Wavelength infrared study of GaAs-$Al_xGa_{1-x}As$ superlattices

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Abstract

Laser infrared radiation, having a wavelength between ultraviolet and visible, has a number of highly interesting applications in biological imaging, surface chemistry, and high-field condensed matter studies. Many materials have been the subject of investigation in the infrared. Interest has focused on wavelengths between (4, 20 μm) length required by the IR photodetectors and IR cameras but in recent years, the focus is increasingly on longer wavelengths required on space applications telecommunications, rapid detection and new opto-electronic devices. The interesting aspect of this work is the systematic study of the influence of correlated structural disorder on the transmission property and wavelenght of Dimer and Trimer Height Barrier Superlattices (DHBSL/THBSL). Ours system consists of a stack ultra fine layer of semiconductor which are alternated periodically, where the small gap material (GaAs) plays the well potential role, and the large gap material (AlGaAs) plays the barrier potential role.

For the dimer structure, the electron will emit on 11.02µm wavelength corresponding to jump 182meV, while the trimer structure electron will emit on three wavelengths (38.19µm, and 66.21µm 104.52µm) respectively corresponding to jump (50meV, 30meV and 20meV). We notice that this wavelength range matches to the range required by the infrared photodetectors (4 to 20µm), infrared cameras (8 to 12µm), fluid detectors and biological molecules detectors (60 to 200 µm).

We have observed from measurements of wavelength, that the introduction of correlated structural disorder by (Doublet, Triplet, Quadruplets, Quintuplets…) provides more wavelengths located above visible domain (far-infrared, microwave).

Keywords: superlattices (*SLs*), correlated structural disorder, transmission coefficient, Laser infrared wavelength (IR)