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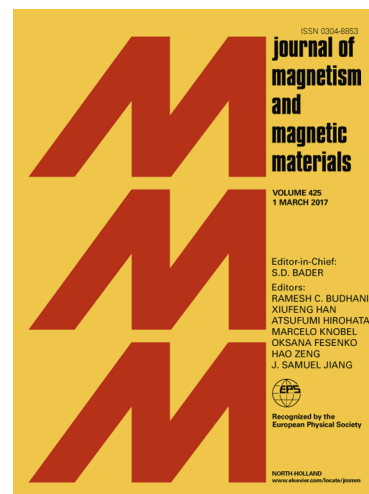
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Unusual increase in permeability in cobalt substituted Ni-Zn-Mg ferrites

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Abstract:

A constant rise in magnetic permeability with a simultaneous decrease in saturation magnetization, and Curie temperature has been recorded throughout the cobalt concentration studied in Ni-Zn ferrite system of composition, $\text{Ni}_{0.57-y}\text{Co}_y\text{Zn}_{0.35}\text{Mg}_{0.08}\text{Fe}_2\text{O}_4$ ($x=0.00, 0.04, 0.08, 0.12, 0.16, 0.20$). The observed increase in magnetic permeability with cobalt addition has been an unusual phenomenon in nickel zinc ferrites. The anomalous increase along with allied magnetic properties has been discussed in terms of the super exchange interactions between the cations occupying tetrahedral and octahedral sites and their distribution by studying lattice parameter, grain size and differential magnetic susceptibility

Keywords: Ferrite, permeability, saturation magnetization, lattice parameter.

1. Introduction

Higher values of saturation magnetization, initial permeability, DC resistivity and moderate value of coercivity with low losses are essential parameters for use of magnetic materials as inductor cores in the high frequency region. The electromagnetic properties associated with Ni-Zn and substituted Ni-Zn ferrites make them useful for core applications up to 100 MHz and higher. Developing a system with higher saturation magnetization demands the knowledge of cation distribution which in turn is highly sensitive to the method of preparation and the kind of impurity ions present in the system. In the direction of increasing saturation magnetization, the influence of magnesium for smaller concentrations was reported in our earlier work [1-2] in nano nickel zinc ferrites. The present investigation describes the effect of cobalt on magnetic properties of nickel-zinc-magnesium ferrite system with a stress on its magnetic anisotropy contribution. For this purpose, the basic composition which yields the maximum saturation magnetization has been selected [2]. The role of magnetic anisotropy on spin alignment with the external magnetic field is analysed from dM/dH versus magnetic field curves.

2. Experimental

Samples having composition, $\text{Ni}_{0.57-y}\text{Co}_y\text{Zn}_{0.35}\text{Mg}_{0.08}\text{Fe}_2\text{O}_4$ ($y=0.00, 0.04, 0.08, 0.12, 0.16, 0.20$) were processed using a ceramic technique, as described in our earlier work [2-3]. The pre-sintered powders were made into both pellets and toroids under the pressure of 5 tons

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