Electronic Supplementary Information

A highly efficient Ni-Mo bimetallic hydrogen evolution catalyst derived from a molybdate incorporated Ni-MOF

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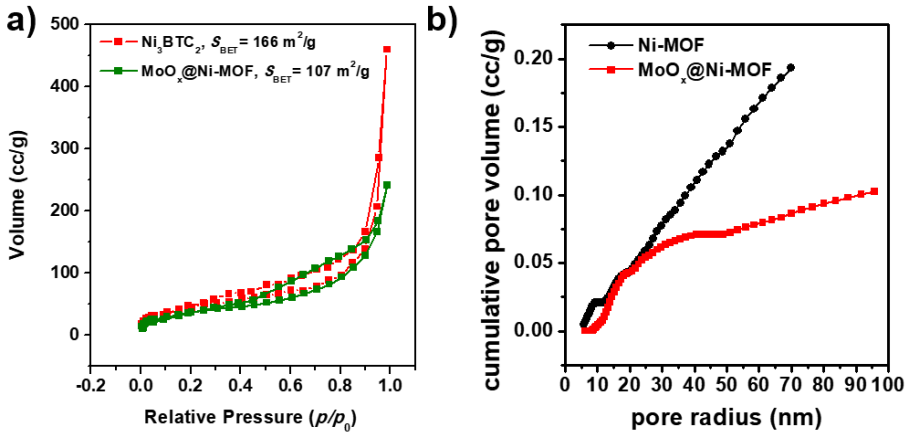

Figure S1. (a) Nitrogen sorption isotherms and (b) cumulative pore volume-size curve of MoO_x@Ni-MOF and Ni-MOF.

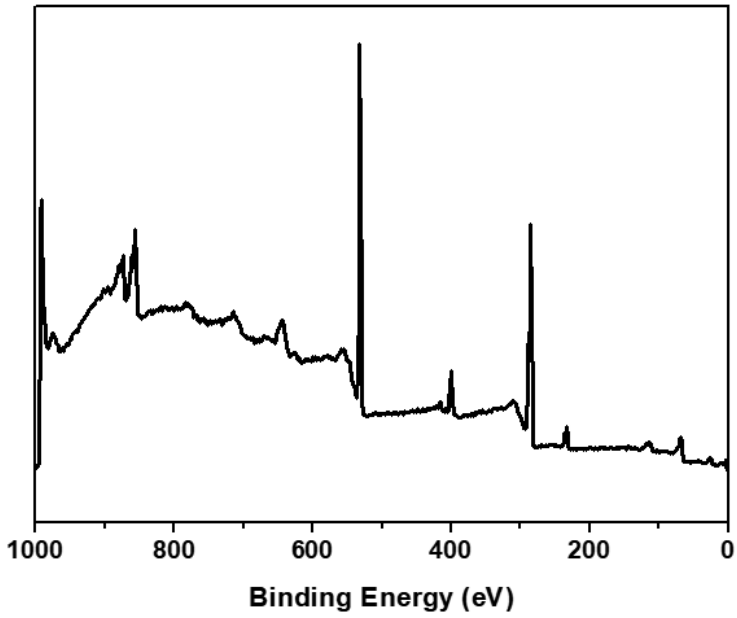

Figure S2. Full-range XPS spectra of molybate incorporated Ni-MOF (Mo:Ni molar ratio= 6:94)

