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MAGNETIC, MICROSTRUCTURE AND ELECTRICAL BEHAVIOUR OF SOME $(Li_{0.5}Fe_{0.5})_{0.7-x}Ni_xZn_{0.3}Fe_2O_4$ FERRITES

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ABSTRACT

The effects of substituting $(Li^{+}_{0.5}Fe^{3+}_{0.5})$ ions with Ni^{2+} ion on microstructural, magnetic, d.c. and a.c. electrical properties of some polycrystalline $(Li_{0.5}Fe_{0.5})_{0.7-x}Ni_xZn_{0.3}Fe_2O_4$ ferrites were studied. The d.c. electrical resistivity (ρ_{dc}) at 300 K increases with Ni content, while the experimental density (d), saturation magnetisation (M_s), initial permeability (μ_i) and Neel Temperature (T_N) show otherwise. The variations of magnetic and electrical properties are explained on the basis of cation distribution between the tetrahedral (A) and octahedral (B) sites. The complex impedance measurement was performed at different input voltage in ten decades of frequency (1 mHz - 10 MHz). The impedance spectrum for all samples is composed of two overlapping semicircles with negative capacitance phenomenon below approximately 1 Hz. However, the negative capacitance phenomenon is absent for x = 0.7. The two semicircles at high and low frequencies are mainly attributed to the grain (b) and grain boundary interfacial (g) processes respectively. The grain boundary interfacial response shows a non-linear dependence on the input voltage, where the corresponding impedance semicircle is smaller for a larger amplitude. However, a linear response is observed for the grain component. Simulation on the impedance data was performed using a complex nonlinear least square (CNLS) fitting method based on an equivalent circuit representation. The simulated quantities are the physical parameters of the microstructural components for the ferrites. The dependences of the a.c. electrical properties of the grain and the grain boundary interfacial components on composition and the amplitude of the input voltage are discussed.

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