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Influence of excitation frequency on A_1(LO) and E_2 Raman modes in In rich $In_{1-x}Ga_xN$ thin films AMBESH DIXIT, Wayne State University (Current IIT Rajasthan, India), J.S. THAKUR, R. NAIK, Wayne State University, V.M. NAIK, University of Michigan-Dearborn — MBE grown $In_{1-x}Ga_xN$ (x = 0, 0.1, 0.3 and 0.54) thin films with bandgap energies varying from 0.77 to 1.85 eV have been investigated using Raman spectroscopy with 1.58 and 2.41eV excitation energies. The carrier mobility for InN film is 900 $cm^2/V{\cdot}s$ and decreases with increasing x with its value being 20 $cm^2/V{\cdot}s$ for $In_{0.46}Ga_{0.54}N$. We observe a one-mode behavior of the A_1(LO) and E_2 modes. An enhancement in intensity of A_1(LO) and $2A_1$(LO) replica modes in $In_{1-x}Ga_xN$ films with bandgap energies close to the excitation energy is observed. For samples with $x > 0$, the A_1(LO) mode shows a higher intensity relative to E_2mode which indicates a resonant enhancement of the A_1(LO) mode due to Frölich interaction. We find that the energies of longitudinal optical modes (A_1(LO) and $2A_1$(LO)) vary nonlinearly, unlike the E_2 mode, with increasing Ga fraction. The width and asymmetry of the A_1(LO) band is higher for the lower excitation energy (1.58 eV). This is perhaps due to the structural disorder in the deeper regions of the films or due to the distribution of regions with different indium fractions. This may explain the lower carrier mobilities observed in $In_{1-x}Ga_xN$ films with higher values of x.

Ambesh Dixit
Wayne State University

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