HIGH-RESOLUTION RECIPROCAL SPACE MAPPING OF InGaAs/GaAs STRUCTURES: FROM PSEUDOMORPHIC TO FULLY RELAXED STATE

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The epitaxial structures are nowadays widely used in the numerous technologies. However, in opposite to the situation of the recent decades, the full coherence of the crystallographic lattice within the sample does not longer reflect the perfection of the designed structure. There are many applications, where the samples with partly or even fully relaxed epitaxial layers are intentionally designed to reach the specific effects. These are, for example, virtual substrates for MOSFET semiconductor devices, silicon on insulator structures, buffering layers in GaN technology, etc. The high-resolution X-ray diffraction is often an only method to characterize the complicated strain design of the mentioned systems. In turn, the reciprocal space mapping technique (RSM) is a very convenient tool for the reconstruction of the relaxation state within the multilayered systems, allowing the judgment on the relaxation degree of each particular layer of the structure. The description of the X-ray diffraction process is, however, not straightforward in this case [1], because of overlapping of the effects of the dynamical X-ray scattering, the lateral crystallographic mismatches, and the defects initiated by the relaxation process. Thus, the precise and accurate evaluation of the RSMs measured from non-pseudomorphic samples requires an extended analysis method.

The present studies on InGaAs/GaAs samples complement the recently reported investigations on GaN and SiGe structures [1]. The series of samples composed of $In_{0.06}Ga_{0.94}As$ layer of different thicknesses on GaAs[001] substrates have been grown using MBE. The symmetric and asymmetric RSMs were measured and simulated for the samples with the fully coherent layer, in the vicinity of the critical thickness of relaxation, and with the fully relaxed layer.

[1] A.I.Benediktovich, I.D.Feranchuk, and A.Ulyanenkov, X-ray dynamical diffraction from partly relaxed epitaxial structures, *Physical Review B* **80** (2009) 235315