Electronic Supplementary Material (ESI) for New Journal of Chemistry.

Supporting Information

Self-supported Molybdenum Doping Ni_3S_2 Nanoneedles as Efficient Bifunctional Catalysts for Overall Water Splitting

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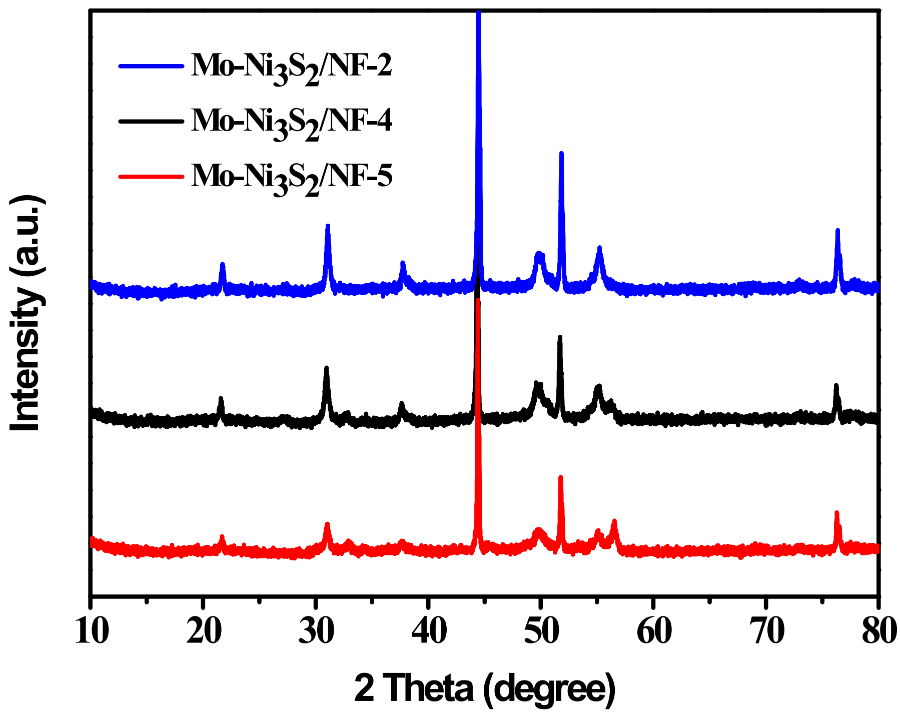

Fig. S1† XRD patterns of Mo-Ni_3S_2/NF-2, Mo-Ni_3S_2/NF-4 and Mo-Ni_3S_2/NF-5.

