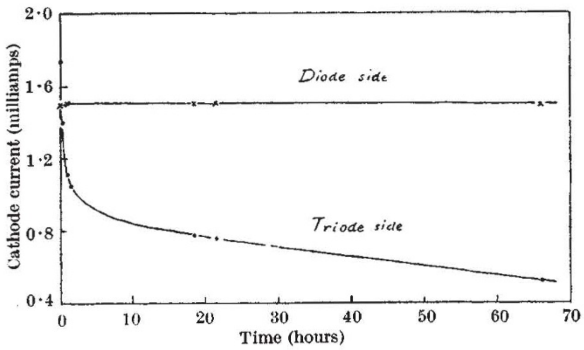

Fig. 2

the purpose are shown in Fig. 2. The anode voltage of the triode was 250 volts and of the diode 3 volts. In this case the currents recorded are temperature-limited with the cathode running at a temperature well below its nominal rating. The low temperature leaves the cathode in a state particularly sensitive to poisoning, and enables the experiment to be completed in a short space of time.

The essential difference between the diode and triode states is that in the former case the cathode is subject to residual gas atom bombardment, whereas in the latter case the cathode is subject to high-energy positive ion bombardment. The tentative conclusion reached is that the emission deterioration is due to positive ion bombardment and not directly to the traverse of current through the cathode. In a valve containing residual gas, the positive ion bombardment of the cathode is directly proportional to the cathode current, and the criterion of low cathode current density for long life remains. If means of removing the residual gas are achieved, then there appears reasonable hope for increasing cathode loading without prejudice to life.

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Twin Crystal Inclusions in Aluminium and Iron

The communication by Messrs. May, Tiedema and Burgers[1] reports the existence of minute unabsorbed crystals embedded in parent grains of aluminium and having a twinned orientation to the parent. Iron resembles aluminium in seldom showing annealing twins with typically straight boundaries. Twenty years ago[2], I reported upon some small ferrite crystals embedded in large recrystallized grains of iron, and found that they were twins of the parent. One of my suggested explanations of their occurrence was "unabsorbed grains of the original fine-grained aggregate whose orientations were by chance relatively twinned to that of the large crystals which eventually grew round them". This is the view now put forward for aluminium by Burgers *et al.*

The importance of correct initial grain size to produce large iron crystals has also been emphasized by Pfeil. Ferrite twins are found to be very stable and do not become absorbed after prolonged annealing below the A_3 temperature. At the time, attention was directed to the possible effect of these internal unabsorbed grains on the tensile properties of large crystals prepared by straining and annealing.

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[1] *Nature*, **162**, 740 (1948).
[2] *J. Iron and Steel Inst.*, **1**, 689 (1928).

PROF. O'NEILL kindly sent us a copy of his comments. We regret that we were not aware of his paper. We should certainly have directed attention to the observations given therein, which, very probably, form another example of non-absorbed grains in twin-position with regard to the growing crystal.

In this connexion it would be worth while to investigate whether in iron, as in aluminium, the twin-relationship is only *approximately* fulfilled.

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Thin Evaporated Calcium Fluoride Films

WE have already outlined[1] the results of an X-ray examination of thin calcium fluoride films, evaporated on polished glass surfaces. The powder X-ray camera used was of the Seeman–Bohlin focusing type. It had a radius of 10 cm. and carried photographic film about 2 cm. wide set symmetrically to the mean plane of incidence of the X-rays. Consequently it was only the portions of the spectral lines due to the scattering in the immediate region of the incident plane which were recorded. From measurements of the relative intensities of the lines, it was evident that there was orientation of either the (111) or the (110) planes of the crystallites, and that this orientation depended on the temperature, T, of the glass substrate during deposition.

Recently, we have employed a cylindrical X-ray powder camera of the type described by Wyllie[2], and also a reflexion electron diffraction camera to examine films of calcium fluoride. As previously, these films were evaporated on to both polished crown and flint glass surfaces, and they had an optical thickness of $\frac{5}{4}\lambda$ 5500. From the positions of the intense arcs on the semi-circular lines appearing in the photographs of both cameras we have been led to the following conclusions. When the temperature is maintained at 25° C. during deposition the (111) planes are strongly orientated approximately parallel to the glass surface within a rocking angle of about 15° (that is, the angle between the glass surface and the (111) plane does not exceed about 15°). For a temperature of 110° C. there is no evidence of orientation of the (111) planes; but the (110) planes are strongly orientated approximately parallel to the surface, within a rocking angle of about 15°. This orientation of the (110) planes persists for temperatures up to 310° C., the highest temperature for which we have made measurements.

It is interesting to note that the orientation and the rocking angle of the crystallites in the films, as measured by the electron diffraction camera (35 kV. electrons), appear to be in good agreement with the