11.1–13 STROBOSCOPIC SECTION TOPOGRAPHY OF VIBRATING QUARTZ RESONATORS

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The time structure of the synchrotron radiation source DORIS has been utilized for stroboscopic topography of thickness shear waves in quartz. The investigations concentrated on changes of dislocation contrast and Pendellösung fringes in section patterns.
The results are the following:

1) With increasing vibrational amplitude the Pendellösung fringe contrast nearly disappears at a certain value and occurs again at even higher values, but now with a decreasing fringe distance towards the margins. If the amplitude is raised further the section pattern is dominated by the higher reflectivity of the strained parts in the crystal (Fig. 1).

2) Dislocation contrast shows a complicated behaviour. With increasing vibrational amplitude the direct image always becomes weaker. The intermediary image is strongly changing (Fig. 2). In suitable cases the direct image nearly vanishes and is replaced by a strong contrast at a place which can be geometrically related to the intersection point of the dislocation line with the boundary of the Borrmann fan in the reflected direction. Due to this effect the dislocation image in projection topographs is shifted without a real motion of the dislocation line.

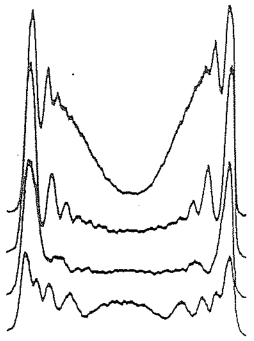

Fig. 1: Change of Pendellösung fringes with increasing vibrational amplitude.

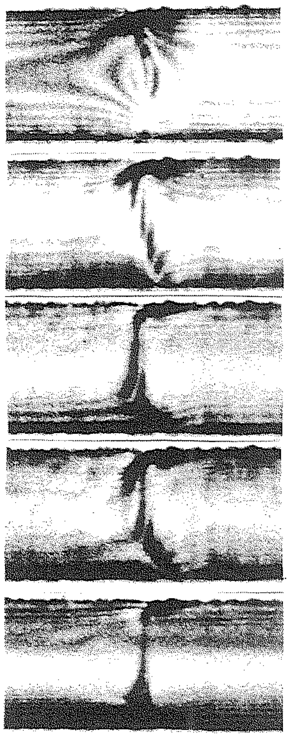

Fig. 2: Section pattern with dislocation image. Acoustic wave amplitude increases from top to bottom.

11.1–14 IMAGE CONTRAST OF SURFACE ACOUSTIC WAVES IN SR-TOPOGRAPHY

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By using the time structure of the synchrotron radiation source DORIS we have investigated travelling acoustic waves on the surface of $LiNbO_3$ with white beam topography. By synchronizing the wave excitation with the source frequency "time frozen" wave images are obtained.

The contrast formation in the Bragg case can be divided into two parts. One contribution is the surface reflected beam which shows intensity modulation due to the periodic curvature of the reflecting net planes. Troughs of the surface wave focus the reflected beam and crests defocus. The focal distance depends on Bragg angle, wave amplitude and the angle between the acoustic wave vector and the plane of incidence.

The second contribution to the image is coming from wavefields which first enter the crystal and are deviated back to the entrance surface by the strain fields of the SAW. Closely above the surface two peaks per acoustic wave period are detected which have different intensities due to the anomalously high or low absorption which has taken place during the wavefield deviation inside the crystal. The peak with the higher intensity is emerging from the troughs, the one with lower intensity from the crests of the wave. With increasing distance from the surface the peak with lower intensity is dispersed whereas the other one is focused resulting in a pattern which is nearly coinciding with the surface reflected pattern.

Experimental evidence and theoretical explanation of the above described image formation will be presented.

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11.1–15 MEMORY EFFECTS OF THE ANTIFERROMAGNETIC DOMAIN STRUCTURES IN MnF_2.

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MnF_2 is antiferromagnetic below $T_N \simeq 67$K. 180° antiferromagnetic domains are physically distinct because the magnetic moments of opposite sign, directed along the $\vec{c}$ axis of the rutile-type structure, are respectively located at the corners and at the center of the unit cell, and these two sites, although equivalent, are not related by a lattice translation. Fig.1 shows the two kinds of domains on a projection on the (001) plane.

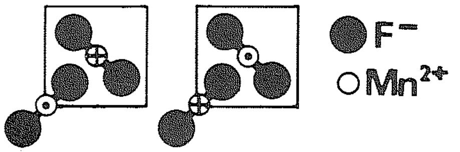

fig 1

Neutrons can distinguish between both types of domains because their structure factors are different for a given neutron polarization parallel to $\vec{c}$-axis. The observation of these domains was performed by polarized neutron diffraction topography [Baruchel, Schlenker and Barbara, J.Magn.Magn.Mat. 15-18,1518 (1980)] : indeed only one domain type is imaged for each polarization state when using the 210 reflection at ∿ 30 K.

The obtained domain structures display several unexpected memory effets. Fig. 2 shows topographs performed at 30 K after cooling from a) room temperature, b) T_N + 30 K, c) T_N + 50 K, d) T_N + 90 K. The first three topographs are very similar but not completely identical: the flipping ratio R, which indicates the ratio of the volumes occupied by each kind of domains, is constant, but the total wall surface S_W is reduced, and the ratio M we define, within the limits of the resolution of our experimental technique, as the fraction of the volume where the domain type switched, is less than 6.10^{-2} for