Supporting Information

Nickel Foam derived Nitrogen doped nickel sulfides nanowires as efficient electrocatalyst for hydrogen evolution reaction

Furong Yu, Huiling Yao, Bo Wang, Kewei Zhang, Zhengyuan Zhang, Li Xie, Jinhui Hao, Baodong Mao, Hao Shen* and Weidong Shi*

School of Chemistry and Chemical Engineering, Jiangsu University, Zhenjiang 212013, P.R. China

*To whom correspondence should be addressed. E-mails: *ujsshenhao@163.com; swd1978@ujs.edu.cn*

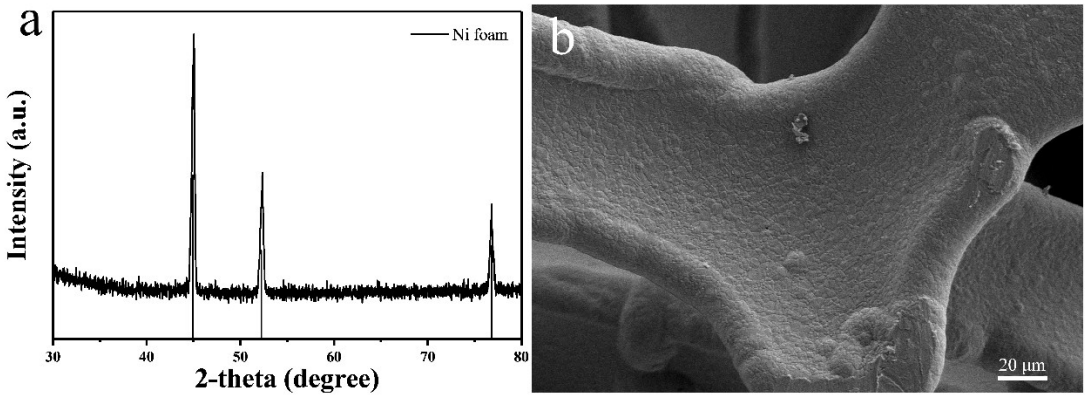

Fig. S1 (a) XRD pattern and (b) SEM image of blank NF.

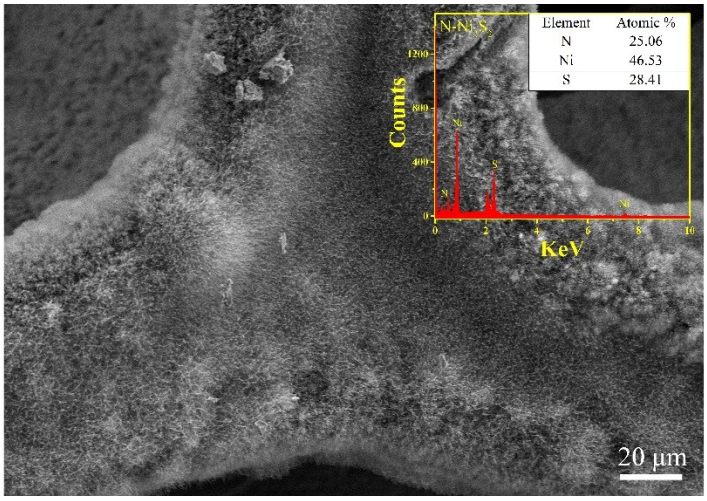

Fig. S2 SEM image and EDS of N-Ni_3S_2 NWs/NF.

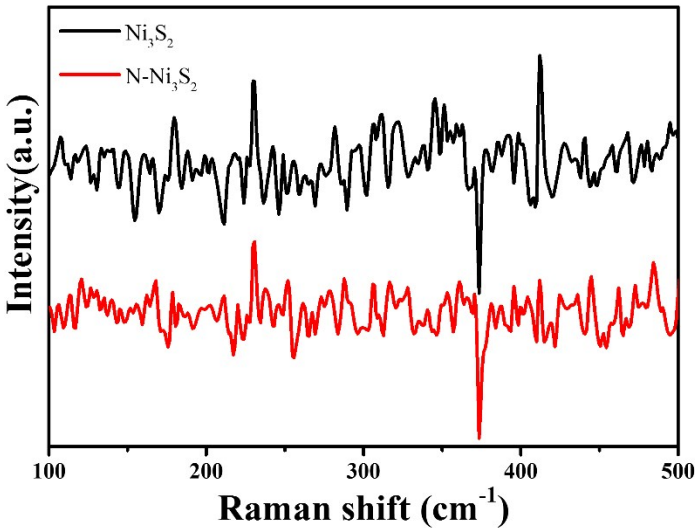

Fig. S3 Raman pattern of Ni_3S_2 NRs/NF and N-Ni_3S_2 NWs/NF.

