orientation at the location of the scratch, as shown in Fig. 3. Since scratches are associated with linear arrays of dislocations and the etching of the above scratches produced characteristic etch pits it is possible that these etch pits are dislocation etch pits. To determine the orientation of these etch pits the sample was cleaved; it was found that the sides of the etch pits were parallel to the (110) cleavage plane.

When concentrated nitric acid was used as the etchant then dendrites of As_2O_3 were produced, as seen in Fig. 4a and b. These crystals were confirmed by X-ray diffraction and microprobe analysis experiments to be crystals of Arsenolite (As_2O_3).

The results presented here suggest that the limited solubility of As_2O_3 in water produced different etching characteristics, depending on the solution volume, concentration and amount of solution agitation used. Etch pits, which are believed to be dislocation etch pits, have been identified.

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The effect of triple junctions on grain-boundary migration

The rate controlling process in recrystallization and grain growth is usually considered to be the motion of grain boundaries. The necessary adjustment or the motion of triple junctions is not considered important. For two dimensional grain growth in a thin sheet, the effect of grain-boundary grooves [1, 2] has been suggested. While the groove effect is a surface effect, the junction effect is a bulk effect. This note presents experimental evidence of both effects.

For the study of grain growth kinetics, it is convenient to observe boundary motion *in situ* inside a microscope [3]. Camphene was chosen because it recrystallizes at room temperature and it is a b c c globular plastic crystal with a rotational transition temperature of −120° C [4]. Thus at room temperature, camphene may simulate the behaviour of b c c metals at high temperatures.

As-received, practical grade camphene (95% purity) from Eastman Kodak contains an orange-brown liquid. The liquid was removed and the solid recrystallized five times from the melt and one time from alcohol. It was then sublimed five times in a 2 mm Hg vacuum. Camphene thus purified was colourless, soft and sticky.

A small flat piece of the purified camphene was placed on a microscope slide and inside a small vacuum cell which is covered with another microscope slide as shown in Fig. 1. The assembly was

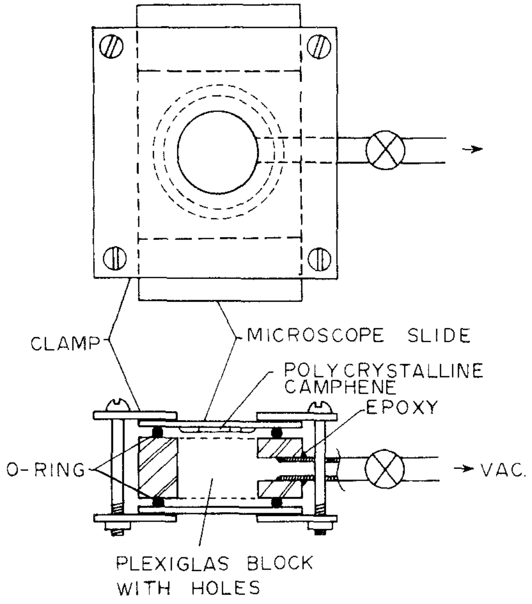

Figure 1 Microscope stage for observing grain growth in camphene.