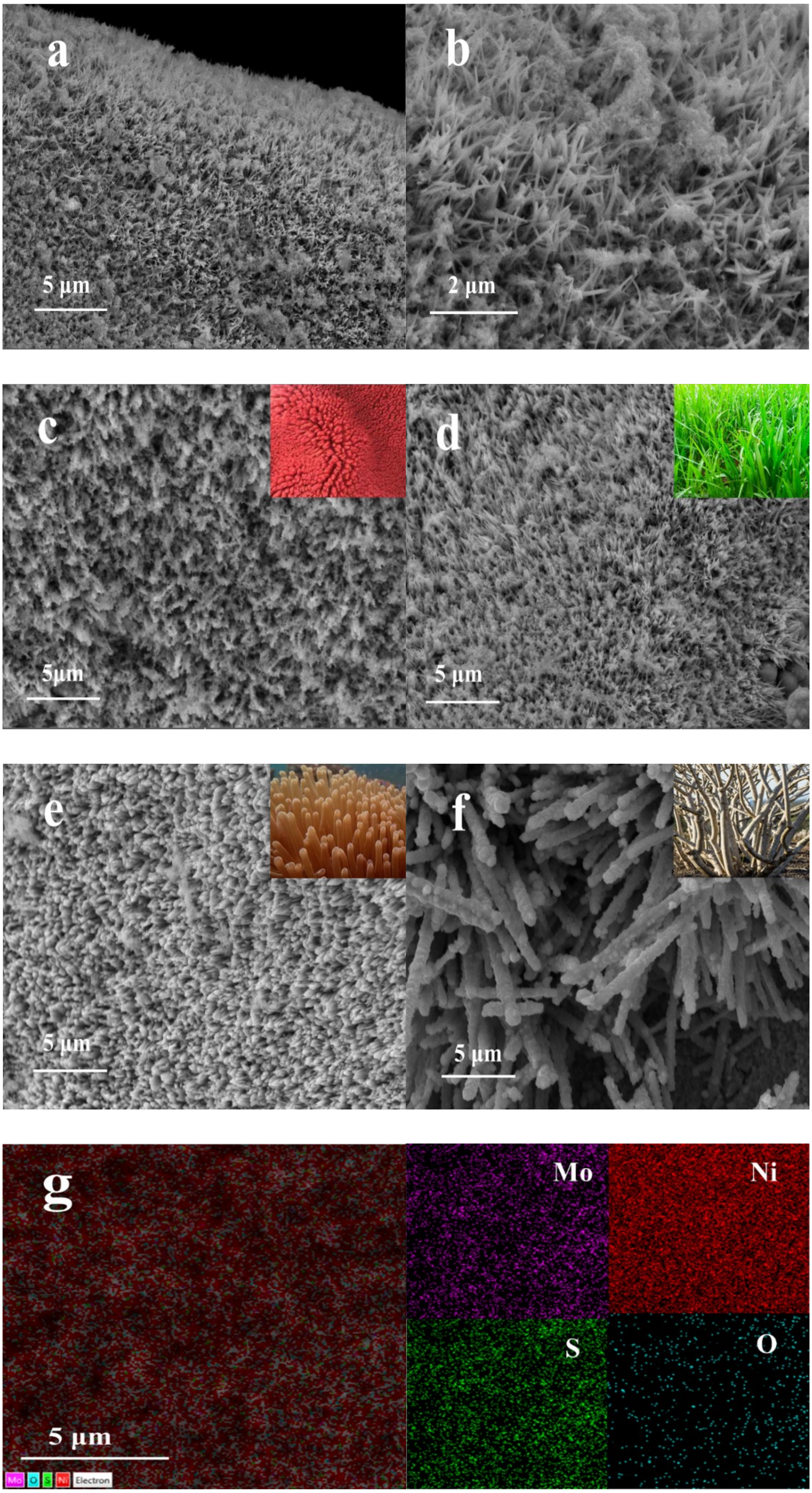

Fig. S2† SEM images of the as-synthesized (a, b) Ni_3S_2/NF, (c) Mo-Ni_3S_2/NF -2, (d) Mo-Ni_3S_2/NF -3, (e) Mo-Ni_3S_2/NF-4, (f) Mo-Ni_3S_2/NF -5 and (g) EDS mapping images of the Mo-Ni_3S_2/NF -3.

