

Electronic properties of vacancy aggregates in n-type silicon for particle detectors

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Vacancy aggregates, formed in silicon exposed to high fluences of hadrons or ions, seem to be the main defects limiting radiation hardness of tracking detectors. Recently, the electronic properties of these defects have been intensively studied using theoretical calculations. However, apart from the case of divacancies, very few experimental results concerning the properties higher order vacancy complexes have been obtained. In this paper, we report the new results obtained by the high-resolution photoinduced transient spectroscopy (HRPITS) indicating the presence of trivacancies (V_3) both in neutron-irradiated n-type MCz Si and proton irradiated epitaxial silicon. Based on the Laplace spectral fringes, the activation energies for electron emission from deep acceptors $V_3(2-/)$ and $V_3(-/0)$, equal to 0.36 and 0.46 eV, respectively, were determined. The activation energies for electron emission from tetravacancy related deep acceptors $V_4(2-/)$ and $V_4(-/0)$, are likely to be 0.39 and 0.55 eV, respectively.

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