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Optimizing the Size and Composition of Solid State/EPR Dosimeters

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In the last few decades alanine/ Electron paramagnetic resonance (EPR) dosimetric system has been accepted by International Atomic Energy Agency as secondary, of transferring type, dosimetric system. In order to increase the sensitivity of solid state/EPR (SS/EPR) system up to now several materials have been studied. The sucrose has been studied for a long time as a dosimeter in radiation accident and in high-dose dosimetry by using different analytical techniques. On the other hand optimization of the shape and size of the dosimeters may increase the sensitivity of the system.
In the current study, an attempt to improve the sensitivity of the SS/EPR dosimetry is made. In view of this cylindrical dosimeters with different diameters and in presence and absence of internal standard Mn/MgO2 have been prepared and tested. As radiation sensitive materials in the dosimeters were used sucrose and alanine. The influence of the diameter of cylindrical dosimeters on the EPR response was studied at 1 mW microwave power and 0.2 mT modulation amplitude, in other to avoid some interference of the instrumental parameters. At absence of Mn in MgO2, the intensity of the EPR signal increased with increasing of the diameter of the dosimeters at the equal doses. It is normal because the quantity of the material increases. In the samples composing internal standard the ratio of the EPR intensity of the signal (Is) to intensity of the manganese standard (IMn) is used. In this case the EPR response is independent of the diameters of the dosimeters. The effect of size and composition of dosimeters used in SS/EPR dosimetry on their response also is studied. It has been found that in absence of internal standard Mn/MgO2, the EPR intensity increased linearly with the absorbed dose up to 20 kGy after that it is saturated. In dependence on the diameter of dosimeters the slope is different. It is biggest in case of 3 and 4 mm diameter. Further increase of the diameter of the dosimeters is not recommended since the increased penetration of the dosimetric material into the electric component of the microwave field in the EPR cavity decreases the EPR response. In presence of internal standard (Mn/MgO2) into the dosimeter (so-called self-calibrated dosimeter) the EPR signal intensity increased linearly with the dose in the all investigation region of dose (3-80 kGy). It can be concluded that the best results give self-calibrated cylindrical dosimeters.

Country/Organization invited to participate

Bulgaria

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