

Support information for
**Ni(OH)₂-derived Lamellar MoS₂/Ni₃S₂/NF
with Fe-doping Hetero-junction
Catalysts for Efficient Overall Water
Splitting**

Minghao Dou ^a, Mengjie Yao ^a, Kai Ding ^a, Yuye Cheng ^a, Hongyu Shao ^a,
Shenjie Li ^{a*}, and Yanyan Chen ^{a*}

^a *School of Chemistry and Chemical Engineering, Hefei University of Technology, Hefei,
Anhui, 230009, PR China.*

*Corresponding Author Email: yanyanchen@hfut.edu.cn; shenjieli@hfut.edu.cn

Contents

Figure S1. XRD pattern of Ni(OH) ₂ /NF.....	S4
Figure S2. SEM images of (a) Ni(OH) ₂ /NF, (b) MoS ₂ /Ni ₃ S ₂ , (c) and (d) Fe-MoS ₂ /Ni ₃ S ₂ /NF.....	S5
Figure S3. TEM images (a-c) and HRTEM image (d) of sample MoS ₂ /Ni ₃ S ₂ /NF.....	S6
Figure S4. Full XPS spectra of sample MoS ₂ /Ni ₃ S ₂ /NF, MoS ₂ /Fe-Ni ₃ S ₂ /NF (a) and Ni(OH) ₂ /NF (b). Ni 2p _{3/2} (c) and O 1s (d) spectra of sample Ni(OH) ₂ /NF.....	S7
Figure S5. SEM images, elemental mapping images and EDS spectrum of sample MoS ₂ /Fe-Ni ₃ S ₂ /NF.....	S8
Figure S6. CV (Cyclic voltammograms) curves of various samples at scan rates ranging from 20 to 100 mV·s ⁻¹ with an interval point of 20 mV·s ⁻¹ in 1.0 M KOH for the determination of the double layer capacitance: (a) bare NF, (b) Ni(OH) ₂ /NF, (c) MoS ₂ /Ni ₃ S ₂ /NF, and (d) Fe-MoS ₂ /Ni ₃ S ₂ /NF.....	S9
Figure S7. Mott-Schottky curves of MoS ₂ /Ni ₃ S ₂ /NF (a) and MoS ₂ /Fe-Ni ₃ S ₂ /NF (b).....	S10
Figure S8. CV curves of MoS ₂ /Ni ₃ S ₂ /NF and MoS ₂ /Fe-Ni ₃ S ₂ /NF (a), corresponding areas of redox features considered for the calculation of the number of active sites (b), absolute ECSA calculated by dividing the elementary charge of an electron for MoS ₂ /Ni ₃ S ₂ /NF and MoS ₂ /Fe-Ni ₃ S ₂ /NF (c), TOF values at different potentials for MoS ₂ /Ni ₃ S ₂ /NF and MoS ₂ /Fe-Ni ₃ S ₂ /NF (d).....	S11
Figure S9. Chronopotentiometry responses for OER of MoS ₂ /Fe-Ni ₃ S ₂ /NF for 100 s (a), plots of sampled current densities against potential for OER of MoS ₂ /Fe-Ni ₃ S ₂ /NF and MoS ₂ /Ni ₃ S ₂ /NF (b), the corresponding Tafel plots for OER (c), Chronopotentiometry	

responses for HER of MoS₂/Fe-Ni₃S₂/NF for 100 s (d), plots of sampled current densities against potential for HER of MoS₂/Fe-Ni₃S₂/NF and MoS₂/Ni₃S₂/NF (e), the Corresponding Tafel plots for HER (f).……………S14

Figure S10. Faradaic efficiency oxygen production measurement of MoS₂/Fe-Ni₃S₂/NF (a), Faradaic efficiency hydrogen production measurement of MoS₂/Fe-Ni₃S₂/NF (b), Faraday efficiency test setup and its hydrogen production stage diagram (c).……………S13

Figure S11. XRD pattern of MoS₂/Fe-Ni₃S₂/NF before and after OER durability testing (20 h) (a) and MoS₂/Fe-Ni₃S₂/NF before and after HER durability testing (20 h) (b).……………S14

Figure S12. TEM images of MoS₂/Fe-Ni₃S₂/NF (a-c) and MoS₂/Fe-Ni₃S₂/NF (d-f) after OER durability testing .……………S15

Figure S13. XPS spectra of Mo 3d (a), Ni 2p (b), S 2p (c), Fe 2p (d) for MoS₂/Fe-Ni₃S₂/NF after OER durability testing (20 h).……………S16

Figure S14. XPS spectra of Mo 3d (a), Ni 2p (b), S 2p (c), Fe 2p (d) for MoS₂/Fe-Ni₃S₂/NF after HER durability testing (20 h).……………S17

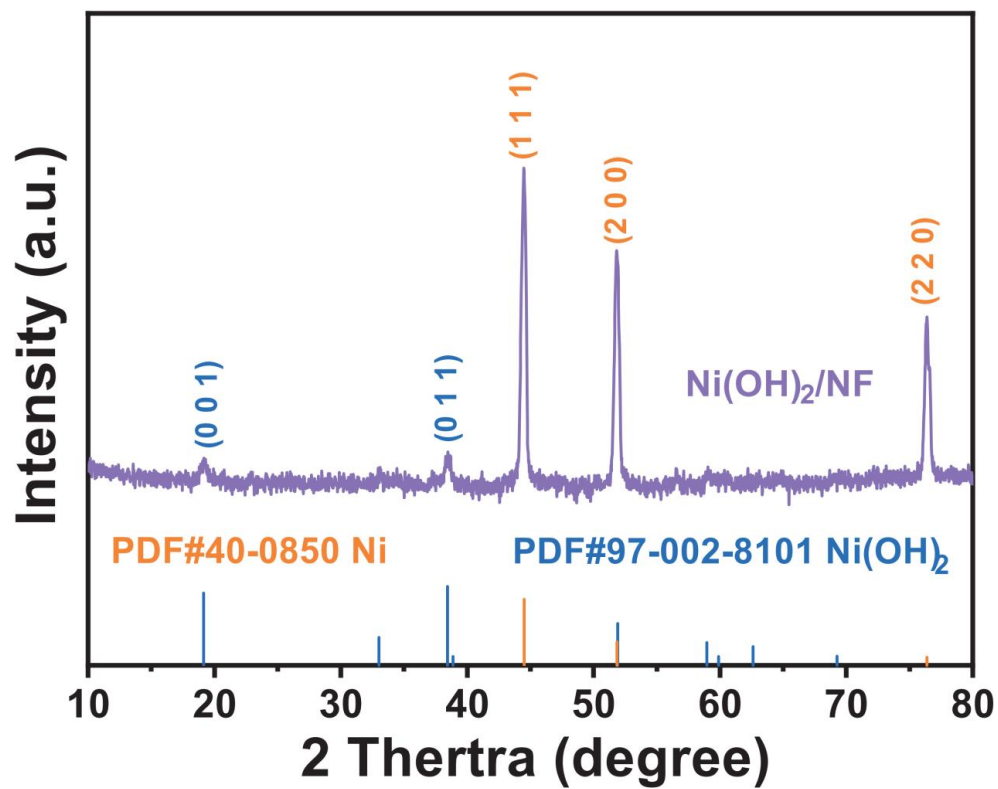


Figure S1. XRD pattern of Ni(OH)₂/NF.