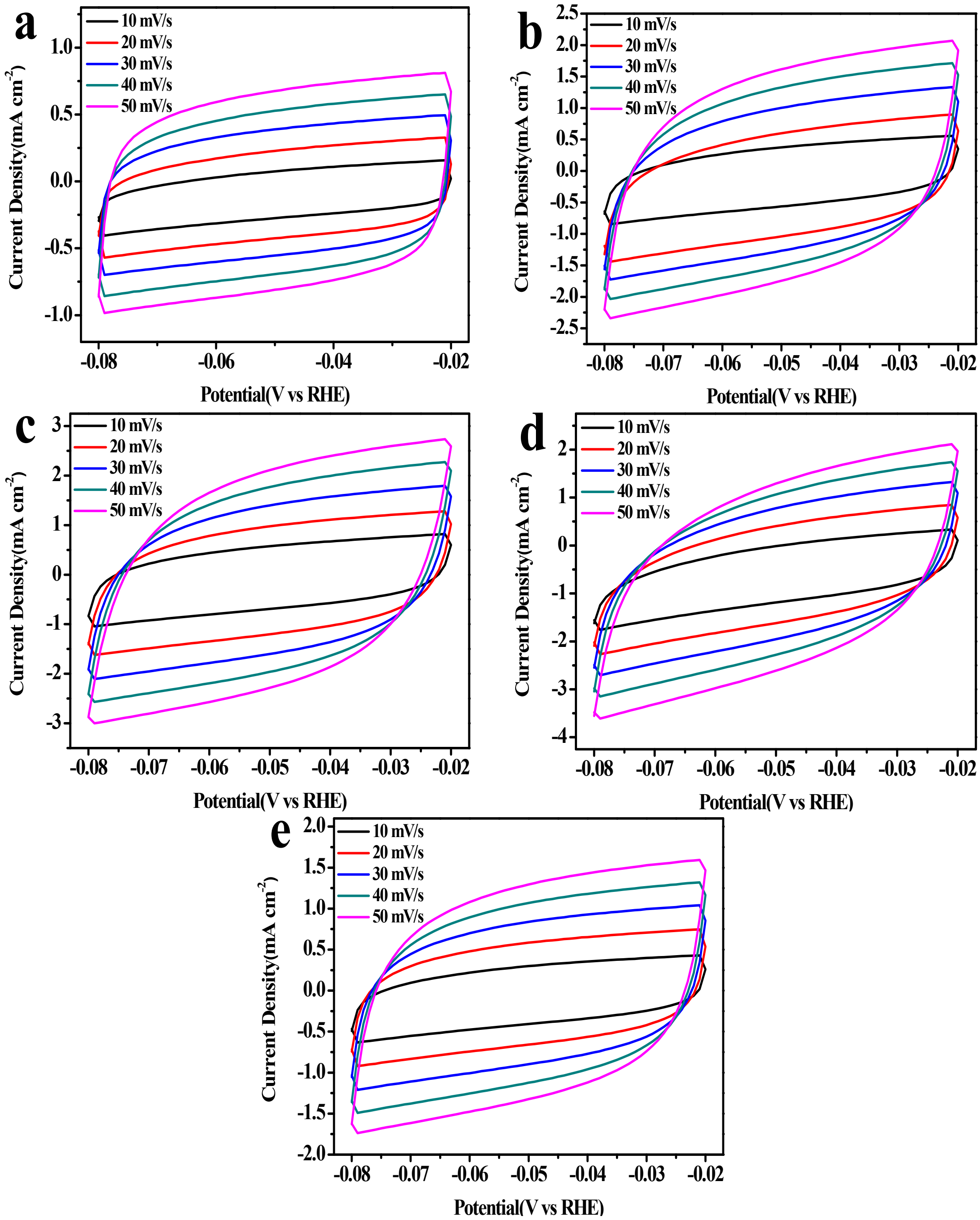

Fig. S3† CVs for HER of (a) Ni_3S_2/NF; (b) Mo-Ni_3S_2/NF-2, (c) Mo-Ni_3S_2/NF-3, (d) Mo-Ni_3S_2/NF-4, (e) Mo-Ni_3S_2/NF-5 with different scan rates (10-50 mV s $^{-1}$) in the region from -1.08 to -1.02 vs RHE.

