

Electronic Supplementary Information

Enhanced Electrocatalytic Oxygen Evolution Reaction by Photothermal Effect and Its Induced Micro-electric Field

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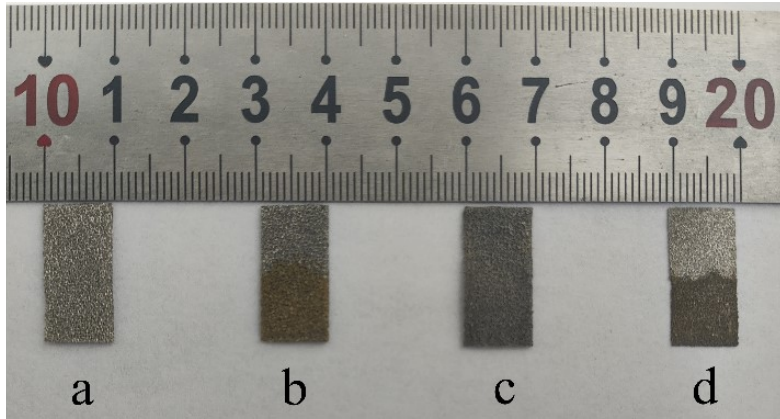


Fig. S1 The electrode pictures of (a) nickel foam (NF), (b) NiFe(OH)_y/NF, (c) NiS_x/NF and (d) NiS_x@NiFe(OH)_y/NF.

