Electronic Supplementary Information

Amorphous Co_xS_y loaded $Mn_{0.5}Cd_{0.5}S$ solid solution for effective visible-light photocatalytic H_2 generation

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Table S1 The elemental content ratio $Mn_{0.5}Cd_{0.5}S$ and Co_xS_y for obtained from XPS test.

Sample	Element	Atomic ratio (%)
$Mn_{0.5}Cd_{0.5}S$	Mn	14.82
	Cd	13.09
	S	23.95
Co_xS_y	Co	13.23
	S	17.42

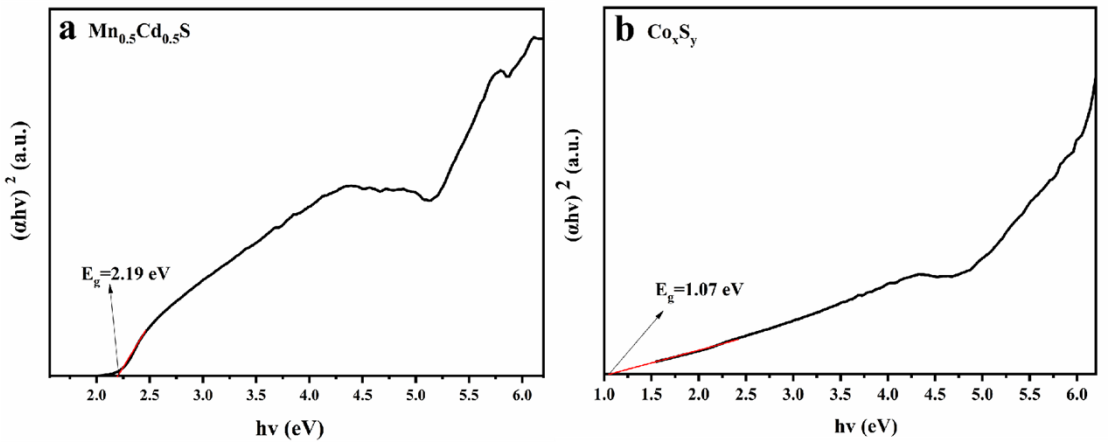

Figure S1 Tac plot of (a) $Mn_{0.5}Cd_{0.5}S$ and (b) Co_xS_y.

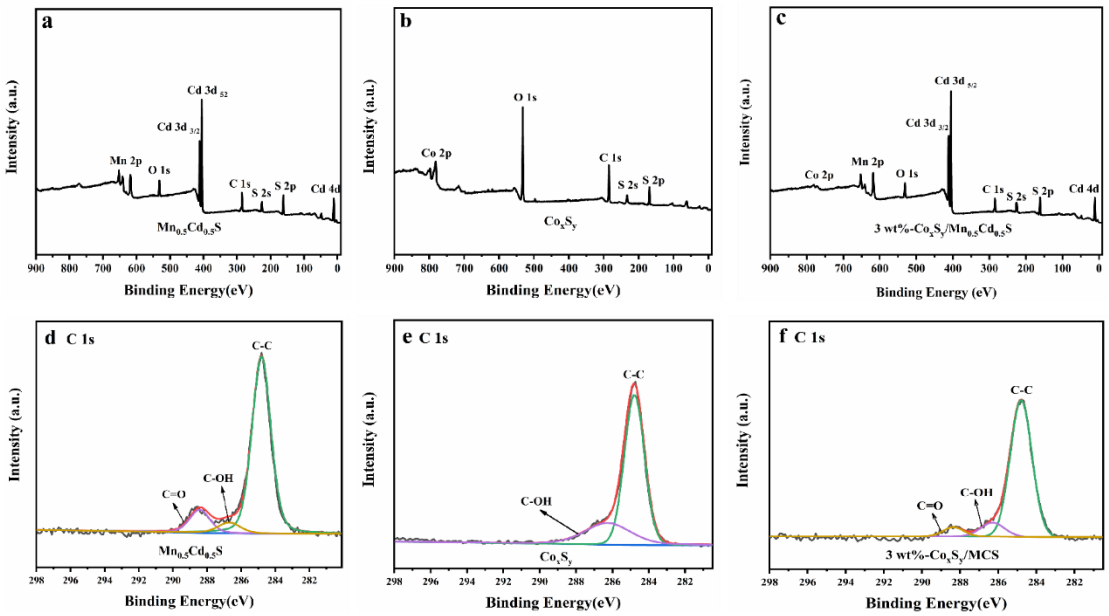

Figure S2 The survey spectrum and the high resolution XPS spectrum for C 1s spectrum of $Mn_{0.5}Cd_{0.5}S$, Co_xS_y, and 3 wt%-Co_xS_y/$Mn_{0.5}Cd_{0.5}S$.

