Development of Photocatalysts for Solar Hydrogen Production

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The importance of hydrogen energy has recently been re-recognized because of the interest in clean energy. Hydrogen is mainly produced by steam reforming of hydrocarbons such as methane in industry. Hydrogen must be produced from water using renewable energy sources such as solar light, if one considers the energy and environmental issues. Therefore, photocatalytic water splitting is still a challenging reaction because it is an ultimate solution to these serious problems. Recently, many new poedered photocatalysts for water splittng have been developed [1]. For, example, a NiO (0.2 wt %)/$NaTaO_3$:La (2%) photocatalyst with a 4.1-eV band gap showed high activity for water splitting into H_2 and O_2 with an apparent quantum yield of 56% at 270 nm. Overall water splitting under visible light irradiation has been achieved by construction of a Z-scheme photocatalysis system employing visible-light-driven photocatalysts for H_2 and O_2 evolution, and an Fe^{3+}/ Fe^{2+} redox couple as an electron relay. Moreover, highly efficient sulfide photocatalysts for production of solar hydrogen was developed by making solid solutions of ZnS and narrow band gap semiconductors. However, these photocatalysts are still out of the practical use. It will be an ultimate green chemical process if solar hydrogen production using the powdered photocatalyst is accomplised. The possibility of the powdered photocatalysts for that purpose is discussed.

[1] A. Kudo, H. Kato, and I. Tsuji, *Chem. Lett.*, **2004**, *33*, 1534.