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TL AND OSL RESPONSES OF SILICON OXIDE IRRADIATED WITH UV-C AND BETA PARTICLES

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Introduction: In the present work TL and OSL of silicon oxide crystals doped with semi-metals and rare-earth elements (Tudela et al, 2019) was studied. This crystal was chosen because it has a Z_{eff} value close to buildings wall, which often contain a lot of natural quartz made from SiO_2. Therefore can be used in environmental dosimetry forbeta and UV-C radiations (Colyott et al., 1999).

Material and method: TL measurements were performed with RISΦ TL/OSL automated reader, model DA-20. For UV-C irradiation, aliquots of sample with mass about 45 mg were placed under an Osram mercury lamp, with 11 W of power. Beta irradiation was performed with $^{90}Sr/^{90}Y$ source.

Results: Figure 1 shows TL glow curves of beta irradiated aliquots with crescent doses 6.1; 8.1; 10.2; 12.2 and 16.3 Gy. Three prominent peaks were observed and increase with dose linearly.

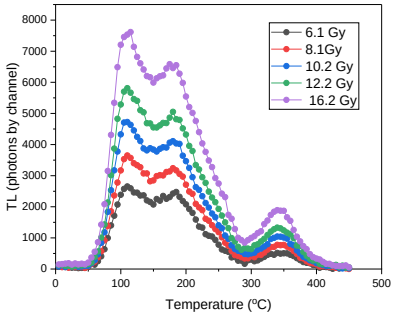

Figure 1: TL glow curves of SiO_2 obtained after different beta dose irradiation.

When the samples were irradiated with UV-C a change in peak at high temperature was noted, as is shown in Figure 2, for more long exposition time the peak temperature decrease; after 3 min of exposure the TL intensity decrease.

By using General Order Kinetics Model (GOK), the TL glow curve was deconvoluted into 6 TL peaks, with peak temperatures at 358, 380, 422, 459, 500 and 593 K, with activation energy of 0.8; 1; 1.12; 1.14 and 1.22 eV and the kinetic order of 1.51; 1.95; 1.81; 1.43; 1.99 and 2, respectively,the figure of merit was 3.98.

OSL signal was observed after UV-C irradiation and a linear response up to 300 s of exposure, as shown in Figure 3

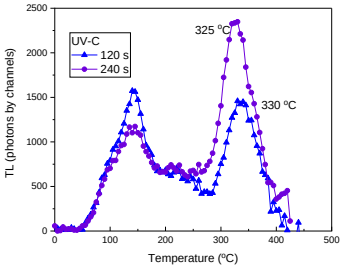

Figure 2: TL glow curves of SiO_2 obtained after different UV-C irradiation times 120 and 240 s.

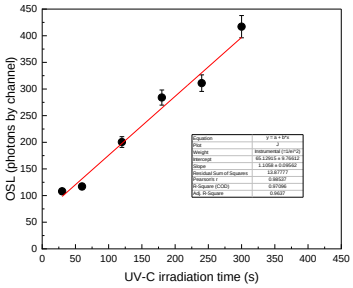

Figure 3. OSL growth curve of SiO_2 irradiated with UV-C.

Conclusions: The results show that silicon oxide can be used for beta and UV-C radiation dosimetry. TLand OSL emission are appropriate for beta radiation dosimetry and OSL for UV-C one.

References:

1. L.E. Colyott, S.W.S. Mckeever, M.S. Akseltod, *An integrating UVB dosemeter system.* Radiation Protection Dosimetry, 1999, p.p. 309-312.
2. G. R.D. Tudela, S.H. Tatumi, L.C. Courrol *et al. Luminescence properties of SiO_2:Tb nanocrystals obtained via sol-gel route and its applicability to environmental ionizing radiation dosimetry*. Journal of Luminescence, 2019, p.p. 123-128