Fabrication of Conductive Poly(3,4-ethylenedioxythiophene) and Graphene Composite Films by a Layer-By-Layer Assembly Method

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Poly(3,4-ethylenedioxythiophene) based thin film has relatively high conductivity, flexibility and transmittance. However, the improvement for mechanical strength and enhanced conductivity is still required to be adatped for commerical applications. In this study, we have successfully demonstrated a nanometer-thick PEDOT and graphene composite film by a layer-by-layer method. The conductivity of 32 nm-thick PEDOT film was improved more than twice by graphene deposition, while the high transmittance of the composite film was maintained. The mechanical strength of the PEDOT and graphene composite film shows 6-fold enhancement over the pristine PEDOT film. Due to the contribution of graphene layer for the improved mechanical strength, the 44 nm-thick graphene/PEDOT/graphene could be obtained as a free standing film by delaminating under a weak base solution. These results show that the superlative electrical and mechanical properties of graphene was utilized to enhance the properties of the conductive PEDOT film and enables to produce a free standing film which could find a variety of applications in optoelectronics.