Highly Efficient Hydrogen Production over $ZnS(en)_{0.5}$-CdS-WO_3 Photocatalyst

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Light conversion efficiency of photocatalyst materials is generally dependent on the electron-hole recombination phenomena and the electronic band characteristics. Thus, multicomponent nanocomposite photocatalysts are studied in order to overcome those drawbacks. In this work, ternary component photocatalyst was synthesized using ethylenediamine (en) as a co-solvent in order to enhance hydrogen production. First, the WO_3 was synthesized via a hydrothermal method, and the other two components (ZnS(en)-CdS) were manufactured in the co-solvent. The final products were characterized by XRD, SEM, and UV-vis spectroscopy. The CdS is well known for the visible light sensitizer with low band gap, and the WO_3 shows chemical stability. However, both CdS and WO_3 material have limits in rapid recombination and low conduction band, respectively. Therefore, ternary compounds are proposed to solve these problems. The $ZnS(en)_{0.5}$-CdS-WO_3 can effectively promote charge separation and reduce the recombination of photogenerated charge carriers. The photocatalysts were used for hydrogen evolution in various reaction temperatures, O_2 partial pressures, and CdS contents.