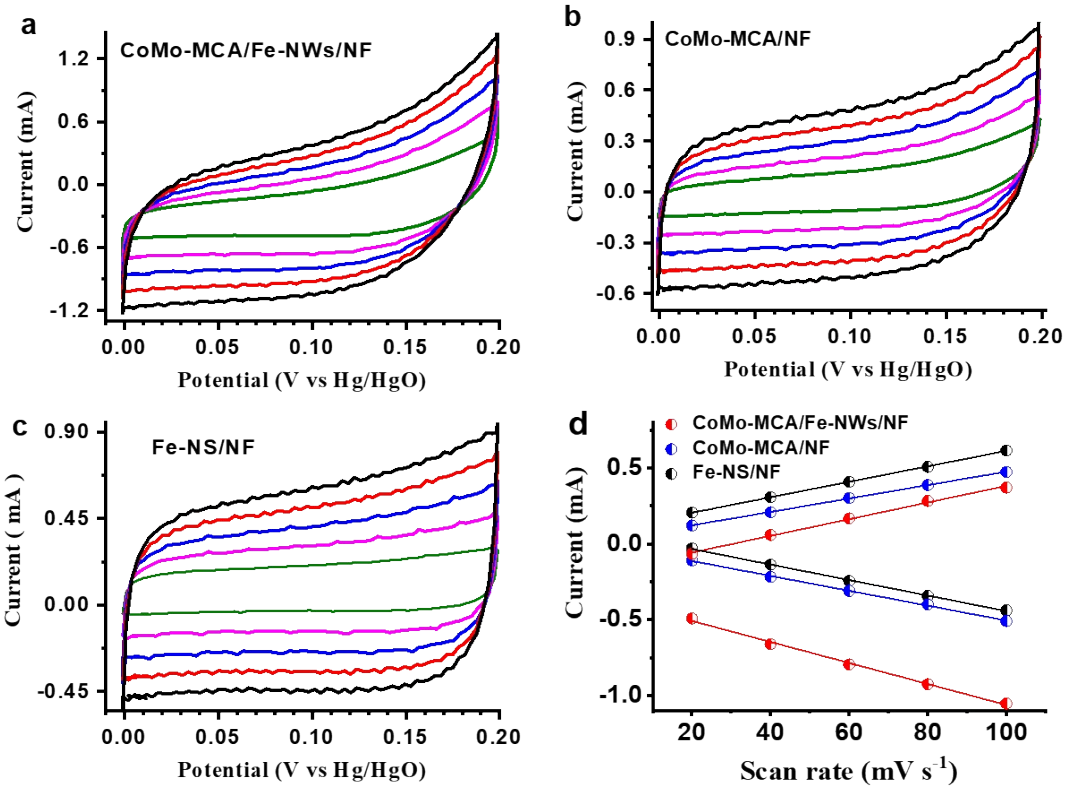

Fig. S4 Capacitive current in the potential window as a function of different scan rates (20, 40, 60, 80, and 100 mV s^{-1}), with the average linear slope corresponding to the double-layer capacitance (Cdl). (a) CoMo-MCA/Fe-NWs/NF, (b) CoMo-MCA/NF, and (c) Fe-NS/NF.

