Electronic Supplementary Information

Self-supported NiMo-based nanowire arrays as bifunctional electrocatalysts for full water splitting

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Figure S1 The XRD pattern of the NiMoO₄/NF.



Figure S2 a) Low-magnification and b) high-magnification SEM images of the NiMoO₄ nanowire arrays on the NF substrate.



Figure S3 The XRD patterns of a) NiMoN/NF-300, b) NiMoN/NF-450 and c) NiMoN/NF-600.



Figure S4 High-magnification SEM images of a) NiMoN/NF-300 and b) NiMoN/NF-600.



Figure S5 The polarization curves of NiMoN/NF-300, NiMoN/NF-450, NiMoN/NF-600, and NiMoN/NF-450 powders electrodes toward the HER.



Figure S6 Cyclic voltammographs for a) NiMoN/NF-300 electrode, b) NiMoN/NF-450, c) NiMoN/NF-600 electrode, and d) NiMoN-450 nanowire powders electrode in the region of 0.2 – 0.3 V vs. RHE in 1 M KOH. The differences in current density ($\Delta j / 2$) at 0.25 V vs. RHE plotted against scan rate fitted to a linear regression allows for the estimation of C_{dl} : e) NiMoN/NF-300 electrode, f) NiMoN/NF-450, g) NiMoN/NF-600 electrode and h) NiMoN-450 powders electrode.



Figure S7 Tafel plots for NiMoN/NF-300, NiMoN/NF-450, and NiMoN/NF-600 electrodes.



Figure S8 Nyquist plots of NiMoN/NF-300, NiMoN/NF-450, NiMoN/NF-600 and NiMoN-450 powders electrodes for HER at η = 100 m V, and the inset shows the corresponding equivalent circuit.



Figure S9 The TOF data of NiMoN/NF-300, NiMoN/NF-450, and NiMoN/NF-600 electrodes.



Figure S10 Comparison of XPS spectrum of NiMoN/NF-450 before and after HER process. a,b) Ni 2p; c,d) Mo 3d; e,f) N 1s and Mo 3p.



Figure S11 The polarization curves of NiMoN/NF-300, NiMoN/NF-450, NiMoN/NF-600 and NiMoN-450 powders electrodes toward the OER.



Figure S12 The TOF data of NiMoN/NF-300, NiMoN/NF-450, NiMoN/NF-600 electrodes.



Figure S13 Tafel plots for NiMoN/NF-300, NiMoN/NF-450, and NiMoN/NF-600 electrodes.



Figure S14 EIS Nyquist plots of NiMoN/NF-300 electrode, NiMoN/NF-450 electrode, NiMoN/NF-600 electrode and NiMoN-450 powders electrode for OER at η = 300 m V.



Figure S15 Cyclic voltammographs for a) NiMoN/NF-300 electrode, b) NiMoN/NF-450, c) NiMoN/NF-600 electrode, and d) NiMoN-450 powders electrode in the region of 1.0 - 1.1 V vs. RHE in 1.0 M KOH. The differences in current density ($\Delta j / 2$) at 1.05 V vs. RHE plotted against scan rate fitted to a linear regression allows for the estimation of C_{dl} : e) NiMoN/NF-300 electrode, f) NiMoN/NF-450, g) NiMoN/NF-600 electrode and h) NiMoN-450 powders electrode.



Figure S16 Comparison of XPS spectrum of NiMoN/NF-450 before and after OER process. a,b) Ni 2p; c,d) Mo 3d; e,f) N 1s and Mo 3p.

Catalysts	η at 10 mA cm ⁻² (mV vs RHE)	η at 100 mA cm ⁻² (mV vs RHE)	Electrolyte (pH)	Ref.
NiMoN/NF-450	22	138	14	This work
NiCo ₂ S ₄ NW/NF	240	-	14	2
P-CoMoS/CC	66	_	14	3
Ni _{0.69} Co _{0.31} -P	96	167	14	9
NiMoN	109	_	14	16
Co4NiP NTs	129	_	14	24
Ni ₃ N-NiMoN-5	31	_	14	41
Fe ₂ Ni ₂ N NPAs	110	_	14	44
NiMoN-550	89	265	14	48
Ni-Mo alloy/porous microspheres	63(20 mA cm ⁻²)	_	14	49
Mo-W-S-2@Ni ₃ S ₂	98	168	14	50

Table S1. Comparison of HER activity of NiMoN/NF-450 electrodes with reported HER catalysts.

Table S2. Comparison of OER activity of NiMoN/NF-450 electrodes with reported OER
catalysts.

Catalysts	η at 10 mAcm ⁻² (mV)	η at 100 mA cm ⁻² (mV)	Electrolyte (pH)	Ref.
NiMoN-450	230	367	14	This work
NiCo ₂ S ₄ NW/NF	260	_	14	2
P-CoMoS/CC	260	_	14	3
NiFe	240	_	14	4
Ni ₂ P nanoparticles	290	_	14	7
Ni _{0.69} Co _{0.31} -P	266	-	14	9
Ni ₃ N nanosheets grown on CC	256	-	14	20
CoMn LDH	324	-	14	21
NiCo _{2.7} (OH) _x amorphous nanocages	350	-	14	22
Co₄NiP NTs	245	_	14	24
Ni ₃ N-NiMoN-5	277	_	14	41
NiMoN-550	295	390	14	48
Ni-Mo alloy/porous microspher <u>es</u>	335 (20 mA cm ⁻²)	-	14	49

Mo-W-S-	285	_	14	50
$2@Ni_3S_2$				

Table S3. Comparison of the catalytic performance of NiMoN/NF-450 electrodes for overall water splitting with other reported bifunctional catalysts.

Catalysts	Voltage at 10 mA cm ⁻² (V)	Electrolyte (pH)	Ref.
NiMoN-450	1.507	14	This work
NiCo ₂ S ₄ NW/NF	1.63	14	2
P-CoMoS/CC	1.54	14	3
Ni2P nanoparticles	1.63	14	7
Ni _{0.69} Co _{0.31} -P	1.59	14	9
C04NiP NTs	1.59	14	24
Ni ₃ N-NiMoN-5	1.54	14	41
Fe ₂ Ni ₂ N NPAs	1.65	14	44
NiMoN-550	1.596	14	48
Ni-Mo alloy/porous microspheres	1.59	14	49
Mo-W-S-2@Ni ₃ S ₂	1.62	14	50