the agreement is good enough to allow an estimate of the effect of pressure on the driving energy for recrystallization to be made. The fractional change in the stored energy per unit volume due to the application of a pressure P is given by

$$\frac{P\delta V}{E_s V} = P \times 2(\beta - \tfrac{1}{3})\chi$$

which is equal to 0·11 at 25 kbar for aluminium. Thus an increase of about 10% in the driving force is expected at 25 kbar. A similar change can also be predicted in the activation energy. When the exponential dependence of the rate of the process is taken into account it is seen that this effect far outweighs the driving force effect.

The movement of the grain boundaries for the recrystallization process in the commercial purity aluminium used in the present experiments is determined by the various impurities present. The Lucke-Detert (1957) theory suggests that the impurities interact with the migrating grain boundaries. The impurity cloud exerts a drag on the moving dislocation and, if the driving force is insufficient to overcome this, the rate of migration of the boundary is controlled by the rate at which impurities can diffuse along behind it. The present results can be explained by the imposition of pressure, inhibiting the migration of the impurities present in the comparatively impure aluminium specimens used, and thus inhibiting the movement of the grain boundaries. The level of the impurity content is too high for the boundaries to break away from their impurity clouds, as is found at very low impurity content, and so the kinetics are controlled in a complex way by the diffusion of the various impurities in the material.

In an attempt to determine the effect of pressure on the migration of grain boundaries in aluminium with impurities present, experiments were done with aluminium specimens containing known amounts of copper as impurity. It is interesting to compare the present results with those obtained by Gordon and Vandermeer (1962) for boundary migration in zone-refined aluminium alloyed with small amounts of copper and cold-rolled to 40% reduction in thickness. This comparison is meaningful if—as Bailey and Hirsch (1961) suggest—grain boundary migration is the important factor in recrystallization. Gordon and Vandermeer found that the activation energy varied from about 15 kcal mole^{-1} (0·65 eV) for zone-refined aluminium (0·00002% Cu), through a maximum of about 40 kcal mole^{-1} (1·75 eV) for Al-0·0005% Cu, to about 29 kcal mole^{-1} (1·26 eV) for Al-0·01% Cu, after which it remained essentially constant with increasing concentration of copper. This they explained on the basis of the Lucke-Detert (1957) theory of impurity controlled grain boundary migration, in which the migration is impurity independent at very low impurity concentrations, followed by a transition region as the impurity content is increased, and leading to an impurity dependent region at still higher impurity concentrations. If the correct value of k for the 0·001% Cu alloy is taken to be the same as for the other two alloys, then the activation energy at 25 kbar is about 24 ± 4 kcal mole^{-1} (1·05 ± 0·17 eV), which is comparable with Gordon and Vandermeer's value for Al-0·0001% Cu taking the expected increase of about 10% at 25 kbar into account. Similarly, the values obtained for Al-0·01% Cu and Al-0·1% Cu at 25 kbar are consistent with their results, if the observed grain boundary migration is occurring in the part of the transition region which is near the impurity controlled region or in the impurity controlled region itself.

The experimental results are consistent with the idea that the application of high pressure moves the range of observation of the process towards the impurity dependent region. Thus, for instance, a material which has an impurity concentration, which would put the recrystallization process in the transition region at atmospheric pressure, moves towards the impurity dependent region as the pressure is increased.