Supporting Information

Localized surface plasmon resonance effect boosts photocatalytic hydrogen evolution of $ZnIn_2S_4$/amorphous MoO_{3-x} nanodot Z-scheme heterojunctions

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Apparent quantum efficiency (AQE)

The experimental conditions were kept constant. The apparent quantum efficiencies (AQE) of ZIS and ZM10 composite photocatalyst were measured using different single-wavelength filters (350, 380, and 420 nm).[1] The value of AQE at a specific wavelength was calculated using the following equation.

$$AQE(\%) = \frac{N_e}{N_p} \times 100\% = \frac{2 \times nH_2 \times N_A \times h \times c}{I \times S \times t \times \lambda} \times 100\% \qquad (1)$$

where N_e is the number of reacting electrons, N_p is the number of incident photons, nH_2 is the amount of hydrogen evolution in 1 h in the units of mol, N_A is the Avogadro constant (6.023×10^{23} mol^{-1}), h is the Planck constant (6.626×10^{-34} J·s), c is the speed of light (3×10^8 m/s), I is the intensity of irradiation light (W/cm^2), S is the corresponding light irradiation area (41.83 cm^2), t is the photoreaction time (3600 s), and λ is the wavelength of incident light (nm).

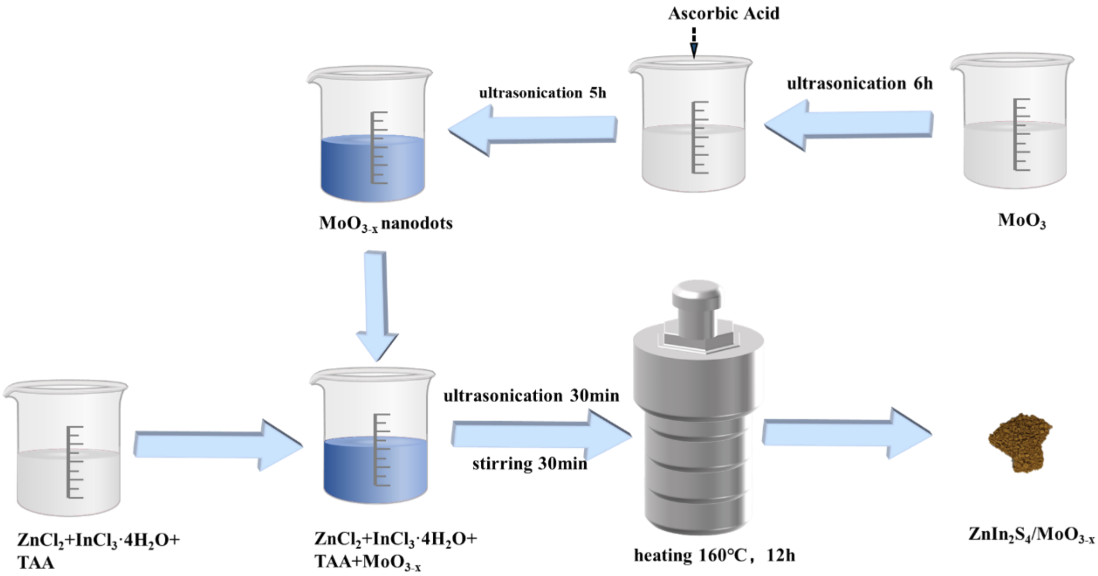

Fig. S1 Schematic of the preparation of $ZnIn_2S_4/MoO_{3-x}$ composite catalysts

