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Effectively enhanced photocatalytic hydrogen production performance of one-pot synthesized MoS_2 clusters/CdS nanorod heterojunction material under visible light

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Abstract: In the present work, the MoS_2 clusters/CdS (CMo/CdS) nanorod (NR) heterojunction photocatalysts were prepared through a simple one-pot solvothermal method under lower temperature. The cluster-structured MoS_2 is uniformly dispersed on the surface of CdS NRs, and the MoS_2 modification does not change the crystal structure and morphology of CdS NRs. The modification of MoS_2 can significantly enhance the photocatalytic hydrogen production performance of CdS NRs. When the molar ratio of MoS_2 to CdS NRs is 3%, the CMo/CdS NRs has the highest photocatalytic hydrogen evolution rate, 12.38 $mmol \cdot g^{-1} \cdot h^{-1}$, which is 17.4 times that of CdS NRs. The enhanced photocatalytic hydrogen production performance can be attributed to the co-catalytic action of MoS_2, which can accelerate the photocatalytic hydrogen production process of CdS NRs. Meanwhile, MoS_2 can reduce the surface resistance of CdS NRs and improve the transmission of the photogenerated electrons to the surface of CdS NRs, resulting in the significant decrease of the recombination rate of the photogenerated electrons and holes, and thus promoting the photocatalytic hydrogen production performance of CdS NRs.

Keywords: Heterojunction; photocatalysis; hydrogen production; MoS_2 clusters; CdS nanorods

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