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Structure and Electrical Properties of ZnO Nanoparticles Blend with POT-DBSA

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Abstract. In this study, we report on a successful preparation nanocomposites poly(o-toluidine) (POT) doping with dodecylbenzene sulfonate acid (DBSA)/ ZnO by in-situ polymerization of (o-toluidine) monomer using ZnO nanoparticles with the weight ratios OT/ZnO: 1/5%, 1/10%, 1/15%. The composite films have been prepared by using the casting method on the different substrates depending on the type of measurement. The surface morphology of the prepared samples was studied by the field emission scanning electron microscopy (FESEM). The results of FESEM indicate that ZnO nanoparticles were successfully embedded in the POT via chemical interactions between ZnO and (O-toluidine) monomer and the EDX spectrum showed the presence of element Zn in POT-DBSA/ZnO composites. The crystal structure was measured by x-ray directional and pattern revealed the presence of ZnO in dopant polymer, in the diffraction the patterns of POT-DBSA. The intensity of the peaks was increased as the amount of ZnO nanoparticles increased in POT-DBSA. The typical rectifying behavior indicated that the formation of a diode observes by the I–V characterization of POT-DBSA/ZnO composites at a thin film layer with top Al thin layer contact.

1. Introduction

Polymers are usually used as insulating and structural materials in packaging and electrical insulations. Combining the advantages of traditional polymers, such as ease of manufacture, lightweight, and low cost, with the characterization of semiconductors and metals, has been the focus of researchers in the industrial fields for the past few decades. In 1977, Heeger, et al[1] obtained on the high conductivity of polyacetylene by doping with I_2, Br_2. or AsF_5. After that, a variety of other conducting polymers and their derivatives have been discovered[2, 3]. Conjugation in polymers enables some of the π-electrons to be delocalized and shared throughout the polymer. The delocalized electrons may move around the entire system and become the charge carriers that make the polymer conductive. Conductivity in polymers can be divided into two types: i) composites conductivity, which is done by adding conducting particles (metallic) to an insulating polymer chain that can be achieved by synthetic method or blending method[4] and ii) conductivity by oxidation/reduction the process creates charge carriers in the form of polarons (radical ions), bipolarons (dications or dianions), or solitons in the polymer[5]. The conducting polymers can be prepared by electrochemical or chemical methods. Poly (o-toluidine) is one of the most promising substituted polyaniline (PANI)[6-8]. It is an electroconductive polymer, good chemical stability, easily polymerization that has several technological applications[9-11]. PANI has hampered its industrial applications due to it have not solubility, poor mechanical properties, and low processability. Therefore, to solve this problem of poor chemical and mechanical properties of polyaniline in many applications, a considerable amount of work has been done to prepare incorporation conducting polymer with other particles[12-17]. Also, the dopant POT with dodecylbenzene sulfonate (DBSA) could be soluble in many common solvents[18, 19]. DBSA has