Supporting Information

Photocatalytic Hydrogen Generation on Bifunctional Ternary Heterostructured $In_2S_3/MoS_2/CdS$ Composite with High Activity and Stability under Visible Light Irradiation

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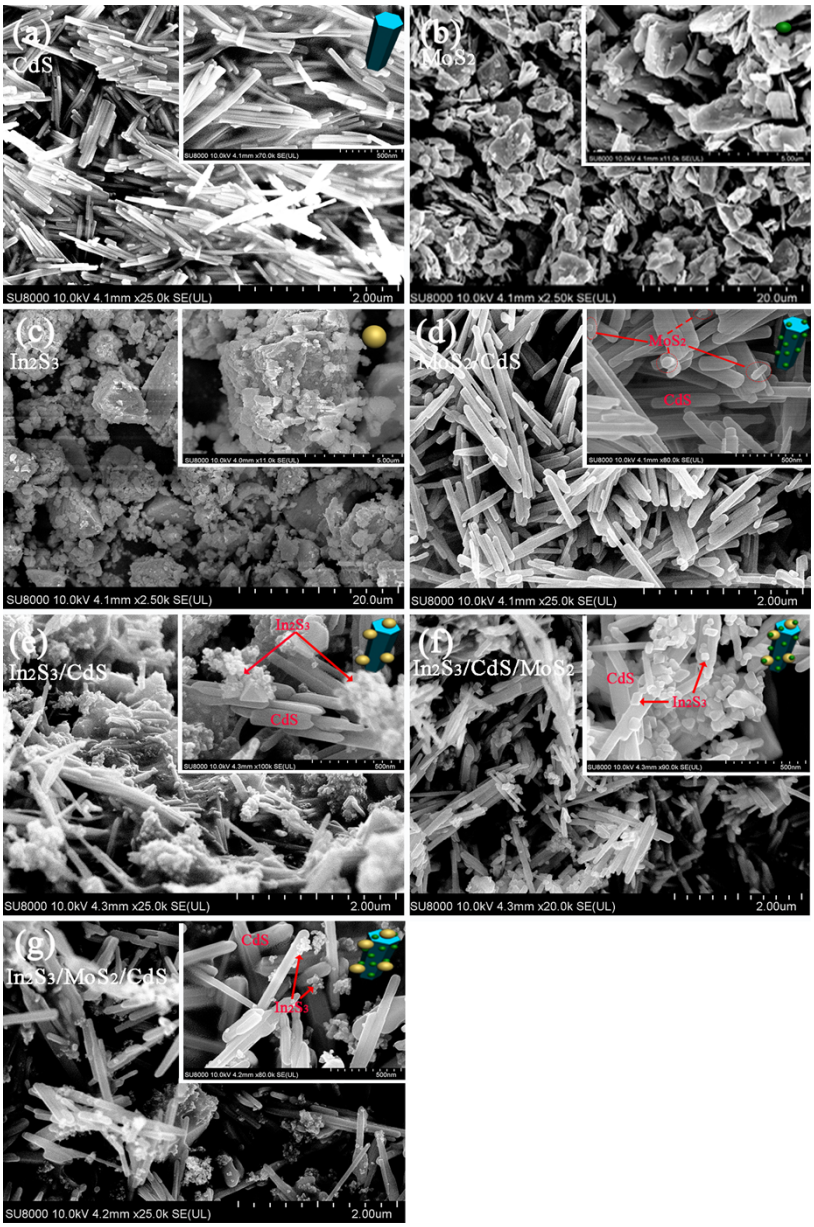

Fig. S1 FESEM images of (a) pure CdS nanorods, (b) pure MoS_2, (c) pure In_2S_3, (d) MoS_2/CdS heterostructures (0.2 wt% of MoS_2), (e) In_2S_3/CdS heterostructures (20 wt% of In_2S_3), (f) In_2S_3/CdS/MoS_2 heterostructures (0.2 wt% of MoS_2 and 20 wt% of In_2S_3) and (g) In_2S_3/MoS_2/CdS heterostructures (0.2 wt% of MoS_2 and 20 wt% of In_2S_3.

