tions to the I_D by comparing the XRDS intensity at equivalent points in reciprocal space. On the contrary, scattering contributions due to static displacements of the atoms were neglected, since they were evaluated as being on the order of a few 0.1% of the measured intensity.
As a result, the I_{CW} data were well fitted by the monotonic Von Laue scattering function $I_{CW}=(f_{Ga}-f_{Al})^2 x(1-x)$ with f_{Ga} and f_{Al} as scattering factors of Ga and Al atoms, respectively. This result shows that Ga and Al atoms, in LPE GaAlAs crystals, are distributed in the cation FCC sublattice in a completely random way. Moreover, the possibility of using XRDS experiments to investigate the atomic arrangement within the substituted sub-lattice in III-V solid solutions has been demonstrated. Recent investigations of phase separation and clustering criteria (see e.g. Stringfellow G.B., J. Electronic Materials 11, 903 (1982)) indicate that XRDS investigations on pseudobinary alloy semiconductors, such as InGaAs and InGaAsP, can be of great interest.

11.5–6 DEFECT STRUCTURE OF DEUTERIUM IN NIOBIUM - A NEW NEUTRON SCATTERING STUDY. By H. Dosch, J. Peisl, Sektion Physik, Universität München, Germany; E. Burkel, Cornell University, Ithaca, N.Y. 14853, USA; B. Dorner ILL, Grenoble, France.

Detailed information on the location of deuterium, the long ranged displacement field and the local atomic distortions of the niobium lattice is deduced from measurements of the coherent elastic diffuse neutron scattering intensity distribution. Huang diffuse scattering (measured with D 10 of the ILL) confirms the cubic symmetry of the long ranging displacement field and the elastic force dipole tensor $P_{ij} = \delta_{ij}(3.32 \pm 0.05)$ eV.
The asymmetry of the scattering distribution leads to a location on tetrahedral sites. The scattering at large Q far away from Bragg reflections, the so-called "Zwischenreflex" - scattering (measured with IN2 of the ILL), cannot be explained by the model deduced from Huang diffuse scattering results. Model calculations which can explain both lead to a local defect structure, where lattice relaxation effects due to the rapid motion of deuterium in the lattice have to be taken into account. This also supplies an explanation for the cubic symmetry of the long ranged displacement field of a defect on tetrahedral sites.

11.6–1 X-RAY POLARIZATION BY BRAGG DIFFRACTION FROM BENT AND FLAT CRYSTALS. By J. Zahrt, Chemistry Dept., Northern Arizona University, Flagstaff, AZ 86011, USA

Recently much attention has been given to the utilization of polarized X-rays in X-ray fluorescence spectrometers (R. Ryon, et.al., Adv. in X-Ray Anal., 25, 63 (1982)). The introduction of the extra scattering event to polarize the beam decreases the intensity. 90° scattering from the interior of a cylinder wall increases the intensity by utilizing a manifold of beams. This paper concerns itself with the development of a phenomenological theory, based on the mosaic model, to serve as a guide to developing better X-ray optics for Bragg scattered polarized X-ray spectrometers. The improved efficiency of the bent crystal (Johann) over the flat crystal has two sources. One is purely geometric and depends on the collimator(s) length ℓ, and radius τ, the radius of the Rowland circle R, and the displacement of the isotropic source from the Rowland circle e. The other source of improvement arises from the mosaic block size t, and from the mosaic distribution function here assumed to be Gaussian with standard deviation of $\eta/\sqrt{2}$. In the approximation of negligible true absorption and 1° and 2° extinction the theoretical results depend only upon geometry.

For Cu Kα diffraction from Cu(113) and ℓ=1cm, e=0.88cm, R=1.5cm and τ=0.15cm the reported efficiency ratio is bent/flat~3 (P. Wobrauschek, personal comm.). Using these parameters and t and η equal to 0.0001cm and 0.001 rad (flat) and 0.00005cm and 0.002 rad (bent) I calculate the ratio to be 3.3. Taking the t's 20 times larger and the η's 2 times larger gives 4.2. Taking ℓ=e=0 and the first set of crystal parameters gives 6.9.

