IT-008

Interfacial Layer Control in DSSC

Wan In Lee

Department of Chemistry, Inha University, Incheon, 402-751, Korea

Recently, dye-sensitized solar cell (DSSC) attracts great attention as a promising alternative to conventional silicon solar cells. One of the key components for the DSSC would be the nanocrystalline TiO2 electrode, and the control of interface between TiO2 and TCO is a highly important issue in improving the photovoltaic conversion efficiency. In this work, we applied various interfacial layers, and analyzed their effect in enhancing photovoltaic properties. In overall, introduction of interfacial layers increased both the Voc and Jsc, since the back-reaction of electrons from TCO to electrolyte could be blocked.

First, several metal oxides with different band gaps and positions were employed as interfacial layer. SnO2, TiO2, and ZrO2 nanoparticles in the size of 3-5 nm have been synthesized. Among them, the interfacial layer of SnO2, which has lower flat-band potential than that of TiO2, exhibited the best performance in increasing the photovoltaic efficiency of DSSC. Second, long-range ordered cubic mesoporous TiO2 films, prepared by using triblock copolymer-templated sol-gel method via evaporation-induced self-assembly (EISA) process, were utilized as an interfacial layer. Mesoporous TiO2 films seem to be one of the best interfacial layers, due to their additional effect, improving the adhesion to TCO and showing an anti-reflective effect. Third, we handled the issues related to the optimum thickness of interfacial layers.

It was also found that in fabricating DSSC at low temperature, the role of interfacial layer turned out to be a lot more important. The self-assembled interfacial layer fabricated at room temperature leads to the efficient transport of photo-injected electrons from TiO2 to TCO, as well as blocking the back-reaction from TCO to I3-. As a result, fill factor (FF) was remarkably increased, as well as increase in Voc and Jsc.

Keywords: DSSC, photoelectrode, interfacial layer