11.7-07 THE X-RAY DYNAMICAL DIFFRACTION PROCESS INSIDE A DISTORTED CRYSTAL. By S. Takagi, K. Ishida and S. Tomizawa, Faculty of Science and Technology, Science University of Tokyo, Noda, 278, Japan.

The dynamical diffraction process inside a distorted as well as a perfect crystal can be described by a set of partial differential equations developed by one of the authors (S.T.). Several kinds of solution to these equations have been developed among which the direct numerical integration method is the most convenient, and has been widely used to simulate the contrast of X-ray diffraction topographs of various kinds of defects inside a nearly perfect crystal. With this method, one has only to put in the boundary conditions comprising the condition of incidence and the strain distribution inside the crystal and one gets the simulation of the image, but the computer tells us nothing about what is happening inside the crystal.
The perturbation approach, i.e. the solution by successive approximation of the equivalent integral equations, has been developed by the same author. This method provides explanation of the diffraction process by the scattering at the defects and the ordinary dynamic progression inside a perfect portion. The explanation is in terms of direct space. That in terms of reciprocal space i.e. of tie points and dispersion surfaces is also available, though this becomes less useful when the strain exceeds a certain limit where the refraction theory of Penning and Polder type fails.
The image contrast of some kinds of typical strain distribution around a one-dimentional defect has been obtained by the perturbation approach. This will be particularly useful in identifying the nature of defects from the contrast of their images in X-ray topographs.

11.7-08 A NEW METHOD FOR DETERMINING CRYSTAL STRUCTURE FACTORS. By T. Saka, S. Samata and N. Kato, Faculty of Engineering, Nagoya University, Chikusa-ku, Nagoya, Japan.

The Pendellösung oscillation of the integrated intensity could be observed in a set-up of white X-ray diffractometry, by rotating a plane-parallel crystal around the scattering vector (ϕ-scanning). The effective crystal thickness is changed as $t = t_0/\cos\phi$, t_0 being the thickness of the crystal. The dynamical theory (Waller integral) gives F-values, accurately and straightforwardly. The advantages of this method are as follows:

1. Only a small part of the crystal ($\lesssim 1$ mm^3) is effective in diffraction. The systematic errors due to inhomogeneity in crystal perfection and the crystal shape can be reduced.
2. A few higher order reflections can be observed separately and simultaneously.
3. The data for a wide range of wavelength (0.3 $\sim$ 3 Å) are available.
4. The geometry involved is very simple.

The experimental set-up consists of RU1500 X-ray generator, a circular hole collimator (angular divergence $\sim$ 10'), 4-circle automatic diffractometer, Ge SSD and a micro-computor processor. The studies on Si (t_0 = 0.4 mm $\sim$ 2 mm) are in progress. So far, the internal consistency in F-values is of the order of 0.5 %. One can expect the improvement by elaborating the experimental procedures and the data processing.

11.7-09 ON THE ROLE OF THE ENTRANCE SLIT AS AN INCOHERENT SOURCE IN THE SECTION TOPOGRAPHY OF SINGLE CRYSTALS. By V.V. Aristov (a), V.G. Kohn (b), V.I. Polovinkina (a) and A.A. Snigirev (a): (a) Institute of Solid State Physics, Academy of Sciences of the USSR, Chernogolovka, Moscow district, 142432, USSR; (b) I.V. Kurchatov Institute of Atomic Energy, Moscow 123182, USSR.

In the section topography of perfect crystals a source of the spherical wave is obtained by a narrow slit placed in front of the crystal whereas the real X-ray source is situated at a distance of several tens of centimetres. The influence of the radiation non-monochromaticity was excluded either by selecting special geometry of experiment or through the preliminary monochromatization. The interference pattern then strongly depends on the relation between the "source-film" distance and the crystal thickness.

In the present paper the role of the radiation non-monochromaticity as well as of the source dimensions in the section topography was analyzed. It is shown that under conventional conditions of the experiment when the radiation is non-monochromatic and the film is placed directly behind the crystal, the slit ahead of the crystal actually plays the role of an incoherent source. The diffraction pattern does not depend in this case on the distance between the source and the crystal. A new type of the interference pattern arising as a result of the increase in the slit dimensions was revealed experimentally. Experimental results agree well with the calculated ones.

11.7-10 THE DIFFRACTION FOCUSING OF X-RAYS BY A PERFECT CRYSTAL. By V.V. Aristov (a), I. Ishikawa (b), S. Kikuta (b), and V.I. Polovinkina (a), Institute of Solid State Physics, Academy of Sciences of the USSR, Chernogolovka, Moscow District, 142432, USSR (a) and Tokyo University, Tokyo, Japan (b).

Recently discovered diffraction focusing of the X-ray spherical wave by a perfect crystal (A.M. Afanas'ev & V. G. Kohn, Fiz. Tverd. Tela (1977) 19, 1775; V.V. Aristov, V.I. Polovinkina, I.M. Shmyt'ko & E.V. Shulakov, Pis'ma Zh. Eksp. Teor. Fiz. (1978) 28, 4; V.V. Aristov, V.I. Polovinkina, A.M. Afanas'ev & V.G. Kohn, Acta Cryst. (1980) A36, 1002) offers good prospects for developing X-ray optical systems and new methods of studying crystals. The first experimental studies have shown that a point monochromatic source of radiation should be used to realize successfully the effect of focusing.

In the present paper a new experimental scheme is proposed in which the problem of producing the monochromatic spherical wave is solved. In this scheme, even when the "crystal-film" distance was short and the "source-crystal" distance long, all the interference effects (focusing, anomalous and classical Pendellösung-effect) peculiar to the X-ray spherical wave diffraction were observed to a high degree of resolution.

The experiment was carried out in Tokyo University with the use of an RU-1000 X-ray source.