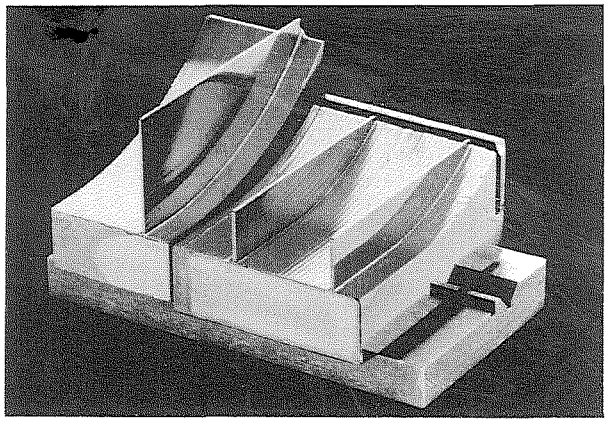
I hope these results will be an aid in the construction of better spectrometers and encourage the determination of the mosaic parameters.

11.6–2 A TWO-CRYSTAL X-RAY INTERFEROMETER OF DIFFERENT SILICON MATERIALS. By P. Becker, Physikalisch-Technische Bundesanstalt, Braunschweig, Federal Republic of Germany.

It has been shown that an X-ray interferometer consisting of two crystals cut from different silicon materials can be successfully operated. Experiments of this kind are of particular interest if lattice spacings of different crystals are to be measured on the meter scale, or if more space in the interfering beam paths is needed. Each of the two crystals shown in the figure belongs to a complete Laue-case interferometer tested separately in order to measure the homogeneity of the crystal lattice. The first crystal, bearing both the beam splitter S and the mirror M, was part of the scanning X-ray interferometer used for the absolute determination of the (220) lattice plane spacing (Becker, Dorenwendt, Ebeling, Lauer, Lucas, Probst, Rademacher, Reim, Seyfried, Siegert, Phys. Rev. Lett. (1981) 46, 1540). The second crystal with the analyzer A belongs to an interferometer cut in a similar way for the same purpose. The relative difference in the Bragg-plane spacings of the two silicon materials was about $(3 \pm 7) \times 10^{-8}$, measured by crystal-to-crystal comparison experiments (Becker, Seyfried, Siegert, Z. Phys. (1982) B 48, 17).

The geometrical deviations of the interferometer from the ideal shape caused by the manufacturing process are thoroughly investigated. In order to align the lattice planes of the two crystals parallel to one another by light optical means, the crystal surfaces are polished to form optical mirrors. Spacing marks are etched on the mirrors in order to realize equal distances between the three lamellas, S, M and A, by use of an optical length measuring device. Only a low interference contrast of ≈0.05 was observed in the outgoing beams. The reason for this is mainly the difference in thickness of more than 100 μm between the beam splitter S and the analyzer A.

Figure : Two crystal X-ray interferometer, crystal parts cut from different silicon materials.



11.6–3 FRAUNHOFER DIFFRACTION OF DYNAMICALLY DIFFRACTED BEAMS IN DISTORTED CRYSTALS. By C. Malgrange, Laboratoire de Minéralogie-Cristallographie, Université Pierre et Marie Curie, Paris, France and J. Gronkowski, University of Experimental Physics, Varsaw, Poland.

Diffraction by a slit is a well-solved problem in classical optics where homogeneous media are considered. An incident plane-wave of wavelength λ going through a slit of width e, gives, over a distance of the order λ^2/e, a beam of constant width e, slightly perturbed by Fresnel diffraction. At larger distances, the beam diverges with a Fraunhofer angular half width equal to λ/e.
It has been shown (A.Authier, C.Malgrange, C.R. Acad.Sc. Paris, (1966), 262, 429) that for an X-ray plane wave at Bragg incidence on a perfect crystal, the same phenomena occur but with a magnification of the order of Λ/λ (Λ means the extinction distance) resulting from the angular magnification in the crystal. Consequently, the distance at which the beam diverges is then of the order of e^2/Λ.
The aim of this work is to show how diffraction acts on the propagation of an X-Ray beam at Bragg incidence in a slightly distorted crystal. Computer experiments have been performed using Takagi's equations in the Bragg case and for a constant strain gradient. The results obtained for various values of the departure from exact Bragg incidence, the strain gradient and the slit width can be interpreted by extending to distorted media the following argument working in media of constant refraction index : Fraunhofer diffraction occurs at distances from the slit at least equal to the distance at which the Fraunhofer image is wider than the width of the slit.

