Table S1. Comparison of HER and OER activities of NiS/Ni_9S_8/NF-2 with other reported TMSs electrocatalysts

Catalyst	J (mA cm^{-2})	Overpotential (mV)		Electrolyte	Reference
		HER	OER		
NiS/Ni_9S_8/NF-2	10	115	176	1 M KOH	**This Work**
Co_3S_4@MoS_2	10	136	280	1 M KOH	[1]
Co_3S_4@FNC-Co3	10	140	250	1 M KOH	[2]
T(Ni_3S_2/MnS-O)	10	116	228	1 M KOH	[3]
FNHNs	10	140	290	1 M KOH	[4]
$Fe_{0.8}Ni_{0.15}S_{1.05}$	10	263	228	1 M KOH	[5]
H-Fe-CoMoS	10	137	282	1 M KOH	[6]
NiS	10	-	320	1 M KOH	[7]
Fe-Ni_3S_2/FeNi	10	-	282	1 M KOH	[8]
$FeNiS_2$ NS/rGO	10	-	200	1 M KOH	[9]
CoNi-S/NS-rGO-550	10	-	290	1 M KOH	[10]
NiCoFe-PS	10	-	195	1 M KOH	[11]
Ni_3S_2	10	-	256	1 M KOH	[12]
N-CoS_2@graphene	10	-	205	1 M KOH	[13]
Fe-MoS/carbon nanocomposites	10	321	-	1 M KOH	[14]
a-CoSx	10	182	-	1 M KOH	[15]
CoS@NiCoLDH	10	124	-	1 M KOH	[16]

Table S2. Comparison of overall water splitting activities of NiS/Ni_9S_8/NF-2 with other reported TMSs electrocatalysts

Catalysts (Cathode)	Catalysts (anode)	J (mA cm^{-2})	Potential (V)	Reference
NiS/Ni_9S_8/NF-2	**NiS/Ni_9S_8/NF-2**	10	1.53	**This Work**
Co_3S_4@MoS_2	**Co_3S_4@MoS_2**	10	1.58	[1]
Co_3S_4@FNC-Co3	**Co_3S_4@FNC-Co3**	10	1.58	[2]
T(Ni_3S_2/MnS-O)	**T(Ni_3S_2/MnS-O)**	10	1.54	[3]
FNHNs	**FNHNs**	10	1.55	[4]
$Fe_{0.8}Ni_{0.15}S_{1.05}$	**$Fe_{0.8}Ni_{0.15}S_{1.05}$**	10	1.63	[5]
V-NiS_2	**V-NiS_2**	10	1.56	[17]
S, N-CNTs/ CoS_2@Co	**S,NCNTs/CoS_2@Co**	10	1.63	[18]
Ni_3S_2-FeS	**Ni_3S_2-FeS**	10	1.61	[19]
$CoNi_2S_4$	**$CoNi_2S_4$**	10	1.58	[20]
SW-CoS@CNT	**SW-CoS@CNT**	10	1.56	[21]

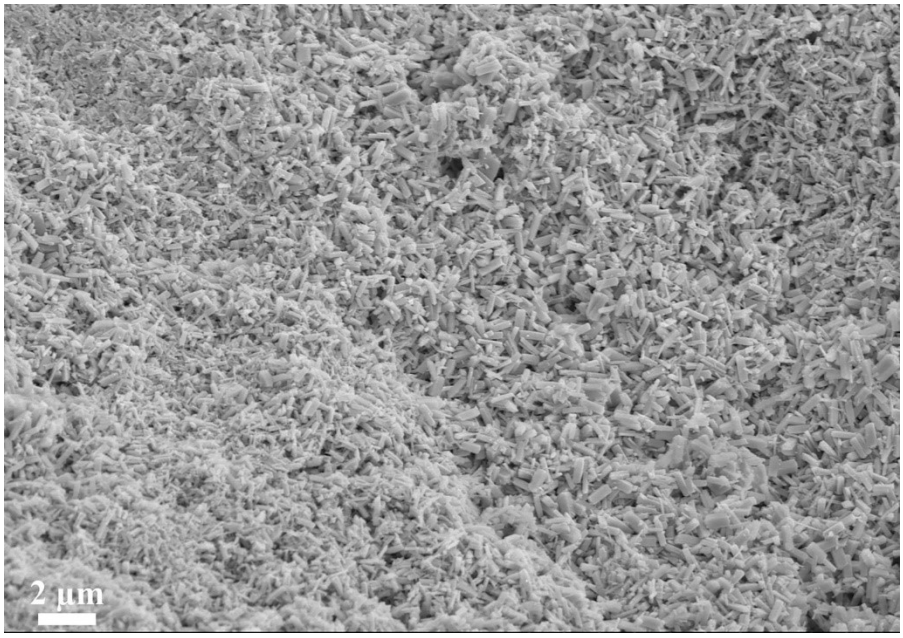

Figure S1. SEM image of $NiC_2O_4 \cdot 2H_2O$/NF-2 precursor.

