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Simulation Study of Multiple-Thick Gas Electron Multiplier-Based Microdosimeters for Fast Neutron Measurements

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Abstract : Microdosimetric detectors based on multiple-thick gas electron multiplier (multiple-THGEM) configurations are being used in various fields of radiation protection and dosimetry. In the present work, microdosimetric response of these detectors to fast neutrons has been investigated by Monte Carlo method. Three similar microdosimeters made of A-150 and rexolite as the wall materials are designed; the first based on single-THGEM, the second based on double-THGEM and the third is based on triple-THGEM. Sensitive volume of the three microdosimeters is a right cylinder of 5 mm height and diameter which is filled with the propane-based tissue-equivalent (TE) gas. The TE gas with 0.11 atm pressure at the room temperature simulates 1 µm of tissue. Lineal energy distributions for several neutron energies from 10 keV to 14 MeV including 241Am-Be neutrons are calculated by the Geant4 simulation toolkit. Also, mean quality factor and dose-equivalent value for any neutron energy has been determined by these distributions. Obtained data derived from the three microdosimeters are in agreement. Therefore, we conclude that the multiple-THGEM structures present similar microdosimetric responses to fast neutrons.

Keywords : fast neutrons, geant4, multiple-thick gas electron multiplier, microdosimeter
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