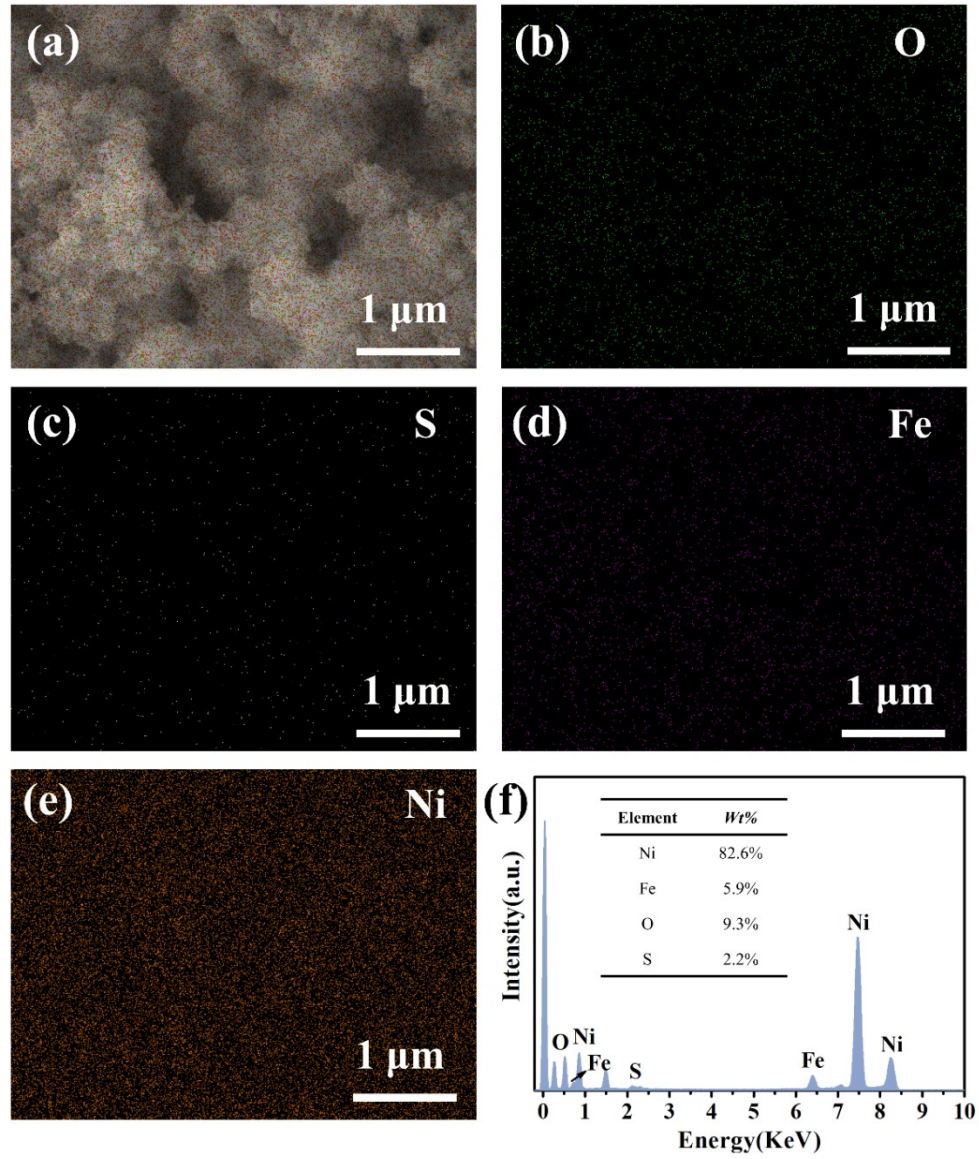


Fig. S2 (a)-(e) EDS mapping for $\text{NiS}_x@ \text{NiFe(OH)}_y/\text{NF}$, (f) EDS analysis result of $\text{NiS}_x@ \text{NiFe(OH)}_y/\text{NF}$.

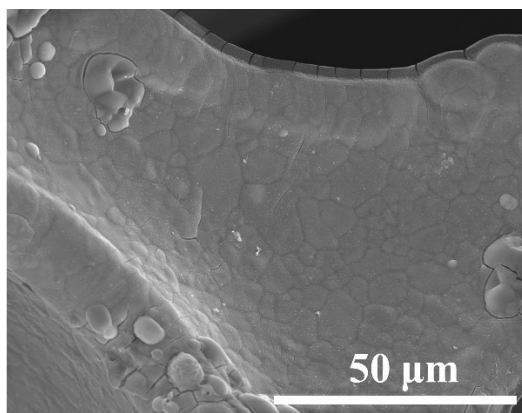


Fig. S3 SEM image of NiS_x/NF.

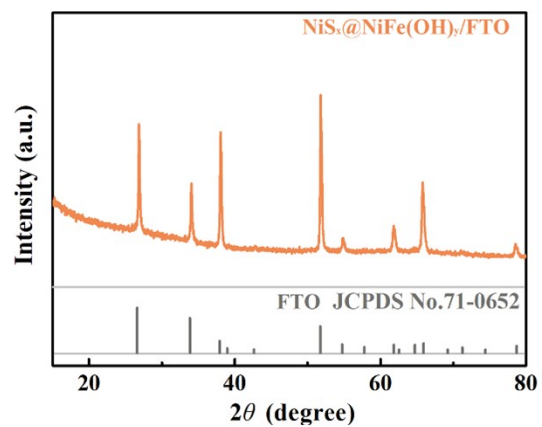


Fig. S4 XRD pattern of electrodeposited $\text{NiS}_x@NiFe(OH)_y$ on the fluorine-doped tin oxide ($\text{NiS}_x@NiFe(OH)_y/FTO$).

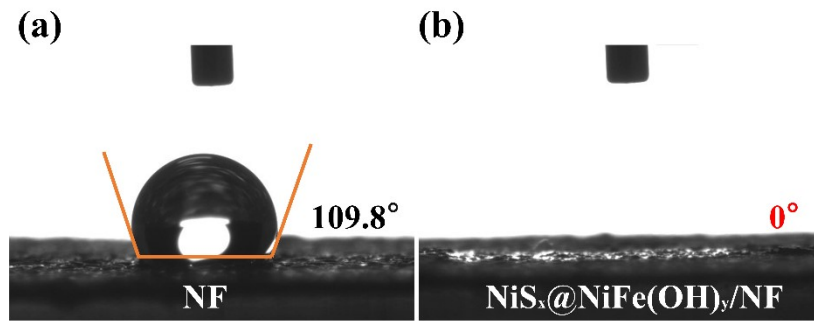


Fig. S5 The static droplet contact angles for (a) NF and (b) NiS_x@NiFe(OH)_y/NF.