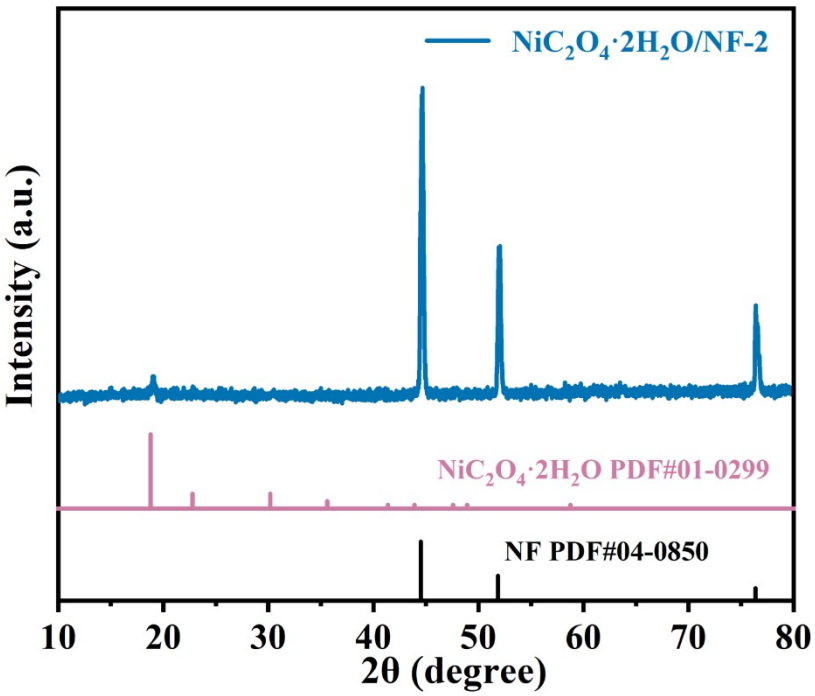

Figure S2. XRD pattern of $NiC_2O_4 \cdot 2H_2O$/NF-2 precursor.

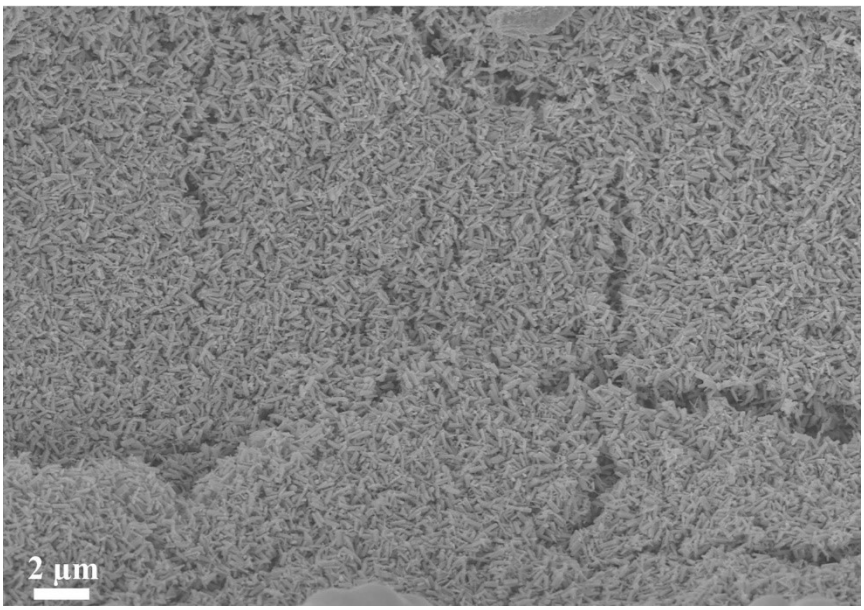

Figure S3. SEM image of NiS/Ni_9S_8/NF-2.

