Phototransfer analysis on TL and OSL responses of LiF:Mg,Ti (TLD-100) after exposure to ^{60}Co radiation

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LiF:Mg,Ti is a dosimetric material studied for several applications and with consistent results about its TL/OSL responses at literature. Some of them show the thermoluminescent (TL) sensitivity of this material to the visible and ultraviolet light after exposure to ^{60}Co source [1], the optically stimulated luminescence (OSL) signal with radiation of ^{90}Sr+^{90}Y and ^{241}Am applied to the radiation dosimetry [2] and the OSL response of LiF:Mg,Ti and CaF_2:Mn after irradiating them with the ^{90}Sr+^{90}Y source of the TL/OSL reader system Risø [3]. Phototransferred TL (PTTL) and OSL (PTOSL) are two phenomena that occur with the charges formed in a dosimetric material after its irradiation with some absorbed dose of radiation. After, the material is submitted to a thermal treatment and illuminated with a light beam. In this process, the charges move from the deep traps to the shallow traps, and then, it is possible to observe the PTTL and PTOSL responses of the material.

In this work, LiF:Mg,Ti pellets (TLD-100) were studied with the aim to observe the presence of PTTL and PTOSL after their exposure to a ^{60}Co gamma radiation source. The UV illumination procedures were performed using a system with a high-pressure short-arc mercury lamp, OSRAM. All the measurements PTTL and PTOSL were evaluated using the reader system Risø, model TL/OSL-DA-20.

Initially, the most adequate UVR wavelength was determined to obtain the best PTTL and PTOSL responses. The pellets were irradiated with an absorbed dose of 1 kGy of a ^{60}Co source and thermally treated to 280°C/15 min. Then, each sample was illuminated in an interval from 230 nm to 410 nm, in steps of 20 nm, during 30 s and with a distance of 10 cm between the light source and the dosimeter. After these 3 steps, the PTTL and PTOSL were measured, and for both the most adequate wavelength (with the most intense signal) was 250 nm. The second study was relative to the verification of the most adequate exposure time to obtain the PTTL and PTOSL signals. In this case, the pellets were also irradiated with 1 kGy (^{60}Co) and thermally treated to 280°C/15 min. Then, the samples were illuminated with the wavelength of 250 nm and in time intervals of 15, 30, 45 and 60 min (distance source-dosimeter of 10 cm). The result obtained showed that the best time interval for illumination of LiF:Mg,Ti was 60 min. Using these parameters, the samples were irradiated with doses from 10 Gy to 10 kGy (^{60}Co) in order to verify the PTTL and PTOSL responses with the increase of absorbed dose.

Keywords: phototransferred response, PTTL/PTOSL, TLD-100 samples

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