© 2019 IJSRST | Volume 6 | Issue 2 | Print ISSN: 2395-6011 | Online ISSN: 2395-602X
Themed Section: Science and Technology

Review on Ferrites : Structural Magnetic and Electrical Properties

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ABSTRACT

Researchers are taking extraordinary interest in the preparation and characterization of lithium ferrites due to their wide variety of applications in many fields. lithium ferrites are a class of smooth magnetic materials which have excellent electric, magnetic and optical properties. The properties of lithium ferrites include high cost of resistivity, Permeability, permittivity, saturation magnetization, low power losses and coercivity. The above referred to wonderful features of lithium ferrites make them appropriate for the use in various packages. In medical field these ferrites are used for treatment cancer and MRI. Lithium ferrites are also utilized in electronic applications.

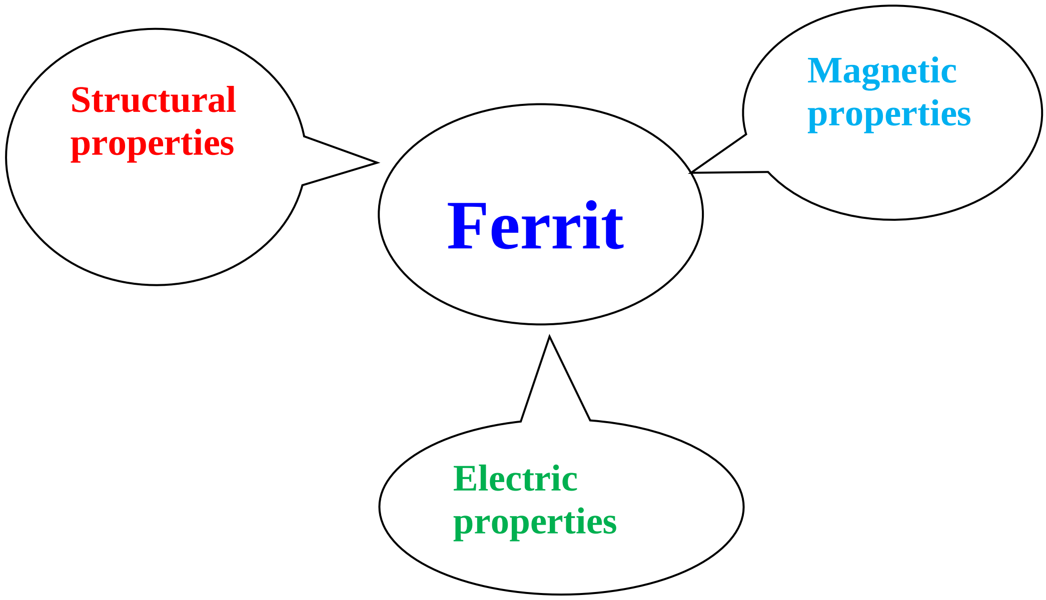
Keywords : Treatment Cancer, MRI. Lithium, Permeability, Permittivity, Saturation Magnetization, Low Power Losses

Introduction:

Ho doped Lithium-Zink ferrites and its dielectric behavior at high frequency and magnetic properties are studied[1] sol–gel synthesized CoFe2-xHoxO4 nano ferrites its structural and physical properties were studied [2] The change in magnetic and structural properties of Gadolinium doped cobalt-zinc ferrites governed by spin rotations and domain wall movement were explained [3] $Co_{0.5}M_{0.3}7Cu0.13Fe_2O_4$ ferrites were studied for its structural, magnetic and electrical behavior, [4] By aloe vera plant-extracted ferrite nanoparticles of MFe_2O_4, M = Ni, Co, Mn, Mg, Zn are prepared [5] zinc ferrite nanoparticles synthesized from Sugarcane juice and its application as degradation of mixed dyes and antibacterial activities are studied[6] Electric and dielectric properties of Neodymium substituted manganese -nikel-zinc are explained[7]

Metal ions substituted cobalt ferrites synthesized by sol–gel auto-combustion route were studied for magnetic properties [8] Nanocrystalline Mn-Zn Ferrites synthesized by microwave assisted method were studied, [9] $NiCr_xFe_{2-x}O_4$ ferrites were studied for its optical, electric, mechanical, and Magnetic properties, [10]

Graphical Abstract: Study of Ferrites



The remanent magnetization and coercivity of the Nanocomposites of hexaferrite became 2 and a 2.5 instances better, respectively by means of adding $BaFe_{11.7}Al_{0.15}$ $Zn_{0.15}O_{19}$ section. The Cole-Cole plots of the nanocomposite x=0.4 at the chosen temperatures suggests two successive semicircles at all the selected temperatures. The First low frequencies semicircle elucidates the contribution of the grain boundary and the second, at excessive frequencies, offers the contribution of grain to conduction manner. Multilateral applications for change spring magnets can be manufactured the usage of the ones nanocomposites. These hexaferrite was fabricated by using the citrate–nitrate auto combustion method [11]