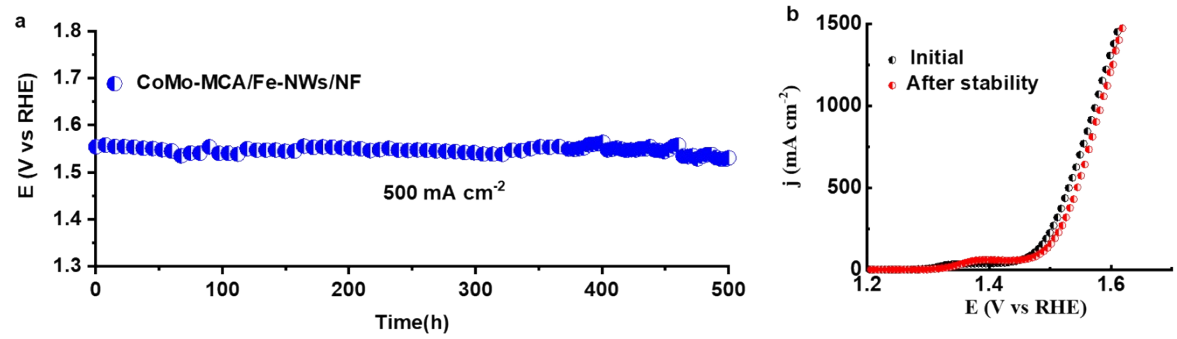

Fig. S5 Electrocatalytic OER activities in 1M KOH. (a) Long-term stability test (500 h) at a constant 500 mA cm^{-2} for the CoMo-MCA/Fe-NWs/NF. (b) steady-state polarization curves before and after the 500-h stability test.

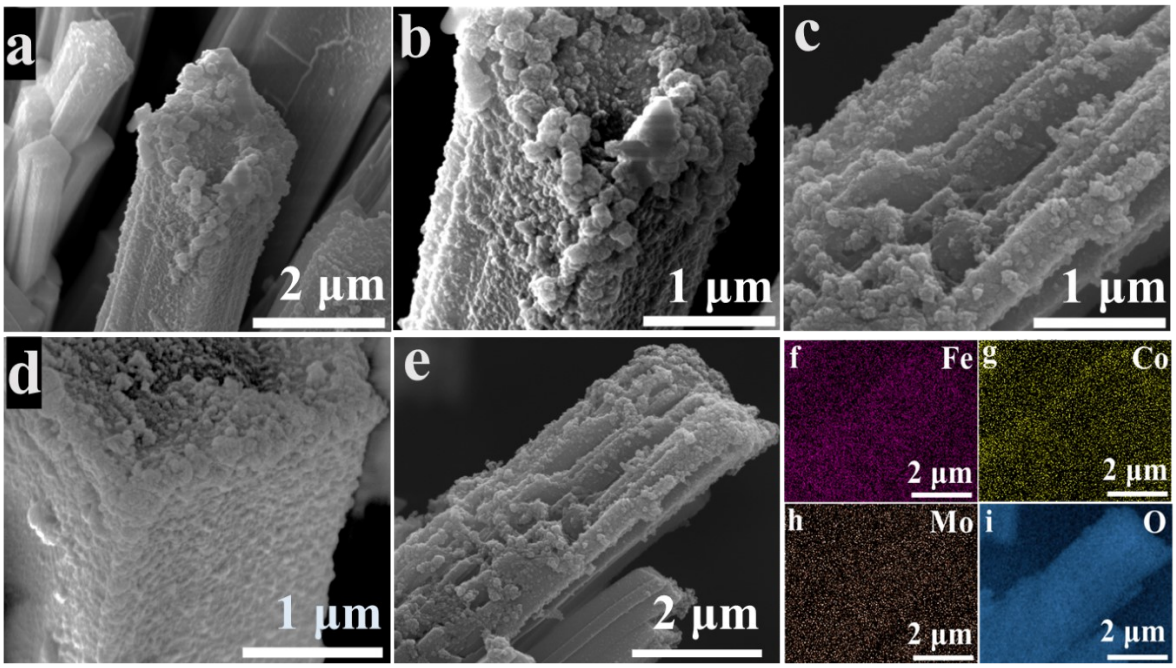

Fig. S6 Structural characterization of CoMo-MCA/Fe-NWs/NF after stability testing. (a−d) FE-SEM images at different magnifications. (e−i) FE-SEM EDS elemental mapping.

