Ultraviolet radiation for the induction of PTOSL in $CaSO_4$:Dy detectors

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The application of artificial sources of ultraviolet radiation (UVR) in various areas such as industry, medicine, dentistry and in research is increasing due to the technological advances of the last decades. This fact may cause health risks to workers if appropriate protection measurements were not adopted. The International Commission on Non-Radiation Protection (ICNIRP) recommends exposure limits to non-ionizing radiation. UVR measuring electronic instruments are expensive, and the use of dosimetric material is a good option for UV dosimetry. The phototransferred optically stimulated luminescence (PTOSL) was already shown to be a useful technique for UVR detection using Al_2O_3:C Landauer dosimeters. The PTOSL phenomenon involves the production of optically stimulated luminescence (OSL) by the phototransfer of charges to empty traps from deeper, filled traps. Thus, by filling the deeper traps of the detector with a pre-dose of ionizing radiation, and submitting the samples subsequently to an adequate thermal treatment to remove any trapped charge from the shallow (dosimetric) traps, charge can be transferred from the deep traps to the shallow traps by exposing the sample to UVR wavelengths. $CaSO_4$:Dy+Teflon pellets produced at IPEN were used in this study. The PTOSL measurements were taken in an OSL reader system Risø, model TL/OSL-DA-20. The UV illumination procedures were performed in a system with a high-pressure mercury lamp. The $CaSO_4$:Dy+Teflon samples were initially characterized in order to verify their reproducibility of OSL response and the variation of response in relation to the absorbed dose, using high doses of a ^{60}Co source. The objective of this study is to characterize the material in terms of its luminescent properties. After this initial step, the samples were: pre-irradiated with a high dose; thermally treated; exposed to the UV source with different wavelengths; finally, the PTOSL responses were taken. The results were satisfactory and showed that the $CaSO_4$:Dy samples present PTOSL response in function of the tested parameters, such as UV wavelength and irradiance.

Keywords: OSL, PTOSL, $CaSO_4$:Dy, ultraviolet radiation, ^{60}Co source

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