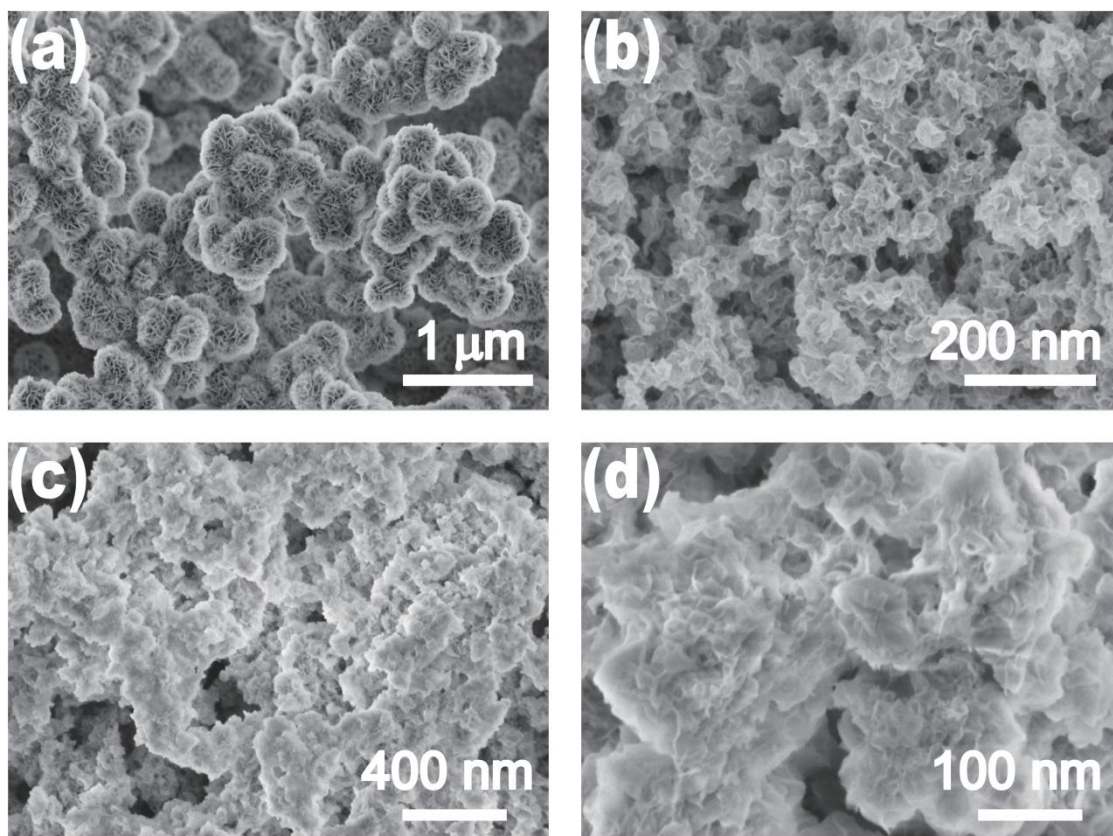


Figure S2. SEM images of (a) $\text{Ni}(\text{OH})_2/\text{NF}$, (b) $\text{MoS}_2/\text{Ni}_3\text{S}_2$, (c) and (d) $\text{Fe-MoS}_2/\text{Ni}_3\text{S}_2/\text{NF}$.

