Extraction of important parameters of a silicon diode used as particles detector

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Abstract

The Capacitance-Voltage characteristics (C-V) and the resistivity (ρ) of a p+nn+ silicon diode used as a particle detector is numerically simulated using the finite difference method. These characteristics permit to extract the important and useful parameters for the design of a detector diode used in a harsh environment and subjected to strong fluencies, such as the depletion voltage (Vdep), the effective concentration and the maximum resistivity, the reduction rate of the donors (c) and the introduction rate of defects (g). When this junction is subjected to strong radiations, physical defects which are created in the semiconductor lattice have undesirable effects and can degrade the performance of the detectors. These defects behave like deep levels and/or generation recombination (g-r) centres.

The depletion voltage and the effective concentration were calculated by using C-V characteristic. The evolution of the effective density in function with the density of traps acceptor led as to find the redaction rate of the donors (c) and the introduction rate (β).

The resistivity increases with increasing of the deep acceptor density to achieve the intrinsic resistivity (maximum).

Keywords Semi-insulating; Semiconductor; Diode; Radiation damage; Modeling.

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