The Bias Effect on Alpha Spectrometry of Very Thin Semi-Insulating GaAs Detectors

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Abstract. The semi-insulating (SI) GaAs detectors have found their place among semiconductor detectors of ionizing radiation mainly due to their good absorption of X- and gamma rays and stable operation. However, their spectrometric properties are behind the traditional silicon detectors. The spectrometry is influenced by detector base material quality and electric field distribution in it. Higher applied bias and thinner structure of detector will lead to better charge collection efficiency (CCE) and energy resolution. The bulk SI GaAs detectors are produced down to 230 μm thickness, due to wafer fragility, and reach up to 83% CCE. In this paper the bulk SI GaAs detectors of Schottky barrier type of 60 μm thickness were manufactured using wet chemical etching and evaporation of Ti/Pt/Au multilayer as circle 0.5 mm Schottky electrode and the Ni/AuGe/Au full area ohmic electrode on the opposite surfaces of substrate. The CCE during alpha spectrometry of triple $^{239}Pu^{238}Pu^{244}Cm$ alpha source has increased up to 91% with applied reverse bias higher than 40 V. The best energy resolution was about 80 keV @ 5.5 MeV alpha particle energy.