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Copper sulfide nanodot decorated TiO_2 nanotube for photocatalytic hydrogen generation from water

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Hydrogen energy presents an ideal alternative to fossil fuels in the future because of its high energy capacity, environmental friendliness and cost effectiveness. To date, much attention has been devoted to one dimensional (1D) semiconductor nanomaterials for hydrogen generation due to its stability, catalytic activity and simple fabrication. 1D semiconductor material such as TiO_2 nanotube (TNT) shows potential as a solar photocatalyst for hydrogen generation by its large surface area and superior charge transport property. However, some problems such as large band gap (3.3-3.8 eV) and high recombination rate of the photogenerated electron hole pair's limits the solar application of TiO_2. Particularly, TNTs decoration with sensitizer offers an effective way to improve the photocatalytic activity for solar application by extending the photo response and promoting the separation of photogenerated electron hole pairs. Recently, using copper sulfide (CuxS) has emerged as an effective sensitizer for improving hydrogen evolution reaction. The copper sulfide family offers a wide spectrum of derivatives and attractive due to their wide absorption band and low reflectance in the visible range, making it a prime candidate for solar energy harvesting. The CuxS nanodots (NDs) onto the surface of TNTs are elaborately investigated on the morphologies, phase and optical properties as well as the photocatalytic behavior of the CuxS/TNT. The results demonstrated that the CuxS ND/TNT is an excellent photocatalyst for efficient and stable hydrogen generation from water without noble metal co-catalysts.

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