by Kelley (5). Values for ΔH_0° were calculated at each temperature and averaged to obtain a value of 80,807 cal. per mole (Table III). The values of ΔH_0° were consistent within the accuracy of this experiment, and an absence of any trend toward increasing or decreasing values indicates that there were no serious systematic errors. Further validity of data obtained in this investigation may be made by calculating the theoretical vapor pressure at some constant temperature using Equation 3 and the values of ΔH_0° reported by previous investigators (Table IV).

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Vapor Pressure of Sodium from 0.5 to 120 Atmospheres

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The vapor pressure of sodium was measured by a static capsule method from 0.5 to 120 atm. An equation, log p = 4.51961 − (5202.12/T), where p is pressure in atmospheres and T is temperature in degrees Kelvin, was fitted to the data with a standard deviation in p of 3.2°. This equation was pooled with equations determined in three previous independent studies. The pooled equation, log p_p = 4.54025 − (5242.11/T), probably offers the most accurate representation of the vapor pressure of sodium from 0.5 to 120 atm.

VAPOR-PRESSURE CURVES for sodium in various ranges above 1 atm. have been obtained by several investigators, each using a different experimental method: Makansi, Muendel, and Selke, 0.047 to 6.489 atm. (5); Kirillov and Grachev, 0.2 to 15.4 atm. (*4*); Ewing *et al.*, 1 to 25 atm. (*3*); Sowa, 1 to 25 atm. (*6*). Up to about 6 atm., there is good agreement within experimental error among the data of Ewing, Sowa, and Makansi; above 6 atm.,

