by Hull from consideration of an almost stationary crack tip (cf. [2] and [3]). Experimental clarification of the initiation and propagation of crazes might be possible in the present system by cinematographic studies.

An important final consideration is whether the mechanism of band formation documented here applies to other glassy polymers. Undocumented observations suggest that this is the case for polystyrene. In the case of polymethyl methacrylate craze formation is much less extensive and generally is limited to bifurcation of the craze-crack front. However, the same mechanism of band formation might still apply. A limited documentation for this polymer is to be found in [5].

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Spin-lattice relaxation of $Gd^{7/2}$ in calcium tungstate

Previous studies of the relaxation behaviour of rare earth ions in calcium tungstate have suggested [1] that for most rare earth ions the Raman process predominates above about 4.2 K and that only at temperatures below about 2.5 K is the direction process of spin-lattice relaxation dominant. This results in such a large temperature dependent line broadening that the e.s.r. spectra are not generally visible except at low temperatures; in the case of neodymium doped calcium tungstate for example, which has been examined in considerable detail [2, 3] the Nd^{3+} spectrum is only observable around 4.2 K where $T_1 > 1$ msec. No relaxation data appear to have been reported previously, however, for gadolinium-doped calcium tungstate in which, by contrast, all seven main lines of the $Gd^{7/2}$ spectrum are easily observable at room temperature [4, 5].

In the present work, spin-lattice relaxation times were measured using the pulse saturation method at 37.5 GHz. Single crystals of vacancy-compensated gadolinium-doped calcium tungstate, grown by the Czochralski technique, were obtained from the International Research and Development Co Ltd, Newcastle; the nominal gadolinium concentrations were 0.005, 0.01 and 0.05 at. % Gd respectively. In preliminary examinations of the spectra at room temperature it was observed that with the highest concentration crystal the main transitions were sometimes split and that each was accompanied by a number of other lines of weaker intensity. Similar anomalous lines have been reported in cerium-doped calcium tungstate by Klein and Mims [6], who proposed that they were due to local charge compensation in chemically uncompensated material, and in neodymium doped calcium tungstate [7]. Consequently, attention was focused on the 0.005% Gd and 0.01% Gd crystals with which clean single lines were found for each of the seven main transitions at room temperature; even with these however the lines tended to split into two components at 4.2 K, the separation being dependent on the orientation and the gadolinium concentration.

Measurements were made with the magnetic field in the plane perpendicular to the c-axis (i.e. in the ϕ plane) over the temperature range 1.5 to 8 K; the accuracy was $\pm 10\%$. The observed decay for each line component was a single exponential. The results shown in Fig. 1 refer to the 0.01% Gd sample at $\phi = 10°$, where it was found that the two line components were separated by about 2 mT. Both components showed very similar behaviour and gave exponents of 1.0 and 0.9 respectively. This

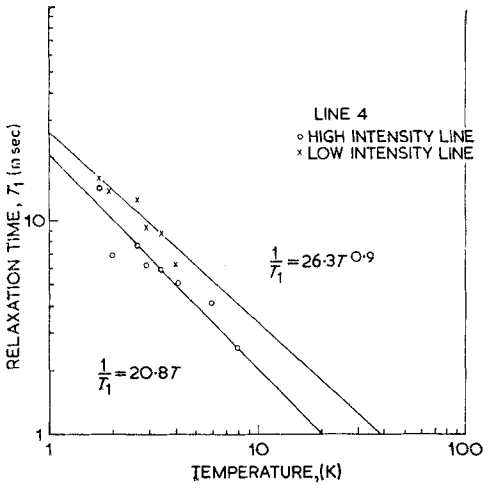

Figure 1 Temperature dependence of T_1 for $Gd/CaWo_4$; $\phi = 10°$, 37.5 GHz.

indicated that over this temperature range the recovery is dominated by the direct process. The magnitude of T_1, which varied from 14 msec at 1.5K to 2 msec at 8K, compared closely with the value of 8 msec at 4.2K for all transitions at 9 GHz reported by Zaripov *et al* [8] for gadolinium-doped strontium tungstate; it is also similar to the values given for neodymium-doped calcium tungstate, [2] and for other rare earth ions in scheelite structures [9]. The biggest difference in the case of $Gd^{7/2}$ in calcium tungstate appears to be that the transition from the direct to Raman process occurs at a considerably higher temperature whose exact position remains to be determined.

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Phase boundary sliding of lamellar eutectic alloy PbSn

For multiphase materials, the phase-boundaries are very important in the hot-deformation mechanisms. The phase-boundary sliding is dependent on the alloy constituents, grain size, grain shape, crystallographic orientation and also the experimental conditions, e.g. temperature, stress and strain-rate.

The experiments were conducted using specimens of lamellar Pb–Sn eutectic alloy which possess an already known fine structure [1]. The material of the test specimens was prepared using the classical method of unidirectional solidification [2]. It was provided in the form of bars of 10 mm diameter. The inter-lamellar spacing was either 1.4 or 3.0 μm. Tensile test specimens of gauge length of 6 mm, width of 1 mm and thickness of 0.3 mm were machined and mechanically polished. The phase-boundary planes were inclined an angle of 25 ± 2 degrees to the longitudinal axis of the test specimen; across the thickness, these planes were perpendicular to the surface of the test specimen. Recovery was achieved by keeping the test specimens at room temperature for a few days followed by electro-polishing [3]. This procedure is assumed to be sufficient to reduce the residual stresses and work-hardening effects. Fiducial lines were scratched on the top surface of the gauge length of the specimen.

The specimens were mounted on a special tensile testing attachment which was fitted under the scanning electron microscope [4]. Tensile tests at constant cross-head speed of 60 μm min^{-1} were carried out at room temperature up to true strain of 0.65.

At a given value of tensile strain, it was found that the amplitude, l, of phase-boundary sliding changes considerably from one boundary to another (Fig. 1). Generally speaking, this