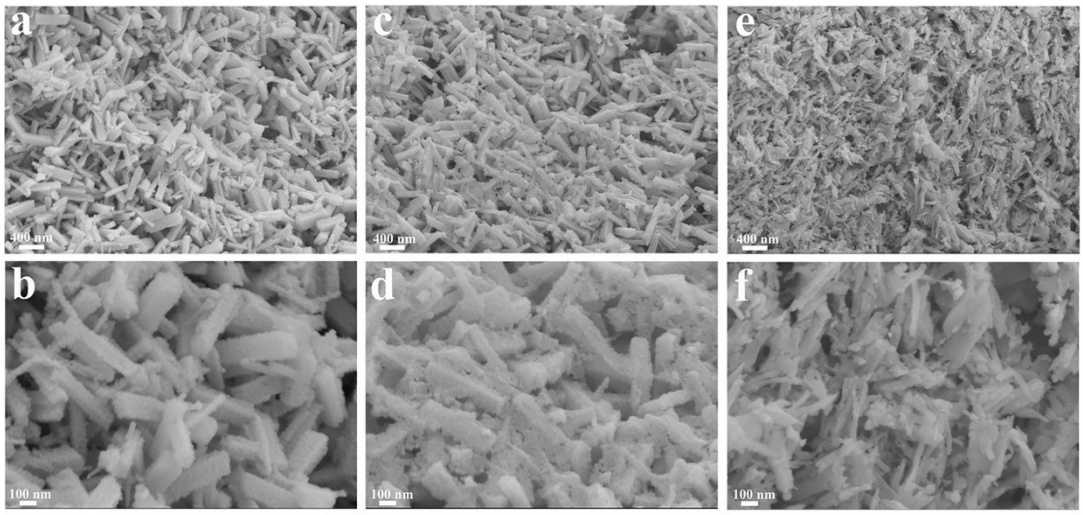

Figure S4. SEM images of (a, b) NiS/Ni_9S_8/NF-1, (c, d) NiS/Ni_9S_8/NF-3 and (e, f) NiS/Ni_9S_8/NF-4.

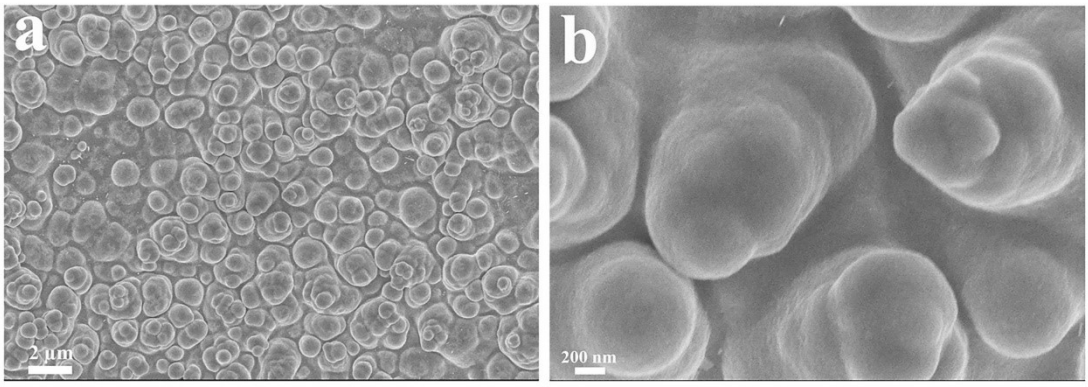

Figure S5. SEM images (a, b) of $NiS/NiS_2/Ni_3S_2/NF$.

