SUPPORTING INFORMATION

Three-dimensional coral-like Zn,O-codoped Ni_3S_2 electrocatalyst for efficient overall water splitting at large current density

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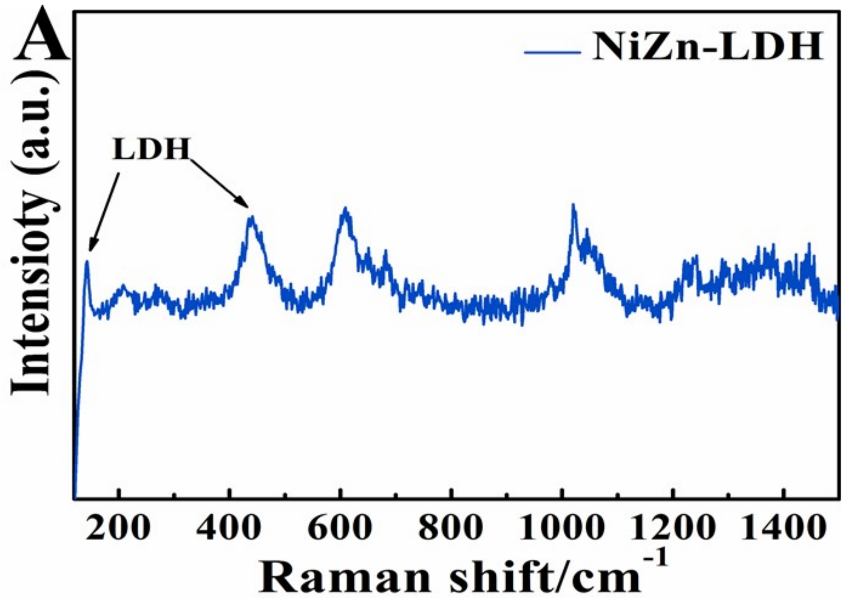

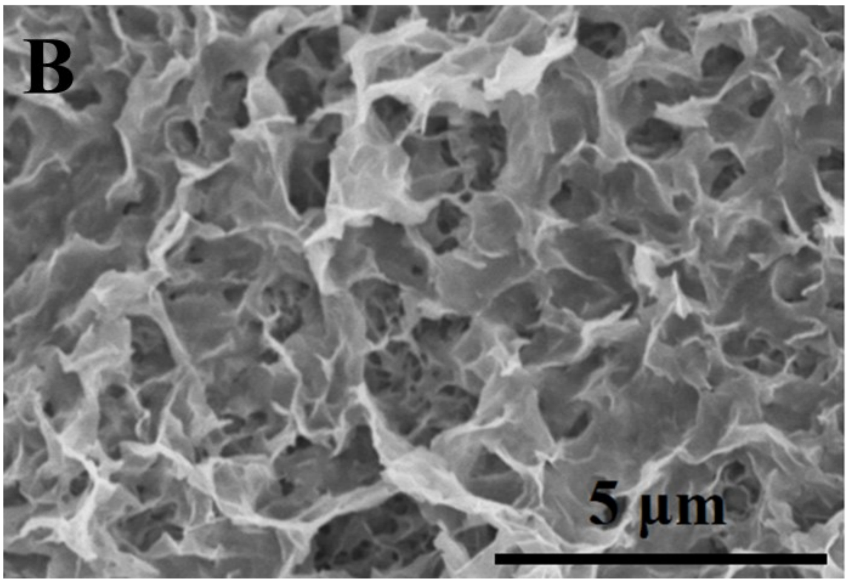

Figure S.1 (A) Raman spectra; (B) SEM image of NiZn-LDH.