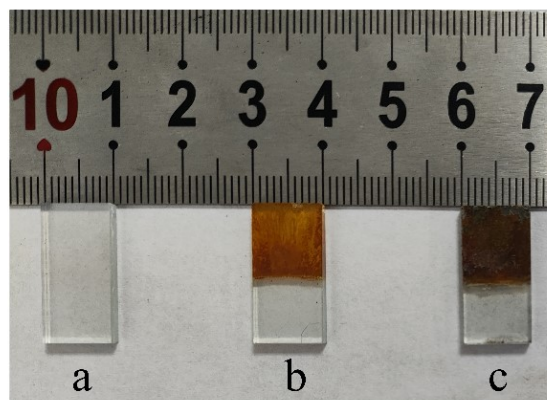


Fig. S6 The electrode pictures of (a) FTO, (b) $\text{NiFe(OH)}_y/\text{FTO}$, (c) $\text{NiS}_x@\text{NiFe(OH)}_y/\text{FTO}$.

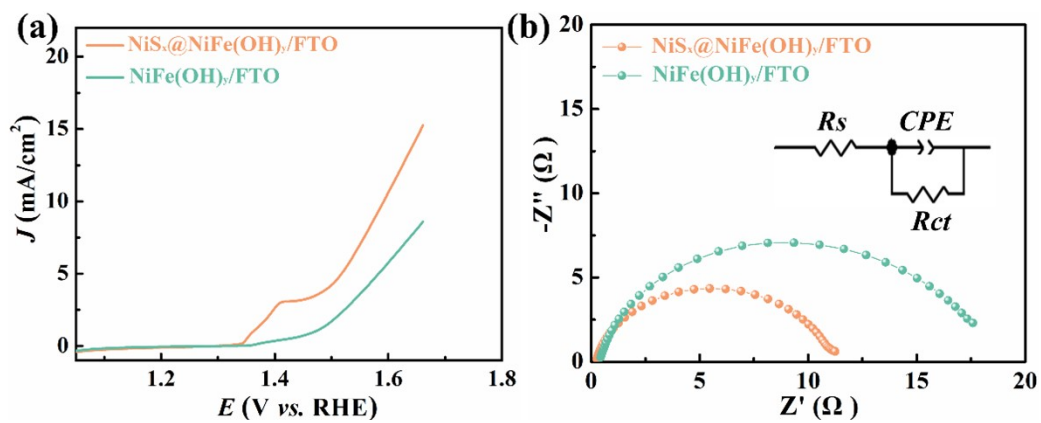


Fig. S7 OER performance of NiFe(OH)_y/FTO and NiS_x@NiFe(OH)_y/FTO: (a) LSV curves, (b) EIS spectra.

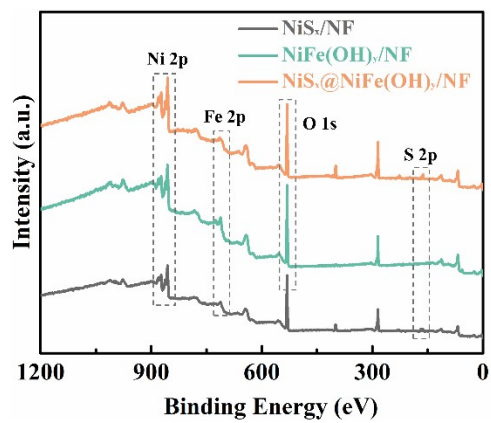


Fig. S8 survey XPS scan of NiS_x@NiFe(OH)_y/NF, NiFe(OH)_y/NF and NiS_x/NF.