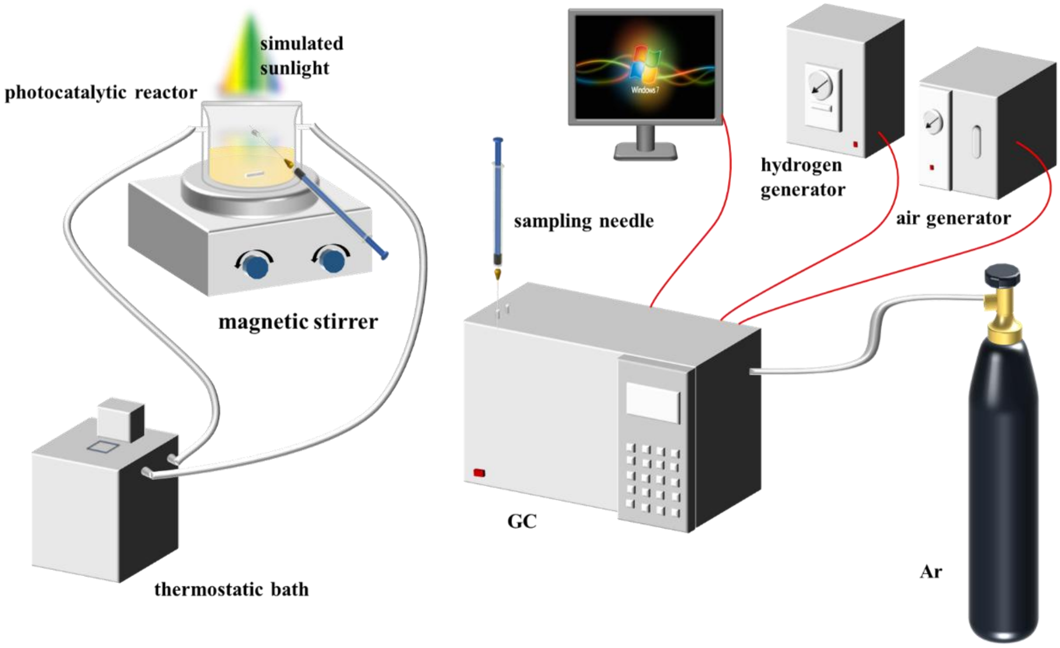

Fig. S2 Photocatalytic system for hydrogen evolution.

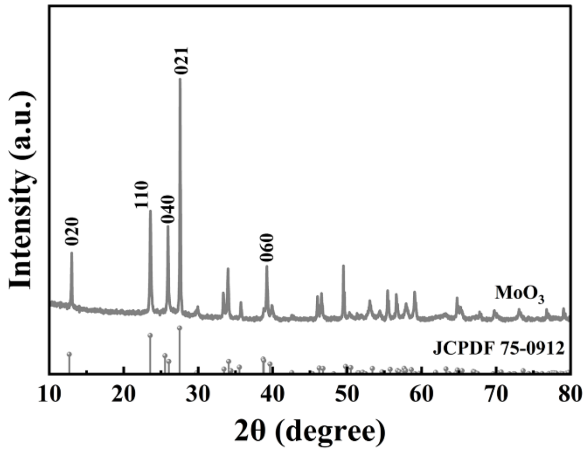

Fig. S3 XRD pattern of MoO_3.

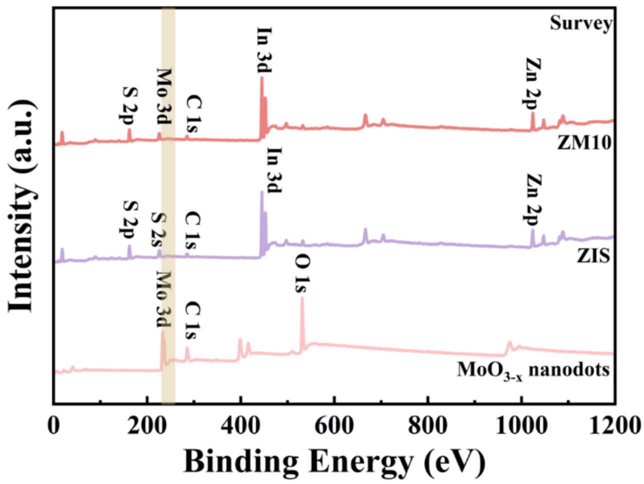

Fig. S4 XPS full-survey spectra of MoO_{3-x} nanodots, ZIS, and ZM10.

