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Authors: Malati Majhi, Ram Bilash Choudhary, Pranabi Maji



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HCl protonated polymeric PANI-ZnS nanocomposites and measurement of their robust dielectric, optical and thermal performance

Malati Majhi^a, Ram Bilash Choudhary^{a*}, Pranabi Maji^a

^aNanostructured Composite Materials Laboratory, Department of Applied Physics, Indian Institute of Technology (Indian School of Mines), Dhanbad 826004, India.

*Corresponding author: e-mail address:<rbchec@yahoo.co.in>

Abstract

Polyaniline –Zinc sulfide (PANI-ZnS) nanocomposites were prepared by in-situ polymerization of aniline monomer with varying amount of ZnS nanoparticles. The as-prepared polymeric nanocomposites were characterized with Fourier Transform Infrared Spectroscopy (FTIR), X-ray Diffraction (XRD), Field Emission Scanning Electron Microscopy (FESEM), Energy Dispersive X ray (EDX), Thermogravimetric Analysis (TGA), Differential Thermal Analysis (DTA) and UV-visible spectroscopy. The structure and morphology of the nanocomposites were investigated by FTIR, XRD and FESEM. FESEM micrographs showed the spherical shape of the ZnS nanoparticles. The UV-visible spectrum revealed the enrichment of doping level for HCl doped PANI-ZnS nanocomposites with frequency range 200 nm-800 nm wavelength. The dielectric properties of the nanocomposites were also investigated by LCR meter with frequency range 200 Hz-5 MHz. The AC conductivity showed an decrease in conductivity of PANI-ZnS nanocomposites from 7.17×10^{-8} to 6.48×10^{-4} for PANI-(10%, 20%, 30% and 40%) ZnS nanocomposites.

Keywords: Polyaniline, ZnS nanoparticles, Dielectric properties, Optical properties

1. Introduction

Conducting polymers have emerged as one of the most interesting research platform due to its potential applications in actuators, high energy density pulse-power and capacitors [1-3], energy storage devices and rechargeable batteries [4-6], electromagnetic shielding [7], chemical and bio sensors [8,9], light emitting diodes [10-15] and light weight battery. Among the different way to synthesize polymeric materials for high dielectric constant devices, one of the important way is to introduce varying concentration of inorganic/conductive fillers into a polymeric matrix [16-19]. Nowadays, many inorganic fillers such as TiO₂ [20], CuS [21], NiFe₂O₄ [22] and SiO₂ [23] have been introduced into polymer matrix so as to enhance the

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