Nanoparticles of roughly spherical in shape with size in range of 10–15 nm, are estimated from X-ray diffraction and TEM micrographs with increase in crystal size coresivity increase and decreases with decreases in size of the magnetic particles. The variation in valance states Mn and Fe atoms in $Zn_xMn_{1-x}Fe_2O_4$ is studied. The magnetic properties of $Zn_xMn_{1-x}Fe_2O_4$ will degrade with loss of Zinc is observed. Due to the combined effects of oxygen partial pressure and temperature in the region of 450^0c the phase is not stable for $Zn_xMn_{1-x}Fe_2O_4$.[12]

Humaira Anwar et al. studied, Structural, Electrical and Dielectric Parameters of Mn-Zn Nano Ferrites prepared by the chemical co-precipitation method, changes due to increase of temperature, while the resistivity of ferrite deceases with increases of temperature. Activation energy of the samples was found to be in the range of 0.70 to 0.77eV. Due to agglomeration in of Mn-Zn ferrites Porosity, crystallite Size, resistivity increases and density decreases with increase in temperature. Maximum weight loss is observed up to temperature of 518 K. The dielectric constant decreases rapidly with increase in frequency [13] It is seen that the coercivity value of the all of nanocomposites are decrease than natural hard Phase and for one-pot synthesized nanocomposites, are greater than pure smooth phase. The coercivity reduction in composites organized by using physical Mixing approach is lots astounding and for smooth phase content material better than 50 %.It is decrease than natural pure phase. For high values of the smooth phase, the exchange Force at the soft grains is weakened and dipolar interaction among pure phase.Moments becomes enormous. So, the opposite domains inside the smooth section with Low nucleation area may be nucleated without problems. This could lower the coercivity Of composite [14]. In addition, whilst the importance of the reverse field is Progressively expanded, the domain partitions of the pure phase flow in the direction of the Interface between the soft and hard phases and could invade into the hard phase Area, which leads to the irreversible magnetization reversal of the hard section. Therefore neighboring grains could purpose additional demagnetizing effect and Bring about the reduction of average coercivity of the composite, as compared to the Pure hard phase [14]. Shuli He et al. explained Maximized precise loss of electricity and intrinsic loss strength drawing near theoretical limits for alternating-current (AC) magnetic-subject heating of nanoparticles are said. That is performed by way of engineering the powerful Magnetic anisotropy barrier of nanoparticles through alloying of hard and soft ferrites. 22 nm $Co_{0.03}Mn_{0.28}Fe_{2.7}O_4/SiO_2$ nanoparticles attain a precise loss power price of 3417 W g^{-1} metallic at a area of 33 kA m^{-1} and 380 kHz [15]. Biocompatible $Zn_{0.3}Fe_{2.7}O_4/SiO_2$ nanoparticles gain particular Loss energy of 500 W g^{-1}Steel and intrinsic loss energy of 26.8 nHm^2 kg^{-}1[15]. At field parameters of 7 kA m^{-1} and 380 kHz, below the medical safety Limit. Magnetic bone cement achieves heating good enough for bone Tumor hyperthermia, incorporating an ultralow dosage of just 1 wt% of nanoparticles[15]. In cell hyperthermia experiments, these nanoparticles exhibit excessive cellular death price at low field parameters. $Zn_{0.3}Fe_{2.7}O_4/SiO_2$ nanoparticles show cellular viabilities above ninety seven% at concentrations up to 500 μg mL^{-1} inside forty eight h, suggesting toxicity lower than that of magnetite[15]. Cristina Ileana Covaliu et al. reported that, biomedical applications magnetic nanoparticles coated with polysaccharide polymers were studied and these microorganisms of as prepared hybrid materials show the non-toxic properties. The magnetic properties of all ferrite nanoparticles and hybrid materials have Shown the super paramagnetic normal behavior, that the saturation magnetization (Ms) values are much decrease than the ones of the corresponding "bulk" ferrite. The lower of Ms might be because of the decrease of the particle sizes[16]. The weak hysteresis might be assigned to the small length of the nanoparticles having a single magnetic domain. In addition, taking into account that at the maximum Losses (eddy currents losses), these substances being aggressive for some medical fields[16]. All Hybrid materials exhibit a decrease saturation magnetization and a decrease susceptibility than the uncoated ferrite nanoparticles due to the decreased content of the magnetic aspect within the composite material however the values are enough excessive for medical programs [16] . Cristina Ileana Covaliu also reported the cobalt ferrite nanoparticles ($CoFe_2O_4$) have a different Conduct: its mixture with polyvinylpyrrolidone (PVP) increases now not only the saturation magnetization, but additionally the hysteresis parameters (coercivity and remanence). An rationalization may be the huge agglomeration of the magnetic nanoparticles that allows the multidomain magnetic structure. He also reported the cobalt ferrite nanoparticles with sizes less than 10 nm have low magnetic reaction skills considering the biomedical applications[17]. As zinc concentration increases the microstructure and relaxation frequency of as synthesized Mn–Zn ferrites changes there is tendency to increase the grain size as the Zn concentration increases, the study also reveals that the average grain sizes of microstructures increases with increasing dwell time[18]

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Cite this Article

Swati Patil, Shankar Dhasade, "Review on Ferrites : Structural Magnetic and Electrical Properties", International Journal of Scientific Research in Science and Technology (IJSRST), Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 6 Issue 2, pp. 1008-1011, March-April 2019.

Journal URL : https://ijsrst.com/IJSRST23100110