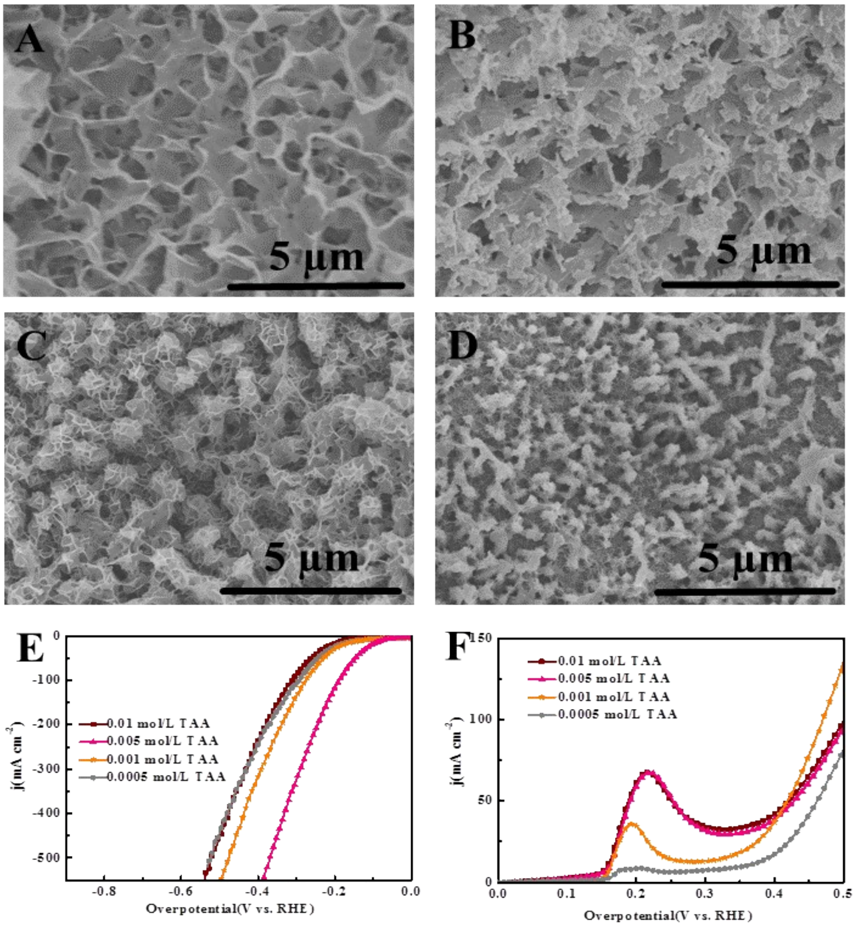

Figure S.2 SEM images of Ni_3S_2 samples grown on foamed nickel with different sulfur source concentrations: (A) 0.0005 mol/L TAA; (B) 0.001 mol/L TAA; (C) 0.005 mol/L TAA ; (D) 0.01 mol/L TAA; Polarization curves of hydrogen evolution and oxygen evolution in 1 M KOH: (E) HER polarization curves; (F) OER polarization curves.

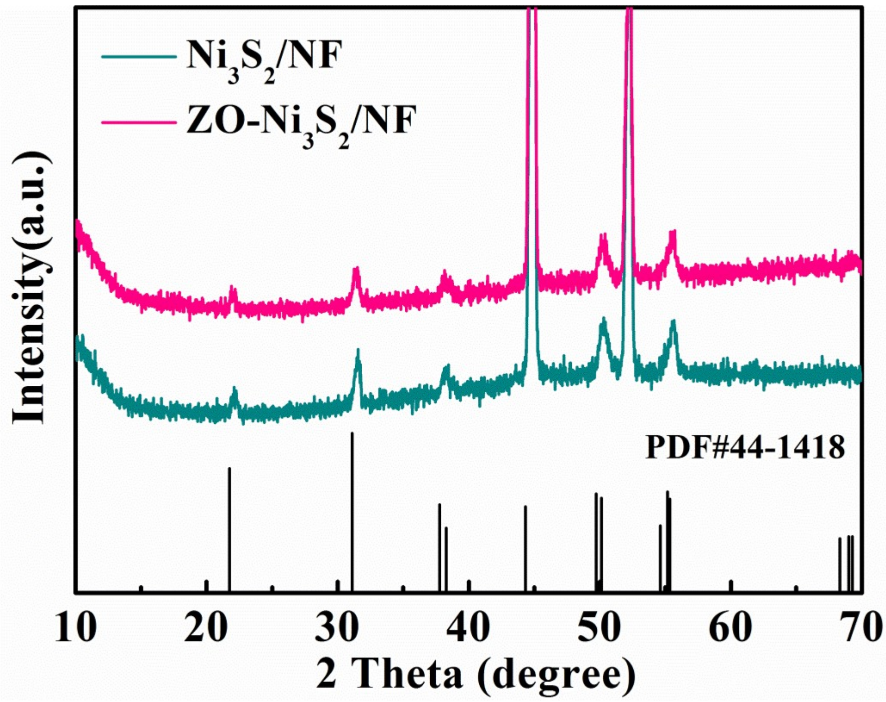

Figure S.3 XRD patterns of Ni_3S_2/NF and ZO-Ni_3S_2/NF.

