

Preparation of Transparent Conducting Polymer Composites and their Structure and Properties

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Highly transparent and conducting polypyrrole- (PPy-N) and polyaniline-Nylon 6 composite films (PANI-N) could be easily obtained by immersing transparent Nylon 6 films impregnated with pyrrole or aniline into an oxidant solution such as aqueous FeCl_3 solution or aqueous $(\text{NH}_4)_2\text{S}_2\text{O}_8$ solution containing HCl. These transparent and conducting polymer composites also exhibited an excellent mechanical properties. In order to obtain the composite films, the interactions between polymer matrices and monomers have been studied carefully as a function of solubility parameter and polymer-solvent interaction parameter. Then, the optimum reaction conditions were investigated in connection with electrical conductivity and transmittance. The conductivity and transmittance of these composite films were of 10^{-2} order (S/cm) and about above 65% at optimum reaction conditions, respectively.

The hydrogen bonding between polypyrrole (PPy) or polyaniline (PANI) and Nylon 6 were characterized by FT-IR and UV-visible spectroscopy. The doping level of PPy and PANI decreased by the interactions between polymer matrix and conducting polymers in the

composites. The physical properties of the polymer matrices were affected by the incorporation of these conducting polymers into the polymer matrices.

The thermal stability in conductivity of transparent and conducting PANI-N were dependent on dopant species and different from that of pristine PANI. It is due to that the interactions between PANI and dopants is weakened by the hydrogen bonding between Nylon 6 and PANI. The thermal crosslinking of undoped PANI after thermal treatment was verified by UV-visible spectrum and reversibly varied by protonic acid doping-process.

The thermal, dynamic mechanical and physical properties of these transparent and conducting polymer composite films were studied in comparison with those of the matrix polymer.