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Report:

The aim of the experiment was the investigation of multilayered gratings by reciprocal space mapping employing the symmetrical and the asymmetrical diffraction geometry.

The diffractometer was used in the triple crystal diffractometer set-up

Behind the vertical double monochromator the set-up included a horizontal Si(111)-monochromator and a similar analyzer as well as slits to limit the extension of the analyzer streak.

In order to overcome the geometrical limitations of the diffractometer set-up for higher impuls transfer (larger angles), we mounted the analyser directly on the detector arm of the second goniometer. We adopted our macros to the new set-up in order to realize different triple crystal diffractometer modes in angular and reciprocal space.

Two superlattices, grown on misoriented substrates by MOVPE at the Phillips University of Marburg, have been investigated. Both have the same miscut angle of 2° but differ in the composition and thus in the lattice strain. We have studied the strain induces spontaneous periodic patterning forming a lateral grating. Therefore we have measured the diffracted intensity in the vicinity of the (002) and (004) reflection. For both samples we have found very different results. The (004)-map of one sample is shown in fig. 1.

It is characterized by a series of spots of diffuse scattering related to the lateral and the vertical periodicity in the grating. They are arranged along coherent so-called grating truncation rods. These truncation rods are inclined with respect to the [004] direction according to the substrate miscut angle. The spot pattern along

the different truncation rods give evidence for the vertical periodicity in the superlattice.

The high angular resolution of the experimental equipment and the source properties at ESRF allowed as to separate clearly the diffuse clouds of superlattice satellites from the tine lines of sharp coherent grating truncation rods. Thus within the superlattice we coud detect contributions of the lateral grating with different lateral elastic coherence of the patterning.

The origin of the different contribution is not clear until now. However it can be related with the asymmetric grating shape, since the diffuse clouds have different size right and left side of the central crystal truncation rod. This phenomena shall be investigated by a further experiment, employing the methods of grazing incidence diffraction and non-specular reflection. That will allow as to separate the contribution of the ***compositional*** grating from the ***strain modulation grating*** and gives also the possibility for depth selective measurements.