

$\gamma_R$  over all temperatures is 1.4 (cf.  $\gamma_G = 1.3$ ), but the value of  $\gamma_R$  from the region where (2) holds, above about  $\frac{1}{4}\theta$ , is 1.6.

#### 4.2.3. The values of $d \ln K/d \ln V$

Since lithium has a positive pressure coefficient of resistance at high temperatures, its behaviour has long been regarded as anomalous. There have been several attempts to explain the anomaly, all of which recognized that compression of the metal must somehow change the electron properties in such a way as to offset the change in lattice vibrations which tends to decrease the resistance (cf. Mott 1934; Frank 1935; Cohen & Heine 1958).

Cohen & Heine (1958) interpreted the positive pressure coefficient of resistance in lithium as due to the close approach of the Fermi surface of lithium to the Brillouin zone boundary (or even to its contact with the zone boundary). They argued that the effect of pressure would be to increase the energy gap at the middle of the (110) face of the Brillouin zone and that this would thus increase the distortion of the Fermi surface (we are considering here only the b.c.c. phase). Such a distortion, they argued, would enhance the probability of Umklapp processes, and this together with possible changes in the average Fermi velocity of the electrons, would increase the electrical resistivity. No one has yet carried out a detailed calculation of these effects and the actual mechanism of the resistance increase is still uncertain (cf. Bailyn 1960).

TABLE 13. CORRELATION OF  $d \ln K/d \ln V$  WITH THE THERMOELECTRIC POWER FOR THE MONOVALENT METALS

metal	$d \ln K/d \ln V$ †	$x^*$	$(d \ln K/d \ln V)/x$
Li	-2.6	6.7	-0.4
Na	1.8	-2.7	-0.7
K	3.0	-4.0	-0.8
Rb	0.7	-2.5	-0.3
Cs	—	-0.2	—
Cu	-1.2	1.6	-0.8
Ag	-0.9	1.1	-0.8
Au	-0.7	1.5	-0.5

\* See text.

† These values were calculated from the limiting high temperature values of  $\partial \ln \rho_i / \partial \ln V$  by subtracting  $2\gamma_G$  (see equation (3)). The value of  $d \ln K/d \ln V$  for Cs is too uncertain for inclusion.

If, however, we accept the general argument of Cohen & Heine it should also apply to the noble metals. From the results of experiments on the anomalous skin effect, ultrasonic attenuation in a magnetic field and the de Haas-van Alpen effect, it is now well established that the Fermi surfaces of copper, silver and gold contact the Brillouin zone boundary. Cohen & Heine (1958) conclude from theoretical considerations that the effect of pressure on these metals should be to increase the area of contact of the Fermi surface and zone boundary; we therefore deduce, by the same argument as that applied to lithium, that this could account for the decidedly negative value of  $d \ln K/d \ln V$  in the noble metals (see table 13).