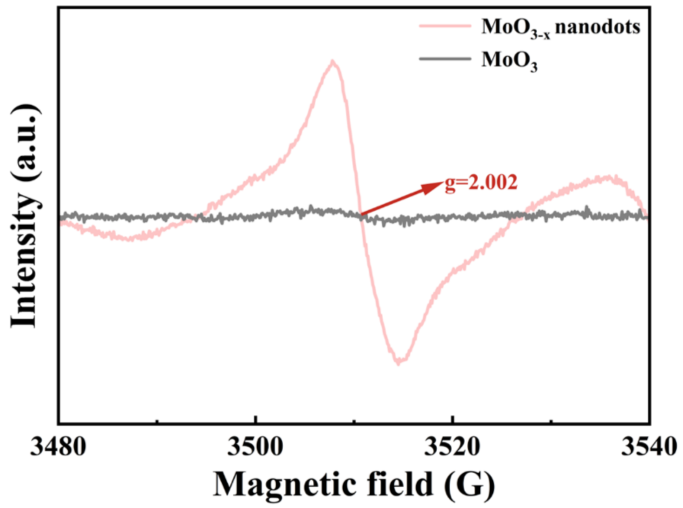

Fig. S5 EPR spectra of the MoO_3 and MoO_{3-x} nanodots.

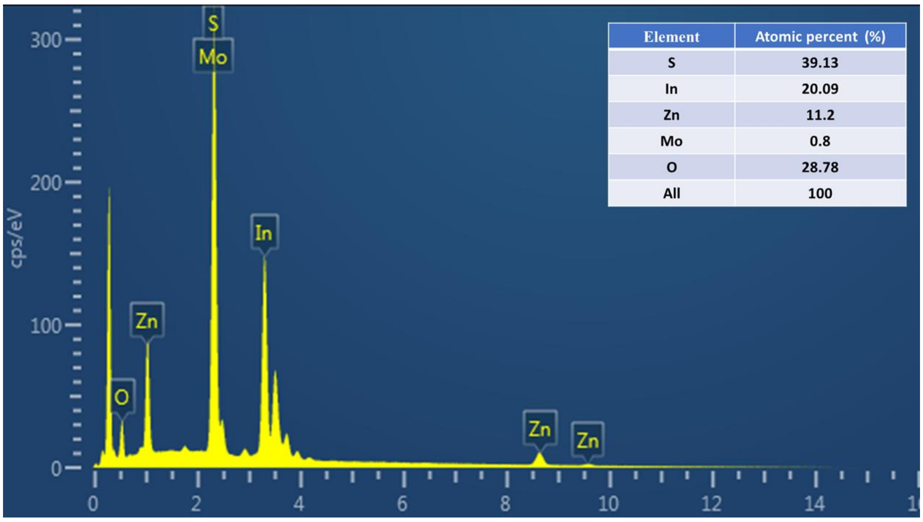

Fig. S6 EDS analysis of ZM10.

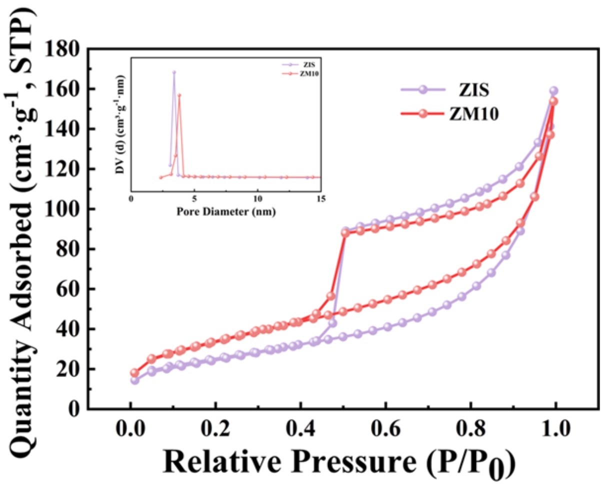

Fig. S7 N_2 adsorption-desorption isotherms for ZIS and ZM10; the inset is the corresponding BJH pore-size distribution curves.