As shown in Fig. S1a-S1c, pure CdS, MoS_2 and In_2S_3 are nanorods, thin flakes and blocky structure, respectively. However, the morphology of the pure In_2S_3 in the TEM image (Fig. 2c) is nanowire. The reason is that the sample in the TEM image is ultrasonic dispersed and spontaneously assembled nanowires, while the sample in the SEM image is not pretreated. Fig. S1d-S1e shows the FESEM images of the binary heterostructures. In MoS_2/CdS, a small amount of MoS_2 is coated on the surface of the CdS nanorods (insert of Fig. S1d), which forms the MoS_2/CdS heterostructures. In In_2S_3/CdS heterostructures, 20% of In_2S_3 is coated on the surface of the CdS nanorods (insert of Fig. S1e), forming the In_2S_3/CdS heterostructures. Fig. 2f-2g shows the FESEM image of the ternary heterostructures. As the resolution ratio of FESEM is not so high, MoS_2 could not be found easily.

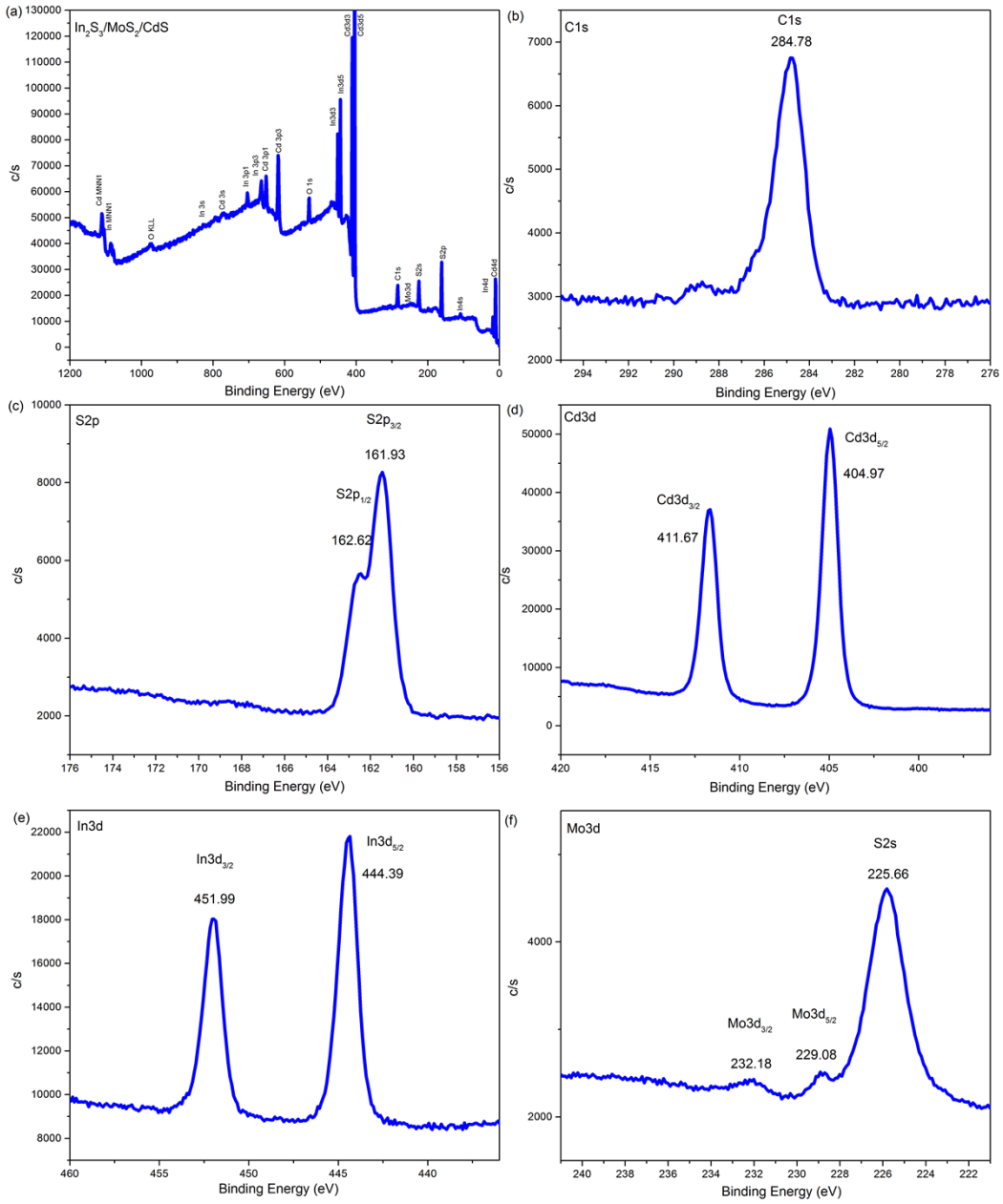

Fig. S2 (a) XPS survey spectra and (b-f) high-resolution XPS spectra of the C1s, S2p, Cd3d, In3d and Mo3d of the In_2S_3/MoS_2/CdS heterosructures.

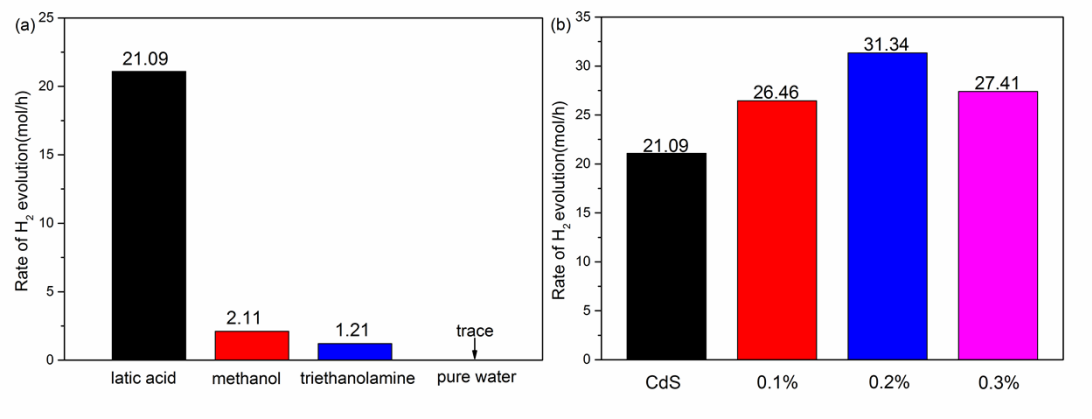

Fig. S3 (a) Rate of H_2 evolution on pure CdS nanorods in the presence of different sacrificial reagents. (b) Rate of H_2 evolution from lactic acid solution on MoS_2/CdS binary heterostructured photocatalysts with different MoS_2 content. Reaction conditions: catalyst, 0.05 g; 100 ml solution containing 10 ml sacrificial reagent; light source (300W Xe Lamp) with a cutoff filter (λ>420 nm).

