Supporting Information

Dual photocarrier separation channel in CdS/ZnS for outstanding photocatalytic hydrogen evolution

Yi Zheng,*[a] Qiaoling Chen,[a] Wenjing Zhang,[a] Chongwen Zhang,[a] Rong Ma,[a] Chunlei Li,*[a] and Jing Zhang*[b,c]

Supporting Figures and Table

Table S1. Cd and Zn Contents of Prepared Samples Based on ICP-OES Results

Sample	Cd（wt%)	Zn（wt%)	S（wt%)	CdS:CdS/ZnS weight ratio
CZS-1	78.26	3.03	18.24	0.96
CZS-2	28.22	45.65	26.4	0.38
CZS-3	27.72	50.79	20.67	0.35
CZS-2′（No Na_2S solution was added）	79.14	0.96	18.29	0.98

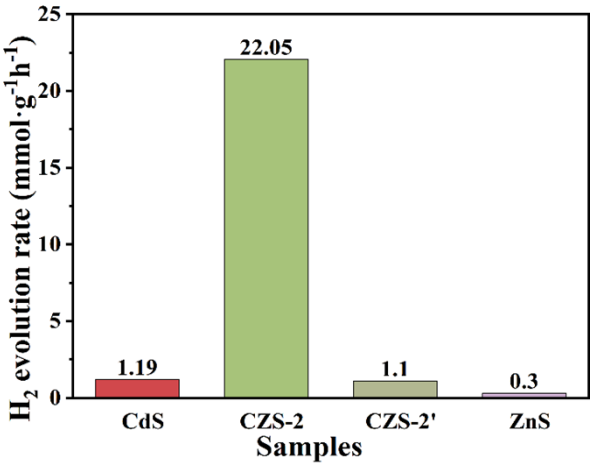

Fig.S1.Photocatalytic performance of the prepared samples samples

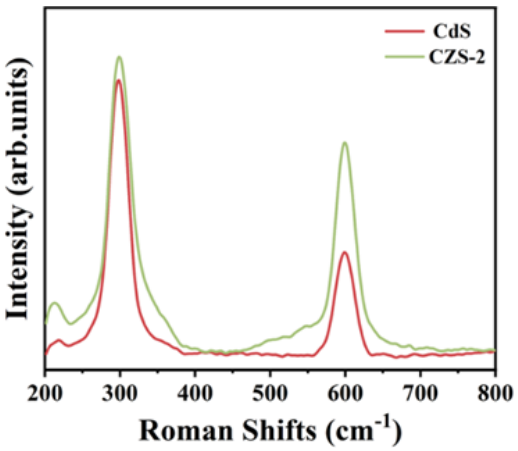

Fig.S2. Raman spectra of the CdS nanocrystals and CZS-2

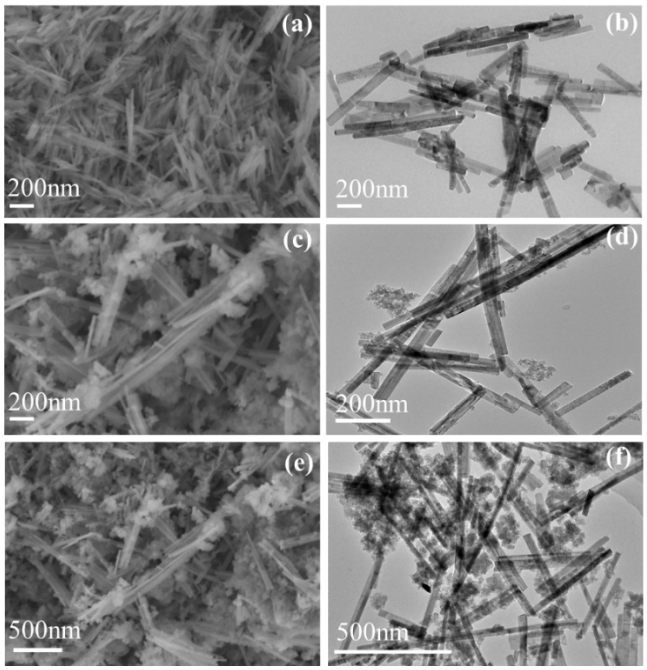

Fig.S3.(a) SEM and (b) TEM images of CdS nanorods , (c) ,(e) SEM and (d), (f)TEM images of CdS/ZnS(CZS-2).