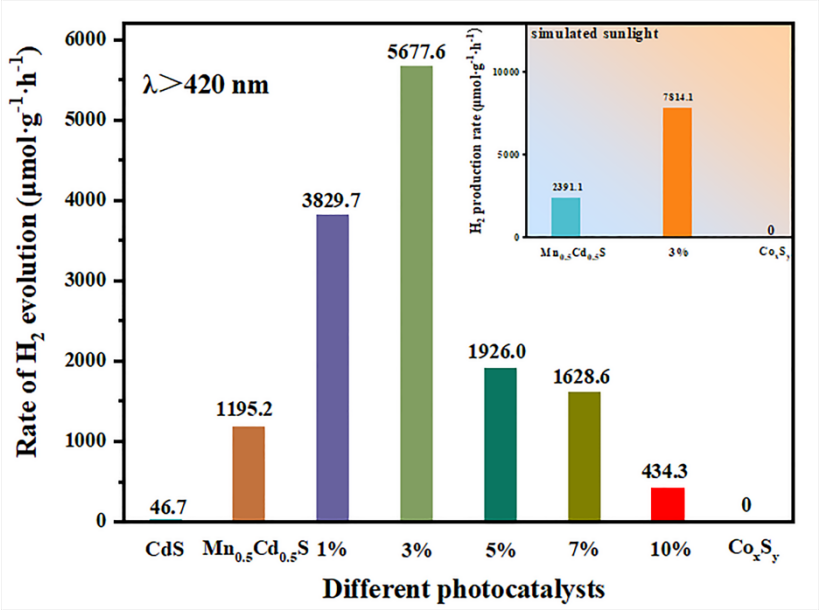

Figure S3 H_2 evolution rate of $Mn_{0.5}Cd_{0.5}S$ and composite catalysts under λ>420 nm and simulated sunlight irradiation.

Table S1 Comparison of H_2 evolution performances between the as-obtained 3 wt%-$Co_xS_y/Mn_{0.5}Cd_{0.5}S$ in this study and other photo catalytic systems in literatures.

Catalysts	Dosage	Light condition	Sacrificial agent	H_2 production rate	Literature source
$P/Mn_{0.25}Cd_{0.75}S$	30 mg	300 W Xe lamp (λ>400 nm)	No sacrificial agents	863 μmol/h/g	[1]
$MoS_2/Mn_{0.5}Cd_{0.5}S$	50 mg	300 W Xe lamp (λ>420 nm)	0.35 M Na_2S and 0.25 M Na_2SO_3	3951.2 μmol/h/g	[2]
$Co_xS_y/Mn_{0.5}Cd_{0.5}S$	30 mg	300 W Xe lamp (λ>420 nm)	0.5 M Na_2S and 0.5 Na_2SO_3	5677.6 μmol/h/g	This work
$NiCo_2S_4/Mn_{0.2}Cd_{0.8}S$	10 mg	300 W Xe lamp	Na_2S/Na_2SO_3	5677.8 μmol/h/g	[3]
$CNTs/Mn_{0.5}Cd_{0.5}S$	30 mg	300 W Xe lamp (λ≥420 nm)	TEOA	869 μmol/h/g	[4]
$Mn_{0.2}Cd_{0.8}S/CoTiO_3$	10 mg	5 W light-emitti ng diode (λ≥420 nm)	Na_2S/Na_2SO_3	2764 μmol/h/g	[5]
$TiO_2/Mn_{0.2}Cd_{0.8}S$	20 mg	300W Xe lamp	0.35 M Na_2S and 0.25M Na_2SO_3	5822.94 μmol/h/g	[6]
$Bi_2MoO_6/Mn_{0.2}Cd_{0.8}S$	50 mg	300 W Xe lamp (λ>420 nm)	0.35 M Na_2S and 0.25 M Na_2SO_3	1500 μmol/h/g	[7]

