ITO를 대체한 고효율 유기박막 태양전지

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Replacement of ITO for efficient organic polymer solar cells

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We have fabricated organic photovoltaic cells (OPVs) with highly conductive poly 3,4-ethylenedioxythiophene : poly styrenesulfonate (PEDOT:PSS) layer as an anode without using transparent conducting oxide (TCO), which has been modified by adding some organic solvents like sorbitol (So), dimethyl sulfoxide (DMSO), N-methyl-pyrrolidone (NMP), dimethylformamide (DMF), and ethylene glycol (EG). The conductivity of PEDOT:PSS film modified with each additive was enhanced by three orders of magnitude. According to atomic force microscopy (AFM) study, conductivity enhancement might be related to better connections between the conducting PEDOT chains. TCO-free solar cells with modified PEDOT:PSS layer and the active layer composed of poly(3-hexylthiophene) (P3HT) and phenyl [6,6] C61 butyric acid methyl ester (PCBM) exhibited a comparable device performance to indium tin oxide (ITO) based organic solar cells. The power conversion efficiency (PCE) of the organic solar cells incorporating DMSO, So + DMSO and EG modified PEDOT:PSS layer reached 3.51, 3.64 and 3.77%, respectively, under illumination of AM 1.5 (100mW/cm^2).

Key words : organic solar cell(유기태양전지), polymer(고분자), PEDOT(PEDOT), ITO(인듐틴옥사이드)

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대면적 유기 태양 전지의 제작

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Fabrication of large area OPV cells

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Recently, bulk hetero-junction cells have been extensively studied by many researchers. Most of these cells were fabricated by spin coater. However, the spin coating process is not favorable to the large-scaled industry because it is not compatible with roll-to-roll process. One of the alternative methods is Doctor blading. In this study, we fabricated large OPV cells having total area of 100 cm^2. The buffer layer was Poly-(3,4-ethylenedioxythiophene) : poly-(styrenesulfonate) aqueous dispersion (PEDOT:PSS) and the active material is poly (3-hexythiophene) (P3HT) and phenyl-C61-butyric acid methyl ester (PCBM) blend in the solvent of Chlorobenzene. All of the organic layers were coated by dragging the blade with a speed of 5～20 mm/s on the stage with a temperature of 50℃. As-bladed PEDOT:PSS layer was baked at 120℃ for 10 minutes to eliminate the water. The cell structure is patterned ITO substrate / PEDOT:PSS / P3HT:PCBM / LiF / Al. The topmost electrode, LiF / Al, was deposited by thermal evaporation. After depositing electrode, and the cell was annealed at 150℃ for 30 minutes. The measured ISC, VOC, fill factor, and PCE were 2.95 A, 5.86 V, 0.32, and 0.78%, respectively. PCE was quite low but the large active area could be obtained successfully.

Key words : OPV cell(유기 태양 전지), large area(대면적)

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