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Effects of Hole Transport Layer Using Au-ionic Doping SWNT on Efficiency of Organic Solar Cells

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Despite recent efforts for fabricating flexible transparent conducting films (TCFs) with low resistance and high transmittance, several obstacles to meet the requirement of flexible displays still remain. Indium tin oxide (ITO) thin films, which have been traditionally used as the TCFs, have a serious obstacle in TCFs applications. SWNTs are the most appropriate materials for conductive films for displays due to their excellent high mechanical strength and electrical conductivity. Recently, it has been demonstrated that acid treatment is an efficient method for surfactant removal. However, the treatment has been reported to destroy most SWNT. In this work, the fabrication by the spraying process of transparent SWNT films and reduction of its sheet resistance by Au-ionic doping treatment on PET substrates is researched.

Arc-discharge SWNTs were dispersed in deionized water by adding sodium dodecyl sulfate (SDS) as surfactant and sonicated, followed by the centrifugation. The dispersed SWNT was spray-coated on PET substrate and dried on a hotplate. When the spray process was terminated, the TCF was immersed into deionized water to remove the surfactant and then it was dried on hotplate. The TCF film was then was doped with Au-ionic doping treatment, rinsed with deionized water and dried. The surface morphology of TCF was characterized by field emission scanning electron microscopy. The sheet resistance and optical transmission properties of the TCF were measured with a four-point probe method and a UV-visible spectrometry, respectively. This was confirmed and discussed on the XPS and UPS studies.

We show that 87 Ω/□ sheet resistances with 81% transmittance at the wavelength of 550 nm. The changes in electrical and optical conductivity of SWNT film before and after Au-ionic doping treatments were discussed. The effects of hole transport interface layer using Au-ionic doping SWNT on the performance of organic solar cells were investigated.

Keywords: Transparent Conducting Films (TCF), Single-well Carbon Nanotubes (SWNT), Au-ionic treatment, Organic Solar Cells