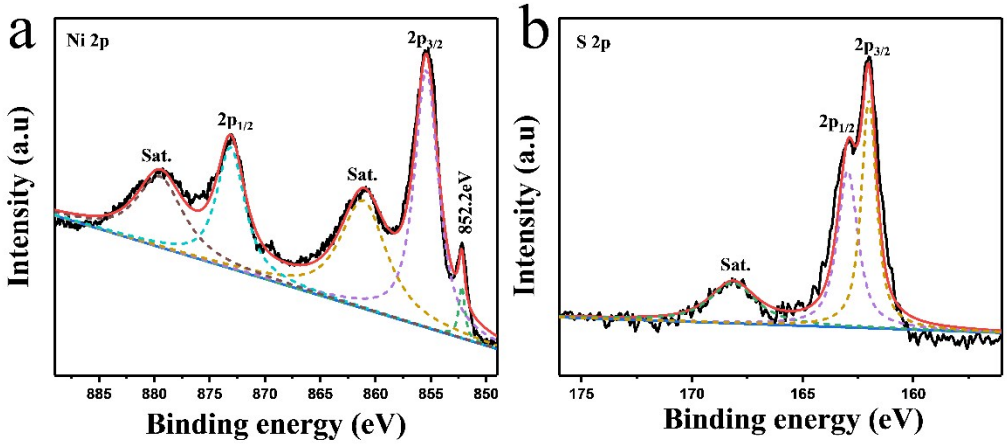

Fig. S4 (a) Ni 2p and (b) S 2p XPS spectra for Ni_3S_2 NRs/NF.

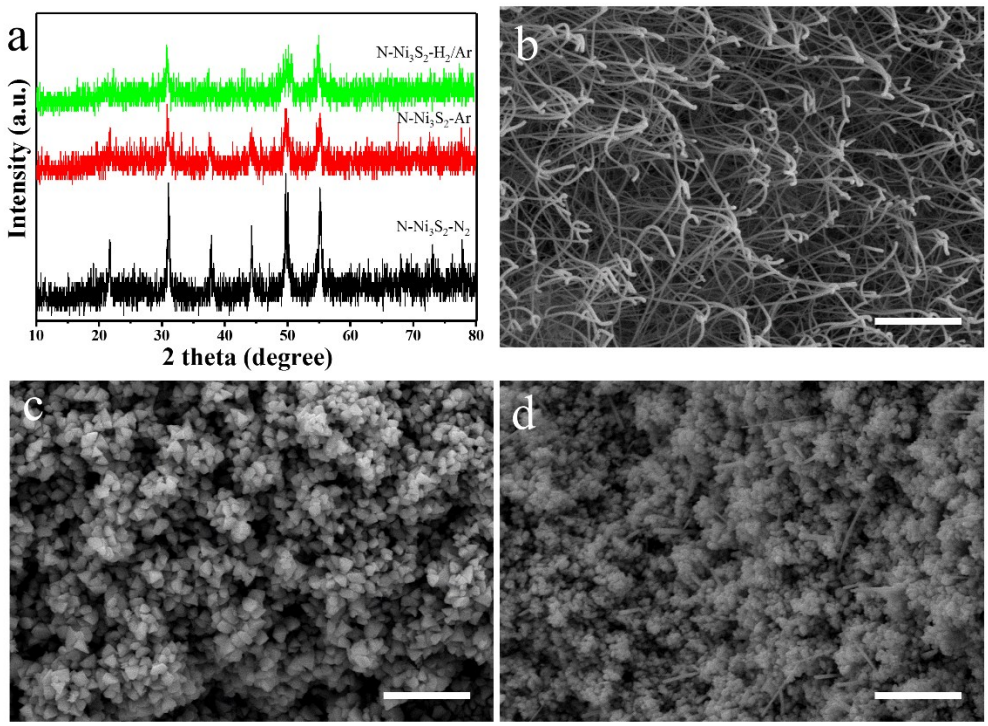

Fig. S5 (a) XRD patterns of N-Ni_3S_2-N_2, N-Ni_3S_2-Ar and N-Ni_3S_2-H_2/Ar. SEM images of (b) N-Ni_3S_2-N_2, (c) N-Ni_3S_2-Ar and (d) N-Ni_3S_2-H_2/Ar. Scale bar is 2 μm.

