Performance of Temperature-Stabilized Radiation Detectors and Preamp J-FET

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Abstract. We have studied the performance of temperature stabilized radiation detectors and charge sensitive preamplifier J-FET transistor. The charge sensitive preamplifier circuit is based on the work of G. Bertuccio et al., where the parallel resistor for discharging the feedback capacitor is elimintad[1]. For further improving the performance of the detector we used active cooling and temperature stabilization with the Peltier module. The precise temperature stabilization is achieved by a microcontroller-controlled system with a PID loop. With this setup, we are capable of stabilizing and cooling the detector and input J-FET transistor to the temperature below -20 °C with a precision of more than 0.01 °C which has a great impact on the detector performance. As a detector we used 4H-SiC Ni Schottky barrier detectors with contact diameter of 1 mm.

Another interesting option is examining the detecting properties of the 4H-SiC detectors in high temperatures. As 4H-SiC is wide bandgap semiconductor, prepared detectors can operate up to several hundred degrees of Celsius. For that, we are prepared a stage with micro heater and the temperature of detector can be controlled from room temperature up to 250 °C. Using this stage, we have measured the current-voltage characteristics of 4H-SiC Schottky barrier detectors and spectrometric performance using ^{241}Am radioisotope at different temperatures.

References:

[1]Bertuccio, G, Rehak, P, & Xi, D. A novel charge sensitive preamplifier without the feedback resistor. Nucl. Instrum. & Meth. in Phys. Res. **A 326** (1993) 71-76.