Supporting Information

Strong interfacial coupling for NiS thin layer covered CdS nanorods with highly efficient photocatalytic hydrogen production

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Figures

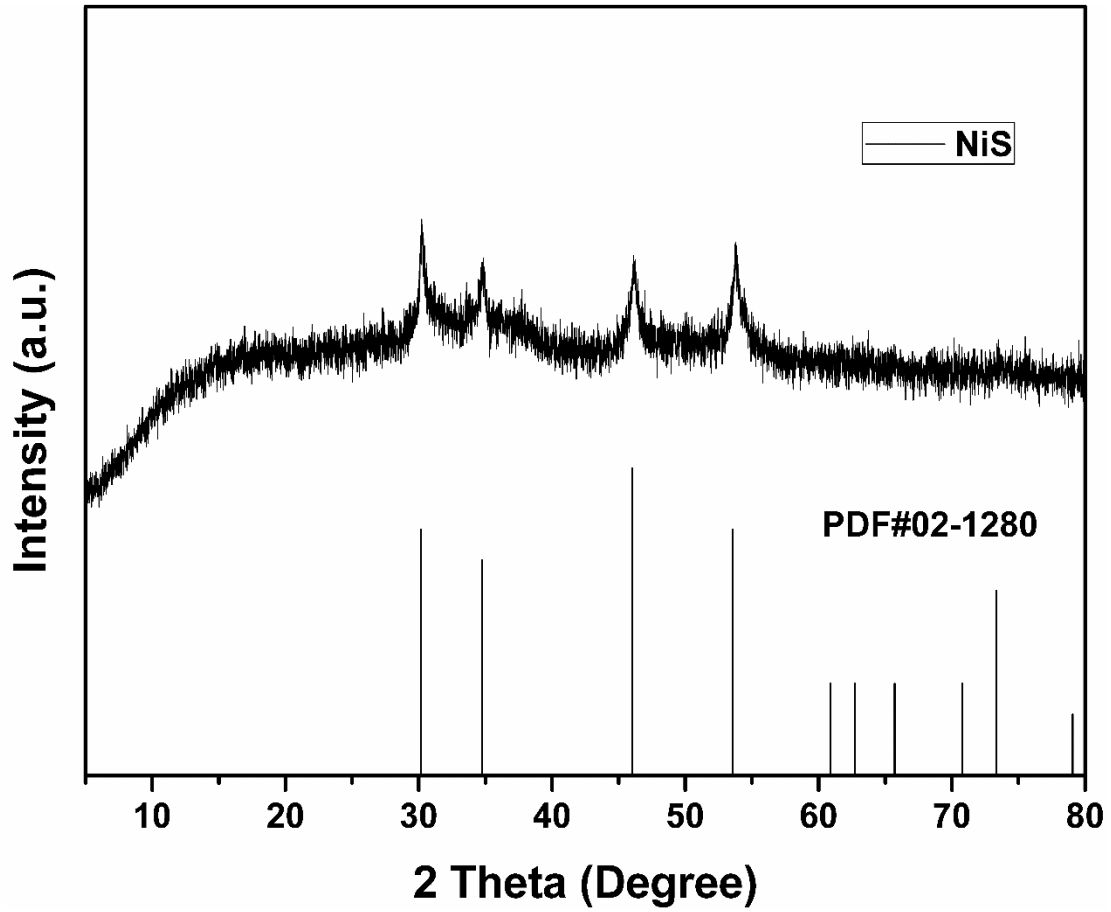

Fig. S1. XRD pattern of pure NiS.

