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Supporting Information

Ultrafast Fabrication of Nickel Sulfide Film on Ni Foam for Efficient Overall Water Splitting

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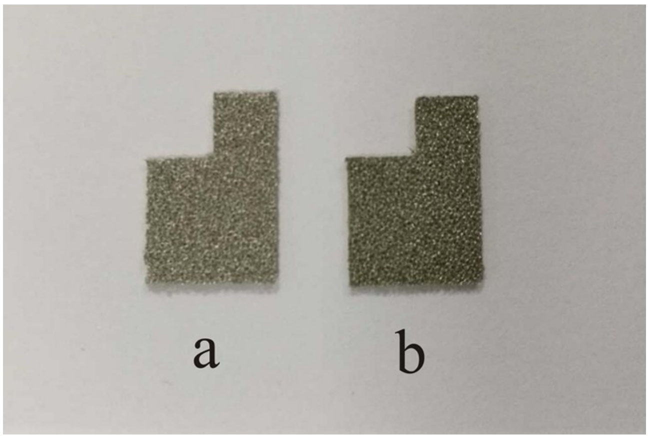

Fig. S1. The photographic image of (a) Ni foam (NF) and (b) Ni_3S_2/NF.

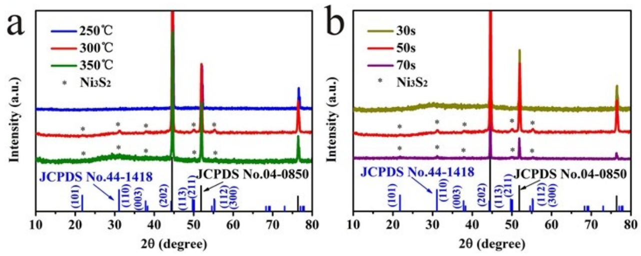

Fig. S2. XRD patterns of Ni_3S_2/Ni foam annealed at (a) different temperatures and (b) time.

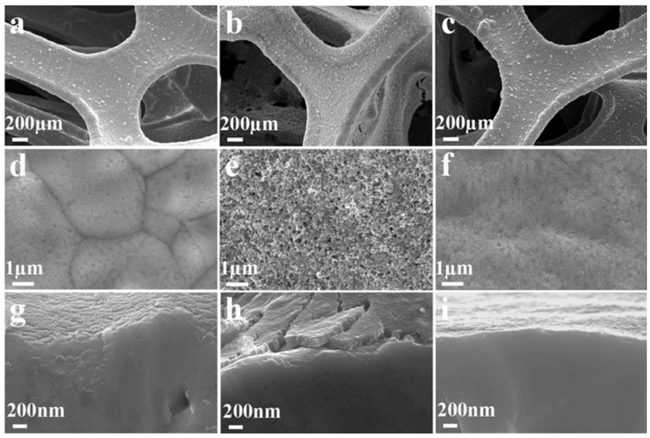

Fig. S3. SEM images of the low and high magnification of (a, d, g) Ni_3S_2/Ni foam annealed at 250 ℃, (b, e, h) Ni_3S_2/Ni foam annealed at 300 ℃ and (c, f, i) Ni_3S_2/Ni foam annealed at 350 ℃.

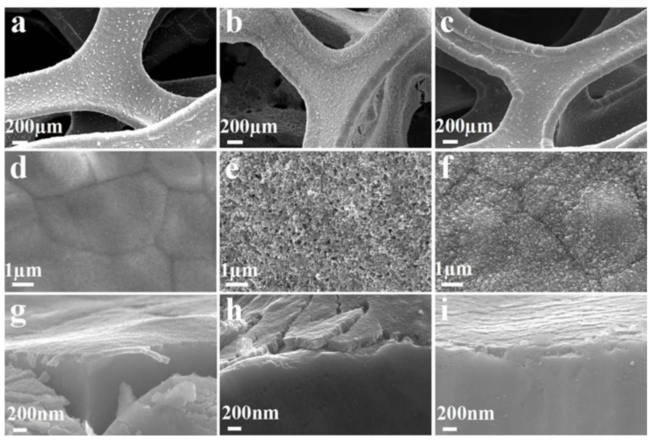

Fig. S4. SEM images of the low and high magnification of (a, d, g) Ni_3S_2/Ni foam annealing for 30 s, (b, e, h) Ni_3S_2/Ni foam annealing for 50 s and (c, f, i) Ni_3S_2/Ni foam annealing for 70 s.

