89: 191453 In situ observation of monomolecular growth steps on crystals growing in aqueous solution. I. Tsuchimoto, K. (Fac. Sci., Tohoku Univ., Sendai, Japan 980). J. Cryst. Growth 1983, 61(2), 253-64 (Eng). An improved method for the measurement of the rates of growth and dissolution of crystals under isothermal conditions. A modified Bridgman technique by continuous crystal melting in a stainless steel crucible was applied to the growth of equiaxed, cm-sized titanomagnetite (Fe$_3$O$_4$-Fe$_2$TiO$_4$), single crystals, in O$_2$-flushed atmospheres. The relation between atom and spin polarization was systematically investigated, through measurements of X-ray diffraction, polarized reflected light microscopy, and electron microprobe analysis. Guidelines are generalized for determining the methods to single crystals.

89: 191513 A refractometric method for continuous investigation of stirred crystal growth organic solutions. Sigel, M.; Fricke, J.; Hiebel, R.; Baner, J. (CEN'T PSC/PAB, F-92200 Bagneux, Fr.). J. Cryst. Growth 1983, 61(2), 229-34 (Eng). A continuous refractometric method with a He-Ne laser at $\lambda = 632.8$ nm for investigating stirred crystal growth solutions, is described. A method that is set reliable for any long-time running experiments, was designed, which allows in situ nondestructive characterization of 0.6 cm$^3$ vol. cell thermostated at $\pm 0.1^\circ$C. The theoretical refractive index is $\Delta n_{\text{sol}} = 3 \times 10^{-4}$, while the effects of room temp., atmospheric pressure change, and dielectric constant due to stirring effects, are negligible. Only long-term reproducibility considerations lead to an actual result, $\Delta n_{\text{sol}} = 6 \times 10^{-5}$. The capabilities of the system were tested with a series of single crystal growths in Si-SiH$_4$ system and by 4-nitropyridine 1-oxide-acetonitrile at a concn. $C_0 = 2.37 \times 10^{-2}$ mol/mol which is cooled from 34 to 20°C. The method can be employed to follow any temp. programming, providing that the elemental segment is not less than $[T_{\text{melt}} = 0.015^\circ$C, while concn. changes at const. temp. as low as $\Delta n_{\text{sol}} = 0.03 \mu$g/l, can be detected. No discontinuity around the solv. point at 29.5°C was noticed.

90: 191484 Analysis of the flow model of the Czochralski growth. Jones, A. D. W. (Sch. Math., Univ. Bristol, Bristol, UK BS8 1TW). J. Cryst. Growth 1983, 61(2), 235-44 (Eng). An experimental model of the flow in Czochralski growth was built and experiments, showing that the working fluids and the rates of rotation, temp. differences and dimensions of the app. were scaled so that the effects of rotation and other parameters were negligible. Observation of rotation and temp. fields, yields that the flow regimes were divided into 6 flow regimes. The investigation of the sepn. effects of crystal rotation, differential rotation, and heating leads to a better understanding of the growth mechanism due to stirring compared with crystal temperature. These effects were correlated with the filamentation and the filamentation of the growth axis.

89: 191529 Study of induction systems for electromagnetic forming during the growth of silicon crystals. I. Leiva, L. R. (USRR). Elektron-tehnika 1983, (2), 20-4 (Russ). The optimum induction systems for the zone-melting growth of Si ribbons and plates in electromagnetic fields were studied. The ribbon or plate thickness is easily controlled by varying the field intensity. Thin-ribbon or thin-ribbon structures are obtained.

89: 191368 Preparition of BP single crystals by high pressure fluid methods. Kuzumaki, Yukihiyo; Misawa, Shunji; Gonda, Shunichiro. (Electrochem. Lab., Haraka Prefect., Haraka, Japan 305). Denki Kagaku oyobi Kogyo Butsuri Kagaku 1983, 51(11), 217-18 (Japan). Single crystals of BP, a III-V compound, semiconductor, were obtained by the high-pressure fluid method. Cu$_2$B$_3$P$_4$ powder was put into a high-pressure fluid, and kind of mixtures were prepared: (1) $1.6$ B (BP) $+$ 55 Cu (CuP) and (2) 1.7 B (BP) $+$ 25% CuP. They were compressed into pellets, heated at 1300°C for 24 h in a induction furnace under a pressure of 1 NPa using a high-frequency induction coil. As a result, the single crystals grew along the (111) plane, and in case (2) they grew as an aggregate of crystallites. The photoluminescence spectra of the single crystals were shown. The growth rate was 0.09 mm (1.8 mm h$^{-1}$) in case (1) and 0.5 mm (2.47 mm h$^{-1}$) for case (2).

89: 191477 Growth of new ferroelastic tantalum oxide (Ta$_2$O$_5$) single crystal. Kojima, Hirotsuo; Tanaka, Isao (Fac. Eng., Yamaguchi Univ., Kuro, Japan 400). Butsuri Kagaku 1983, 51(11), 219-20 (Japan). Ta$_2$O$_5$ single crystals were prepared from a sintered rod composed of Ta$_2$O$_5$ powder by using an induction furnace under a pressure of 0.5-4.0 kPa. The addition of no gas and the rotation of the shaft was 15-40 rpm. The single crystal had a cleavage along the (001) plane, and became colorless by annihilation of yellow color in the absence of N$_2$ gas. The growth rate of the crystal was 15-40 rpm. The induction time $t$ increases in steps with decreasing supersaturation. This is most easily understood if it is assumed that $t$ is not the nucleation time for nucleation, but rather a relaxation time of the cryst.
The Preparation of BP Single Crystals by High Pressure Flux Method

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ABSTRACT

The preparation of BP single crystals was carried out by the high pressure flux method. Two types of fluxes were used: CuP and Ni₃P₅. The growth of crystals was observed to depend on the type of flux used. The growth rate was higher with CuP flux than with Ni₃P₅ flux. The crystals grown by CuP flux were transparent and had a good optical quality. The crystals grown by Ni₃P₅ flux were more transparent than those grown by CuP flux, but their optical quality was slightly lower.

Fig. 1 Schematic illustration of crystal growth apparatus

Fig. 2 BP single crystals by CuP flux (a) and Ni₃P₅ flux (b)
Fig. 3 Etching patterns of BP single crystals by optical microscope and scanning electron microscope. (a) Cu,P flux (b) Ni,P flux. Also line profiles of B and P are shown.

X-ray powder X-ray diffraction analysis reveals that the crystals are of the same space group as the parent compound, Ni,P. The mosaic spread of the crystals is about 2 degrees. The etching patterns obtained on the surface of the crystals with Cu,P flux are shown in Fig. 3(a). The orientation of the crystals is confirmed by the line profiles of B and P, which are shown in Fig. 3(b).

Ni,P flux is effective in producing etched patterns on the surface of the crystals. The etching rate is faster than that obtained with Cu,P flux. The etched patterns are more distinct and the contrast is higher than those obtained with Cu,P flux.

Fig. 4 Cathodoluminescence spectra of BP single crystals

Fig. 5 shows the cathodoluminescence spectra of BP single crystals. The peak positions are indicated by arrows. The spectra were recorded at room temperature. The emission bands are due to transitions from the valence band to the conduction band. The peaks at 2.47 eV and 1.82 eV correspond to transition energies of 3.1 eV and 3.0 eV, respectively.

References


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