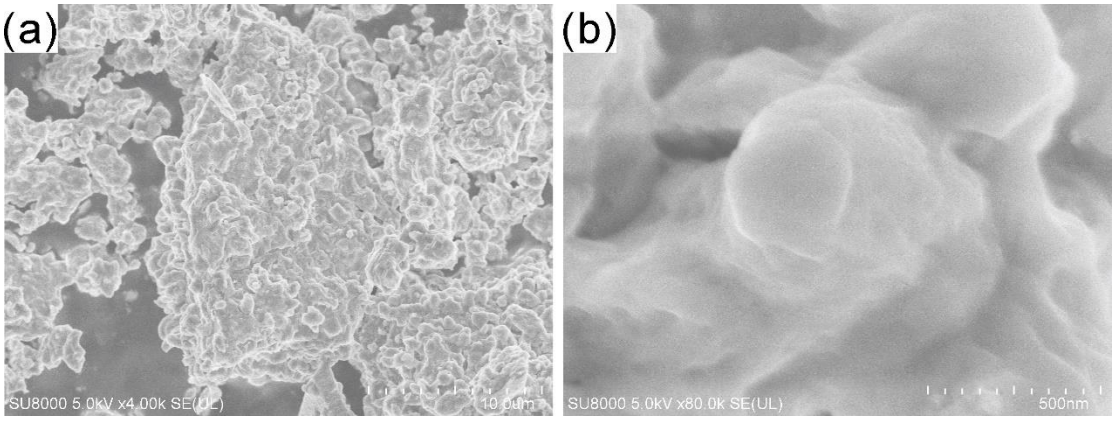

Fig. S2. (a) Low- and (b) high-magnification SEM images of pure NiS.

