Graft Copolymer Directed TiO2 Films with Large Pores and Interconnectivity

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I will introduce the synthesis of well-organized mesoporous TiO_2 films templated by the organized graft copolymer, i.e. poly(vinyl chloride)-graft-poly(oxyethylene methacrylate) (PVC-g-POEM) as a structure directing agent.[1] Well-organized mesoporous TiO_2 films with high porosity and excellent channel connectivity were developed via the sol gel process using PVC-g-POEM graft copolymer synthesized by atom transfer radical polymerization (ATRP). The careful adjustment of copolymer composition and solvent affinity using a THF/H_2O/HCl mixture was used to systematically vary the material structure.[2] Despite organized morphology, the thickness of sol-gel derived TiO_2 film via a spin-coating process is often limited to the submicron scale due to crack formation during calcination. Our group recently reported micron-thick, mesoporous TiO_2 films templated by PVC-g-POEM, via the addition of the P25 nanoparticles.[3] TiO_2 nanospheres with hierarchical pores were also prepared using the combined process of ATRP and sol-gel process.[4] In addition, 3-dimensional (3D) nanostructured TiO_2 photoelectrodes with interconnectivity, high surface area and bimodal pores were synthesized using a graft/crosslink polymerization and sol-gel process.[5] Track-etched polycarbonate (PC) membranes were also used as a soft template to synthesize mesoporous TiO_2 nanowires or nanotubes and the relation between structure and efficiency was systematically investigated.[6] Finally, we introduced solid-state polymerizable conductive monomer with good conductivity and penetration to photoelectrode to I_2-free solid-state DSSCs, which involves easily accessible and widely applicable fabrication method.[7-9] A graft copolymer-templated, organized mesoporous TiO_2 film with a large surface area was also prepared using spindle-shaped, preformed TiO_2 nanoparticles.[10]

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