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WATERPROOFING PELLETS FOR OPTICALLY STIMULATED LUMINESCENCE DOSIMETRY

ROCCA, R. R.[1], FERNANDES, C. P.[1]

[1]Instituto do Mar, Universidade Federal de São Paulo, 11070-100 Santos, SP, Brazil, rrocca@unifesp.br

Introduction: Optically Stimulated Luminescence (OSL) measurements occur with photon excitation and sometimes it is necessary to heat samples, in order to eliminate electrons trapped in shallow and unstable traps. Many production methods of these dosimetric materials produce powder samples agglomerated to form pellets, with fixed volume and mass. Some attempts to manufacture dosimeters using Teflon® have already been carried out. However, the homogeneous mixture between the sample of interest and polytetrafluoroethylene (PTFE) - which is a bad heat conductor - generates a temperature gradient between the equipment and the sample. Likewise, PTFE presents a luminescent signal when exposed to ionizing radiation, in addition to a non-transparent whitish color. Then, a correction of the signal emitted by the sample must be performed, since the whitish color absorbs part of the photons from the stimulation and emission of the sample. Thus, in this study, another possibility for the manufacture of more efficient dosimeters was analyzed. Commercial enamel has shown good results for this purpose, as a thin layer is sufficient to hold the sample's grains, being the layer transparent. Finally, commercial enamel helps in cases where samples present hygroscopy, serving as a waterproofing agent.

Materials and methods: The sample to be studied must be sieved to obtain uniformly sized grains. For this study, grains between 0.075 and 0.150 mm were used, which is the commonly selected range for dating sediments with quartz. Since aluminum is a good conductor of heat, discs of this material were used for the base of the aliquots. Thus, a thin layer of commercial enamel was applied over the discs, followed by uniform sieving of the sample, and finally, a second layer of enamel, this being optional. For hygroscopic materials the second layer of enamel will serve as a waterproofer keeping the material protected. For non-hygroscopic materials, the second layer of enamel can be applied to completely fix the grains. Afterwards, wait for the pellets to dry completely.

Results: Several enamels were tested to verify which one presents the lowest luminescence absorption emitted by the sample. Thus, the one with the lowest absorption reduced the OSL signal by 36% - when reading is performed with assisted temperature (figure 01). The maximum temperature that the enamel can withstand without being degraded was also tested. Thus, it was observed that discs heated at 120°C for 24 hours have greater resistance. After this process, the pellets can undergo irradiation and OSL reading with heating up to 140°C. Similarly, reproducibility was tested by carrying out the irradiation process and reading the OSL 500 times, resulting in a reproducible signal within the sample's proper fluctuation. And so, since it is an enamel, the aliquots can even be washed without harming the sample being analyzed.

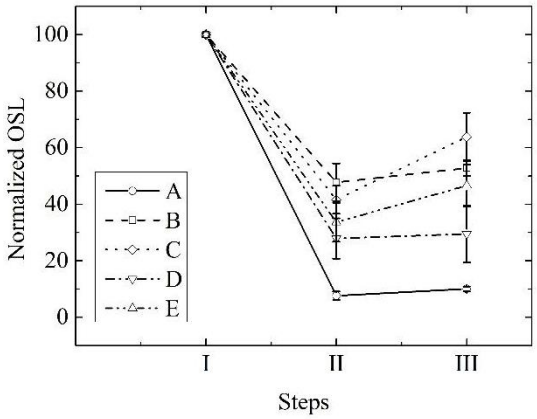

Figure 01: OSL measurements. Being: I - without enamel; II - with enamel; III - with an assisted temperature of 110 °C; A, B, C, D and E - commercial enamels tested.

Conclusions: The enamel does not emit an OSL signal when subjected to ionizing radiation. This method can be used for hygroscopic samples. Also it is useful in cases where the luminescent reader is not close to the irradiation source and successive readings of the dosimeters are necessary.