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seen, especially for the elements in the fourth, fifth, and sixth periods. The value for the alkali metals, which is close to the mean for all the metals, decreases as one moves along the period, with a minimum occurring at about the group IIIA elements. The value then gradually rises to a maximum at about the group IB metals, with a few minor oscillations between the group IIIA and IB metals. From the maximum at group IB, γ_G decreases almost steadily until the end of the row is reached.

The Grüneisen constants for the rare earths are shown in Fig. 33a, and it is seen that γ_G increases with increasing atomic number. The values for γ_G scatter considerably about the straight line drawn through the points.

The Grüneisen constant, γ_G, as calculated from the total heat capacity at constant volume, C_v, is always equal to, or less than, that calculated from C_v^I. The mean value of γ_G (from C_v) is 1.50 ±0.78. The error ±0.78 corresponds to a percentage error of ±52.0%. Comparing these calculated γ_G values with the literature values we find that 33 out of 51 of these values agree with one another within ±10%. Most of the differences between the other 18 sets of values can be explained on the basis of revised thermal expansion and compressibility data. Such differences are to be expected, since many of the γ_G literature values are based on data over 30 years old. Thus, the agreement between literature values and those calculated herein seem to be reasonably good.

Grüneisen Constant γ_S. A comparison of γ_G (from C_v^I) and γ_S was

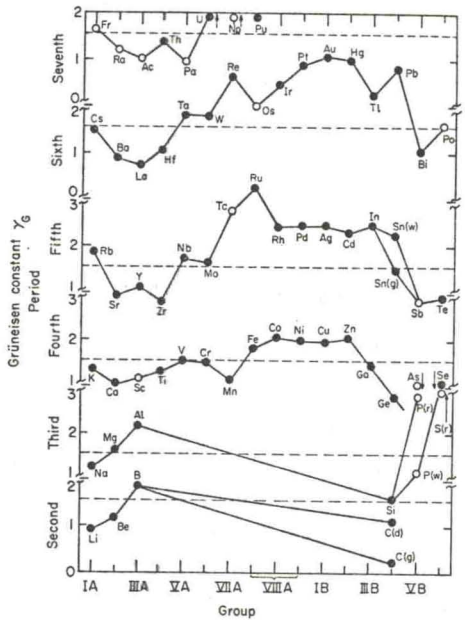

FIG. 32. Grüneisen constant, γ_G, as calculated from C_v^I, of all of the elements considered in this review with the exception of the rare-earth metals. The horizontal dashed line represents the mean values. Open points are estimated data.

made, thus extending analysis of Slater[17] and of Gilvarry[11,17] to all of the elements for which experimental data exist. Arbitrarily the following criteria were used in assessing the data: (1) if γ_S lies within ±25% of γ_G, then the agreement was considered to be very good; if γ_S lies between ±25 and ±50% of γ_G, then the agreement was considered to be good; (3) if γ_S lies between ±50 and ±80%, the agreement was considered fair; and (4) if it was more than ±80%, the agreement was considered to be poor. This scale is about the same as Gilvarry used.[11,17] It was found that for 18 elements the agreement was very good (B, Na, Al, K, Ca, Fe, Zn, Sr, Y, Nb, Cd, Sn(w), Cs, Pr, Ho, Er, Tm, and Yb); for 11 elements the agreement was good (Mg, V, Cr, Ni, Cu, Se, In, Nd, Sm, Au, and Tl); for 11 elements the agreement was fair (Li, Ti, Mo, Rh, Te, Ba, Dy, Hf, Pb, Th, and Pu); and for 20 elements the agreement was