DETERMINATION OF LATERAL INHOMOGENEITY OF THE CHEMICAL COMPOSITION PROFILE OF AlAs/GaAs DISTRIBUTED BRAGG REFLECTORS GROWN BY MBE ON (100)-ORIENTED GaAs SUBSTRATE

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Keywords: X-ray diffraction, MBE, Bragg mirrors

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A 15-pair AlAs/GaAs distributed Bragg reflector (DBR) was grown by molecular beam epitaxy (MBE) [1]. The GaAs/AlAs heterostructure was deposited on a (001)±0.5 oriented GaAs:Si wafer with diameter of 50.8 ± 0.4 mm and thickness of about 450 µm. Optical reflectance (OR) and high resolution X-ray diffraction (HRXRD) techniques were used for characterization of the DBR structure and verification of its intended parameters.

To determine the lateral inhomogeneity of the chemical composition profile of the investigated sample, series of rocking curve measurements in the vicinity of (004) GaAs reflection were performed using a Philips high-resolution diffractometer with CuKα_1 radiation and 4-reflection Bartels monochromator Ge(220). The measurements were made along two perpendicular diameters, starting from the edge, with the interval of 1 mm. For each experimental rocking curve a simulated one was fitted with X'Pert Epitaxy 3.0b program. In this way the GaAs and AlAs layer thickness as a function of the distance from the edge of the wafer was determined (Fig. 1).

It was found that there is a region in the central part of the wafer with constant thickness of AlAs and GaAs layers. This region occupies about 25% of the surface area. It was also determined that the thickness of both layers decreases with the increasing distance from the centre of the wafer surface.

This structural feature is confirmed by optical reflectivity measurement. In Fig. 2 it is seen that the reflectivity spectra are shifted relative to each other depending on the region of the wafer where the data were collected. A blue shift of the reflectivity spectra is observed with the increase of the distance from the centre of the sample to the point where the data had been collected.

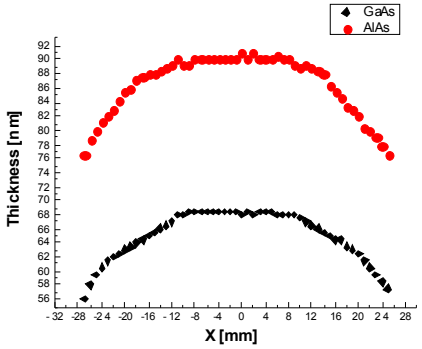

Figure 1. Thickness of the AlAs and GaAs periods for 15 pair AlAs/GaAs DBR as a function of the distance X from the centre of the sample.

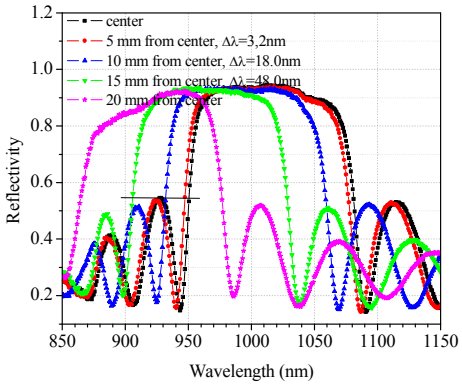

Figure 2. Reflectivity spectra for 15 pair AlAs/GaAs DBR measured as a function of the distance from the centre of the sample.

References

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