07.X-14 CRYSTAL STRUCTURE AND THE OPTICAL PROPERTIES OF DIELECTRIC CRYSTALS: A REVIEW.* By D. Eimerl, Lawrence Livermore National Laboratory, Livermore, California 94550, USA.

The development of new optical materials for specific applications requires an understanding of the relationship between structure and chemistry and the optical properties. The relevant properties here are the refractive indices, the optical absorption, and the nonlinear optical coefficients controlling second harmonic generation, and four-wave mixing. The UV absorption in general, and the average refractive index of birefringent materials can be described quite well in terms of a Gladstone-Dale model. Some early work on the birefringence and nonlinear optical constants was based on bond models with effective charges. However, for the most part only qualitative conceptual models exist for these properties, and only recently has the development of quantitative models been examined.

The optical properties of high-band-gap dielectric crystals are a simple function of the electron states of the crystal. The low-lying states are single electron excitations which usually are quite localized. They are being studied quantitatively using models based on anionic groupings within the crystal structure. This model extends the bond models, which are based on pairings within the crystal structure. Calculations based on simple quasimolecular elements within the crystal give a good empirical and quantitative picture of the optical properties.

Examples will be presented for the birefringence and nonlinear optical properties of several crystals. One particularly useful class of crystals contains the aminoacid L-arginine, and other useful classes contain simple organic acids such as tartrates and malates. Recent work in the USA and the People's Republic China will be reviewed.

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07.X-15 CRYSTAL STRUCTURE AND CRYSTAL OPTICS. By R.E. Newnham, Materials Research Laboratory, Pennsylvania State University, University Park, PA, 16802, U.S.A.

Structure-property relationships involving linear and non-linear optical properties of engineering interest will be discussed from a crystallographic viewpoint. Absorption, dispersion, birefringence, electro-optic coefficients, and photoelastic effects are all important in integrated optic systems. Illustrative examples will be drawn from silicate glasses, III-V semiconductor compounds, polar ferroelectric crystals, and organic molecular structures. The importance of symmetry, molecular packing, and electronic polarizability will be emphasized.

07.1-1 THE EFFECT OF MICROGRAVITY ON THE GROWTH OF GaSb. By L.Petrás I.Gyuró, and E.Lendvay, Research Inst. for Technical Physics of the Hungarian Academy of Sci, Budapest

During the space flight of the first Hungarian astronaut on board of SALYUT-6 a part of his program was the growth of GaSb crystal under microgravity. Polycrystalline GaSb was closed into a quartz capsule of 8 mm in diameter and an ingot was grown from it without seed crystal using a Bridgman method in a horizontal furnace under microgravity circumstances (I.Gyuró at al., Acta Astron. Vol. 11, No.7-8, 361-368, 1984). In order to estimate the effect of microgravity on the growth mechanism correctly, a parallel growth process was done under terrestrial conditions, and the defect structure of the samples were compared. Both samples were cut lengthwise and the grain boundaries were developed by chemical etching. It appeared that both samples were macrocrystalline but the "space sample" [A] contained larger crystallites than that of the terrestrial one [sample B]. The orientations of the crystallites were determined by the aid of X-ray patterns. The results showed that there was no correlation between the orientation of neighbouring crystallites of sample A. In the case of sample B, however, a special type of twinning was observed: 511 type planes of some crystallites and 333 plane of an other were parallel to each other. It was therefore possible to make double crystal topograph from nearly the whole specimen simultaneously, because these planes have the same Bragg angles. Topographs were made from different crystallites of sample A, too. The topograph of

the sample B shows system of parallel dislocations running out to the surface. In the middle of the sample a strong contrast on the topograph due to strains shows that the direction of heat conduction was radial, because of the strong contact of the sample with the wall of the capsule (E.Lendvay et al. J. of Crystal Growth 71, 538-550, 1985). The correlation of the orientations shows the strong interaction between the crystallites. The "space sample" is poorer in defects than the other one. The absence of strain in the middle of the ingot confirm, that the direction of heat conduction was essentially axial during the cooling cycle. The fact that there is no correlation between the orientations of the grains in this sample shows that the interaction between the growing crystallites of the boule was very weak.

07.1-2 INFLUENCE OF MICROGRAVITY ON CRISTALLIZATION FRONT TOPOGRAPHY.
By D.Alamino and F.L.Falcon, Pedagogical Institute "Juan Marinello" and Cuban Institute for Sugar Research, La Habana, Cuba.

As a result of some crystal growing experiments from liquid solution in orbital stations, a remarkable difference has been observed in cristallization front microtopography between twin experiments developed both on Earth and under microgravity conditions.

In the particular case of "Zone" experiment performed on board of the orbital complex Saliut 6-Soyuz 37-Soyuz 38 (September, 1980) the sample analysis disclosed increase in height and decrease in anisotropy of the growing steps on (100) surface of sucrose crystalline layers grown by through of Temperature Gradient Zone Melting (TGZM).

Additionally, results are reported when the same method is applied to crystal growing, where samples have different relative orientation of the temperature gradient and the terrestial gravity vector.

In this work the experimental arrangement employed in the spatial and terrestial experiments are described specifying the conditions, under which, the above mentioned experiments were developed (thermal regime, duration, geometric characteristics of samples, etc). There are also explained the microphotographic techniques applied to the study of cristalline layers relief, including some photographs obtained by means of this method.

In order to explain the changes of shape in the growing in microgravity conditions, hydrodynamic behaviour of the system is analysed in both conditions, concluding that according to known convective processes (free and Marangoni's convection, due to concentration gradients or temperature gradients) it is not possible to explain the differences found.

It is also exposed a possible transport mechanism in the solid-liquid fronteer that explains the obtained results.

07.1-3 NUCLEATION POTENCY OF EUTECTIC PHASES. By V.V. Podolinsky, Yu.N. Taran and V.G. Drykin, Department of Physics, Institute of Construction Engineers, Dnepropetrovsk, USSR.

The solid-solid interface between two eutectic crystals can be analysed as well as the solid-liquid interface. In this case the value of the α factor defines the degree of atomic roughness of the solid-solid interface between two eutectic crystals.

$$\alpha = \xi \frac{\Delta H_A - \Delta H_B}{KT} = \xi \frac{\Delta H_{diss}}{KT}$$

where ξ is the anisotropy factor, ΔH_A is the heat of evaporation for one phase per A-atom, ΔH_B is the same value for the other phase, ΔH_{diss} is the heat of dissolution of A-atom in B-crystal. If the α factor for the solid-solid interface is higher than the critical value 2,5 then the smooth interface between eutectic crystals will have to be less free energy than rough interface. This will have to lead to the non-reciprocal nucleation behavior in the systems in which one phase grows faceted and the other phase grows non-faceted because the nucleation must occur on the faceted crystal to form the solid-solid smooth interface with less free energy. If the α factor for the solid-solid interface is smaller than the critical value then the nucleation must occur on the non-faceted crystal to form the solid-solid rough interface with less free energy.