Response of Gallium Arsenide Surface Barrier Detectors for Heavy-Ion Detection in Nuclear Physics

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The objective of this work was to determine the response of Gallium Arsenide (GaAs) Schottky diodes under heavy-particle irradiation. Schottky barrier detectors were fabricated using an undoped GaAs wafer, with a NiGeAu (25/55/150 nm) ohmic contact and a Ti/Pt/Au (20/100/200 nm) Schottky contact. Irradiation of the devices was performed using ^{1}H, ^{16}O, ^{35}Cl, and ^{63}Cu ions, with energies ranging from 14.5 MeV up to 90 MeV, in order to cover a broad range of energies and atomic masses. All irradiations were carried out at the *SAFIIRA* (Sistema de Feixes Iônicos para Irradiações e Aplicações) facility, using the Pelletron-IFUSP accelerator. Simulations of the characteristics of the irradiated devices were performed using the ECORCE (Étude du Comportement sous Radiation des Composants Électroniques) software. The rise times of the signals acquired from the preamplifier were measured as a function of the applied voltage under both forward and reverse bias conditions. A rise time of 5.96(45) ns was achieved at a reverse bias voltage of −140 V, while values above 55(1) ns were obtained for all forward-bias conditions. For all incident ions, the response time was below 11 ns under reverse bias voltages above −20 V and was reasonably independent of the ion species. Distortions observed in the energy spectra indicate that the energy resolution of these detectors still requires improvement for their proper application in nuclear physics, possibly requiring higher-purity GaAs material. Nevertheless, these detectors may represent a viable option in applications where energy resolution can be compromised in favor of faster response times.