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Thermoluminescence and optically stimulated luminescence of UV-illuminated $\alpha - Al_2O_3$:C,Mg.

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The progressive depletion of the ozone layer causes a decrease in the protection barrier against solar radiation and may increase the people exposure to UV. In addition, there is an increased use of artificial UV sources. This excess exposure can cause skin cancer, erythema, opacification of the lens and inflammation of the eyes. Due to this a search for new materials and practical methods for UV detection and dosimetry becomes important. Al_2O_3:C,Mg is a very sensitive luminescent material for applications in optical data storage and imaging. It has been successfully used in dosimetry of neutrons, protons and heavy charged particles. Currently, it is known as a fluorescent nuclear track detector (FNTD). Although Al_2O_3:C,Mg is very promising in the monitoring of beta, gamma e X radiation, there are no specific previous studies on the influence of UV irrradiation on this crystal nor about its possibility of use as an UV-dosimeter. The goal of this work is to investigate the thermoluminescence (TL) and optically stimulated luminescence (OSL) response of the Al_2O_3:C,Mg single crystal induced by UV irradiation. UV irradiation was performed with a Hg lamp (60 mW/cm^2 at the sample position) with different illumination times (10 to 60s). TL glow curves were obtained using a heating rate of 1 K/s, from RT to 500 K. OSL emission was stimulated using blue light emitting diodes (470 nm, FWHM = 20 nm) delivering 80 mW/cm^2 at the sample position in CW mode. OSL measurement was carried out with 90 of the maximum LED power density. The OSL signal was detected with a bialkali photomultiplier tube (PMT) behind an UV transmitting filter (Hoya U-340, 7.5 mm thick).The TL and OSL results were analyzed by area under the curve, whole range and partial integration, and peak intensity. The activation energy and frequency factor (s) of the TL glow peaks were obtained by glow curve fitting using the GlowFit software, assuming a first-order kinetics. TL results showed three low intensity peaks at low temperatures (about 320 (peak I), 350 (peak II) and 375 K (peak III)) and the main peak at 455 K (peak IV). The OSL results showed a typical decay curve, even for a short exposure to UV. In addition, the sample also presented a linear response (area of TL main peak) with UV illumination time. The results showed that, for both TL and OSL, Al_2O_3:C,Mg is sensitive to UV radiation.