15-Crystal Growth

PS-1.02.22 SURFACE SUPERSATURATION ON GROWING OF CRYSTAL by A. M. Askhabov
Inst. of Geol., Komi Science Center, RAS, Syktyvkar, Russia
Super saturation $\sigma$ on growing surface of crystal as a function of volume super saturation $\sigma$ is nonlinear and determined by equation (Askhabov, 1993):

$$\sigma = \sigma^* \left[ \left( 1 + \sigma^* \right)^{1/3} - 1 \right]$$

The parameter $\sigma^*$ in (1) depends mainly on correlation of volume diffusion and surface kinetics processes during crystal growth. The values of $\sigma^*$ for different crystal faces of crystal are found based on experimental data $R(\sigma)$, where $R$ is growth rate of crystal faces. Equation (1) is a more suitable for determination $\sigma$ for growing crystal in the conditions of free and fixed convection. For example, for the K-Alum crystals growing in the free convection condition, the dependence $\sigma$ (for) based on experimental data $R(\sigma)$ is:

$$\sigma = 0.02 \left[ (1 + 100 \sigma)^{1/3} - 1 \right] \text{ for (111)}$$

$$\sigma = 0.03 \left[ (1 + 54 \sigma)^{1/3} - 1 \right] \text{ for (001)}$$

On the growth center $\sigma$ is more, than one far from center. Because of this, gradient of supersaturation are appear on the face and cause the formation of macrosteps. When the gradient achieve critical values the morphological stability of growing crystal faces are lost. For the crystal growing in the dynamic conditions, $\sigma$ achieves 0.80-0.90. Absolutely kinetic regime for the crystal growth from solution can not be achieved. That's why only experimental dependence $V_0(\sigma)$, got as result of calculation $\sigma$ from $\sigma$, can be compared to theoretical models of crystal growth.

References: A. M. Askhabov, Crystal growth from solution, Syktyvkar, 1993, 22p (Russ.)

PS-1.02.23 GROWTH DEFECT INVESTIGATIONS IN SILVER THIOGALLATE. By E. N. Fedorova, A. P. Yeliseyev, E. G. Nenashov, T. N. Maroz, United Inst. of Geology, Geophysics and Mineralogy, Sib. Br. Acad. Sc., 630090, Novosibirsk, Russia

Silver thio gallate, AgGaS$_2$, is a well known commercial crystal for nonlinear application and belongs to the chalcopyrite type structure. As a rule, AgGaS$_2$ crystals exhibit twinning defects in (112) crystallographic planes and there is a problem in obtaining crystals of sufficient size which contain no defects and could be used in optical elements manufacture. The crystals of different technological stages of synthesis and growth have been investigated by Infrared and Raman spectroscopy methods. The nonstoichiometry can result in appearance of modes forbidden by ideal symmetry in the region of Stranski valence vibration. Thus IR spectra of some powder samples have an absorption band at 300 cm$^{-1}$ assigned to $A_v$, forbidden mode. A single crystal used in the Raman measurements has been grown by Bridgemam - Stockbarger technique and orientated along the principal crystallographic axes.

At examination in polarized microscope the sample looks like one large domain with visible twinning defects in (112) plane at one end. From the low-energy side of the $A_v$ (295 cm$^{-1}$) mode one can observe a 275 cm$^{-1}$ mode as a shoulder which was identified as vacancy-sulphur vibration rather than the second-order, the structure of which vanishes at 80K. As a result of our experimental study the defects present in AgGaS$_2$ it is possible to discuss the influence of stoichiometry on the optical quality of single crystals and twinning phenomena.

PS-1.02.24 ON THE PREPARATION OF 11GaO·7Al$_2$O$_3$·CaF$_2$ SINGLE CRYSTAL. Xiu-jun Feng* and Qi jun Yu, Department of Materials Engineering, Wuhan University of Technology, Wuhan, China.

The preparation of 11GaO·7Al$_2$O$_3$·CaF$_2$ (Ca$_3$A$_2$·CaF$_2$ for short in the following) single crystals is important for the analysis of its structure. Generally it is recognized that it is impossible to obtain a stoichiometric Ca$_3$A$_2$·

---