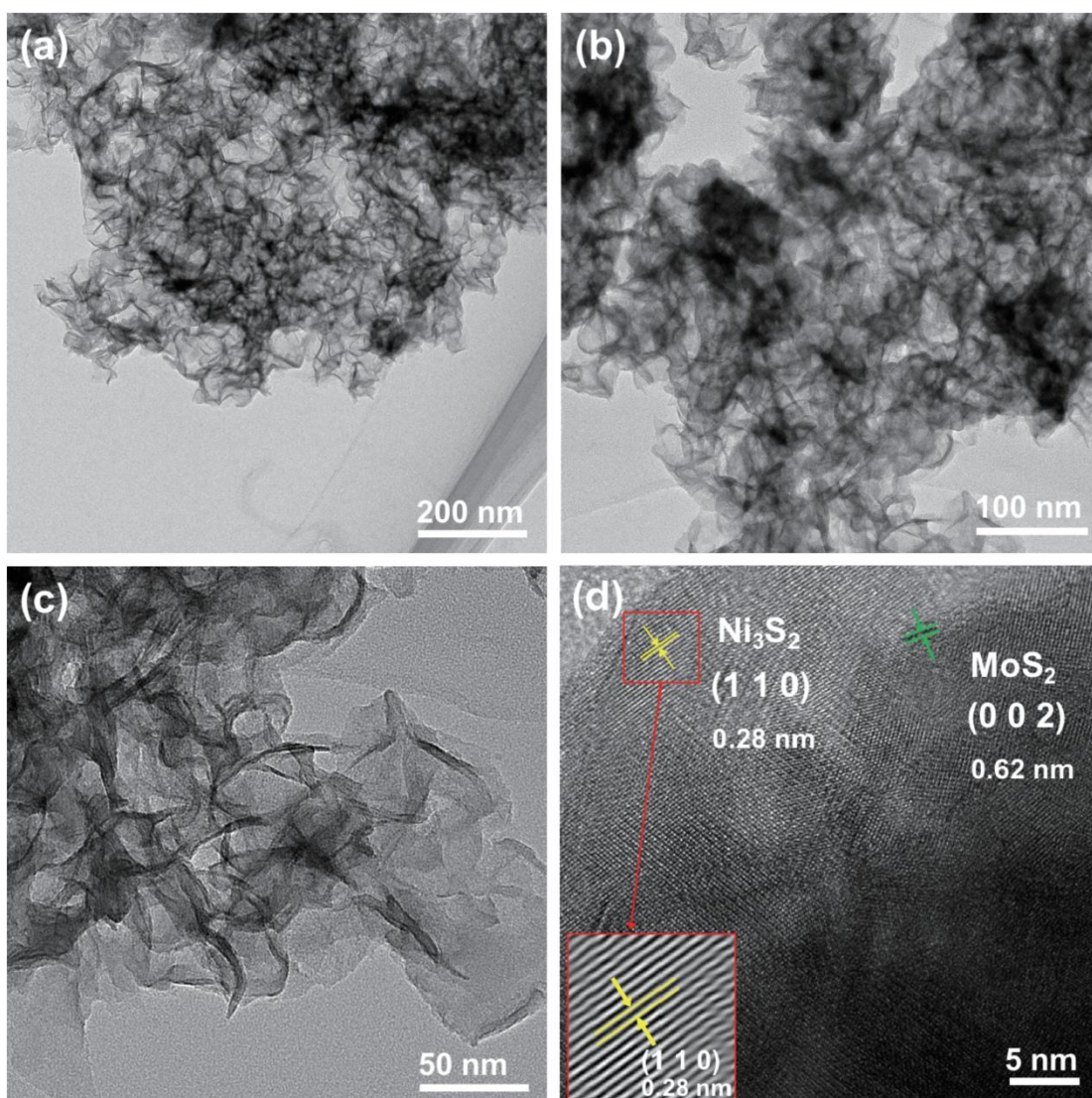


Figure S3. TEM images (a-c) and HRTEM image (d) of sample $\text{MoS}_2/\text{Ni}_3\text{S}_2/\text{NF}$.

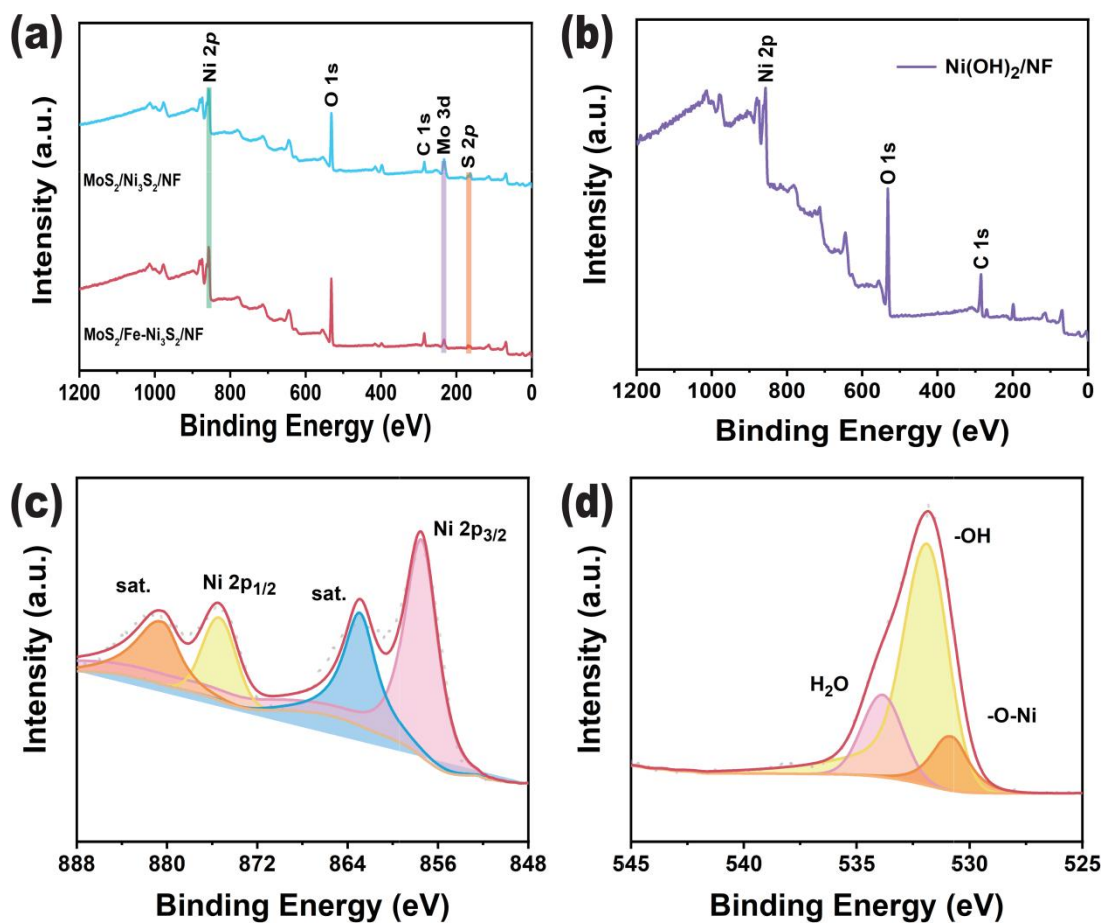


Figure S4. Full XPS spectra of sample MoS₂/Ni₃S₂/NF, MoS₂/Fe-Ni₃S₂/NF (a) and Ni(OH)₂/NF (b) Ni 2p_{3/2} (c) and O 1s (d) spectra of sample Ni(OH)₂/NF.

