Nanocomposites and nanomaterials

Dye Sensitized Photocatalytic Hydrogen Evolution by CoS nanoparticles

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Photocatalytic hydrogen evolution is one of the most promising strategy for the widespread use of the sustainable and free solar energy to develop clean and renewable energy sources. The photocatalytic hydrogen evolution systems usually contain a metal-based cocatalyst, a photosensitizer and a sacrificial electron donor. Dye sensitization is powerful strategy to enable the visible-light harvesting of wide band gap semiconductors. The Eosin Y-fixed Pt-TiO_2 exhibited quite steady and high efficiency H_2 production from aqueous triethanolamine (TEOA) solution under visible-light irradiation for long periods **[1]**. In this study TEOA used as a electron donor, Eosin-Y (EY) used as a photosensitizer and CoS used as a metal-based cocatalyst. CoS nanoparticles was synthesized by modifying the applied method by Wang et al. **[2]** The prepared metal-based cocatalyst was characterised by X-Ray powder diffraction (XRD), scanning electron microscopy (SEM), raman spectroscopy, thermal gravimetric analysis (TGA) and particle size analyzer. Photoexcitation of the EY adsorbed onto the semiconductor causes to the injection of electrons into the conduction band of the CoS. The electrons are consumed by the reduction of water to produce H_2. The oxidized EY molecules are subsequently reduced and then regenerated by accepting electrons from the TEOA as an electron donor. It is known that EY degradation with time in this system. But thanks to the CoS nanoparticles used in H_2 production continues to be stable.

[1] Abe, R.; Hara, K.; Sayama, K.; Domen, K.; Arakawa, H. J. Photochem. Photobiol., A **2000**, 137, 63.
[2] Wang, Q.; Jiao, L.; Du, H.; Peng, W.; Han, Y.; Song, D.; Si, Y.; Wang Y.; Yuan, H.; J. Mater. Chem., **2011,** 21 (2), ,285–568