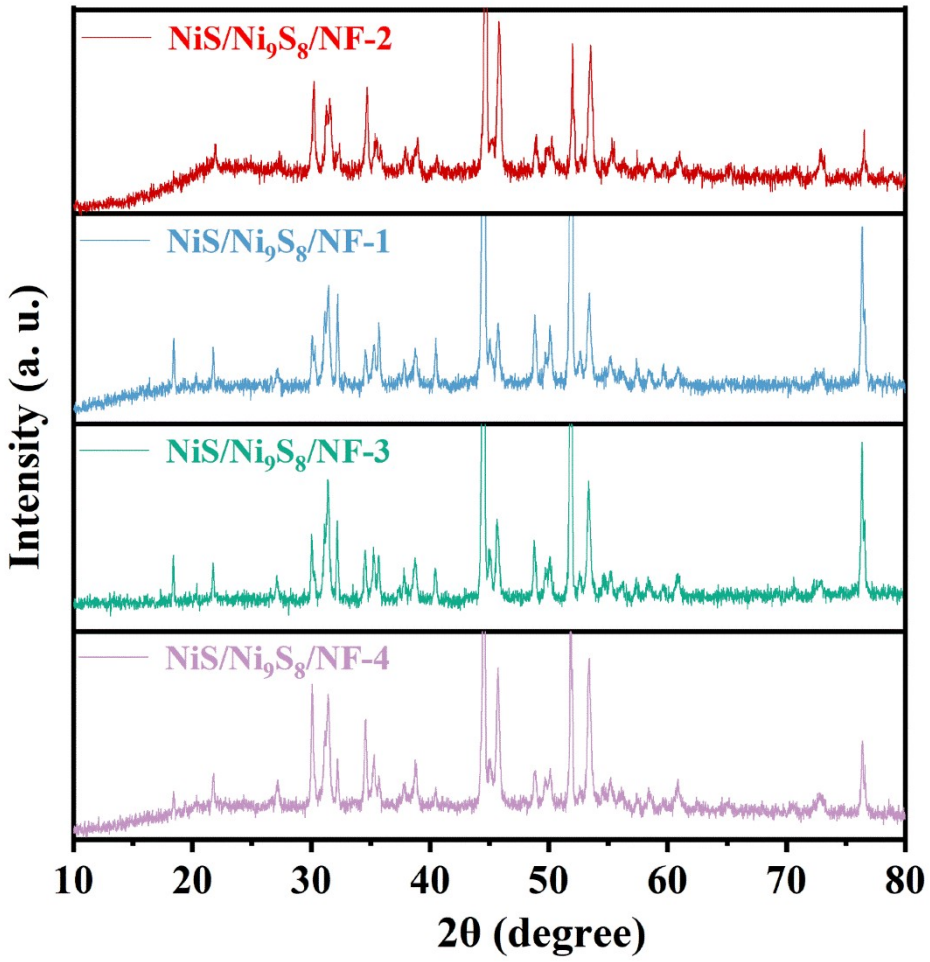

Figure S6. XRD patterns of NiS/Ni_9S_8/NF-1, NiS/Ni_9S_8/NF-3 and NiS/Ni_9S_8/NF-4.

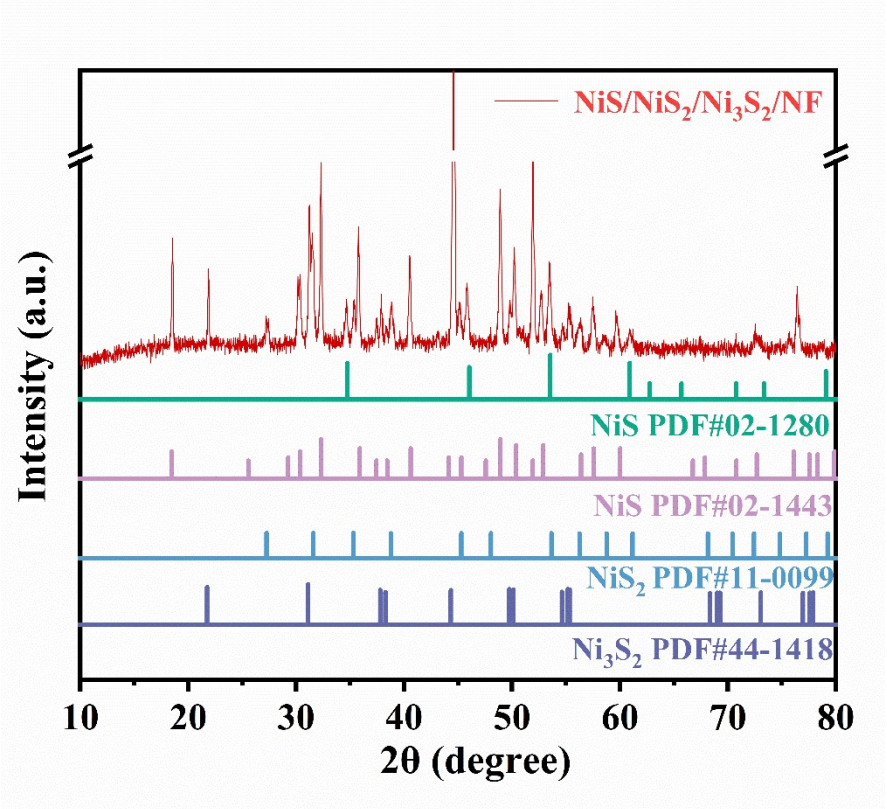

Figure S7. XRD pattern of $NiS/NiS_2/Ni_3S_2/NF$.