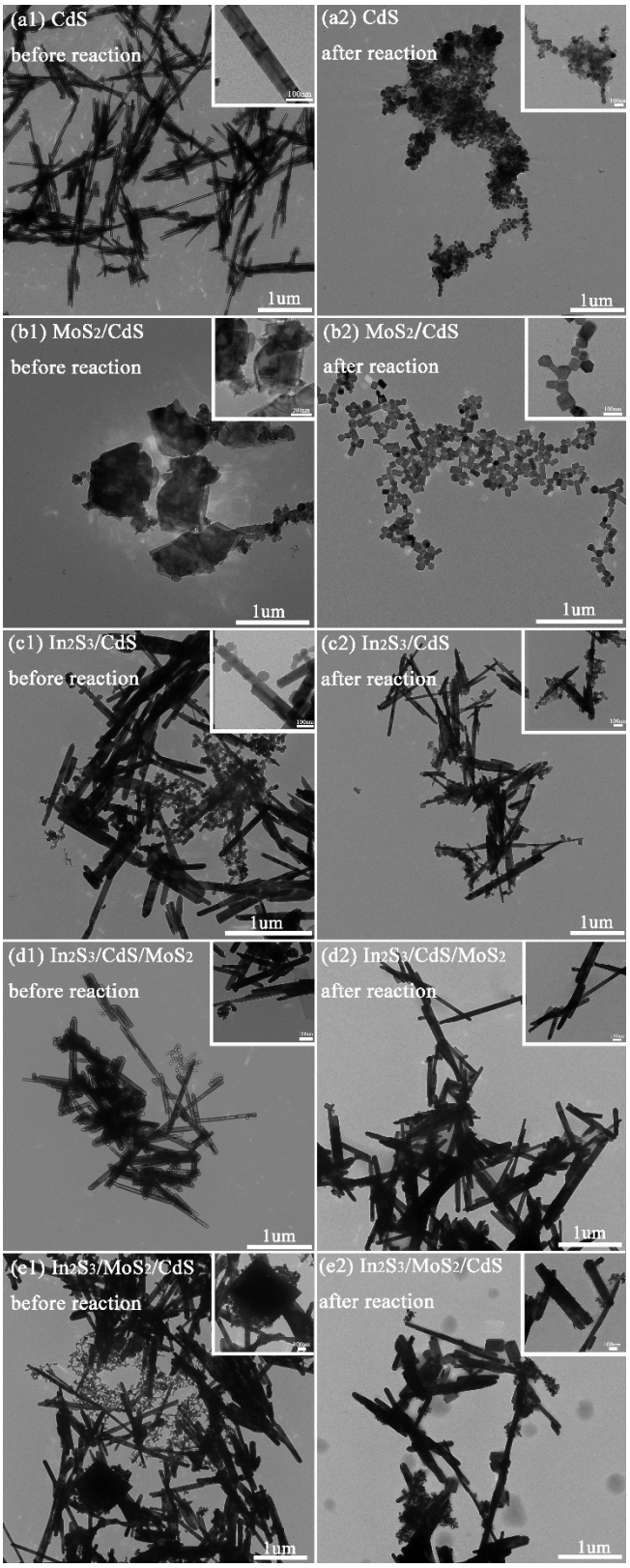

Fig. S4 TEM images of (a) pure CdS nanorods, (b) MoS_2/CdS heterostructures, (c) In_2S_3/CdS heterostructures, (d) In_2S_3/CdS/MoS_2 heterostructures and (e) In_2S_3/MoS_2/CdS heterostructures before and after reaction.

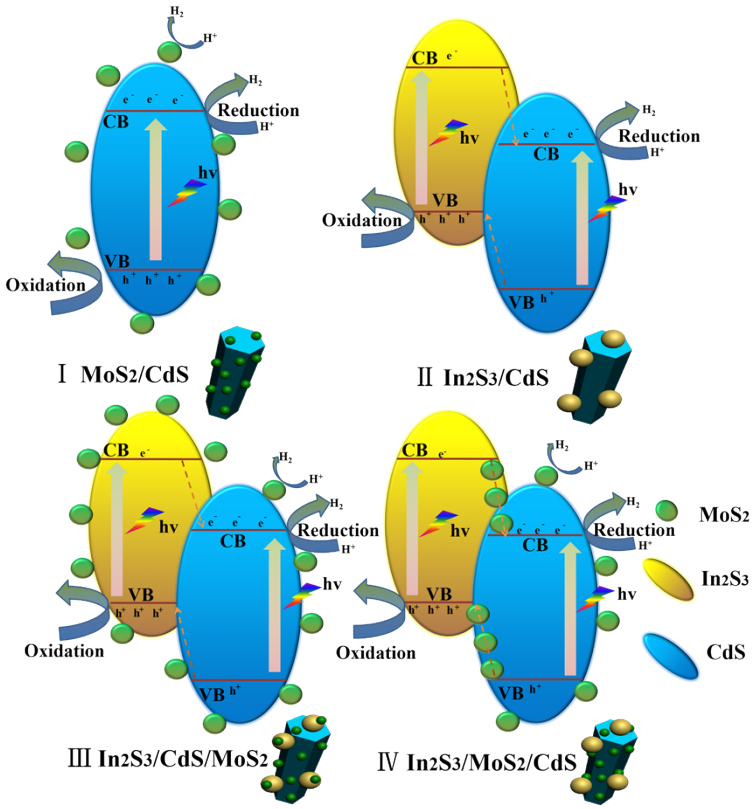

Fig. S5 Schematic illustration of the charge transfer and separation on the MoS_2/CdS, In_2S_3/CdS, In_2S_3/CdS/MoS_2 and In_2S_3/MoS_2/CdS heterostructures under visible light.