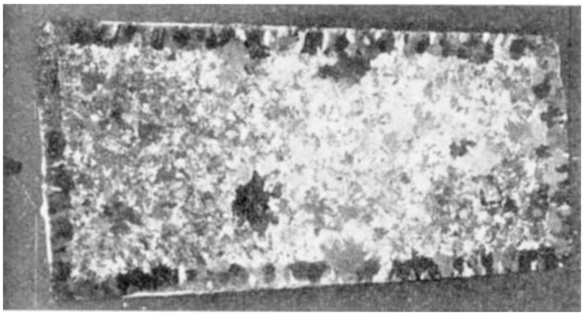

Fig. 1. Columnar growth in a uranium 0·45 per cent chromium specimen, solution treated at 720° C for 15 min followed by isothermal transformation at 625° C for 8 min (× c. 3·9)

The growth-rate G was established at four different temperatures by measuring the change in length of columnar grains after various transformation periods. In Fig. 1 the columnar grains formed isothermally at 625° C after 8 min can be seen clearly. The results of G are given in Table 1.

To calculate the rate of nucleation, $\dot{N}$, the relation $\dot{N} = G/D^4$ was used, where D is the mean macro grain size, measured after the completion of the transformation. The results of calculated $\dot{N}$ values are given in Table 2.

Table 1. GROWTH-RATE AS FUNCTION OF TEMPERATURE

T (° C)	G cm/sec × 10^{+4}
630	0·47
625	1·00
615	1·30
605	1·78

Probable error ± 20 per cent.

Table 2. RATE OF NUCLEATION AS FUNCTION OF TEMPERATURE

T (° C)	$\dot{N}\ \frac{1}{cm^3\ sec}$
630	0·5
625	1·7
615	7·3
605	52

Further work is being conducted on various uranium alloys, and also attempts are being made to synthesize theoretical *TTT* curves from the measured G and calculated $\dot{N}$ values, and to compare them with experimental *TTT* curves.

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MINERALOGY

Direct Electron-optical Resolution of Anti-phase Domains in a Silicate

IN this communication the direct electron-optical resolution of anti-phase domain patterns in a plagioclase feldspar is recorded. (The specimen, from Frederiksvärn, Norway, was kindly provided by Dr. P. H. Ribbe. A partial chemical analysis, made by J. H. Scoon, yielded $KAlSi_3O_8$, 3·4 per cent; $NaAlSi_3O_8$, 45·2 per cent; $CaAl_2Si_2O_8$, 51·8 per cent by weight.)

Relevant X-ray diffraction data for material of this composition have been presented by Gay[1] and indicate that, in addition to primary Bragg maxima due to a triclinic unit cell (appropriate to this member of the solid-solution series albite-anorthite), additional maxima occur in pairs symmetrically disposed about the additional reciprocal lattice points due to a doubled unit cell (anorthite-type cell[2]). An electron diffraction photograph illustrating the character of these paired maxima is presented as Fig. 1*a*, where a single pair of the maxima have been ringed and the primary Bragg maxima have also been indicated, *B*.

In its essentials this distribution of intensity in reciprocal space can be compared directly with that observed by Glossop and Pashley[3] in the examination of anti-phase

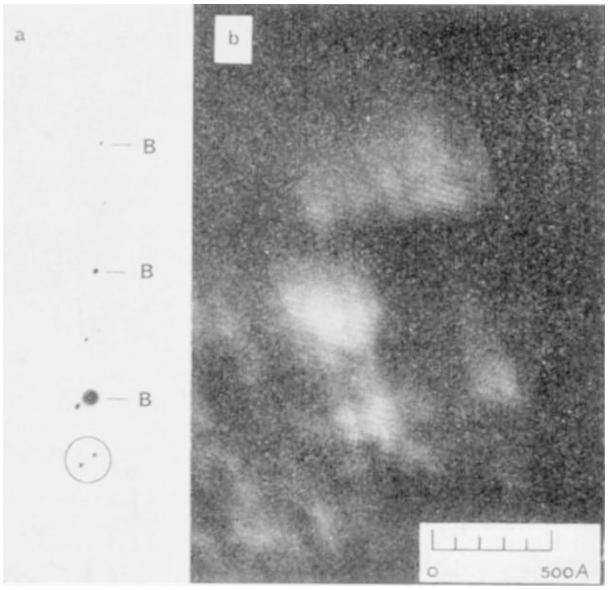

Fig. 1. *a*, Part of an electron diffraction photograph of the plagioclase studied. A pair of subsidiary intensity maxima have been ringed and the primary Bragg maxima have been indicated by letter *B*; *b*, part of the dark-field photograph obtained with a pair of diffraction maxima. The fringe pattern defines a distance of approximately 30 Å for the width of the individual domains

domains in an ordered copper–gold alloy; and implies, as suggested[4] in the case of nepheline where similar additional maxima are observed, that an antisymmetrical distribution in respect of a multiple cell is involved.

It has been possible in the feldspar, as in the alloys examined by Glossop and Pashley[3], to use the paired maxima for the direct electron optical resolution of the domain structure involved. This was done on finely crushed material mounted on a carbon film by selecting a single crystal orientated in such a way that a single pair of maxima, near the origin of the diffraction pattern, were in the reflecting position. The dark field image due to the pair of maxima was obtained by isolating them using a 25μ objective aperture but without introducing tilt in the direct beam. (The latter technique was used by Glossop and Pashley in order to obtain high resolution under dark field conditions.)

The anti-phase domains resolved during the present experiments were extremely regular and approximately 30 Å thick. The most striking feature of the anti-phase array (of which a small part is reproduced in Fig. 1*b*) was the absence of major dislocations in the pattern as studied in a semicircular area of 0·25μ radius.

The results of the present experiments were anticipated on the basis of a detailed thermodynamic analysis of anti-phase phenomena, as observed in several silicate systems, by one of us (J. D. C. McC.). This theoretical treatment, which will appear shortly, will deal with other aspects of the phenomena.

The present observations represent the first direct proof of the existence of anti-phase phenomena in crystalline solids other than the metal alloys. A model of similar character has recently been proposed for the plagioclase feldspars by Megaw[5].

The experiments described here were done on an *E.M.*6 which was kindly provided for the combined use of the Departments of Mineralogy and Geology at Cambridge by the Department of Scientific and Industrial Research.

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