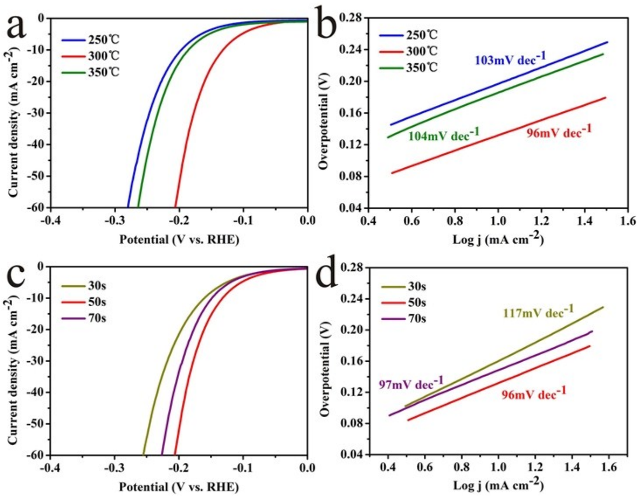

Fig. S5. (a) The LSV curves of the HER performance of Ni_3S_2/NF annealed at 250 ℃, 300 ℃ and 350 ℃. (b) Corresponding Tafel plots for Ni foam, Ni_3S_2/NF annealed at 250 ℃, 300 ℃ and 350 ℃. (c) The LSV curves of the HER performance of Ni_3S_2/NF annealed for 30 s, 50 s and 70 s. (d) Corresponding Tafel plots for Ni foam, Ni_3S_2/NF annealed for 30 s, 50 s and 70 s.

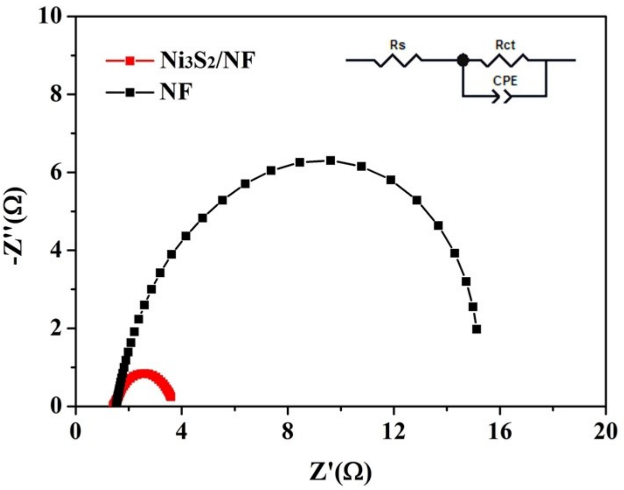

Fig. S6. Nyquist plots of Ni foam, Ni_3S_2/NF obtained by the electrochemical impedance spectroscopy (EIS) measurements.

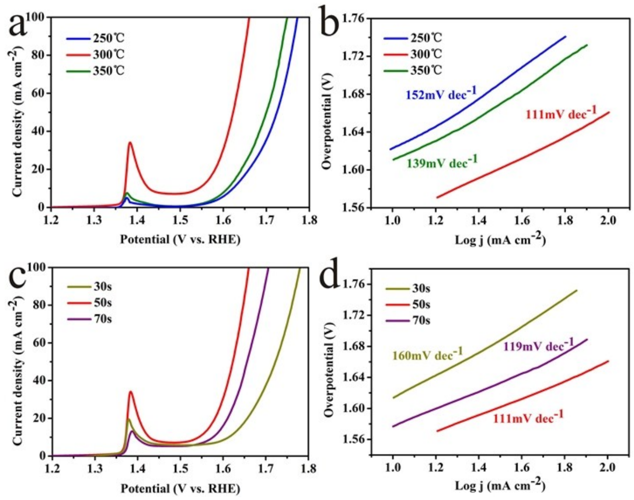

Fig. S7. (a) The LSV curves of the OER performance of Ni_3S_2/NF annealed at 250 ℃, 300 ℃ and 350 ℃. (b) Corresponding Tafel plots for Ni foam, Ni_3S_2/NF annealed at 250 ℃, 300 ℃ and 350 ℃. (c) The LSV curves of the OER performance of Ni_3S_2/NF annealed for 30 s, 50 s and 70 s. (d) Corresponding Tafel plots for Ni foam, Ni_3S_2/NF annealed for 30 s, 50 s and 70 s.

