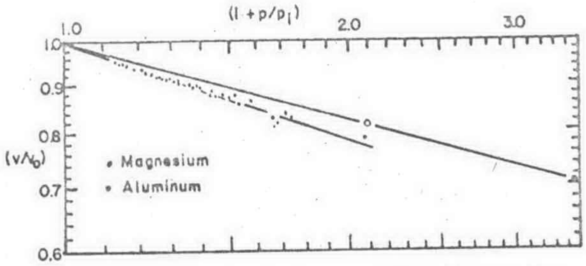

Fig. 3. Log–log plot for shock compression of magnesium and aluminum. Data from Refs. 8 and 9.

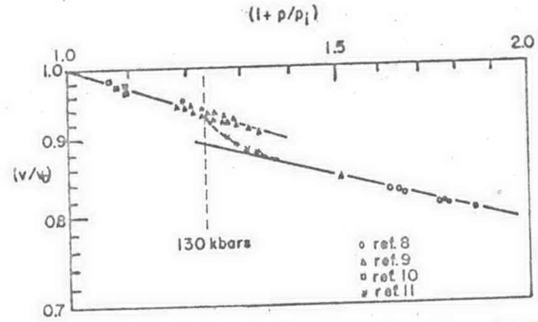

Fig. 4. Log–log plot for shock compression of iron. Data from Refs. 8, 9, 10, and 11.

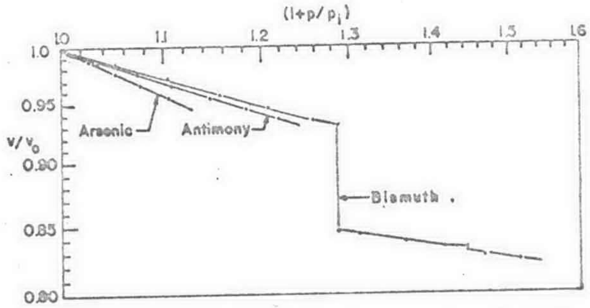

Fig. 5. Log–log plot for osothermal compression of arsenic, antimony, and bismuth. Data from Ref. 6.

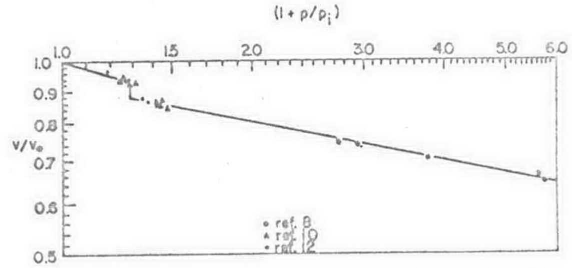

Fig. 6. Log–log plot for shock compression of bismuth. Data from Refs. 8, 10, and 12.

were taken from Bridgman[6] (static pressure data), and from the brilliant work pioneered at Los Alamos using dynamic (shock) methods.[7–15] Data for ϵ_0 were taken from Seitz[16] and the Bureau of Standards.[17]

Values of a, found empirically from the slopes of the log–log plots of data obtained by the shock loading method, were an average of 15% higher than corresponding values for static compression, owing apparently to shock heating and other dissipative factors[18,19] that differentiate the shock process from the more common isothermal or adiabatic processes. The ratio of isothermal compressibility (β_T) to adiabatic compressibility (β_S) is found from thermodynamics to be

$$\beta_T/\beta_S = C_p/C_v. \tag{19}$$

Since C_p and C_v are nearly the same for solids, little difference should exist between isothermal and adiabatic compressibilities as compared to the larger difference between the isothermal and shock wave compressibilities. From Eq. (10) and the expected independence of p_i on the method used, one obtains

$$a_T\beta_{T0} = a_S\beta_{S0} = a_H\beta_{H0}. \tag{20}$$

Grüneisen Constants

A comparison of the γ's obtained from the a's and Eq. (18) with those obtained by more direct methods by Grüneisen,[20] Slater,[20] and Benedek[21] are given in Table II. Included in this comparison are results computed from Eq. (15) using the data previously derived by the approximate method given in Ref. 1. The favorable comparison of results indicates that the present theory of a is satisfactory. The γ's obtained from the ϕ's and Eq. (15) are apparently not seriously in error either, which implies that the approximation used previously to calculate ϕ was reasonably reliable, but the method of relating ϕ to a, which involved the change of ϕ with density, was seriously in error.

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