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"STUDY OF MAGNETIC CHARACTERISTICS OF MG^{+2} SUBSTITUTED Ni Cu Zn FERRITE, SYNTHESIZED BY NITRATE CITRATE AUTOCOMBUSION METHOD"

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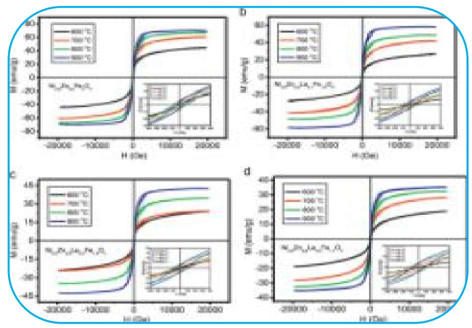
ABSTRACT :



The ferrite composition [Ni 0.25-x Mg x Cu.2 Zn0.55] Fe2O4 with values x= 0.00, 0.05, 0.1, 0.15, 0.2, 0.25 were synthesized by auto combustion method. XRD analysis of prepared ferrite powder shows the cubic spinal structure. The resultant powder was calcined at 650 0C / 2hr and the pressed ferrite were sintered at 950 0c / 4hr. We describe magnetic parameters of the developed ferrites, such as the , nB values, and magnetic moments from the hysteresis curve. On the basis of our experimental findings, we also describe. The typical hysteresis loops of as-prepared ferrites measured at room temperature. All of the samples displayed the same general shape for their magnetic hysteresis, which is evidence of the magnetically ordered material. The normalized A.C.susceptibility of the ferrites as a function of temperature

KEYWORDS: *Ferrite composition, Nitrate Citrate Autocombusion method.*

INTRODUCTION:

Present day information technology plays important role in human life. The electromagnetic components are more demanded having very small size, low prize and high efficiency. The ferrites are used in various fields like surface mounting technology component which is widely used in electronic things such as digital camera, Cellular phone and computer. NiCuZn ferrite is material for M.L.C.I. due to its better magnetic properties at particular higher frequency The Mg -Cu-Zn ferrite is magnetic material for wide applications for environmental stability. The initial permeability is high at low magnitostriction constant The magnitostriction constant of Mg- Cu-Zn is lower than Ni-Cu-Zn. Here expectation is that by adding the Mg, the Mg-Cu-Zn ferrite is to be prepared. To study hysteresis curve and AC Succeptibility.

Experimental

The analytical grade magnesium nitrate [Mg $[N0_3]_2.6H_2O$], zinc nitrate [Zn $[NO_3]_2.6H_2O$], copper nitrate [Cu $[NO_3]_2.6H_2O$], iron nitrate [Fe $[NO_3]_2.9H_2O$] and citric acid [$C_6H_8O_7H_2O$] were used to prepare [Ni $_{0.25-x}$ $_{Mg\ 0.20}$ Cu $_{0.20}$ Zn $_{0.55}$] Fe_2O_4 with x=0.0, 0.05, 0.1 0.15, 0.2, 0.25 by autocombusion method. The metallic nitrates and citric acid were dissolved in de-ionized water and mixed in 1:3 m ratio of nitrate to citric acid. The solution was heated to transfer it in to gel. Then the dried gel burnt in self propagating combustion manner until all gel was completely burns out to form fully loose powder. The burnt precursor powder was calcined at 650 ^{0}C / 2hr. The calcined powder was granulated by using PVA as binder. It is uniaxially pressed at 1.5 to 2 ton / cm^2 to form pellet and toroidal specimen. These specimens were sintered at 950 ^{0}C / 4hr. In air atmosphere the sintered ferrites were characterized with respect to phase identification, crystallite size, and lattice parameter determined using X-ray diffraction with CuKα radiation [λ =1.5406Å]. The magnetic properties like hysteresis curve and AC Susceptibility is studied.

Result and Discussion

1. Magnetization (VSM):

Figure .1 depicts the typical hysteresis loops of as-prepared ferrites measured at room temperature. All of the samples displayed the same general shape for their magnetic hysteresis, which is evidence of the magnetically ordered material.

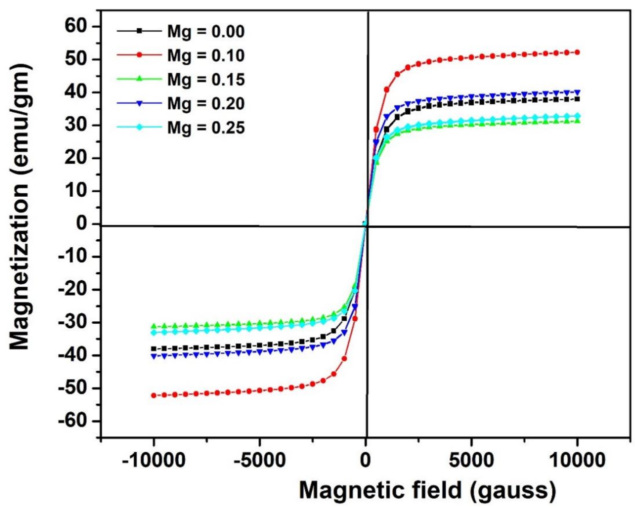


Figure.1: Magnetic hysteresis loops of the ferrites.

