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Characteristics of SiC detectors after neutron irradiation

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The results of an investigation of silicon carbide (SiC) detectors when irradiated with neutrons are presented. SiC detectors were manufactured on the basis of the epitaxial layer of 4H-SiC n-type conductivity [1, 2]. The thickness of n-type epitaxial layer was 25 μm. Schottky barrier contacts with a diameter of 3.0 mm were made by vacuum evaporation of a double layer of Ni and Au 10 and 20 nm thick. The initial energy resolution of detectors was < 25 keV for α-particles (E = 5.5 MeV).
The radiation resistance of SiC detectors was studied experimentally by analyzing their characteristics before and after neutron irradiation with integral fluxes of 5.1 ⊠1013 and 5.4 ⊠1014 n/cm2 in the energy range of 0.001⊠14 MeV. The irradiation was carried out at the pulse reactor IBR-2M (JINR, Dubna).
The α-source 226Ra (E = 4.8, 5.5, 6.0, 7.7 MeV) that was used for calibration and control of spectrometric characteristics of SiC detectors. It is shown that after neutron irradiation, significant degradation was observed: the reverse current increased by more than two and ten times; the peaks from the alpha particles shifted towards smaller channels and became much wider; the charge collection efficiency (CCE) decreased from 100% to 98%, and 70% (operating voltage 300 V) at the neutron irradiation fluence of 5.1x10ˆ13 and 5.4x10ˆ14 n/cm2, respectively. Although the degradation exists, the SiC detectors successfully survive intense neutron radiation and show better radiation resistance than silicon detectors.

Primary author: EVSEEV, Sergey (JINR)

Co-authors: Mr GUROV, Yu. (NRNU, MEPhI); Mr KOPYLOV, Yu. (JINR); Mr ROZOV, S. (JINR); Mr SANDUKOVSKY, V. (JINR); Ms STRELETSKAYA, E. (JINR); Mr ZAMYATIN, N. (JINR); Mr HRUBCIN, L. (IEE SAS); Mr ZAT'KO, B. (IEE SAS); Mr BOHACEK, P. (IEE SAS)

Presenter: EVSEEV, Sergey (JINR)

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