FORMATION AND EVOLUTION OF IMPURITY STRIATION IN CORUNDUM CRYSTAL

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The study of correlation between non-uniform distribution of impurity in corundum single crystals and conditions of impurity striation during crystal growth and postgrowth treatment has been carried out. Experimental study of the dependence of microstriation period on the value of axial temperature gradient shows that increasing of temperature gradient leads to decreasing of the microstriation period. This is typical for crystals grown by Czochralsky, Kyropulos methods and HDSM. The analytical dependence of microstriation period on temperature gradient have been obtained for two following cases:

- diffusional mixing of the melt (HDSM); and
- limited diffusion in the melt in the presence of convection flows (Czochralsky method).

Obtained values of microstriation period (~ 50μ) are very close to respective experiment values. Microstriation period is increasing in the presence of typical distribution of point defects and ultramicrostriation in crystals. Ultramicrostriation with the width of the striate of 0.01-.0.03μ and the distance between striates of 0.05-0.25μ unlike other types of the impurity striation has a discrete character, i.e. the striates and spaces between them consist of separated parts. The size of such parts may be changed by the type and concentration of impurity in the melt in a range of 100-1000Å.

The evolution of micro- and ultramicrostriation in high temperature treatment processes has been studied. Such treatment results in a decreasing of the microstriation amplitude by ~15%. One express-method of diffusion constant D calculation may be proposed in the case of impurity striation. Experimental values of D in different points of crystal, actually at different temperatures, allows to build a temperature dependence of D. This dependence may be used for calculation of an activation energy of diffusion process and a pre-exponential coefficient. The temperature dependence of a diffusion coefficient in the case of Chromium diffusion into a corundum crystal looks as follows:

$$D=4 * 10^{-4} \exp(-3.5/kT) \quad [cm^2 c^{-1}]$$

ZONE MELTING STUDY OF $LiSrAlF_6$ AND $LiSrAlF_6:Cr^{3+}$ BY THERMAL ANALYSIS

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$LiSrAlF_6:Cr^{3+}$ (LiSAF:Cr) is known as an efficient tunable laser crystal. Like other fluorides, the optical quality of this crystal is closely dependent on the synthesis of the starting material used to growth the crystal, as well as, the growth process itself. LiSAF crystals can be obtained by zone melting, Bridgman and Czochralski methods. The growth of this matrix is usually mentioned in the literature but no detailed study was done concerning stoichiometric variations during melting, influence of impurities and/or Cr^{3+} incorporation in the growth process. In this work we have synthesized, purified and grown LiSAF and $LiSAF:Cr^{3+}$ by zone melting technique under HF atmosphere. The doped LiSAF was synthesized with 1, 2 and 3 mole % of chromium. The complete process of preparation of these compounds was characterized by thermal analysis (TG/DTA), x-ray diffraction and chemical analysis. We observed that stoichiometric variations might result due to the high evaporation rate of one of the components in the melt. The Cr incorporation was approximately uniform.

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