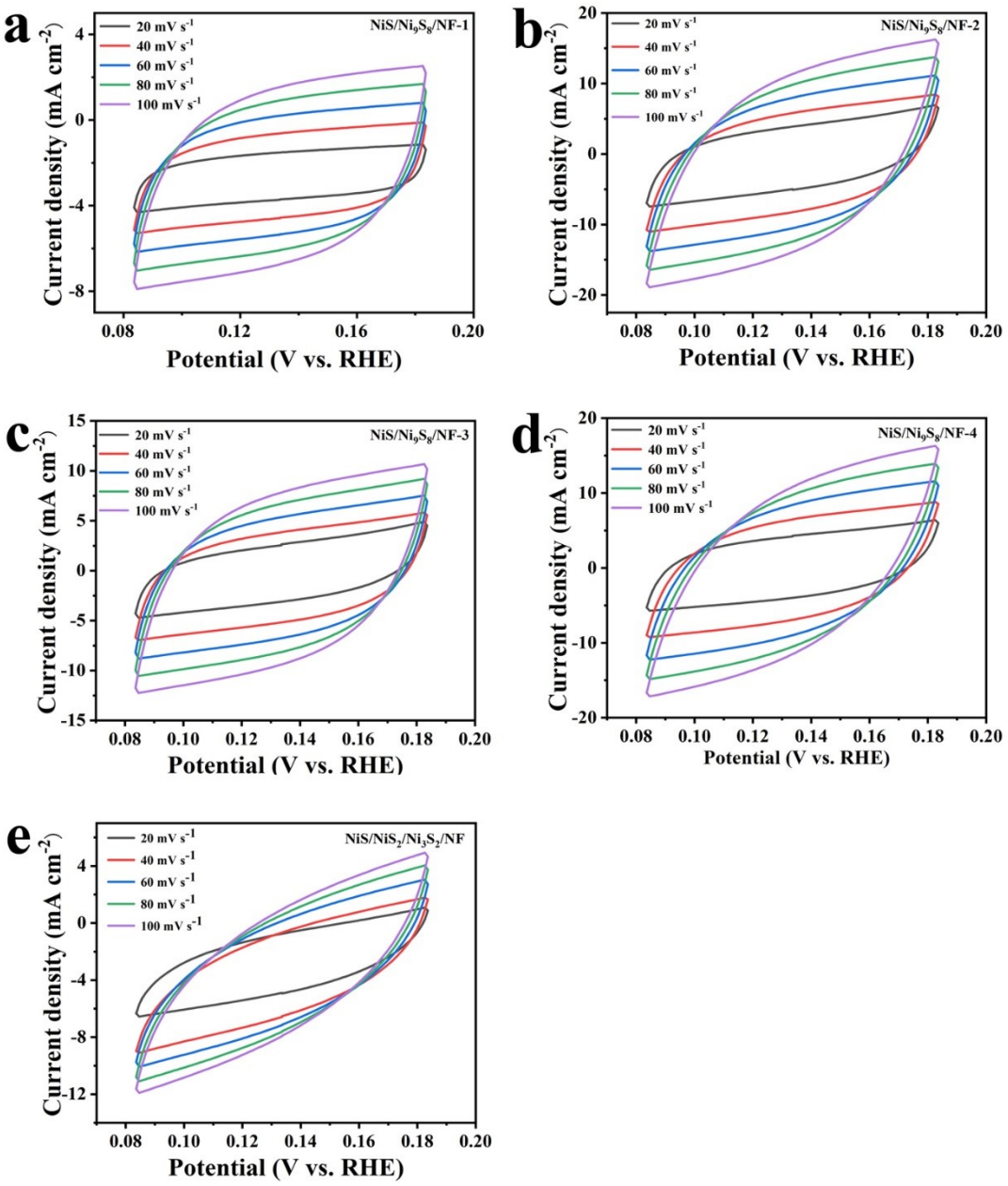

Figure S8. Cyclic voltammograms of (a) NiS/Ni_9S_8/NF-1, (b) NiS/Ni_9S_8/NF-2, (c) NiS/Ni_9S_8/NF-3, (d) NiS/Ni_9S_8/NF-4 and (e) NiS/NiS_2/Ni_3S_2/NF in -0.9 ~ -0.8 V *vs.* RHE at different scan rates from 20 mV s^{-1} to 100 mV s^{-1} in 1.0 M KOH.