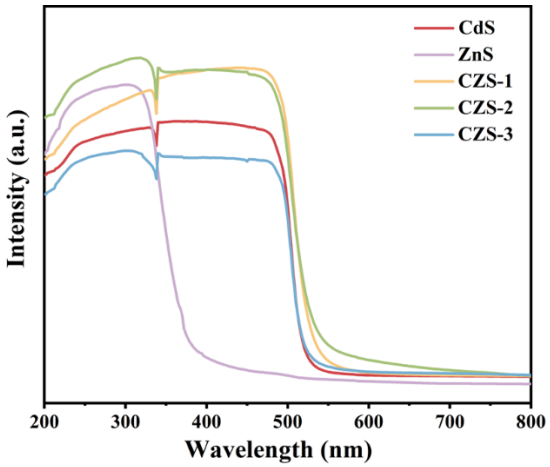

Fig.S4. UV–vis diffuse reflectance spectra of CdS, ZnS and CZS-X nanocomposites.

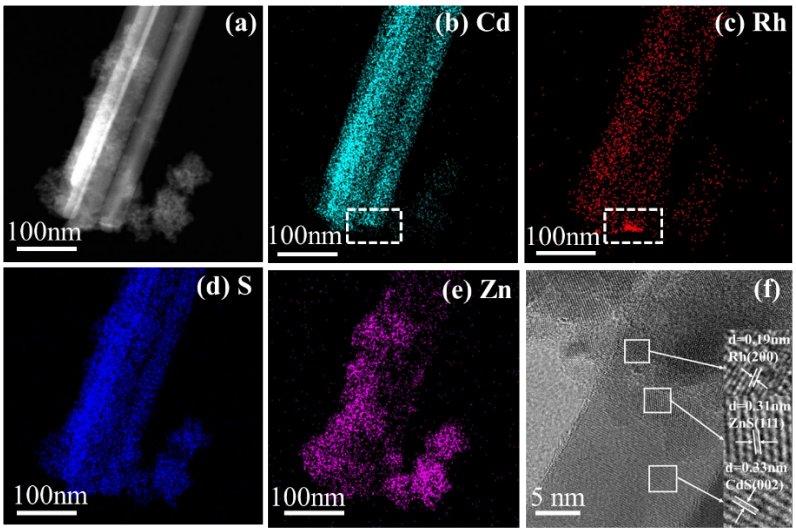

Fig.S5. (a,b,c,d,e) elemental mapping images and HRTEM images (f) of CdS/ZnS/Rh.

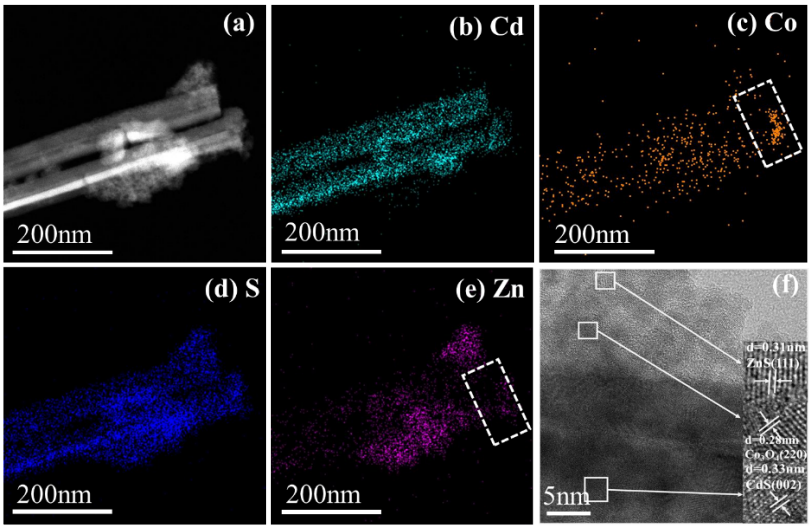

Fig.S6. (a,b,c,d,e) elemental mapping images and HRTEM images (f) of CdS/ZnS/Co_3O_4