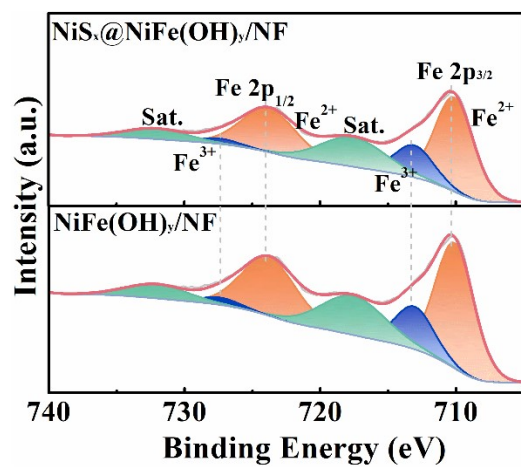


Fig. S9 High-resolution XPS comparison of Fe 2p for $\text{NiS}_x@\text{NiFe(OH)}_y/\text{NF}$ and $\text{NiFe(OH)}_y/\text{NF}$.

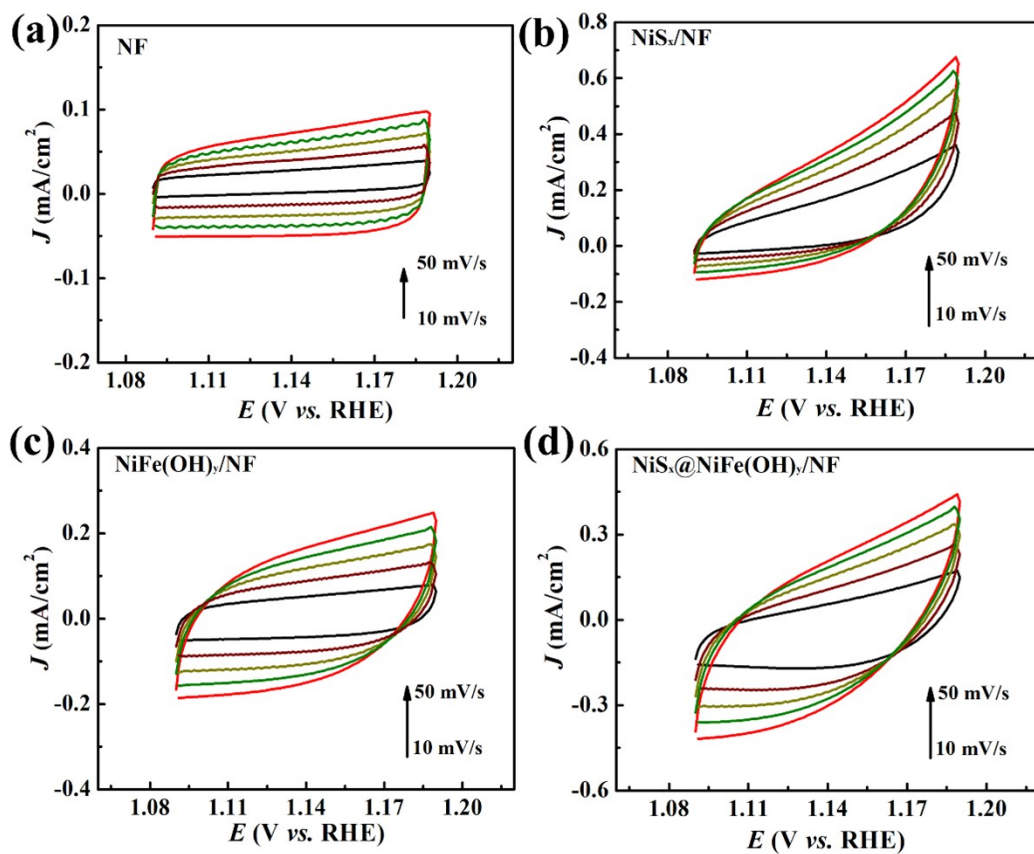


Fig. S10 CV curves of (a) NF, (b) NiS_x/NF, (c) NiFe(OH)_y/NF and (d) NiS_x@NiFe(OH)_y/NF at different scan rates (10, 20, 30, 40, and 50 mV/s).

