HIGHLY CONDUCTIVE ORGANIC-INORGANIC HYBRID TRANSPARENT FILMS

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To achieve simultaneously both optical transparency and electrical conductivity, we performed the fabrication of a single walled carbon nanotubes (SWNT)/silver fibers-based transparent conductive film using the silver fibers produced by electrospinning method. Electrospun silver fibers provided a segregated structure of the silver nanoparticles within the fibrous microstuctures as a framework. Additional depositing SWNT/poly-(3,4-ethylenedioxythiophene) doped with poly (styrenesulfonate) (PEDOT:PSS) layers remarkably decreases the very high surface resistance (>3000 kΩ/sq) of films of only electrospun silver fibers, without changing the optical transmittance at 550 nm. The surface resistance of the SWNT/silver film after three depositions is decreased to 17 Ω/sq with 80% transmittance. Successive depositions of SWNT/PEDOT:PSS layers reduce the surface resistance down to 2 Ω/sq without a severe optical transmittance loss (ca. 65%). These superior transparent conductive films exhibit a comparable performance to that of ITOs. The individual silver nanoparticles within the electrospun fibers on the substrate were connected with SWNTs, leading to the activation of a conductive network by bridging the gaps among separate silver nanoparticles,. The construction of microscopic conductive network with a minimum of electrically conductive nanomaterials produced the superior electrical conductivity keeping the optical transparency.

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