

Supporting Information

Immersion-Driven Structural Evolution of NiFeS Nanosheets for Efficient Water Splitting

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This part includes:

Figure S1-S3

Table S1

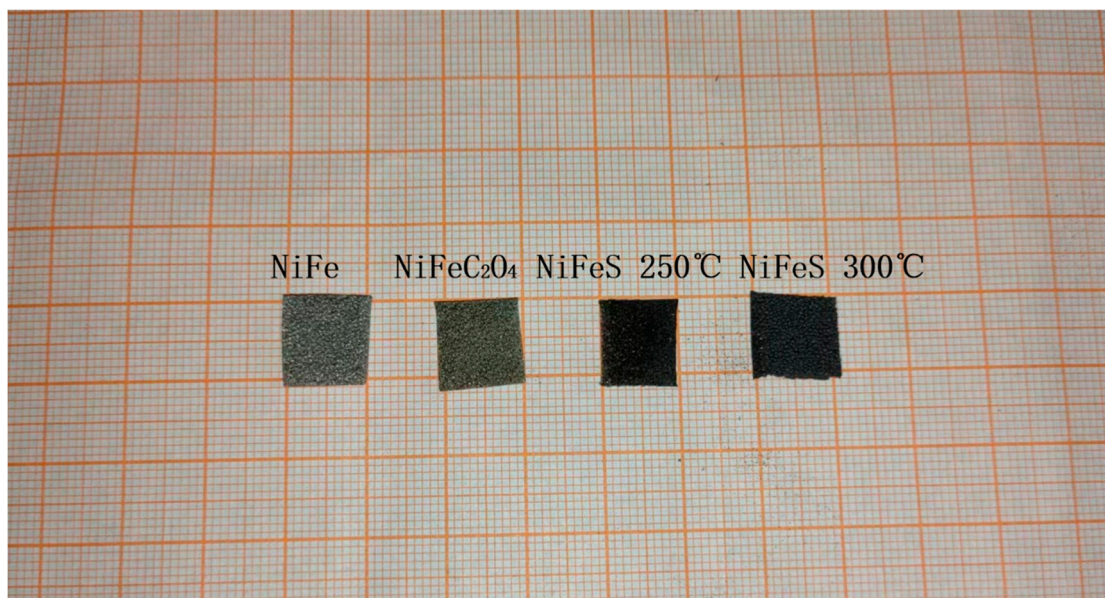


Figure S1. Optical photographs showing the fabrication processes of the NiFeS/NFF-250 and NiFeS/NFF-300 electrodes.

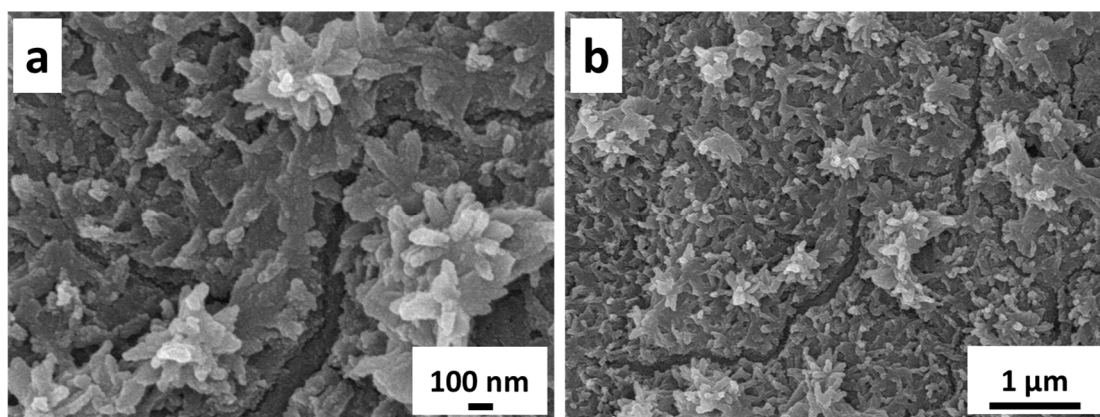


Figure S2. SEM images of NiFeS/NFF-300 after the OER durability at different magnifications.

