GaAs Detectors Irradiated by Electrons at Different Dose Rates
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MOTIVATION

- Bulk Semi-insulating (SI) GaAs: suitable material for preparation of high-energy charged particle detectors, gamma ray detectors as well as the neutron detectors.
- The radiation damage studies of semiconductor based devices occupy the attention of researchers.
- Our previous research on radiation-hardness of SI GaAs detectors:
  - to gamma rays: up to 1.14 Mrad [1]
  - to neutrons: up to the fluency of 6.38 × 1014 cm⁻² [2]
  - to electrons: up to 70 kGy by now [3]
- We have extended the radiation-hardness study of SI GaAs detectors to high energy electrons (5 MeV) by investigating the influence of various dose rates on spectrometric and electric properties of small area detectors.

INVESTIGATED DETECTORS

- GaAs detectors irradiated in the Slovak Radiation Detectors to Extremely High Gamma Doses, Institute of Nuclear and Physical Engineering, Faculty of Electrical Engineering and Information Technology, Slovak University of Technology, Ilkovičova 3, 812 19 Bratislava, Slovakia
- The groups of investigated detectors:
  - 5A1 Pos
  - 5A1 Neg
  - 5A2 Pos
  - 5A2 Neg
  - 5A3 Pos
  - 5A3 Neg
  - 5A4 Pos
  - 5A4 Neg

IRRADIATION BY ELECTRONS

The groups of investigated detectors

RESULTS

- We have investigated the influence of various dose rates at low doses of 5 MeV electrons on spectrometric and electric properties of SI GaAs detectors.
- At highest dose rate (80 kGy/h) the drop of break-down voltage and of reverse current at 1 kGy was observed, followed by increase of these parameters at 4 kGy.
- At lower dose rates, the increase of these parameters at 1 kGy dose was observed.
- Detectors exhibited the slight decrease of CCE (1 - 2 %) with increasing dose at all dose rates used.
- The FWHM of detectors improved at 2 kGy with 80 kGy/h dose rate and at 1 kGy with 20 kGy/h dose rate.

SPECTRA MEASUREMENTS

SPECTRA OF 241-Am FOR DIFFERENT DOSES OBTAINED BY VARIOUS DOSE RATES

CONCLUSIONS

- We have investigated the influence of various dose rates at low doses of 5 MeV electrons on spectrometric and electric properties of SI GaAs detectors.
- At highest dose rate (80 kGy/h) the drop of break-down voltage and of reverse current at 1 kGy was observed, followed by increase of these parameters at 4 kGy. At lower dose rates, the increase of these parameters at 1 kGy dose was observed.
- Detectors exhibited the slight decrease of CCE (1 - 2 %) with increasing dose at all dose rates used.
- The FWHM of detectors improved at 2 kGy with 80 kGy/h dose rate and at 1 kGy with 20 kGy/h dose rate.

References:

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