

Magnetic and dielectric properties of polymer-coated $\text{Ni}_{0.5}\text{Co}_{0.3}\text{Cu}_{0.2}\text{Fe}_2\text{O}_4$ nanostructures

ABSTRACT

$\text{Ni}_{0.5}\text{Co}_{0.3}\text{Cu}_{0.2}\text{Fe}_2\text{O}_4$ and $\text{Ni}_{0.5}\text{Co}_{0.3}\text{Cu}_{0.2}\text{Fe}_2\text{O}_4$ /polyethylene glycol (PEG) were synthesized by using the co-precipitation method. The structural, morphological, magnetic, and dielectric properties of the products were characterized by X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FTIR), field emission scanning electron microscopy (FESEM), energy-dispersive X-ray spectroscopy (EDX), vibrating sample magnetometry (VSM), and Agilent dielectric probing, respectively. XRD analysis confirms the spinel structure of samples with an average particle size of 13 and 21 nm for $\text{Ni}_{0.5}\text{Co}_{0.3}\text{Cu}_{0.2}\text{Fe}_2\text{O}_4$ and $\text{Ni}_{0.5}\text{Co}_{0.3}\text{Cu}_{0.2}\text{Fe}_2\text{O}_4$ /PEG, respectively. FTIR analysis shows the presence of two vibrational bands between 400 and 600 cm^{-1} corresponding to lattice vibrations in tetrahedral and octahedral sites. FESEM images indicate the formation of nano-sized particles. The results of VSM imply that both samples show a ferromagnetic behavior. The complex dielectric permittivity of the samples was changed after PEG coating. The real part of the permittivity varied from 4.1 to around 5.7 by adding PEG. Adding PEG polymer caused variation in the average crystallite size, lattice constant, and magnetic coercivity.

Keyword: Spinel ferrite; Co-precipitation; Polymer; Complex permittivity; Ferromagnetic