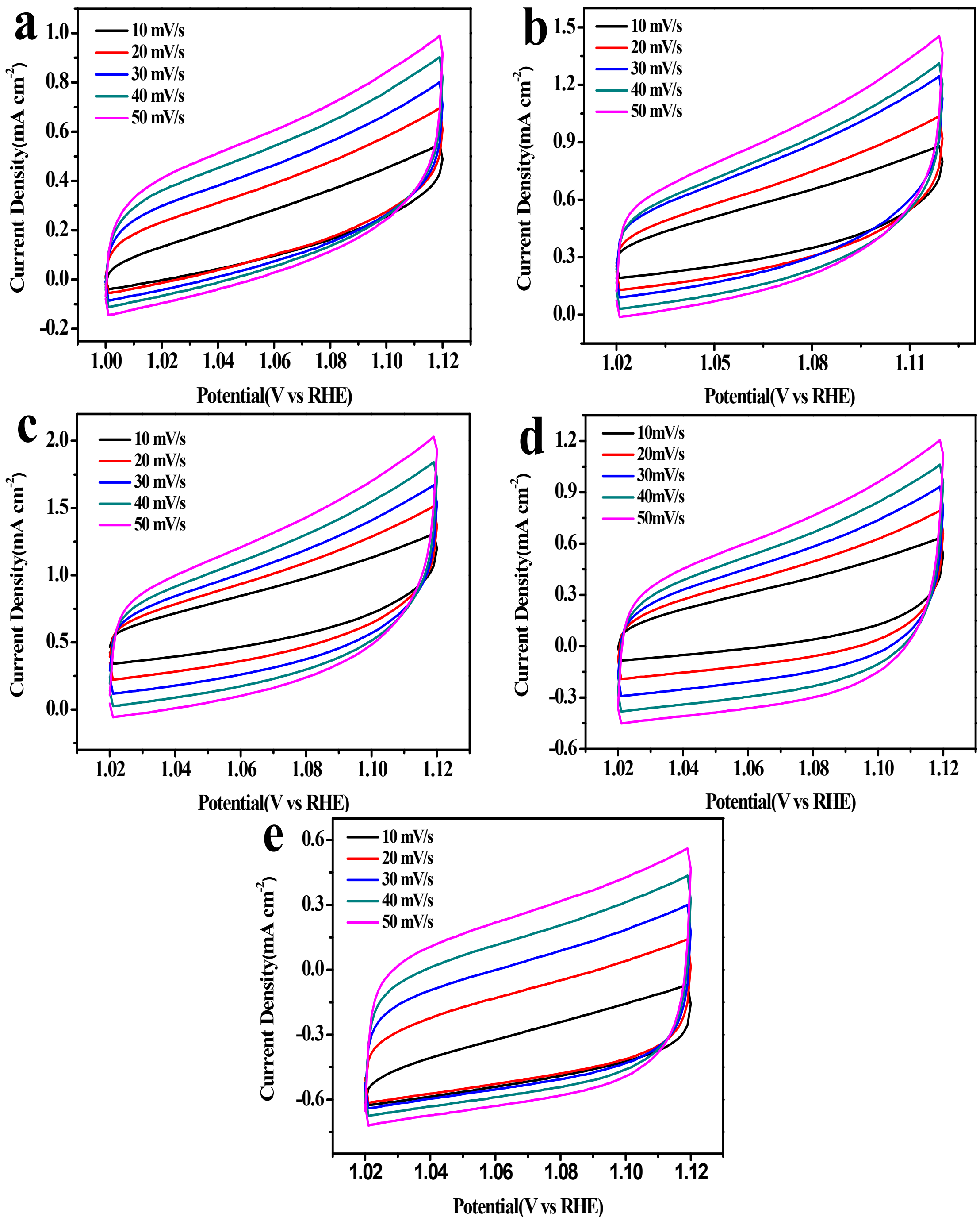

Fig. S4† CVs for OER of (a) Ni_3S_2/NF; (b) Mo-Ni_3S_2/NF-2, (c) Mo-Ni_3S_2/NF-3, (d) Mo-Ni_3S_2/NF-4, (e) Mo-Ni_3S_2/NF-5 with different scan rates (10-50 mV s^{-1}) in the region from 1.00 to 1.12 vs RHE.