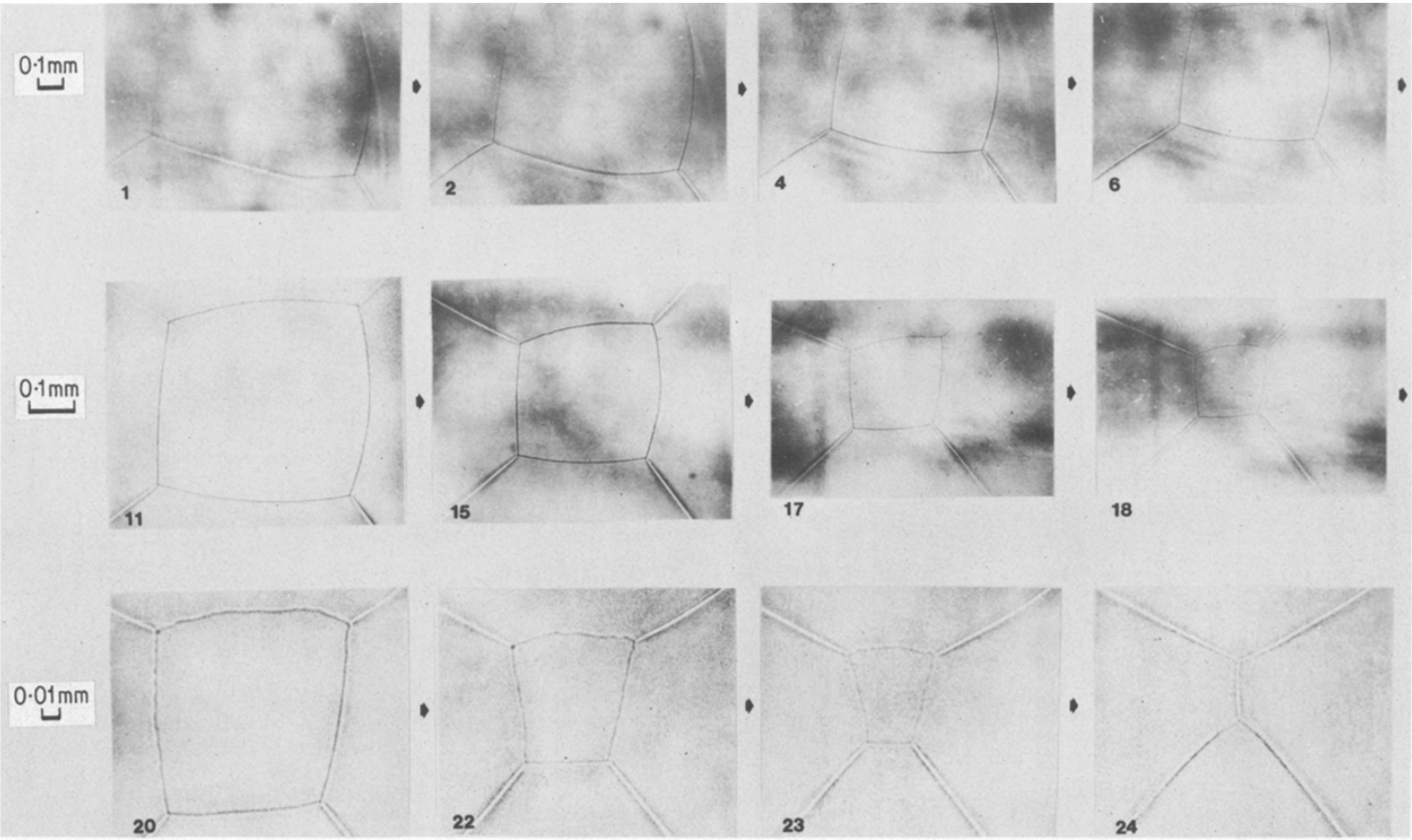

Figure 2 Successive stages for the shrinking of a four-sided grain.

