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White and green jadeite characterization by thermoluminescence

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Except for gemologically or industrially important silicate minerals, a large number of other natural silicate minerals have been investigated only concerning geological/mineralogical aspects. Jadeite is a silicate mineral with chemical formula NaAlSi₂O₆ belongs to the Piroxene group. Two kind of this mineral were used in this work to be investigated as to radiation effect on their Thermoluminescence properties; also to study the possibility of them to be used in high dose dosimetry. These samples, one white (WJ) and other one green colored (GJ), have been obtained from China. As usual, they were pulverized and sieved to retain grains sizes between 0.080 and 0.180 mm for TL measurements. A 60Co source was used for gamma-irradiation at IPEN – Institute for Nuclear and Energy Researches, SP, Brazil. Furthermore, for high doses gamma-irradiation, it was used a Nordion JS 9600 (dose rate of 30 kGy/h) at CBE/EMBRARAD, Cotia, SP, Brazil. The powder was divided into portions and irradiated in the range of dose varying 0.05 to 3000 kGy. Moreover, the TL measurements have been carried out on Harshaw model 4500 TL reader (temperature range: 50 °C up to 400 °C and heating rate: 4 °C.s⁻¹).

WJ presented glow curve with 110, 190 and 235 °C peaks, the last one appears just as a shoulder. All these peaks grow with radiation dose. Since 110 °C peak is unstable at room temperature, it is not suitable to be used in dosimetry. 190 °C peak grows up to about 10 kGy saturating afterward. The glow curve of GJ the green variety, has TL peaks at 140, 210, 250 and 330 °C. The 140 °C peak grows slowly, 210 °C peak grows faster and 330 °C peak is the one that grows very fast with the dose. This last peak responds growing almost two decade going from low to about 200 kGy, decreasing beyond this dose-value. The TL response as function of dose describe a parabola with maximum around 200 kGy (in log/log representation). At around 3000 kGy the TL response is still high. We expect that green jadeite can be used for measurement of dose as high as 1300 kGy.

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