

Fabrication of hierarchically-ordered, crack-free TiO₂ Films from self-assembly of polystyrene bead and hydrophilically preformed TiO₂

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Hierarchically-ordered, crack-free TiO₂ films were prepared from one-step self-assembly of a 400-nm polystyrene bead and hydrophilically preformed TiO₂. There are reported that substantial crack formation of the film occur due to large volume contraction during the calcination process when using Titanium(IV) bis(ammonium lactato) dihydroxide (TALH) as precursor. But, the use of hydrophilically preformed TiO₂ can make less cracked films with higher thickness and a meso/macroscale hierarchical structure. Preformed TiO₂ particles assembled electrostatically onto surface of the polystyrene bead, as confirmed by scanning electron microscope and a zeta potential analyzer. This TiO₂ structures were used as a photoanode of quasi-solid-state dye-sensitized solar cells using a nanogel electrolyte. Efficiency of this preformed TiO₂-based cell was 1.8-fold greater than that of a titanium(IV) bis(ammonium lactato) dihydroxide-based cell.