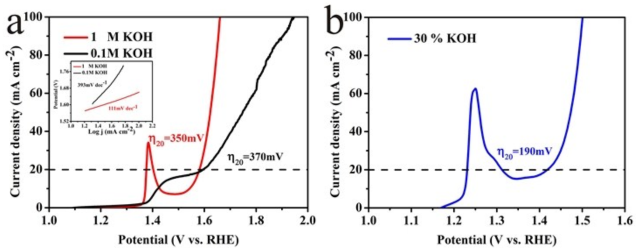

Fig. S8. (a) The LSV curves of the OER performance of Ni_3S_2/NF in 0.1M and 1 M KOH solution, and the corresponding Tafel plots (inset). (b) The LSV curve of the OER performance of Ni_3S_2/NF in 30 wt% KOH electrolyte.

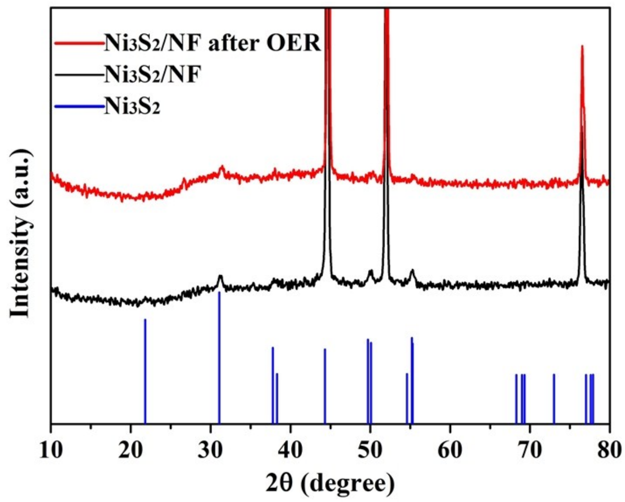

Fig. S9. XRD patterns of Ni_3S_2/NF before and after OER

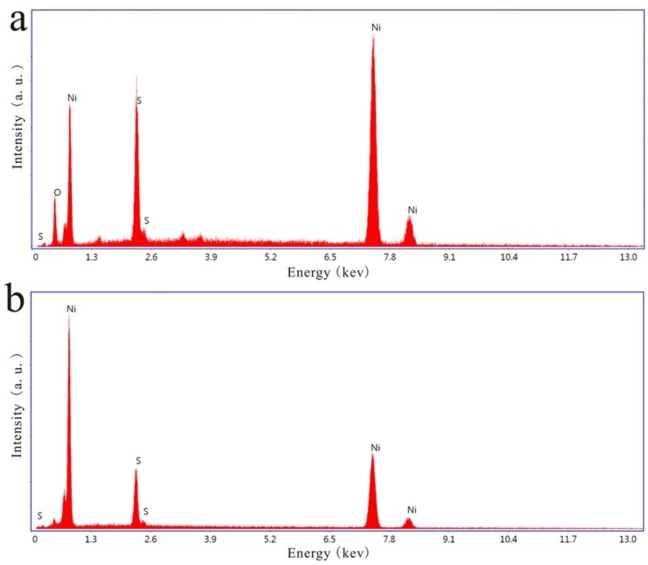

Fig. S10. EDX spectra of Ni_3S_2/Ni foam (a) after and (b) before OER

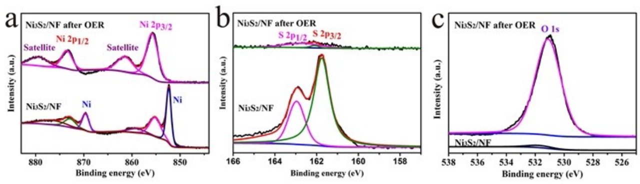

Fig. S11. XPS spectra of (a) Ni 2p, (b) S 2p and (c) O 1s for Ni_3S_2/Ni foam before and after OER.