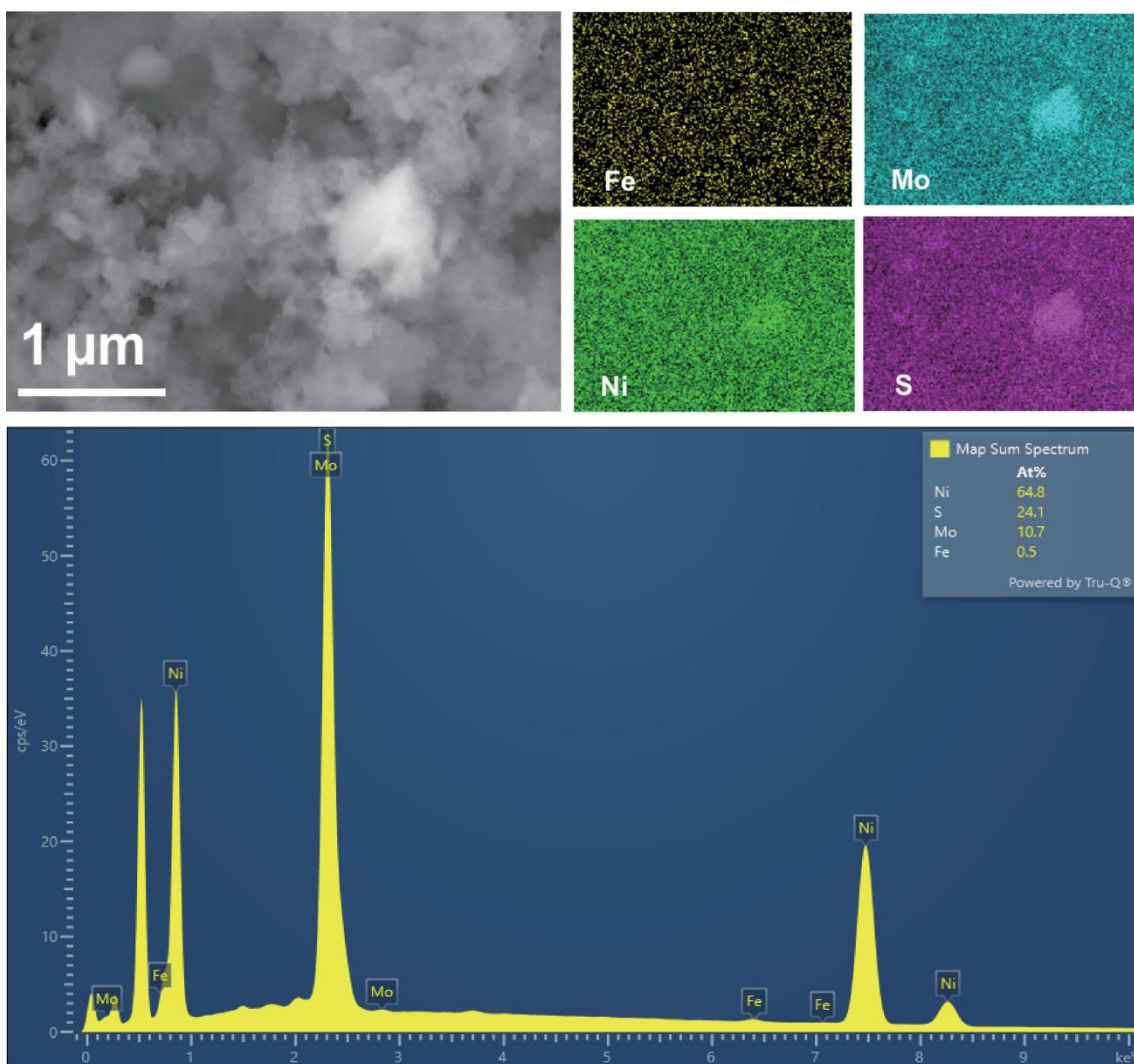


Figure S5. SEM images, elemental mapping images and EDS spectrum of sample $\text{MoS}_2/\text{Fe-Ni}_3\text{S}_2/\text{NF}$.

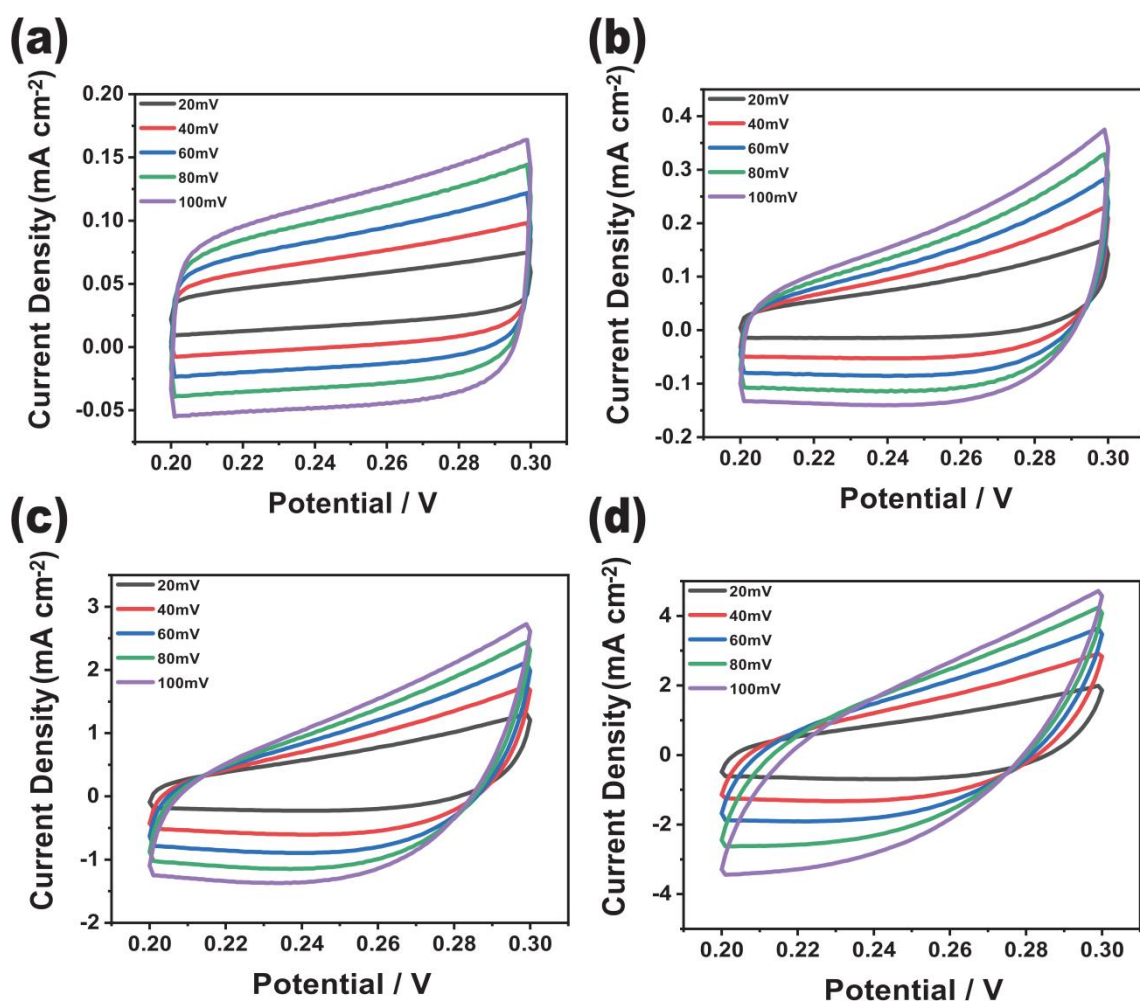


Figure S6. CV (Cyclic voltammograms) curves of various samples at scan rates ranging from 20 to 100 $\text{mV}\cdot\text{s}^{-1}$ with an interval point of 20 $\text{mV}\cdot\text{s}^{-1}$ in 1.0 M KOH for the determination of the double layer capacitance: (a) bare NF, (b) $\text{Ni}(\text{OH})_2/\text{NF}$, (c) $\text{MoS}_2/\text{Ni}_3\text{S}_2/\text{NF}$, and (d) $\text{MoS}_2/\text{Fe-Ni}_3\text{S}_2/\text{NF}$.

