characterization of hyper hydride hpg.e detector

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introduction

at lnl it is running a r&d program on new technologies for the production of hyper pure germanium (hpge) detectors. in this framework different kinds of passivation have been proposed.

this work is focused on the analysis of some characteristics of a hyper hydride passivation method that has been developed at lnl. the aim is the study of the effects of this process on the crystal, in particular the determination of its efficiency in charge collection and of the dead layer induced below the passivated surface.

experimental setup

for these studies a planar hpge detector of 21 mm (height) x 39 mm (diameter) was used, produced with a contact of implanted b in one of the parallel faces of the cylinder and a diffused li contact on the other one. the detector was mounted on a cryostat conveniently modified for these experiments and cooled at 77k. this setup is described in detail in another report of this volume [1].

some different standard calibration gamma sources were used to perform the preliminary test of the detector and to acquire data for the efficiency estimation. a single-peak source of 241am, collimated with a lead collimator of 1.5 mm (diameter), was mounted on a motion device in order to shift vertically the source along the lateral surface of the detector. this procedure allowed the acquisition of scans at different distances from the contacts, separated by 0.6 mm, for the determination of the dead layer.

measurements

putting different calibration sources in front of the end-cup of the cryostat, the crystal efficiency has been determined as a function of the energy of the radiation source, normalizing the photo-peak integral to the acquisition live time, the solid angle, the source activity, the branching ratio and the attenuation coefficient due to the absorbent layers inside the cryostat. the results are shown in figure 1. the lateral scans performed with the collimated low-energy γ-rays source have been used for the determination of the thickness of the dead layer, where decrease of charge collection occurs: the beer-lambert law for the γ-rays absorption has been applied to the measured counting rate, taking into account the activity after the collimator and the absorbing layers.

conclusions

the results show that hyper hydride passivation induces a uniform dead layer inside the crystal.

this experiment is inserted into the program of comparison of different passivation methods, as described in another report of this volume [2].

[1] m. gelain et al., this annual report.
[2] m. gelain et al., this annual report.