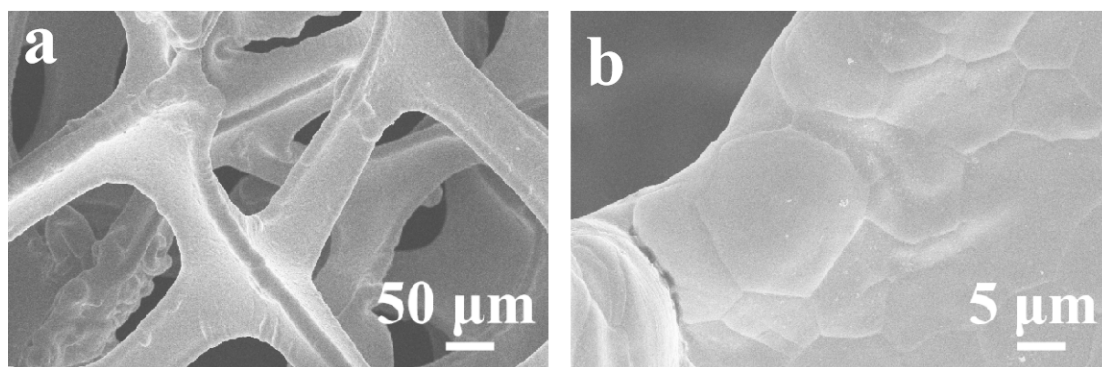


# Supplementary Material

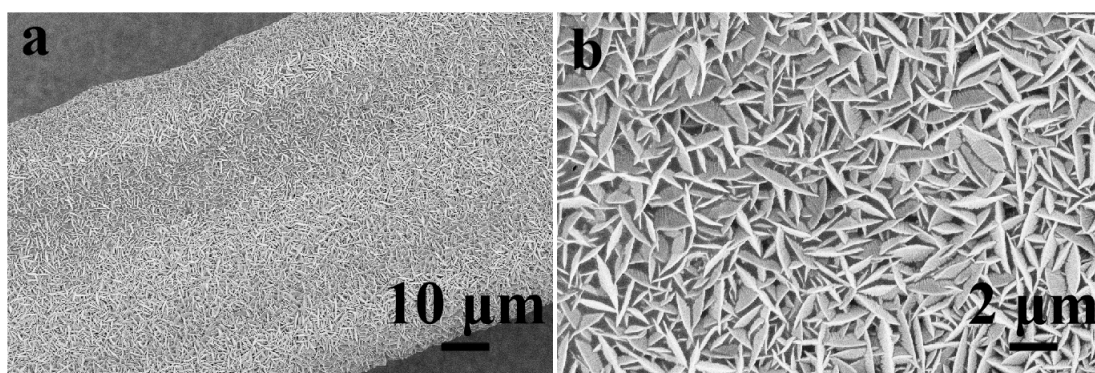
## Amorphous Co-Mo-B film: a high-active electrocatalyst for hydrogen generation in alkaline seawater

### Electrochemical tests:

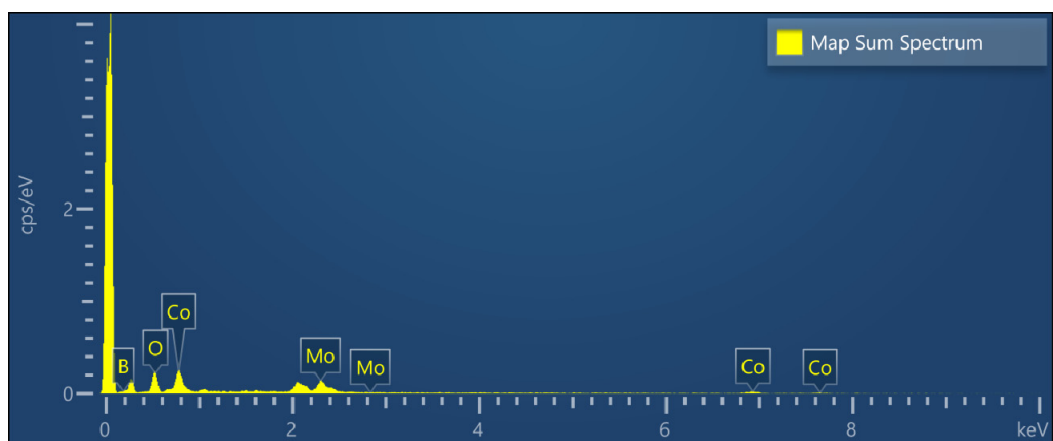
All electrochemical experiments were performed with a CHI 760E electrochemical workstation in alkaline media, using Co-Mo-B/NF and Co-B/NF as working electrodes, graphite rod as counter electrode and Hg/HgO electrode as reference electrode, respectively. All measured potentials were referenced to that of reversible hydrogen electrode (RHE) in accordance with the Nernst equation:  $E(\text{RHE}) = E(\text{Hg/HgO}) + (0.098 + 0.059 \times \text{pH})$ . To estimate the electrochemically active surface areas, the double-layer capacitance of the Co-Mo-B/NF, Co-B/NF, and bare NF were measured by conducting cyclic voltammetry (CV) at non-Faradaic potentials ranging from 0.0904 to 0.1904 V *vs.* RHE for HER at different scan rates of 20, 40, 60, 80, and 100 mV s<sup>-1</sup> in 1 M KOH.



