Preparation, Characterization and Applications of ZnO Nanoparticles Based Polymer Composites

ABSTRACT

Nanoparticles of zinc oxide and polyaniline (emeraldine base) were successfully prepared using simple and easy methodology. Thus prepared nanoparticles of zinc oxide and polyaniline (emeraldine base) were characterized by FTIR spectroscopy, electron microscopy (SEM and TEM) and XRD. These studies confirm the formation of particles of different shapes in the nano range.

The preparation of electrically conducting nanocomposites containing polyaniline, supporting polymer matrix and zinc oxide nanoparticles also was done by solution method. Supporting polymer matrices of cellulose acetate, polyvinylchloride, polyacrylonitrile, polycarbonate and nylon 6,6 were used to impart mechanical strength and processibility to the nanocomposite films.

The films of nanocomposites were studied for their dc electrical conductivity and its temperature dependence as well as for their stability in terms of dc electrical conductivity retention by cyclic ageing and isothermal ageing techniques. The nanocomposite films/powder were also characterized by using FTIR, SEM, TEM, TGA and XRD.

The dc electrical conductivity of the nanocomposites was found to be fairly good and stable below 100°C if the materials are annealed for few hours at 100°C prior to use. It was also observed that the increase in the content of zinc oxide nanoparticles in the nanocomposites caused decrease in the electrical conductivity.

The stability of nanocomposites containing polyaniline, supporting polymer and zinc oxide nanoparticles in terms of dc electrical conductivity retention is remarkable. Therefore, these nanocomposites may offer to control the electrical conductivity by manipulating the zinc oxide nanoparticles content in nanocomposites. It may also be inferred from this study that the solution mixing process to produce nanocomposites has promising future if handled carefully.