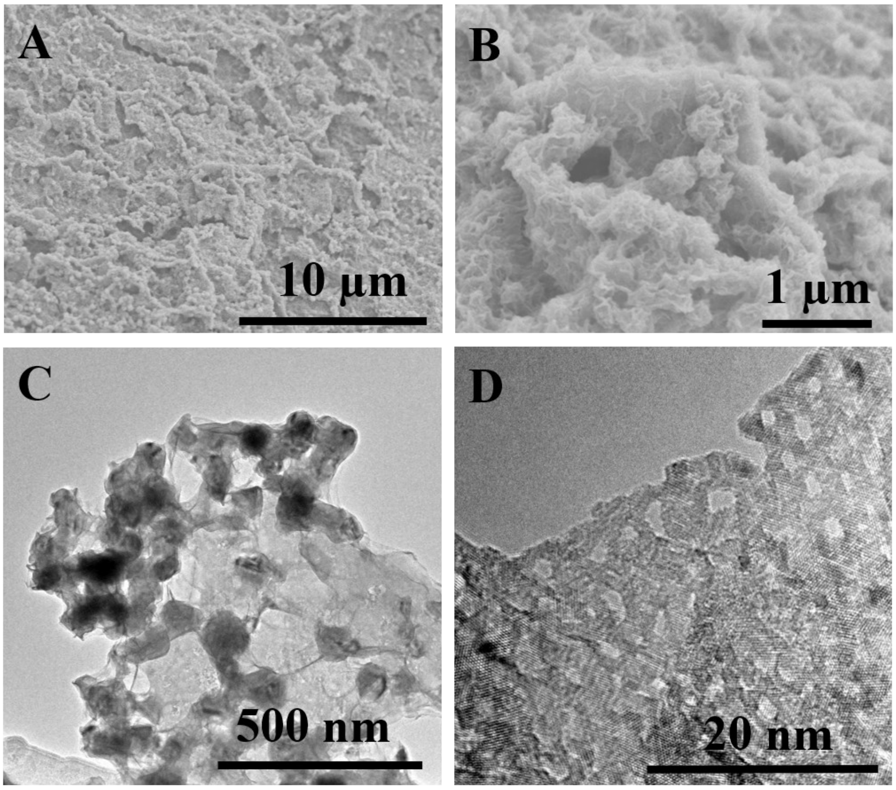

Figure S.4 (A,B) SEM images; (C) TEM images and (D) High-resolution TEM of Ni_3S_2/NF.