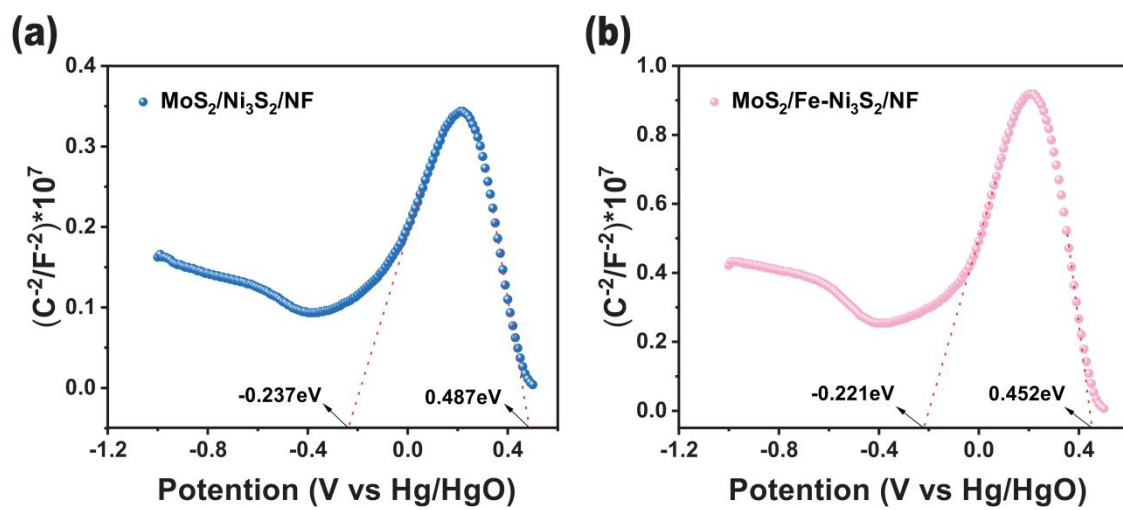


Figure S7. Mott-Schottky curves of $\text{MoS}_2/\text{Ni}_3\text{S}_2/\text{NF}$ (a) and $\text{MoS}_2/\text{Fe-Ni}_3\text{S}_2/\text{NF}$ (b).

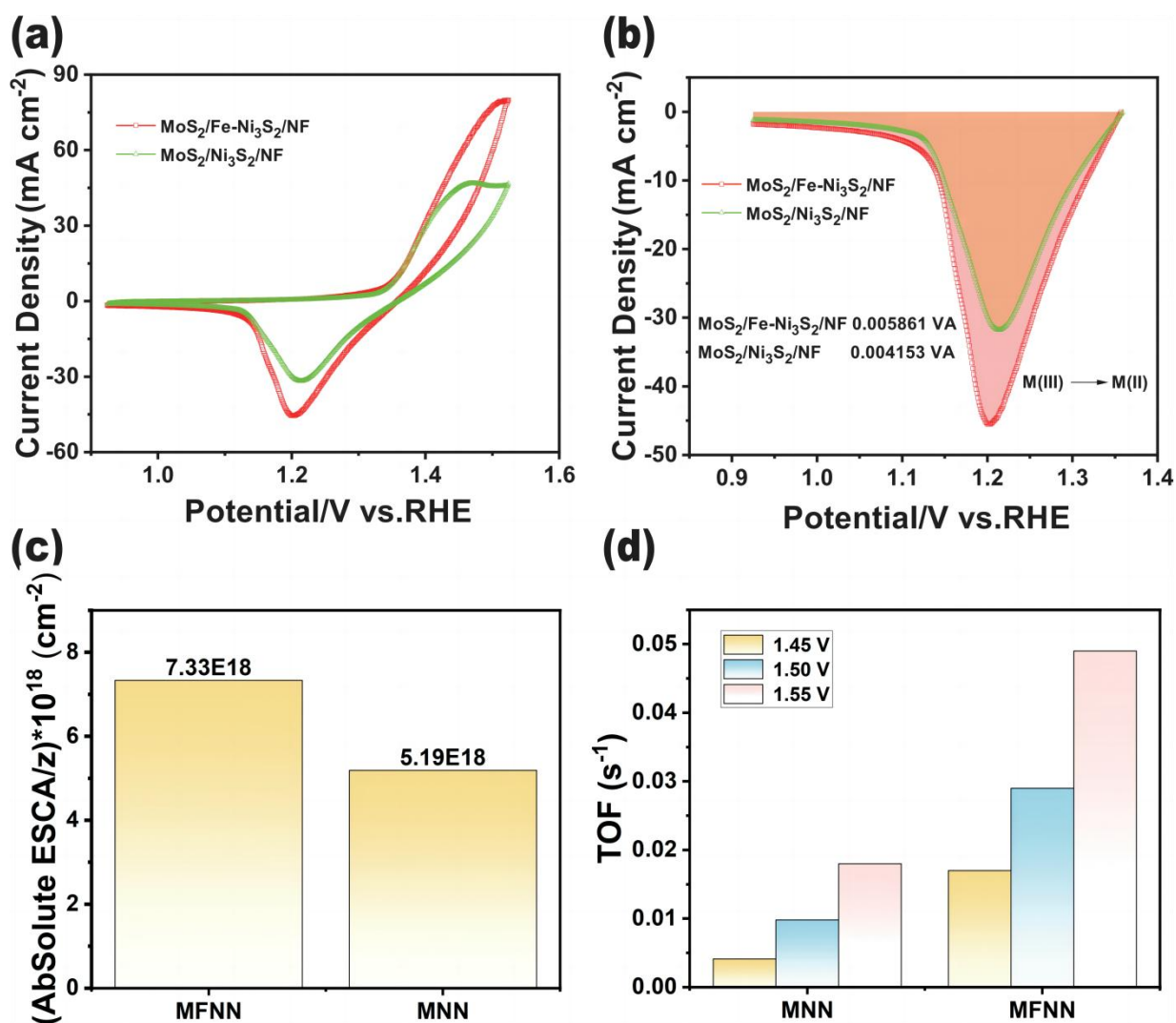


Figure S8. CV curves of MoS₂/Ni₃S₂/NF and MoS₂/Fe-Ni₃S₂/NF (a), corresponding areas of redox features considered for the calculation of the number of active sites (b), absolute ECSA calculated by dividing the elementary charge of an electron for MoS₂/Ni₃S₂/NF and MoS₂/Fe-Ni₃S₂/NF (c), TOF values at different potentials for MoS₂/Ni₃S₂/NF and MoS₂/Fe-Ni₃S₂/NF (d).