Table .1 provides the values of saturation magnetization (Ms), coercivity, and remanence for each ferrite composition. When there was a higher concentration of magnesium in the sample, the saturation magnetization rose. This can be understood in terms of the distribution of cations and the exchange interactions that take place between the A sites and the B sites of the ferrite. In NiCuZn ferrite, the A sites are occupied by the stable Zn^{2+}ions, whereas the B sites are occupied by the Ni^{2+} ions and the Mg^{2+} ions. The magnetic moment of Ni^{2+} ions is 2.83 B, which is greater than that of Mg^{2+} ions, which is just 2.0 B. Because of this, it causes the saturation magnetization of the ferrite to become more intense. The saturation magnetization was at its highest possible value in the ferrite with x = 0.25.

2. AC susceptibility studies (χ_T/ χ_{RT}):

Figure 2 depicts the normalized A.C. Susceptibility of the ferrites as a function of temperature. This parameter is denoted by the notation (χ/ χ_{RT}). The values of (χ/ χ_{RT}) in all of the ferrites remained unaffected up to a certain temperature. Later, they experienced a sharp decline as they come closer to the Curie temperature. Due to not having enough thermal energy, the aligned moments of spins remain stable up to the temperature of Curie. This is what causes the normalized susceptibility to behave in a steady manner up to this temperature. This behavior demonstrates that these materials possesses ferromagnetic properties. However, above the Curie temperature, the drop in susceptibility is due to sufficient thermal energy that disrupted the moment's alignment. This occurs when the temperature is higher than the Curie temperature. In this context, it denotes the change from a ferrimagnetic state to a paramagnetic state that has occurred in the material.

Table .1 provides the Curie temperature for each developed ferrite sample. It was discovered that the Curie temperature goes down when there is a rise in the amount of Mg content. This is because there is a rise in the ferrimagnetic zone, while there is a fall in the paramagnetic region at the same time. Additionally, the substitution of Mg produces an increase in A-B interactions as a result of the replacement of Ni^{2+} on the octahedral (B) site by Mg^{2+}. A behaviour of a similar nature was seen in prior research [18, 19]. When a material is heated above the Curie point, it enters a condition that is completely disordered and loses its ability to magnetize. The high Curie temperature for ferrite with Mg = 0.5 and 0.10 is caused by the influential exchange contact (A-B) that exists between the various sub-lattices [7]. All the samples exhibit M.D. behavior.

Table 1: Compositional data of developed ferrites.

Content(x)	**0.00**	**0.05**	**0.10**	**0.15**	**0.20**	**0.25**
Crystallite size from XRD(nm)	22.8	38.81	39.28	41.03	39.29	40.64
Saturation Magnetisation Ms (emu/gm)	20.78	27.62	30.23	16.34	21.14	17.61
Corecivity, Hc(Guass)	2.99	3.01	2.15	1.31	0.22	1.85
Curie temp. from AC susceptibility	230	228	225	160	125	124

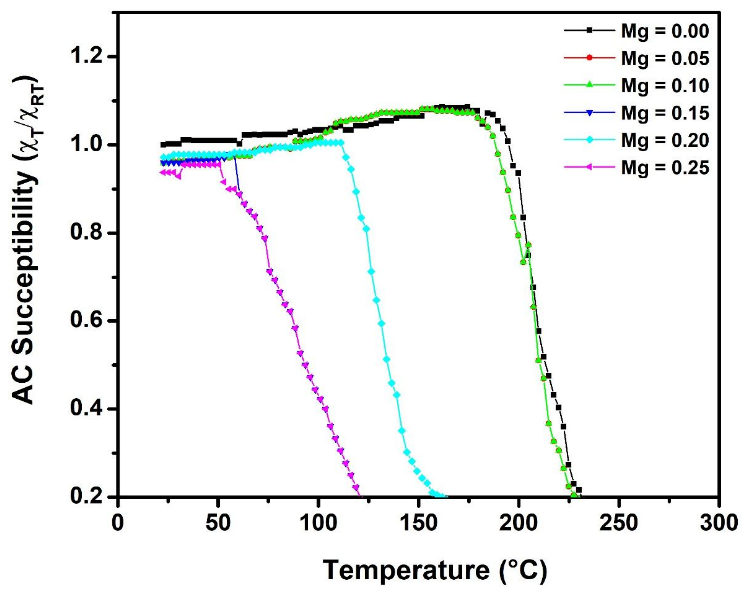


Figure .2: Normalized AC susceptibility (χ_T/χ_{RT}) of the ferrites as a function of temperature.

Conclusions:

The findings of the experiments show an improvement in the magnetic characteristics of NiCuZn ferrites by adding Mg^{2+}. From the VSM analysis, all the ferrite samples displayed an obvious general shape for their magnetic hysteresis, which is evidence of the magnetically ordered material. The saturation magnetization was at its highest possible value in the ferrite with x = 0.25.The values of (χT/ χRT) in all of the ferrites remained unaffected up to a certain temperature. Later, they experienced a sharp decline as they came closer to the Curie temperature. The Curie temperature found to decrease upon a rise in the amount of Mg in the ferrite system. It has been discovered that the values of the Bohr magneton (n_B), decrease when there is an increase in the amount of Mg^{2+} present. Due to its lowest coercivity and highest initial permeability, would be the suitable material in MLCI with reduced layers and more miniaturization.

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