the pressure axis, with no observable tendency to approach either a maximum or a horizontal asymptote. No indication of polymorphism is observed. The data can be fitted very well by the Simon fusion equation:

$$P/15\,000\ \text{atm} = (T/429°\text{K})^{4.34} - 1, \qquad (2)$$

the corrected melting temperatures never varying more than 1% from this curve. The values of the constants in Eq. (2) were determined by the method of least squares. In order to estimate the uncertainty in these values, the Simon equation was also fitted by the method of least squares to the maximum and minimum curves, which were drawn through the extremities of the range of uncertainty for the measured melting temperatures. The results indicated that a could vary as much as ±20%, while c changed only by ±2%.

By way of comparison, Butuzov and Ponyatovskii[16]

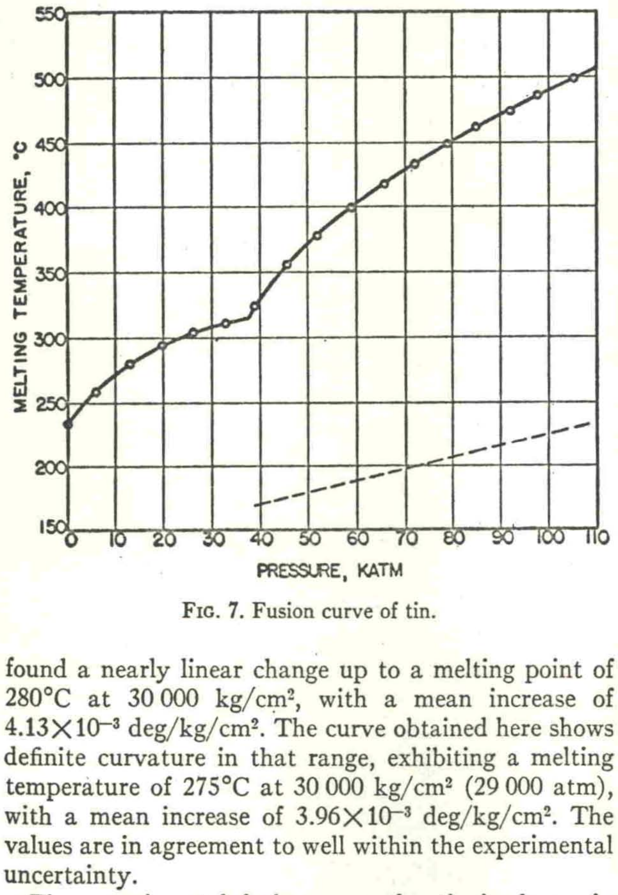

FIG. 7. Fusion curve of tin.

found a nearly linear change up to a melting point of 280°C at 30 000 kg/cm², with a mean increase of 4.13×10^{-3} deg/kg/cm². The curve obtained here shows definite curvature in that range, exhibiting a melting temperature of 275°C at 30 000 kg/cm² (29 000 atm), with a mean increase of 3.96×10^{-3} deg/kg/cm². The values are in agreement to well within the experimental uncertainty.

The experimental fusion curve for tin is shown in Fig. 7. A phase transition is indicated, with a triple point at about 38 000 atm and 318°C. The curve of the first phase rises smoothly from the normal melting temperature of 232°C at atmospheric pressure to the triple point, where a discontinuity in slope occurs. (This discontinuity was found to be reversible, and occurred consistently at the same pressure for all samples.) The fusion curve of the second phase rises smoothly from the triple point to a melting temperature of about 500°C at 105 000 atm. The curves of both phases seem to be normal in the sense of Bridgman (with the exception, of course, that the curve of the first phase does not continue indefinitely). The data for the first phase can be fitted well by the Simon equation:

$$P/7400\ \text{atm} = (T/505°\text{K})^{11.3} - 1, \qquad (3)$$

and the data for the second phase by the equation:

$$(P - 38\,000)/21\,800 = (T/591)^{5.25} - 1, \qquad (4)$$

where T_0 in the transformed Simon equation for the second phase is taken to be the triple-point temperature, or 591°K. The percentage uncertainties in the Simon coefficients and exponents are about the same as those for the corresponding values in the indium equation.

These results can be compared to those of Butuzov and Gonikberg,[17] who reported a melting temperature of 309°C at 30 000 kg/cm² (29 000 atm) for tin. The value indicated at that pressure by the data of this experiment is also 309°C. Butuzov and Gonikberg only carried their experiments to 34 000 kg/cm² (32 900 atm), and hence did not detect the phase change to a higher pressure modification.

An experimental attempt was also made to determine the phase structure of tin below the fusion curve, without complete success. The electrical resistance of the sample was determined as a function of temperature (at constant pressure) up to the melting point for each of the pressures at which the melting temperature was measured, and consistent discontinuities in these curves were sought. There was some indication (by a change in slope of the resistance vs temperature curve, which seemed to appear fairly consistently over a certain pressure range) that a phase transition-equilibrium line might exist as shown by the dashed line in Fig. 7. There is considerable uncertainty in the exact position and curvature of the line, which may of course be partly due to a possible tendency of the lower temperature phase to superheat into a region of instability and therefore not consistently indicate a phase transition at the point of equilibrium. No consistent indications of phase transitions were detected at pressures below those covered by the dashed line of Fig. 7, and the phase structure in the neighborhood of the triple point on the fusion curve is uncertain. It was concluded that new and more refined experimental techniques would be necessary to determine this phase structure, and this will probably be taken up as a later project.

The rather outstanding success of the Simon equation in fitting the experimental data of not only indium and tin but also the Group VIII metals investigated by

[16] V. P. Butuzov and E. G. Ponyatovskii, Kristallografiya 1, 736 (1956).

[17] V. P. Butuzov and M. G. Gonikberg, Doklady Akad. Nauk S.S.S.R. 91, 1083 (1953) (English translation NSF-tr-144, December, 1953).