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Supporting Information

Non-noble Metal MoS_2-$Cd_{0.5}Zn_{0.5}S$ Photocatalyst with Efficient Activity for High H_2 Evolution under Visible Light Irradiation

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Supporting Information

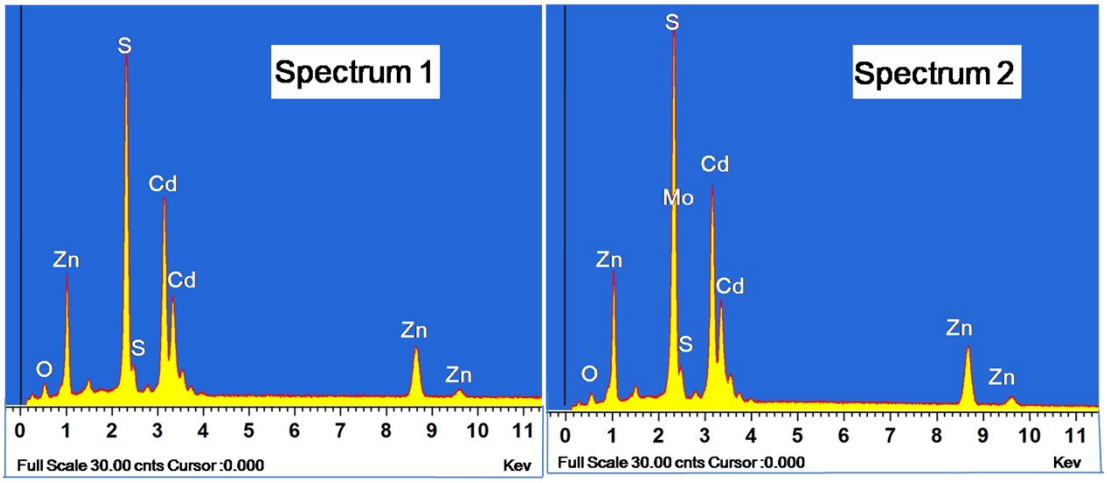

Figure S1. EDX spectra of $Cd_{0.5}Zn_{0.5}S$ (Spectrum 1) and MoS_2-$Cd_{0.5}Zn_{0.5}S$ (Spectrum 2).

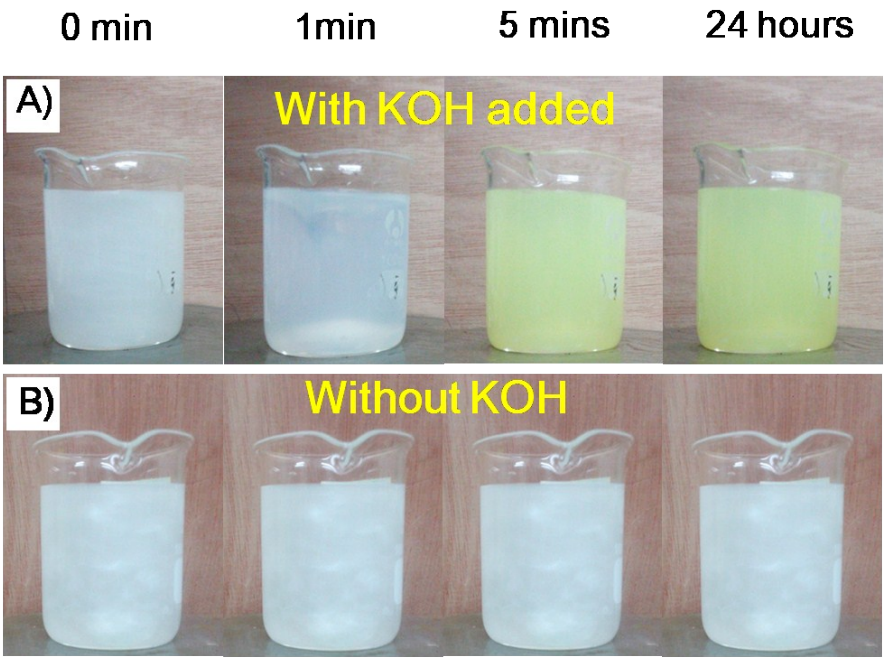

Figure S2. Time-dependent photos of the solution involving the starting reactants (zinc acetate, cadmium acetate and thiourea) for the synthesis of $Zn_xCd_{1-x}S$ solid

solution. KOH plays an efficient role in the formation process of $Zn_xCd_{1-x}S$ solid solution. As shown in Figure S2, photos A) show the change of solution after the adding KOH. At first, the reaction solution presented a white flocculus mixture. After KOH was added into the above solution, the solution became transparent in one minute. Subsequently, a pale yellow solution appeared after 5 mins, which would keep unchanged till 24 hours. On the contrary, photos B) show the solution without KOH, which stayed as a white flocculus mixture all the time without any change under magnetic stirring for 24 hours. With the increasing amount of KOH added, the change time of the solution from white to yellow shortened obviously. Results indicate that KOH favors the formation of cadmium and zinc hydroxides colloidal solution and accelerates the formation of their sulfides.

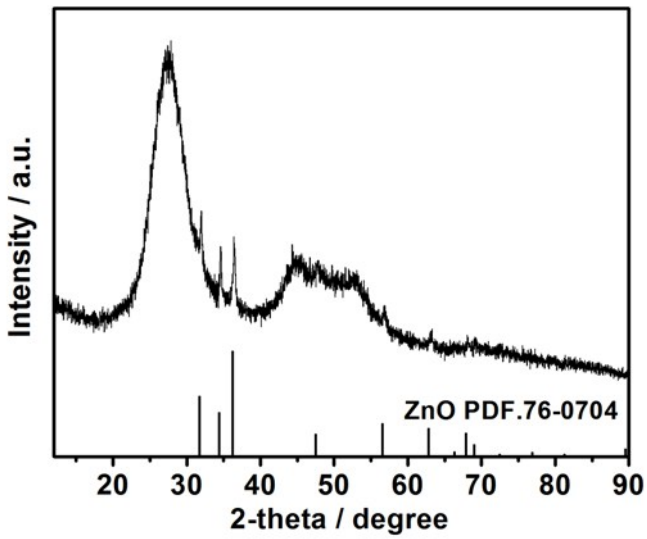

Figure S3. XRD pattern of $Cd_{0.5}Zn_{0.5}S$ without hydrothermal treatment. To prove the important role of hydrothermal process in the formation of $Zn_xCd_{1-x}S$ solid solution, the photocatalyst was synthesized through only one-step hydrothermal reaction in the

second process of MoS_2 formation. The obtained sample showed a relatively poor H_2 evolution rate of 2.65 $mmol \cdot h^{-1} \cdot g^{-1}$. XRD pattern of the obtained sample is shown in Figure S3. Some sharp peaks of the 2θ = 32.0, 34.6 and 36.4 correspond to the (100) (002) (101) planes of ZnO (JCPDS file NO.76-0704). The XRD results indicate that there is ZnO formed besides poor crystalline form of CdS or $Zn_xCd_{1-x}S$. Thus, the first step of hydrothermal process is essential for the formation of $Zn_xCd_{1-x}S$ solid solution and benefits to improving photocatalytic activity in H_2 evolution reaction.