11.6–4 X-RAY DIFFRACTION IN A FINITE CRYSTAL WITH A LINEAR LATTICE PERIOD VARIATION. By A.V.Kolpakov and V.I.Punegov, Department of Physics, Moscow State University, Moscow, USSR.

In (*) (Chukhovskii F.N. et al. Acta Cryst., 1978, A34, 610) a dynamical theory of X-ray diffraction in a semi-infinite crystal with a constant deformation gradient has been presented. A kinematical theory for thin crystals with a linear onedimentional lattice constant variation has been developed in (**) (Kolpakov A.V. et al. Kristallografija, 1977, 22, 473). The present report discusses a dynamical diffraction in a crystal of finite thickness with a linear change in the interplanar spacing. For this case the amplitude of Bragg reflection R (the notations see in (*)) is:

$$R(z=0)=\frac{\pi\kappa^2 P e^{-i\frac{\pi}{4}}}{|\gamma_0|\lambda(\sin\theta_B)^{\frac{1}{2}}}\frac{D_{-\nu-1}(-x_1)D_{\nu-1}(x_0)-D_{\nu-1}(x_1)D_{-\nu-1}(-x_0)}{D_{-\nu-1}(-x_1)D_{-\nu}(x_0)+D_{\nu-1}(x_1)D_{\nu}(-x_0)}$$

where D_j - Weber's function of the j-th order

The results for a thin or semi-infinit crystal follow from this general solution. We interpret the results by analogy with Fresnel construction (**). In particular, it is shown, that the diffraction in finite and semi-infinite crystal with linear lattice period variation to be similar to Fresnel diffraction at the slit and screen edge, respectively. The intensity maxima of the one-sided oscillation profile of the reflection curve for a semi-infinite crystal correspond to the Bragg conditions for odd Fresnel layers in the crystal. For the practical purposes we have been developed a good convergent approximation.

11.7–1 DIFFRACTION OF THERMALLY SCATTERED X-RAYS IN CRYSTALS. By Y. Kashiwase and Y. Kainuma, College of General Education, Nagoya University, Chikusa-ku, Nagoya 464, Japan.

The aim of this paper is to review our recent experimental studies on the diffraction pattern formed by the thermal diffuse scattering (TDS) reflected secondarily by the net planes in a crystal which has been predicted theoretically by one of the present authors (Kainuma,J. phys. Soc.(1961)16,228). The patterns were observed in the Bragg arrangement by the present authors on the Laue photograph of a urea nitrate crystal (Kashiwase,Kainuma and Minoura, J.Phys.Soc. Jpn.(1981)50,2793) and pyrolytic graphite crystals (Kashiwase,Kainuma and Minoura, Jpn.J. Appl.Phys. (1982)21,L34. Acta Cryst.(1982)A38, 390). The patterns consisted of a defect line across the 002 diffuse spot and an excess line across the diffuse background around the incident beam spot. On the other hand, an excess line in place of defect line was found across the 200 diffuse spot on Laue photograph of a calcite crystal in the Bragg arrangement (Kashiwase and Kainuma, J.Phys.Soc.Jpn. (1982) 51,2379). Strong excess lines were also observed across the 111 diffuse spot in the Bragg arrangement and across the 220 diffuse spot in the Laue arrangement on Laue a photograph of a germanium crystal (Kashiwase and Kainuma, delivered at the Meeting of the Phys.Soc.Jpn. held at Yokohama National University (1982) to be published). The crystals given above are classified into two groups. The former crystals are relatively imperfect. TDS related to the defect line is very strong owing to their