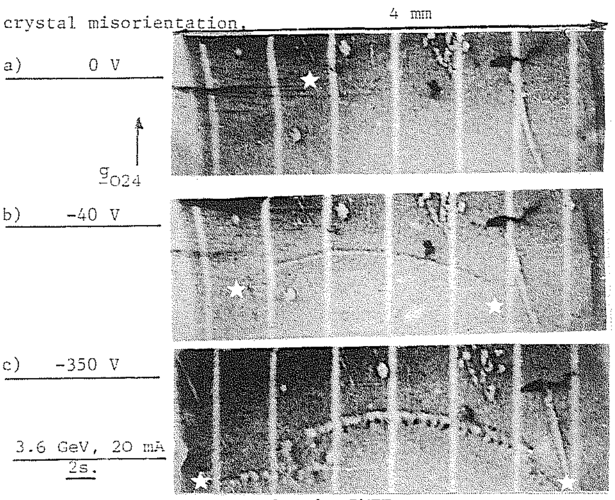
11.3–5 QUASI LIFETIME WHITE SYNCHROTRON X-RADIATION TOPOGRAPHY OF ELECTRODE INDUCED STRESS IN A $BaTiO_3$ SINGLE CRYSTAL. By J.D. Stephenson, Freie Universität and Fritz Haber Inst. der MPG, Berlin, FRG.

Computer simulation of (Bragg) Laue patterns from top seeded single crystals of tetragonal (001) $BaTiO_3$ using white synchrotron radiation topography (Stephenson, phys. stat. sol. (a), to be published) have suggested that the surface domain structure exists in two forms;

a) as a surface combination of both c and (misorientated) a ferroelectric domains which produce distinctly separate (double) Laue patterns and,

b) as a possible combination of differently stressed surface and bulk c domains which form when the crystal is subjected to an [001] electric potential. The difference between Laue pattern superpositions in this case is almost imperceptible. The surface c domains (~1 µm thick) are variously reported to be created by a high field gradient (~10^4 to 10^5V/mm) existing in a surface charged layer.

Increase in applied [001] potential created an extendable line distortion at the perimeter of the aluminium (evaporated) electrode.☆ This defect appeared dark-white in 024 topographs and white-dark in $0\bar{2}4$ topographs, typical of reverse dislocation contrast when the sign of the g - vector is reversed. The length of the defect similarly decreased when the potential was step-wise returned to zero and possibly created by the high field gradient (and corresponding piezoelectric distortion) at the electrode edge. The following figures show successive changes in 024 topographs due to a stepwise decrease in applied potential. The vertical white lines are images of a wire mesh placed before the crystal to detect local crystal misorientation.



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11.3–6 STUDY OF MICROSTRUCTURAL DEFECTS INDUCED BY MICROWAVE ELECTRIC FIELDS IN SILICON SINGLE CRYSTALS BY A HIGH RESOLUTION X-RAY DIFFRACTION METHOD, By Krishan Lal. National Physical Laboratory, Hillside Road, New Delhi - 110 012, India and Peter Thoma, Physikalisch - Technische Bundesanstalt, 3300 Braunschweig, F.R.G.

Defects induced by microwave fields of 2.45 GHz in dislocation free (111) silicon single crystal discs of 23 mm dia and ~ 1 mm thickness were studied by employing a triple crystal x-ray diffractometer (Lal and Thoma, Solid State Commun.(1981)40,637; Phys. Stat. Sol.(1983)80(a),491). A 2 µm thick and 2 mm wide strip of Al was deposited along [$\bar{1}$ 10] or [$\bar{2}$ 11] on one of the surfaces of the specimen. The other surface was completely coated with Al. Microwaves travelled along the strip line. X-ray beam from a fine focus tube (Philips; 2 KW; Mo target) was collimated and diffracted from a grooved crystal monochromator having diffracting surfaces along {111} planes. A highly collinated $K\alpha_1$ beam was used as the exploring x-ray beam. The specimen was aligned for diffraction in the Laue geometry and experiments were performed with 2 20, 2 $\bar{2}$0, 02 $\bar{2}$, 0 $\bar{2}$2, 11 $\bar{3}$ and $\bar{1}$ $\bar{1}$ 3 reciprocal lattice points. Diffraction curves from different regions of the specimen and high resolution traverse topographs were recorded. Curvature measurements were made which give orientation of diffraction vector and intensity of diffraction from different portions of the specimen.

A small shift in the position of the diffraction peak was observed at a microwave power of ~30mW. As the power was increased large reversible and irreversible changes in the topographs and in the curvature measurements were observed. The shapes of the diffraction curves did not show any remarkable change up to ~10W of microwave power. Significant broadening was observed when microwave power was about 13W. Considerable decrease in the radius of curvature was observed as a result of a few applications of 10W microwave power. During the application of microwave power large increase in the diffracted intensity was observed in some regions of the specimen. A decrease in intensity was observed in other regions. These changes were also observed in the integrated intensity. The increases or decreases were anisotropic with respect to the directions of the strip line and diffraction vector. The magnitude of the change in the diffracted intensity was dependent on the magnitude of microwave power. A comparison of high resolution topographs recorded before, during and after the application of microwave power confirmed these results. Images of defects produced by microwaves could be recorded in topographs. Irreversible changes were observed in the curvature measurements that could be used for microwave power measurements. Some of the observed defects were found to anneal out even when the specimen was left at room temperature for several days.