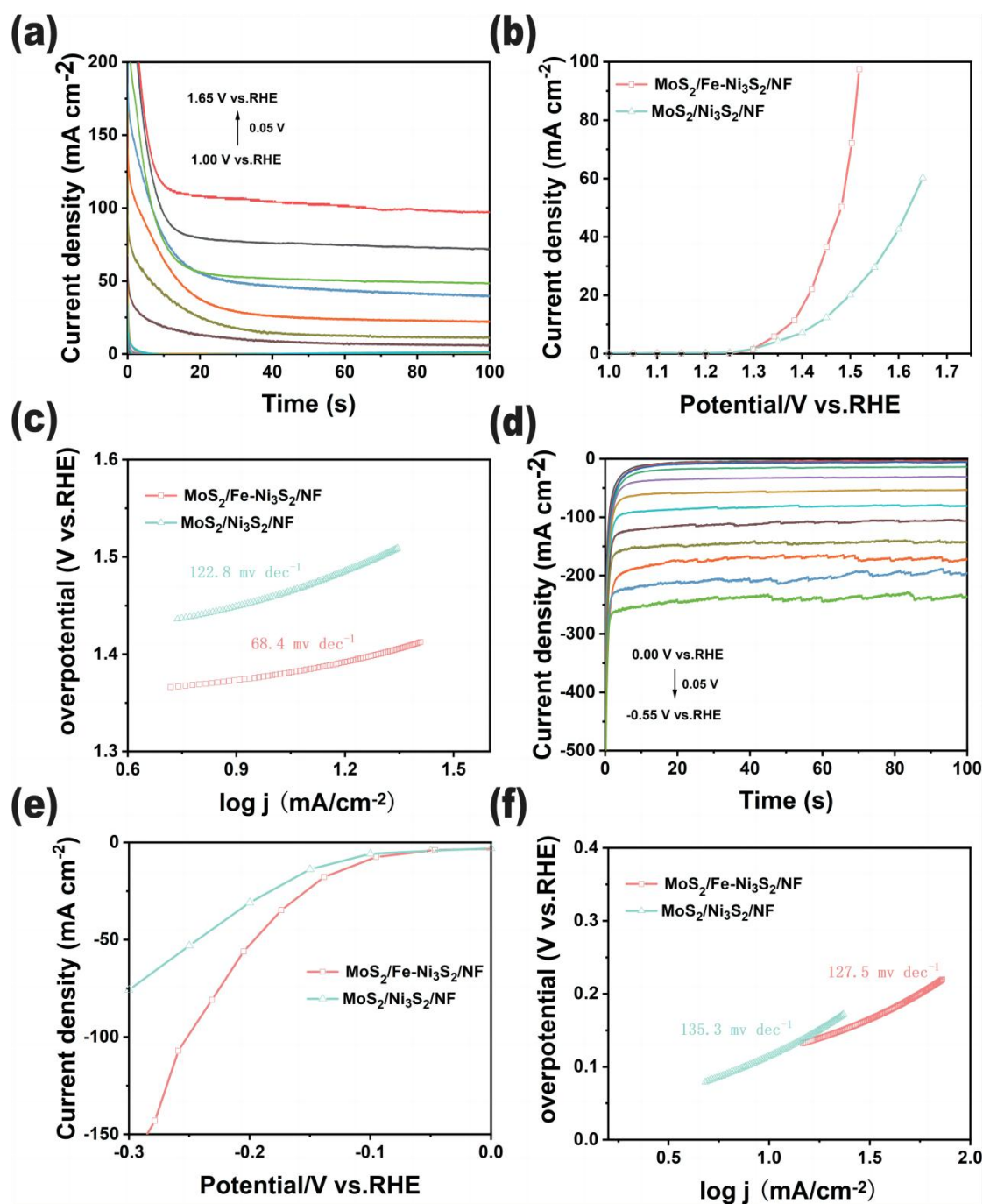


Figure S9. Chronopotentiometry responses for OER of MoS₂/Fe-Ni₃S₂/NF for 100 s (a), plots of sampled current densities against potential for OER of MoS₂/Fe-Ni₃S₂/NF and MoS₂/Ni₃S₂/NF (b), the corresponding Tafel plots for OER (c), Chronopotentiometry responses for HER of MoS₂/Fe-Ni₃S₂/NF for 100 s (d), plots of sampled current densities against potential for HER of MoS₂/Fe-Ni₃S₂/NF and MoS₂/Ni₃S₂/NF (e), the Corresponding Tafel plots for HER (f).

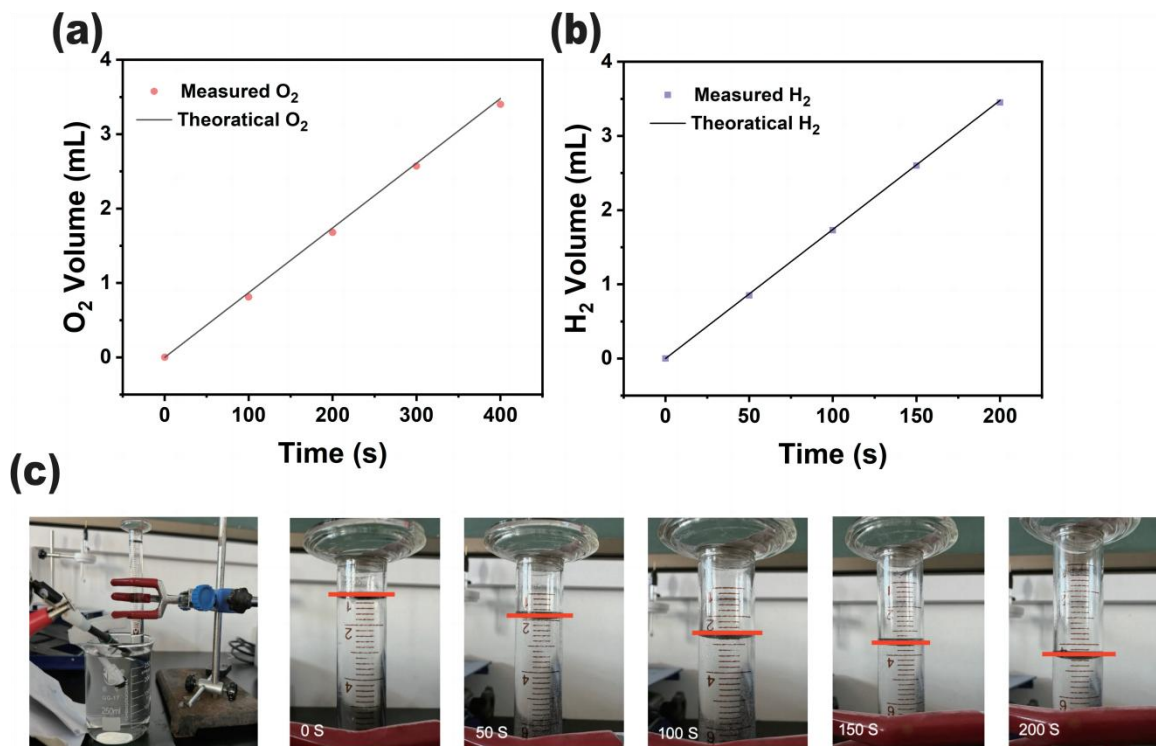


Figure S10. Faradaic efficiency oxygen production measurement of MoS₂/Fe-Ni₃S₂/NF (a), Faradaic efficiency hydrogen production measurement of MoS₂/Fe-Ni₃S₂/NF (b), Faraday efficiency test setup and its hydrogen production stage diagram (c).

