

Enhancement of Dielectric Properties of Co-Precipitated Spinel Ferrites NiFe₂O₄/Carbon Nano Fibers Nanohybrid

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Abstract : Nickel ferrite was prepared via wet chemical co-precipitation route. Carbon Nano Fibers (CNFs) were used to prepare NiFe₂O₄/CNFs nanohybrids. Polar solvent (ortho-xylene) was used for the dispersion of CNFs in ferrite matrix. X-ray diffraction patterns confirmed the formation of NiFe₂O₄/CNFs nanohybrids without any impurity peak. FTIR patterns showed two consistent characteristic absorption bands for tetrahedral and octahedral sites, confirming the formation of spinel structure of NiFe₂O₄. Scanning Electron Microscopy (SEM) images confirmed the coating of nickel ferrite nanoparticles on CNFs, which confirms the efficiency of deployed method. The dielectric properties were measured as a function of frequency at room temperature. Pure NiFe₂O₄ showed dielectric constant of 1.79×10^3 at 100 Hz, which increased massively to 2.92×10^6 at 100 Hz with the addition of 20% by weight of CNFs, proving it to be potential candidate for applications in supercapacitors. The impedance analysis showed a considerable decrease of resistance, reactance and cole-cole plot which confirms the decline of impedance on addition of CNFs. The pure NiFe₂O₄ has highest impedance values of 5.89×10^7 Ohm at 100 Hz while the NiFe₂O₄/CNFs nanohybrid with CNFs (20% by weight) has the lowest impedance values of 4.25×10^3 Ohm at 100 Hz, which proves this nanohybrid is useful for high-frequency applications.

Keywords : AC impedance, co-precipitation, nanohybrid, Fourier transform infrared spectroscopy, x-ray diffraction

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