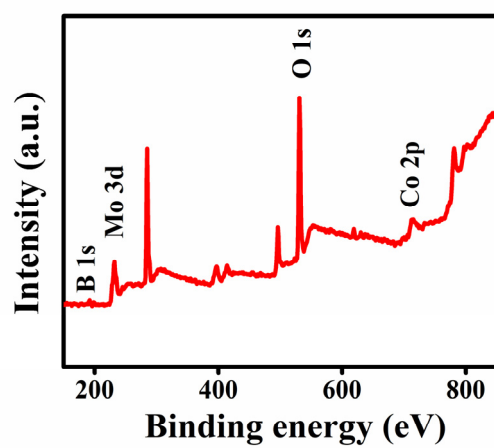
**Figure S1.** (a) Low- and (b) high-magnification SEM images of bare NF.



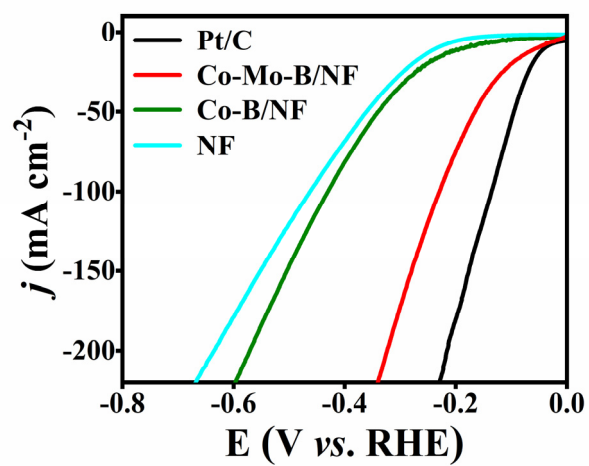
**Figure S2.** (a) Low- and (b) high-magnification SEM images of Co-B/NF.



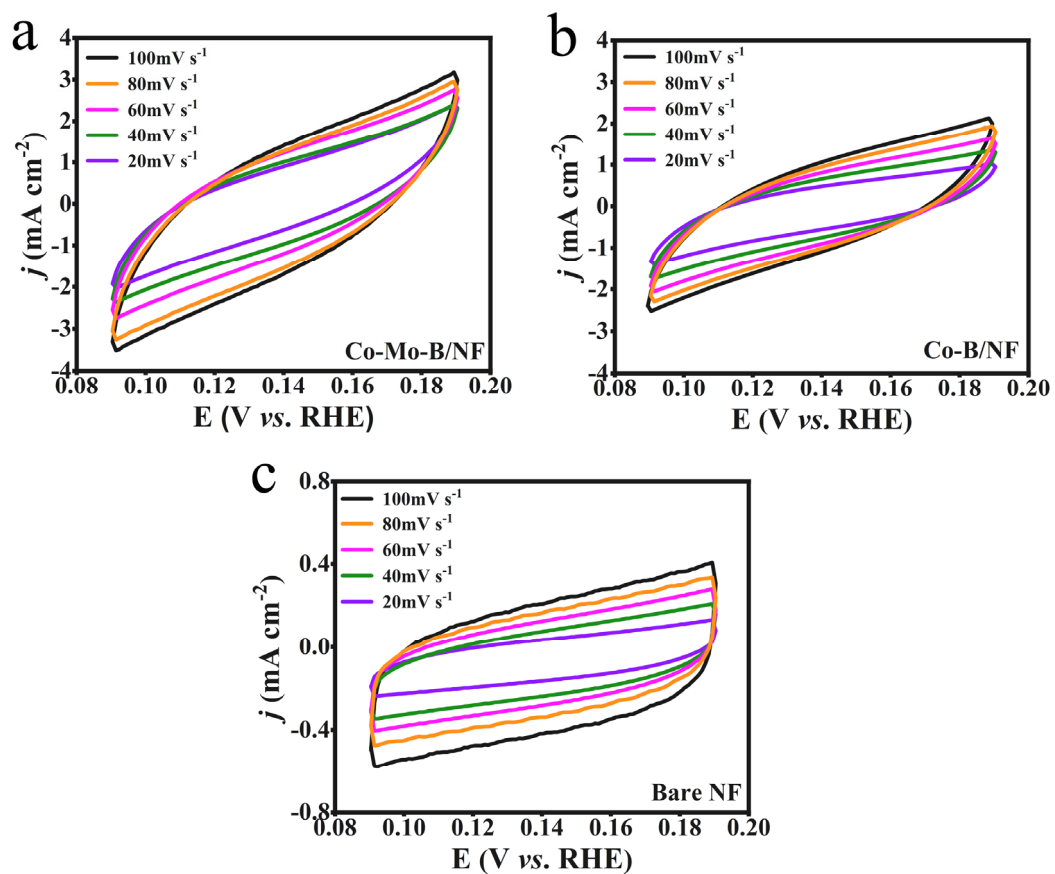
**Figure S3.** EDX spectrum of Co-Mo-B/NF.