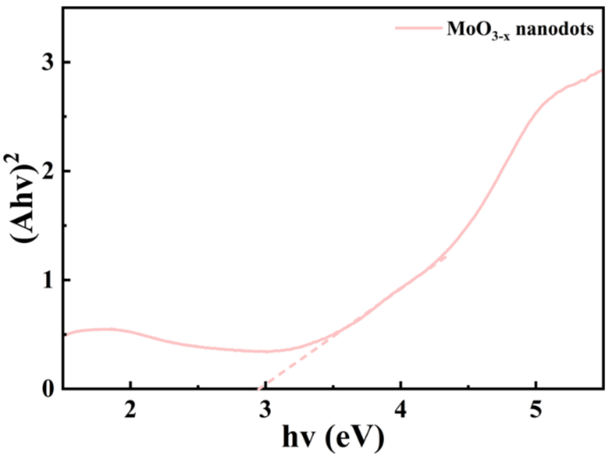

Fig. S8 The band gap of MoO_{3-x} nanodots.

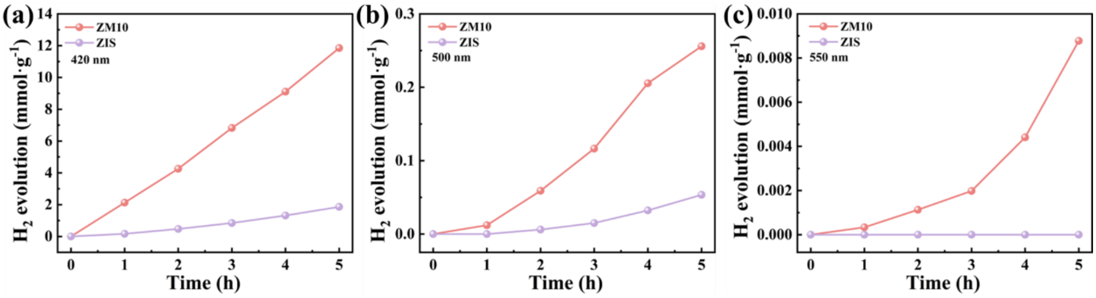

Fig. S9 Hydrogen evolution performance of ZM10 and ZIS when irradiated using monochromatic lights at (a) 420 nm, (b) 500 nm, (c) 550 nm.

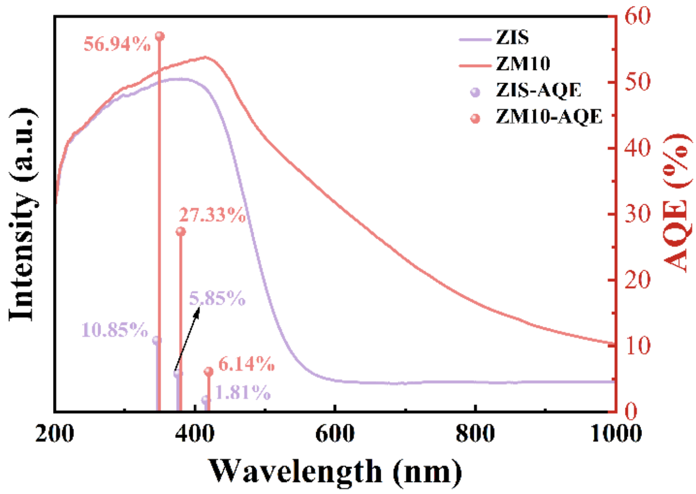

Fig. S10 The wavelength-dependent AQEs of ZIS and ZM10.