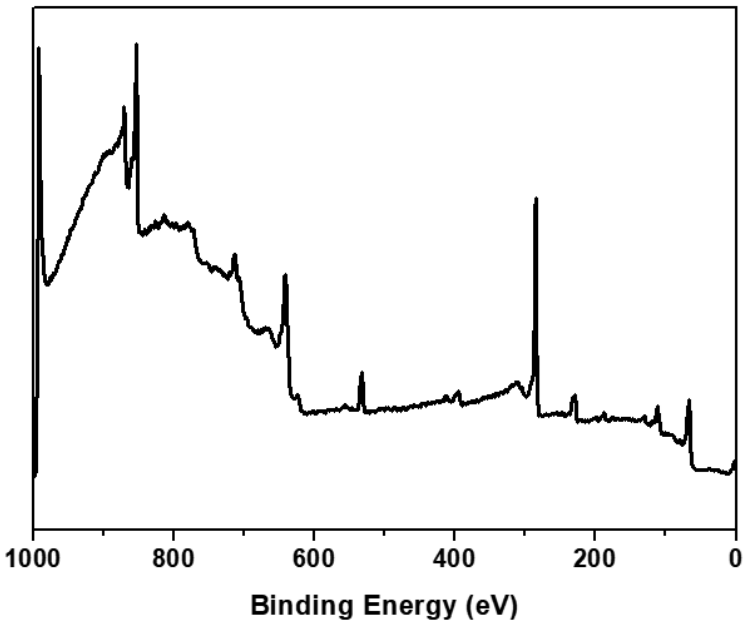

Figure S3. Full-range XPS spectra of NiMo-C sample.

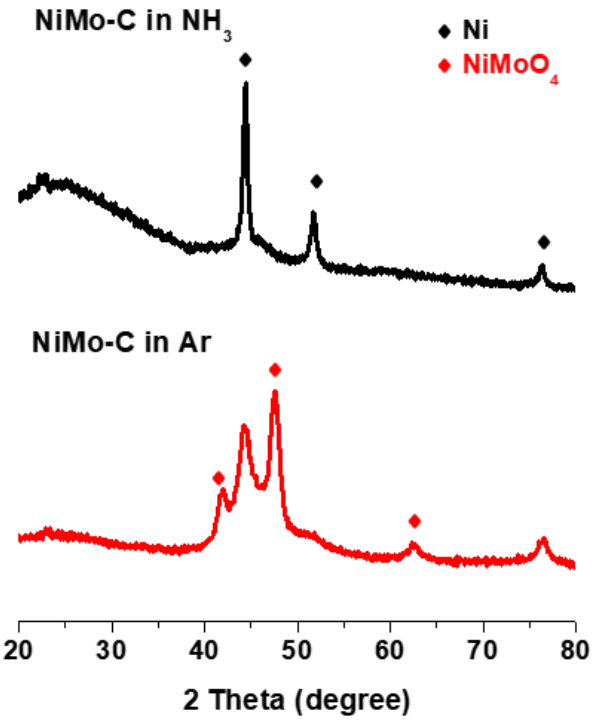

Figure S4. XRD patterns of the NiMo-C heated in NH_3 and Ar respectively.

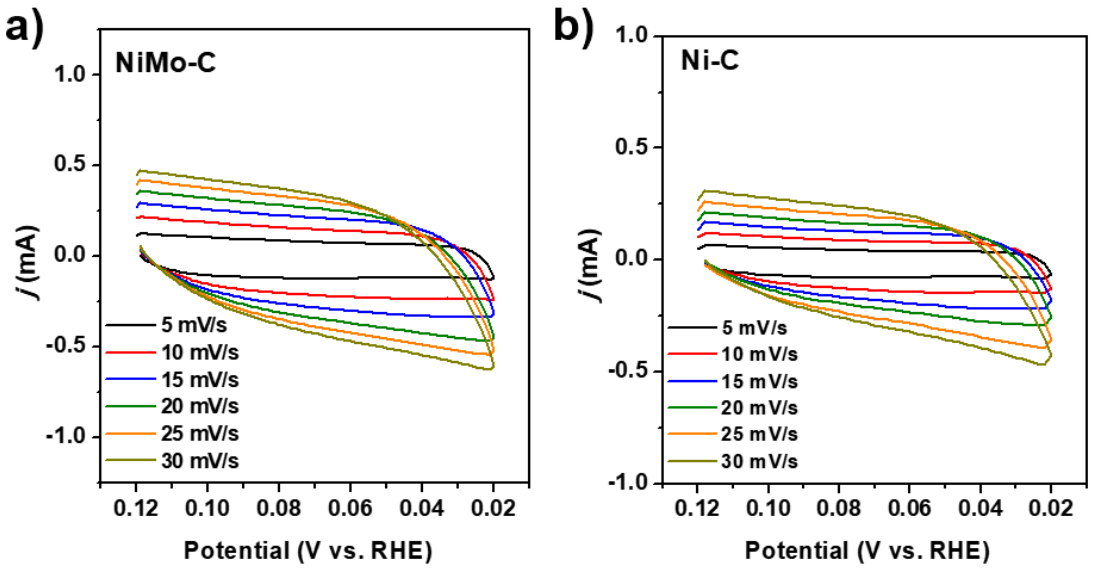

Figure S5 Cyclic voltammetry tests in region without hydrogen evolution with different scan rates to determine the electrochemical double layer capacitance (C_{dl}) of (a) NiMo-C and (b) Ni-C.

