Supplementary Data

Cauliflower-like $Mn_{0.2}Cd_{0.8}S$ decorated with ReS_2 nanosheet for boosting photocatalytic H_2 evolution activity
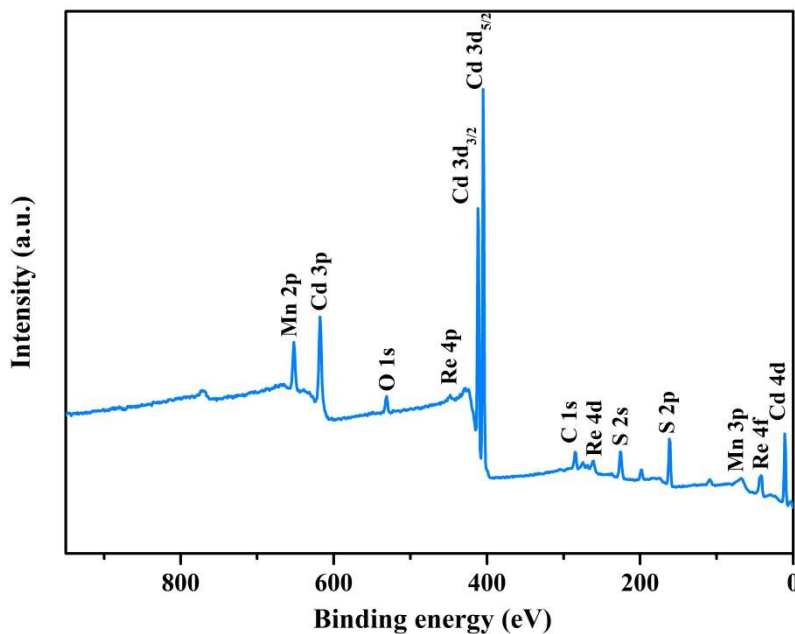

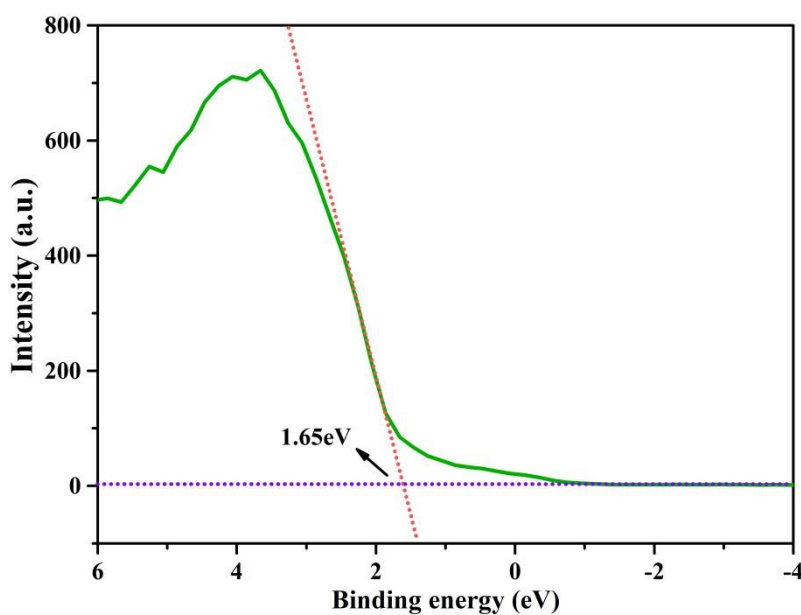Fig. S1. XPS survey spectrum of the 5wt% ReS_2/MCS composite

