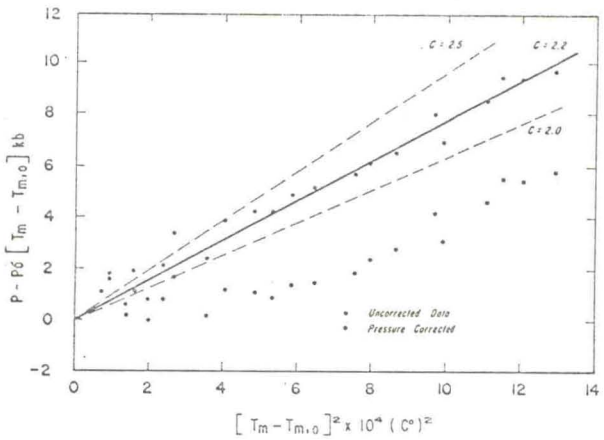

FIG. 3. Normalized melting pressure as a function of the square of the increase in melting temperature. This curve is used in the determination of the Simon equation parameter.

IV. RESISTANCE MEASUREMENT

The high-temperature measurements were made by heating the sample to the melting point at several fixed pressures. As discussed in the previous section the pressure increases as the temperature is raised. By using the pressure increase determined at the melting point and assuming a linear increase with temperature at intermediate points a small pressure correction was applied to the raw data. The results from 9 different samples are shown in Fig. 5 where the reference temperature T_0 was taken at 30°C. One can never be sure that the application of pressure will not alter the dimensions of the specimen; thus all results are given relative to the resistance at room temperature at each pressure. The initial decrease in $r_p(T,T_0)$ was calculated using Eq. (4) in which the compressibilities were estimated using Grüneisen's relation, $K_T=\alpha V/\gamma C_v$, with experimental values of thermal expansion.[25] The calculated decrease is shown as a solid line in Fig. 5. The data at higher temperatures appear to fall below this calculated curve. It is possible that the difference is due to the decrease in the equilibrium number of vacancies at high pressures.[26] The vacancy contribution to the resistance can be estimated from the measurements of Meechan and Eggleston.[27] The dashed curve in Fig. 5 is the calculated resistance ratio including the effect of vacancies.

The initial heating cycle generally gave a slightly larger value for $r_p(T,T_0)$ than successive cycles even at the same pressure. This may cause the results to be too low at higher pressures. To check this possibility, four runs were made at about 53 kbar, each sample being melted only once, and the resistance measured only on the initial temperature increase. The average of these results, as shown by the squares in Fig. 5, was slightly higher than the other measurements but not significantly so. As the temperature increased the surrounding BN became conducting, the insulation resistance dropping to about 10 Ω at the melting point. This was due to a black substance that would form over the surface of the BN above 600°C. This material proved to be conducting and tended to short out the gold at high

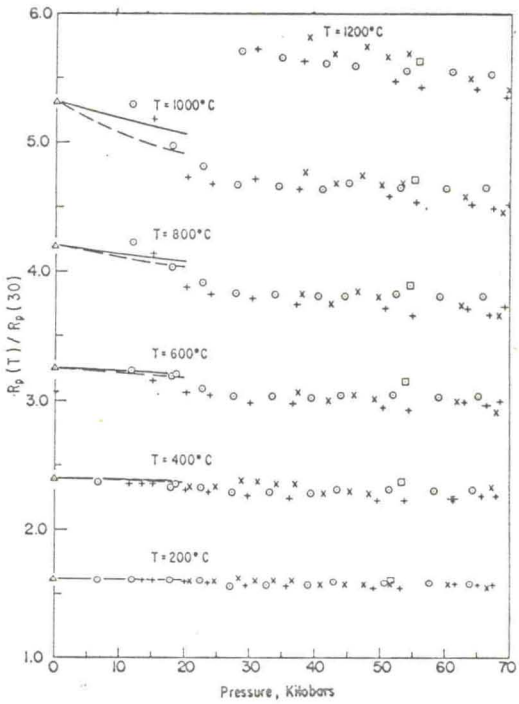

FIG. 5. Resistance of gold at temperature T to that at 30°C as a function of pressure. The solid line follows the calculated initial slope at zero pressure and the dashed line is the calculated curve after a vacancy correction is made.

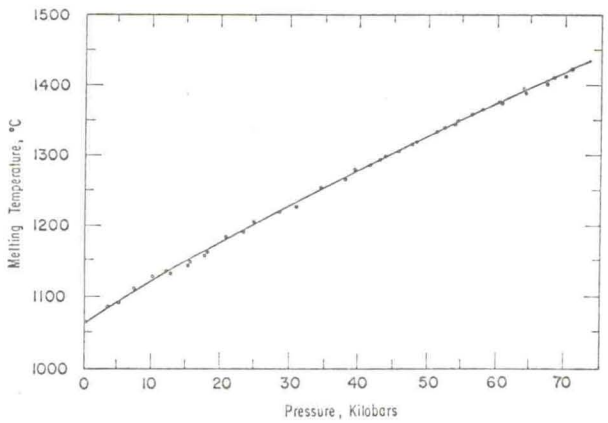

FIG. 4. Pressure dependence of the melting temperature of gold.

[25] See Refs. 8 and 9.

[26] H. H. Grimes, National Aeronautics and Space Administration Technical Note, NASA TN D-2371, UR-64-201366 (National Aeronautics and Space Administration, Washington, D. C., July 1964).

[27] C. J. Meechan and R. R. Eggleston, Acta Met. 2, 680 (1954).