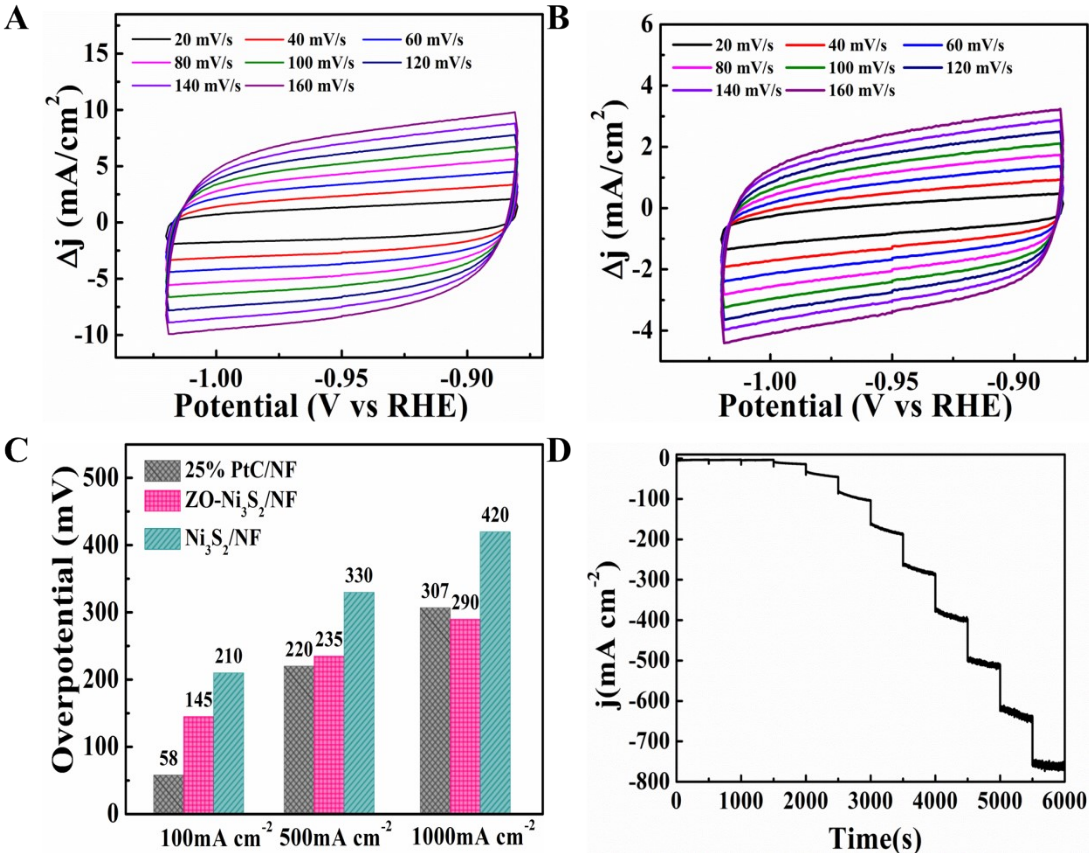

Figure S.5 Cyclic voltammograms at different speeds at a potential range of -0.88-1.02 V vs. RHE: (A) ZO-Ni_3S_2/NF; (B) Ni_3S_2/NF; (C) Summary of overpotential at 100, 500, and 1000 mA cm^{-2} for ZO-Ni_3S_2/NF, Ni_3S_2/NF-np and 25% PtC/NF;(D) Multi-step chronoamperometric curves of HER over ZO-Ni_3S_2/NF.

