Supporting Information

Constructing a direct Z-scheme photocatalytic system based on 2D/2D $WO_3/ZnIn_2S_4$ nanocomposite for efficient hydrogen evolution under visible light

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Number of pages: 6

Number of figures: 7

Experimental Section.

Synthesis of pure WO_3: In a typical experiment, 0.5 g of $Na_2WO_4•2H_2O$ and 0.3 g of citric acid were dispersed into 30 mL of deionized water with stirring for 15 min. Subsequently, adjusting the pH value of the resultant suspension to 0.4 by adding 6 M HCl aqueous solution dropwise and then kept vigorous stirring at room temperature for 30 min. The suspension was transferred to a 50 ml Teflon-lined stainless steel autoclave to undergo a hydrothermal treatment at 120 °C for 12 h. After cooling naturally, the sample was collected and washed with water several times before being dried at 60 °C overnight. Eventually, the product was annealed in air at 500 °C for 2 h to obtain pure WO_3.

Synthesis of $ZnIn_2S_4$ nanosheets (ZIS): Briefly, $Zn(CH_3•COO)_2•2H_2O$ (1.5mmol) and 3mmol of $InCl_3$ (3mmol) were dissolved into 250 ml distilled water and stirred for 30min. Subsequently, excessive thioacetamide (TAA, 8mmol) was added into the above solution and stirred for another 30min. The solution was then heated to 95 °C and kept vigorous stirring at this temperature for 5h. After that, the as-synthesized product was collected by centrifugation, washed with water before re-dispersing into 200 ml water. The suspension was sonicated continuously for 30 min and then centrifuged at 6000 rpm for 5 min to remove aggregates. Finally, the $ZnIn_2S_4$ nanosheets (named ZIS) were obtained after freeze drying.

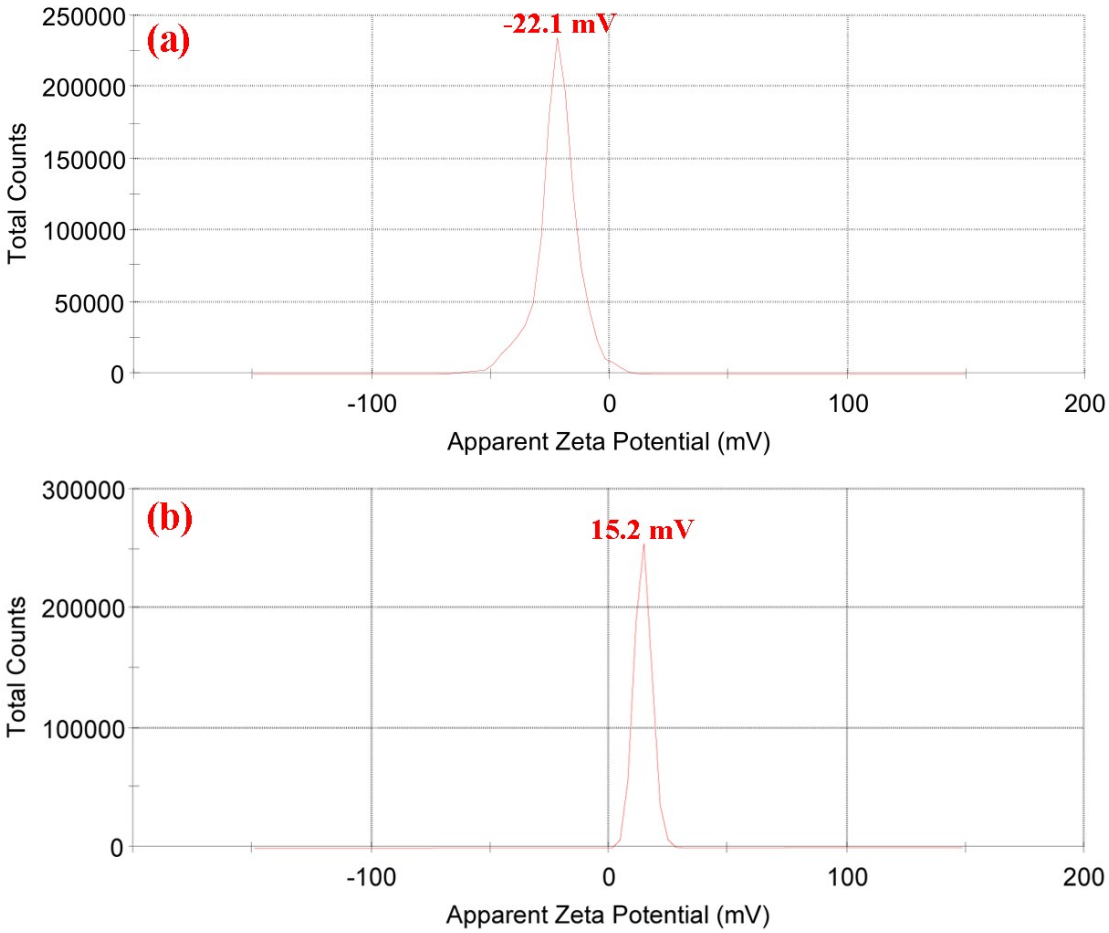

Fig. S1 Zeta potential of WO_3 (a) and APTES-modified WO_3 (b).

