High efficiency Solid-State Dye-Sensitized Solar Cells with Dual pores Honeycomb-like Organized TiO_2 Photoanodes

김상진, 안성훈, 허성연, 이창수, 김종학*
연세대학교
(jonghak@yonsei.ac.kr*)

Bimodal meso/macroscopic interconnected honeycomb-like nanostructured TiO_2 photoanodes with dual pores were prepared via careful control of hybrid sol/solvent interactions using direct assembly of the hydrophilically preformed TiO_2 nanocrystals and the amphiphilic PVC-*g*-POEM graft copolymer. The amphiphilic PVC-*g*-POEM graft copolymer worked as a structure-directing agent not only on a mesoscopic scale, forming self-assembly of micelles, but also in macroscopic crystal growth of TiO_2. A honeycomb-like structure was generated by increasing the amount of HCl/H_2O mixture, a poor solvent for the PVC main chains while its size increased with increasing amounts of toluene, which is a poor solvent for the POEM side chains as well as PVC chains. In particular, the conversion efficiency of the HC-2 cell without any $TiCl_4$ treatment was the highest, 7.4 % at 100 mW/cm^2, which is one of the highest values observed for ssDSSCs. The higher cell efficiency is attributed to the enhanced Jsc value resulting from the well-organized, interconnected HC structure with large pores, high porosity and excellent light scattering ability.