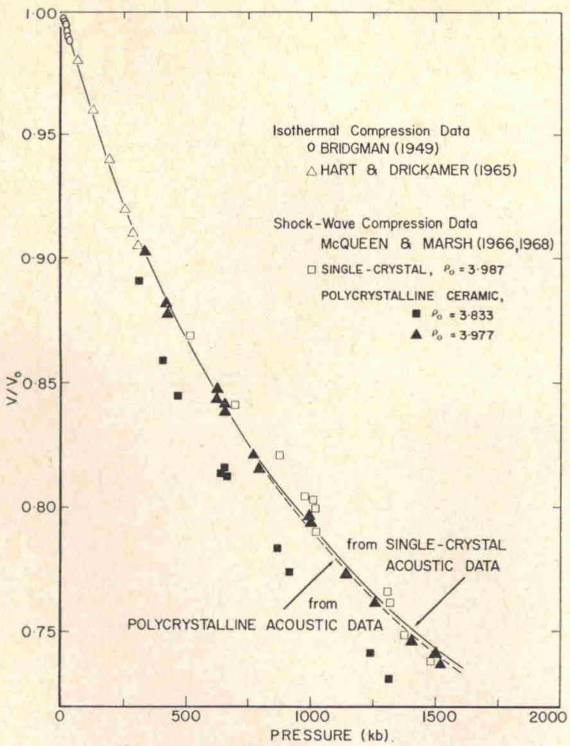

FIG. 5. The compression of single-crystal and polycrystalline alumina.

temperature for alumina was found as $1044(\pm 3)$°K, and it may be noted that this value of the elastic Debye theta agrees very well with thermal Debye theta obtained from the low-temperature specific heat data.[5] The thermal Debye theta, according to the Barron–Berg–Morrison scheme, is $1045(\pm 6)$°K.[7]

The equivalent values of the Debye temperature of alumina as a function of pressure were also evaluated at the constant temperature of 298°K, and these results have been entered in Table III. It may be noted that a linear increase of about $\frac{1}{2}\%$ in the Debye temperature due to a pressure of 10 kbar is seen here. This increase of the Debye temperature with pressure can be understood by considering the Grüneisen theory of solids in which the frequency of lattice vibrations ν is assumed to be a function only of volume. Thus, we write

$$\nu \sim V^{-\gamma_G},$$

where γ_G is the Grüneisen parameter. Introducing the definition of the Debye temperature and taking the ratio of the theta at a pressure p to that at the reference pressure p_0, we find that

$$\ln[\Theta_D/\Theta_{D(0)}] = \gamma_G \ln(V_0/V). \qquad (5.19)$$

According to this relation, Θ_D increases parabolically with pressure for all the solids of which $(V_0/V) > 1$.

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