

Particle Size Dependent Magnetic Properties of CuFe₂O₄ Spinel Ferrite Nanoparticles Synthesized by Starch-Assisted Sol-Gel Auto-Combustion Method

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Abstract : In this work, copper ferrite CuFe₂O₄ spinel ferrite 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 CuFe₂O₄ 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 530 cm⁻¹ (ν_1) and around 360 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 copper ferrite nanoparticles with change of particle size. This change in magnetic behavior with change of particle size of CuFe₂O₄ nanoparticles was also observed. The change in magnetic properties with change of particle size is due to cation redistribution, which was confirmed by X-Ray photoelectron study.

Keywords : copper ferrite, nanoparticles, magnetic property, CuFe₂O₄

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