### 11.1-03 DOUBLE-CRYSTAL SPECTROMETER MEASUREMENTS OF THE VARIATION IN THE LATTICE SPACING BETWEEN THE TWIN LAMELLAE AND THE TWIN LAYER BOUNDARY IN AMETHYST QUARTZ.

By Z. Baran, Instituto de Física, Universidade Federal da Bahia, Salvador Brasil and K. Godwod , Institute of Physics, Polish Academy of Sciences, Warsaw, Poland.

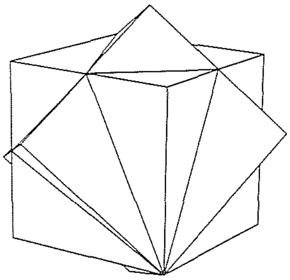
The natural face of major rhombohedron, r, $(10\bar{1}1)$ of amethyst from Bahia was examined preliminarly by optical microscopy and X-Ray topography and has revealed the set of parallel light and dark layers. These can be compared directly with the topograph images recorded by H.H. Schlossin and A.R.Lang (Phil. Mag.(1965)12,283). These experiments demonstrated that, in the region of chief concern where the twin lamellae were present, twinning, according to the Brazil law, took place. These twins are enantiomorphic twins. They consist of left-and right-handed lamellae separated by thin layer boundary and arranged parallel to the terminal r face. The purpose of the present work is to measure the differences in lattice spacings between these twin lamellae and the twin layer boundary. The measurement was made by an X-ray double crystal arrangement of parallel setting. The first crystal is perfect silicon crystal adjusted for the 533 reflection of $CuK\alpha_1$ in the asymmetrical Bragg case. The amethyst quartz under investigation is taken as second crystal and adjusted for the $40\bar{4}4$ reflection in the symmetrical Bragg case. In this arrangement, the lattice plane spacing of the two crystals are nearly equal ($d=0.8355$ Å for amethyst and $d=0.8281$ Å for silicon crystal). For $0^{\circ}$ and $180^{\circ}$ azimuth a series of diffraction topographs were successively taken at mean angular intervals of about 2 sec of arc through the diffraction peak. For each azimuth the rocking curve was recorded by step scanning with the interval of 0.4 sec of arc. This method was applied by J. Yoshimura et al. (J.Cryst.Growth (1979)46,691). By this means, for each set of twin layer boundaries on the crystal surface, two angular positions giving the maximum diffracted intensity, $\Delta\theta_0$ and $\Delta\theta_{180}$, were determined from the observation of the respective series of topographs, where the angular position giving the maximum intensity for the selected area as perfect part of the crystal, was taken to be the zero position. The variation of the lattice spacing was found to be $\Delta d/d = -1/2(\cot\theta_B)\ (\Delta\theta_o + \Delta\theta_{180}) \simeq 2\mathrm{x}10^{-5}$. From this data the effect of the internal stress on the spacing of lattice plane can be deduced.

This work has been supported by Conselho Nacional de Desenvolvimento Científico e Tecnológico and the Universidade Federal da Bahia (Brazil).

### 11.1-04 TWINNING IN DIAMOND: AN X-RAY TOPOGRAPHIC STUDY.

By W. G. Machado and Moreton Moore, Royal Holloway College, University of London, Egham, Surrey, TW20 0EX, England.

There are several different types of growth twinning in diamond of which the most common is the spinel (contact) twin or macle. The two parts of the twin are nearly always about the same size, and the crystal is usually thin perpendicular to the composition plane. Preferential growth in the re-entrants could account for this tabular habit, so long as these re-entrants do not fill up. X-ray topography has revealed twin-growth from a very early stage, without preferential growth promoted by dislocations. Less common are interpenetrant twins: pairs of cubes twinned about [111]. These appear by X-ray topography to have the fibrous internal structures typical of coloured diamonds of cubic habit[1]. Natural rounded rhombic dodecahedral diamonds have been shown to be dissolved octahedra[2] and here a twinned dodecahedral diamond from Brazil appears to be a dissolved twinned octahedron. Multiple twinning, on the same or on different planes, is also exhibited by some diamonds.



1. M. Moore & A.R.Lang (1972) Phil.Mag.26, 1313-1325.
2. M. Moore & A.R.Lang (1974) J.Cryst.Growth, 26, 133-139.

### 11.1-05 NEUTRON DIFFRACTION TOPOGRAPHIC INVESTIGATION OF ANTIFERROMAGNETIC S-DOMAINS IN NiO.

By J. Baruchel(1) M. Schlenker (1), K. Kurosawa (2) and S. Saito (2).
(1) Lab. Louis Néel, CNRS, Grenoble, France. (2) Univ. of Osaka Prefecture ,Sakai, Osaka, Japan.

NiO is cubic in its paramagnetic phase above $T_N = 523$ K. Below this temperature, the magnetic order is associated with a lowering of symmetry : the magnetic moments lie within alternated ferromagnetic sheets perpendicular to a <1 1 1> $\vec{k}$ propagation vector. The four possible wave vectors may lead to four kinds of domains ($\vec{k}$-domains). Besides three S-domains, associated with the equivalent sublattice magnetization directions within a single $\vec{k}$ domain, can occur. S-domains had up to now only been observed through indirect methods : optical methods (Saito, Miura and Kurosawa, J.Phys.C., 13, 1513 (1980)), and X-ray topography (Nakahigashi et al, J.Phys.Soc.Jpn 38, 1634 (1975)). A direct observation, taking advantage of the interaction of neutrons with atomic magnetic moments, was carried out by neutron topography, on a nearly single $\vec{k}$-domain platelet. Area contrast arises between S domains on a given 311 type magnetic reflection because they have different structure factors. From the images thus obtained it is possible to rule out $<1\bar{1}0>$ as antiferromagnetic direction, and to infer that the magnetic moments are along a direction close to $<11\bar{2}>$ . These images allow an unambiguous identification of the sublattice magnetization in each domain. The sample is crystallographically twinned with twin walls parallel to the (111) surface, so that for $\vec{k}$ along [111] , the arrangement or direction of magnetic moments within a S-domain is not modified by twinning. It was found that an unexpected area contrast between S-domains arises on some neutron topographs made using nuclear reflections as well as the corresponding X-rays topographs. This effect is explained by taking into account the different magnetostrictive distortion and the related variation in deviation from Bragg's law between the parts of a single S-domain belonging to neighbouring twin lamellae.