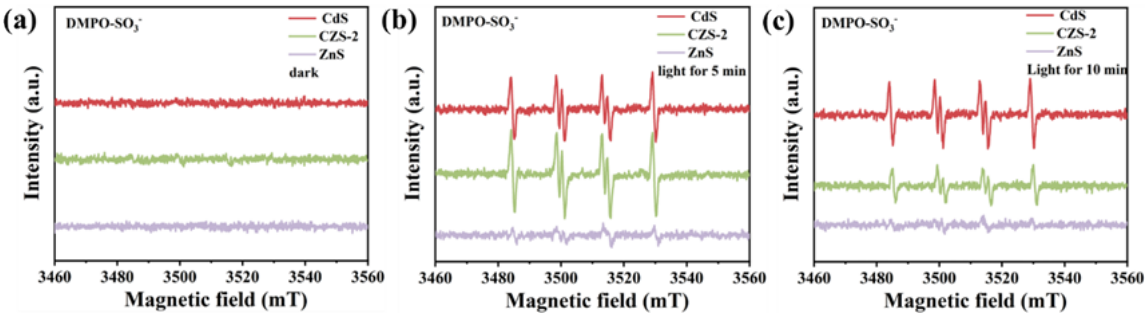

Fig.S7.ESR spectra of CdS ,ZnS,CZS-2 samples (a) at dark and (b) light for 5 min,(c) light for 10 min

Table S2. Comparison of the photocatalytic H_2 evolution rates over CdS/ZnS based photocatalysts

Catalyst system	Sacrificial agent	RH_2)(Evolution rate)	AQY(%)	light source	Reference
CdS/ZnS	0.35M Na_2S 0.25M Na_2SO_3	1102.5 μmol h^{-1}	4.68	300 w xenon lamp AM1.5G	This work
CdS/ZnS	0.35M Na_2S 0.25M Na_2SO_3	140.2 umol h^{-1}	3.76	300 w xenon lamp λ >400nm	24

			9.5	300 w xenon	42
CdS/ZnS	0.35M Na_2S 0.25M Na_2SO_3	233.15 umol h^{-1}		lamp λ >420nm	
			--	300 w xenon	44
CdS/ZnS	0.5 M Na_2S-Na_2SO_3	94.05 μmol h^{-1}		lamp λ >420nm	
			9.3	300 w xenon lamp	53
CdS/ZnS	0.5M Na_2S 0.5M Na_2SO_3	241 umol h^{-1}		AM1.5G	
			50.61	225 w xenon lamp	65
CdS/ZnS	0.35M Na_2S 0.25M Na_2SO_3	726 μmol h^{-1}		λ >380nm	
			--	Solar light India	69
CdS/ZnS	0.1 M Na_2S-Na_2SO_4	3430 μmol h^{-1}		(14.57° N, 78.83° E)	

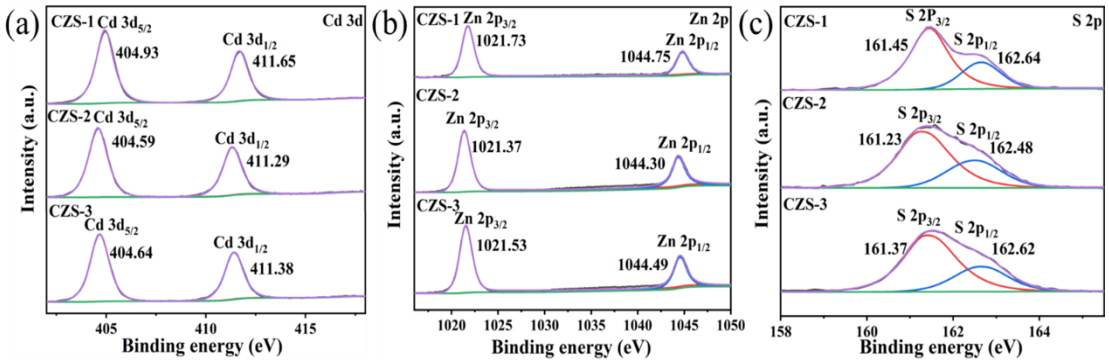

Fig. S8. high-resolution XPS spectra of (a) Cd 3d, (c) Zn 2p and (d) S 2p of the CZS-1,CZS-2 and CZS-3 sample.

