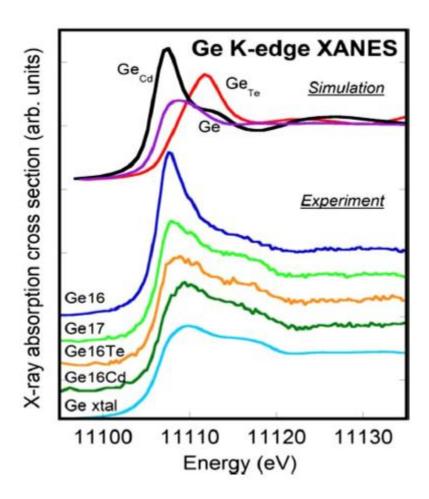
ESRF	Experiment title: Ge deep donors in CdTe	Experiment number: HS 4034
Beamline:	Date of experiment:	Date of report:
BM-08	from: to:	30/8/2014
Shifts:	Local contact(s):	Received at ESRF:
9	C. Maurizio	
Names and affiliations of applicants (* indicates experimentalists):		
F Roscherini R Frahoni and A Cavallini University of Rologna		

Report:

High resistivity CdTe can be achieved by introducing impurities that create deep levels which, in turn, control the electronic transport properties of the material via a compensation process. We have characterized the effects of thermal annealing of high resistivity CdTe:Ge under either Te- or Cd-rich atmosphere to understand how modifications in the structure of Ge-related defective states and their electrical activity affect the material transport properties. We have investigated the transport properties with current-voltage analyses, the electrically active deep traps by photoinduced current transient spectroscopy and the local environment of Ge atoms by x-ray absorption spectroscopy. By correlating the modifications observed, we determined the occurrence of Ge clustering effects and associated them to the formation of electrically active deep donor traps, one located at EC-0.31 eV and the other one at midgap, with an activation energy of 0.82 eV. This is one of the few studies in which a determination of the local structure of a dopant is correlated to its electronic signature.

The dopant concentration of the samples was only between $10^{16}~\rm cm^{-3}$ and $10^{16}~\rm cm^{-3}$. Hence, only XANES spectra, reported in the figure, could be recorded. Comparison of the spectra with ab-initio simulations performed in the full multiple scattering muffin tin approach provided a rather clear result. In the lowest concentration sample Ge is substitutional to Cd (Ge_{Cd}). At higher concentrations, Ge clustering occurs and is almost total for the two annealed samples (Ge16Te and Ge16Cd).



The results have been published in:

JOURNAL OF APPLIED PHYSICS 110, 053706 (2011)

Ge clustering effects in Ge doped CdTe: Electrical and structural properties

B. Fraboni, ¹ F. Boscherini, ^{1,2} P. Fochuk, ³ and A. Cavallini ¹ Department of Physics, University of Bologna, viale C. Berti Pichat 6/2, I-40127, Bologna, Italy ²IOM-CNR, OGG, c/o ESRF, BP 220, F-38043 Grenoble Cedex, France

³Inorganic Chemistry Department, Chernivtsi National University, Chernivtsi, 58012 Ukraine