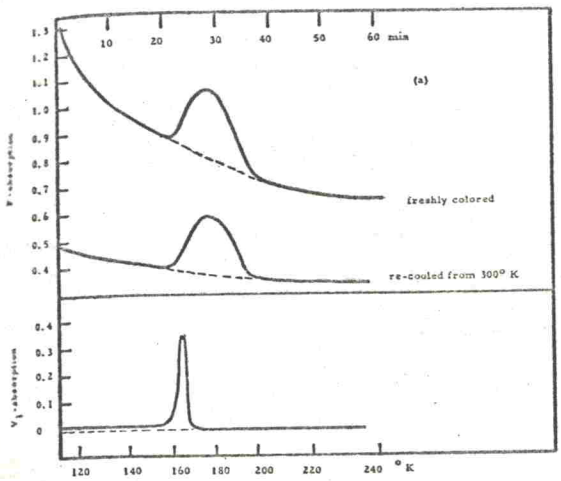

FIG. 1. F and V_1 absorption during warming after optical bleaching at 113°K.

a steep drop in the "F-absorption glow curve," i.e., the curve giving the absorption in the maximum of the F band as a function of time or temperature during gradual warming of the crystals. The unstable centers are removed by raising the crystal to room temperature so that the absorption glow curve obtained after recooling to 113°K shows only a slight fall entirely explained by the broadening and shift of the maximum of the F band with rising temperature.

Optical bleaching by F irradiation occurs at 113°K with a saturation value of 30 percent of the F centers bleached, and is followed by a partial recovery in the dark in which up to $\frac{1}{3}$ of the bleached F centers reappear within about 10 minutes. The effects are similar to those reported by Markham, Platt, and Mador[1] on x-rayed KBr at 78°K. But their explanation of the recovery in terms of a dissociation of F' centers cannot apply in our case where F irradiation has been found to reduce and not to enhance the F' band. Instead, we believe that the recovery is connected with a narrow (0.17 ev) absorption band at 8750A which we have found to appear during optical F bleaching.

The result of main interest concerns a large-scale restoration phenomenon which occurs if the crystals are first bleached at 113°K by F irradiation and then slowly warmed in the dark (2.3°K per min). The F-absorption glow curves observed under these conditions for a virgin crystal and a crystal recooled from room temperature (Fig. 1(a)) show a large peak around 175°K superimposed on the normal absorption glow curves discussed above. This means that F centers are temporarily recreated and subsequently bleached thermally. The thermal bleaching can be prevented and the restored absorption be arrested by rapid recooling from a temperature near the restoration peak (Fig. 2). It is seen that nearly all the optically bleached F centers can be regained by this procedure.

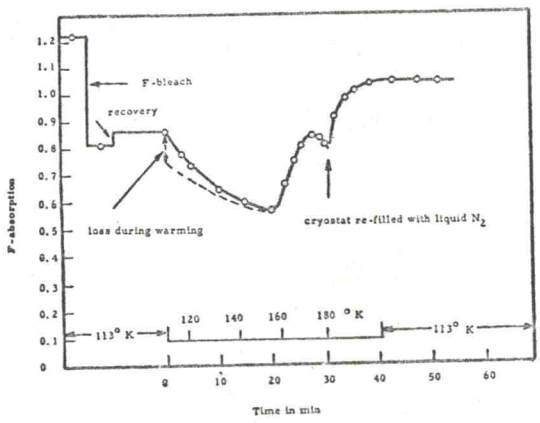

FIG. 2. Restoration of optically bleached F centers by warming and recooling.

Even more remarkable is the fact that simultaneously with the F centers, V_1 centers are recreated as revealed by a sharp peak in the absorption glow curve obtained by observing the absorption in the maximum of the V_1 band during warming. The curve shown in Fig. 1(b) refers to a crystal recooled from room temperature so that at the beginning of the experiment it did not contain any V_1 centers but only more stable higher V centers. The fact that the peak occurs slightly below that for the F centers and is very much sharper implies a very short lifetime of the restored V_1 centers in accordance with their low dissociation temperature of 128°K as observed by Dutton and Maurer.[2] It appears very significant that the height of the V_1 restoration peak, representing only a fraction of the total number of transient V_1 centers involved, is about twice as large as the height of the original V_1 band present in the crystals immediately after x-raying.

In explanation of the effects described we offer the following tentative suggestions: Crystals x-rayed at low temperature contain a large number of positive holes in so far optically unidentified V_x centers. Electrons released by F irradiation are trapped at these centers to form complex metastable centers (possibly associated with the peak at 8750A) which on breakup by thermal activation yield unstable F centers and V_1 centers in close proximity to each other.

* 1953–1954 at Duke University, Durham, North Carolina.
[1] Markham, Platt, and Mador, Phys. Rev. 92, 597 (1933).
[2] D. Dutton and R. Maurer, Phys. Rev. 90, 126 (1953).

Effect of Hydrostatic Pressure on the Superconducting Transition of Tin and Thallium

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THE dependence on pressure of the magnetic threshold field of superconductivity has been measured for tin and for thallium for pressures transmittable by liquid helium. The experimental technique consisted of measuring the difference of the threshold fields of two similar ellipsoidal single crystals at the same temperature. The pressure on one ellipsoid was held fixed while the pressure on the other was varied by means of tank helium gas. The transition was followed by means of 60-cycle ac susceptibility measurements.

The summary of results to date on tin and thallium is given in Table I, which contains a review of previous determinations of the pressure coefficients. The values for tin marked by asterisks are deduced from data on wires in tension, in which the hydrostatic stress is one-third the tensile stress for isotropic materials. The rather good agreement among the tin data between the pressure coefficients directly measured in hydrostatic experiments and those deduced from wire straining suggests that in the latter the shear components have a small or negligible effect on the superconducting transition in tin. This speculation is now being checked with a thin-walled tin cylinder stressed in pure shear.

No ready explanation is at hand for reconciling the results of the present work on thallium and those of Kan, Lazarev, and Sudovstov[1] with those recently reported by Chester and Jones,[2] differing as they do in both magnitude and sign. The technique employed by Chester and Jones results in massive plastic deformation at room temperature while that used by Kan *et al.* may produce some plastic deformation near the ice point. To examine the effects of mild plastic deformation, an ellipsoid was machined from a single crystal twisted 180° over the 1.2-cm length of the ellipsoid. The threshold curve and pressure coefficient for this sample were the same as for the undeformed crystal.