Synthesis, structural and electrical characterization of soft Ni-Cr nanoferrites

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Ferrites which are ferrimagnetic ceramic materials have different metal oxides converged with iron (Fe^{3+}) to form their core segment. Ferrites are of two kinds, soft and hard. Soft materials are used for electromagnets because they are simply magnetized and demagnetized. On the other hand, hard materials are hard to magnetize and demagnetize, so they are used for permanent magnets. The core properties of ferrites depend on composition, synthesis techniques, temperature, cation distribution and the particle size. Although iron and metallic alloys are scientifically useful as magnetic materials, these materials are impractical because of low resistivity at high frequency. Because of high electrical resistivity of these ferrites, these are superior at high frequencies. In this talk, the fabrication of Cr doped $Ni_{0.5}$-$Zn_{0.5}Cr_xFe_{2-x}O_4$ ($0.1 \leq x \leq 0.4$) is reported. The material was characterized by x-ray diffraction technique to get the information related to structure, average crystallite size, x-ray density, porosity, the specific surface area and surface to volume ratio as shown in the Fig. The variation of electrical parameters like DC electrical resistivity and mobility as a function of temperature was investigated in the range of 435 to 770 K. The activation energies of all the samples were calculated from the DC electrical resistivity data. The dielectric parameters such as dielectric constant (ε), dielectric loss (tanα) and AC conductivity (α_{ac}) are measured in the temperature range of 300 to 770 K. It was observed that the dielectric constant was found to increase with the Cr^{3+} concentration, while tanα and αac decreased. The results are explained on the basis of increase in interfacial and dipolar polarization in the samples. Transition temperatures obtained from dielectric constant are in agreement with Curie temperatures, obtained from resistivity plots.

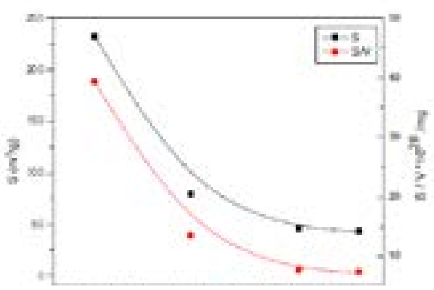

Figure 1: Variation of the specific surface area to volume ratio of Ni-Cr nanoferrites

Biography

Asghari Maqsood has her expertise in the fabrication and characterization of new materials. She prepared single crystals of rare-earth disilicates with the formula $R_2 Si_2O_7$ (R=Tm, Er, Ho, Dy). These materials were characterized through X-diffraction, magnetic, electrical and dielectric measurements. The results appeared in the ISI indexed journals, indicating the structural and importance of these materials from the application and academic interest. She also has the experience of dealing with high-temperature superconductors, thin-films of groups II-VI semiconductors and their application in solar cell technology. She developed a research laboratory namely Thermal Physics at Quaid-i-Azam University for post graduates, leading to MPhil and PhD degrees. The research group got involved in the synthesis of nanoferrites and their characterization almost a decade ago. The researchers have completed their research projects related to soft and hard nanoferrites for their PhD's under her supervision. The materials showed their applications in electronics, utility at high frequency, mechanical stiffness, etc. The systems $CoFe_2O_4$, Cu/Cd doped Mg-Zn; Cd doped Ni- ferrites are studied at length and the results are reported in publications.

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