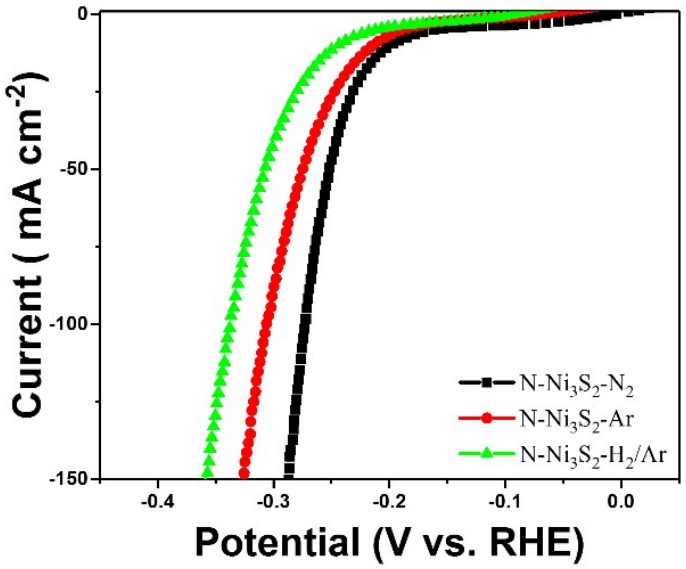

Fig. S6 HER polarization curves of N-Ni_3S_2-N_2, N-Ni_3S_2-Ar and N-Ni_3S_2-H_2/Ar.

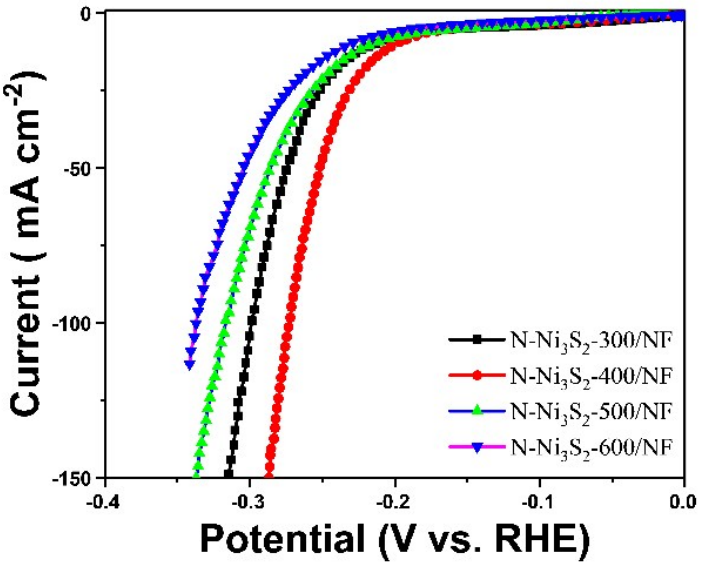

Fig. S7 HER polarization curves of N-Ni_3S_2-300/NF, N-Ni_3S_2-400/NF, N-Ni_3S_2-500/NF and N-Ni_3S_2-600/NF.

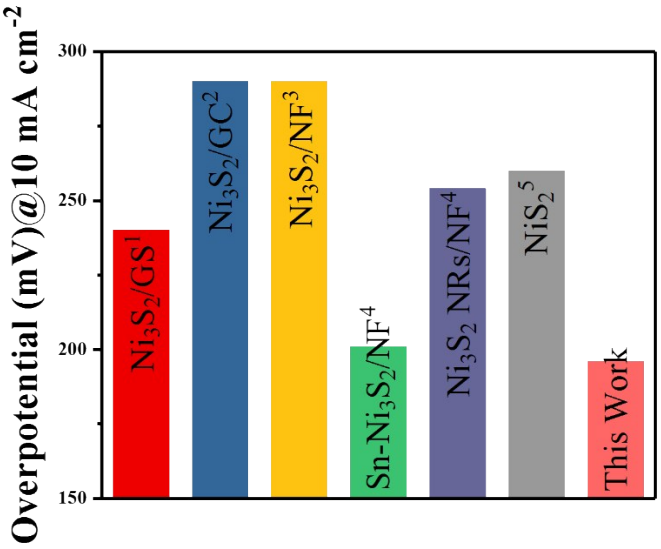

Fig. S8 HER overpotentials of the N-Ni_3S_2 NWs/NF and the reported electrocatalysts for comparison at 10 mA cm^{-2} in 0.5 M H_2SO_4[1-5].

