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STUDY OF THE CONTRAST INDUCED BY ULTRA-ACOUSTIC WAVES IN PIEZOELECTRIC DEVICES IN STROBOSCOPIC X-RAY SECTION TOPOGRAPHS

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Although the use of white beam stroboscopic topography at synchrotron stations has allowed a good understanding of the propagation of ultra-acoustic waves [1], section topography remains a powerful tool for a quantitative analysis of the deformation induced by the waves [2]. When the deformation increases one may observe different states: firstly the usual extinction fringes are only slightly enlarged, then new fringes appear and progressively become the only visible fringes. Their number is linked to the mode of the excited ultra-acoustic wave. Then the whole image is changed: the fringes are curved and their shape allows to quantitatively measure the shape of the deformation along the surface of the device. At the same time the number of visible fringes decreases.

In the present study we will examine by means of experiments performed at synchrotron stations at LURE and at ESRF the different states of the contrast. We will study the transition from weak to important deformations showing the appearance of the new set of fringes. We will show how the fringes in the most deformed areas are linked to the fringes in the less deformed areas, near the edges of the device, where the deformation becomes negligible. Simulations computed in the case of weak and intermediate amplitudes of vibration are in good agreement with the experiments. In the case of important deformations the contrast may be interpreted by means of the kinematical theory only.

These experiments demonstrate the interest of an 'old' technique, section topography, used together with a modern one, synchrotron topography, since the resolution achievable with a conventional setting in the laboratory would not permit such a high resolution study of the fringes.

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GROWTH MORPHOLOGY OF SINGLE CRYSTALS DURING SOLIDIFICATION OF Ga-Mg-Zn ALLOY

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The stable quasicrystalline icosahedral phase has been found in Ga-Mg-Zn by melt spinning technique as well as by slow cooling from the melt [1]. In addition the authors observed icosahedral crystals with pentagonal dodecahedral growth morphology in shrinkage cavities. The aim of our investigations was to analyse solidification process for Ga-Mg-Zn alloy for compositions in the vicinity of quasicrystalline phase existence. Slow solidification from the melt was performed using home made apparatus. The sample composition has been different for prepared alloys with Ga content from 16% up to 56%, Mg from 32% to 38 % and Zn content varied between 52% and 10%. During solidification process of different composition of alloys several types of single crystals has been obtained. Polygonal forms of $mgzn_2$ (Laves phase) single crystals crystallised in the shrinkage cavities, the single crystals of $Ga_{28}Mg_{42}Zn_{30}$ and faceted forms of $Ga_{14}Mg_{27}Zn_{59}$ single crystals were for the first time observed in our experiment. Apart from that relatively large (2mm x 2mm) polygonal Mg single crystals crystallised in shrinkage cavities. For some compositions in the whole volume of the sample colonies of Zn whiskers were spread out. Having hexagonal cross section and lateral faces {1120} or {1010} type their growth direction was [0001].

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GROWTH OF SOLID SOLUTION CRYSTALS (Pb,Sn)Te AND (Pb,Ge)Te DOPED WITH Ga AND In.

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Crystals for IR-optoelectronics should have well-define dopant concentration, should be uniform in composition and possess low dislocation density. A4B6 compounds can be grown either from vapour or from melt as well as by vapour-solid-liquid (VLS) method. The last method gives good results because the coexistence of tree phases provides stable growth conditions. Bridgman direct crystallization, as the simplest procedure to produce crystals, commonly results in not high crystal quality. Nevertheless semiconductor crystals with well-define composition can be prepared, if the preparation conditions are optimized. VLS-method was applied to grow (Pb,Ge)Te, (Pb,Sn,Ge)Te, (Pb,Sn)Te, PbTe(Ga), (Pb,Sn)Te(Ga) with different mole fraction and dopant concentration using LVS-conditions both in source and in condensation zone. It is allow us to obtain the uniform in composition crystals with the yield more than 70% relative to initial source mass (about 100g). For solid solutions the typical dislocation density was 10^4-10^5 cm^{-2}. The low angle boundaries and segregations more 1 micron in size were absent in these crystals. Component distribution in crystals deduced from EMA, XRD and Hall coefficient measurements is seems to be uniform. Bridgman growth was carried out in the case of (Pb,Sn)Te, (Pb,Sn)Te(Ga), (Pb,Ge)Te(In), (Pb,Ge)Te. To avoid strong variation of composition along crystal Te- or metal enriched melt was used. The conditions were optimised taking into account the positions of the isomolarity lines, the direction of the maximal slope of liquidus surface, and the position of the relevant tie lines suppose the local equilibrium between solid and liquid phases near crystallisation front.

Keywords: BRIDGMAN GROWTH, VLS

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THIN FILM GROWTH FROM VAPORS BY EFFUSIVE AMPOULE PHYSICAL VAPOR TRANSPORT

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A series of effusive ampoule physical vapor transport (EAPVT) experiments were conducted in both low Earth orbit on the US Space Shuttle Endeavour and in the laboratory as ground controls. The experiments used the Moderate Temperature Facility (MTF) to grow oriented and ordered thin films from materials with nonlinear optical properties such as donor-acceptor conjugated organics and organometallics. The technique was tested by growing N,N dimethyl-*p*-2,2-dicyanovinyl aniline (DCVA), triethylphosphine sulfide (TPS) and hydroxyquinoline aluminum sulfate (AlQ3). The active control during the deposition process was exercised by three deposition variables: the source material temperature, the background pressure external to the growth ampoule and the substrate temperature. Successful growth of DCVA thin films occurred when the temperature difference between the source material and the copper substrate was 14°C and the background nitrogen pressure was such that the transport was either diffusive or convective. A qualitative diffusion limited boundary was estimated to occur at a pressure of approximately 20 torr. The characterization of the microscopic physical structure and macroscopic optical properties of the microgravity and unit gravity grown thin films has been done with visible-near infrared reflection absorption spectroscopy, polarized Fourier transform infrared spectrometry (FTIR), differential interference contrast optical microscopy (DIC) and stylus profilometry. The work presented in this paper is a prime example of a novel thin film technology developed on the ground as a direct result of information gleaned from experiments conducted in microgravity on Space Transportation System (STS) 59 and STS 69.

Keywords: THIN FILM, VAPOR TRANSPORT, MICROGRAVITY