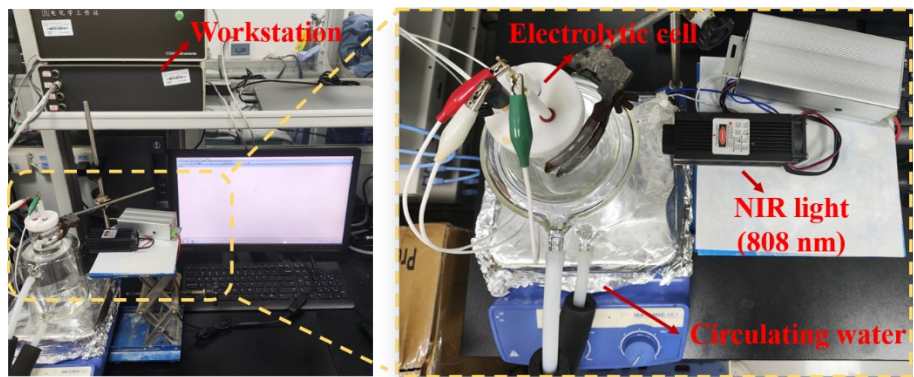


Fig. S11 The device picture of photothermal effect assist OER.

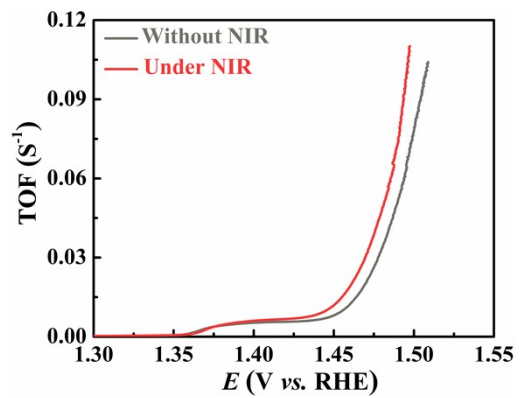


Fig. S12 TOF values of NiS_x@NiFe(OH)_y/NF under and without NIR light.

