A binary dumbbell visible light driven photocatalyst for simultaneous hydrogen production with the selective oxidation of bezyl alcohol to benzaldehyde

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Abstract:

Photocatalytic H_2 production with selective oxidation of organic moieties is a fascinating reach area. However, rational design of photocatalysts and photocatalytic performance is still inadequate. In this work, we efficiently synthesized the MoS_2 tipped CdS NWs photocatalyst using soft templates via the two-step hydrothermal method for efficient H_2 production with selective oxidation of benzyl alcohol (BO) under visible light illumination. The optimized MoS_2 tipped CdS (20% MoS_2) photocatalyst exhibits the highest photocatalytic H_2 production efficiency of 13.55 mmol g^{-1} h^{-1} with 99% selective oxidation of BO. The directional loading of MoS_2 at the tips of CdS NWs is the key factor toward superior H_2 production with 99% selective oxidation of BO. The amazing enhancement in the photocatalytic performance and selectivity of optimized photocatalyst is due to the spatial separation of their photoexcited charge carriers through the Schottky junction. Moreover, the unique structure of MoS_2 flower at the tip of 1D CdS NWs offers separate active sites for adsorption and surface reactions such as H_2 production at the MoS_2 flower and selective oxidation of BO at the stem of CdS NWs. This rational design of photocatalyst could be an inspiring work for the further development of efficient photocatalytic system for H_2 production with selective oxidation of BO.

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