NANOMATERIALS FOR ENERGY APPLICATIONS: PHOTOCATALYTIC HYDROGEN PRODUCTION AND ENHANCED OIL RECOVERY

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ABSTRACT

Nanomaterials with different dimensionalities are of great interests to researchers. One dimensional (1-D) nanomaterials are considered favorably for charges transport along its axial direction. Two types of 1-D nanomaterials, CuO/TiO$_2$ and Zn$_3$P$_2$, are used as photocatalyst to generate hydrogen from water/methanol solution under light irradiation. A green, novel, and fast microwave-assisted method is introduced to synthesize one dimensional CuO/TiO$_2$ rods nanocomposites. Systematic investigation of effect of deposited CuO amount on photocatalytic hydrogen production rate reveals that CuO helps extend light absorption of TiO$_2$ from UV to visible light region. Zn$_3$P$_2$ nanowires are synthesized by chemical vapor deposition and surface functionalized in-situ to offer Zn$_3$P$_2$ nanowires better resistance to degradation and enhance hydrogen production rate. Two dimensional (2-D) nanodisks are able to attach at oil/water interface, known as Pickering emulsion, subsequently formed extremely stable emulsion droplets. Layered 2-D ZrP nanodisks fabricated form three synthesis methods, hydrothermal, reflux, and microwave-assisted, are characterized. After surface modification and exfoliation, amphiphilic ZrP nanodisks are obtained and used for evaluation of enhanced oil recovery. The results showed oil recovery rate is increased in the presence of ZrP amphiphilic nanodisks.

SELECTED PUBLICATION