iWoRiD 2022
23rd International Workshop on Radiation Imaging Detectors
26 – 30 June 2022
Riva del Garda, Italy

Contribution ID: **124**

Type: **Poster**

Silicon-Carbide detectors operating at increased temperatures

Monday 27 June 2022 16:41 (1 minute)

The 4H-SiC is a wide band gap semiconductor, the detector structures made of which are capable of operation at higher temperatures. In this article, we present an experimental result of 4H-SiC detectors operating at temperatures up to 500 ℃. The polytype 4H-SiC has the band gap energy of 3.23 eV at room temperature. Moreover, this material has excellent physical and chemical stability and also breakdown voltage (3-5×10⁶ Vcm⁻¹) and high carrier saturation velocity (2×10⁷ cms⁻¹). In our previous works we studied electrical and spectrometric performance of fabricated SiC detectors showing a very promising properties for working in radiation harsh environments [1, 2].
In this contribution we are concentrating on electric properties and spectrometric performance of the detectors operating at very high temperatures up to 500 ℃. The precise temperature stabilization was achieved by a low-noise custom microcontroller-controlled system with a PID loop using ceramic heaters in the customized vacuum chamber. At first the current-voltage characteristics were measured. The leakage current at 300 V was 1 pA and 10 nA at RT and 500 ℃, respectively. The detectors also show a very little temperature dependence of the energy resolution of α-particle peak generated by ²³⁸Pu radioisotope. Fig. 1 demonstrates the comparison of α-particle spectra measured at 25 and 500 ℃, respectively. The calculated energy resolution in FWHM (Full Width at Half Maximum) increases from 34 keV at RT up to 36 keV at 500 ℃. In summary we can state that the 4H-SiC detector is a good candidate for high resolution α-particles spectroscopy in a wide range of increased temperatures.

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Session Classification: Poster