

Synthesis of Micrometer-thick Organized Films Using Graft Copolymer and Preformed Nanoparticles for High Efficiency Solid-state Dye-sensitized Solar Cells

안성훈, 서진아, 전하림, 김상진, 김종학*
연세대학교 화학생명공학과
(jonghak@yonsei.ac.kr*)

Crack free, micrometer-thick (approximately 6 μ m), organized mesoporous TiO₂ films were prepared via an efficient one-pot procedure using the spindle-shaped, preformed TiO₂ nanoparticles and the PVC-g-POEM graft copolymer as building blocks and a structure-directing agent, respectively. The TiO₂ film exhibited uniform mesoporous networks with a high surface area (157.9 m²/g) and good connectivity, as well as bimodal porosity with sub-4 nm micropores and 16 nm mesopores. The use of org-TiO₂ film as a photoelectrode resulted in a great improvement in the performance up to 7.1% at 100 mW/cm², which is one of the highest energy conversion efficiencies obtained for N719 dye-based ssDSSCs. The high efficiency was due to increased dye loading, larger recombination resistance and enhanced electron lifetime. Because org-TiO₂ film is highly transparent, the efficiency would be further improved upon the introduction of a scattering layer, which is currently under investigation in our lab.