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**Structural, Microstructural, Electrical, and Magnetic Properties of  $\text{CuFe}_{2-(x+y)}\text{Eu}_x\text{Sc}_y\text{O}_4$  (where x and y vary from 0 to 0.03) Nanoparticles**

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**Abstract**

In the present work, the  $\text{CuFe}_{2-(x+y)}\text{Eu}_x\text{Sc}_y\text{O}_4$  nanoparticles were prepared by solution combustion method for reporting the structural, microstructural, dielectric, and magnetic properties of prepared samples. The XRD (X-ray diffractometer) patterns confirm the spinel cubic structure with space group  $\text{Fd}\bar{3}m$ . The average crystallite size was found in the range from 25 to 10 nm for  $x = y = 0.00, 0.01, 0.02,$  and  $0.03$  concentrations. The SEM (scanning electron microscopy) investigations indicate the porous nature and particle agglomeration. The elemental composition of the samples was studied by using energy-dispersive X-ray spectroscopy (EDS). The FTIR (Fourier transform-infrared spectroscopy) investigation shows the two absorption bands around  $554.07\text{ cm}^{-1}$  and  $468.98\text{ cm}^{-1}$  due to stretching vibrations of the  $\text{Cu}\rightleftharpoons\text{Ometal-oxygen}$  bond at the A-site and stretching vibrations of  $\text{Fe}\rightleftharpoons\text{Ometal-oxygen}$  bond at the B-site, respectively. The real and imaginary parts of dielectric constant, dielectric loss tangent, AC conductivity, and impedance spectroscopy have been recorded by the methods of impedance analyzer from the range 0.1 KHz to 1 MHz. The dielectric constant and dielectric loss show maximum value at smaller frequency region and are decreases with increase in frequency. AC conductivity increases with the increase of frequency. The real and imaginary part of impedance spectra as function of frequency was studied. The Cole-Cole plots drawn from the impedance spectra show one semicircle for each of the samples. The magnetic hysteresis loop reveals the soft ferromagnetic nature. The magnetic parameters such as saturation magnetization, coercivity, and remanence magnetization decrease with the increase of  $\text{Eu}^{3+}$  and  $\text{Sc}^{3+}$  concentration.

**Keywords:**

AC Conductivity, Scanning electron micrograph, Saturation magnetization, Solution combustion method

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