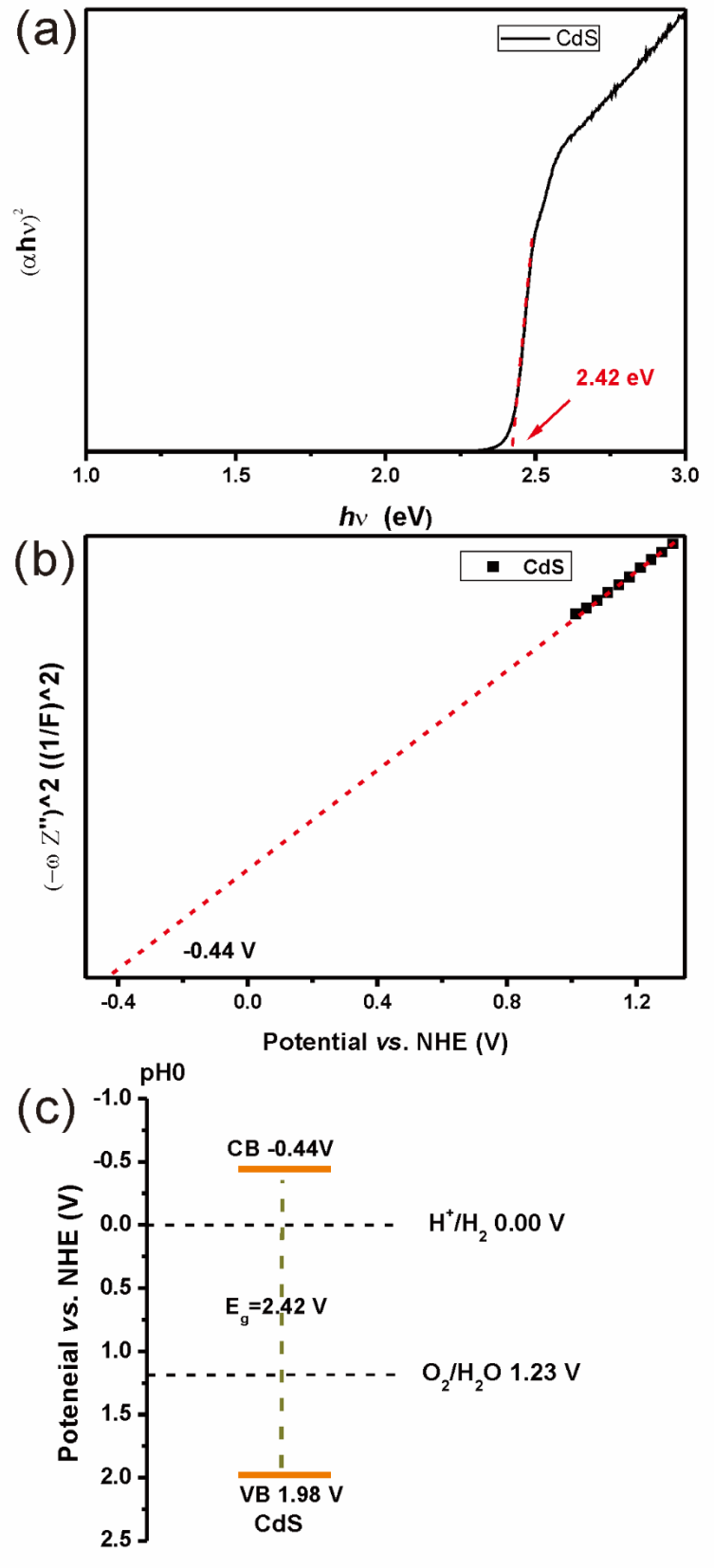

Fig. S3. (a) The plot of $(\alpha h\nu)^2$ versus $h\nu$ of CdS, (b) Mott–Schottky plots of CdS, (c) Energy band diagram of CdS.

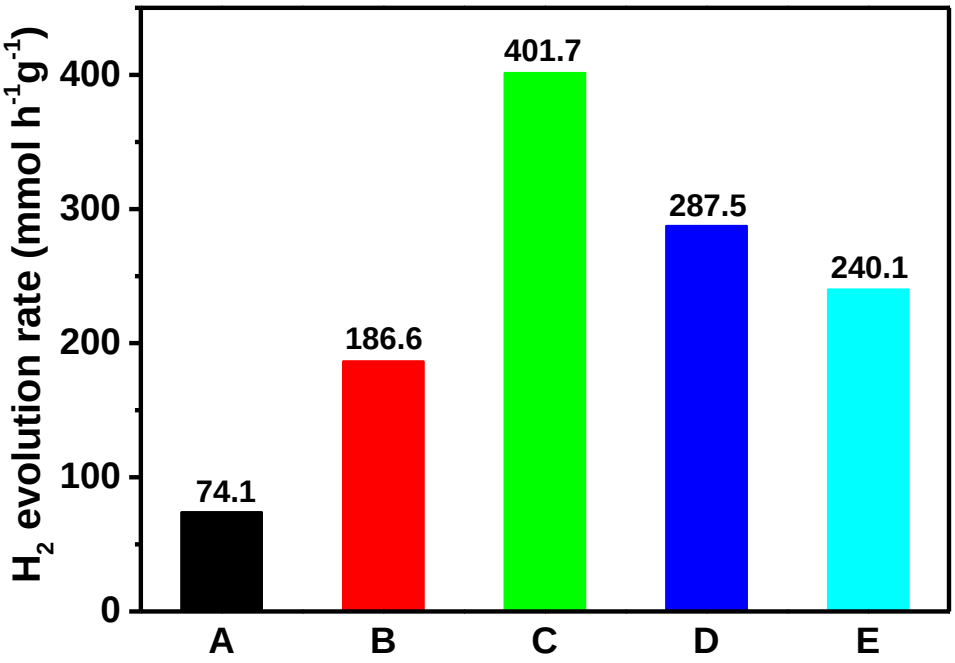

Fig. S4. The H_2-production rate over 25NS-C photocatalyst using different concentrations of hole scavenger under visible light irradiation. (A) 0.25 M Na_2S, 0.35 M Na_2SO_3, (B) 0.50 M Na_2S, 0.70 M Na_2SO_3, (C) 0.75 M Na_2S, 1.05 M Na_2SO_3, (D) 0.875 M Na_2S, 1.225 M Na_2SO_3, (E) 1.0 M Na_2S, 1.4 M Na_2SO_3.

