LETTERS TO THE EDITORS

CRYSTALLOGRAPHY

Mimetic Twinning in Urea–Ammonium Bromide

DURING an investigation of the crystal structure of the 1 : 1 complex formed by urea and ammonium bromide it was found that certain of the crystals obtained from solution exhibited orthorhombic symmetry whereas the remainder appeared to belong to the lower monoclinic system. Examination of these under the polarizing microscope did not reveal any obvious macrotwinning.

Structure determination afterwards revealed the true symmetry to be monoclinic and the pseudo-symmetry shown by some of the crystals appears to be a result of twinning by crystallites of small dimensions.

The pseudo-orthorhombic cell may be satisfactorily accounted for on the grounds of equal numbers of crystallites twinned as a result of a 180° rotation about the c axis as shown below. The symmetry of the monoclinic cell projection is $p2$ and the resulting symmetry of the orthorhombic cell cmm (shown in dotted outline).

In order for it to be possible for an orthorhombic cell of this symmetry to result from this type of twinning, the geometrical relation $a \cos \beta = \frac{c}{4}$ must hold within the monoclinic cell. This is satisfied by the complex with $a = 8{\cdot}9$ Å., $c = 7{\cdot}1$ Å. and $\beta = 102°$. (The relationship mentioned above is similar to that which results in twinning according to the Carlsbad law as evidenced in felspar when $a \cos \beta = \frac{c}{2}$.)

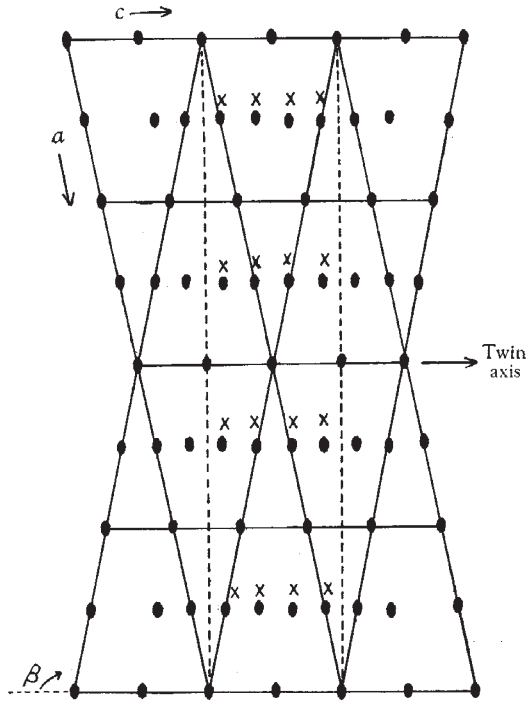

Fig. 1. Formation of the pseudo-orthorhombic cell resulting from twinning. Redundant two-fold axes within the cell (that is, those which do not superimpose) are marked with a cross

A further feature resulting from this twinning is that only half the urea molecules and bromide ions are directly superimposed in projection along with b axis, and consequently the Fourier map for this projection of the pseudo-orthorhombic cell shows a set of peaks for these having only half the expected electron density.

Further work on the structure is in progress and full details will be published later.

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PHYSICS

Pure Rotational Absorption of Ozone in the Region 125–500 Microns

PURE rotation spectra of gaseous ozone have been recorded in the laboratory for the wave-length range 125–500μ. This extends the region observed by Danti and Lord (125–200μ) to longer wave-lengths, but has a useful overlap with their results[1]. It also covers part of the observed far infra-red solar spectrum where some unidentified features were attributed to absorption by ozone in the upper atmosphere[2].

Ozone was made by passing oxygen through a glass apparatus with an annular region in which there was a silent discharge. A mixture of oxygen and ozone was condensed in a trap surrounded by liquid nitrogen and, by slowly warming up the trap, the oxygen was removed by fractional distillation, leaving liquid ozone. This was then evaporated into an absorption cell which was part of the interferometer arrangement shown in Fig. 1. In this the whole optical path between the source and the detector can be evacuated to a pressure of less than 10^{-3} mm. mercury, and a trap cooled externally with liquid nitrogen further reduces the amount of water vapour to the point where its absorption is negligible. The glass absorption cell was 10 cm. in length and was fitted with crystal quartz windows 2 mm. thick. These were sealed with silicone rubber 'O' rings, and silicone grease was used in stopcocks and joints