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Temperature Dependent Investigations on Single Crystal Gallium Ferrite Using X-ray Diffraction and Raman Spectroscopy S. MUKHERJEE, Dept. of Physics, IIT Kanpur, India, RAJEEV GUPTA, Dept. of Physics and Materials Science Programme, IIT Kanpur, India, ASHISH GARG, Materials Science and Engineering, IIT Kanpur, India — $Ga_{2-x}Fe_xO_3$ ($0.8 \leq x \leq 1.2$) or GFO is a room temperature paramagnetic piezoelectric material with its ferrimagnetic to paramagnetic transition temperature (T_c), varying from 200 K to 300 K. We synthesized GFO ($x \sim 1.08$-1.10) single crystals using flux growth method. Partial occupancies of the cationic sites obtained using Reitveld refinement of XRD data were used to calculate the lattice magnetic moment. We have also carried out Raman scattering as a function of temperature from 18 K to 450 K. Temperature evolution of the peak positions of most of the modes can be adequately described using an anharmonic model suggesting absence of any lattice anomaly across the phase transitions. This observation is consistent with the XRD data. However, the temperature dependence of the line width of a number of modes exhibits a change in slope across the phase transition boundary. In order to understand and quantify this change in the line width as a function of temperature we calculate the product of electron-phonon coupling strength and the density of states at the Fermi level. The deviation from anharmonicity is qualitatively explained as a consequence of a weak magneto-elastic effect in the low temperature phase.

Rajeev Gupta
Dept of Physics and Materials Science Programme, IIT Kanpur, India

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