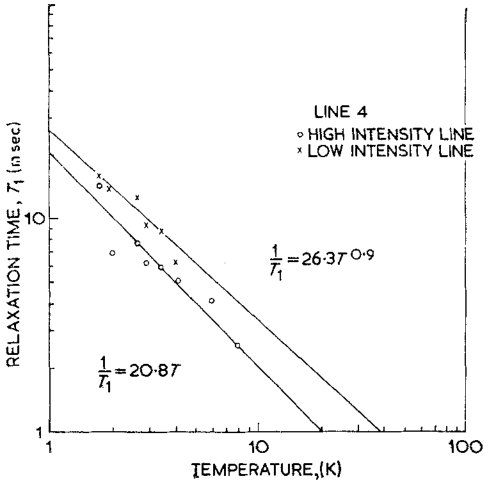

Figure 1 Temperature dependence of T_1 for Gd/CaWo$_4$; ϕ = 10°, 37.5 GHz.

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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Received 31 December 1973
and accepted 7 January 1974

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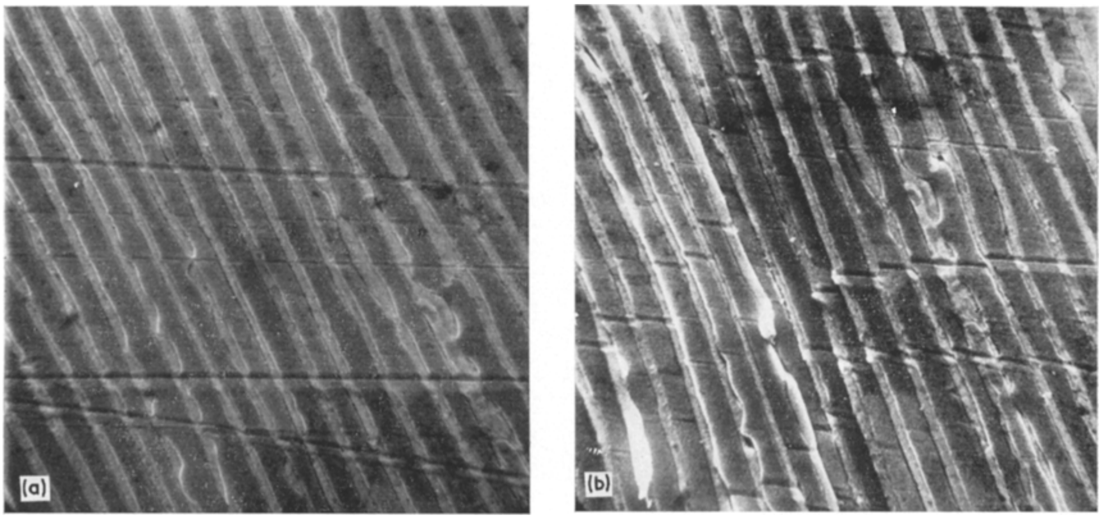
Phase boundary sliding of lamellar eutectic alloy PbSn

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



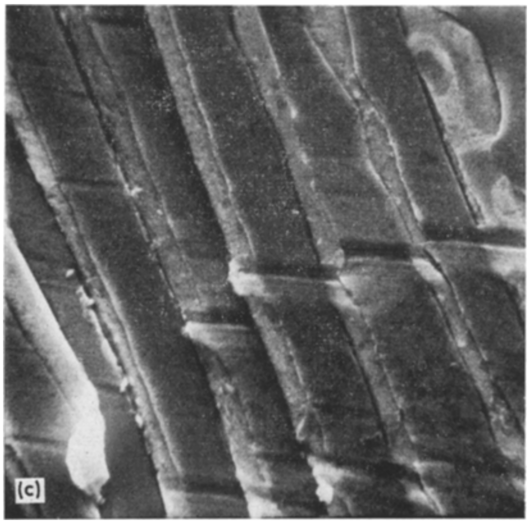
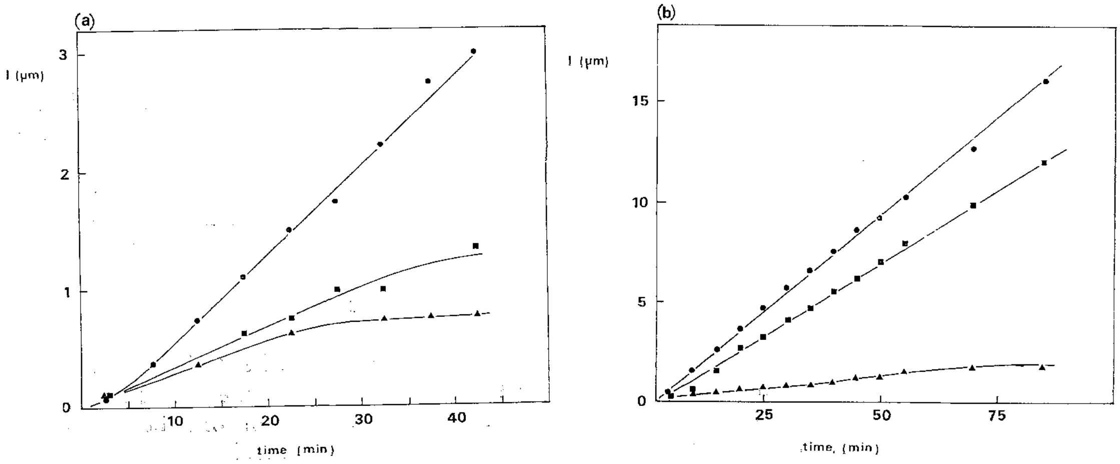