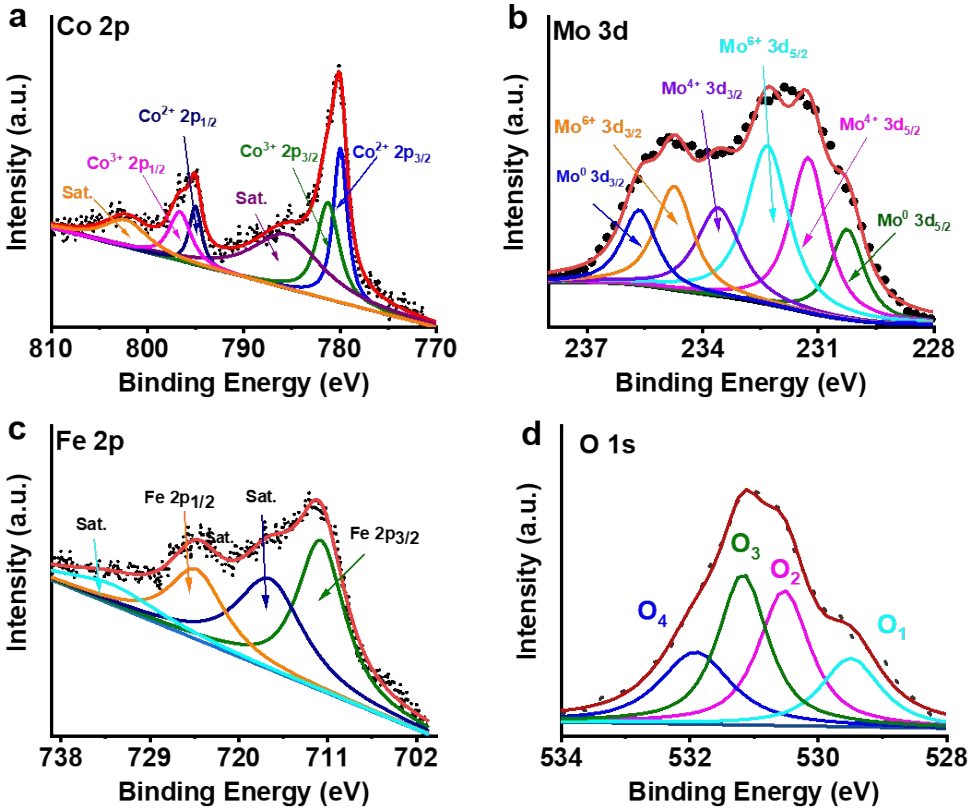

Fig. S7 (a-d) High-resolution XPS spectra for (a) Co 2p, (b) Mo 3d, (c) Fe 2p, and (d) O 1s from the hybrid CoMo-MCA/Fe-NWs/NF after stability testing.

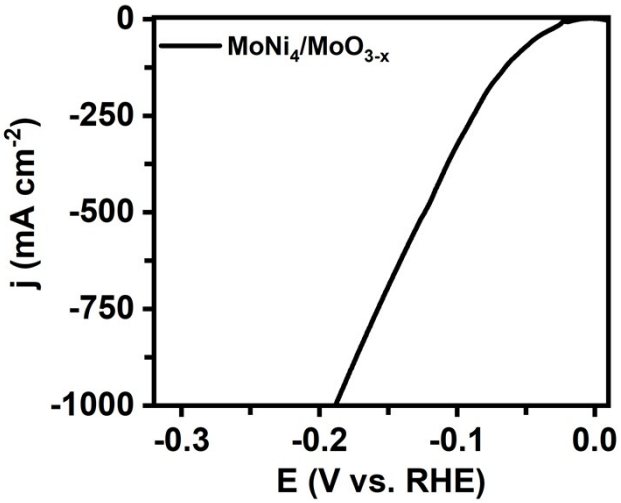

Fig. S8 (a) FE-SEM of the $MoNi_4/MoO_{3-x}$ for electrocatalyst and (b) LSV HER polarization curve.

