

These equations and the general equation of state enable us to derive equations for some of the internal variables⁽⁴⁾ of solids: namely

$$(v-B) = \frac{wRTJ\phi}{LM^0} = \frac{ARTwve^{v/J}}{M^0} \quad (4)$$

$$\sum_x N_x = \frac{wJP\phi}{M^0L} = \frac{AwPve^{v/J}}{M^0} \quad (5)$$

$$Zn = \frac{\sum_x N_x}{\sum N_x} = \frac{w/M^0}{\sum N_x} \\ = \frac{L}{JP\phi} = \frac{e^{-v/J}}{APv} \quad (6)$$

where $(v-B)$ is the defect volume and Zn is the number average degree of association.

Since as originally derived A is an undetermined integration constant, the first computations were of the values of $(v-B)/A$, (ZnA) and ϕ/A as a function of pressure. The calculations were carried out on an IBM 1620 computer and the input consisted of J, L, R, T, w, M^0, H and the pressure range. H is the integration constant in the integrated form of Tait's equation as evaluated in I. Table 1 summarizes the values of the input variables. Except in the case of potassium where the Br II values (see I) were used, the combined Br II and Br III values for J and L as derived from Bridgman's data were chosen. The data from

the two sets were combined in the following manner. For each set separately (Br II and Br III) a set of equally spaced values of P vs. dP/dv was calculated from the experimental data over the range covered. These calculated values from the separate sets were then combined to find the best values of J and L for the combined set. The raw data could not be combined since they covered different ranges and were given at different intervals. In this way all the data were used and the best values derived therefrom.

In calculating the values of J and L we noted Bridgman's assertion that these were room temperature values. However he does not identify this temperature further. In I, since the temperature does not appear explicitly, this posed no problem, although minor variations in the room temperature in Bridgman's work would have the effect of introducing small irregularities into the curves. Perhaps some of the apparently systematic variations in some of the curves in I, notably in the case of potassium, can be traced to systematic variation of this sort during the various experimental runs. In the calculations in this paper we must use the temperature explicitly and have chosen room temperature as 300°K. This choice is undoubtedly wrong but a reasonable choice must be made.

In this paper we will confine ourselves to a consideration of pressure effects at constant temperature and an examination of the Bridgman data previously analyzed in I. The interesting results of

Table 1. Values † of the input parameters for the determination of $(v-B)/A$, ZnA , and ϕ/A . Pressure range 0–100,000 kg/cm² (except as noted). Temperature 300°K (room temperature). R (gas constant) = 84.783 (kg/cm²)cm³ mole⁻¹°C

Metal	M^0 (at. wt.)	J (cm ³)	L (kg/cm ²)	$H \times 10^{-6}$ (kg/cm ²)	Source†
Lithium	6.939	0.372105*	24211.7*	3.62242*	Br II–Br III
Sodium	22.9898	0.185566	14416.8	3.25935	Br II–Br III
Potassium	39.102	0.184129	3453.65	2.12937	Br II
Rubidium	85.47	0.104465	3660.75	1.97998	Br II–Br III
Cesium low pressure 0–23,000	132.91	0.112291	5453.45	0.58229	

* The numbers in these columns are truncated. Computations were made using a minimum of 8 digits. In certain cases 15 or 20 digits were used.

† The determination of these values is described in Ref. 1. The weight of all sample w was taken as 1 g so that the volumes calculated were the specific volumes.