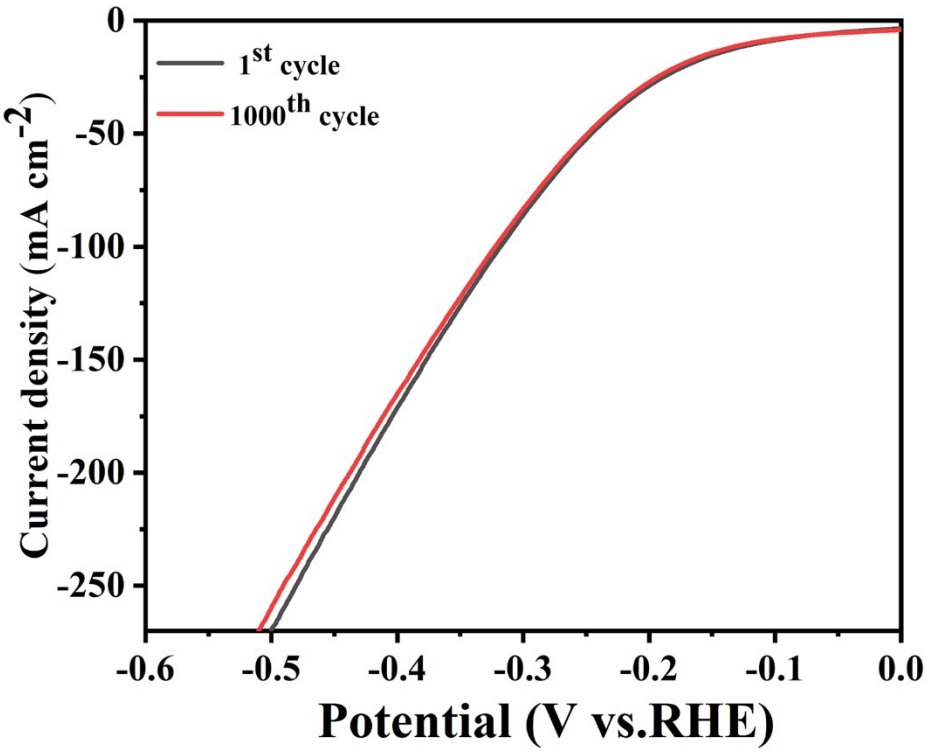

Figure S9. Polarization curves of NiS/Ni_9S_8/NF-2 before and after 1000 CV cycles.

