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Characterization of Photoelectron Behavior of Working Electrodes with the Titanium Dioxide Window Layer in Dye-sensitized Solar Cells

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Porous nano crystalline TiO_2 is currently used as a working electrode in a dye-sensitized solar cell (DSSC). The conventional working electrode is comprised of absorption layer (particle size:～20 nm) and scattering layer (particle size:～300 nm). We inserted window layer with 10 nm particle size in order to increase transmittance and specific surface area of TiO_2. The electrochemical impedance spectroscope analysis was conducted to analysis characterization of the electronic behavior. The Bode phase plot and Nyquist plot were interpreted to confirm the internal resistance caused by the insertion of window layer and carrier lifetime. The photocurrent that occurred in working electrode, which is caused by rise in specific surface area, increased. Accordingly, it was found that insertion of window layer in the working electrode lead to not only effectively transmitting the light, but also increasing of specific surface area. Therefore, it was concluded that insertion of window layer contributes to high conversion efficiency of DSSCs.

Keywords: dye-sensitized solar cells, working electrodes, window layer, photoelectrodes, photocurrent

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Transparent Conducting Zinc-Tin-Oxide Layer for Application to Blue Light Emitting-diode

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To use the GaN based light-emitting diodes (LEDs) as solid state lighting sources, the improvement of light extraction and internal quantum efficiency is essential factors for high brightness LEDs. In this study, we suggested the new materials system of a zinc tin oxide (ZTO) layer formed on blue LED epi-structures to improve the light extraction. ZTO is a representative n-type oxide material consisted of ZnO and SnO system. Moreover, ZTO is one of the promising oxide semiconductor material. Even though ZTO has higher chemical stability than IGZO owing to its SnO2 content this has high mobility and high reliability. After formation of ZTO layer on p-GaN layer by using the spin coating method, structural and optical properties are investigated. The x-ray diffraction (XRD) measurement results show the successful formation of ZTO. The photoluminescence (PL) and absorption spectrum shows that it has 3.6-4.1eV band gap. Finally, the light extraction properties of ZTO/LED chip using electroluminescence (EL) measurement were investigated. The experimental and theoretical analyses were simultaneously conducted.

Keywords: light emitting diodes, Zinc-Tin-Oxide (ZTO)