

Proton energy dependent damage to thin Silicon pad diodes

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This work deals with the bulk damage due to 23 MeV, 188 MeV and 23 GeV protons to 200 μ m silicon pad sensors (bulk materials: FTH, MC or dd-FZ). I-V, C-V-f and TSC measurements were performed at subsequent annealing steps.

Two challenges in performing TSC measurements will be pointed out: the first one concerns the application of a forward current in the order of 1mA at the filling temperature $T=10$ K; the second one is related to the impact of higher filling temperature on the measured TSC spectra.

The TSC spectra are analyzed with a revisited SRH statistics, modified to account for the cluster-related defect contributions.

A proton-energy dependent introduction of defects is found, except for cluster-related defects. Moreover, shallow defects are present in different concentration according to the material type. A correlation between the leakage current and the concentrations of three defects (the V2, E5 and H(220K) defects) is notable. It is not excluded that the changes in the space charge in p-type sensors are mainly due to the E(30K) and the BiOi defects, and three deep acceptors (namely the H(116K), H(140K) and the H(152K)).

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