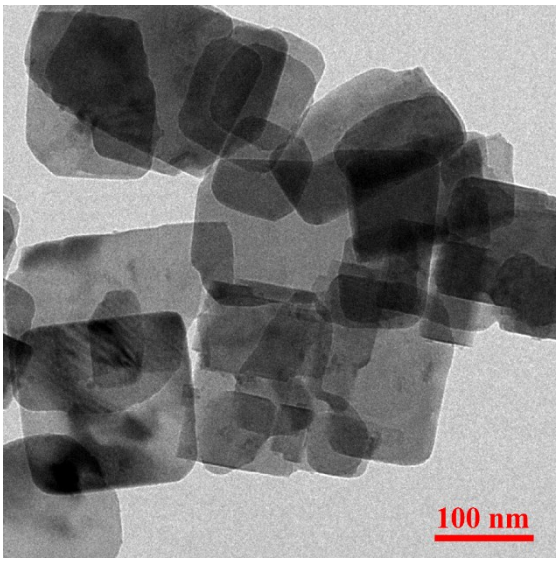

Fig. S2 TEM image of APTES-modified WO_3.

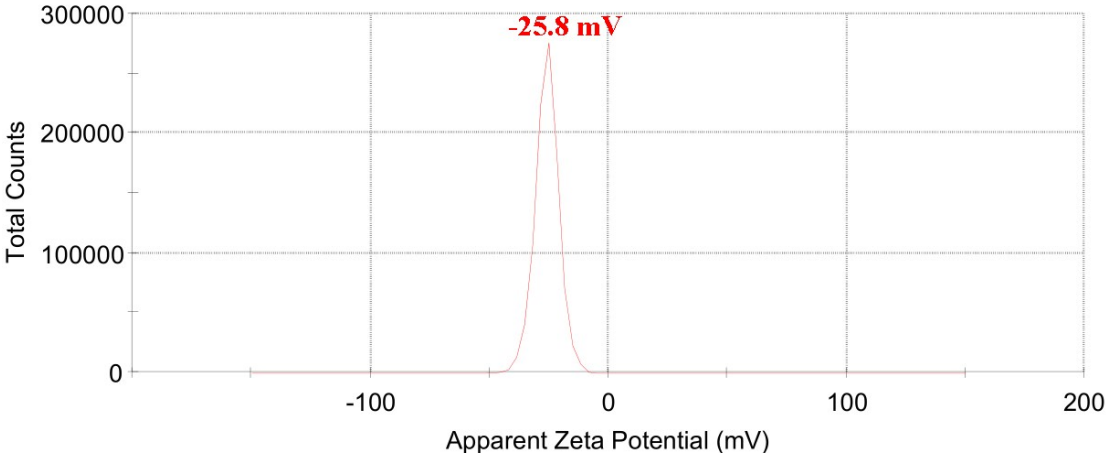

Fig. S3 Zeta potential of ZIS nanosheets.

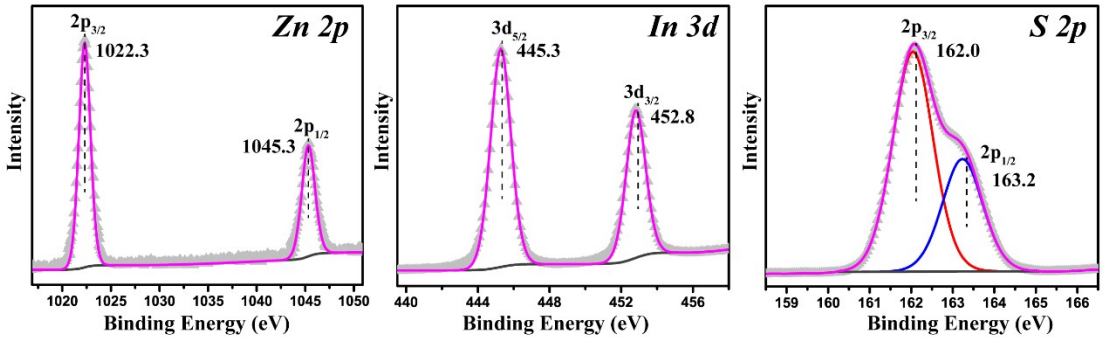

Fig. S4 High-resolution X-ray photoelectron spectroscopy (XPS) spectra of Zn 2p, In 3d, and S 2p of pure $ZnIn_2S_4$.

