Titanium oxide anode in inverse structure for dye sensitized solar cell applications by electrophoretic self-assembly and sol-gel processes

R.F. Louh Sean Huang Danny Ho
Department of Materials Science and Engineering
Feng Chia University, Taichung, Taiwan 40724
(This study is sponsored under NSC 98-2923-E-035-002-MY3 project)
Email：rflouh@fcu.edu.tw

The aim of this study is to fabricate titanium oxide (TiO_2) anode in inverse opal structure for dye sensitized solar cell (DSSC) applications via combined electrophoretic self-assembly (EPSA) and sol-gel processes. The polystyrene (PS) microspheres of 270 nm size were produced by emulsion-free polymerization. A stable colloid of PS microspheres in water-ethanol solvent was used to manufacture the 3-D photonic crystal template with periodic ordered opal structure onto the surface of indium tin oxide (ITO) coated glass substrate by EPSA. The titanium tetraisopropoxide (TTIP) sol precursor in mixture of ethanol and ethanol glycol was impregnated to fill up the voids inside PS template. The polycondensation of TiO_2 was completed by absorption of ambient moisture. Further annealing at 450^{o}C for 1 hr of samples was carried out for removal of PS microspheres and formation of TiO_2 photonic crystal. The microstructure, composition, and crystalline phase analysis of obtained TiO_2 in inverse opal structure were examined by SEM, EDS, and XRD.

Keywords: electrophoretic self-assembly (EPSA), titanium oxide, inverse opal structure, sol-gel, polystyrene microspheres, photonic crystal template, DSSC anode.