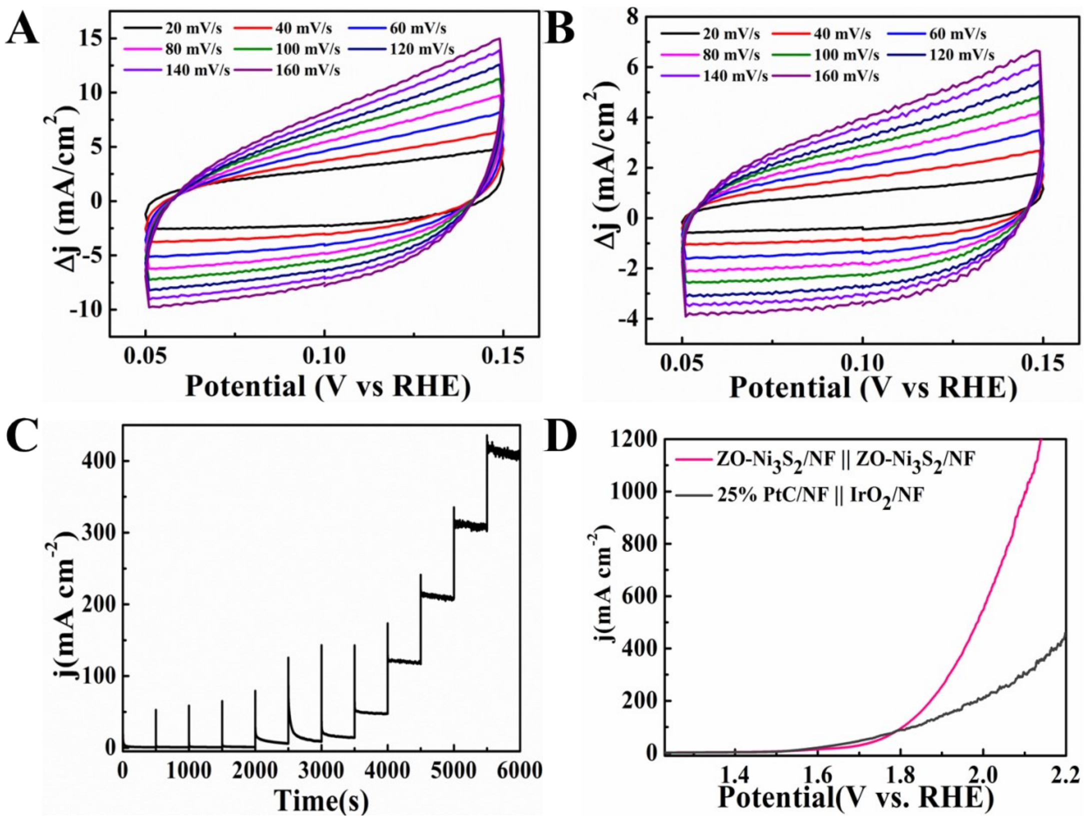

Figure S.6 Cyclic voltammograms at different speeds at a potential range of 0.05-0.15 V vs. RHE: (A) ZO-Ni_3S_2/NF; (B) Ni_3S_2/NF; (C) Multi-step chronoamperometric curves of OER over ZO-Ni_3S_2/NF; (D) The polarization curve of ZO-Ni_3S_2/NF-np for water splitting.

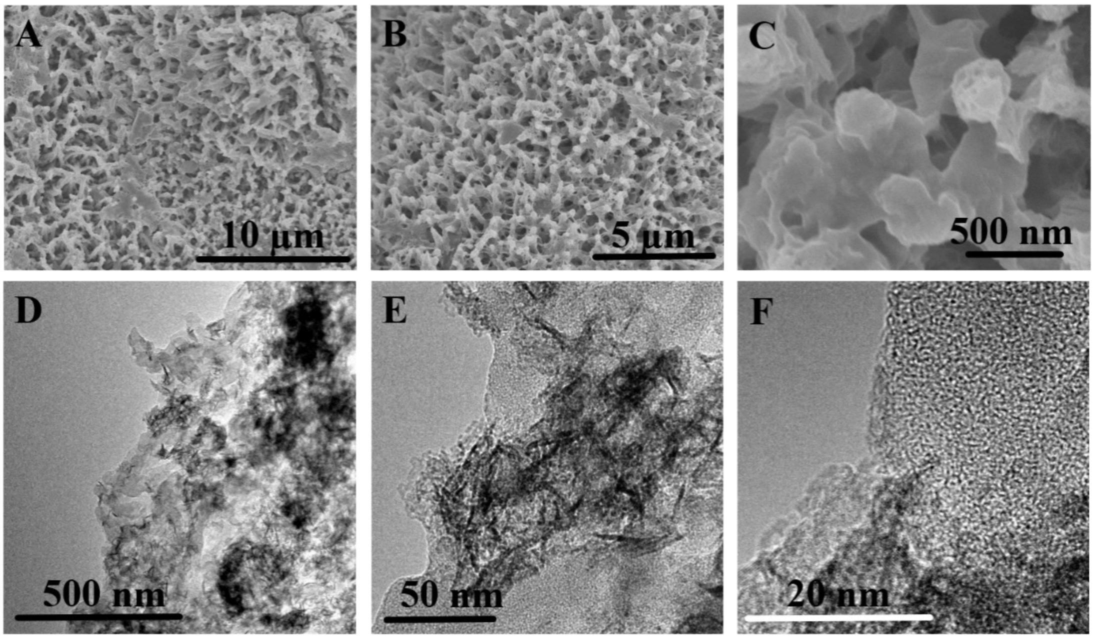

Figure S.7 SEM images (A-C) and (D-F) TEM images of ZO-Ni_3S_2/NF after electrochemical test

Table S.1 The ICP test data of zinc content in ZO-Ni_3S_2/NF.

	1	2	3
Initial Amount	9.81 mg		
Residual Amount	4.285 mg	4.771 mg	4.468 mg
	Average: 4.508 mg		
NiZn-LDH/NF	5.302 mg		
Residual Amount	2.4 mg	2.1 mg	1.95 mg
	Average: 2.15 mg		
ZO-Ni_3S_2/NF	3.152 mg		

Table S.2 Comparison of the HER catalytic performance of ZO-Ni_3S_2/NF with other recently reported hydroxide-based electrocatalysts in alkaline solution.

