염료감응형 태양전지용 질산 전처리된 TiO_2 광전극의 전기화학적 특성

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Electrochemical Properties of HNO3 Pre-treated TiO_2 Photoelectrode for Dye-SEnsitized Solar Cells

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Abstract : Dye-sensitized solar cells (DSSCs) have been widely investigated as a next-generation solar cell because of their simple fabrication process and low coats. The cells use a porous nanocrystalline TiO2 matrix coated with a sensitizer dye that acts as the light-harvesting element. The photo-exited dye injects electrons into the TiO_2 particles, and the oxide dye reacts with I- in the electrolyte in regenerative cycle that is completed by the reduction of I_3^- at a platinum-coated counter electrode. Since TiO_2 porous film plays a key role in the enhancement of photoelectric conversion efficiency of DSSC, many scientists focus their researches on it. Especially, a high light-to-electricity conversion efficiency results from particle size and crystallographic phase, film porosity, surface structure, charge and surface area to volume ratio of porous TiO_2 electrodes, on which the dye can be sufficiently adsorbed. Effective treatment of the photoanode is important to improve DSSC performance. In this paper, to obtain properties of surface and dispersion as nitric acid treated TiO_2 photoelectrode was investigate. The photovoltaic characteristics of DSSCs based the electrode fabricated by nitric acid pre-treatment TiO_2 materials gave better performances on both of short circuit current density and open circuit voltage. We compare dispersion of TiO_2 nanoparticles before and after nitric acid treatment and measured Ti oxidized state from XPS. Low charge transfer resistance was obtained in nitric acid treated sample than that of untreated sample. The dye-sensitized solar cell based on the nitric acid treatment had open-circuit voltage of 0.71 V, a short-circuit current of 15.2 mAcm-2 and an energy conversion efficiency of 6.6 % under light intensity of 100 $mWcm^{-2}$. About 14 % increases in efficiency obtained when the TiO_2 electrode was treated by nitric acid.

Key Words : Dye-sensitized solar cell, Nitric acid, TiO_2, photoelectrode