TL RESPONSE OF NANOCRISTALLYNE $BaSO_4$ DOPED WITH DIFFERENT CONCENTRATIONS OF Eu AND Dy

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Introduction: Nanotechnology and nanomaterials have attracted several researchers from different areas, specially that of luminescence applied to dosimetry. The main advantage of using nanomaterials or materials doped with nanocomposites is that they exhibit enhanced optical, electronic, and structural properties [1]. In the present study $BaSO_4$ doped with Eu and Dy were synthesized via a chemical co-precipitation route, and then the thermoluminescent (TL) characteristics of these nanocrystallines materials were analyzed for gamma beam dosimetry purpose. As TL is one of the most common and useful techniques for radiation dosimetry, the TL response of different samples of $BaSO_4$:Dy and $BaSO_4$:Eu nanocristals were compared.

Experimental: The samples ($BaSO_4$:Dy and $BaSO_4$:Eu) were synthesized by a co-precipitation technique at the Center of Chemistry and Environment (CQMA) at the IPEN. In order to compare the use of different concentrations of Eu and Dy, samples with several concentrations were acquired: 0.05%, 0.1%, 0.2% and 1%. To obtain the pellets, the $BaSO_4$:Dy and $BaSO_4$:Eu samples were mixed with Teflon in the following ratio: 2 (Teflon):1 (powered sample). In order to optimize the homogenization of the pellets this mixture process was realized at liquid nitrogen temperature. Each pellet presents 6 mm of diameter, 1 mm of thickness and mass of 50 mg. The use of Teflon as a binder allows a more resistant pellet. Pure samples of Teflon were also prepared, in order to evaluate their influence on the TL signal.
The pellets were irradiated at a Gamma Cell-220 System of ^{60}Co (1.38 kGy/h), and an x-ray industrial system (ISOVOLT 160HS/Pantak-Seifert) with several established standard radiation qualities. This unit operates from 5 kV to 160 kV. After the exposure, TL glow curves were recorded on a Risö TL/OSL Reader and Controller, model DA-20, utilizing a personal computer for the data acquisition.

Results and Discussion: In order to characterize the new samples of $BaSO_4$ doped with Dy and Eu, some properties were evaluated: reproducibility of the response, lower detection limits and dose-response curve. The TL peak, for all concentrations, appeared at approximately 223 °C. All samples of $BaSO_4$ dopped with Eu and Dy presented suitable responses, and they show potential use gamma high-dose dosimetry. It was also possible to observe a decrease of the TL response following the increase on the dopant concentrations. Comparing the manufacturing processes, the calcinated samples presented a better response.

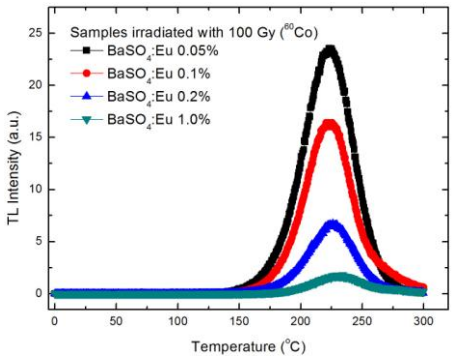

Fig. 1- TL glow curves of the nanocrystalline $BaSO_4$:Eu with varying dopant concentrations exposed to 100 Gy of gamma rays.

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Reference:
[1] Lochab, S.P., Pandey, A., Sahare, P.D., Chauhan, R.S., Salah, N., Ranjan, R., **2007**, Nanocrystalline MgB_4O_7:Dy for high dose measurement of gamma radiation, phys. stat. sol.(a) *204(7)*, 2416–2425.