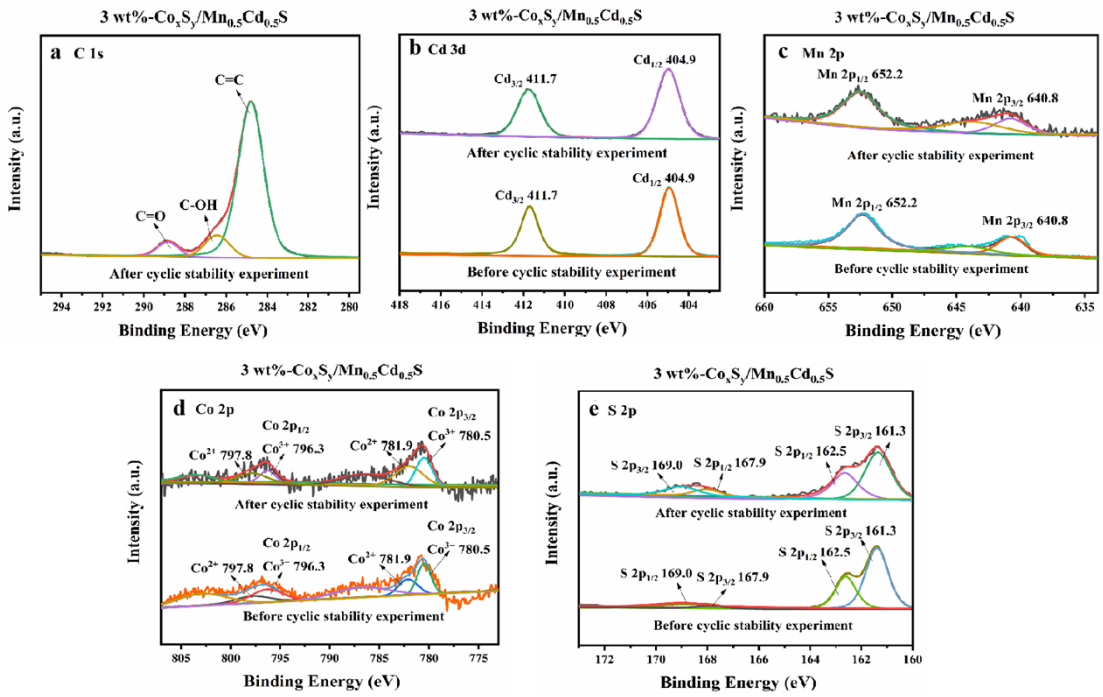

Figure S4 (a)-(e) The C 1s spectrum and the high resolution XPS spectrum for Cd 3d, Mn 2p, Co 2p, and S 2p spectrum of 3 wt%-$Co_xS_y/Mn_{0.5}Cd_{0.5}S$ after cyclic stability experiment.

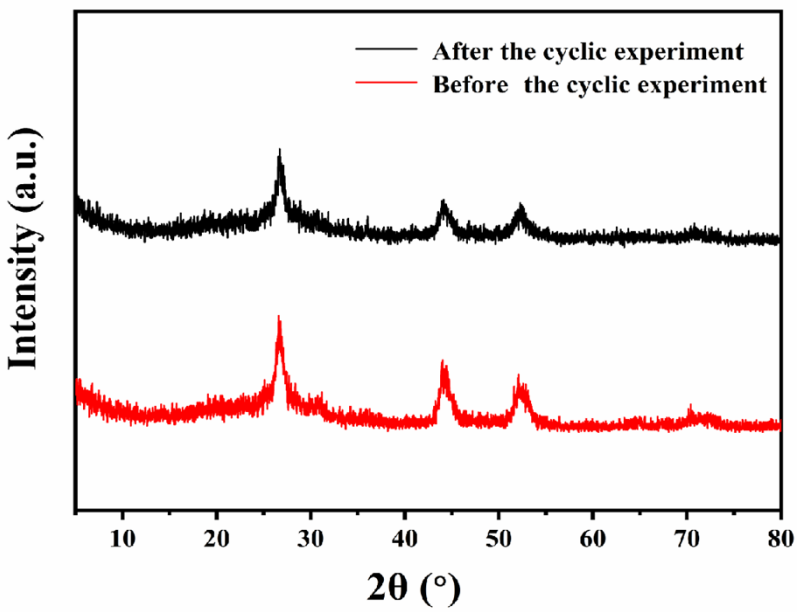

Figure S5 XRD of 3 wt%- $Co_xS_y/Mn_{0.5}Cd_{0.5}S$ before and after the cyclic experiment.

