Contribution ID: **33**   Type: **not specified**

Defect characterization studies and modelling of defect spectra for 60Co gamma-irradiated epitaxial p-type Si diodes

Tuesday, 29 November 2022 11:20 (20 minutes)

Boron-doped silicon detectors used in high radiation environment like the HL-LHC show a degradation in device performance due to the radiation induced deactivation of the active boron dopant. This effect is known as the so-called Acceptor Removal Effect (ARE) and depends on particle type, energy and radiation dose. Here we present defect characterization studies using TSC (Thermally Stimulated Current technique) and DLTS (Deep Level Transient Spectroscopy) on a set of epitaxial ^{60}Co irradiated p-type Si diodes with two different resistivities (50 and 250 Ωcm). The irradiation dose was in the range of 100 kGy to 2 MGy. In our studies, we correlate radiation induced changes in the macroscopic device properties with the formation of microscopic defects. Furthermore, we used the defect parameters obtained by DLTS measurements for modelling the corresponding TSC spectra and compare them with our experimental results. This allows to open the discussion about the assignment of so far unspecified TSC peaks like the X-defect, to defect levels well identified in DLTS.

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Session Classification: Defect and Material Characterization