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GaAs detectors with an ultra-thin Schottky contact for spectrometry of charged particles

Radiation damage-resistant semiconductor detectors are needed in experiments on measurements of cross-sections of nuclear reactions in the interactions of heavy ions with energies close to the Coulomb barrier for astrophysical applications. The low yield of such nuclear reactions is accompanied by enormous Rutherford scattering cross-sections that can quickly lead to failure of the conventional Si detectors. This work reports results of the development and characterization of detectors based on HP GaAs epilayers with an ultra-thin Schottky contact for such applications.

42 μm-thick GaAs epilayers with the carrier concentration of $3 \cdot 10^{11}\ cm^{-3}$ grown by chloride vapor phase epitaxy were used for fabrication of the detectors [1]. An ultra-thin Pt Schottky contact (12 nm) to the GaAs epilayers was formed by the ion-plasma sputtering method.

Spectrometric characteristics of the detectors were measured using α-particle sources. The measured energy resolution (FWHM) of 13.2 keV (on the 5.499 MeV line of ^{238}Pu) was at the level of the best Si detectors. Operating characteristics of the fabricated devices were examined. On the basis of the carried out measurements and simulation it is shown that the FWHM of the detector is close to its limit for VPE GaAs detectors and is mainly determined by the fluctuation in the number of collected electron-hole pairs.

1. G.I. Koltsov et al., Semiconductors 46 (8) (2012) 1066–1071.

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