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A Simple Method for Fabricating Highly Electrically Conductive Cotton Fabric without Metals or Nanoparticles, using PEDOT:PSS

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Abstract

Analogous to the electrical components industry, various concentrations of poly(3,4-ethylenedioxythiophene):poly(styrenesulfonate) (PEDOT:PSS) incorporated into cotton fabric may yield the same result for electronic textile applications in which a wide-range of resistances from 0.4×10^{12} Ω to 5.3 Ω can be obtained without the use of metal, carbon and/or silica nanoparticles and a such differs from most conventional methods. Utilizing the drop casting method for the preparation of conductive cotton fabrics along with the secondary dopant, dimethylsulfoxide (DMSO), (which affects a PEDOT:PSS film's conductivity) a highly electrically conductive cotton fabric with metallic properties can be fabricated for electronic textiles applications. The conductive cotton with 21.7 wt.% PEDOT:PSS has a sheet resistance of 1.58 Ω/sq that is approximately 51 % lower than the best experimental value reported in the literature for conductive polymer-coated fabrics. Moreover, temperature dependent resistance measurements for PEDOT:PSS-treated cotton reveal that the conductive cotton showed different behaviors, including a metal-semiconductor transition dependent on the PEDOT:PSS concentration. Finally, and most importantly, for the first time we have