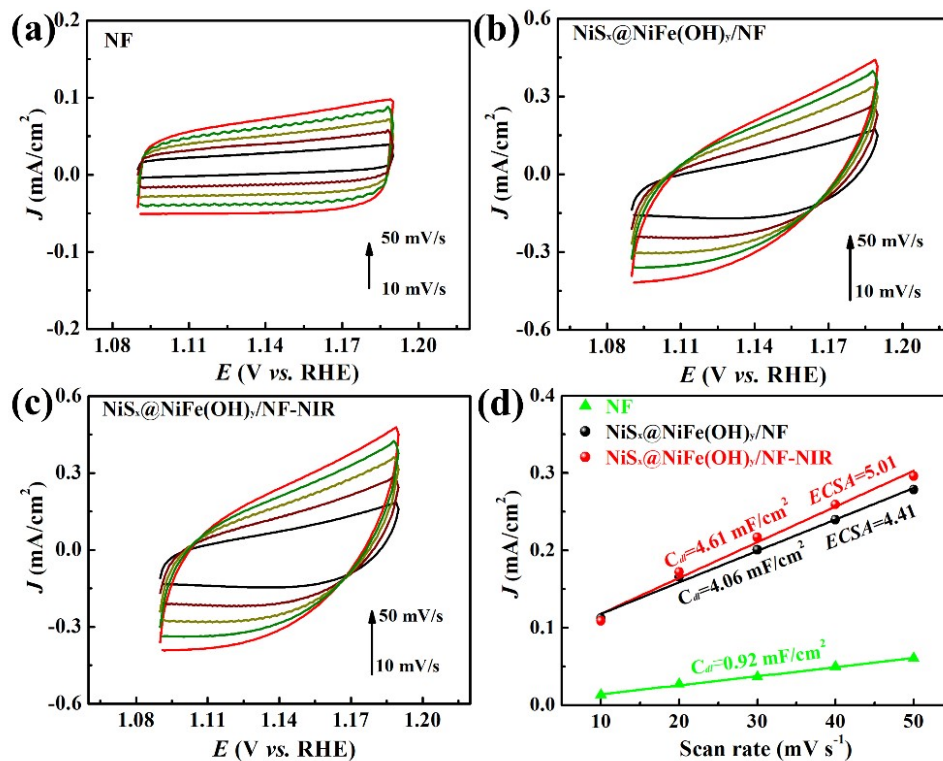


Fig. S13 CV curves of (a) NF, (b) NiS_x@NiFe(OH)_y/NF, (c) NiS_x@NiFe(OH)_y/NF-NIR at different scan rates (10, 20, 30, 40, and 50 mV/s). (d) ECSA data of NiS_x@NiFe(OH)_y/NF and NiS_x@NiFe(OH)_y/NF-NIR.

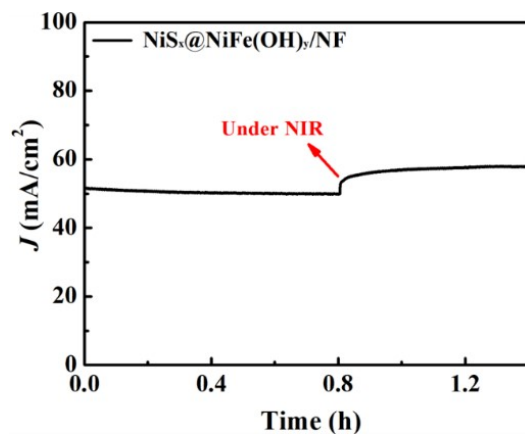


Fig. S14 J - T curves of NiS_x@NiFe(OH)_y/NF at 1.6 V vs. RHE under and without NIR light.

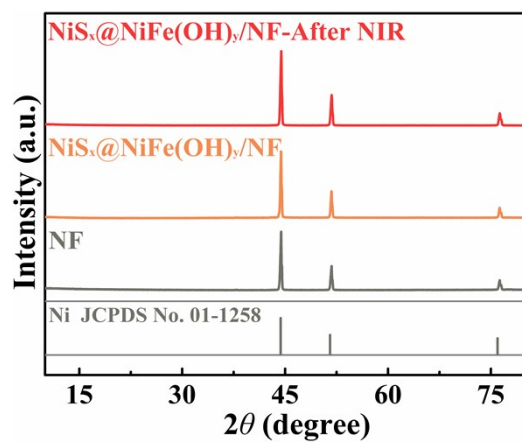


Fig. S15 XRD patterns of $\text{NiS}_x@ \text{NiFe}(\text{OH})_y/\text{NF}$ after *J-T* test under NIR light ($\text{NiS}_x@ \text{NiFe}(\text{OH})_y/\text{NF}$ -After NIR), $\text{NiS}_x@ \text{NiFe}(\text{OH})_y/\text{NF}$ and NF.