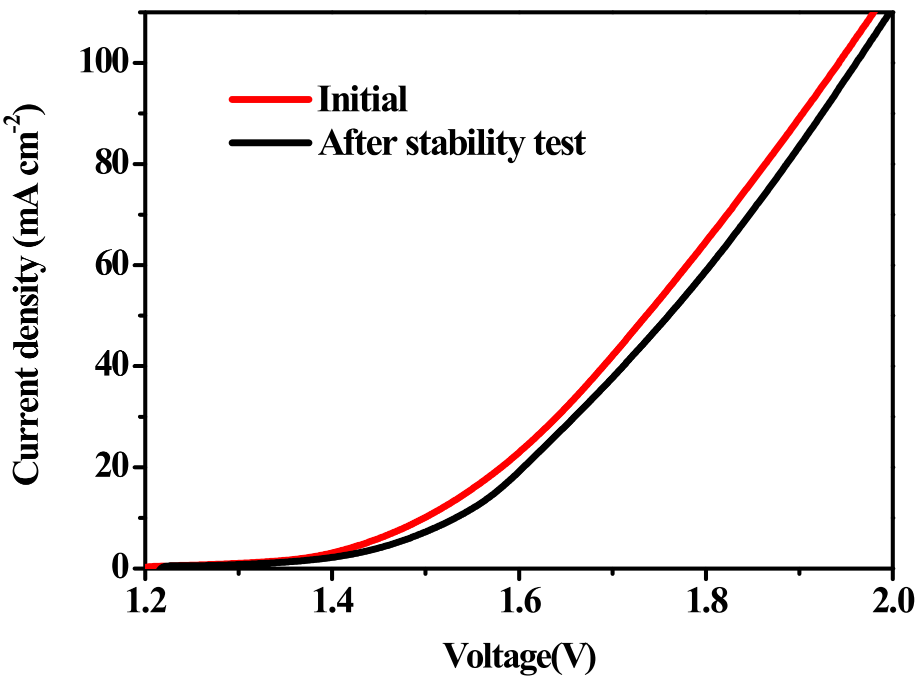

Fig. S5† Overall water splitting polarization curves before and after overall water splitting stability test.

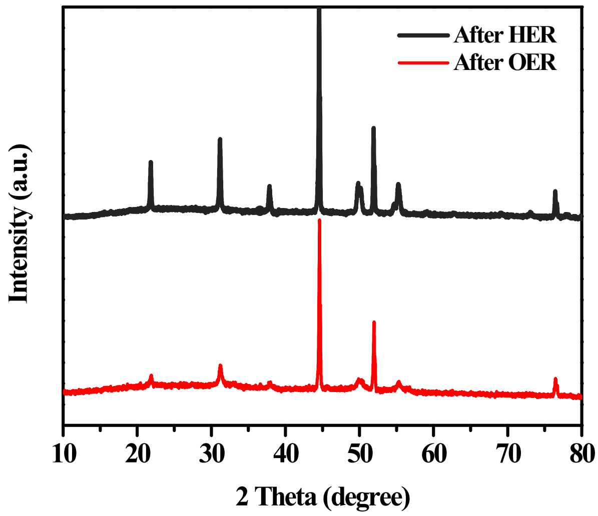

Fig. S6† XRD patterns of Mo-Ni_3S_2-3 after HER and OER.

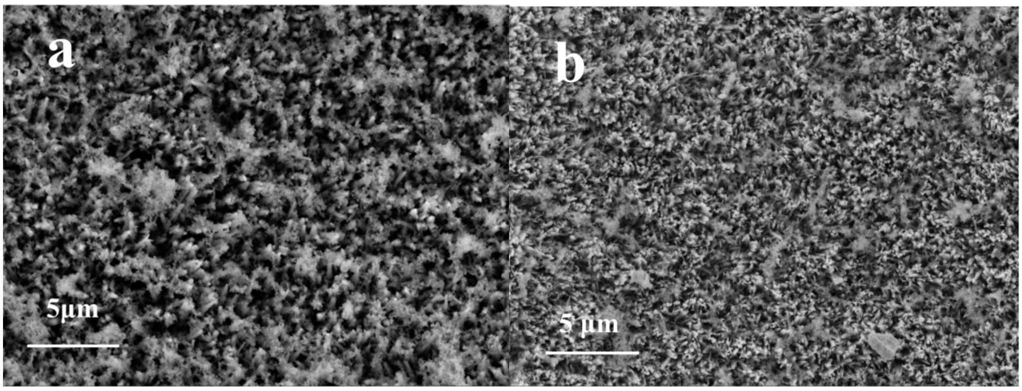

Fig. S7† The SEM of Mo-Ni_3S_2-3 after long-term (a) OER and (b) HER electrolysis.