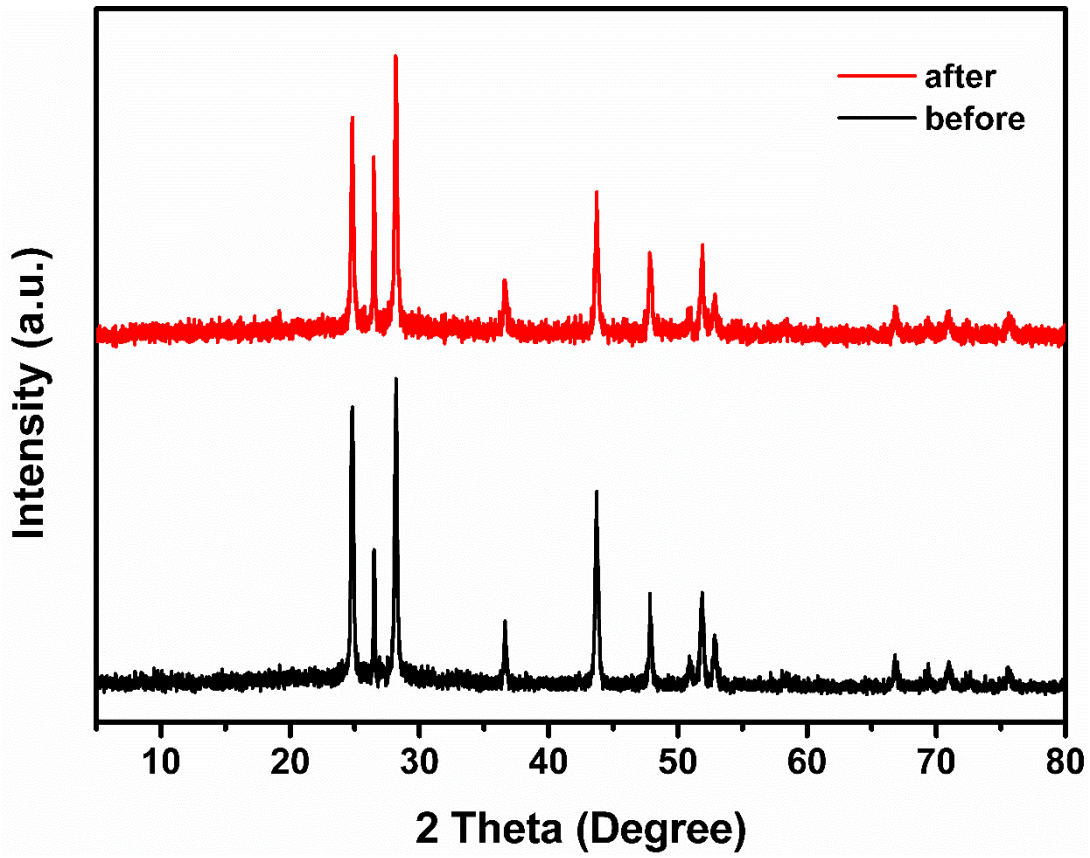

Fig. S5. XRD patterns of 25NS-C before reaction and after 3h of photocatalytic reaction.

