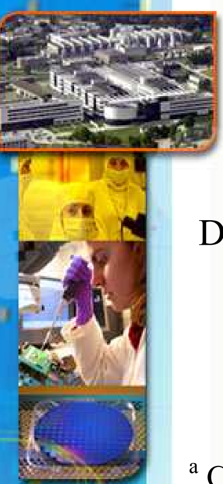

DETERMINATION OF STRESS AND TEXTURE GRADIENT IN CdTe THICK FILMS USING A HIGH ENERGY WHITE MICROBEAM

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Polycrystalline CdTe is being developed for its use as photoconductor in optoelectronic applications where large dimensions are required such as x-ray detectors in the medical field. This material is grown by close space sublimation (CSS): a CdTe solid source is evaporated and then the vapours are condensed on a graphite substrate located at a very close distance. In order to ensure an efficient collection of the charge carriers towards the electrodes, the control of the structural quality of the material such as its texture, its crystalline morphology (grain structure, diameter, and their distribution, nature of point and extended defects [1]…) and its stress state during the growth is of primary importance, in particular its variation along the thickness of the layer. Previous experimental studies such as x-ray diffraction (XRD) measurements and electron backscattered diffraction (EBSD) maps have shown that, as growth proceeds, the material is gradually textured along the <111> crystallographic orientation. It has been also observed that the crystalline morphology and the related texture depend on the different growth stages at work during growth such as nucleation of isolated islands, coalescence, and thickening: indeed, although isolated islands are randomly oriented, when island coalescence occurs, the film tends to be preferentially oriented along particular crystallographic directions. The different structural changes as growth proceeds are thus likely to generate distinct stress states along the thickness of the material [2].

The study of these stresses and their distribution in thickness as a function of the evolution of the structural properties such as local texture and local grain morphology would give some new insight into the elastic and plastic energy dissipation processes during the different growth stages: furthermore, it would enable us to provide a more accurate modelling of these phenomena.

For this purpose, we used high energy synchrotron diffraction following the method introduced by Reimers et al [3]. We used a white beam on ID15A at ESRF and by energy dispersive measurements, we measured the stress and texture gradient in thick (from a few tens to a few hundreds of μm) CdTe films. Due to the high intensity and the high parallelism of the high energy synchrotron radiation the sample gauge volume has been reduced to approximately 5 μm x 0,1 mm x 3 mm and we followed by step of 5 μm, the texture and stress of the film across the thickness.

In this paper, we will describe the experiments, the first results and we shall detail the absorption corrections needed to evaluate quantitatively and accurately the texture and stress in such films. A model is then proposed to explain the observed texture and stress evolution with film thickness.

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[3] W. Reimers, M. Broda, G. Brusch, D. Dantz, K.-D. Liss, A. Pyzalla, T. Schmackers and T. Tschentscher, Journal of Nondestructive Evaluation, Vol. 17, No. 3, 1998