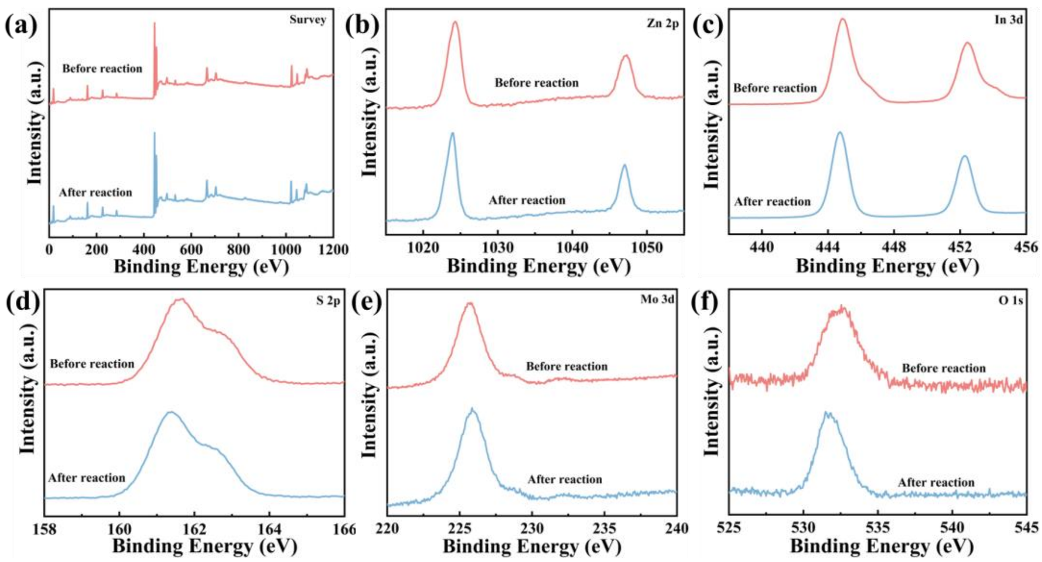

Fig. S11 XPS spectra of ZM10 before and after reaction. (a) Full-survey XPS spectra, (b) Zn 2p spectrum, (c) In 3d spectrum, (d) S 2s spectrum, (e) Mo 3d spectrum, (f) O 1s spectrum.

Table. S1. ICP test calculation results.

Quality of ZM10 (g)	Content of Zn (%)	Content of Mo (%)	Moles of Zn (mol)	Moles of Mo (mol)	Molar ratio
0.0437	13.82	1.06	9.26×10^{-5}	4.83×10^{-6}	19:1

Table. S2. Comparison of hydrogen production efficiency of ZIS or MoO_{3-x} based photocatalysts.

Photocatalyst	**Mass (mg)**	**Light Source**	**Sacrificial reagent**	**Hydrogen evolution rate ($mmol\cdot g^{-1}\cdot h^{-1}$)**	**Ref**
MoO_3@Mo-$ZnIn_2S_4$	10	300W Xe lamp	TEOA	5.5	2
Mo-doped $ZnIn_2S_4$	20	300W Xe lamp	TEOA	4.6	3
H_xMoO_3@ $ZnIn_2S_4$	20	300W Xe lamp	TEOA	5.9	4
MoS_2/ $ZnIn_2S_4$	80	300W Xe lamp	Na_2S and Na_2SO_3	3.9	5
$MoO_2/ZnIn_2S_4$	10	300W Xe lamp	Na_2S and Na_2SO_3	3.7	6
CdS/MoO_{3-x}	25	350W Xe lamp	Lactic acid	7.44	7
BP-MoO_{3-x}	10	300W Xe lamp	/	0.4	8
α-MoO_{3-x}/g-C_3N_4	50	300W Xe lamp	TEOA	6.4	9
$MoO_{3-x}/Mn_{0.3}Cd_{0.7}S$	50	300W Xe lamp	Lactic acid	2.3	10
$ZnIn_2S_4/MoO_{3-x}$	30	300W Xe lamp	TEOA	11.08	This work

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