In spite of considerable efforts, we have not yet been able to determine the arrangement of the molecules within the cell; but I think we can say safely that only the space groups C_{3i}^2, C_{3v}^5 or D_3^7 can come into consideration.

We have also been able to obtain quite good powder diagrams of γ-oxygen. The spectrum shows those features which are typical for a lattice with rotating molecules. The diagrams were interpreted by a *cubic* cell ($a = 6{\cdot}83$ A.) containing 8 molecules, corresponding to a density of $\rho = 1{\cdot}30$. In this case we have also been able to find the arrangement of molecules within the cell which satisfies the intensity distribution.

The lattice belongs to the space group T_h^6. The position of the individual atoms are not fixed by this space group, but only the molecular centres. The molecules rotate in the lattice, and they are grouped into pairs along the trigonal axis. The distance between the two molecules of a pair (3·48 A.) is somewhat smaller than the minimum distance (3·68 A.) between neighbouring pairs. This indicates that the molecules of the pair are tied up with stronger forces than molecules of different pairs.

The study of the absorption bands of liquid oxygen by Ellis and Kneser[3] also indicates the existence of groups (O_2–O_2). This tendency to form groups explains the fact that γ-oxygen, although it possesses rotating molecules, does not appear in a closest spherical packing of molecules, as in the case of β-nitrogen. The centres of the pairs (O_2–O_2), however, form a face centred lattice, and we may, therefore, say *that γ-oxygen forms a closest cubical packing of pairs of oxygen molecules.*

γ-Oxygen may also be regarded as belonging to the space group T^4. In this case we arrange the molecules in two fourfold equivalent positions with parameters x_1 and x_2. Putting $x_1 = -x_2$, the symmetry of the lattice is raised to that of the space group T_h^6.

As shown in previous papers also, the lattices of α-N_2 and α-CO approximately fulfil these conditions, and they are therefore closely related to that of γ-oxygen.

The lattice of γ-oxygen is obtained when in α-nitrogen or in α-CO each atom is replaced by a rotating oxygen molecule (O_2), and the parameters are subject to the relation $x_1 = -x_2$.

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Cinematographic Record of the α⇄γ Iron Transition, as seen by the Electron-Microscope

RECENTLY E. Bruche and W. Knecht[1] described the electronoptical observation of the transition of α- into γ-iron. In their beautiful experiments, however, the emission of the test-piece (after activation by means of an evaporated barium layer) at the transition temperature of about 900° C. was so small that the actual occurrence of the process could not be observed on the fluorescent screen without sufficient adaptation of the eye. In order to obtain a fluorescent image clear enough to be photographed, the temperature of the test-piece had to be raised to about 1000° C. A photographic record of the transition could therefore only be obtained by observing whether, after lowering the temperature to the neighbourhood of the transition point and raising it again at 1000°, the texture of the test-piece had changed or not.

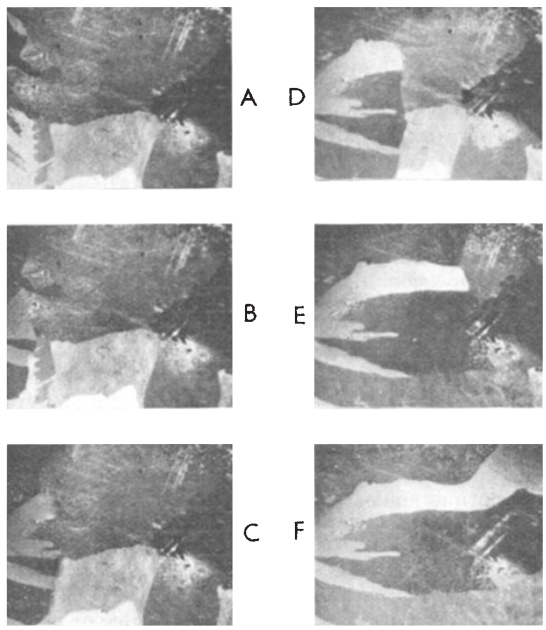

FIG. 1. Growth of α-iron crystals in the original γ-phase.

Using an 'electron-microscope' with one magnetic lens, similar to that described by other authors[2], we succeeded in obtaining even below 900° C. an intensive emission from a strip of iron after careful activating by means of evaporated barium or strontium oxide, so that the fluorescent image could easily be photographed with a film camera (N.A. 1 : 2·7; $f = 4$ cm.) after an exposure of 1–2 sec. Since by slowly lowering or raising the temperature through the transition point the growth of the new crystals could be made to take place in 5–10 minutes, it was thus possible to obtain a cinematographic record of the transition process (a photograph was taken every 4 seconds). In Fig. 1, *A–F*, six separate photographs have been reproduced. They show clearly the growth of α-crystals (starting at the left) in the original γ-phase. It is of interest to remark that the progressive growth of the newly-formed crystals observed here is essentially different from the sudden formation of martensite needles in austenite, of which a cinematographic record by means of ordinary microphotography has been made by Wiester[3].

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[3] H. J. Wiester, *Z. Metallk.*, **24**, 276; 1932. A similar cinematographic record of the α–γ-transition in iron and steel has also been obtained by H. Esser and H. Cornelius (*Stahl und Eisen*, **53**, 532; 1933).