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High Conductivity of Transparent SWNT Films on PET by Ionic Doping

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Single-well carbon nanotubes (SWNT) have been proposed as a promising candidate for various applications owing to their excellent properties. In particular, their fascinating electrical and mechanical properties could provide a new area for the development of advanced engineering materials. A transparent conductive thin film (TCF) has increased for applications such as liquid crystal displays, touch panels, and flexible displays. 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. But, a bundle of CNTs has different electrical properties than their individual counterparts. In this work, the fabrication by the spraying process of transparent SWNT films and reduction of its sheet resistance on PET substrates is researched. Arc-discharge SWNTs were dispersed in deionized water by adding sodum 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 at 100 ℃. 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 treated with 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. Results, we show that 97 Ω/< sheet resistance can be achieved with 81% transmittance at the wavelength of 550 nm. The changes in electrical and optical conductivity of SWNT film before and after ionic doping treatments were discussed.

Keywords: Transparent Conducting Films (TCF), Single-well Carbon Nanotubes (SWNT), Spray coating