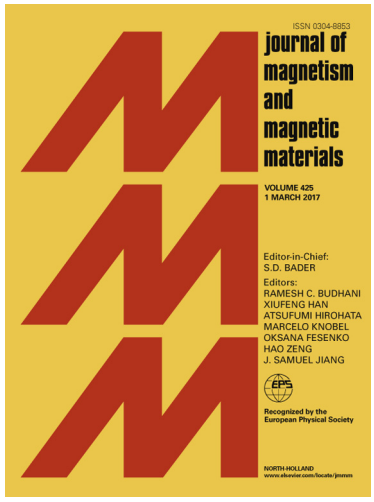

Influence of Al^{3+} substitution on the electrical resistivity and dielectric behavior of $Ni_{0.25}Cu_{0.20}Zn_{0.55}Al_xFe_{2-x}O_4$ ferrites synthesized by solid state reaction technique

K.R. Rahman, F.-U.-Z. Chowdhury, M.N.I. Khan

PII: S0304-8853(17)31208-8
DOI: http://dx.doi.org/10.1016/j.jmmm.2017.07.098
Reference: MAGMA 63029

To appear in: *Journal of Magnetism and Magnetic Materials*

Received Date: 17 April 2017
Revised Date: 21 July 2017
Accepted Date: 31 July 2017

Please cite this article as: K.R. Rahman, F.-U.-Z. Chowdhury, M.N.I. Khan, Influence of Al^{3+} substitution on the electrical resistivity and dielectric behavior of $Ni_{0.25}Cu_{0.20}Zn_{0.55}Al_xFe_{2-x}O_4$ ferrites synthesized by solid state reaction technique, *Journal of Magnetism and Magnetic Materials* (2017), doi: http://dx.doi.org/10.1016/j.jmmm.2017.07.098

Influence of Al^{3+} substitution on the electrical resistivity and dielectric behavior of $Ni_{0.25}Cu_{0.20}Zn_{0.55}Al_xFe_{2-x}O_4$ ferrites synthesized by solid state reaction technique

K.R. Rahman [a], F.-U.-Z. Chowdhury [a, *] and M.N.I. Khan [b]

[a] Department of Physics, Chittagong University of Engineering and Technology, Chittagong 4349, Bangladesh.

[b] Materials Science Division, Atomic Energy Center, Dhaka 1000, Bangladesh.

Abstract

In this paper, the effect of Al^{3+} substitution on the electrical and dielectric properties of $Ni_{0.25}Cu_{0.20}Zn_{0.55}Al_xFe_{2-x}O_4$ ferrites with x = 0.0, 0.05. 0.10, 0.15 and 0.20, synthesized by solid state reaction has been reported. Using two probe method, the DC resistivity has been investigated in the temperature range from 30 ^oC to 300 ^oC. Activation energy was calculated from the Arrhenius plot. The electrical conduction is explained on the basis of the hopping mechanism. The frequency dependent dielectric properties of these spinel ferrites have been studied at room temperature by measuring AC resistivity, conductivity (σ_{ac}), dielectric constant and dielectric loss tangent ($tan\delta$) in the frequency range between 1 kHz and 120 MHz. The study of dielectric properties showed that the dielectric constant and dielectric loss increased with increasing non-magnetic Al ions. The dependence of dielectric constant with frequency has been explained by Maxwell-Wagner interfacial polarization. Cole-Cole plots show semicircular arc(s) for the samples, and equivalent RC circuits have been proposed to clarify the phenomena involved therein. The analysis of complex impedance spectroscopy has been used to distinguish between the grain and grain boundary contribution to the total resistance.

Keywords: DC resistivity, Activation energy, Dielectric properties, AC conductivity, Impedance spectroscopy, Cole-Cole plot.

[*] Corresponding author: (F.-U.-Z. Chowdhury) Email: faruque@cuet.ac.bd