ULTRA-FAST SIMULTANEOUS FITTING OF SEVERAL BRAGG REFLECTIONS FROM AlAs/GaAs SUPERLATTICES USING METHOD OF EIGENWAVES

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X-ray diffraction (XRD) and x-ray reflectometry (XRR) are well-established non-destructive techniques for determining thin layer thickness, crystallinity, composition and interface roughness. The reliability and accuracy of obtained information increases if several different measurements form the same sample are fitted simultaneously. The advantages of such a capability are the following: (i) by combining XRR, which is sensitive to the uppermost layer, with XRD, which is sensitive to the underlying structures, cap-layer thickness and superlattice structure analysis can be improved; (ii) the simultaneous fit of symmetric and asymmetric reflections allows comprehensive analysis of parameters parallel and perpendicular to the sample surface; (iii) in cases of AlAs/GaAs structures, simultaneous analysis of permitted 004 and quasi-forbidden 002 reflections profits from the increased AlAs contrast sensitivity.

The effective simultaneous fit of multiple data is possible only if the calculating procedures are fast enough. In the case of superlattices with large number of periods, the calculation time is essentially increasing because of large number of physical layers composing the sample. The method of eigenwaves [1], allows ultra-fast simulation of x-ray scattering processes (XRR and XRD) from regular superlattices, which considerably speeds up the entire fit procedure. In this report, the method of eigenwaves is used for simultaneous fit of different Bragg reflections from (AlAs/GaAs)\(_{20}\)/GaAs superlattice by software LEPTOS [2].
