Dosimetric properties of $CaSO_4$:Tm and $CaSO_4$:Tm,Ag crystals produced by slow evaporation route

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The dosimetry of ionizing radiation is an essential tool in diagnostic radiology procedures, radiation therapy and evaluation of doses received by occupationally exposed individuals. Thermoluminescence (TL) is a useful technique in these types of monitoring. Nowadays, optically stimulated luminescence (OSL) technique has been also used, mostly because of no need of heating samples. Thus, the motivation of this work was to produce TL/OSL dosimeters based on crystals of $CaSO_4$ doped with thulium and silver, through a suitable new route.

The crystals were produced by an adaptation of the slow evaporation route using calcium carbonate ($CaCO_3$) as precursor, and incorporating the dopants (Tm_2O_3, Ag_2O and silver nanoparticles) in a solution of sulfuric acid, which is evaporated resulting in $CaSO_4$:Tm or $CaSO_4$:Tm,Ag crystal powder.

X-ray diffraction analyses showed that produced samples exhibit only a single phase corresponding to the crystal structure of anhydrite. Radioluminescence confirmed the presence of Tm^{3+} in the crystal matrix. TL/OSL characteristics such as glow curves, linearity, reproducibility, fading, kinetics order, and activation energy were evaluated. Samples doped with Tm and silver nanoparticles have shown the highest TL intensity and were compared with commercial TLDs (TLD-100, TLD-900), showing its potential to be used as dosimeters.

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