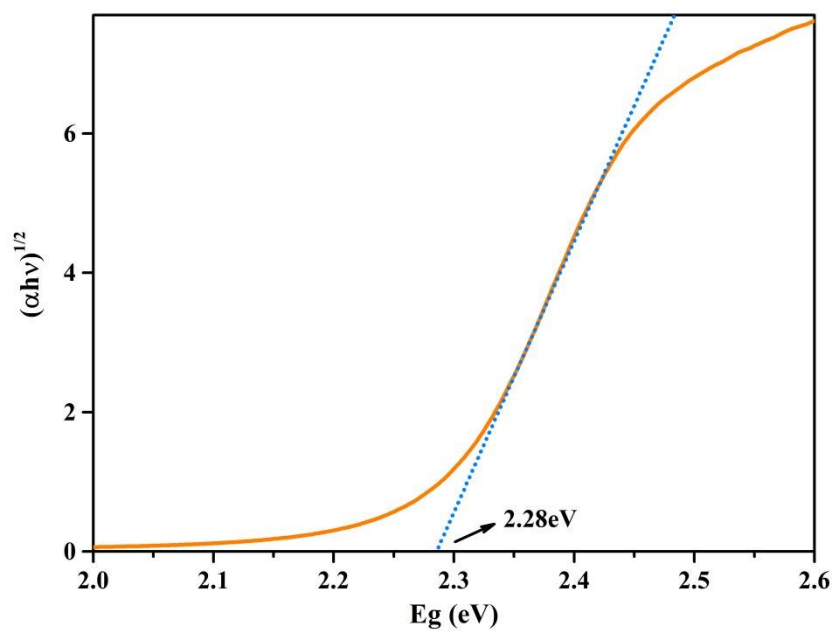

Fig. S2. XPS valence band spectrum of MCS

Fig. S3. Kubelka-Munk plots of MCS

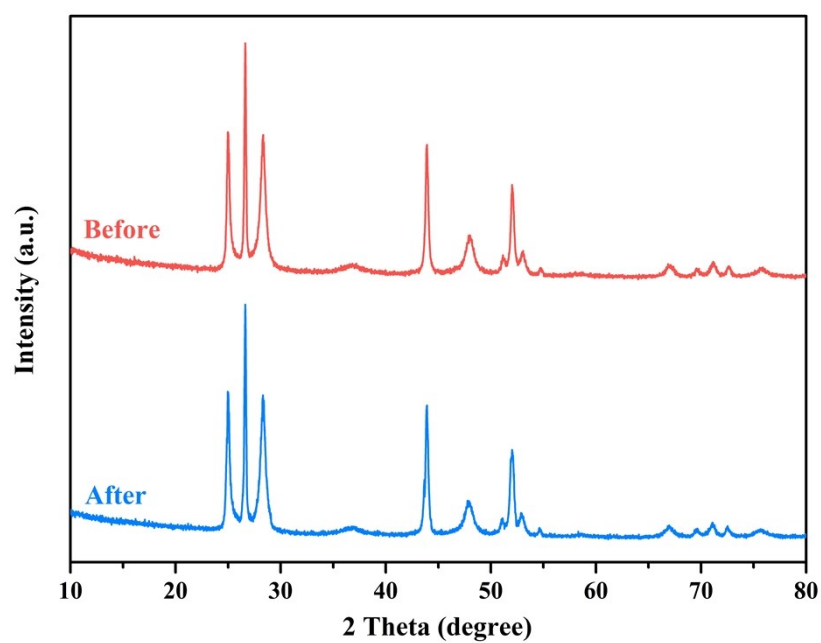
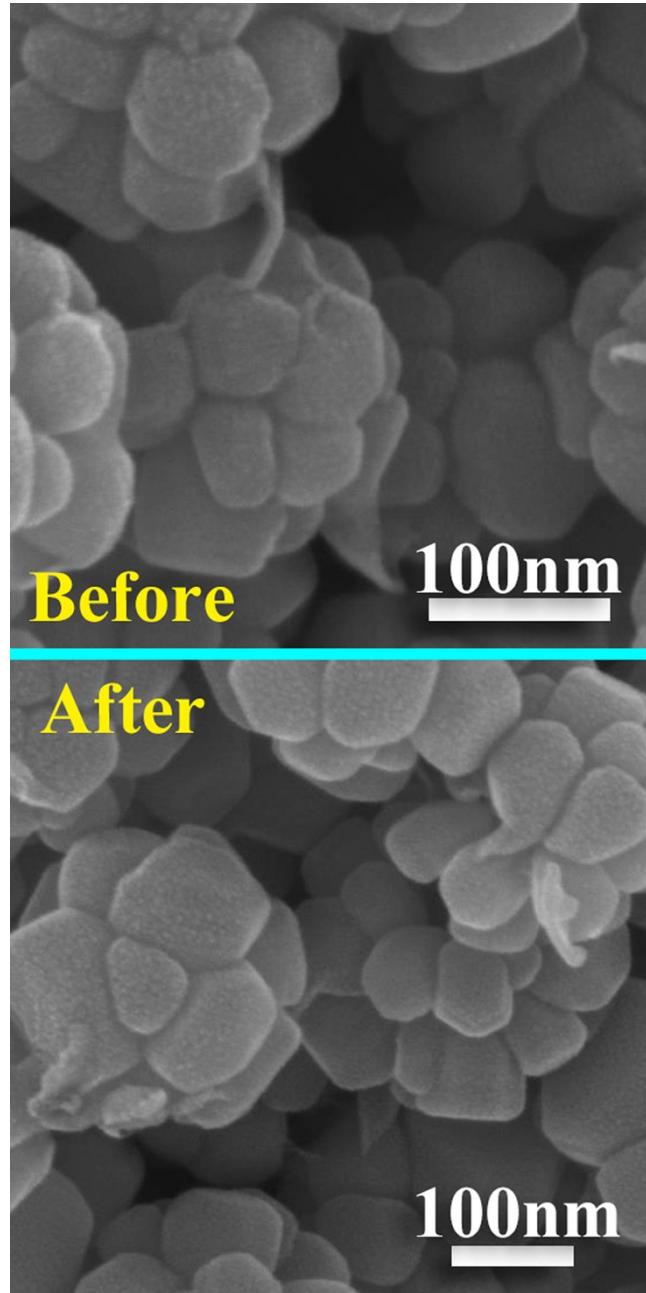Fig. S4. XRD spectra of 5 wt% ReS$_2$/MCS composite before and after cycling test.

