R12-12: Characterization of Bulk and Surface Transport Mechanisms by Means of the Photocurrent Technique

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As recently showed by Zappettini et al [1], the Boron Oxide Encapsulated Vertical Bridgman growth technique allows to obtain CZT crystals of great interest as X-ray spectroscopic detectors operating at room temperature. With this method indium doped semi-insulator CZT ingots have been grown with large single grains and with resistivity values on the order of 1E10 ohm*cm and with dislocation density in the 1E-3 – 1E-4 cm\textsuperscript{-2} range. Crucial points for this class of ternary materials are, on the one hand, the transport properties related with bulk defects density and nature, and, on the other hand, the quality of contacts, surfaces with high defect density, hence strong recombination rate. The photocurrent technique allows both to study bulk material properties and to obtain contact quality information. From DC photocurrent spectra it's possible to obtain information about the bulk trap levels, about the kinds of contact layer defects, and on the distributions of electric field in the sample volume. By varying the bias, with constant wavelength, instead, we can obtain the value of transport proprieties parameters like the product $\mu t$ and the ratio $S/\mu$, this last one related to the contact surface properties of the sample. Further details on the characteristic times of the recombination centres, on the cross sections and on the involved mechanisms can be gained by time-resolved measurements or varying other measurement parameters, e.g. the incident beam intensity or the sample temperature. The authors exploit the peculiarity of this technique by studying planar samples of different thickness which underwent different surface processing (like etching, passivation, contact deposition), comparing the achieved results with the answers of different experimental techniques, like X and Gamma ray spectroscopy, current-tension characterization and absorption, transmission and photoluminescence measurements. [1] A. Zappettini et al, IEEE TRANS. NUCL. SCI., VOL. 54, NO. 4, 2007

R12-13: Electromigration of Fast Diffused Elements in CdTe

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Electromigration of fast diffused elements in undoped and In-doped CdTe was investigated using various electric fields at temperatures within the range of 20-700°C. The electric field was applied during annealing of the sample in a vacuum or Cd overpressure. Line profiles of both the resistivity and low-temperature photoluminescence (PL) were measured in the direction of the applied electric field in order to determine a line profile of elements in the sample. The profile of resistivity was measured using moving contact along a sample and the intensity of the free exciton, acceptor- and donor-bound exciton and DAP lines, respectively, were measured along the sample in PL measurement. The significant shift of the intensity of the acceptor bound exciton line at 1.589eV and DAP line at 1.539eV along the sample were identified together with the local change of resistivity. It was found that the electromigration is the temperature activated process and is enhanced by in-diffusion of Cd during annealing at Cd-saturated overpressure due to the kick-out effect. The electromigration was found to be effective method for purification of the CdTe samples and can be used for preparation of a high performance detector grade material.

R12-14: Progress in the Growth of CdMnTe by the MTPVT Method

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CdMnTe is believed to be a good candidate to compete with CdZnTe in X-ray and gamma ray detection applications. The aim of this work is to present the progress in the growth of Cd\textsubscript{1-x}Mn\textsubscript{x}Te by the Multi-Tube Physical Vapour Transport (MTPVT) technique with $x \leq 3\%$.

The material has been characterised using glow discharge mass spectrometry (GDMS), infra-red mapping, resistivity mapping by time-dependent charge measurement (TDCM), current-voltage and alpha particle spectroscopy. The CdMnTe material has been observed to be of a uniform high resistivity ($10^{3}$-10$^{5}$ ohmcm). The charge transport properties of CdMnTe are typically much poorer than that of CdTe and CdZnTe, however an alpha particle response was observed at room temperature and a mobility lifetime product was calculated.

To understand these electrical properties, photo-induced current transient spectroscopy (PICTS) measurements were carried out in order to investigate the defects present in the band gap and to calculate their activation energy and their concentration. The effect of these defects on the mobility lifetime product and resistivity is discussed.