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Zinc Oxide (ZnO) Doped Poly(o-toluidine): Synthesis and Characterization

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Conducting polymer composites of poly(o-toluidine)/Zinc Oxide (POT/ZnO) were synthesized by polymerization of o-toluidine with ZnO. The ZnO is varied in four different weight percentages of POT in POT/ZnO composites. The synthesized polymer composites are characterized by dielectric and XRD techniques. X-ray diffraction pattern shows increases in the crystallinity which is due to interaction of POT with ZnO. The dielectric parameter of these composite shows independent nature with frequency, which makes these composites useful in high energy storage devices.

Keywords: Polymer Nanocomposites, Chemical Oxidation, XRD, Dielectric Properties.

1. INTRODUCTION

For achieving the higher degree of operational performance, device integration, elasticity of material, and minimization of footprint, Present research impetus on nanostructures is significantly driven by the necessity for minimizing features. In the range of nanomaterials, ZnO nanostructures of conducting polymers have gained most attraction to sciencetific study in term of electronics materials,[1–4] biological and chemical sensing,[5–7] and optical applications.[8–10] Polymer nanocomposites have supreme importance for a huge continuum of research, as polymers have uncomparable variability in their properties like magnetic, optical and structural properties over metal and semiconductor.[11,12] POT has superior value over poly(aniline) due to brilliant processabilty as well as good thermal and ecological firmness.[15] Several others have already demonstrated Schottkey diodes with POT/metal contact.[16] In the present work, the authors emphases to probed the role of anionic radii of engaged dopants for making the High energy storage devices characteristic parameters, the precise characteristic of anionic dimension of dopants is not glowing explore.[17] Attempting ZnO nanoparticles as dopants is surely an unconventional effort,[18] the efforts made to investigating possible effects of the same in high energy storage devices performance. Over the past few years, with the ever-increasing environmental problems and the up-coming depletion of fossil fuels, a great deal of research towards developing sustainable and renewable clean energy has been carried out to meet the growing demands for energy for electronic devices.

In this work, we demonstrate a facile method to prepare CP nanoparticles serving as the material used to makes useful in High energy storage devices. The as prepared CP nanoparticles demonstrate high dielectric constant and shows independent behavior with a wide range of frequency. The outstanding chemical oxidation performances of the High energy storage devices can be attributed to binder free electrode structure.

2. EXPERIMENTAL DETAILS

2.1. Materials

O-toluidine (Merck India, AR grade) refrigerated after distillation, Ammonium peroxodisulphate (APS) (Merck India, AR grade), Hydrochloric acid (Qualigens Fine Chemicals, LR grade), Ammonia solution in water (99%, Merck India), Zinc(II)-acetatdihydrat ($Zn(CH_3COO)_2 \cdot 2H_2O$), AR Grade) and sodium hydroxide (NaOH), and methanol (Merck) were used as such without further purification.

2.2. Synthesis of Poly(o-toluidine)

POT was synthesized through oxidative polymerization using APS as oxidant.[19] APS was added drop wise into the acidified solution of o-toluidine, followed by constant stirring for 8 hours at temperature between 0–5 °C, polymerization instantly start with adding APS. The precipitate obtained after the polymerization was filtered and washed two times with deionized water. The dark green colored POT powder was obtained after drying at 80 °C in oven for 2 h.

2.3. Synthesis of ZnO Nanoparticles

ZnO nanoparticles was prepared by using stock solutions of $Zn(CH_3COO)_2 \cdot 2H_2O$ (0.1 M), in 50 ml methanol under continous stirring. To this stock solution 0.9 M sodium hydroxide

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