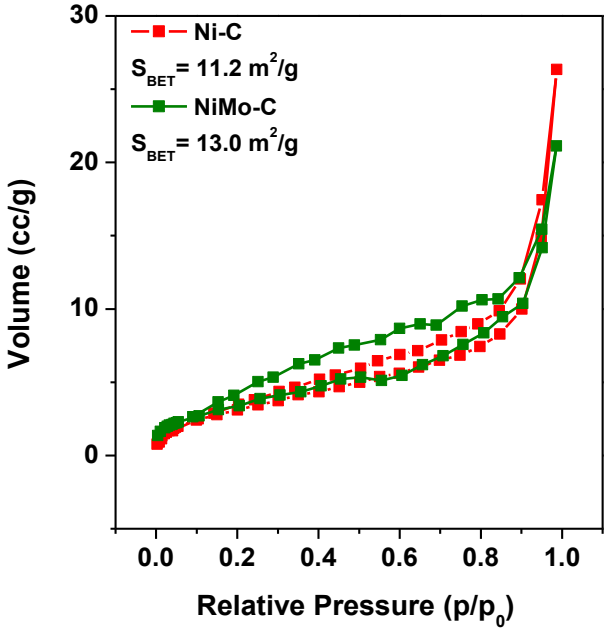

Figure S6. Nitrogen sorption isotherms of Ni-C and NiMo-C. Surface area from BET method is calculated.

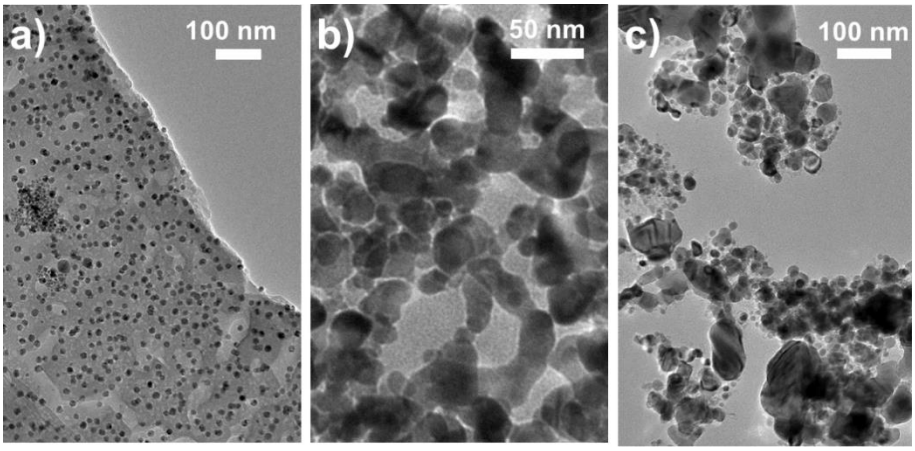

Figure S7. TEM images of the NiMo-C yielded from different temperature: a) 350 °C b) 550 °C and c) 650 °C.

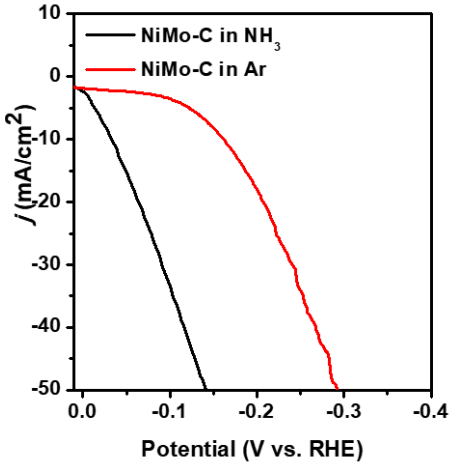

Figure S8. LSV curves in 1 M KOH of the NiMo-C heated in NH_3 and Ar respectively.