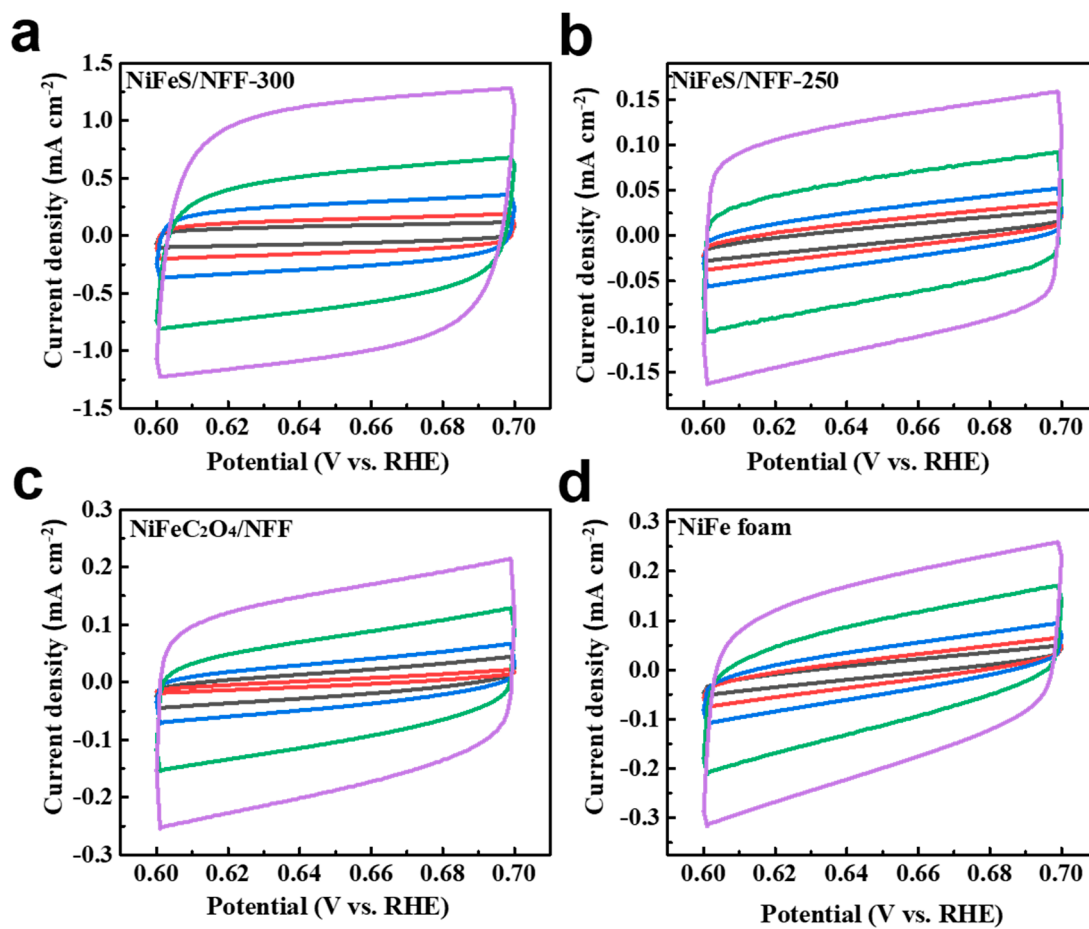


Figure S3. CVs for (a) NiFeS/NFF-300, (b) NiFeS/NFF-250, (c) NiFeC₂O₄/NFF, and (d) NiFe foam measured in the potential range from 0.6 to 0.7 V vs. RHE at different scan rates from 5 to 100 mV s⁻¹ in the 1 M KOH.

Table S1. Comparison of the electrocatalytic OER performance of the NiFeS with other non-precious

catalysts	η_{10} (mV)	Reference
CoFe ₂ O ₄ NSs	275	1
NiFeHCH	389	2
MoS ₂ @CoO	325	3
α -Mn ₂ O ₃	340	4
Co ₆ W ₆ C@NC	268	5
CeO _x CoP	264	6
Ni _{0.33} Co _{0.67} S ₂	320	7
Co ₃ O ₄ @PPy	440	8
CoSe ₂ CNTs	300	9
CuCo ₂ S ₄ CNS	269	10
VFe-MOF@NF	246	11
FeNi ₃ @NC	277	12
Ni-Fe-P-B	269	13
NiS ₂ /MoS ₂	234	14
Ni/NiSP _x	231	15
NiFeS/NFF	230	Our work