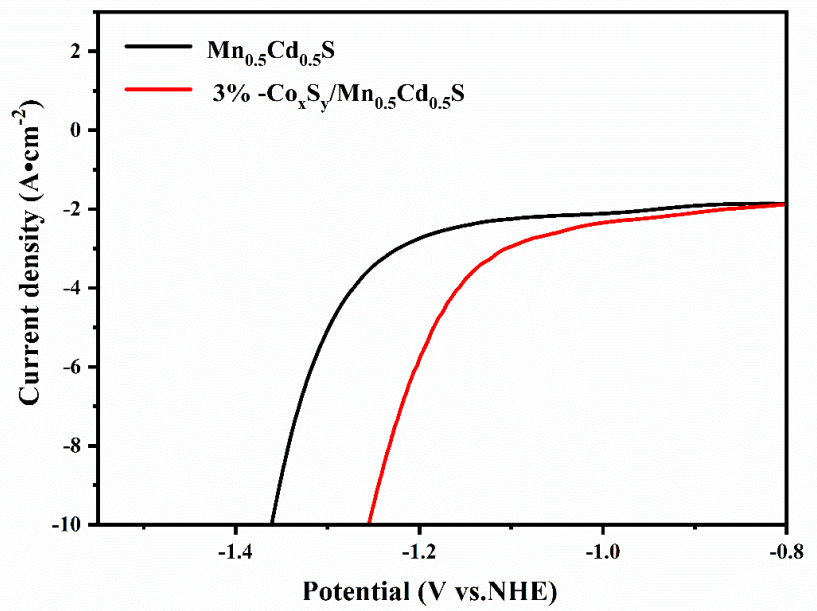

Figure S6 LSV plots for catalysts $Mn_{0.5}Cd_{0.5}S$ and 3 wt%-Co_xS_y/MCS.

Table S3 Energy band structure information of $Mn_{0.5}Cd_{0.5}S$ and Co_xS_y.

Samples	**$Mn_{0.5}Cd_{0.5}S$**	**Co_xS_y**
Bandgap energy (eV)	2.19	1.07
Conduction band vs.NHE (eV)	(-0.93)~(-1.13)	(-1.10)~(-1.30)
Valance band vs.NHE (eV)	1.06~1.26	(-0.03)~(-0.23)

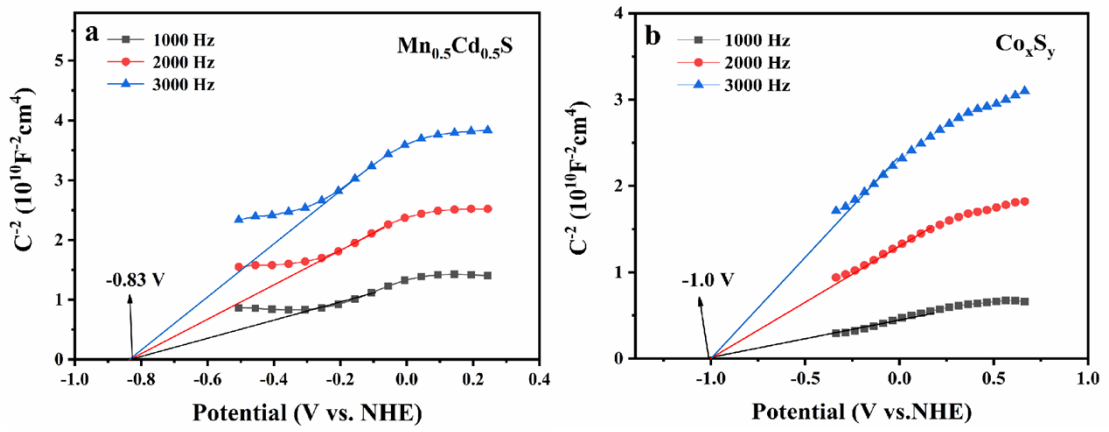

Figure S7 Mott–Schottky plots of (a) $Mn_{0.5}d_{0.5}S$ and (b) Co_xS_y.

References

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