Synthesis of Cu_3SnS_4 Nanoparticles with a Novel Structure as Low-Cost Counter Electrode in Dye-Sensitized Solar Cell

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Cu_3SnS_4 (CTS) nanoparticles with dendritic structure were synthesized by a facile solvothermal method. The NPs with unique structure are suitable as the precursor of the CE due to their large specific surface area. CTS powder was dispersed in distilled water to form a uniform nanoparticle “ink”. A pure CTS counter electrode for dye-sensitized solar cell (DSSC) was fabricated by coating the CTS “ink” on fluorine-doped tin oxide glass substrate. Electrochemical impedance spectroscopy indicated that CTS-based CE has a Pt-like electrocatalytic activity for the reduction of I_3^- to I^- in DSSC. DSSC with this novel CE exhibited an impressive power conversion efficiency of 7.13%, which is similar to that Pt/FTO based device (7.24%). This work presents a new approach that using inexpensive CTS replace noble metal Pt as counter electrode for developing low-cost DSSC.

Keywords: Cu_3SnS_4 ; nanoparticle; coating; counter electrode; dye-sensitized solar cell

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