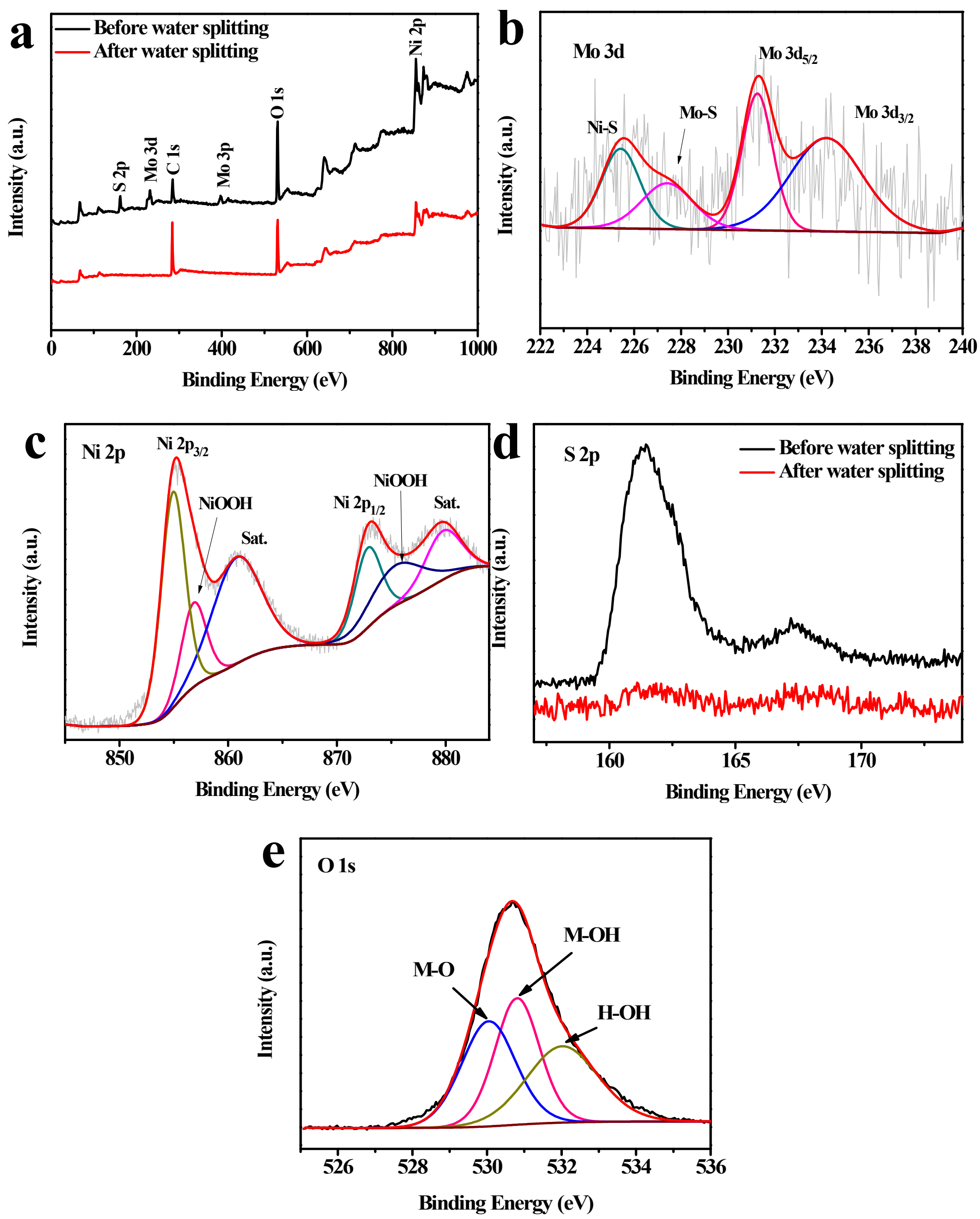

Fig. S8† The XPS spectra of Mo-Ni_3S_2-3 (cathode) after OER stability test (a) survey (b) Mo 3d (c) Ni 2p (d) S 2p and (e) O 1s.

