One Pot Synthesis Of Multi-Functional Tin Oxide Nanostructures For High Efficiency Dye-Sensitized Solar Cells

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ABSTRACT

Photoanode plays a key role in dye sensitized solar cells (DSSCs) as a scaffold for dye molecules, transport medium for photogenerated electrons, and scatters light for improved absorption. Herein, tin oxide nanostructures unifying the above three characteristics were optimized by a hydrothermal process and used as photoanode in DSSCs. The optimized morphology is a combination of hollow porous nanoparticles of size ~50 nm and micron sized spheres with BET surface area (up to 29 m^2/g) to allow large dye-loading and light scattering as well as high crystallinity to support efficient charge transport. The optimized morphology gave the highest photovoltaic conversion efficiency (~7.5%), so far achieved in DSSCs with high open circuit voltage (~700 mV) and short circuit current density (~21 mA/cm^2) employing conventional N3 dye and iodide/triiodide electrolyte. The best performing device achieved an incident photon to current conversion efficiency of ~90%. The performance of the optimized tin oxide nanostructures was comparable to that of conventional titanium based DSSCs fabricated at similar conditions.

KEYWORDS: Photovoltaic; UV–VIS spectroscopy measurements; TiO2–SnO2 composite structure; Electron life time and recombination

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