Glass Frit을 이용한 염료감응 태양전지의 광 특성 연구

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Effect of Glass Frit in TiO_2 Electrode for DSSCs

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Dye sensitized solar cells(DSSCs) have been extensively studied due to their various advantages such as low production cost, colorful design, and eco-friendly process. Long optical path length is one of the most effective method to improve light harvest efficiency for DSSCs. Multi-layered TiO_2 nano-structured film with scattering layer has been studied to generate scattering effect by many researchers. It was expected that the difference of refractive index between TiO_2 particles and glass frit would generate the light scattering effect and provide the long optical path length. Therefore, to enhance the scattering effect, the frits of Bi_2O_3-B_2O_3-ZnO glass system that has the different refractive index were added to TiO_2 pastes in this study. First of all, the absorbance and haze factor of TiO_2 electrode with dyes and the refractive index of glass frit and TiO_2 were measured, respectively. To study the effect of frits, the efficiencies of DSSCs added glass frit and without glass frit were compared. Our results showed slightly higher efficiency with the different absorbance and haze factor of TiO_2 and glass frit. It was considered that the light scattering effect would be improved with adding frits to TiO_2 paste. Our preliminary studies will be useful for increasing efficiency of DSSCs.

Key words : Dye-sensitized solar cell, Photovoltaic, TiO_2 electrode, Glass frit, light harvest efficiency, DSSC

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다결정 실리콘 박형 태양전지를 위한 다결정 실리콘 씨앗층 제조 연구

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Study on the fabrication of a polycrystalline silicon (pc-Si) seed layer for the pc-Si lamelliform solar cell

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We studied the fabrication of polycrystalline silicon (pc-Si) films as seed layers for application of pc-Si thin film solar cells, in which amorphous silicon (a-Si) films in a structure of glass/Al/Al_2O_3/a-Si are crystallized by the aluminum-induced layer exchange (ALILE) process. The properties of pc-Si films formed by the ALILE process are strongly determined by the oxide layer as well as the various process parameters like annealing temperature, time, etc. In this study, the effects of the oxide film thickness on the crystallization of a-Si in the ALILE process, where the thickness of Al_2O_3 layer was varied from 4 to 50 nm. For preparation of the experimental film structure, aluminum (~300 nm thickness) and a-Si (~300 nm thickness) layers were deposited using DC sputtering and PECVD method, respectively, and Al_2O_3 layer with the various thicknesses by RF sputtering. The crystallization of a-Si was then carried out by the thermal annealing process using a furnace with the in-situ microscope. The characteristics of the produced pc-Si films were analyzed by optical microscope (OM), scanning electron microscope (SEM), Raman spectrometer, and X-ray diffractometer (XRD). As results, the crystallinity was exponentially decayed with the increase of Al_2O_3 thickness and the grain size showed the similar tendency. The maximum pc-Si grain size fabricated by ALILE process was about 45 μm at the Al_2O_3 layer thickness of 4 nm. The preferential crystal orientation was <111> and more dominant with the thinner Al_2O_3 layer. In summary, we obtained a pc-Si film not only with ~45 μm grain size but also with the crystallinity of about 75% at 4 nm Al_2O_3 layer thickness by ALILE process with the structure of a glass/Al/Al_2O_3/a-Si.

Key words : Polycrystalline silicon(다결정 실리콘), Polycrystalline silicon solar cell(다결정 실리콘 태양전지), Metal-induced crystallization(금속유도 결정화), Al-induced layer exchange(알루미늄유도 막교환), Seed layer (씨앗층)

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