Figure 1 Eutectic lamellar Pb–Sn of 3 μm interlamellar spacing observed with electron scanning microscope: (a) before deformation (× 1400); (b) same area after deformation: true strain, 0.65; constant cross-head speed, 60 μm min^{-1} room temperature (× 1400). (c) Detail of (b) (× 2800). Tensile axis is vertical. It is noticed that some phase boundaries do not slide. (The lead-rich phases appear clear.)

Figure 2 Amplitude, *l*, of phase-boundary sliding against strain time. (a) Interlamellar spacing, λ = 1.4 μm. (b) Interlamellar spacing, λ = 3.0 μm. Constant strain velocity, 60 μm min^{-1}.



amplitude varies linearily with deformation time as shown in Fig. 2a and b. However, this linear relationship was not observed at the low rates of phase-boundary sliding at large values of strain. The ratio between the maximum rate of phase-boundary sliding and the interlamellar spacing was found to be approximately constant for the two lamellar structures studied.

It should be noticed that the intracrystalline deformation accompanying the phase-boundary sliding may be considered negligible since this deformation is certainly less than the 2% error assumed in measuring the total tensile strain of 0.65 true strain. It was also observed that:

1. the sum of the amplitudes of the phase-boundary sliding of a few dozens of consecutive lamellae accounts approximately for the total tensile deformation of the specimen;
2. within each phase, the distance between the fiducial lines and as well as their orientation with respect to the phase-boundary plane remain always constant.

The degree of perfection of phase-boundary plane may greatly affect the mechanism of phase-boundary sliding. It may also explain on one hand the large dispersion of the sliding velocities of different lamellae. On the other hand, it may be also responsible for localized hardening which reduces the rate of phase-boundary sliding at large deformation.

It is planned to continue this investigation furthermore in order to establish correlation among different parameters such as shear stress, sliding velocity, interlamellar spacing and phase-boundary crystallography.

Acknowledgments

The authors thank the Centre National de la Recherche Scientifique for supporting this work financially. They also record their indebtedness to R. Racek for preparing the material.

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Received 21 January
and accepted 6 February 1973

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A scanning electron microscopic examination of sintered barium sodium niobate

In recent years, barium sodium niobate ($Ba_2NaNb_5O_{15}$ or BNN) has been proven to be an outstanding electro-optic material [1, 2]. So far, however, no study of the sintering mechanisms of polycrystalline BNN samples has been reported. In the present work some observations have been made regarding the sintering processes in BNN ceramic compacts using scanning electron microscopy (SEM). The use of SEM not only helps in observing the changes in grain and pore sizes with the degree of sintering, but it also enables the study of the associated morphological changes [3].

Reagent grade barium carbonate, sodium carbonate and niobium pentoxide were mixed in an agate mortar and pestle using methyl alcohol as a grinding medium. After drying, the powders were calcined at 1200 ± 5°C for 24 h. The resultant material was checked that it was single phase tungsten bronze barium sodium niobate ($Ba_2NaNb_5O_{15}$) from its X-ray diffraction pattern, using only Cu$K\alpha$ lines, taken with a Guinier camera. The calcined powder was then screened to −200 +300 mesh and compacts or pellets of about 0.5 in. diameter and 0.4 in. thick were made by pressing in a hydraulic press at a pressure about 15 000 psi* without the use of any binder.

The pellets were heated in a box furnace, maintaining temperature control within ± 5°C. The sintering temperatures chosen were 1200 and 1350°C, with sintering times up to 120 h in ambient atmosphere. After the furnace was raised to the appropriate temperature, the specimen was inserted in the furnace in a platinum crucible, heat-treated and then, after a specified sintering time, taken out of the maximum temperature zone to a lower

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*10^3 psi = 6.89 Nmm^{-2}