Table S1. Comparison of the HER activity of some recently reported non-noble electrocatalysts

Catalysts	Substrate	Electrolyte	η_{10}	Tafel slop	Reference

			(mV vs RHE)	**(mV/dec)**	
Ni_3S_2 films	NF	1.0 M KOH	131	96	This work
Ni_3S_2 nanorods	NF	1.0 M KOH	200	107	*Energy Environ. Sci.*, 2013, **6**, 2921.
Ni_3S_2 nanosheets	NF	1.0 M KOH	223	-	*J. Am. Chem. Soc.*, 2015, **137**, 14023.
NiS microsphere	NF	1.0 M KOH	~140	83	*Chem. Commun.*, 2016, **52**, 1486.
CoS_2 nanotubes	CC	1.0 M KOH	193	88	*Adv. Energy Mater.*, 2017, **7**, 1602355.
WP_2 nanoparticles	Carbon fiber paper	1.0 M KOH	175	131	*J. Power Sources*, 2017, **349**, 138.
$Fe_{0.5}Co_{0.5}$ @ NC/NCNS	GCE	1.0 M KOH	150	49.1	*J. Mater. Chem. A*, 2017, **5**, 5413.
$NiCo_2S_4$ nanowires	NF	1.0 M KOH	210	59	*Adv. Funct. Mater.*, 2016, **26**, 4661.

Table S2. Comparison of the OER performance of some recently reported non-noble electrocatalysts

Catalysts	**Substrate**	**Electrolyte**	η_{10} (mV vs RHE)	**Tafel slop (mV/dec)**	**Reference**
Ni_3S_2	NF	1.0 M KOH	312	111	This work
$W_{0.5}Co_{0.4}Fe_{0.1}$	NF	1.0 M KOH	320	55	*Angew. Chem. Int. Ed.*, 2017, **56**, 4502.
$NiCo_2O_4$	NF	1.0 M KOH	420	53	*Angew. Chem. Int. Ed.*, 2016, **55**, 6290.
NiFe-LDH/N-graphene	RDE	1.0 M KOH	337	45	*Adv. Mater.*, 2015, **26**, 4516.
NiCo oxide	FTO	1.0 NaOH	340	51	*Adv. Energy*

					Mater., 2015, **5**, 1500091.
Co_2B	GC	0.1 M KOH	360	45	*Adv. Energy Mater.*, 2016, **6**, 1502313.
Co_3O_4@C	CP	1.0 M KOH	310	69	*Nano Energy*, 2016, **25**, 42.
$LiCoO_2$	GC	1.0 M KOH	320	59	*Energy Environ. Sci.*, 2016, **9**, 184.
Ni_3S_2 nanosheets	NF	1.0 M KOH	260	-	*J. Am. Chem. Soc.*, 2015, **137**, 14023.

Table S3. Comparison of the overall water splitting performance of some recently reported non-noble electrocatalysts

Catalysts	**Substrate**	**Electrolyte**	**η_{10} (V)**	**Reference**
Ni_3S_2	NF	1.0 M KOH	1.68	This work
Ni_3S_2	NF	1.0 M KOH	1.75	*J. Am. Chem. Soc.*, 2015, **137**, 14023.
NiFe LDH	NF	1.0 M KOH	1.70	*Science*, 2014, **345**, 1593.
Ni_5P_4	NF	1.0 M KOH	1.70	*Angew. Chem.*, 2015, **127**, 12538.
FeSe2	NF	1.0 M KOH	1.73	*Angew. Chem. Int. Ed.*, 2017, **56**, 10506.
CoSe	G/Ni mesh	1.0 M KOH	1.75	*J. Mater. Chem. A*, 2016, **4**, 14789.
Co2P	Co-foil	1.0 M KOH	1.71	*J. Mater. Chem. A*, 2017, **5**, 10561.
Co-Ni-B	NF	1.0 M KOH	1.72	*J. Mater. Chem. A*, 2017, **5**, 12379.
Co_4Mo2	NC	1.0 M KOH	1.74	*J. Mater. Chem. A*, 2017,

				5, 16929.
N,S-CNT	CC	1.0 M KOH	2.03	*Adv. Energy Mater.*, 2016, **6**, 1502313.
NFPGN	GC	1.0 M KOH	1.90	*J. Mater. Chem. A*, 2017, **5**, 7784.