AQY is calculated as follows:

$$AQY = \frac{2 \times v \times N_A}{IS\lambda/hc}$$

$$= \frac{2 \times 6.022 \times 10^{-23} \times \left(5.09 \times \frac{10^{-4}}{3600}\right)}{0.061 \times 28.26 \times \frac{420}{6.626 \times 10^{-34} \times 3 \times 10^{8}}} = 4.68\%$$

where v is the H_2 rate (mol s^{-1}), , N_A isAvogadro's constant (mol^{-1}), I is the light intensity (W cm^{-2}), S is the irradiation area (cm^2), I is the wavelength of incident light (nm), h is the Planck constant (J s) and c is the speed of light(nm s^{-1}).

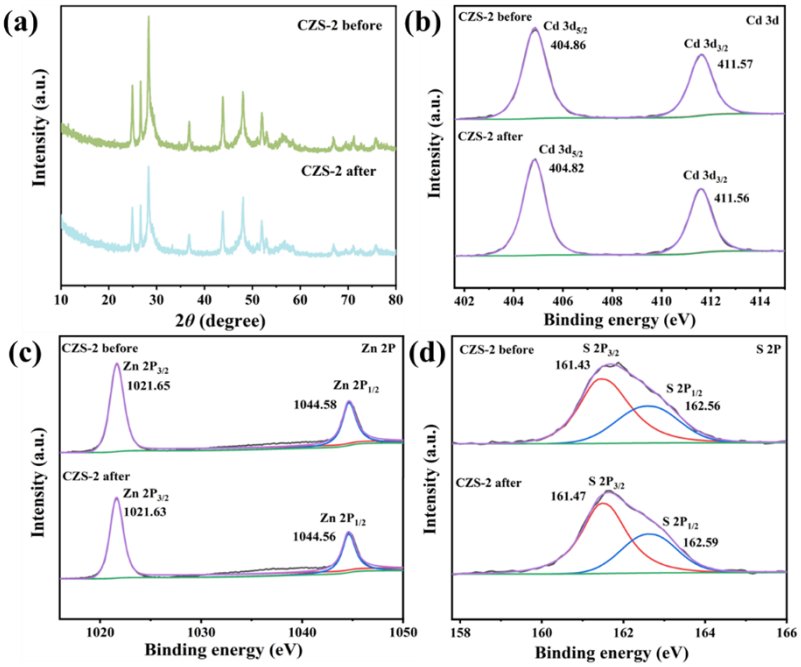

Fig.S9.(a) XRD and high-resolution XPS spectra of (b) Cd 3d, (c) Zn 2p and (d) S 2p of the CZS-2 sample before and after cycling measurements.

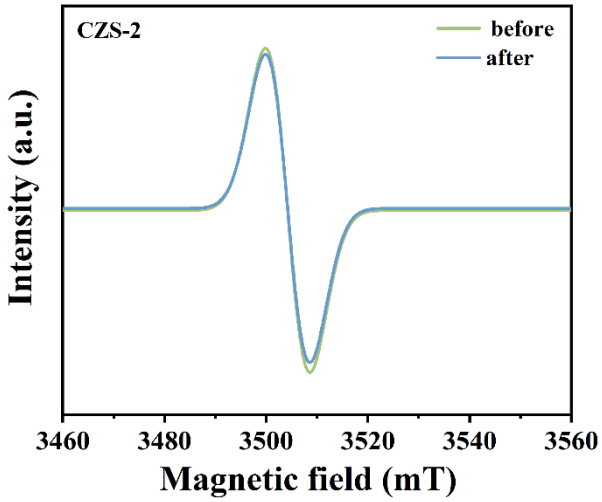

Fig.S10 EPR spectra of CZS-2 before and after the reaction