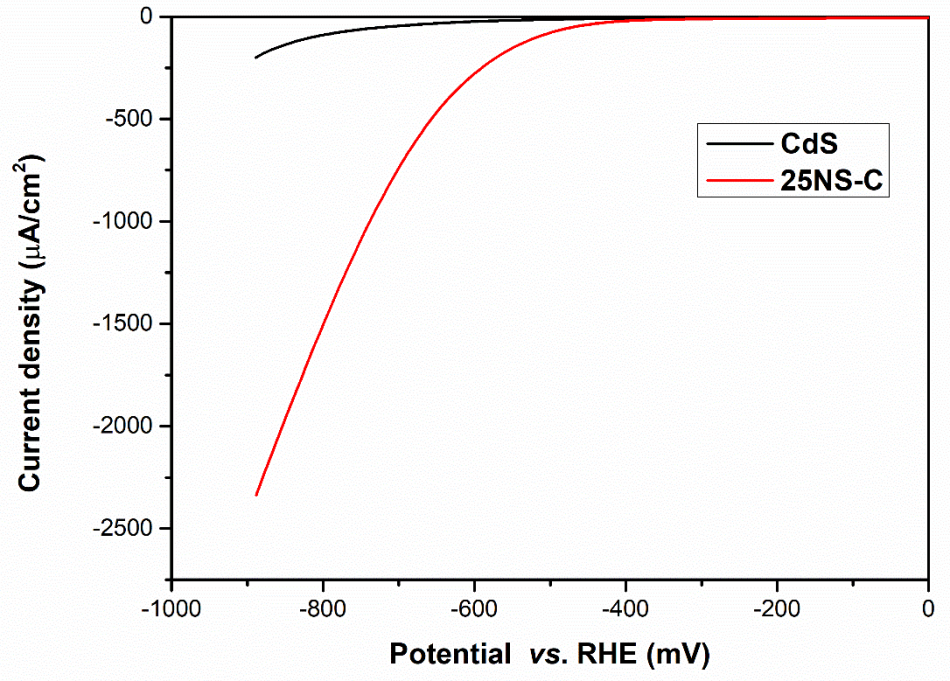

Fig S6. The LSV curves of CdS and 25NS-C samples.

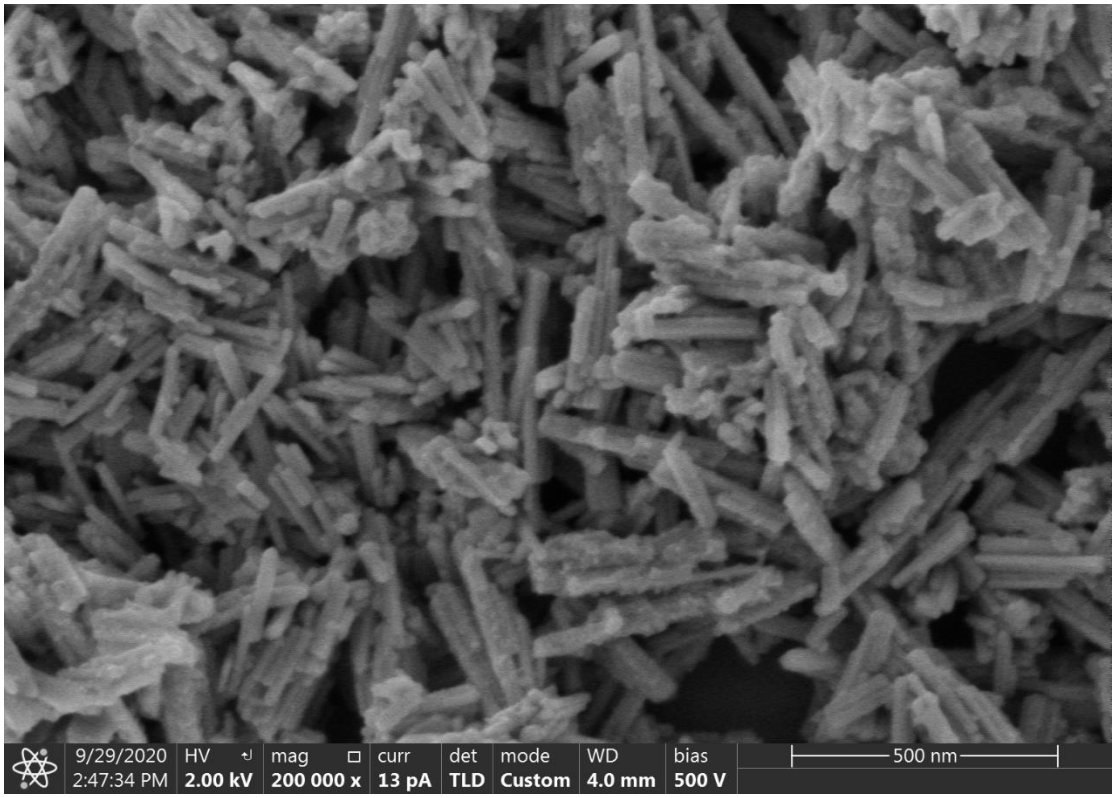

Fig S7. The SEM image of 25NS-C after photocatalytic reaction.

