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Controlled Conductivity of Poly (3,4-Ethylenedioxythiophene): Poly (4-Styrene Sulfonate) Composites with Polyester

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Abstract : Poly (3.4-ethylenedioxythiophene) doped with poly (4-styrene sulfonate) (PEDOT: PSS) attracted a great deal of attention because of its unique characteristics of flexibility, optical properties, heat resistance and colloidal dispersion in water. It is well known that when high boiling solvents such as ethylene glycol or dimethyl sulfoxide are added as a secondary dopant to the micellar structure, PEDOT microcrystallizes and becomes highly conductive. In previous study bis(4-hydroxyphenyl) sulfone (BPS) was used as a secondary dopant for PEDOT:PSS and the enhancement of the conductivity was revealed. However, ductility is one of the serious issues which limited the application of PEDOT:PSS/BPS. So far, the composition with polymer binders has been conducted, however, polymer binders decrease the conductivity of the materials. In this study, PEDOT: PSS composites with polyester (PEs) were prepared by a simple aqueous process using PEs emulsion. The structural studies revealed that PEDOT:PSS and PEs were homogeneously distributed in the composites. It was found that the properties of PEDOT:PSS were remarkably enhanced by the incorporation of PEs. According to the tensile test, the ductility of PEDOT:PSS was remarkably improved. Interestingly, the conductivity of PEDOT:PSS/PEs composites was higher than that of neat PEDOT:PSS. For example, the conductivity increased by 8% at PEs content of 25 wt%. Since PEDOT:PSS were homogeneously dispersed on the surface of PEs particles, it was assumed that the conductive pathway was constructed by PEs particles in the nanocomposites. Therefore, a significant increase in conductivity was achieved.

Keywords : polymer composites, conductivity, PEDOT:PSS, polyester
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