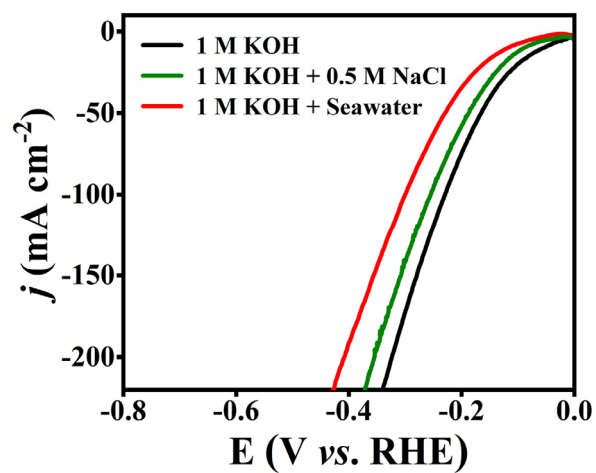
**Figure S4.** XPS survey spectrum of Co-Mo-B/NF.



**Figure S5.** LSV curves of Co-Mo-B/NF, Co-B/NF, Pt/C, and bare NF for HER in 1 M KOH with a scan rate of 5 mV s<sup>-1</sup> (without IR correction).

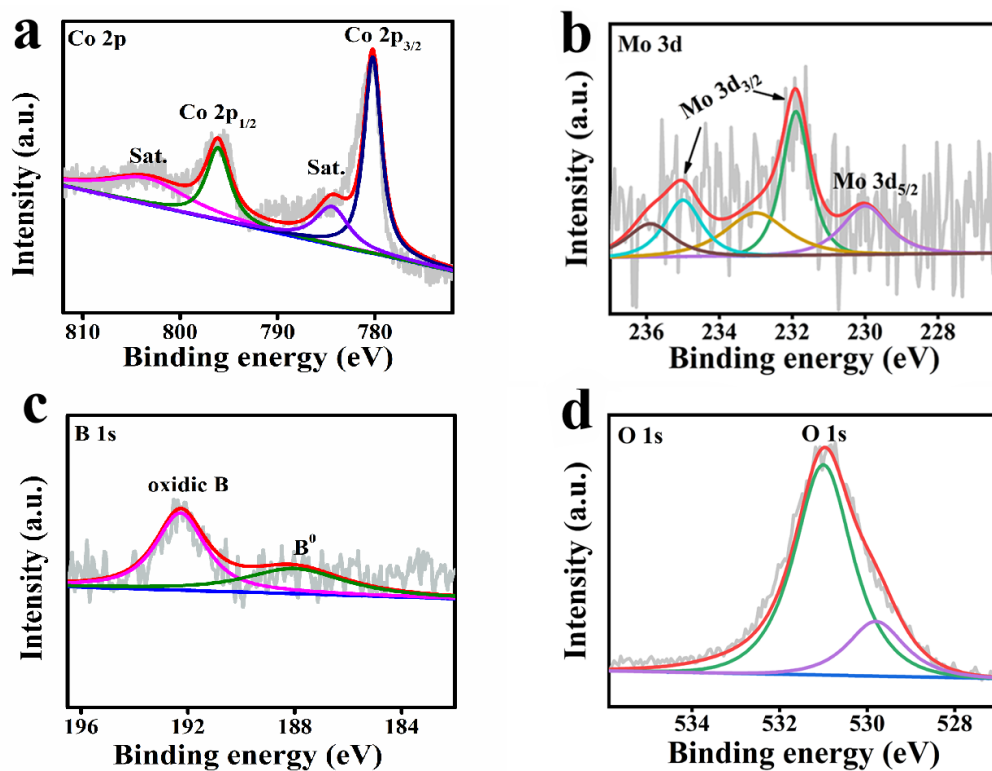


**Figure S6.** CV curves for Co-Mo-B/NF (a), Co-B/NF (b), and bare NF (c) in the non-Faradaic capacitance current range at scan rates of 20, 40, 60, 80, and 100 mV s<sup>-1</sup> in 1 M KOH.