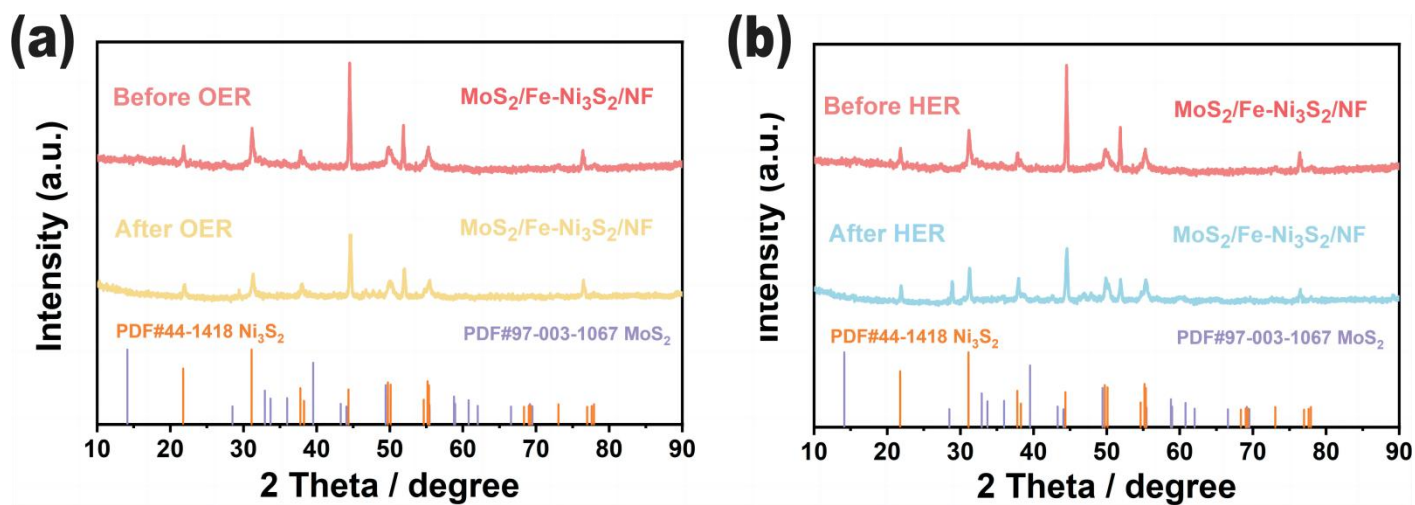


Figure S11. XRD patterns of MoS₂/Fe-Ni₃S₂/NF before and after OER durability testing (20 h) (a) and MoS₂/Fe-Ni₃S₂/NF before and after HER durability testing (20h) (b).

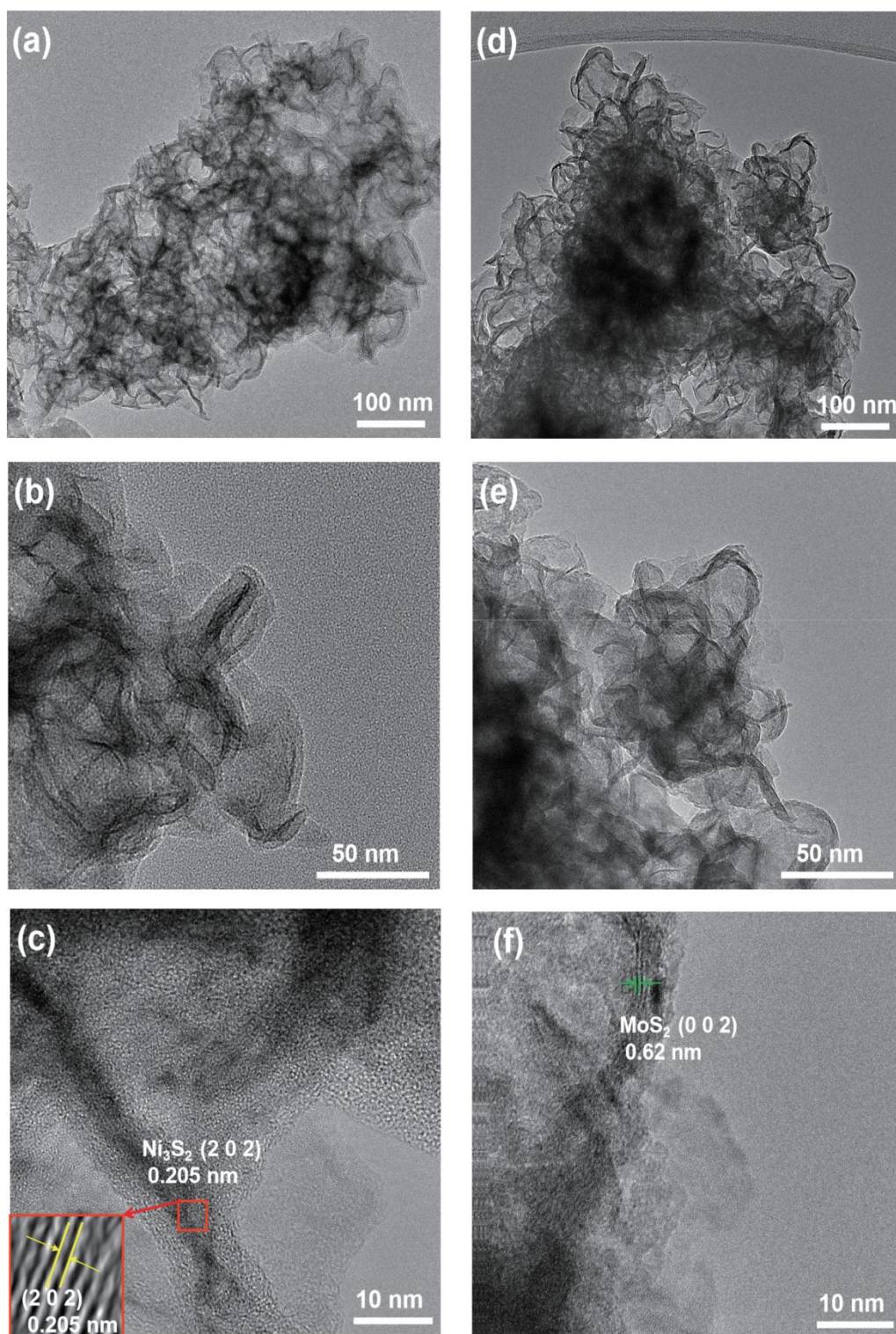


Figure S12. TEM images of $\text{MoS}_2/\text{Fe-Ni}_3\text{S}_2/\text{NF}$ (a-c) and $\text{MoS}_2/\text{Fe-Ni}_3\text{S}_2/\text{NF}$ (d-f) after OER durability testing.

