11.7-12 CONTROL OF ANOMALOUS NEUTRON TRANSMISSION BY ULTRASONIC VIBRATIONS. By B. Chalupa, R. Michalec and P. Mikula, Nuclear Physics Institute, Czechoslovak Academy of Sciences, 250 68 Rež near Prague, Czechoslovakia.

One of the most important phenomena following from the dynamical diffraction theory is the effect of anomalous transmission (AT) of radiation (X-rays, neutrons) through absorbing perfect crystals. The above displayed figure represents the experimentally measured transmission curves for a nonvibrating crystal (Tn) and for the same crystal vibrating at a frequency of 2.26 MHz (Tv), excited into vibrations by means of piezoceramic BaTiO3. The restoration of the AT effect depends on the vibration amplitude and as such may be easily controlled.

11.7-13 EXTINCTION IN NEUTRON DIFFRACTION. A QUANTUM MECHANICAL TREATMENT. By J. Kulda, Nuclear Physics Institute, Czechoslovak Academy of Sciences, 250 68 Rež near Prague, Czechoslovakia.

Recently we have studied the influence of mechanical resonance vibrations on AT of neutrons in a perfect TiB2 single crystal having the thickness t equal to 10 mm (μ=0.02×10⁻² m⁻¹ y - linear absorption coefficient). A double crystal (1,-1) arrangement was employed using the neutron of 0.116 nm wavelength, reflected by (220) planes. The FWHM of the double-crystal rocking curve was 1.8 seconds of arc.
11. REAL AND IDEAL CRYSTALS

Extinction in real crystals is understood as the violation of the kinematic relation

\[ \Phi = \lambda^2 \left( \frac{4}{3} \pi \rho \tan \theta \sin \theta \right) = Q \cdot V \]  

(2)

between the integrated reflecting power and crystal volume. This can occur in two ways:

A - proportionality between \( \Phi \) and \( V \) is conserved, but with a different constant \( \rho \ectar Q; \) this effect, being independent of the total crystal volume, is to be attributed to interference of coherent waves scattered by neighboring atoms.

B - gradual saturation of (2) starts above some value \( V \), being caused by multiple reflections on equiangular crystallites. As a consequence of the statistical nature of the mosaic structure a sufficiently long beam path in the crystal is necessary to provide appreciable probability of this effect; the small neutron coherence length (\( \sim 3 \text{nm} \)) in usual experiments implies the incoherent nature of this process.

Based on this argumentation the following improvement of the existing extinction theory is proposed: The primary extinction should be identified with the \( A \) mechanism and described by a mean value of the reflectivity \( P(\theta) \) given by eq.(1). The conventional treatment (Becker and Coppens, Acts Cryst. A10(1974)129) based on the intensity-coupling equations with accordingly modified coefficients should be used for secondary extinction (B) only, where its use seems fully justified from the physical point of view.

11.7-14 X-RAY DIFFRACTION IN MULTILAYER CRYSTALS (MLC). By A.V.Kolpakov, Department of Physics, Moscow State University, Moscow, USSR.

In the report are discussed possibilities of MLC-investigations by X-ray diffraction and offered a critical analysis of the appropriate theoretical and experimental results. The relevant MLC-structures are: heteroepitaxial films, heterojunctions, superlattices, ion implanted surface layers (see e.g.: Khapachev Yu.P. et al. Kristallografija, 1977, 22, 437; Khapachev Yu.P. et al. ibid., 1979, 24, 430; Afanasev A.M. et al. phys. stat. sol. a, 1977, 42, 415; Belyaev Yu.N., Kolpakov A.V. ibid., 1983, 76, 641). We report about formulation \( \tilde{\Phi}(\theta) \) of the inverse problem of the X-ray diffraction, we have determined the film thickness, lattice parameter distortion and components concentration from the entrance surface X-ray diffraction data. We discuss the internal stress influence too.

11.7-15 THE RECONSTRUCTION OF THE MULTILAYER CRYSTAL (MLC) STRUCTURE FROM X-RAY DATA AS AN INVERSE PROBLEM (IP). By A.V. Goncharskii and A.V.Kolpakov, Department of Physics, Moscow State University, Moscow, USSR.

The X-ray diffraction direct problems (DP) have been analytically treated for some simple models, which describe onedimensional lattice constant variations in some important practical point of view objects as heteroepitaxial thin films, heterojunctions, superlattices and ion implanted surface layers (see e.g.: Khucchini F.N. Metallofizika, 1981, 3, No 5, 3; Khapachev Yu.P. et al. Kristallografija, 1977, 22, 437; Khapachev Yu.P. et al. ibid., 1979, 24, 430; Afanasev A.M. et al. phys. stat. sol. a, 1977, 42, 415; Belyaev Yu.N., Kolpakov A.V. ibid., 1983, 76, 641).

We report about formulation IP of the reconstruction MLC-structure from X-ray diffraction data. This formulation is based on the DP solution \( \tilde{\Phi}(\theta) \) - input information parameters. The theoretical spectrum \( \Phi(\theta) \) is a convolution integral of the DP solution \( \Phi(\theta) \) and the apparatus function \( K(\theta) \), which is a priori known or may be defined from IP-solution. We take as an example the symmetrical Bragg diffraction in a crystal plate, which has a finite thickness. The crystal lattice has a linear onedimensional lattice constant variation. Further we make use of the recently received analytical solution this problem (Kolpakov A.V., Punegov V.I.) to be published).

We introduce and analyse the random value \( \delta(\theta) \). The dimensionality of the vector \( \delta \) equals of the MLC-parameters number (i.e. thickness \( E \)...