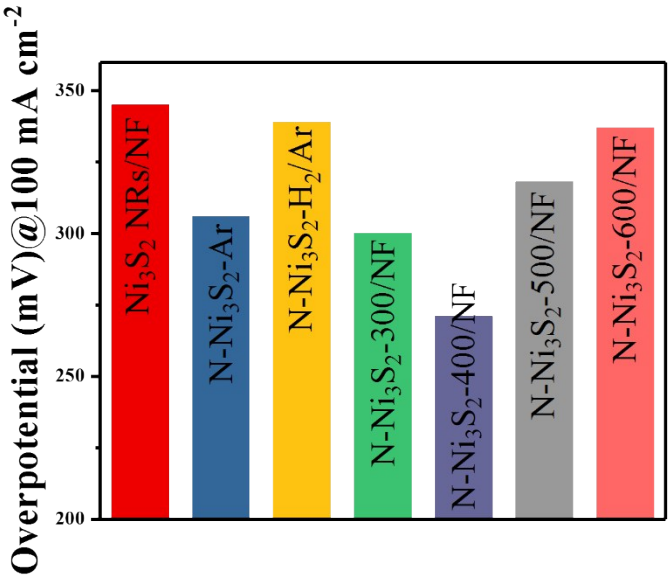

Fig. S9 HER overpotentials of Ni_3S_2 NRs/NF, N-Ni_3S_2-Ar, N-Ni_3S_2-H_2/Ar, N-Ni_3S_2-300/NF, N-Ni_3S_2-400/NF (same as N-Ni_3S_2-N_2), N-Ni_3S_2-500/NF and N-Ni_3S_2-600/NF for comparison at 100 mA cm^{-2} in 0.5 M H_2SO_4.

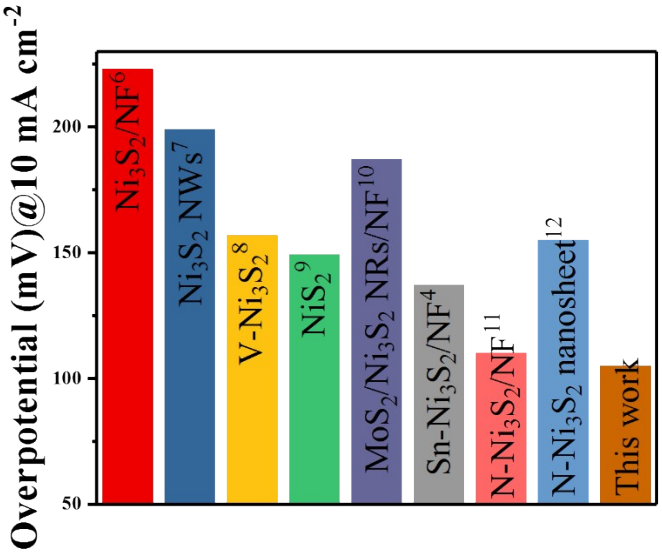

Fig. S10 HER overpotentials of the N-Ni_3S_2 NWs/NF and the reported electrocatalysts for comparison at 10 mA cm^{-2} in 1 M KOH[4, 6-12].

References for SI

1. X. Wu, B. Yang, Z. Li, L. Lei and X. Zhang, *RSC Adv*., 2015, **5**, 32976-32982.
2. D. Y. Chung, J. W. Han, D. Lim, J. Jo, S. J. Yoo, H. Lee and Y. Sung, *Nanoscale*, 2015, **7**, 5157-5163.
3. B. Busupalli, S. Battu, S. K. Haram and B. L. V. Prasad, *Chemistry Select*, 2016, **1**, 6708-6712.
4. J. Yu, F. X. Ma, Y. Du, P. P. Wang, C. Y. Xu and L. Zhen, *ChemElectroChem*, 2017, **4**, 594-600.
5. D. Kong, J. J. Cha, H. Wang, H. R. Lee and Y. Cui, *Energ. Environ. Sci*., 2013, **6**, 3553-3558.
6. L. L. Feng, G. Yu, Y. Wu, G. D. Li, H. Li, Y. Sun, T. Asefa, W. Chen and X. Zou, *J. Am. Chem. Soc*., 2015, **137**, 14023-14026.
7. J. Li, P. K. Shen and Z. Tian, *Int. J. Hydrogen Energy*, 2017, **42**, 7136-7142.
8. Y. Qu, M. Yang, J. Chai, Z. Tang, M. Shao, C. T. Kwok, M. Yang, Z. Wang, D. Chua, S. Wang, Z. Lu and H. Pan, *ACS Appl. Mater. Interfaces*, 2017, **9**, 5959-5967.
9. C. Tang, Z. Pu, Q. Liu, A. M. Asiri and X. Sun, *Electrochim. Acta*, 2015, **153**, 508-514.
10. N. Zhang, J. Lei, J. Xie, H. Huang and Y. Yu, *RSC Adv*., 2017, **7**, 46286-46296.
11. P. Chen, T. Zhou, M. Zhang, Y. Tong, C. Zhong, N. Zhang, L. Zhang, C. Wu and Y. Xie, *Adv. Mater.*, 2017, **29**, 1701584.
12. T. Kou, T. Smart, B. Yao, I. Chen, D. Thota, Y. Ping and Y. Li, *Adv. Energy Mater*., 2018, **0**, 1703538.