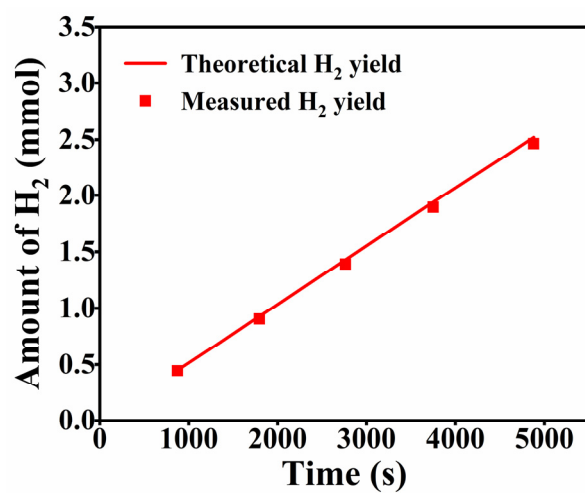


**Figure S7.** LSV curves of Co-Mo-B/NF in 1 M KOH, 1 M KOH + 0.5 M NaCl, and 1 M KOH + seawater with a scan rate of 5 mV s<sup>-1</sup> (without IR correction).





**Figure S8.** High-resolution XPS spectra of (a) Co 2p, (b) Mo 3d, (c) B 1s, and (d) O 1s regions for Co-Mo-B/NF after stability test in alkaline seawater.



**Figure S9.** The Faradaic efficiency of Co-Mo-B/NF at 100 mA cm<sup>-2</sup> in alkaline seawater.

**Table S1.** Comparison of HER performance of Co-Mo-B/NF with recent reported electrocatalysts in alkaline freshwater.

HER catalysts	Current density (mA cm <sup>-2</sup> )	Overpotential (mV)	Electrolyte	Ref.
Co-Mo-B/NF	100	174	1 M KOH	This work
Mo-CoP <sub>x</sub> /NF	100	~300	1 M KOH	<i>Mater. Today Nano</i> <b>2022</b> , 18, 100216.
CoMoS <sub>4</sub> /β-Co(OH) <sub>2</sub>	100	313	1 M KOH	<i>Nanoscale</i> <b>2016</b> , 8, 18887–18892.
NiCo <sub>2</sub> O <sub>4</sub>	100	245	1 M NaOH	<i>Angew. Chem. Int. Ed.</i> <b>2016</b> , 55, 6290–6294.
MoS <sub>2</sub> -CoS <sub>2</sub> @PCMT	100	300	1 M KOH	<i>J. Power Sources</i> <b>2021</b> , 514, 230580.
HC-MoS <sub>2</sub> /Mo <sub>2</sub> C	100	354	1 M KOH	<i>Nat. Commun.</i> <b>2020</b> , 11, 3724.
Co/CoMoN/NF	100	173	1 M KOH	<i>Adv. Sci.</i> <b>2022</b> , 9, 2105313.
Ni <sub>3</sub> S <sub>2</sub> /MoS <sub>2</sub> -CC	100	173	1 M KOH	<i>J. Mater. Chem. A</i> <b>2019</b> , 7, 2895–2900.
CoN/NF	100	212	1 M KOH	<i>J. Mater. Chem. A</i> <b>2019</b> , 7, 19728–19732.

**Table S2.** Comparison of HER performance of Co-Mo-B/NF with recent reported electrocatalysts in alkaline seawater.

HER catalysts	Current density (mA cm <sup>-2</sup> )	Overpotential (mV)	Electrolyte	Ref.
Co-Mo-B/NF	100	199	1 M KOH + seawater	This work
S-NiMoO <sub>4</sub> @NiFe-LDH/NF	100	220	1 M KOH + seawater	<i>J. Colloid Interface Sci.</i> <b>2022</b> , 613, 349–358.
CoCuS	100	289	1 M KOH + seawater	<i>Int. J. Hydrogen Energy</i> <b>2021</b> , 9, 0360–3199.
Co-N,P-HCS	100	287	1 M KOH + seawater	<i>Adv. Mater.</i> <b>2022</b> , e2204021.
Ni <sub>2</sub> P-Fe <sub>2</sub> P/NF	100	252	1 M KOH + seawater	<i>Adv. Funct. Mater.</i> <b>2020</b> , 31, 12006484.
NiCoHPi@Ni <sub>3</sub> N/NF	100	182	1 M KOH + seawater	<i>ACS Appl. Mater. Inter.</i> <b>2022</b> , 14, 22061–22070.