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Synthesis and Characterization of nano-crystalline $Li_{0.5+0.5x}Fe_{2.5-1.5x}pb_xo_4$ Ferrites for Microwave Device Applications

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Abstract—*Successful synthesis of polycrystalline $Li_{0.5+0.5x}Fe_{2.5-1.5x}Pb_xO_4$ ($0.00 \leq x \leq 0.08$) ferrites has been achieved using citrate gel synthetic method. The presence of single phase spinel cubic structure has been confirmed by X-ray diffraction analysis. A small amount of second phase is present in the sample with x = 0.08. This indicates that introducing an appropriate amount of Pb ions into the ferrite matrix can replace the Fe ions. Surface morphology analysis of the samples was performed using scanning electron microscopy. The increase of Pb content led to the increase of average grain size up to x = 0.06. The average grain size for the sample with x = 0.08 was found to decrease. This has been attributed to the secondary phase formation along the grain boundaries that inhibits the grain growth. The dielectric analysis of the present ferrite system revealed that dielectric properties have been improved much by Pb substitution. The dielectric permittivity of $Li_{0.5+0.5x}Fe_{2.5-1.5x}Pb_xO_4$ferrite nano-crystals shows a maximum value of 7×10^7 at 100 Hz frequency for x = 0.08 sample. The Cole-Cole plots depicted a single semi-circle for all the samples. This shows that $Li_{0.5+0.5x}Fe_{2.5-1.5x}Pb_xO_4$ ferrite nano-crystals are composed of well conducting grains and poorly conducting grain boundaries. Magnetic properties have been measured using vibrating sample magnetometer for all the samples at room temperature. Magnetic properties of $Li_{0.5+0.5x}Fe_{2.5-1.5x}Pb_xO_4$ ferrite nano-crystals are strongly affected by Pb substitution.*

Keywords*: Dielectric properties; SEM; Impedance spectroscopy; Cole-Cole plots; Magnetic properties;*