Contribution ID: **12** Type: **not specified**

Study of Surface Radiation Damage in Silicon Sensors

Monday 23 May 2011 16:00 (20 minutes)

The surface radiation damage of 12 keV X-rays on silicon test structures fabricated on high-ohmic n-type silicon and on strip sensors is investigated. At these X-ray energies no bulk damage in silicon is expected. However fixed oxide charges in the SiO2/Si3N4 layer and interface traps at the Si-SiO2 interface build up.

Using TDRC (Thermally Dielectric Relaxation Current) and C-V and G-V (Capacitance-Voltage, Conductance-Voltage) measurements we investigate as function of X-ray dose the microscopic defects in test structures with different crystal orientations and compare the results to the macroscopic properties of strip sensors as obtained from C-V and I-V measurements. Due to the irradiation the density of positive oxide charges increases and three dominant interface traps build up. The TDRC and the C/G-V results allow us to determine the energy levels and capture cross sections of the traps and the dose dependence of the trap and oxide charge densities. We find that both saturate (and even decrease) for doses above a few MGy. The annealing of the defects is studied at 70C and 80C and the activation energies for the annealing of the interface traps and the oxide charges determined. We find that the annealing times of the different trap levels are very different.

For the strip sensors the radiation induced oxide charges and the interface traps increase the full depletion voltage, the surface leakage current and the inter-strip capacitances. In addition an electron accumulation layer forms at the Si-SiO2 interface whose extension increases with dose and decreases with applied voltage. This accumulation layer has a significant impact on the performance of the sensors.

Authors: Mrs PINTILIE, Ioana (National Institute of Materials Physics, Romania); Mr ZHANG, Jiaguo (Institute of Experimental Physics, University of Hamburg, Germany)

Co-authors: Mr FRETWURST, Eckhart (Institute of Experimental Physics, University of Hamburg, Germany); Mr SCHWANDT, Joern (Institute of Experimental Physics, University of Hamburg, Germany)

Presenter: Mr ZHANG, Jiaguo (Institute of Experimental Physics, University of Hamburg, Germany)

Session Classification: Defect and Material Characterization