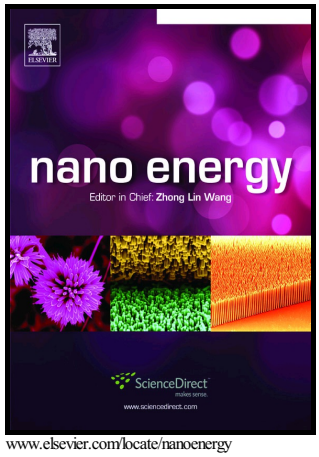

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Keywords. Quantum dots, WS_2 nanosheets, Band gap energy matched, Photocatalytic hydrogen evolution, Nanocomposites

Abstract: Suitable band engineering is required in order to develop new photocatalysts for water splitting under visible light irradiation. Based on the quantum size effect, the band gap energy varies with the size of the quantum dots (QDs) tuning. Besides, tuning the band gap energy of CdSe QDs can match well with the band gap energy of WS_2 nanosheets, which is benefiting the separation of electron-hole pairs generated in CdSe QDs under irradiation. Some links exist between the photocatalytic activity and band gap energy of QDs. The highest rate of hydrogen evolution under visible light irradiation is 14 mmol h^{-1} with 58% quantum efficiency at wavelength λ=420 nm when the QDs size is 7-8 nm and the band gap of QDs is 1.48 eV. Designing and fabricating band gap energy matched nanocomposite photocatalysts can present potential applications in solving future clean energy problems.

1. Introduction

Since the first report on using TiO_2 as catalyst for photoinduced water splitting in 1972, photocatalytic water splitting using semiconductors as catalysts has been considered a promising method to solve energy shortage and environmental remediation. [1] Numerous semiconductors, such as metal sulphides [2, 3] and metal oxide [4, 5], have been studied as photocatalysts. Quantum dots (QDs) have attracted extensive attention in recent years because of their substantial advantages over organic dyes, these advantages include size-tunable optical properties, broad absorption and high photochemical stability. [6-8] QDs are generally known as photoluminescence materials because of their ultrafast electron-hole recombination