Table S1. Collected data of H_2-evolution activity over CdS-based photocatalysts.

Photocatalyst	Light source	Reactant solution	Activity/ $mmol \cdot h^{-1} \cdot g^{-1}$	References
NiS/CdS	Xe-Vis (≥420 nm)	10 vol.% lactic acid	49.2	[1]
MoS_2/CdS	Xe-Vis (≥420 nm)	10 vol.% lactic acid	49.8	[2]
NiS/CdS	Xe-Vis (≥420 nm)	20 vol.% lactic acid	30.1	[3]
BP-Au-CdS	UV−vis−NIR	0.35M Na_2S-0.25M Na_2SO_3	10.1	[4]
NiS/CdS	Xe-Vis (≥420 nm)	20 vol.% lactic acid	158.7	[5]
Pd@CdS/PdS	Xe-Vis (> 400 nm)	0.1M Na_2S-0.1M Na_2SO_3	144.8	[6]
Ni_2P/CdS	Xe-Vis (≥420 nm)	0.35M Na_2S-0.25M Na_2SO_3	34.9	[7]

$Ni(OH)_2$/CdS	Xe-Vis (≥420 nm)	10 vol.% ethanol (pH 14.7)	35	[8]
Co_2P/CdS	Metal halide lamp (sunlight)	10 vol.% lactic acid	262.16	[9]
Ni/CdS	447 nm laser	10 vol.% ethanol (pH 14.7)	63	[10]
Ni_2P/CdS	Xe-Vis (≥420 nm)	1.25M Na_2S-1.75M Na_2SO_3	~1200μmol·h^{-1}·g^{-1}	[11]
NiS/CdS	Xe-Vis (≥420 nm)	0.75M Na_2S-1.25M Na_2SO_3	401.7 mmol·h^{-1}·g^{-1}	This work

References

1. K. He and L. Guo, *International Journal of Hydrogen Energy*, 2017, **42**, 23995-24005.
2. X.-L. Yin, L.-L. Li, W.-J. Jiang, Y. Zhang, X. Zhang, L.-J. Wan and J.-S. Hu, *ACS Applied Materials & Interfaces*, 2016, **8**, 15258-15266.
3. Y. Zhang, Z. Peng, S. Guan and X. Fu, *Applied Catalysis B: Environmental*, 2018, **224**, 1000-1008.
4. X. Cai, L. Mao, S. Yang, K. Han and J. Zhang, *ACS Energy Letters*, 2018, **3**, 932-939.
5. S. Guan, X. Fu, Y. Zhang and Z. Peng, *Chemical Science*, 2018, **9**, 1574-1585.
6. Q. Sun, N. Wang, J. Yu and J. C. Yu, *Advanced Materials*, 2018, **30**, 1804368.
7. J. Wang, P. Wang, J. Hou, J. Qian, C. Wang and Y. Ao, *Catalysis Science & Technology*, 2018, **8**, 5406-5415.
8. I. Vamvasakis, I. T. Papadas, T. Tzanoudakis, C. Drivas, S. A. Choulis, S. Kennou and G. S. Armatas, *ACS Catalysis*, 2018, **8**, 8726-8738.
9. N. Li, Y. Ding, J. Wu, Z. Zhao, X. Li, Y.-Z. Zheng, M. Huang and X. Tao, *ACS Applied Materials & Interfaces*, 2019, **11**, 22297-22306.
10. T. Simon, N. Bouchonville, M. J. Berr, A. Vaneski, A. Adrović, D. Volbers, R. Wyrwich, M. Döblinger, A. S. Susha, A. L. Rogach, F. Jäckel, J. K. Stolarczyk and J. Feldmann, *Nature Materials*, 2014, **13**, 1013-1018.
11. Z. Sun, H. Zheng, J. Li and P. Du, *Energy & Environmental Science*, 2015, **8**, 2668-2676.