Table S1. Overpotential comparison for OER catalysts at 500 mA cm^{-2} in **1 M KOH**

Catalysts	η_{500} (mV)	Reference
CoMo-MCA/Fe-NWs/NF	**300**	**This work**
Fe-$Co_{5.47}N$/MoN@NF	310	Small 2024, 20, 2310535
NiFe LDH-CeW@NFF	309	Appl. Catal. B Environ. 2023, 330, 122612
Te-$NiFe_2O_4$@C/NF	313	Chem. Eng. J. 2023, 464, 142604
Fe,P-$NiSe_2$ NFs	317	Adv. Mater. 2021, 33, 2101425
S-(Ni,Fe)OOH	328	Energy Environ. Sci. 2020, 13, 3439-3446
NiCoS	330	Appl. Catal. B: Environ. 2021, 291, 120071
Fe-NiCo-LDH/NF	340	Adv. Funct. Mater. 2023, 33, 2304403

Table S2. Overpotential comparison for OER catalysts at 500 mA cm^{-2} in **1 M KOH + Sea water**

Catalysts	η_{500} (mV)	References
CoMo-MCA/Fe-NWs/NF	**356**	**This work**
NiIr-LDH	361	J. Am. Chem. Soc., 2022, 144, 9254–9263
NiMoN@NiFeN	369	Nat. Commun. 2019, 10, 5106
B-Co_2Fe LDH	376	Nano Energy 2021, 83, 105838
Ni_3FeN@C/NF	394	J. Mater. Chem. A 2021, 9, 13562-13569
S-(Ni,Fe)OOH	398	Energy Environ. Sci. 2020,13, 3439-3446
NiCoS	440	Appl. Catal. B: Environ. 2021, 291, 120071

Table S3. The comparison of the cell voltage at 500 mA cm^{-2} for overall water-splitting activities electrocatalysts in **1 M KOH**.

Electrolyzers	V_{500} (V)	References
CoMo-MCA/Fe-NWs/NF|| $MoNi_4/MoO_{3-x}$	**1.66**	**This work**
$Fe_2P/Ni_{1.5}Co_{1.5}N/Ni_2P$(+/-)	1.67	ACS Nano 2023, 17, 1681-1692
FeP-Ni_2P(+/-)	1.72	Nat. Commun.2018, 9, 2551
Fe,P-$NiSe_2$NFs (+/-)	1.73	Adv. Mater. 2021, 33, 2101425
NiMoOx/NiMoS (+/-)	1.75	Nat. Commun. 2020, 11, 5462
Ni_3FeN@C||Ni_3N@C	1.80	J. Mater. Chem. A 2021, 9, 13562-13569
CoPx||CoPx@FeOOH	1.833	Appl. Catal. B Environ. 2021, 294, 120256
Ni_2P-Fe_2P/NF	1.865	Adv. Funct. Mater. 2021, 31, 2006484

Table S4. The comparison of the cell voltage at 500 mA cm^{-2} for overall water-splitting activities electrocatalysts in **1 M KOH + Seawater**.

Catalyst	V_{500} (V)	References
CoMo-MCA/Fe-NWs/NF|| $MoNi_4/MoO_{3-x}$	**1.71**	**This work**
$Fe_2P/Ni_{1.5}Co_{1.5}N/Ni_2P$ (+/-)	1.742	ACS Nano 2023, 17, 1681-1692
S-(Ni,Fe)OOH|| NiMoN	1.837	Energy Environ. Sci. 2020,13, 3439-3446
S,P-(Ni,Mo,Fe)OOH/NiMoP/Wood aerogel (+/-)	1.861	Appl. Catal. B Environ. 2021, 293, 120215
CoPx||CoPx@FeOOH	1.867	Appl. Catal. B Environ. 2021, 294, 120256
Ni_3FeN@C||Ni_3N@C	1.91	J. Mater. Chem. A 2021, 9, 13562-13569
NiCoS||NiMoS	1.94	Appl. Catal. B: Environ. 2021, 291, 120071
Ni_2P-Fe_2P/NF(+/-)	2.004	Adv. Funct. Mater. 2021, 31, 2006484