Fig. S5. SEM image of 5 wt% ReS$_2$/MCS composite before and after cycling test.

Table S1 Hydrogen evolution rate of photocatalyst modified with co-catalyst.

Photocatalyst	Light source	Incident light	Sacrificial reagent	H_2 evolution rate (mmol h^{-1} g^{-1})	AQE (λ)	Ref.
$ReS_2/Mn_{0.2}Cd_{0.8}S$	300 W Xe lamp	≥420nm	Na_2S-Na_2SO_3	17.31	16.8% (420nm)	This work
$NiS/Mn_{0.5}Cd_{0.5}S$	300 W Xe lamp	≥420nm	Na_2S-Na_2SO_3	8.386	5.21% (420nm)	S1
$MoS_2/Mn_{0.5}Cd_{0.5}S$	300 W Xe lamp	≥420nm	Na_2S-Na_2SO_3	3.938	29.2% (450nm)	S2
MoS_x/CdS	300 W Xe lamp	≥420nm	Na_2S-Na_2SO_3	22.5	/	S3
MoS_x/TiO_2	300 W Xe lamp	/	Methanol	1.836	13.6% (365nm)	S4
NiS/g-C_3N_4	3 W LED lamp	≥420nm	TEOA	0.244	/	S5
NiS/TiO_2	300 W Xe lamp	≥300nm	Methanol	0.314	/	S6
NiS/CdS	/	≥420nm	Na_2S-Na_2SO_3	7.27	51.3% (420nm)	S7
NiS/g-C_3N_4	350 W Xe lamp	≥420nm	TEOA	0.594	/	S8
NiS/C_3N_4	300 W Xe lamp	≥420nm	TEOA	4.82	1.9% (440nm)	S9
NiS/g-C_3N_4	300 W Xe lamp	Natural sunlight	TEOA	16.4	/	S10
$NiS/MgAl$-LDH	300 W Xe lamp	≥420nm	Methanol	0.072	/	S11
MoS_x/TiO_2	3 W LED lamp	≥365nm	Methanol	1.1	10.9%	S12
MoS_x/TiO_2	3 W LED lamp	≥365nm	Lactic acid	3.452	16.5%	S13
MoS_x/CdS	300 W Xe lamp	≥400nm	Lactic acid	8.08	/	S14

[S1] X. L. Liu, X. Z. Liang, P. Wang, B. B. Huang, X. Y. Qin, X. Y. Zhang and Y. Dai, *Appl. Catal. B-Environ.*, 2017, **203**, 282−288.

[S2] H. S. Zhai, X. L. Liu, P. Wang, B. B. Huang and Q. Q. Zhang, *Appl. Surf. Sci.*, 2017, **430**, 515−522.

[S3] X. L. Yin, L. L. Li, M. L. Liu, D. C. Li, L. Shang and J. M. Dou, *Chem. Eng. J.*, 2019, **370**, 305−313.

[S4] F. Y. Du, H. Lu, S. S. Lu, J. Wang, Y. Xiao, W. R. Xue, S. N. Cao, *Int. J. Hydrog. Energy*, 2018, **43**, 3223−3234.

[S5] M. Wang, J. J. Cheng, X. F. Wang, X. K. Hong, J. J. Fan and H. G. Yu, *Chinese J. Catal.*, 2021, **42**, 37−45.

[S6] Y. J. Xin, Y. Lu, C. C. Han, L. Ge, P. Qiu, Y. J. Li and S. M. Fang, *Mater. Res. Bull.*, 2017, **87**, 123−129.

[S7] W. Zhang, Y. B. Wang, Z. Wang, Z. Y. Zhong and R. Xu, *Chem. Commun.*, 2010, **46**, 7631−7633.

[S8] K. L. He, J. Xie, M. L. Li and X. Li, *Appl. Surf. Sci.*, 2017, **430**, 208−217.

[S9] J. D. Hong, Y. S. Wang, Y. B. Wang, W. Zhang and Rong Xu, *ChemSusChem*, 2013, **6**, 2263−2268.

[S10] H. Zhao, H. Z. Zhang, G. W. Cui, Y. M. Dong, G. L. Wang, P. P. Jiang, X. M. Wu and N. Zhao, *Appl. Catal. B-Environ.*, 2017, **225**, 284−290.

[S11] J. S. Chen, C. Wang, Y. Zhang, Z. Z. Guo, Y. X. Luo and Chang, J. Mao, *Appl. Surf. Sci.*, 2019, 144999.

[S12] H. G. Yu, R. R. Yuan, D. D. Gao, Y. Xu and J. G. Yu, *Chem. Eng. J.*, 2019, **375**, 121934.

[S13] D. D. Gao, R. R. Yuan, J. J. Fan, X. K. Hong and H. G. Yu, *J. Mater. Sci.*, 2020, **56** 122−132.

[S14] X.L. Fu, L. Zhang, L. H. Liu, H. Li, S. G Meng, X. J. Ye and S. F. Chen, *J. Mater. Chem. A*, 2017, **5**, 15287−15293.