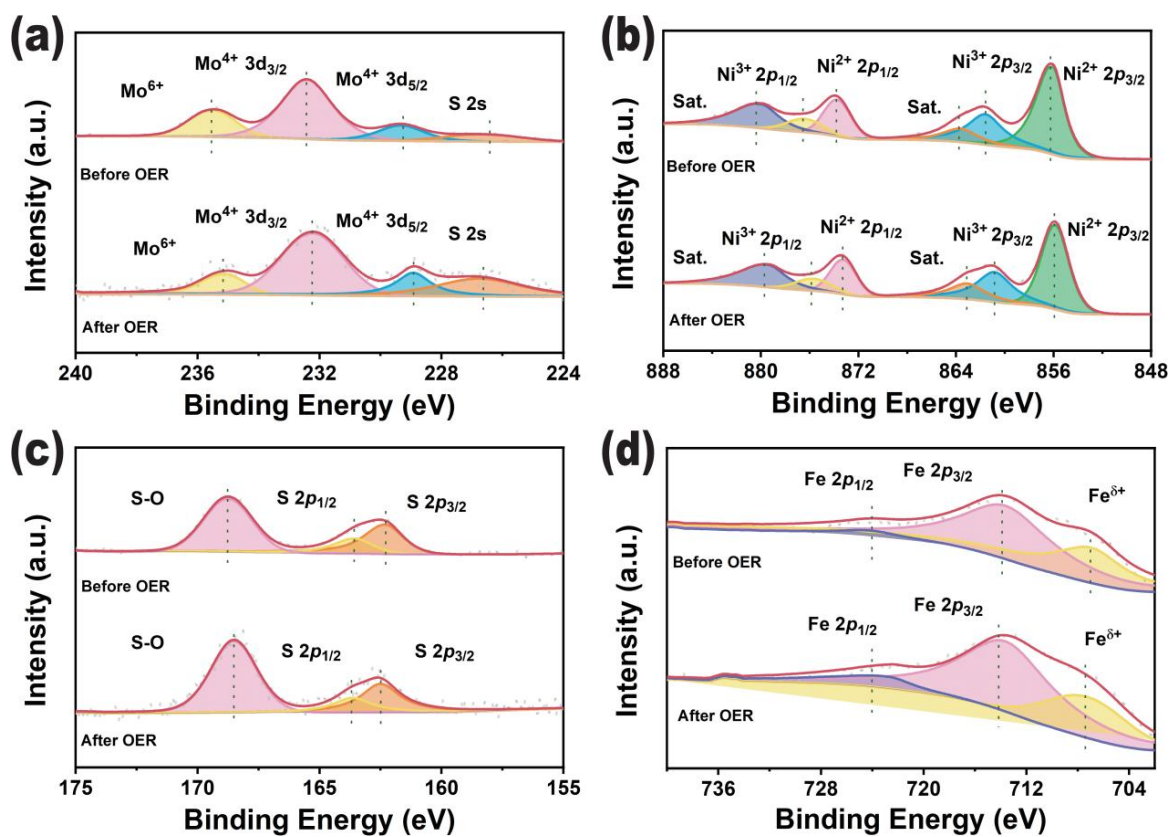


Figure S13. XPS spectra of Mo 3d (a), Ni 2p (b), S 2p (c), Fe 2p (d) for MoS₂/Fe-Ni₃S₂/NF after OER durability testing (20 h).

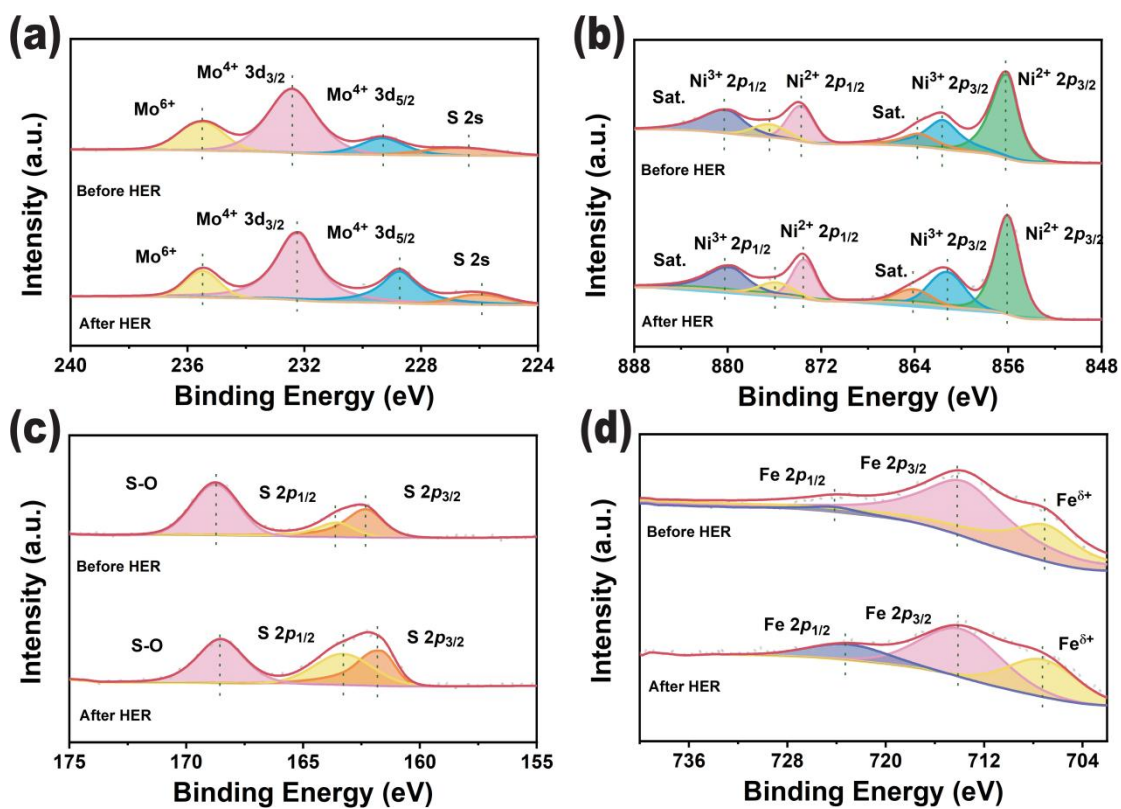


Figure S14. XPS spectra of Mo 3d (a), Ni 2p (b), S 2p (c), Fe 2p (d) for MoS₂/Fe-Ni₃S₂/NF after HER durability testing (20 h).