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Radiation damage in n-type silicon after electron irradiation with energies between 1.5 MeV and 15 MeV

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The study of the radiation damage by electrons of different energies allows investigating separately point and cluster defects: 1 MeV electrons produce only point defects, whereas at 15 MeV cluster defects dominate.
For these studies pad diodes fabricated on high resistivity n-type Standard Float Zone (STFZ), Diffusion Oxygenated Float Zone (DOFZ) and thin epitaxial layers grown on Czochralski substrate (EPI) were used. The electrical properties of the diodes have been characterized by capacitance- and current-voltage (CV/IV) measurements. For the characterization of the radiation induced defects the Thermally Stimulated Current (TSC) and Deep Level Transient Spectroscopy (DLTS) methods were used. Isothermal annealing at 80 C and isochronal annealing measurements were performed allowing the study of defect kinetics.
From DLTS measurements the formation of point and cluster defects as function of electron energy will be demonstrated via the concentration ratio of the single vacancy related defect VO, the double vacancy V2 and the tri vacancy defect complex V3.
By TSC measurements the development of cluster related deep hole traps and a shallow donor has been investigated and detailed annealing studies have been performed. These microscopic findings are compared with the development of the macroscopic diode properties.

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