

absolute zero [3]. The change in volume from V_1 to V_2 at 0°K is given

dV .

from the $U_0 - V$ curve so obtained. The temperature of the solid, θ_D^2 , and the assumption that a Debye approximation is quite reasonable. It is assumed that $\theta_D^2 \propto d^2 U_0 / dr^2$, where d is the constant of proportionality, and U_0 is the internal energy from heat measurements [3].

from the formula relating θ , V , and the melting temperature of V . A value for the Lindemann constant from the work of DUGDALE and SIMON [3], and the Lindemann melting formula was valid for their experiments (up to 3000 atmospheres).

Grüneisen model (*) of the solid to calculate the volume, V , at the melting temperature.

Calculations, one can calculate the zero of the internal energy. This gives a value which can be compared with that calculated from

and 2. Fig. 1 shows the isochores calculated in the manner outlined above and derived: for comparison a melting curve deduced from the work of MILLS and GRILLY [6] have measured

the specific heat at constant volume, for (a) only on volume, and (b) the temperature dependence. The calorimetric experiments of GIBBS are approximately true of solid helium.

the melting curve of helium up to 3500 atmospheres; they gave their results in the form of the following equation:

$$P + 17.80 = 17.315 T^{1.5554},$$

where P is the melting pressure in kg/cm^2 corresponding to the temperature T in $^\circ\text{K}$. Points of this curve have been plotted up to 20000 atmospheres in Fig. 1. Other experimenters [7] have made measurements up to higher pressures (up to 9000 atmospheres) but their results are less accurate. In any case, all measurements so far are consi-

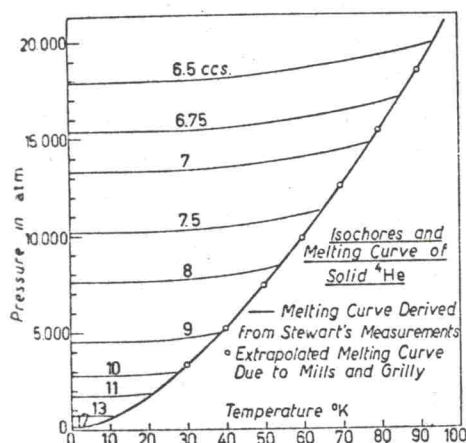


Fig. 1.

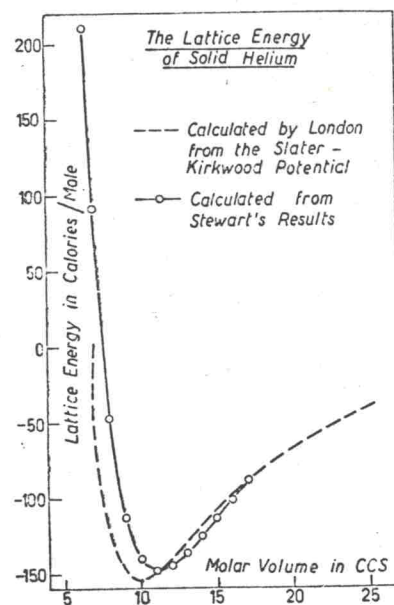


Fig. 2.

istent with the equation given by MILLS and GRILLY. It is seen that the agreement between the extrapolated experimental curve and the melting curve deduced, as described above, from Stewart's experiments is very close indeed.

Fig. 2 shows the lattice energy of solid helium calculated as described together with London's calculation of the lattice energy assuming a Slater-Kirkwood potential [8]. The agreement for large molar volumes is satisfactory: at the minimum of energy and at molar volumes smaller than this the agreement is not good. It is of course known that the Slater-Kirkwood potential does not predict altogether correctly the properties of the gas phase [9]; moreover, the values of θ_D which have been taken were chosen to represent the low temperature specific heats [3] reasonably well and they may differ signi-