MRS Proceedings

MRS Proceedings / Volume 1123 / 2008

DOI: http://dx.doi.org/10.1557/PROC-1123-1123-P05-01 (About DOI)

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Editors : B. Sopori, J. Yang, T. Surek, B. Dimmler

Articles

Dielectric Function and Defect Structure of CdTe Implanted by 350-keV Bi Ions

2008 MRS Fall Meeting.

Peter Petrik[a1], Miklós Fried[a1], Zsolt Zolnai[a1], Nguyen Q. Khánh[a1], Jian Li[a2], Robert W. Collins[a2] and Tivadar Lohner[a1]

[a1] Research Institute for Technical Physics and Materials Science, H-1525 Budapest, POB 49, Hungary

[a2] Department of Physics and Astronomy, University of Toledo, Toledo, OH 43606, USA

Abstract

In this work we have developed optical models for the ellipsometric characterization of Bi-implanted CdTe. We have characterized the amount and nature of disorder using Rutherford Backscattering Spectrometry combined with channeling (RBS/C). Samples with a systematically varying degree of disorder were prepared using ion implantation of Bi into single-crystalline CdTe at an energy of 350 keV with increasing doses from 3.75×10^{13} cm^{-2} to 6×10^{14} cm^{-2}. The motivation for use of the high atomic mass Bi ions was that previous studies using lighter ions revealed damage at a low level, even for doses several times higher than the amorphization threshold estimated by simulation [P. Petrik et al., *phys. stat. sol. (c)* 5, 1358 (2008)]. In contrast, Bi ions create sufficient disorder for investigation of the changes in dielectric function critical point (CP) features in a wider variety of structures from single-crystalline to the disordered state. The CP features can be described by numerous methods starting from the standard CP model, through the parameterization of Adachi [Adachi et al., *J. Appl. Phys.* 74, 3435 (1993)], and finally to the generalized CP models. The standard CP model has been demonstrated to be a reliable approach for polycrystalline CdTe characterization used in photovoltaic applications [Li et al., *phys. stat. sol. (a)* 205, 901 (2008)].