

Enhancing absorption of light with Bragg Stack and mesoporous interfacial layer for high efficiency solid-state Dye-sensitized solar cell

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A heterostructured photoanode including of a organized mesoporous TiO₂ (om-TiO₂) interfacial layer (IF layer), a 7 or 10µm-thick nanocrystalline TiO₂ layer (NC layer), and a 2µm-thick mesoporous Bragg stack (meso-BS layer) was prepared onto a FTO glass via spin coating and doctor-blade method. An om-TiO₂ layer fabricated via a sol-gel process, where a poly(vinyl chloride)-*g*- poly(oxyethylene methacrylate) (PVC-*g*-POEM) graft copolymer is used as a structure-directing agent showed a high porosity, transmittance and interconnectivity. The meso-BS layer with large pores is fabricated by deposition of om-TiO₂ and colloidal SiO₂ (col-SiO₂) layers alternatively. DSSCs fabricated with the heterostructured photoanode and a polymerized ionic liquid (PIL) which is solide state electrolyte showed an energy conversion efficiencies of 6.6% at 100 mW/cm², one of the highest value reported and much larger than DSSCs prepared with only a IF/NC layer (6.0%) or a NC layer (4.5%). Those Improvements are attributed to the improved light transmittance, decreased interfacial resistance at the electrode/electrolyte, and better electrolyte infiltration.