

Detection Properties of Semi-Insulating GaAs Radiation Detectors at Low Temperatures

Norbert Gál, Bohumír Zařko, Pavol Boháček and Eva Kováčová

Institute of Electrical Engineering, Slovak Academy of Sciences, Dúbravská cesta 9, 841 04 Bratislava, Slovak Republic

Corresponding author: norbert.gal@savba.sk

Abstract. Semi-insulating GaAs is a great choice for detector material thanks to its favorable price, high radiation hardness, good stopping power for γ - and X-rays due to relatively high atomic number, high carrier mobility, high resistivity and wide band-gap of 1.42 eV enabling room temperature operation.¹

In this work we present an experimental results of semi-insulating GaAs radiation detectors in temperature ranges below room temperature. The precise temperature stabilization was achieved by a low-noise custom microcontroller-controlled system with a PID loop using water-cooled Peltier module in custom made vacuum chamber. With this setup, we are capable of stabilizing and cooling the detector to a temperature below -50 °C with a precision of better than ± 0.1 °C which is mandatory for precise measuring of the detector performance. We measured the current-voltage characteristics and spectrometric performance using ²⁴¹Am radioisotope of semi-insulating GaAs radiation detectors at different temperatures. The achieved results are very promising, precise stabilizing and cooling the detector have a great impact on their performance.

References:

¹Šagátová A., Zařko B., Nečas V., Dubecký F., Anh T. L, Sedlačková K., Boháček B., Zápřažný Z., From single GaAs detector to sensor for radiation imaging camera, Applied Surface Science, Volume 461, 2018, Pages 3-9, ISSN 0169-4332