Role of electrode metallization in performance of bulk semi-insulating InP radiation detectors

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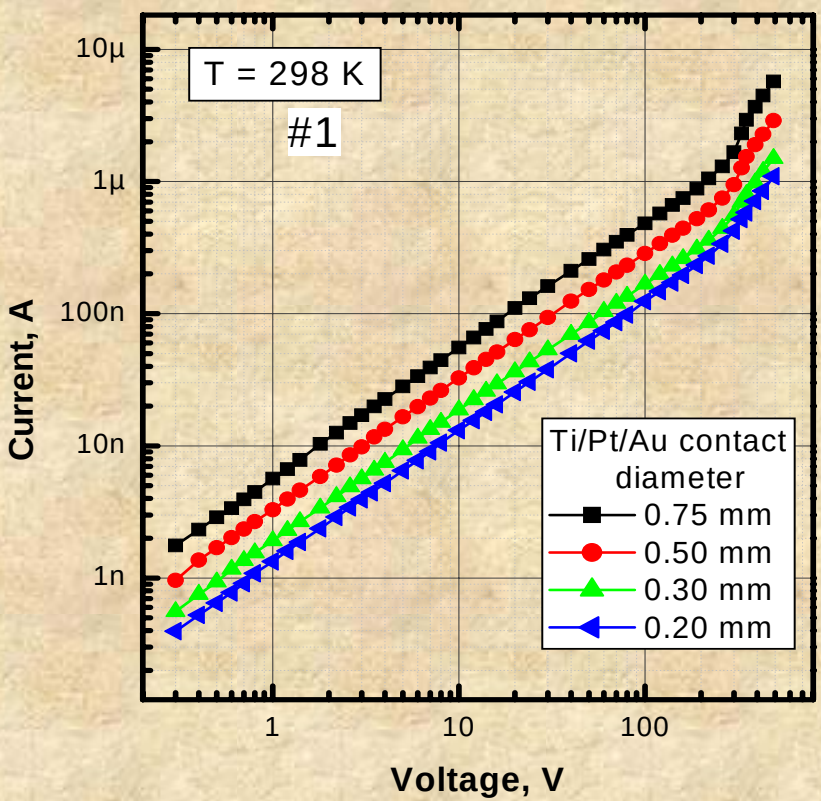
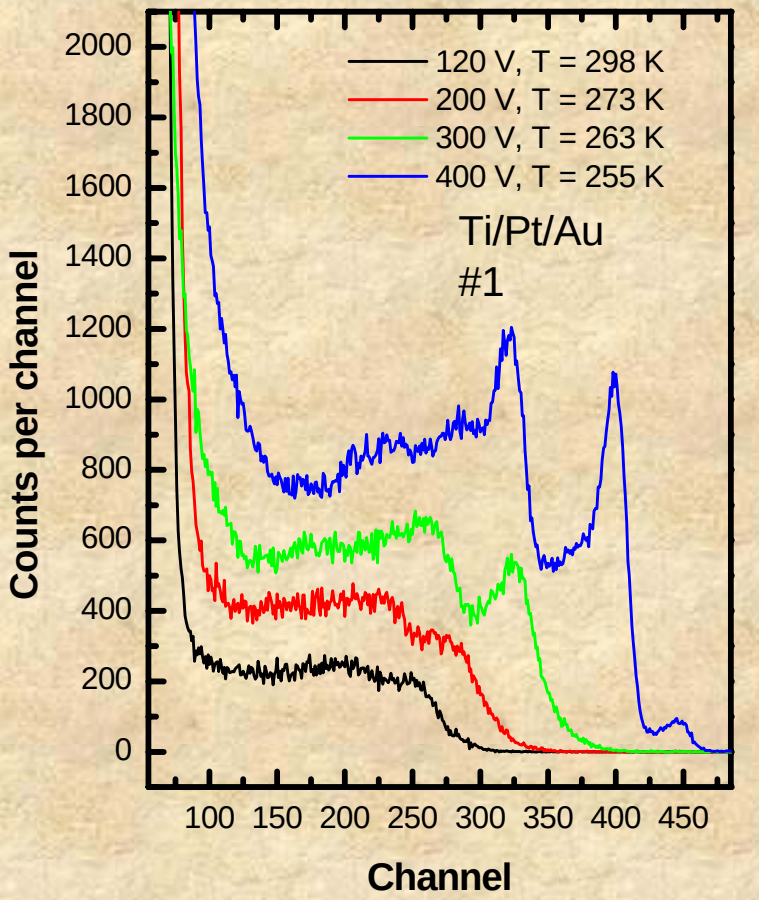


In this paper the study of SI InP:Fe–based particle detectors with emphasise to investigation of the role of electrode technology is presented. Detectors fabricated with various active contact areas (0.0314 – 0.442 mm^2) and three types of a "blocking" electrode metallizations (Ti/Pt/Au, Pt/Al and ZnAu) are studied. Room temperature (RT) current vs. voltage (I–V) dependencies and pulse–height spectra of ^{241}Am and ^{57}Co measured by detectors at various temperatures (300 K – 255 K) are presented.



Radiation detectors based on bulk LEC SI InP with different "blocking" contact metallizations (Ti/Pt/Au, Pt/Al and ZnAu eutectic alloy) were investigated. I–V characteristics show almost linear behaviour with suddenly decreasing dynamic resistance at a bias voltage over about 300 V. The pulse height spectra of ^{57}Co and ^{241}Am were measured at different temperatures (253 to 298 K) and applied biases (100 – 500 V). Good spectrometric performance was achieved with detectors #1 based on the IREE LEC SI InP:Fe+Zn material with Ti/Pt/Au contact metallization. Detector with the contact diameter of 0.5 mm attains an energy resolution of about 6.3 keV and 7.0 keV (in FWHM) for detected 60 keV and 122 keV γ–photon peaks, respectively. The best value of the charge collection efficiency (CCE) 83 % was observed at 255 K at a bias voltage of 500 V. Radiation detectors # 2 based on ROMELAB LEC SI InP:Fe with AuZn metallization demonstrate worse spectrometric performance even at reduced temperatures and high bias voltage. In such circumstance, the evaluation of FWHM and CCE was rather impossible. Explanation of this effect in present stage we relate to the worse base material characteristics, in particular short charge carriers lifetimes, than used metallization. Noting however, the fact of very similar electrical transport parameters (resistivity, Hall mobility) of both used SI InP wafers.

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