

Fabrication of an organized mesoporous SnO<sub>2</sub> film electrocatalyzed with CoS nanoparticles for Pt-free counter electrode in dye-sensitized solar cells

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An organized mesoporous SnO<sub>2</sub> (OM-SnO<sub>2</sub>) film were prepared using graft copolymer PVC-g-POEM as a sacrificial template for depositing CoS nanoparticles. This Pt-free counter electrode shows high energy conversion efficiencis of 6.6 % using solid-solite electrolyte, 7.5 % using liquid-state electrolyte which are the highest values reported for Pt-free dye-sensitized solar cells. These results correspond to improvements about 14 %, 9 % compared to a conventional Pt counter electrode prepared with chloroplatinic acid hexahydrate (H<sub>2</sub>PtCl<sub>6</sub>). In this experiment, the OM-SnO<sub>2</sub> film plays key component for ability to deposit a large amount of CoS nanoparticles which acts as electrocatalysts via facile solvothermal reaction. The OM-SnO<sub>2</sub> film with a high porosity, larger pores, and good interconnectivity can be prepared using a poly(vinyl chloride)-g-poly(oxyethylene methacrylate) (PVC-g-POEM) graft copolymer as template, which has enhanced electron transport property with good interaction sites for the formation of CoS nanoparticles.