07.1-04 FLUID FLOW EFFECTS ON THE GROWTH OF GGG AND DOPED GGG CRYSTALS. By Zhang Le-hui, Bai Nai-zhi, Lin Cheng-tien, Institute of Physics, Chinese Academy of Sciences, Beijing, China.

Single crystals of gadolinium galium garnet (GGG) and doped GGG have been grown by the Czochralski method. Growth experiments related to the coupling effects of thermal convection and forced convection in the melt have been carried out. Experimental results show that after the inversion of the interface from convex to planar, different fluid flow effects cause different solid-liquid interface shapes. The shapes determine the various dislocation formations. These observations are significant to the growth of dislocation-free crystals. The dislocations are revealed by chemical etching, stress birefringence and X-ray topography, which are methods reliable and complementary to one another in nature. The measurement of transient growth rate oscillations by fluid flow effects has also been carried out. The method involves the growing of a large amount of metallic iridium into the crystals. The transient growth rate of an interface can be calculated by the empirical relation $V_c = E/R^m$, where V_c is the critical growth rate of an interface which captures a foreign particle of radius R; E and m are constants dependent on certain conditions. This relation has been verified with GGG and doped GGG in our experiments. Further, the oscillations are smaller with smaller melt depth.

07.1-05 THE FABRICATION BY JOINING OF LONG SEEDS FOR THE GROWTH OF LARGE SYNTHETIC QUARTZ CRYSTALS. By I.R.A.Christie, D.F.Croxall, J.M.Holt, B.J.Isherwood and A.G.Todd, GEC Hirst Research Centre, Wembley, England.

Certain current designs of SAW devices require substrates of high quality single crystal quartz that are over 200 mm in length and a demand for even larger crystals is predicted. Quartz crystals are grown synthetically by a hydrothermal technique on seed plates, usually of basal (0001) orientation. The morphological development of the grown crystal is such that seeds of larger dimension than the required crystal substrates are necessary. The world supply of high quality, natural quartz crystals from which seed plates of the required dimension may be cut is already restricted and is diminishing.

The possibility of fabricating large seeds by joining individual crystal plates is under investigation. Initial results from small scale trials are very encouraging and it has proved possible to achieve hydrothermal growth on joined basal plates to produce good quality crystals with lattice misorientations of $\lesssim 0.01^\circ$ in crystals up to 85 mm in length. The results obtained suggest that, by this route, high quality large dimension (>500 mm) crystals, suitable for piezoelectric and optical devices, may be grown. Full scale trials in commercial autoclaves are planned.

The long and short range accommodation of stresses generated by the lattice mismatch and the formation of structural defects at the junction of the crystal plates have been studied by X-ray diffraction, principally X-ray topography and orientation goniometry. The results of these investigations and the procedures developed for seed plate orientation and bonding will be described.

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07.1-06 MORPHOLOGY OF METAL SMOKE PARTICLES HEXAGONAL METALS, Mg, Zn AND Cd.

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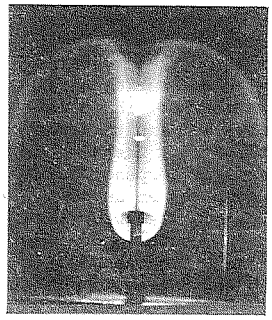

Fig. 1

A metal smoke (Fig. 1) is made by evaporation and subsequent condensation in an atmosphere of inactive gas at low pressure. A study of smoke particles by electron microscopy and electron diffraction was initiated by one (R.U.) of the present authors in 1962 and this study has been continued since that time at Nagoya University and then at Meijo University.

Since the particles are crystallites grown in a free atmosphere, they often show perfect three-dimensional shapes as reported in Uyeda's review articles [1,2]. The present paper gives some new results obtained for Mg, Zn and Cd.

Figures 2,3 and 4 show scanning images of Mg crystallites each of which has presumably been grown from a liquid drop. Figure 4 may approximately be an equilibrium form. On the other hand, hexagonal plates which are often indented on each side are surely growth forms. Strange shapes as shown in Fig. 5 are also found, although they are less frequent.

Zn and Cd have common crystal habits. Figure 6 seems to correspond to Fig. 3 of Mg. It is worth noting that

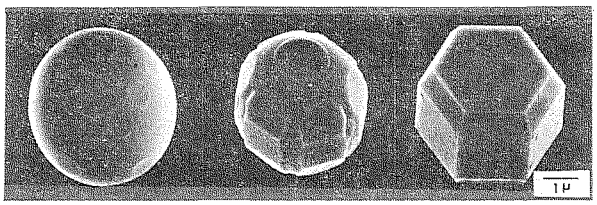

Fig. 2 Mg Fig. 3 Mg Fig. 4 Mg

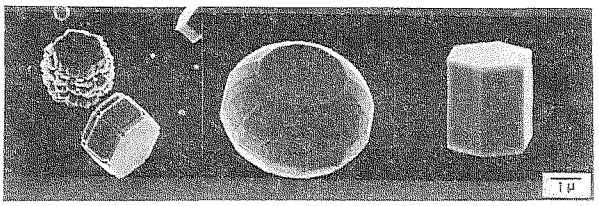

Fig. 5 Mg Fig. 6 Zn Fig. 7 Zn

the crystals of this type are truncated always only by one of the c-planes. Hexagonal plates indented on each side are also found similar to Mg. Non-truncated hexagonal prisms as shown in Fig. 7, which are never found for Mg, often appear for Zn and Cd. Besides these shapes, very thin plates sided with $10\bar{1}0$ and or $11\bar{2}0$, and triangular pyramids of the first and second kinds are found, although they are rare.

[1] R. Uyeda, J. Cryst. Growth, 24/25 (1974) 69-75
[2] R. Uyeda, J. Cryst. Growth, 45 (1978) 485-489