2nd European Symposium

X-Ray Topography and High Resolution Diffraction

PROGRAMME AND ABSTRACTS

Humboldt-University
and Max-Planck-Arbeitsgruppe "Röntgenbeugung"

Berlin, Germany, 5-7 September 1994
THE EXTINCTION LENGTH OF THE X-RAYS DIFFRACTED
BY THE ONE-DIMENSIONAL MODULATED STRUCTURES

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The X-ray and the extreme ultraviolet radiation diffraction by the periodic one-dimensional modulated multilayer interference structures (MIS) is considered. In the case of the perfect semi-infinite MIS there exists a maximum number $n_{ext}$ of the layers, effectively reflecting in the diffraction region of the incidence angles. This number is defined by the condition $n_{ext} \leq L_{ext}/d$, where $L_{ext}$ is the extinction length and $d$ is the space period of the MIS. If the angle of incidence $\theta$ is far from the diffraction angular region, then depending on $\theta$ for the real absorbing MIS there exists a finite maximum number $n(\theta)$ of the structure layers, which are interacting with the incident wave field. This number is defined by the condition $n(\theta) \leq L(\theta)/d$, where $L(\theta)$ is depth of penetration.

The parameter $n(\theta)$ may be changed by the corresponding selection of the materials, as well as of the relations between the layer thicknesses in the one period of the MIS (e.g. see [1, 2]). By this the reflection coefficient $R \approx 1$, if the condition $N \leq n_{ext} << n(\theta)$ is fulfilled, where $N$ is the real MIS layers' whole quantity. In particular the MIS reflectivity is increasing while the $L_{ext}$ is decreasing. In view of this in the paper it is investigated the extinction length $L_{ext}$ of the one-dimensional modulated MIS. It is shown in particular, that even in the case of the perfect transparent MIS with the periodic one-dimensional modulated polarizability (the case with cosine-like polarizability is considered in [3]) the angle of incidence, which is corresponding to the extinction length, does not coincide with the middle of the angular region of the unstable solutions.

X-RAY SPECULAR STANDING WAVE

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In the case of Laue geometry of diffraction and the backscattering from the single crystals and the high quality multilayer interference structures (MIS) the diffraction angles of incidence corresponds to the region of the total external reflection. One of the two waves reflected from the structure surface is well-known as a specular (mirror) reflected wave, and the other one is the plane wave reflected from the structure in the opposite direction of the incident wave (specular backscattered wave, see [1, 2]). In consequence of the interference of these two specular waves is forming a specular standing wave (SSW) directly over the structure surface with the same space period as for the set of reflecting lattice planes. The dispositions of the SSW crests and nodal points along the structure surface are depending on angle of incidence and the Bragg angle. One may determine the dispositions and the length of the chemical bond of the foreign atoms, adsorbed on the pure structure surface, by measuring the secondary radiation and shifting SSW along the structure surface. Moreover, one may obtain the impurity atoms two-dimensional disposition pattern by combining of this method with the ordinary one in which the distances are measured in the case of the Bragg geometry of diffraction from the other set of the net planes of the same structure.