

Structural and Magnetic Properties of NiFe₂O₄ Spinel Ferrite Nanoparticles Synthesized by Starch-Assisted Sol-Gel Auto-Combustion Method

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Abstract : Nickel spinel ferrite NiFe₂O₄ nanoparticles with different particle size at different annealing temperature were synthesized using the starch-assisted sol-gel auto-combustion method. The synthesized nanoparticles were characterized by conventional powder X-ray diffraction (XRD) spectroscopy, Raman Spectroscopy, Fourier Transform Infrared Spectroscopy, Field-Emission Scanning Electron Microscopy, X-ray Photoelectron Spectroscopy and Vibrating Sample Magnetometer. The XRD patterns confirmed the formation of NiFe₂O₄ spinel ferrite nanoparticles. Field-Emission Scanning Electron Microscopy revealed that particles are of spherical morphology with particle size 5-20 nm at lower annealing temperature. An infrared spectroscopy study showed the presence of two principal absorption bands in the frequency range around 525 cm⁻¹ (ν_1) and around 340 cm⁻¹ (ν_2); which indicate the presence of tetrahedral and octahedral group complexes, respectively, within the spinel ferrite nanoparticles. Raman spectroscopy study also indicated the change in octahedral and tetrahedral site related Raman modes in nickel ferrite nanoparticles with change of particle size. This change in magnetic behavior with change of particle size of NiFe₂O₄ nanoparticles was observed.

Keywords : nickel ferrite, nanoparticles, magnetic property, NiFe₂O₄

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