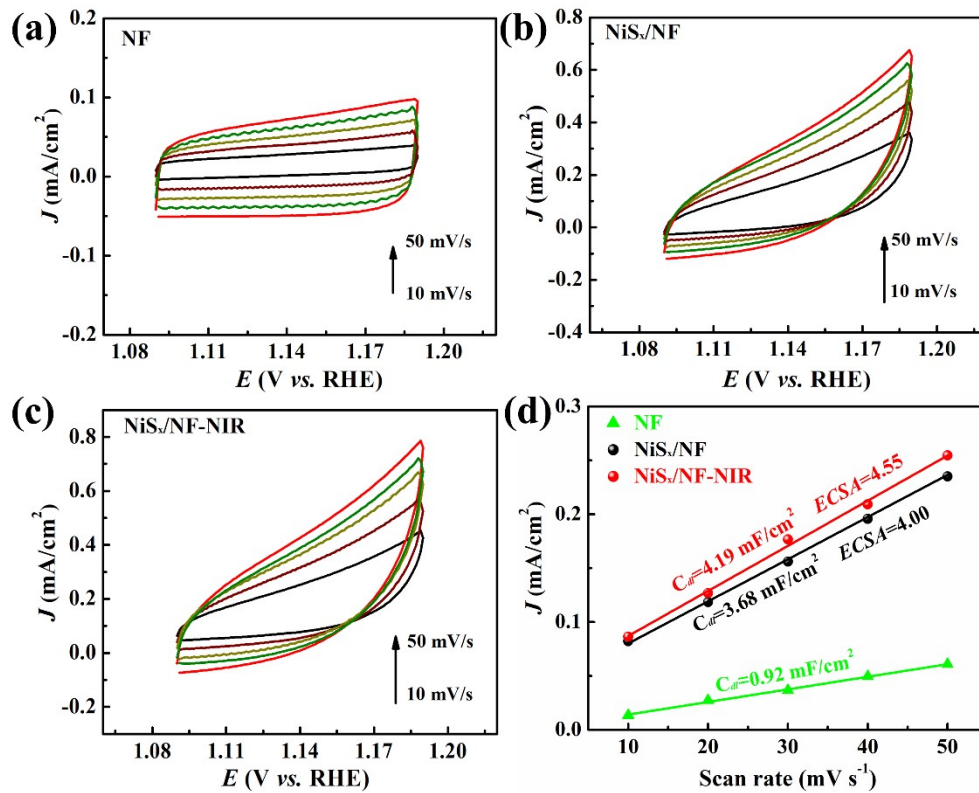


Fig. S16 CV curves of (a) NF, (b) NiS_x/NF, (c) NiS_x/NF-NIR at different scan rates (10, 20, 30, 40, and 50 mV/s). (d) ECSA data of NiS_x/NF and NiS_x/NF-NIR.

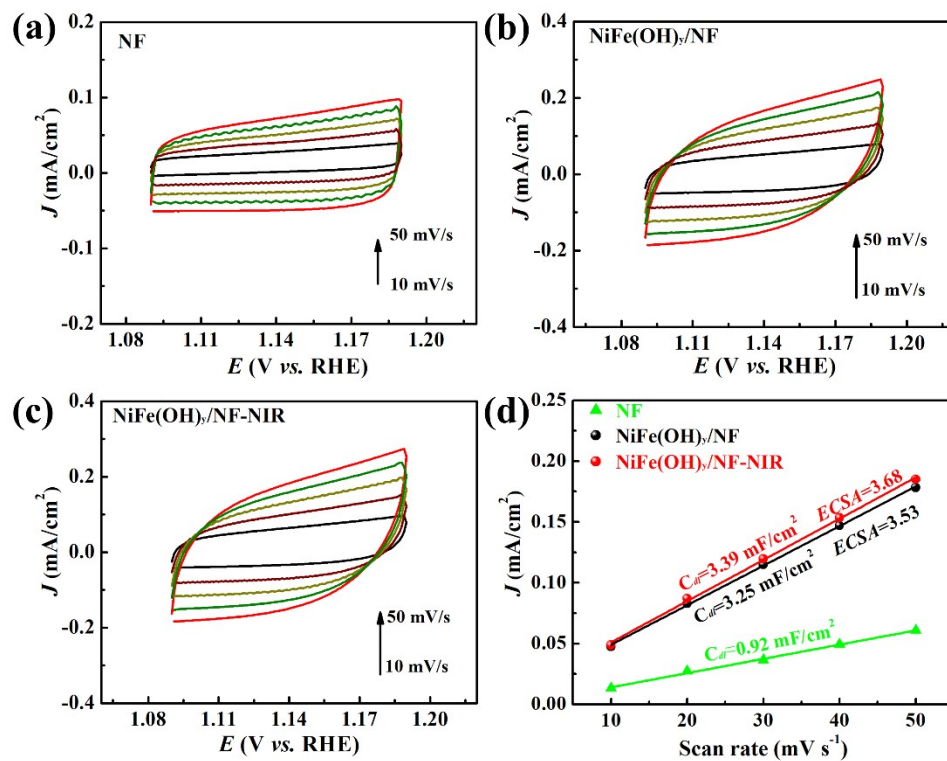


Fig. S17 CV curves of (a) NF, (b) NiFe(OH)_y/NF, (c) @NiFe(OH)_y/NF-NIR at different scan rates (10, 20, 30, 40, and 50 mV/s). (d) ECSA data of NiFe(OH)_y/NF and NiFe(OH)_y/NF-NIR.