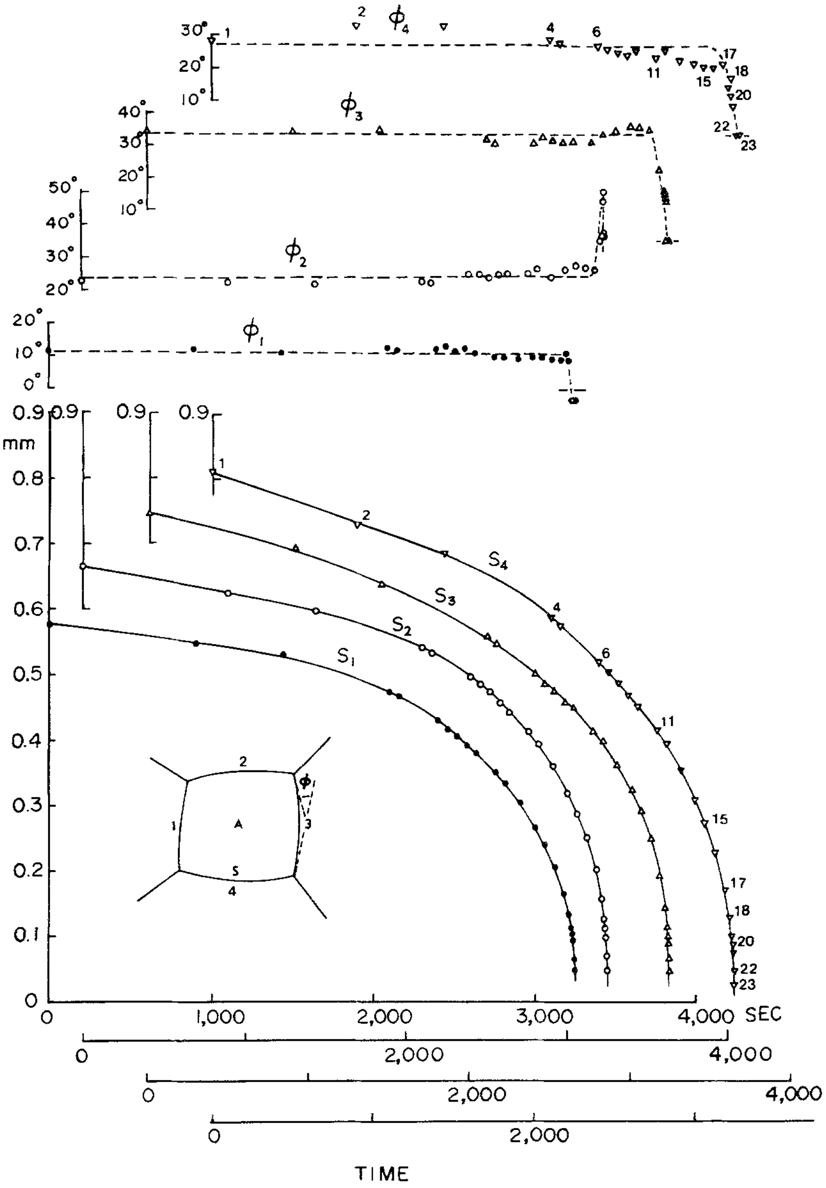

Figure 3 Lengths and angles of grain-boundary arcs during the shrinking process.

heated slowly from the bottom to sublime the camphene and to condense it onto the underside of the top slide which was colder. Then the assembly was annealed at about 30° C so that the condensed camphene became a uniform transparent film. While the grains were still growing the assembly was cooled to room temperature and inserted in the microscope where the grains continued to grow at a reduced speed. Thermal grooves formed at the boundaries enabled direct observation of the process.

Grain growth took place by shrinking of 3, 4 or 5 sided grains. The uniformity of thickness near the shrinking grain can be examined by changing the microscope aperture and observing its image. If the surface is flat, a circular shape is seen. Otherwise the image may distort into an irregular shape revealing the surface profile.

A four-sided shrinking grain was photographed at different time intervals. A total of 24 frames were taken and some of them are shown in Fig. 2. The groove effect is evident in the first two frames.

The breakaway process seems to have started from a high driving force region at the lower right corner. The old grooves are seen to have been left behind while the new grooves are following the boundaries.

For most of the frames in Fig. 2 the shape of the shrinking grain remains similar, as shown in Fig. 3 by the measurements of the angles and the lengths of the four grain-boundary arcs as a function of time. However, the situation seems to change at the 18th frame. One of the boundaries starts to become straight and the angle decreases toward zero. Other boundaries seem to experience similar changes until the whole grain disappears.

Since the boundaries cannot move without the junctions moving at the same time and vice versa, the slow moving ones are rate controlling. When the driving force is small, the boundaries move slowly and the junctions seem to have plenty of time to follow the boundaries and adjust themselves to nearly equilibrium configurations. This is the situation for most of the frames in Fig. 2. The motion of the boundary is the rate controlling process. However, when the boundary velocity is sufficiently high so that the junctions cannot follow easily, the local equilibrium at the junctions is upset and the angles of the boundary arcs begin to change. Finally, the boundary velocity is limited by the junction velocity. When that happens, the boundaries have sufficient mobility to follow the junctions and to adjust themselves to nearly equilibrium configurations, namely planar (or straight in the picture) boundaries. The junction motion is then the rate controlling process. Details will be published soon.

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Factors determining the electric strength of polymeric dielectrics

The problem of the electric strength of solid dielectrics has been tackled by many investigators, and different theories have been put forward to explain the phenomena of electrical breakdown [1].

The effect of intermolecular forces on alkali halide crystals has been shown by Vorob'ev [2], who established a correlation between the different physical properties of alkali halides (such as hardness, compressibility, melting point and electric strength) and the lattice energy. A linear relationship has more recently been found by Vijh [3–5] between related molecular parameters (lattice space and energy), the electric strength, and the elastic moduli of the alkali halides. This leads to the conclusion that the factors determining the thermal, mechanical and electrical properties are synonymous.

It has been suggested by Artbauer [6, 7] that there is a considerable significance of the molecular structure on the electric strength of polymeric materials. The important factors are the intermolecular forces acting between the different macromolecules (secondary bonding) and the free volume presented in all polymers. Artbauer [7] concluded that the time and temperature dependence of the electric strength is mainly due to molecular relaxation processes.

The effect of molecular motion due to electric stress has been studied in this laboratory by means of the photo-elastic technique. Test specimens fabricated from epoxy-resins (CIBA CT200 + Hardener HT901) were moulded around two stainless steel conic electrodes having a tip radius of 2 mm. and maintained at a distance of 100 to 200 μm. Paraffin oil was used to suppress unwanted disch-