Commercial Al_2O_3:C detectors in standard beta radiation beams, using TL and OSL techniques

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Luminescence techniques as thermoluminescence (TL) e optically stimulated luminescence (OSL) in radiation dosimetry have been discussed by different authors in relation to their applications, including a comparison between them about their advantages and disadvantages [1,2]. Although the TL technique is nowadays so utilized as the technique OSL, the last one presents some advantages in relation to the first technique, as: it requires no heating of the sample, the samples may be read several times, and OSL is a relatively cheaper method than TL [3].

The Al_2O_3:C material, initially developed as TL dosimeter, is a detector which has become the main OSL material studied, because it presents good TL response, excellent OSL dosimetric characteristics [4], and it is characterized by its high sensitivity [5]. This kind of material has already been studied in several radiation beams, through the TL and OSL phenomena, including beta radiation, in which beams it showed good behaviour [6,7].

The objective of this work was to characterize and to evaluate the performance of Al_2O_3:C commercial detectors, using the TL and OSL techniques, in standard beta radiation beams.

In this work, Al_2O_3:C detectors (TLD-500), Rexon, were exposed to beta radiation of the two beta secondary standard systems at the Calibration Laboratory at IPEN: BSS1, Buchler GmbH and Co, Germany (^{90}Sr+^{90}Y, ^{204}Tl, ^{147}Pm), and BSS2, Isotrak, Germany (^{90}Sr+^{90}Y, ^{85}Kr, ^{147}Pm), at the specified conditions in their calibration certificates. The measurements were obtained evaluating the detectors at the TL/OSL reader, Risø, model DA-20, and the TL and OSL responses were always taken after the irradiations. After the measurements, the detectors were optically and termally treated for posterior re-utilization.

During this study, the TL and OSL responses of the detectors were used to characterize the samples, as reproducibility and linearity of their response, lower detection limit and energy dependence.

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