TL and OSL characterization of $CaSO_4$:Tb, $CaSO_4$:Tb,Ag, and $CaSO_4$:Tb,Ag(NP)

A. M. B. Silva[(1)], Danilo O. Junot [(2)], Linda V.E. Caldas[(2)] and D. N. Souza[(1)]

(1) Departamento de Física, Universidade Federal de Sergipe; Marechal Rondon Avenue; São Cristovão,SE, Brazil

(2) Instituto de Pesquisas Energéticas e Nucleares, Comissão Nacional de Energia Nuclear, IPEN/CNEN-SP, Av. Prof. Lineu Prestes, São Paulo, Brazil

Various materials with luminescent properties are used for ionizing radiation dosimetry by thermoluminescence (TL) and optically stimulated luminescence (OSL) techniques. However, several researches are proposing the improvement of TL/OSL materials to expand the dosimetric properties of those already used, considering that no TL/OSL dosimeter has all the ideal characteristics for monitoring radiation. According to recently reported research, some unusual rare earth elements, such as terbium, have shown to be promising as dopant in $CaSO_4$ matrix. As there are no reports on the structural characterization of $CaSO_4$:Tb with the incorporation of silver, the proposal of this work was to produce and characterize doped $CaSO_4$ crystals with terbium using silver, including as nanoparticle, Ag(NP), as a second doping for use as TL/OSL dosimeter.

The phosphors were characterized by x-ray diffraction technique, thus confirmed the viability of the slow evaporation route used in the production. The silver that was incorporated as nanoparticles was prepared by the method purposed by Lee and Meisel [1] and characterized by scanning electron microscopy and UV-Vis. The composites were obtained from the addition of Teflon to the phosphors.

By thermoluminescence and optically stimulated luminescence studies it was observed that the presence of silver nanoparticles increases the intensity of the TL emission of the phosphor. The phosphorus presented a typical exponential OSL decay curve with a very slow component that indicates that the traps are not high optically active for blue LEDs. $CaSO_4$:Tb,Ag(NP) presented a higher sensitivity to radiation than $CaSO_4$:Tb,Ag. All samples have a luminescent signal reproducible and linear, with TL and OSL responses proportional to the absorbed doses.

Keywords: dosimetry, thermoluminescence, optically stimulated luminescence.

[1] LEE, P.; MEISEL, D. Adsorption and surface-enhanced Raman of dyes on silver and gold sols. The Journal of Physical Chemistry, v.86,n.17,p.3391-3395,Aug 1982.