Catalyst	Overpotential (mV, at 100 mA cm^{-2})	Overpotential (mV, at 500 mA cm^{-2})	Tafel slope (mV dec^{-1})	Reference
ZO-Ni_3S_2/NF	**145**	**235**	**102**	**This work**
Cu-Ni_3S_2/Co_3S_4/NF	150	-	50.4	Appl. Catal. B Environ. 2021, 293, 120225
$Ni_{2(1-x)}Mo_{2x}P$	162	240	46.6	Nano Energy, 2018, 53, 492-500
Ni_3S_2@NiV-LDH/NF	256	~580	69	Nanoscale, 2019, 11, 8855-8863
$NiFe_2O_4$/NiFe LDH	-	297	67.1	ACS Appl. Mater. Interfaces 2018, 10, 31, 26283–26292
Ni_3S_2@NGCLs/NF	225	-	74	Chem. Eng. J. 2020, 401, 126045
Co-Ni_3S_2@CNTs/GNF	350	-	138	J. Mater. Chem. A, 2018, 6, 10490-10496
$NiWO_4$/Ni_3S_2	274	-	112	Appl. Catal. B Environ. 2020, 274, 119120
δ-FeOOH/Ni_3S_2/NF	210	-	82.6	J. Mater. Chem. A, 2020,8, 21199-21207
NS-horn/NF	350	-	139	Appl. Catal. B Environ. 2019, 257, 117911
CoFe-OOH@Co_2P/NF	~230	-	76	Electrochimica Acta, 2020, 360:136994

Table S.3 Comparison of the OER catalytic performance of ZO-Ni_3S_2/NF with other recently reported hydroxide-based electrocatalysts in alkaline solution.

catalyst	Overpotential (mV, at 100 mA cm^{-2})	Overpotential (mV, at 500 mA cm^{-2})	Tafel slope (mV dec-1)	Reference
ZO-Ni_3S_2/NF	**360**	**450**	**74.5**	**This work**
Ni_3S_2 NTFs	400	-	101.2	Appl. Catal. B: Environ. 2019, 243, 693-702
$Ni_{2(1-x)}Mo_{2x}P$	340	-	-	Nano Energy, 2018, 53, 492-500
Ni_3S_2@NiV-LDH/NF	320	~490	57	Nanoscale, 2019, 11, 8855-8863
Ni_3S_2	400 @ 10 mA cm^{-2}	-	51	ACS Appl. Mater. Interfaces. 2018, 10, 12807-12815
Ni_3S_2-GQDs/NF	394	-	95.5	Small 2017, 13, 1700264
Fe-Ni_3S_2/FeNi	495	-	54	Small 2017, 13, 1604161
$Ni(OH)_2/Ni_3S_2$	497	-	94.6	J. Mater. Chem. A 2018, 6, 6938-6946
Ni_2P/Ni_3S_2/NF	330	-	62	Nano Energy, 2018, 51, 26-36
NS-horn/NF	370	-	120	Appl. Catal. B Environ. 2019, 257, 117911
CoFe-OOH@Co_2P/NF	~220	-	39	Electrochimica Acta, 2020, 360:136994

Table S.4 Comparison of the water splitting performance of ZO-Ni_3S_2/NF with other recently reported hydroxide-based electrocatalysts in alkaline solution.

catalyst	Water splitting potential (V, at 10 mA cm^{-2})	Water splitting potential (V, at 100 mA cm^{-2})	Reference
ZO-Ni_3S_2/NF	**1.548**	**1.806**	**This work**
Ni_3S_2 NTFs	1.611	-	Appl. Catal. B: Environ. 2019, 243, 693-702
Ni_3S_2	2	-	ACS Appl. Mater. Interfaces. 2018, 10, 12807-12815
Ni_3S_2-GQDs/NF	1.58	-	Small 2017, 13, 1700264
$Ni(OH)_2$/Ni_3S_2	1.57	-	J. Mater. Chem. A 2018, 6, 6938-6946
NS-horn/NF	1.57	~1.95	Appl. Catal. B Environ. 2019, 257, 117911
Cu-Ni_3S_2/Co_3S_4/NF	1.49	~1.85	Appl. Catal. B: Environ. 2021, 293, 120225
Ni_3S_2@NGCLs/NF	1.55	-	Chem. Eng. J. 2020, 401, 126045
δ-FeOOH/Ni_3S_2/NF	1.525	~1.84	J. Mater. Chem. A, 2020,8, 21199-21207
CoS_x/Ni_3S_2@NF	1.573	-	ACS Appl. Mater. Interfaces, 2018, 10, 27712–27722