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#11-4 Response of 4H-SiC Detectors to Ionizing Particles

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We report on response of newly designed 4H-SiC Schottky barrier diode (SBD) detector to alpha, beta and gamma particles. In order to optimize SiC SBD detector's thermal neutron efficiency, it's of particular importance to understand its behavior in various radiation fields. The optimal size of the SBD is limited by degradation of electronic properties, and consequently their charge particle detection. We have manufactured diodes up to 3 x 3 mm active surface area to study those properties in correlation with increasing of detector size. Approximately 25 μm thick epitaxial layer is grown on SiC substrate by chemical vapor deposition, which is sufficient to stop alpha particles up to 6.8 MeV. Different active volume sizes of the detector based have been electrically characterized and exposed to radiation fields of alpha, beta and gamma particles. Extensive studies of the detector response to the various alpha emitters in the 3.27 MeV to 8.79 MeV energy range have been carried out. Results presented here demonstrate not only excellent linear response of the different detector active area to alpha particles, but also shows linear response to gamma particles. The detectors show a linear energy response, high charge collection efficiency and high energy resolution for the alpha particle energies bellow 6.7 MeV which is in a correlation with the range of charged particles in epitaxial layer of our detectors. Electrical characteristics of the detectors were assessed by temperature dependent current-voltage (I-V) and capacitance-voltage (C-V) measurements as well as by Laplace DLTS characterization of the electrically active defects. Ideality factor of the diodes is found to be in the range of 1.01 to 1.02 and free carrier concentration is in the range of 3x10^14 cm^-3 to 4.5x10^14 cm^-3. Co-60 and Cs-137 gamma radiations were carried out in Ruđer Bošković Institute's Secondary Standard Dosimetry Laboratory with the air kerma rates up to 77 mGy/min.

Primary authors: BERNAT, Robert; Dr CAPAN, Ivana (Ruđer Bošković Institute); Dr EREŠ, Zoran (Ruđer Bošković Institute); Mr BRODAR, Tomislav (Ruđer Bošković Institute); Mr BAKRAČ, Luka (Ruđer Bošković Institute); Dr MAKINO, Tahakiro (National Institutes for Quantum and Radiological Science and Technology); Dr OHSHIMA, Takeshi (National Institutes for Quantum and Radiological Science and Technology); Dr PASTUOVIĆ, Željko (Australian Nuclear Science and Technology Organisation); Mr SARBUTT, Adam (Australian Nuclear Science and Technology Organisation)

Presenter: BERNAT, Robert

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