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Report:

A series of $In_{0.86}Ga_{0.14}As$ epitaxial layers with different thicknesses grown on the InP (001) substrates were investigated. The theoretical critical thickness of this heteroepitaxial system is h_c = 40 Å. The investigations of the structural properties were performed in the thickness range above and belove the critical thickness h_c. Nominal thicknesses of the epitaxial layers were: h_1 = 12 Å, h_2 = 16 Å, h_3 = 28 Å, h_4 = 40 Å, h_5 = 60 Å, and h_6 = 120 Å. The measurements were carried out for 004 symetrical reflection using the ROBL high resolution diffractometer with the radiation wavelenght λ = 1.196 Å.

The minimum detectable layer thickness turned out to be 28 Å. The best results obtained for the thickest epitaxial layer h_6 = 120 Å and are presented in Figs.1 and 2. The appearence of high order sideband reflections indicates the very good crystalline structure of the investigated epitaxial layer. From the angular sideband positions the layer thickness has been calculated to be h_6=152 Å.

The omega scan performed for the layer 004 reflection (Fig. 2) shows that the relaxation mechanism is due rather to the formation of misfit dislocations than to a ripple structure. The kinematical scattering component (the upper part of the figure) and the diffuse component with two lobes are clearly visible. The presented distribution of the diffusion scattering intensity indicates that the condition $\rho h < 1$ is fulfilled, where ρ is linear dislocations density.

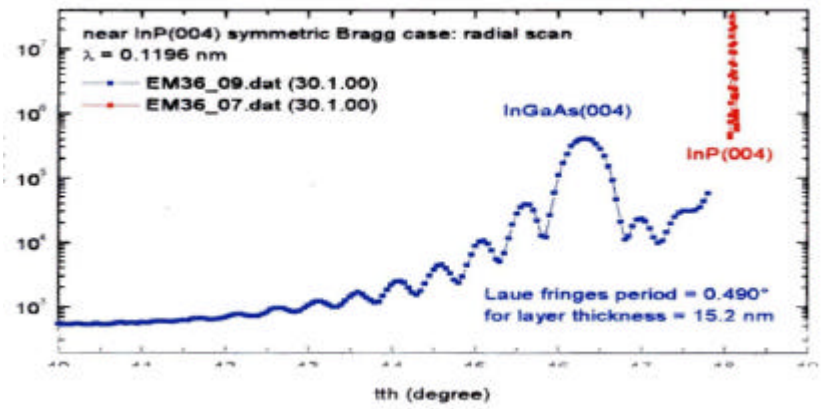

Fig.1. θ/2θ scan for the epitaxial layer of the nominal thickness h_6 =120 Å; 004 reflexion.

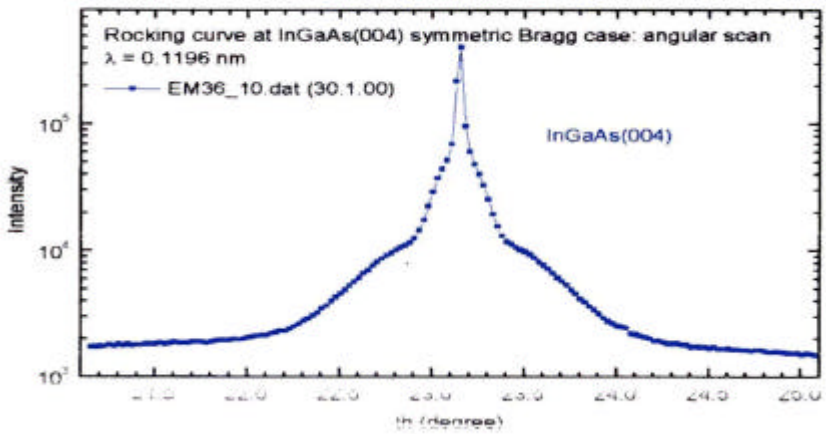

Fig.2. Omega scan for the epitaxial layer of nominal layer thickness h_6 = 120 Å; 004 reflection.

Further, the studies at a stepped surface formed on the 5° cutoff (in the 110 direction) 001 GaAs samples were performed. The investigation were performed by means of high angle diffractometry and reflectometry (specular and non specular case). All these methods did not reveal any effects due to the lateral structure. Only the non specular method showed the typical intensity oscillations for the unetched 5° cutoff 001 GaAs sample. The omega measurements were performed at different 2theta position close to the critical angle. The best results we obtained for counter position $2\theta = 1.0^o$. The lateral correlation length as determined from the angular distance between neighbouring intensity maxima amounts to 97.5nm.