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Analysis of the radiation effects on some properties of GaAs:Cr and Si sensors exposed to a 22 MeV electron beam

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Nowadays, the experiments related to the High Energy Physics and others fields demand the use of detectors with greater radiation resistance, and the novel material GaAs:Cr had demonstrated excellent radiation hardness compared with other semiconductors. On the basis of the evidences obtained in the JINR experiment with the use of 22 MeV electrons beam generated by the LINAC-800 accelerator, an analysis of the electron radiation effects on GaAs:Cr and Si detectors is presented. The measured I-V characteristics showed a dark current increase with dose, and an asymmetry between the two branches of the behaviors for all detectors. Analyzing the MIP spectra and CCE dose dependence measurements a deterioration process of the detectors collection capacity with the dose increase was found, although the behaviors are somewhat different according to the detector type. The detailed explanation of these effects from the microscopic point of view appears in the text, and are generally linked to the generation of atomic displacement, vacancies and other radiation defects, modifying the energy levels structure of the target material. These changes affect the lifetime and concentration of the charge carriers, and other characteristics of the target material.

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