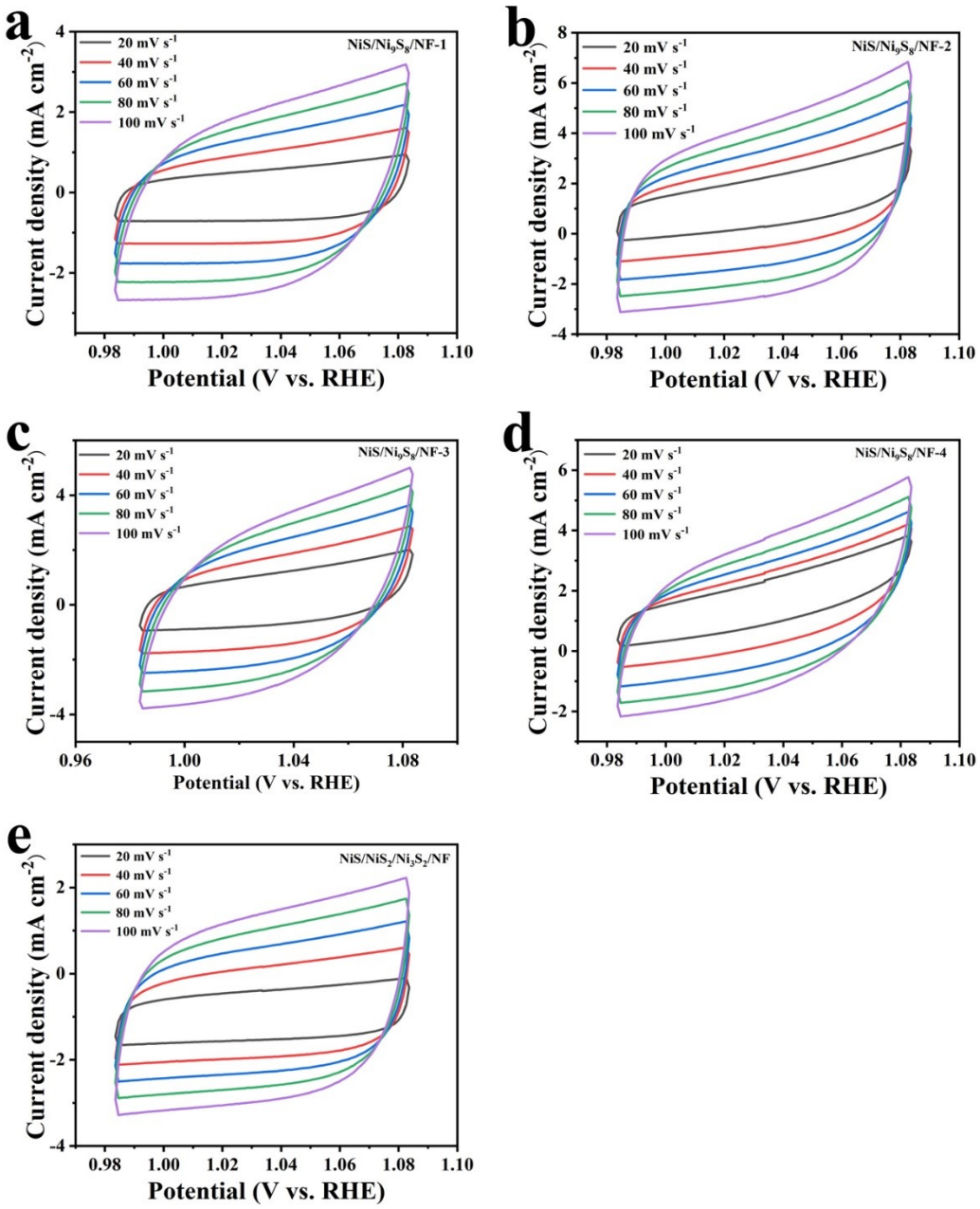

Figure S10. Cyclic voltammograms of (a) NiS/Ni_9S_8/NF-1, (b) NiS/Ni_9S_8/NF-2, (c) NiS/Ni_9S_8/NF-3, (d) NiS/Ni_9S_8/NF-4 and (e) NiS/NiS_2/Ni_3S_2/NF in -0.9 ~ -0.8 V *vs.* RHE at different scan rates from 20 mV s^{-1} to 100 mV s^{-1} in 1.0 M KOH.

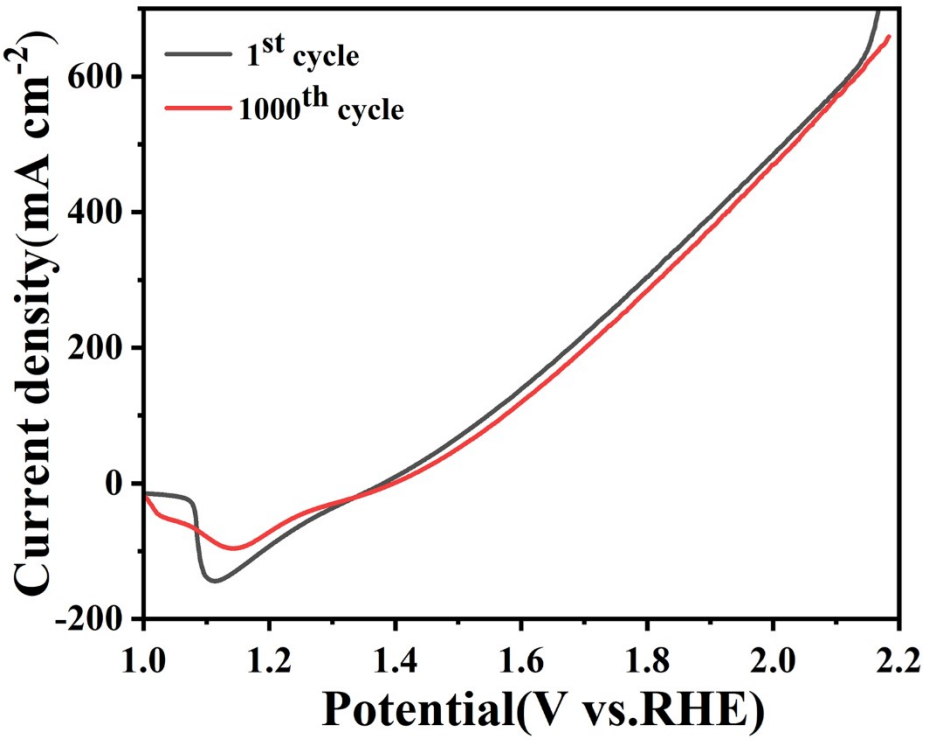

Figure S11. Polarization curves of NiS/Ni_9S_8/NF-2 before and after 1000 CV cycles.

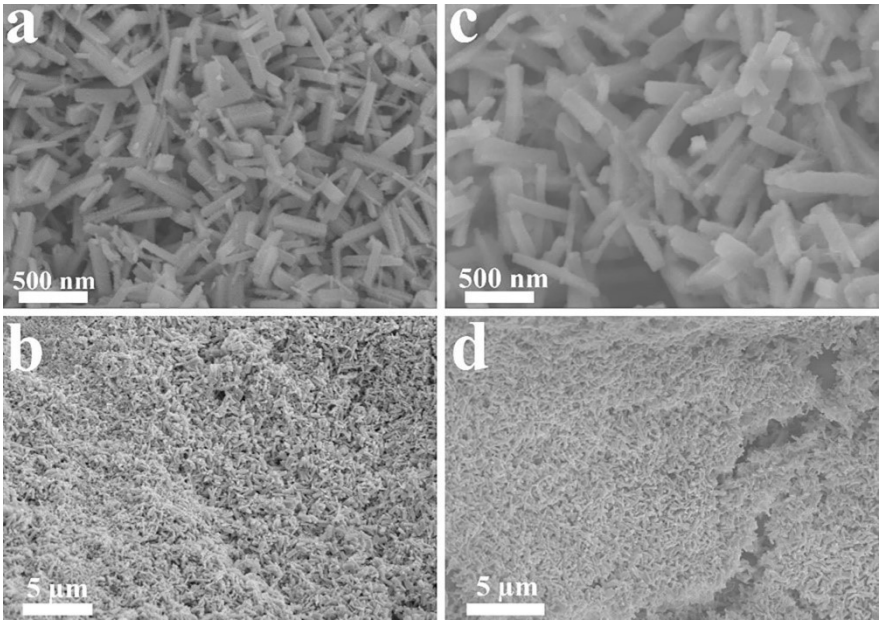

Figure S12. The SEM images of NiS/Ni_9S_8/NF-2 sample after (a,b) HER and (c,d) OER.

