Journal of Physics: Conference Series **167** (2009) 012044 doi:10.1088/1742-6596/167/1/012044

Dependence on the growth direction of the strain in AlGaSb alloys

M Rojas-López[1], E Momox-Beristain[2], R Delgado-Macuil[1], V L Gayou[1] A Orduña-Díaz[1], B Salazar- Hernández[3], A G Rodríguez [4],

[1] *CIBA-Tlaxcala, IPN, Tlaxcala, Tlax. México*
[2] *FC-BUAP, Puebla, Pue. México*
[3] *CIICAp-UAEM, Cuernavaca, Mor. México*
[4] *IICO-UASLP, San Luis Potosí, S.L.P. México*

E-mail: marlonrl@yahoo.com.mx

Abstract. High resolution x-ray diffraction profiles were obtained from $Al_xGa_{1-x}Sb$ layers grown on (001) and (111) GaSb substrates. The out of plane lattice parameter, was estimated directly from the symmetrical diffractions for (001) and (111) alloys. These results show that all the layers are strained, and those grown on (001) GaSb are slightly more strained than the corresponding layers grown on (111) GaSb. This difference is explained by the dependence of the strain ratio on growth direction. The out of plane lattice parameter as a function of Al content is higher than the corresponding bulk lattice parameter of $Al_xGa_{1-x}Sb$ layers obtained with Vegard's law. Also, the perpendicular and the in-plane lattice parameter expected for pseudomorphic alloys, was estimated from the strain ratios, assuming an elastic deformation and using the EDX alloy composition to interpolate the elastic constants C_{ij}. This estimation also shows that almost all the layers are fully strained.

1. Introduction

$Al_xGa_{1-x}Sb$ compound is an important material for infrared, optical and high speed devices in the spectral region from 1.3 to 6.5 μm [1-2]. This material also has been used for low-noise and high-speed avalanche photodiodes [3], as well as injection lasers made of AlGaAsSb and GaInAsSb lattice matched to either GaSb or InAs substrates emitting in the wavelength range of 2-4 μm [4]. These devices have been fabricated primarily from layers grown by molecular beam epitaxy (MBE), liquid phase epitaxy (LPE) and by organometallic vapor phase epitaxy (OMVPE). However, the growth of AlSb-containing compounds by OMVPE presents some problems as the high level of carbon, a p-type impurity that is incorporated with methyl-based precursors and has hindered n-type doping [5]. For this reason, this material turns out to be interesting to the scientific community and it is by that it is required to investigate more about the properties of this kind of III-V semiconductor. In this work, it is performed an analysis of vibrational properties of the ternary $Al_xGa_{1-x}Sb$ alloy grown by LPE on GaSb substrates with (001) and (111) crystallographic orientation, using Raman spectroscopy. The out of plane and in-plane lattice parameters are determined by High Resolution X-ray Diffraction (HRXRD) for both (001) and (111) orientations.

