Block Copolymer Directed Synthesis of Worm-like TiO_2 Film for Solid-State Dye-Sensitized Solar Cells

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PS-*b*-P2VP block copolymer was synthesized via anionic polymerization and directly combined with preformed TiO_2 nanocrystals to form crack-free, micron-thick, worm-like organized TiO_2 films. The characterizations by XRD, SEM, and GI-SAXS analyses revealed that the prepared TiO_2 have an organized morphology and good interconnectivity. Additional experiments about the morphological properties of the TiO_2 were performed with various polymer concentration and its relative ratio to TiO_2. The TiO_2 film synthesized by using high polymer concentration of 6 wt% and a polymer:TiO_2 ratio of 1:2 (P6T2 film) showed a well-organized structure with a large specific surface area and smaller mesopores. The solid state dye-sensitized solar cells fabricated with N719 dye and 2.8 μm-thick P6T2 photoanode showed an energy conversion efficiency of 4.0% with the highest Jsc value at 100 mW/cm^2. Due to its larger surface area, well-organized pores and good interconnectivity, ssDSSCs with P6T2 photoanode showed much better performance than that of commercial TiO_2 paste (2.3%).