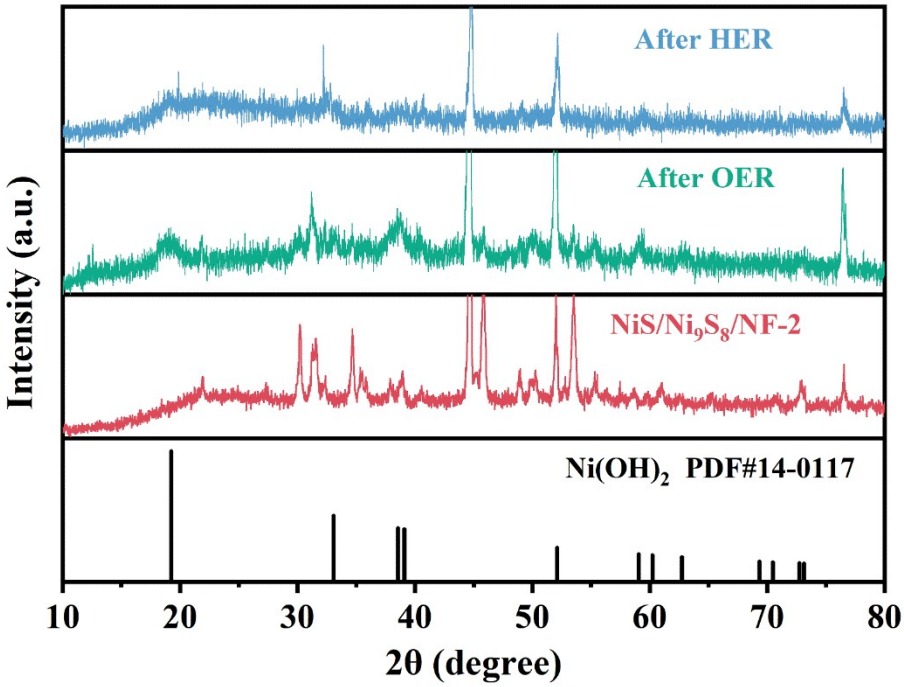

Figure S13. XRD patterns of NiS/Ni_9S_8/NF-2 after 100 h long term electrolysis for the HER and 80 h long term electrolysis for the OER.

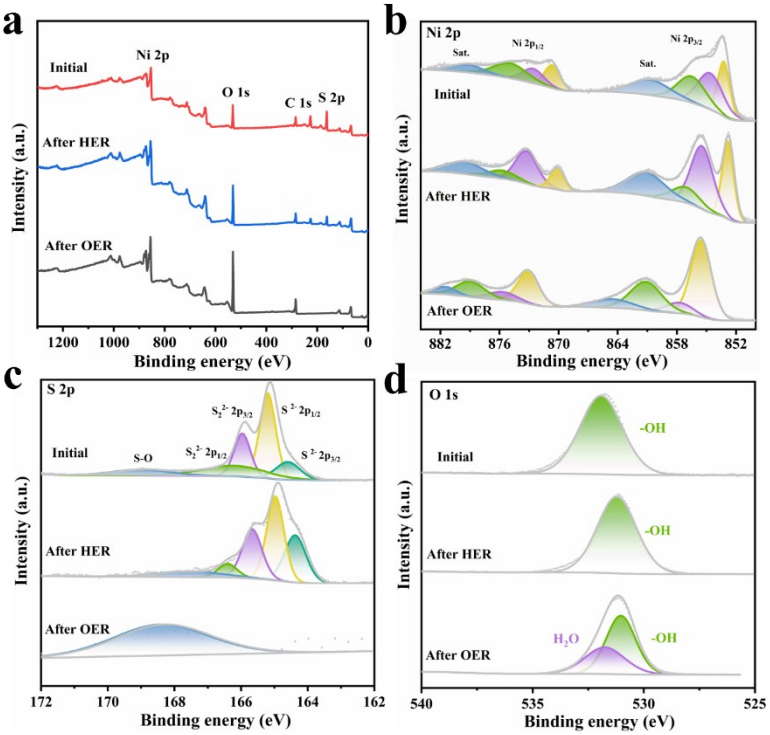

Figure S14. (a) XPS survey, (b)Ni 2p, (c)S 2p, (d) O 1s spectra of NiS/Ni_9S_8/NF-2 after i-t performance test of water splitting.