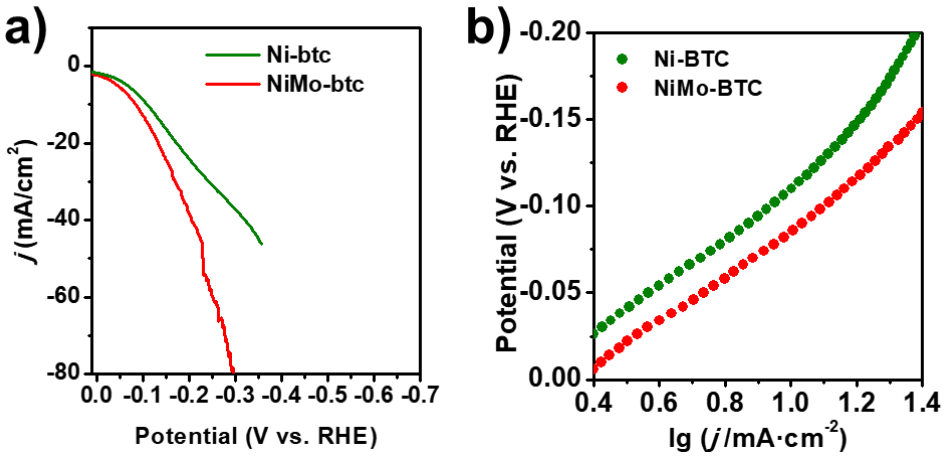

Figure S9. (a) LSV curves and (b) Tafel plots in 0.5 M H_2SO_4 of the NiMo-C and Ni-C.

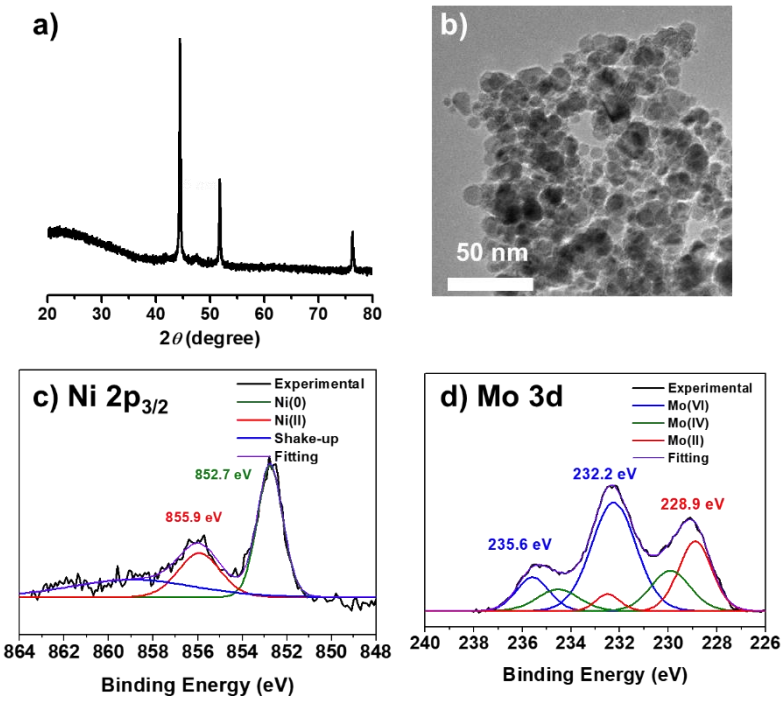

Figure S10. Structure characterization of the NiMo-C catalyst after galvanostatic test in Figure 5a: (a) the XRD pattern (b) TEM image, (c-d) XPS spectra in Ni $2p_{3/2}$ and Mo 3d region.

Table S1 Summary of the HER catalytic activity of representative metal-carbon nanocomposites in alkaline solutions

Catalyst	**Electrolyte**	**Loading (mg/cm^2)**	***η* (mV)**	***j* (mA·cm^{-2})**	**Ref.**
MOF-derived NiMo-C	1M KOH	2	58	20	This work
MOF-derived Ni-C	1M KOH	2	111	20	This work
Ni-Mo nanopowders	1M KOH	2	80	20	1
MoC_x nano octahedron	1M KOH	0.8	151	10	2
Mo_xC-Ni@NCV	1 M KOH	1.1	126	10	3
NiMoN@carbon cloth	1 M KOH	2.5	109	10	4
NanoMoC@GS	1 M KOH	0.76	77	10	5
Ni/NiO@ MWCNTs	1M KOH	0.28 8	80 95	10 100	6

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