

LUMINESCENT RESPONSE FROM BeO EXPOSED TO ALPHA, BETA AND X RADIATIONS

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Introduction: The ionizing radiations are applied with great success in different areas such as medicine (diagnosical and therapeutic applications) and industry. The optically stimulated luminescence (OSL) is one of the most promising techniques which has been studied in solid state dosimetry [1]. The Beryllium Oxide (BeO) is not only a great material for TL dosimetry, but it has also been used as OSL dosimeter presenting advantages as high sensitivity to ionization radiation, linear dose response and effective atomic number ($Z_{\text{eff}} = 7.2$) similar to human soft tissue ($Z_{\text{eff}} \sim 7.6$) [1]. This work presents the OSL and TL responses from BeO detectors exposed to X, alpha and beta radiation beams.

Experimental: The BeO samples were in the form of discs of 4 mm in diameter and 0.8 mm in thickness. Before each characterization test the samples were heated to 750°C during fifteen minutes. The following irradiation systems were utilized: reference X radiation qualities recommended by the IEC 61267 [2], and beta and alpha sources ($^{90}\text{Sr}+^{90}\text{Y}$ and ^{241}Am) available in the TL/OSL reader system. All measurements were taken using a RISÖ TL/OSL system, model DA-20 in continuous wave OSL (CW-OSL) mode, with blue LEDs for stimulation. For the measurements, an UV transmitting broadband glass filter (Hoya U-340) was used in front of the PMT. Each OSL measurement was carried out during 100 s of LED stimulation with a power of 90%. The OSL intensity was achieved by integration of the whole OSL luminescence curve (100 s). The TL measurements were performed with a linear heating rate of $10^\circ\text{C}\cdot\text{s}^{-1}$ until 450°C. The light emission was integrated in the temperature interval between 150°C and 300°C. For each radiation kind, the characterization tests performed were reproducibility, lower detection limit, dose-response curve, energy dependence and fading.

Results and Discussion: The three radiation kinds present good sensibility for both techniques (TL and OSL). A TL emission curve and an OSL decay curve of a BeO disc are shown in Fig.1.

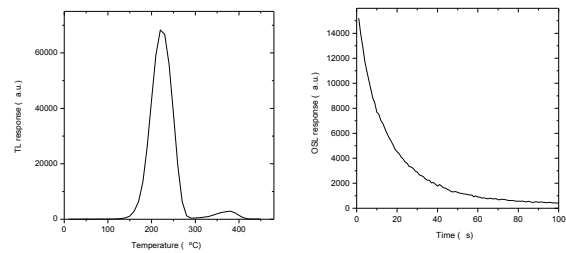


Fig. 1. TL and OSL curves of BeO after irradiation with a dose of 1 Gy (X rays, RQR5 quality).

For the OSL response reproducibility study, the samples were irradiated with 1 Gy. Ten measurements of each detector were taken, and all detectors presented results within the limit of $\pm 2\%$. The OSL dose response curve was obtained in the range between 1 Gy and 200 Gy. The BeO detectors show linearity of their OSL response in the measured dose range. The fading was investigated using 18 dosimeters, during one week. The first measurement was taken after ten minutes of irradiation, subsequently 6 h, 24 h, 48 h and 168 h. The fading after 24 h was approximately 6% compared with the first. The OSL response after one week remained the same. Sommer et al [3] showed also an initial fading of 6% in the first few hours, but remained $\sim 1\%$ during the following six months.

Acknowledgements. The authors are grateful for partial financial support from the Brazilian agencies CAPES, FAPESP, CNPq and MCT (Project INCT for Radiation Metrology in Medicine).

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