11.1-06 OBSERVATION OF CHIRALITY DOMAINS IN TERBIUM BY POLARIZED NEUTRON DIFFRACTION TOPOGRAPHY.

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Terbium has an antiferromagnetic helical phase in the temperature range $T_c = 219 - T_N = 226$ K ; the magnetic moments then lie normal to the sixfold $\vec{c}$ axis , are ferromagnetically aligned in basal planes and rotate by about 19° between successive Tb sheets. The rotation can be right-handed or left-handed, leading to the possibility of two kinds of spiral-spin or chirality domains. These domains have been invoked to explain anomalies in susceptibility measurements (Del Moral and Lee, J.Phys.F, 4, 280 (1974)) or ultrasound attenuation (Palmer, J.Phys.F., 5, 2370 (1975)), and some evidence for their actual existence was given by polarized neutron diffraction measurements (Felcher and al, J. de Phys. 32, C 1 - 577 (1971)). We have carried out the first observation of chirality domains, using a good quality (10$\bar{1}$0) single crystal of terbium (grown at the Centre for Materials Science, Birmingham), by polarized neutron topography. Different domain structures are observed depending on the thermal history of the sample. When it is warmed from the ferromagnetic phase, one observes stripe domains elongated perpendicular to the helical axis, about 0.15 mm wide. Cooling the sample from the paramagnetic phase produces walls of rather irregular shapes, the domain structure being reproducible in successive coolings. This suggests that the wall locations could be related to crystal defects when cooling through T_N, while the more regular arrangement we obtain when warming through T_c could be associated with the ferromagnetic domain structure of the low temperature phase.

11.1-07 NEUTRON DIFFRACTION TOPOGRAPHIC INVESTIGATION OF THE ELECTRIC FIELD RELATED EXTINCTION REDUCTION IN α-$LiIO_3$.

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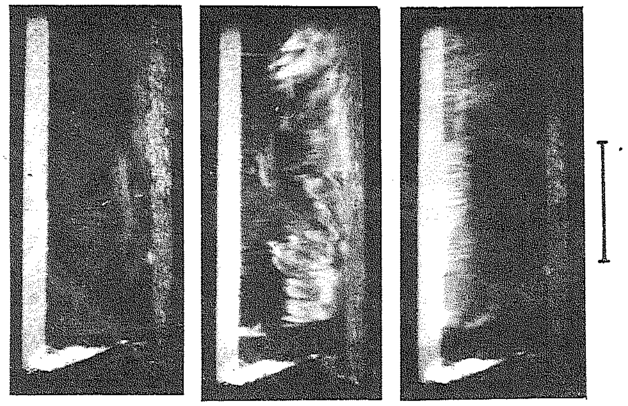
A strong reduction of the extinction in neutron diffraction was recently reported (Xu-Zheng Yi et al, Acta Physica Sinica 28, 694 (1979)) in the pyroelectric, piezoelectric and ionic conductor (Remoissenet et al., Mat.Res.Bull. 10, 181 (1975)) α-$LiIO_3$, when an electric field is applied along the $\vec{c}$-axis. In order to improve the understanding of this phenomenon, we have performed neutron and γ-ray diffraction measurements, and neutron diffraction topography experiments on samples produced in various growth conditions. Neutron diffraction measurements indicate that extinction is reduced in the 002 reflection for all the samples, but the rate of enhancement of the diffracted intensity as a function of the applied field varies from sample to sample. The width of half maximum of the γ-ray rocking curves is not modified by the application of an electric field but tails associated with regions misoriented by about ∿ 20" with respect to the matrix appear on both sides of these curves. Neutron section topographs (Schlenker et al, J.Appl.Phys. 46, 2845 (1975)) show (fig. 1) that the extinction reduction is neither homogeneous across the sample volume nor localized near the electrodes only but appears as a strong enhancement of the defect image visibility. The effect only occurs where an electric field parallel to $\vec{c}$ is present. This suggests that the mechanism leading to an enhanced distortion of regions in the neighbourhood of the defects could be an accumulation of charges in these regions. Topographs made at 170 K and 354 K show that the ionic conductivity is a crucial parameter of the problem and are in agreement with this model. Other experiments were performed in order to test the influence of piezoelectricity on the observed phenomenon.

This work is at present under further development.



a b c

Fig. 1 : 002 section topographs of a sample of α-$LiIO_3$, which differ by the applied electric field :
a) short circuited
b) + 200 V cm^{-1}
c) - 200 V cm^{-1}.
Scale mark : 5 mm ; $\vec{c}$ is horizontal

11.1-08 THE DIFFRACTION CONTRAST OF DISLOCATION OBSERVED IN THE CASE OF X-RAY ANOMALOUS TRANSMISSION.

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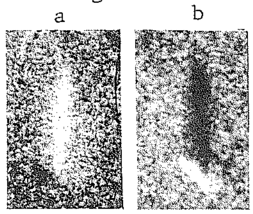
In absorbing crystals (μt>>1) the image of dislocations recorded on X-ray topographs usually appears as a bright shadow. The brightness of the dislocation diffraction contrast has been explained either by the absorption effects (Borrmann, Phys. Bl. (1959) 15, 508; Shulpina & Datsenko, Ukr. fiz. Zh. (1967) 12, 1974; Chukhovskii & Shtolberg, Zh. eksper. Fiz. (1973) 64, 1033) or by interbranch scattering (Suvorov et al., Phys. Stat. Sol. a, (1980) 60, 27). Observations of the 30°-type dislocation diffraction contrast performed by means of the Lang technique for the [001] oriented GaAs sample (μt∿5) show a white dislocation image for the $\bar{g}$ vector (Fig. 1a) and a black one for the reversed $\bar{g}$ vector (Fig. 1b). In the present case also the path curvature effect of anomalously transmitted Bloch wave seems to play a significant role in the image formation. Topographs taken for 220 and $\overline{22}0$ reflections are presented in Fig. 2 (a,b) respectively. The white image is seen very well in Fig. 2a, whereas a black one is observed in Fig. 2b. Moreover,

Fig. 1
a b



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