Electronic Supplementary Information

Fig. S1. XRD patterns of Ni-Mo-S/NF;

Fig. S2. (a-b) SEM images of Ni-Mo-S/NF;
Fig. S3. EDS spectrum of Ni$_3$S$_2$@Ni$_2$P/MoS$_2$/NF.

Fig. S4. XRD pattern of Ni$_3$S$_2$@Ni$_2$P/MoS$_2$/NF after stability measure.
Fig. S5. SEM images of Ni$_3$S$_2$@Ni$_2$P/MoS$_2$/NF after 40h stability test.

Fig. S6. XPS survey spectra of Ni$_3$S$_2$@Ni$_2$P/MoS$_2$/NF in (a) Ni 2p region (b) Mo 3d region (c) P 2p region and (d) S 2p region after OER stability test.
Fig. S7. XPS survey spectra of Ni$_3$S$_2$@Ni$_2$P/MoS$_2$/NF in (a) Ni 2p region (b) Mo 3d region (c) P 2p region and (d) S 2p region after HER stability test.
**Fig. S8.** CV images within scan rate of 10–60 mV/s of Ni$_3$S$_2$@Ni$_2$P/MoS$_2$/NF, Ni-Mo-P/NF, Ni$_3$S$_2$/NF and Ni$_2$P/NF electrocatalysts.

Calculation of ECSA for each catalyst:

ECSA = $C_{dl}/C_s$

ECSA$_{Ni_3S_2@Ni_2P/MoS_2} = 4.5$ mF cm$^2$/40 μF cm$^2 = 112.5$ cm$^2_{ECSA}$

ECSA$_{Ni-Mo-S} = 3$ mF cm$^2$/40 μF cm$^2 = 75$ cm$^2_{ECSA}$

ECSA$_{Ni_3S_2} = 2.8$ mF cm$^2$/40 μF cm$^2 = 70$ cm$^2_{ECSA}$

ECSA$_{Ni_2P} = 1.8$ mF cm$^2$/40 μF cm$^2 = 45$ cm$^2_{ECSA}$
Fig. S9. OER polarization curves normalized for the ECSA of the studied catalysts in 1 M KOH.

Fig. S10. HER polarization curves normalized for the ECSA of the studied catalysts in 1 M KOH.
**Fig. S11.** Polarization curves of Ni-Mo-P-S/NF in 1.0 M KOH for overall water splitting.

**Fig. S12.** Picture of Ni-Mo-P-S/NF as cathode and anode for overall water splitting.