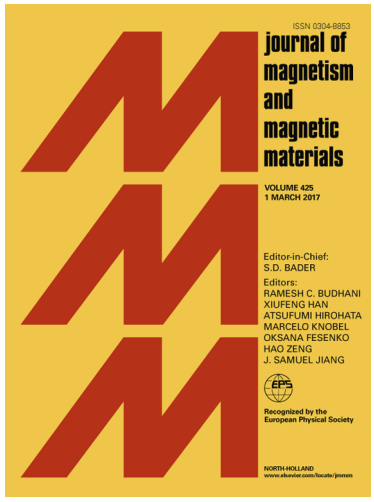

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Investigation of structural, morphological and electromagnetic properties of $Mg_{0.25}Mn_{0.25}Zn_{0.5-x}Sr_xFe_2O_4$ Ferrites

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Abstract

Polycrystalline $Mg_{0.25}Mn_{0.25}Zn_{0.5-x}Sr_xFe_2O_4$ ($0 \leq x \leq 0.20$) ferrites were synthesized using the solid state reaction sintering at 1373K and 1473K for 4h. The XRD patterns revealed the formation of single phase cubic spinel with Sr_2FeO_4 and $SrFe_{12}O_{19}$ as impurity phases. The decrement in the lattice parameter for Sr^{2+} substituted samples is attributed to the difference in ionic radii of cations. The crystallite size decreases with increase in Sr^{2+} content. Low frequency dielectric dispersion is attributed due to the Maxwell-Wagner interfacial polarization. The appearance of the peak in dielectric loss spectrum for x = 0.15 and 0.20 at 1373K and x = 0.20 at 1473K suggests the presence of relaxing dipoles. The loss peak shifts towards lower frequency side with Sr^{2+} content at 1373K which is due to the strengthening of dipole-dipole interactions. The complex impedance spectra clearly revealed that the both grain and grain boundary effects on the electrical properties. A complex electric modulus spectrum indicates that a non-Debye type of conductivity relaxation exists. The saturation magnetization and remanence gradually decreases with Sr^{2+} substitution which may be due to the existence of non-magnetic phase in the space between the magnetic particles and the substitution of Zn^{2+} cation in $Mg_{0.25}Mn_{0.25}Zn_{0.5}Fe_2O_4$ ferrite lattice by Sr^{2+} content. The permeability decreases significantly while the cut-off frequency increases with the Sr^{2+} content at 1373K and decreases at 1473K, obeying the Snoek's law. The decrease in permeability with Sr^{2+} content is attributed due to the decrease in magnetization because non-magnetic ions weaken the inter-site exchange interaction.