References

1. Fang, H.; Huang, T.; Liang, D.; Qiu, M.; Sun, Y.; Yao, S.; Yu, J.; Dinesh, M. M.; Guo, Z.; Xia, Y.; Mao, S. Prussian blue analog-derived 2D ultrathin CoFe_2O_4 nanosheets as high-activity electrocatalysts for the oxygen evolution reaction in alkaline and neutral media. *J. Mater. Chem. A* **2019**, 7 (13), 7328-7332.
2. Karthick, K.; Anantharaj, S.; Ede, S. R.; Kundu, S. Nanosheets of nickel iron hydroxy carbonate hydrate with pronounced OER activity under alkaline and near-neutral conditions. *Inorg. Chem.* **2019**, 58 (3), 1895-1904.
3. Cheng, P.; Yuan, C.; Zhou, Q.; Hu, X.; Li, J.; Lin, X.; Wang, X.; Jin, M.; Shui, L.; Gao, X.; Nötzel, R.; Zhou, G.; Zhang, Z.; Liu, J. Core-shell $\text{MoS}_2@\text{CoO}$ electrocatalyst for water splitting in neutral and alkaline solutions. *J. Phys. Chem. C* **2019**, 123 (10), 5833-5839.
4. Kölbach, M.; Fiechter, S.; van de Krol, R.; Bogdanoff, P. Evaluation of electrodeposited $\alpha\text{-Mn}_2\text{O}_3$ as a catalyst for the oxygen evolution reaction. *Catal. Today* **2017**, 290, 2-9.
5. Chen, J.; Ren, B.; Cui, H.; Wang, C. Constructing pure phase tungsten-based bimetallic carbide nanosheet as an efficient bifunctional electrocatalyst for overall water splitting. *Small* **2020**, 16 (23), e1907556.
6. Zhang, T.; Wu, X.; Fan, Y.; Shan, C.; Wang, B.; Xu, H.; Tang, Y. Hollow CeO_x/CoP heterostructures using two-dimensional Co-MOF as template for efficient and stable electrocatalytic water splitting. *ChemNanoMat* **2020**, 6 (7), 1119-1126.
7. Peng, Z.; Jia, D.; Al-Enizi, A. M.; Elzatahry, A. A.; Zheng, G. From water oxidation to reduction: homologous Ni-Co based nanowires as complementary water splitting electrocatalysts. *Adv. Energy Mater.* **2015**, 5 (9), 1402031.
8. Tong, Y.; Liu, H.; Dai, M.; Xiao, L.; Wu, X. Metal-organic framework derived $\text{Co}_3\text{O}_4/\text{PPy}$ bifunctional electrocatalysts for efficient overall water splitting. *Chinese Chem. Lett.* **2020**, 31 (9), 2295-2299.
9. Wei, G.; Du, K.; Zhao, X.; Wang, J.; Yan, W.; An, C.; An, C. Cable-like carbon nanotubes decorated metal-organic framework derived ultrathin $\text{CoSe}_2/\text{CNTs}$ nanosheets for electrocatalytic overall water splitting. *Chinese Chem. Lett.* **2020**, 31 (10), 2641-2644.
10. Hao, Z.; Wei, P.; Yang, Y.; Sun, J.; Song, Y.; Guo, D.; Liu, L. Self-assembled CuCo_2S_4

nanosheets with rich surface Co^{3+} as efficient electrocatalysts for oxygen evolution reaction. *Appl. Surf. Sci.* **2021**, 536, 147826.

11. Han, L.; Xu, J.; Huang, Y.; Dong, W.; Jia, X. High-performance electrocatalyst of vanadium-iron bimetal organic framework arrays on nickel foam for overall water splitting. *Chinese Chem. Lett.* **2021**, 32 (7), 2263-2268.

12. Chen, D.; Zhu, J.; Mu, X.; Cheng, R.; Li, W.; Liu, S.; Pu, Z.; Lin, C.; Mu, S. Nitrogen-doped carbon coupled FeNi_3 intermetallic compound as advanced bifunctional electrocatalyst for OER, ORR and Zn-air batteries. *Appl. Catal. B: Environ.* **2020**, 268, 118729.

13. Tang, W.; Liu, X.; Li, Y.; Pu, Y.; Lu, Y.; Song, Z.; Wang, Q.; Yu, R.; Shui, J. Boosting electrocatalytic water splitting via metal-metalloid combined modulation in quaternary Ni-Fe-P-B amorphous compound. *Nano Res.* **2020**, 13 (2), 447-454.

14. Li, C.; Liu, M.; Ding, H.; He, L.; Wang, E.; Wang, B.; Fan, S.; Liu, K. A lightly Fe-doped $(\text{NiS}_2/\text{MoS}_2)$ /carbon nanotube hybrid electrocatalyst film with laser-drilled micropores for stabilized overall water splitting and pH-universal hydrogen evolution reaction. *J. Mater. Chem. A* **2020**, 8 (34), 17527-17536.

15. Chen, X.; Li, Q.; Che, Q.; Chen, Y.; Tan, Y.; Xu, X. Self-supported Ni/NiSP_x microdendrite structure for highly efficient and stable overall water splitting in simulated industrial environment. *ACS Sustain. Chem. Eng.* **2019**, 7 (13), 11778-11786.