TL and TSEE response of wollastonite-teflon composites in X-ray beams

D.N. Souza[1], A. P. Melo[2,3], L.V.E. Caldas[2]

[1]*Departamento de Física, Universidade Federal de Sergipe, São Cristóvão, SE, Brazil*
[2]*Instituto de Pesquisas Energéticas e Nucleares, CNEN/SP, São Paulo, SP,Brazil*
[3]*Centro Federal de Educação Tecnológica de Sergipe, CEFET/SE, Aracaju, SE, Brazil.*

Several authors have studied how to improve the combination between techniques and materials to investigate the evaluation of new detectors for radiation dosimetry of low cost [1,2]. The technique of thermally stimulated exoelectron emission (TSEE) and thermoluminescence (TL) are interesting to this aim, because they are of low cost and high resolution (ppm). In this work, natural Wollastonite samples were acquired from Minas Gerais, Brazil. Pellets of Wollastonite-Teflon composites were studied in relation to some TSEE and TL dosimetric characteristics: emission curves, calibration curves, minimum detection limits, and energy dependence (X ray radiation). The natural Wollastonite samples were cleaned and then powdered, and only the grains with diameters between 0.075 and 0.149 mm were utilized in this work to produce thin sintered pellets of Wollastonite-Teflon composites (5.5mm in diameter and 0.8mm in thickness, and 50mg of weight). The samples were thermally treated at 300°C during 30 min followed by 400°C during 1.5h to obtain the properties required for this study. The cooling of the samples was performed slowly in the same oven. The samples were irradiated with X rays (Pantak/Seifert System). The doses were between 1.5Gy up to 6.0Gy. A TSEE readout system was utilized with a continuous gas flow and associated electronics, and a temperature programmer that supplies a linear rate of 5°C/s. The TL readout system was from Nuclear Instruments Systems, model 2000 A/B; the data acquisition was performed using a virtual instrument (ADC-212/3 Pico Technology Ltd.) and a personal computer. The thermal treatment for re-utilization of the materials was 300°C during 1 hour in an unsealed oven. TL and TSEE glow curves were studied in the temperature range of 50 to 300^{o}C. The calibration curves of TSEE and TL response presented linearity between 1.5Gy and 6.0Gy for the radiation energy of 33,05keV and an energy dependence between 27keV and 41keV (dose of 1.5Gy) was less than 15%. TL and TSEE properties as glow peak positions and dose responses were determined and analyzed.

References

[1] C. M. S. de Magalhães, Z. S. Macedo, M. E. G. Valerio, A. C. Hernandes , D.N. Souza, Preparation of composites of topaz embebed in glassmatrix for application in solid state themoluminescence dosimetry . Nucl. Inst. Meth. B, 218, 277-282, 2004.

[2] A. P. Melo, M.E.G. Valerio and L.V.E Caldas, Thermoluminescent characteristics of mineral samples acquired as jade, Nucl. Inst. Meth. B, 218, 198-201, 2003.

E-mail: lcaldas@ipen.br