Monte Carlo Simulation dosimetry study of cylindrical FD-7 radiophotoluminescent dosimeters in different radiation environments

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Abstract

We present the results of a simulation study to estimate the dose deposited in radiophotoluminescence (RPL) dosimeters exposed to various fields of ionizing radiations (photons, neutrons and electrons) and for different energy spectra. Commercial cylindrical (1.5 mm diameter, 8.5 mm length) FD-7 silver doped phosphate glasses manufactured by Chiyoda Technology (Japan) and used for dosimetry are considered. Monte-Carlo simulations performed with PHITS allowed us to determine: i) the dose attenuation within the RPL volume, ii) the dose-fluence ratio and iii) the conversion factor from dose to water or silica, often the standard in irradiation facilities, to RPL material, in different irradiation conditions. This set of information supplies reference information that RPL users can exploit to determine the dose absorbed in real irradiation conditions once the fluence is known. The relationship between the dose absorbed in calibration conditions, typically gamma radiation, and more complex operation radiation environment is given.

Keywords: dosimetry, radiophotoluminescence, phits, monte, carlo simulations

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