Table. S1 Comparison of HER properties for catalysts of superior electrochemistry materials.

Catalyst	electrolyte	Backing material	Overpotential (mV vs. RHE)	Ref
Mo-Ni_3S_2	1.0 M KOH	NF	170 mV@10 mA cm^{-2}	This work
Sn-Ni_3S_2/NF	1.0 M KOH	NF	171 mV@100 mA cm^{-2}	[1]
CoSx/Ni_3S_2	1.0 M KOH	NF	139 mV@10 mA cm^{-2}	[2]
$MoSe_2$-$CoSe_2$	1.0 M KOH	NF	237 mV@10 mA cm^{-2}	[3]
MoP/Ni_2P	1.0 M KOH	NF	75 mV@10 mA cm^{-2}	[4]
V-Ni_3S_2@NiFeLDH	1.0 M KOH	NF	120 mV @10 mA cm^{-2}	[5]
N-Ni_3S_2	1.0 M KOH	NF	110 mV @ 10 mA cm^{-2}	[7]
MoS_2/NiS	1.0 M KOH	NF	187 mV @100 mA cm^{-2}	[9]

Table. S2 Comparison of OER properties for catalysts of superior electrochemistry materials.

Catalyst	electrolyte	Backing material	Overpotential (mV vs. RHE)	Ref
Mo-Ni_3S_2	1.0 M KOH	NF	174 mV @ 50 mA cm^{-2}	This work
Sn-Ni_3S_2/NF	1.0 M KOH	NF	267 mV@100 mA cm^{-2}	[1]
CoSx/Ni_3S_2	1.0 M KOH	NF	280 mV@20 mA cm^{-2}	[2]
MoP/Ni_2P	1.0 M KOH	NF	309 mV @10 mA cm^{-2}	[4]
V-Ni_3S_2 @ NiFeLDH	1.0 M KOH	NF	209 mV @10 mA cm^{-2}	[5]
MoS_2/Ni_3S_2	0.1 M KOH	NF	218 mV @ 10 mA cm^{-2}	[6]
N-Ni_3S_2	1.0 M KOH	NF	330 mV @ 100 mA cm^{-2}	[7]
MoS_2/NiS	1.0 M KOH	NF	292 mV @100 mA cm^{-2}	[9]

Table. S3 Comparison of overall water splitting properties for catalysts of superior electrochemistry materials.

Catalyst	electrolyte	Backing material	Overpotential (mV vs. RHE)	Ref
Mo-Ni_3S_2	1.0 M KOH	NF	1.49 V @ 10 mA cm^{-2}	This work
Sn-Ni_3S_2	1.0 M KOH	NF	1.46 V@10 mA cm^{-2}	[1]
CoSx/Ni_3S_2	1.0 M KOH	NF	1.57 V @10 mA cm^{-2}	[2]
MoP/Ni_2P	1.0 M KOH	NF	1.55 V@10 mA cm^{-2}	[4]
V-Ni_3S_2@NiFeLDH	1.0 M KOH	NF	1.55 V@10 mA cm^{-2}	[5]

MoS_2/Ni_3S_2	0.1 M KOH	NF	1.56 V @ 10 mA cm^{-2}	[6]
$N\text{-}Ni_3S_2$	1.0 M KOH	NF	1.48 V @ 10 mA cm^{-2}	[7]
Ni/Ni_8P_3	1.0 M KOH	NF	1.61 V @ 10 mA cm^{-2}	[8]
MoS_2/NiS	1.0 M KOH	NF	1.60 V @10 mA cm^{-2}	[9]

Notes and references

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