

Dye-sensitized solar cells based on Double Layer Photoelectrodes: Performance improvement and their mechanisms

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A hierarchical TiO₂ photoelectrode organized of TiO₂ nanoparticles as bottom layer and TiO₂ nanospheres as top layer was fabricated and applied to dye-sensitized solar cells (DSSCs) photoelectrode. TiO₂ nanospheres as scattering layer were successfully prepared via successive ATRP and sol-gel process. And then, calcination at 450 °C, TiO₂ nanospheres with hierarchical pores were generated. Results indicate in remarkable enhancement of the cell performance and dye adsorption ability. Furthermore, the TiO₂ nanoparticle layer contacts to FTO substrate are greatly facilitated the electron transfer process due to effective blocking electron recombination in comparison with an only the TiO₂ nanosphere layer. View a from cell performance, the overall solar energy conversion efficiency of 5.51% was achieved with the TiO₂ nanospheres layer are used to scattering layer on the TiO₂ nanoparticles layer (hierarchical TiO₂ photoelectrode), which is 20% higher than that pristine TiO₂ photoelectrode with only TiO₂ nanoparticles layer.