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Impact of CuZn on structural, morphological and magnetic properties of spinel nanocrystalline ferrites for variety of applications

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The influence of Cu-Zn substitution on the structural and morphological characteristics of Ni nanocrystalline ferrites have been discussed in this work. The detailed and systematic magnetic characterizations were also done for Cu-Zn substituted Ni nanoferrites. The nanocrystalline ferrites of Cu-Zn with different compositions were synthesized using sol gel self-combustion hybrid method. X-ray diffraction (XRD), field emission scanning electron microscopy (FESEM), transmission electron microscope (TEM) and vibrating sample magnetometer (VSM) were used to find out the properties of CuZn substituted nanocrystalline ferrites. Single phase structure of CuZn substituted in Ni nanocrystalline ferrites were investigated for all the samples. Crystallite size, lattice constant and volume of the cell were found to be increased by increasing Cu contents in spinel structure. The better morphology with well-organized nanocrystals of CuZn ferrites at x=0 and 1.0 were observed from both FESEM and TEM analysis. The average grain size was 35-46 nm for all prepared nanocrystalline samples. Magnetic properties such as coercivity, saturation, remanence, magnetic squareness, magneto crystalline anisotropy constant (K) and Bohr magneton were measured from the recorded hysteresis MH loops. The magnetic saturation and remanence were increased as Cu contents increased. However, coercivity follow the Stoner-Wolforth model except for x=0.6 which may be due to the site occupancy and replacement of Cu contents from octahedral site. The squareness ratio confirms the super-paramagnetic behavior of the CuZn substituted in Ni nanocrystalline ferrites. Furthermore, CuZn substituted Ni nanocrystalline ferrites may be suitable for many industrial and domestic applications such as component of transformers, core, switching and MLCI's due to variety of the soft magnetic characteristics.

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Microscopic understanding of high temperature superconductivity and its possible role towards enhancement of critical temperature

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The family of cuprate superconductors synthesized over the last 25-30 years has shown a remarkable promise in the journey towards fulfilling our dream of achieving superconductivity at room temperature. The peculiarity and richness of microscopic physics involved in superconducting pair formation in cuprate systems is discussed from theoretical perspectives with inclusion of our own work on this aspect. The possible clues to achieving still higher superconducting transition temperature, obtainable from the studies of various classes of superconductors of both conventional and exotic types, are sketched out.

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