

# DOSIMETRIC PROPERTIES OF SILICATES APPLIED TO HIGH-DOSE DOSIMETRY USING THE OSL TECHNIQUE

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**Introduction:** The silicates are the most abundant minerals present at the earth surface. Thermoluminescence and electronic paramagnetic resonance properties of silicates have been studied by Melo et al. [1, 2]. In this study, Melo et al. showed that silicates of the inosilicate family can be used for high-dose dosimetry. By neutron activation analyses trace elements as Ca, F, Na, La, Ce, Sm, Eu, Tb, Yb, Sb, Cr, Hf, Sc, Zn, Co, Nd and Lu were found. Cano [3], by the X ray fluorescence technique, found the Mn element, assigning the TL signal to this element. In the present work the reproductibility, residual signal, minimum detectable dose, dose-response curve and fading of the OSL signal of some silicates were studied.

**Experimental:** All samples (tremolite, diopside, rhodonite) were cleaned, powdered and sieved, retaining the 177  $\mu\text{m}$ –74  $\mu\text{m}$  size fraction. All powder samples were exposed to gamma radiation at a Gamma Cell and a Panoramic 60-Co source, and exposed to beta radiation of a  $^{90}\text{Sr}/^{90}\text{Y}$  source. For the gamma irradiations the samples were placed in a black plastic envelope and sandwiched between PMMA plates to ensure the electronic equilibrium. The OSL measurements and the beta irradiations were made using a TL/OSL Risøe system, TL/OSL-DA-20 model. As excitation source blue leds with 90% of power and 60s excitation time were utilized.

**Results and Discussion:** The reproductibility of the OSL sample response exposed to gamma radiation were 9.1%, 10.2% and 9.6% for tremolite (TRE), diopside (DIO) and rhodonite (ROD) samples, respectively. For the samples exposed to beta radiation, the reproductibility values were 9.7%, 9.4% and 2.5%. After exposing all samples to radiation, OSL and TL measurements was taken two times to obtain the residual signal values. The values were (12.6 $\pm$ 3.6)%, (10.2 $\pm$ 1.4)% and (3.5 $\pm$ 0.6)% for TRE, DIO and ROD samples, respectively.

The minimum detectable dose showed higher values for samples exposed to gamma radiation than for samples exposed to beta radiation. The values obtained were 32.86 Gy (gamma radiation) and 7.12 Gy (beta radiation) for TRE samples, 34.92 Gy (gamma

radiation) and 6.39 Gy (beta radiation) for DIO samples and 52.86 Gy (gamma radiation) and 8.91 Gy (beta radiation) for ROD samples.

The dose-response curves were obtained using samples irradiated in the dose interval of 1 Gy to 20 kGy (gamma radiation) and from 100 mGy to 20 Gy (beta radiation). For all samples the behavior of the dose-response was sublinear when exposed to beta radiation. When exposed to gamma radiation linearity intervals were observed to TRE samples from 50 Gy to 1000 Gy and for ROD samples from 50 Gy to 2000 Gy. The behavior of the diopside samples to gamma radiation was also sublinear.

The fading study was done in samples exposed to gamma and beta radiations with absorbed doses of 1 kGy and 10 Gy, respectively. All samples were placed in a black plastic envelope to protect them from the ambient light. The fading values of the samples exposed to gamma and beta radiations were (66 $\pm$ 1)% and (46 $\pm$ 7)% for TRE samples, (80 $\pm$ 8)% and (62 $\pm$ 8)% for DIO samples and (88 $\pm$ 2)% and (63 $\pm$ 8)% for ROD samples. All samples presented usefulness for high-dose dosimetry taking the fading into account.

**Acknowledgements.** The authors thank CNPq, CAPES and FAPESP, Brazil, for partial financial support.

## References:

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