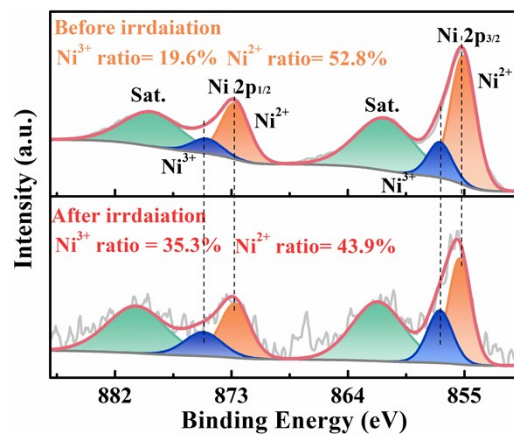


Fig. S18 High-resolution XPS comparison of Ni 2p in NiS_x@NiFe(OH)_y/NF before and after NIR light irradiation.

Table S1 Tafel slope comparison of NiS_x@NiFe(OH)_y/NF to recently reported NiFe-based

Electrocatalysts for OER.

Electrocatalyst	Tafel slope (mV dec ⁻¹)	Testing condition	Reference
NiS_x@NiFe(OH)_y/NF	38.0	1.0 M KOH+NIR light	This work
NiS_x@NiFe(OH)_y/NF	45.1	1.0 M KOH	This work
Ni _{0.3} Fe _{0.7} -LDH@NF	56.68	1.0 M KOH	[1]
NiS/LDH/NF-5	61.2	1.0 M KOH	[2]
NiFeB	31.13	1.0 M KOH	[3]
NiFe/NiFeOOH	65.0	1.0 M KOH	[4]
A-NiFe NS/CuS	41	1.0 M KOH	[5]
Fe ₂ O ₃ /Fe _{0.64} Ni _{0.36} @C-800	82.98	1.0 M KOH	[6]
NiFe@C	87.6	1.0 M KOH	[7]
NiFe 2-1	58.6	1.0 M KOH	[8]
NiFe/NiFe:Pi	38	1.0 M KOH	[9]
fcc-Ni ₃ Fe/C	72	1.0 M KOH	[10]
Ni ₅ P ₄ /NiP ₂ /NiFe LDH	46.6	1.0 M KOH	[11]
NiFe(OH) _x /NiFe-MOF	52.05	1.0 M KOH	[12]
NiFe/NiFe-OH	41	1.0 M KOH	[13]
NiFe alloy	51.9	1.0 M KOH	[14]
FeOOH@Fe ₂ O ₃ @Ni(OH) ₂ /NF	60.15	1.0 M KOH	[15]
NiFe-HD/pre-NF	81	1.0 M KOH	[16]

Table S2. Fitted Values of the Equivalent Circuit Shown in **Fig. 2d** and **Fig. 4c**.

Electrode	R_s (Ω)	R_{ct} (Ω)	CPE
NF	2.52 (0.45)	3.17 (0.97)	0.02 (3.27)
NiS _x /NF	2.37 (0.41)	1.15 (2.06)	0.13 (4.51)
NiFe(OH) _y /NF	2.60 (0.49)	0.61 (3.38)	0.08 (8.41)
NiS _x @NiFe(OH) _y /NF	2.14 (0.43)	0.50 (4.39)	0.24 (8.91)
NiS _x @NiFe(OH) _y /NF-NIR	2.10 (0.34)	0.44 (3.63)	0.22 (8.02)

Table S3 The oxygen generation rate on NiS_x@NiFe(OH)_y/NF in 1.0 M KOH at 1.6 V vs. RHE for 8 h in the presence and absence of NIR light irradiation (808 nm, 2 W cm⁻²).

Electrocatalyst	N_{O_2} (mmol h ⁻¹)
NiS _x @NiFe(OH) _y /NF	0.58
NiS _x @NiFe(OH) _y /NF-NIR	0.44

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