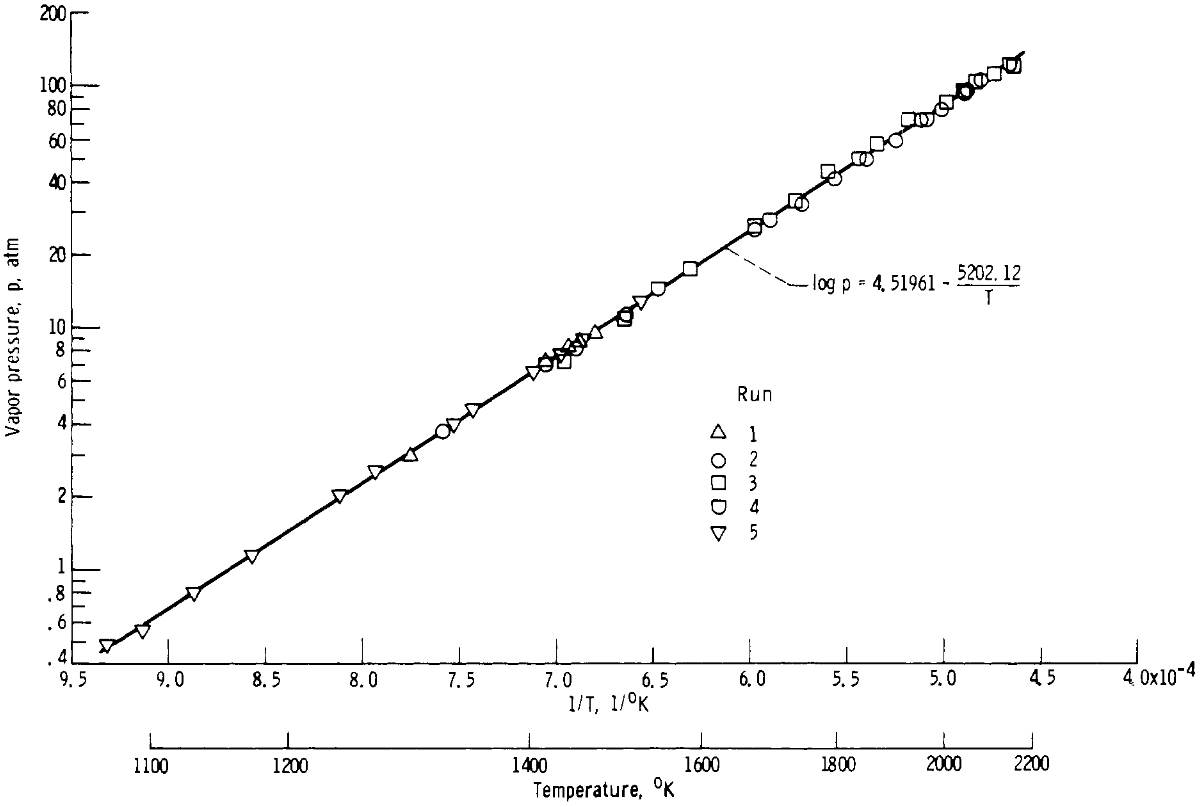

Figure 1. Vapor pressure of sodium

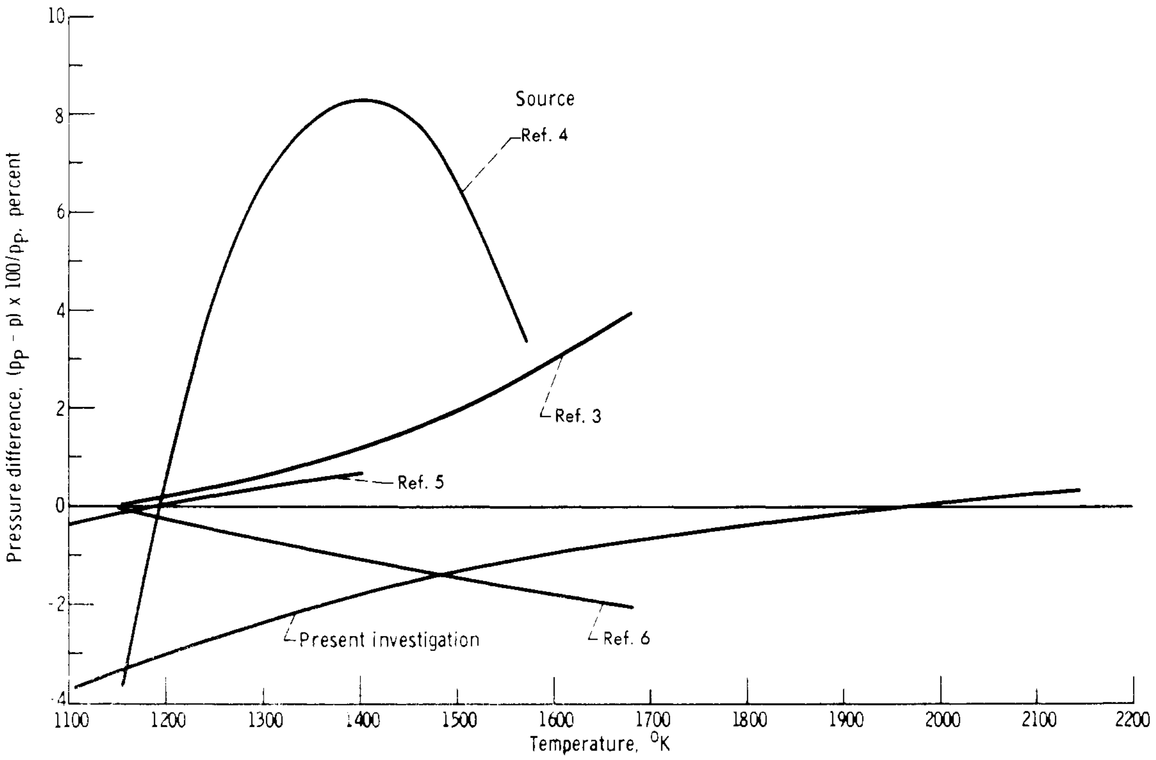

Figure 2. Comparison of vapor pressure data for sodium

however, the determinations (*3*, *6*) show marked divergence. Kirillov's vapor pressure data are, in general, low and show little agreement with other investigator's results.

For the past several years, a static capsule method has been used at the Lewis Research Center to measure the vapor pressure of liquid metals (*1*). The final results obtained for sodium from 0.5 to 120 atm. are presented herein and compared with those of other investigations. Details of the apparatus, the procedure, and an evaluation of the experimental errors have been given by Bowles and Rosenblum (*2*).

RESULTS AND DISCUSSION

The 49 data points from five vapor pressure runs were fitted by the method of least squares to the following equation:

$$\log p = 4.51961 - \frac{5202.12}{T} \qquad (1)$$

where p is the pressure in atmospheres and T is the temperature in ° K. The standard deviation in p as calculated from this equation is 3.2%. A semilog plot of this equation as p *vs.* $1/T$, together with the experimental points is shown in Figure 1.

The vapor-pressure equation determined in this study, Equation 1 together with the equations of Makansi Muendel, and Selke (*5*) and Ewing *et al.* (*3*) and the regression equation that was calculated from Sowa's data (*6*) was pooled to generate a single curve. Each vapor-pressure equation was solved for p at integral intervals of the value $1/T \times 10^{-4}$ from six through nine and then the regression equation was found in the form of $\log p = A + B/T$ that best fit these values. The pooled equation,

$$\log p_p = 4.54025 - \frac{5242.11}{T} \qquad (2)$$

where p_p is in atmospheres, has a standard deviation in p_p of 1.6%. A graphical comparison of the experimental vapor-pressure-temperature relation is shown in Figure 2. The abscissa is given as temperature in ° K., and the ordinate is expressed as $(p_p - p) \times 100/p_p$, or the per cent difference in vapor pressure between pooled vapor-pressure values (Equation 2) and the vapor pressure calculated from an individual investigator's vapor-pressure curve. Each curve of per cent difference covers only the temperature range of the respective vapor-pressure determination.

A per cent difference curve derived from the vapor pressure data of Kirillov and Grachev (*4*) is included in Figure 2. The wide discrepancy between Kirillov and Grachev's data and the data set used to generate p_p permits the rejection of the bulk of their data with a confidence of better than 99.7%.

As is evident in Figure 2 and as can be inferred from the small value of the standard error of estimate in p_p of 1.6%, the agreement among the vapor pressure curves is good. This agreement becomes still more striking when one realizes that different experimental vapor-pressure methods were used in each investigation. Equation 2 probably offers the most accurate representation of the vapor pressure of sodium from 0.5 to 120 atm.

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