

function of relative volume V/V_0 for all the alkali metals at 0°C . The data are taken from Bridgman (1925).* ρ_0 is the resistivity at the volume V_0 at which $p = 0$ and ρ is the resistivity corresponding to the volume V . Let us now consider how far theory can account for the pressure dependence of the ideal resistivity.

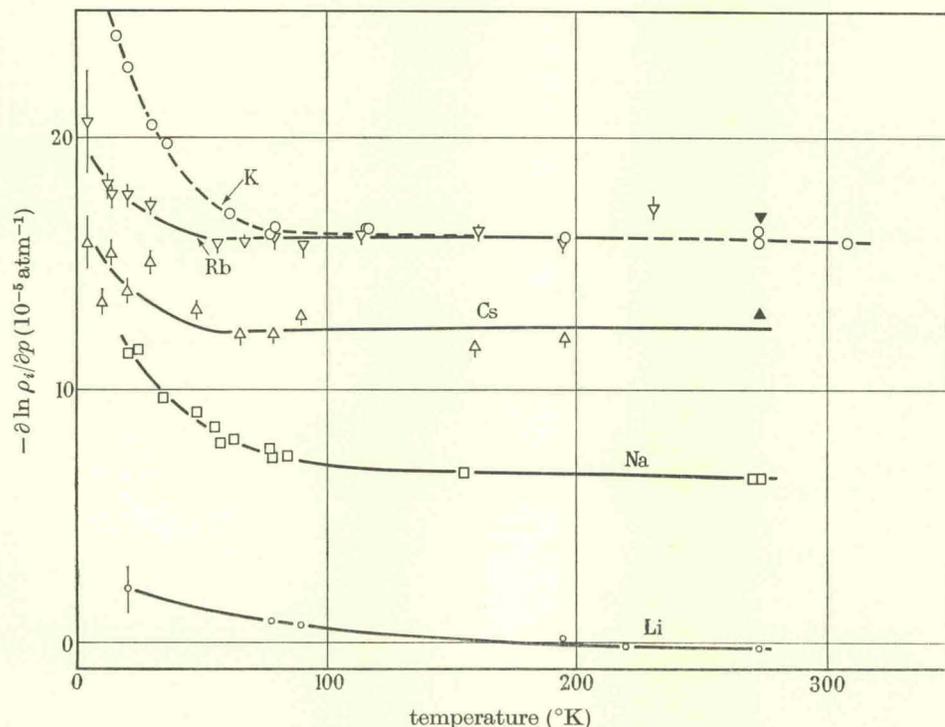


FIGURE 6. The pressure coefficient of the ideal resistivity of the alkali metals as a function of temperature. The data for lithium, sodium and potassium are taken from I; the solid points are from Bridgman (1925).

4.4.1. Rubidium

If we look at table 14 we see that $d \ln K / d \ln V$ for rubidium is quite similar in magnitude to that for sodium or potassium; indeed the general dependence of resistivity on volume (figure 7) is rather similar for sodium, potassium and rubidium over the first 25% change in volume. To understand the behaviour of rubidium, therefore, let us look briefly at how Hasegawa (1964) has interpreted the pressure dependence of ρ_i in sodium and potassium. Hasegawa assumes that the Fermi surfaces of these metals are spherical (see table 12) and that they remain

* Bridgman (1952) has made measurements on the resistivity of the alkali metals up to considerably higher pressures (nominally up to 100 kbar). More recently Stager & Drickamer (1963) have made measurements up to 500 kbar on the four lighter alkali metals and have found many strange and complicated effects. Here we have concentrated on Bridgman's results at lower pressures since they are the only ones which can be compared directly with the present work. Moreover, they are in the region where we have the best hope of a quantitative comparison with theory.

so under modest pressures (cf. Ham 1962). In addition he assumes that the anisotropy of the phonon spectrum does not change significantly with volume; as far as one can tell from the elastic constants this is true (see Daniels (1960) for sodium and Smith & Smith (1964) for potassium).

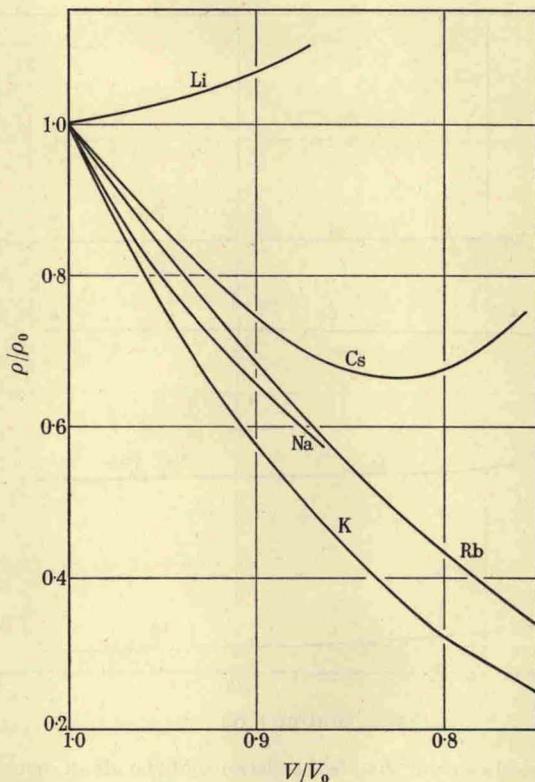


FIGURE 7. Relative resistivity plotted against relative volume for the alkali metals at 0°C (from the data of Bridgman (1925)).

Since the anisotropy of the phonon spectrum and that of the Fermi surface do not change, and since the relative size of the Fermi surface and Brillouin zone does not alter under compression, the geometry in k space of all the phonon electron scattering processes is unchanged by the volume change. This means that the proportions of normal and umklapp processes are likewise unchanged.

Hasegawa finds that the major part of the change with volume of the parameter K (equation (1)) is due to the change in the matrix elements themselves. In essence, the increase in the kinetic energy of electrons on compression diminishes the effect of the scattering potential. Hasegawa finds quite good numerical agreement with experiment; see table 14.

We know that although rubidium has a slightly distorted Fermi surface it is nevertheless nearly spherical. In the absence of other information, therefore, it seems probable that the sort of considerations already applied to sodium and potassium might be sufficient to explain the pressure dependence of ρ_i in rubidium.