

Preparation and Dielectric Properties of Polyaniline -Coated Magnetite Nanocomposites

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Abstract

The conductive polymers such as polyaniline (PANI) exhibit considerable electrical conductive properties. The coating of PANI with magnetic (Fe_3O_4) nanoparticles formed composites ($\text{PANI}/\text{Fe}_3\text{O}_4$) with required dielectric properties. The morphology result study of $\text{PANI}/\text{Fe}_3\text{O}_4$ by field emission scanning electron microscope (FESEM) indicate the presence of PANI with tubes like structure containing different wt % of Fe_3O_4 nanoparticles (5, 15, 25 wt %). The structural pattern investigated by XRD revealed the presence of Fe_3O_4 nanoparticles at $2\theta = 35.58^\circ$, while the amorphous structure indicates the presence of PANI matrix. However, the chemical bonding analysis using FTIR shows chemical conjugation of bonds at 3336, 3300 and 3277 cm^{-1} due to presence of NH group in PANI and OH group in Fe_3O_4 nanoparticles, while presence of 504 and 526 cm^{-1} suggesting that Fe_3O_4 nanoparticles are present in the composites materials. The dielectric properties study by 4-point probe and VSM shows that PANI and $\text{PANI}/\text{Fe}_3\text{O}_4$ nanocomposites exhibit good electrical properties (1.55 to 1.35 S/cm) which are decreasing with increase of Fe_3O_4 nanoparticles, may be resulting due to insulating behaviour of the magnetic nanoparticles, while the magnetic properties of $\text{PANI}/\text{Fe}_3\text{O}_4$ nanocomposites indicate super paramagnetic properties with saturation magnetization of (59.4, 5.96, 11.94 and 15.43 emu/g).