

QUANTUM WELLS PARAMETERS OF $In_{0,3}Ga_{0,7}As/GaAs$ VCSEL LASERS

A. Dorogan², V. Dorogan², A. Mereuta¹, A. Syrbu¹,
N. Syrbu², T. Vieru², V. Ursaki³, V. Zalamai³

¹Swiss Federal Institute of Technology in Lausanne, Lausanne, Switzerland

²Technical University of Moldova, Kishinev, Moldova

³Institute of Applied Physics, Academy of Sciences of Moldova, Kishinev, Moldova

E-mail: syrbunn@yahoo.com

Injection lasers based on quantum well (QW) and quantum dots (QD) heterostructures with a low value of threshold current density J_{th} with continuous emission regime and output power value of 3W have been manufactured [1]. VCSEL lasers based on $In_{0,3}Ga_{0,7}As/GaAs$ nanostructures are used in different optoelectronic systems and fiber optic communications systems.

The measurement of optical reflection and transmittance spectra had been carried out using MJP-2 and JASCO-670 spectrometers at 10K and 300K for S- and P-polarizations and different light angles incident to the surface of $In_{0,3}Ga_{0,7}As/GaAs$ heterostructure with quantum wells. The samples' cooling had been made in a optical cryogenic system of a locked cycle LTS-22-S-330 Workhorse. In the reflection spectra of $In_{0,3}Ga_{0,7}As/GaAs$ nanolayers the hh, lh1-e1(1s), hh1, lh1-e2(1s), hh2, lh2-e2(1s), and hh3, lh3-e3(1s) the transitions and particularities, conditioned by the quantum dots (QD) formed at the boundary of buffer layers and nanolayers, had been revealed. The valence zones of light and heavy holes in $In_{0,3}Ga_{0,7}As/GaAs$ heterostructures condition the appearance of electronic transitions hh1-e1 and lh1-e1, hh2-e2 and lh2-e2, which appear as doublet structures 1.1553eV - 1.1653eV etc (fig. 1).

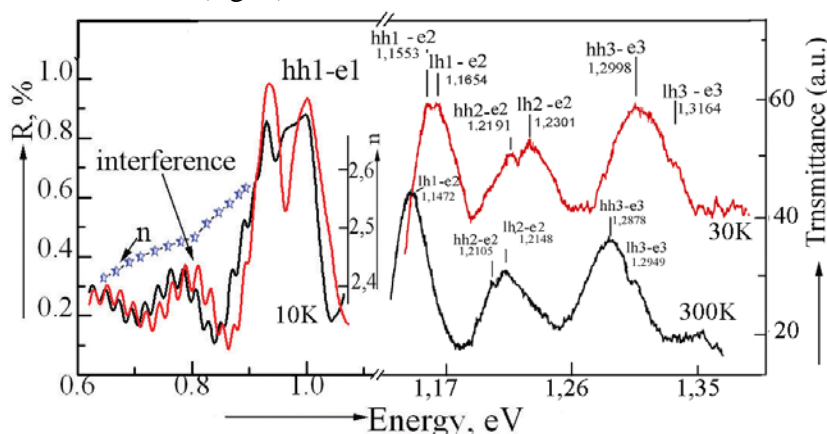


Fig. 1 Reflection and transmittance spectra of $In_{0,3}Ga_{0,7}As/GaAs$ heterostructures at 10K and 300K.

Thin maxima had been revealed in transmittance spectra of heterolayers, which are conditioned by the ground (1s) and excited (2s, 3s) states of excitonic transitions hh1-e1, lh1-e1 in QW. The 1s reflection lines' shape had been calculated for the single oscillator model. The oscillator force and the damping factor had been estimated for QW and QD transitions. The emission lifetime of the exciton in the QW is the same ($\tau_0 = (2\Gamma_0)^{-1} \approx 2 \cdot 10^{-12}$, $c = 5$ ps) for the studied sample. The interference of reflection spectra of $In_{0,3}Ga_{0,7}As/GaAs$ layers was revealed in the energy region $E < E(\text{hh1-e1})$, which gave the possibility to determine and calculate the layer's refractive index n .

Financial supports from IRSES PVICOKEST – 269167 and STCU # 5402 projects are acknowledged.

[1] N.N. Ledentsov, M. Grundmann, N. Kirstaedter, O. Schmidt, R. Heitz, J. Bohrer, D. Bimberg, V.M. Ustinov, V.A. Shchukin, P.S. Kop'ev, Zh.I. Alferov, S.S. Ruvimov, A.O. Kosogov, P. Werner, U. Richter, U. Gosele, J. Heydenreich. *Sol. St. Electron.*, **40**, 785 (1996).