Supplementary Information

Studying on the different morphology of Zn_{0.5}Cd_{0.5}S for

photocatalytic H₂ production

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Some detailed Experimental Section:

1. Characterization

X-ray diffraction (XRD) patterns of the samples were obtained on a Bruker D8 Advance X-ray diffract meter with Cu K α radiation ($\lambda = 1.5406$ Å). UV-visible diffuse reflection spectra (UV-vis DRS) were recorded using a Hitachi UV-365 spectrophotometer with BaSO₄ as reference. Scanning electron microscopy (SEM) images of the samples were obtained by a field emission SEM (FESEM, FEI Nova NANOSEM 230). Transmission electron microscopy (TEM) and high-resolution transmission electron microscopy (HRTEM) images were performed on a JEM-ARM200F electron microscope operated at an acceleration voltage of 200 kV. The elemental compositions were detected by an energy-dispersive X-ray spectrometer (EDX) attached to the TEM instrument. X-ray photoelectron spectroscopy (XPS) analysis was conducted on an ESCALAB 250 photoelectron spectrometer (Thermo Fisher Scientific) at 3.0×10⁻¹⁰ mbar using Al Kα X-ray beam (1486.6 eV). All binding energies of elements were corrected with reference to the C 1s peak of the surface adventitious carbon at 284.6 eV. N2 physisorption measurements were carried out at 77 K using a Micromeritics Tristar II 3020 surface area analyzer. Multipoint Brunauer-Emmett-Teller (BET) specific surface areas were then determined from the adsorption isotherms.



Figure S1. The photocatalytic activity of $Zn_xCd_{1-x}S$ in lactic acid solution.

Samples	Quality (g)	Constant volume (ml)	Dilution ratio	Element	Content (mg/kg)	Mass fraction %	The molar ratio
				Zn	245595.1	24.5595%	0.51
ZCS-0D	0.0437	25	100	Cd	407057.3	40.7057%	0.49
				S	124105.6	12.4106%	1
ZCS-1D	0.0428	25	100	Zn	245411.8	24.5412%	0.50
				Cd	432494.2	43.2494%	0.50
				S	91983.6	9.1984%	1
				Zn	289212.8	28.9213%	0.51
ZCS-2D	0.0444	25	100	Cd	466828.3	46.6828%	0.49
				S	65157.1	6.5157%	1
ZCS-3D	0.0497	25	100	Zn	242981.7	24.2982%	0.49
				Cd	428493.7	42.8494%	0.51
				S	68204.8	6.8205%	1

Table S1. The ICP-OES of ZCS-0D, ZCS-1D, ZCS-2D, ZCS-3D.



Figure S2. The EDX spectrum (a and b) and its element mapping images of Zn (d), Cd (e) and S (f) from SEM image of ZCS-0D (c).



Figure S3. The EDX spectrum (a and b) and its element mapping images of Zn (d), Cd (e) and S (f) from SEM image of ZCS-1D (c).



Figure S4. The EDX spectrum (a and b) and its element mapping images of Zn (d), Cd (e) and S (f) from SEM image of ZCS-2D (c).



Figure S5. The EDX spectrum (a and b) and its element mapping images of Zn (d), Cd (e) and S (f) from SEM image of ZCS-3D (c).



Figure S6. The XRD, DRS and photocatalytic activity of ZnS, CdS and ZCS-2D.

Samples	elements	Measured concentration (mg/L)	dilution ratio	Concentration of the original sample solution (mg/L)
ZCS-0D	Cd	0.1491	1	0.1491
ZCS-1D	Cd	13.7115	1	13.7115
ZCS-2D	Cd	0.1204	1	0.1204
ZCS-3D	Cd	9.6018	1	9.6018
ZCS-0D	Zn	5.3305	10	53.3049
ZCS-1D	Zn	6.1120	20	122.2398
ZCS-2D	Zn	4.9630	50	248.1520
ZCS-3D	Zn	2.1442	10	21.4415

Table S2. The element dissolution of Cd and Zn elements during photocatalysis.

Samples	S_{BET}^{a} (m ² g ⁻¹)	Pore volume ^b (cm ³ g ⁻¹)	Average pore size °			
ZCS-0D	78.1368	0.470869	26.8171			
ZCS-1D	45.9136	0.984803	88.8172			
ZCS-2D	130.7391	0.442509	15.8171			
ZCS-3D	50.2253	0.676879	137.3006			
^a BET specific surface area. ^b BJH adsorption cumulative volume of pores. ^c BJH						
adsorption average pore diameter.						

Table S3. The $S_{\text{BET}},$ pore volume and average pore size of ZCS-0D, ZCS-1D, ZCS-

2D and ZCS-3D.