11th International Conference on Advanced Materials
Rio de Janeiro Brazil
September 20 - 25
ICAM2009

Changes in the optical response of GaSb grown over GaInAsSb films and GaSb substrates

J. J. Prías-Barragán*, L. Tirado-Mejía, J. F. Gómez, A. P. Cardona, M. de los Ríos, L. Torres, and H. Ariza-Calderón

Laboratorio de Optoelectrónica, Universidad del Quindío, e-mail: jjprias@uniquindio.edu.co
* Corresponding author.

Abstract – Undoped GaSb films were grown by liquid phase epitaxy technique over doped GaSb substrates and over GaInAsSb films, forming a heterostructure. The samples were characterized by mean optical absorption, photoluminescence and photoreflectance spectroscopies. We found changes in the optical absorption and the radiative emission of the homo and heterostructures configurations related with the growth conditions and interface effects.

Thermophotovoltaic cells (TPV) are devices with interesting applications in the alternative energies field. Plenty of attention has been given to these devices, being the AlGaSbAs/GaInAsSb/GaSb heterostructure one of their reported configurations for TPV based on GaSb [1,2]. Looking for new TPV designs we study in this work the optical response of GaSb over doped-GaSb commercial substrates, and over GaInAsSb epitaxial films grown over the same substrates. The growth of the homostructure and the heterostructure samples were accomplished in a conventional liquid phase epitaxy system with horizontal graphite boat and slider ruler.

The techniques used in the characterization of growth samples were optical absorption, photoluminescence (PL) and photorreflectance (PR). The optical absorption measurements were made in a Fourier Transform Infrared Spectrometer (FTIR) Shimatzu IR Prestige 21. Photoluminescence spectra were measured in a cryostat at 11 K, using as excitation source the 488 nm line of an Ar-ion Lexel 95 laser with an excitation power of 4 W/cm^2. The radiative emission of samples was analyzed through an SPEX 500M monochromator and detected with a thermoelectrically cooled GaInAs infrared Hamamatsu detector. Photoreflectance (PR) measurements were also carried out at low temperature by mean a cryostat system, and the modulation source was a He-Ne laser in the line 632.8 nm. The PR measurements were made in order to establish the band-gap of the samples.

GaSb substrates were also characterized in order to determine the differences in the optical response of crystalline and epitaxial films, in the homo- and heterostructures. The variations observed were related with the growth conditions and interface effects. In Figure 1 and Figure 2 we show the FTIR absorption and PL spectra respectively, for GaSb:Si single crystal and GaSb film grown over GaSb:Si. In these spectra there are observed two absorption edges associated to transitions involving conduction and valence bands.

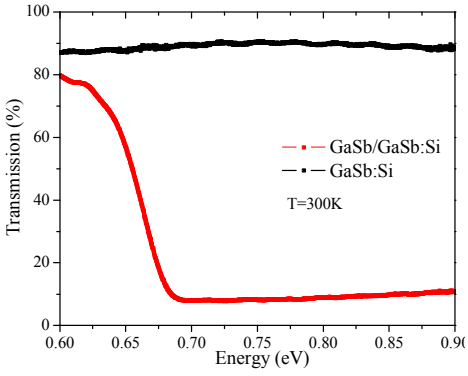

Figure 1: Transmission spectra in homostructure and single crystal at 300K.

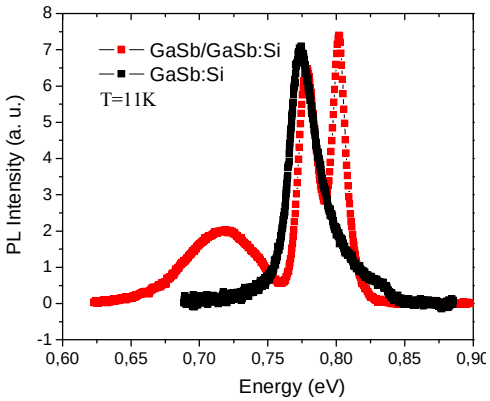

Figure 2: Photoluminiscence spectra in homostructure and single crystal at 300K.

References

[1] K. Qiu, A.C.S. Hayden, M.G. Mauk, O.V. Sulima. Generation of electricity using InGaAsSb and GaSb TPV cells in combustion-driven radiant sources Solar Energy Materials and Solar Cells, Volume 90, Issue 1, 6 January 2006, Pages 68-81.
[2] A. Amariei, E.K. Polychroniadis, F. Dimroth, A.W. Bett. Growth and structural characterization of GaInAsSb films on GaSb substrates. Journal of Crystal Growth, Volume 275, Issues 1-2, 15 February 2005, Pages e1229-e1234.