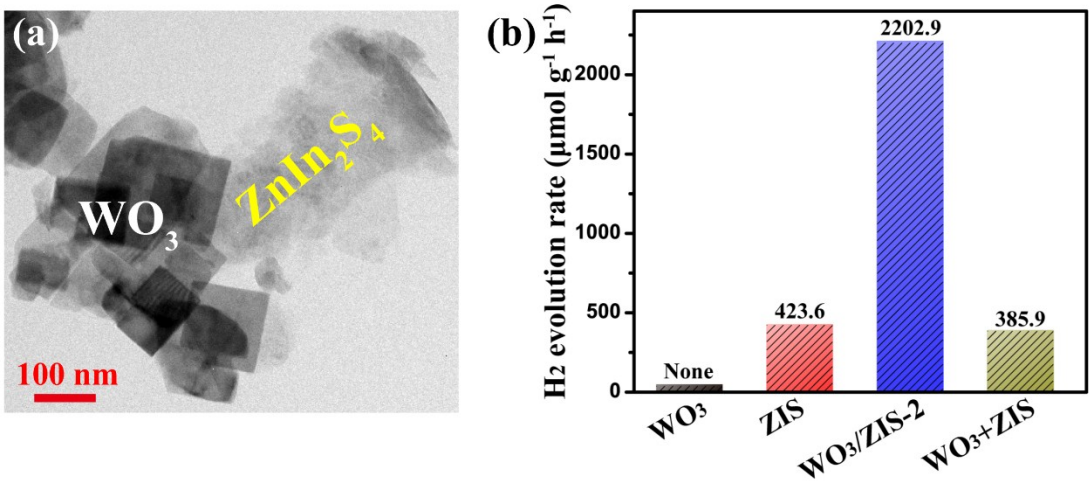

Fig. S5 (a) TEM image of WO_3+ZIS and (b) the H_2 evolution performances of different samples.

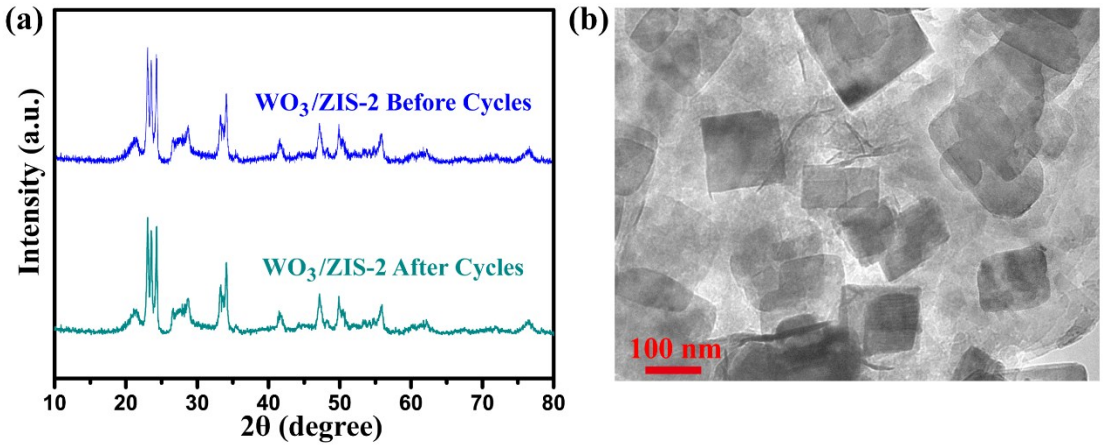

Fig. S6 XRD pattern (a) and TEM image (b) over WO_3/ZIS-2 sample after four cycles.

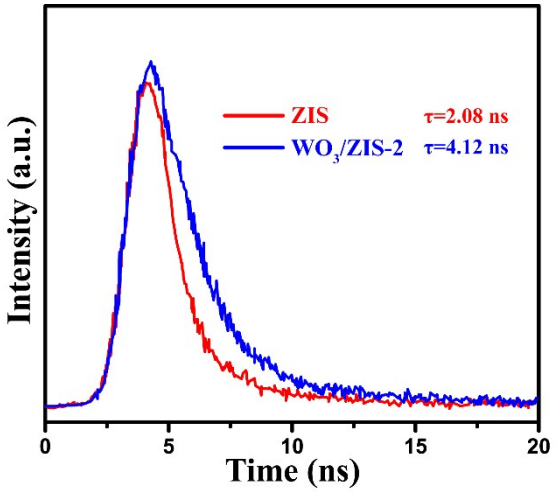

Fig. S7 The time resolved photoluminescence decay spectra of as-obtained ZIS and WO_3/ZIS-2.