PS15.01.19 A PHENOMENOLOGICAL MODELLING FOR THE ASYMMETRIC INTENSITY PROFILES OF SPATIALLY OSCILLATING X-RAY MOIRÉ FRINGES.

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It has been shown that X-ray moiré fringes are not exactly a projected image from a crystal, but oscillate spatially on the beam paths out of the crystal.[1,2] This oscillation results from such changes of fringe profiles as (a) the change in the shape asymmetry of profiles, (b) shift of the basal positions of profiles, and (c)-(e) changes in the width, peak height, and subpeak structure of profiles.[2] As a simple model for such changing fringe profiles, we propose the following sawtooth-wave expression

$$I(Y)=\frac{1}{2}b\frac{bl^2}{a(l-a)}\left(\frac{1}{\pi}\right)^2\sum_{n=1}\left(\frac{1}{n}\right)^2\sin\frac{n\pi a}{l}\sin\frac{2n\pi}{l}\left(Y+\frac{1}{4}l+\frac{1}{2}s\right) \quad (1a)$$

$$a=a_o+a_v\sin\frac{2\pi}{d}\left(X+X_o\right). \quad (1b)$$

Here, $I(Y)$ gives the wavefield intensity, l is the fringe period, and a, b and s are parameters giving the amplitude and wave positions of this intensty oscillation; a_V and d are the amplitude and period of the spatial oscillation of fringes along the X axis; eqs.(1a) and (1b) are written, for example, for fringe profiles viewed in the image plane (X, Y) of moiré topographs. This model reproduces the profile changes (a) and (b) above in a consistent and correlated manner (Fig. 1), basically in agreement with the actual profile change. The model seems to provide a good base for the fuller discussion of this incomprehensible profile change. Furthermore, the occurrence of asymmetric profiles requires higher harmonic components of the intensity oscillation, plus the fundamental one, since an asymmetric profile cannot be synthesized by any superposition of only symmetric waves with the same frequency. This implies that the wavefield of moiré fringes in space has some anharmonicity.

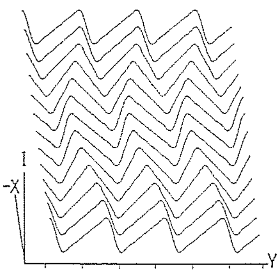

Fig.1 Simulated fringe profiles

References: 1) Yoshimura, J. (1989). *J. Phys. Soc. Jpn.* **58**, 1283. 2) Yoshimura, J. *Acta Cryst.* A**52**, to be published.

PR15.01.20 ANALYSIS OF SINGLE CRYSTAL DIFFRACTION PROFILES, THEORY AND EXPERIMENTS.

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Diffraction profiles contain information on real crystal properties such as the angular and the radial mosaic spread. Furthermore, the knowledge of theoretically calculated profiles permits a better handling of measured weak reflections and the correction of systematic errors within collected data sets.

The calculation of reflection profiles from single crystals is successful only at knowledge of several experimental components. The most important components, which influence the line profile shape, are the spectral and intensity distribution of the virtual focus from the incident radiation [1], the shape and absorption of the crystal polyhedron [2], the mosaic block distribution and TDS [3].

Experimental procedures and the theoretical background for the determination of these quantities are presented and discussed. Furthermore a model for the mosaic block distributions from single crystals and the theoretical calculations are presented, which agree very good with experimentally determined data.

[1]Lange, J.: Analysis of reflection profiles. ECM-16 Abstracts (1995), 160.

[2]Zimmermann, S., Lange, J., Burzlaff, H.: Zur Vermessung von Einkristallpolyedern mit Hilfe einer CCD-Kamera, Z. Krist., Suppl. No. 9 (1995), p. 388.

[3]Rouse, K. D., Cooper, M. J.: The Correction of Measured Integrated Bragg Intensities for Anisotropic Thermal Diffuse Scattering, Acta Cryst. A**25** (1969) 615621.

PR15.01.21 X-RAY ANGULAR SCANNER AND ITS APPLICATION TO X-RAY IMAGING.

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On the basis of multilayer mirror with angular region of 0.5° at CuK$_\alpha$ radiation the programmable scanner is developed. The azimuthal-elevation mirror mounting with the polar axis along incident beam enables to scan in a cone of 1°×1° width. During the azimuthal motion of the mirror the grazing angle of the incident beam lies in the region 0.5°-1.1° and is a constant value. At this condition the average reflection efficiency of the mirror is about 30%. Two stepping motors with gears provide the accuracy of beam positioning of 1 arc.sec along elevation coordinate and 1 arc.min along azimuth coordinate. The software allows both random access to a given point and arbitrary law scanning. As a demonstration of the scanner capabilities the prototype of X-ray raster scanning microscope was developed and tested. The spatial resolution in this experiment was limited by the divergence of a narrow X-ray beam and was measured to be about 20 μm in object plane. No focusing elements were applied. The images are formed by computer processing of the detector signal registered in each image pixel. At the figure is shown the image of a copper grid with a mesh of 110μm. The contrast of opened parts of the 50μm wires is less then the contrast of the knots because of the partial transparency of the wires. Total number of image elements is 80×80, four contrast levels.