First Latin-American Congress
on Solid State Dosimetry and Radiation Measurements
13-17 September, 2021

TL AND OSL ANALYSIS OF NATURAL ORANGE CALCITE CRYSTAL

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Introduction: In Thermoluminescence studies calcite propertiers are widely analysed and different TL properties depend on the content of the impurities and defects found in the calcite net[1]. In addition to TL, OSL emission is also widely used in dating and dosimetry methods. Both phenomena emits light proportional to the amount of dose of ionizing radiation[2]. Calcite samples are a relevant topic in TL, however few studies have been observed in orange calcite.

Material and method: The crystallographic characterization was obtained using X-rays diffraction (XRD), with a Rigaku spectrometry, at an initial angle of 3° to 90°, for 0.20s. Impurities concentration were determined using total reflection X-rays fluorescence (TXRF) analysis, with S2 PICOFOX equipment, the sample was dried in an oven at 60 ° C for 15 min. The estimated time of measurements was 300s. The powder sample was subjected to visible TL measurements through RISØ, heating from 0 to 500 °C, at 5 °C/s. Beta irradiotions were performed with a $^{90}Sr/^{90}Y$ source, with doses from 0.16 to 19.44 Gy. OSL measurements were taken during 40s of stimulation at a temperature of 60°C, with blue stimulation.

Results: XRD result comproved that the sample has calcium carbonate net and trigonal rhombohedral system (ref.cod.01-072-1652). TXRF results identified the impurities present in the calcite sample as shown in Figure 1, the predominant presence of the element Ca, and the orange color of the crystal may be due to the presence of the element Fe, impurities as Ti, Cr, Mn, Sr, Sm and Er, related to luminescence centers were determined too.In Figure 2 it is possible to observe TL glow curves detected in visible region, for aliquots irradiated with doses from 0.324 to 19.440 Gy. A broad peak of TL visible at 93 °C starting at a temperature of 50 °C and other smaller peaks in the region between 100 to 200 °C is clearly observed.Figure 3 shows the OSL decay curves irradiated with doses between 0.486 and 19.44 Gy, the signal increaseswith the dose, however, at low doses the signal intensity is very low and starts to grow substantially after 10 Gy.

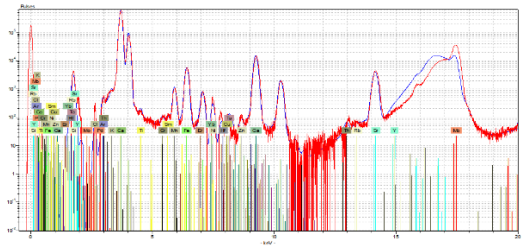

Figure 1: X-rays diffraction of calcite. Source: Author.

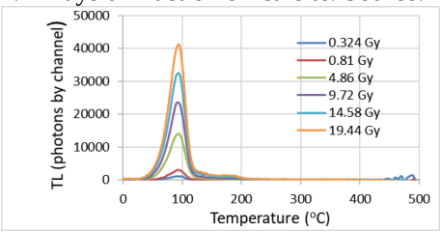

Figure 2: TL curves in the VIS region. Source: Author.

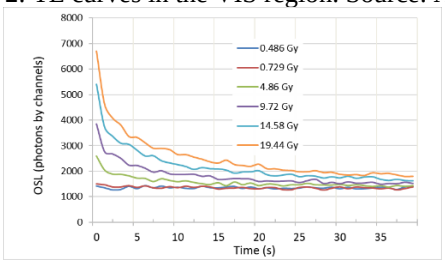

Figure 3: OSL curves of calcite. Source: Author.

Conclusions: The sample studied is a calcite that has several impurities. Generally, calcites do not emit ultraviolet light, in this case we observed these emissions in OSL, which makes the sample unique in this aspect and usable in ionizing radiation dosimetry and dating.

References:

1. W.L. Medlin, *The nature of traps and emission centers in thermoluminescent rock materials. In Thermoluminescence of Geological Materials*, Academic Press: New York, 1968.
2. J.M. Guilheiro, S.H. Tatumi, A.de F. Soares *et al. Correlation study between OSL, TL and PL emissionsof yellow calcite.* Jornal of Luminescence, 2021, pp.1-8.