

The Properties of NiO Thin Film as an Anode Buffer Layer in P₃HT:PCBM Bulk Hetero-Junction Solar Cell

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Organic photovoltaic cells are very attractive recently because of advantages of low cost, large area and light weight fabrication. A PEDOT:PSS layer has been used between the ITO anode electrode and P₃HT:PCBM layers in organic solar cells based on the bulk hetero-junction structure. However, PEDOT:PSS has been reported to have problems using a buffer layer between ITO anode electrode and P₃HT:PCBM bulk hetero-junction layers. In the present work, we have studied the effect of the NiO anode buffer layer between photoactive and ITO anode layers in the P₃HT:PCBM bulk hetero-junction solar cell. NiO anode buffer layer was deposited with RF sputtering on ITO substrate. The photoactive area was 0.04cm², and its thickness was 100nm deposited by spin coating in glove box and annealed at 150°C for 20 minutes at hot plate (N₂ ambient). Al electrode (100nm) was deposited by thermal evaporation in ~10⁻⁶ torr. Device electrical properties of device was measured under 100mW/cm²(AM1.5G). 3.4X10⁻¹ Ωcm of NiO film resistivity was obtained at 80nm thickness with control of substrate temperature and O₂ partial pressure during sputtering, and annealing conditions. The electrical and optical properties of this film were depended on the O₂ partial pressure and substrate temperature during deposition, and duration time at room temperature in O₂ vacuum ambient. Power conversion efficiency (PCE) value (4.7%) of the P₃HT:PCBM bulk hetero-junction solar cell fabricated with NiO anode buffer layer was higher than that (3.0%) of the P₃HT:PCBM bulk hetero-junction solar cell fabricated with a conventional PEDOT:PSS anode buffer layer under AM1.5G illumination. These results have been described with improvement of charge transport across the interface between the photoactive layer and ITO anode electrode.

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