

Investigating the optical modes of $\text{In}_x\text{Ga}_{1-x}\text{N}$ alloy and $\text{In}_{0.5}\text{Ga}_{0.5}\text{N}/\text{GaN}$ MQW in far-infrared reflectivity spectra

G.Mirjalili, R.Amraei

University of Yazd, Department of Physics
E-mail: Gmirjalili@yazduni.ac.ir

(Received:12/6/2005, received in revised form:17/12/2005)

Abstract: Optical properties of $\text{In}_x\text{Ga}_{1-x}\text{N}$ alloy and $\text{In}_{0.5}\text{Ga}_{0.5}\text{N}/\text{GaN}$ multi quantum wells have been investigated in the region of far infrared. Far-IR reflectivity spectra of $\text{In}_{0.5}\text{Ga}_{0.5}\text{N}/\text{GaN}$ multi quantum wells on GaAs substrate have been obtained by oblique incidence p- and s-polarization light using effective medium approximation. The spectra and the dielectric functions response give a good information about the phonon and plasmon contribution in doped MQW as well as the mole fraction of compounds in the alloys. The changes in position of optical modes are good tools for measurement of the amount of free carrier and the amount of mole fraction in the samples. During study of $\text{In}_x\text{Ga}_{1-x}\text{N}$ reflectivity spectra, two distinct reststrahl bands with frequency near those of pure InN and GaN were observed over entire composition range. Each band shifts to lower frequencies and decreases in amplitude as the concentration of corresponding compound in alloy decreased. Analysis of dielectric function gives the TO-like and LO-like mode frequencies. The changes in LO mode frequencies, due to coupling of phonon-plasmon, have been observed.

Keyword: $\text{In}_x\text{Ga}_{1-x}\text{N}/\text{GaN}$, MQW, Reflectivity Spectra, Far-Infrared, Optical Mode, Plasmon, Phonon, LO, TO.