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EFFECT OF THE SYNTHESIS METHODS ON THE LUMINESCENCE RESPONSE OF MgB_4O_7:Dy

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Introduction: Luminescent materials are widely applied for radiation dosimetry because of their special optical properties. Magnesium tetraborate (MBO) doped with lanthanide has been frequently used as a matrix for thermoluminescent (TL) dosimetry. There are few studies of the Optically Stimulated Luminescence (OSL) response of this material. On the other hand, the synthesis route can affect the luminescence response of the material. The aim of this paper is to evaluate the influence os the synthesis methods on the luminescence response of MBO:Dy.

Material and method: In the work two synthesis routes were used, with 0.1 mol % of disprosium: *(a)* solid state synthesis [1], *(b)* combustion synthesis using urea or glycine as a fuel. For the first method the basic composition reagents were mixed and homogenized and then heated. Samples were prepared with two different heating conditions: a) heating to 900°C/4h + 500°C/1h and b) heating to 900°C for 7h. The second synthesis route is based on the oxidation reduction reaction between nitrates and fuels (urea or glycine) at temperatures about 500°C. The powder produced was heated at 900°C/4h [2]. To characterize the samples, X-ray diffraction (XRD) measurements were performed, confirming the crystalline phases of the materials. Pellets were prepared with 6mm diameter and 1mm thickness. The OSL and TL responses were measured using an automated LexsygSmart OSL reader equipped with an internal $^{90}Sr/^{90}Y$ source with a dose rate of 100 mGy/s.

Results: Fig. 1 presents the TL dose-response curve of the MBO:Dy prepared with the different routes. The results show that the TL sensitivity of the pellets produced by combustion route is higher that produced by solid state technique. Comparing the TL response with the fuel type of the compbustion synthesis, it is observed that the best results obtained were with urea. On the other hand, IRSL response was not observed for the samples produced by either synthesis technique. Only the samples produced by the combustion technique using urea as a fuel and heated to 900°C/4h + 500°C/1h presented a BSL response in the dose range studied.

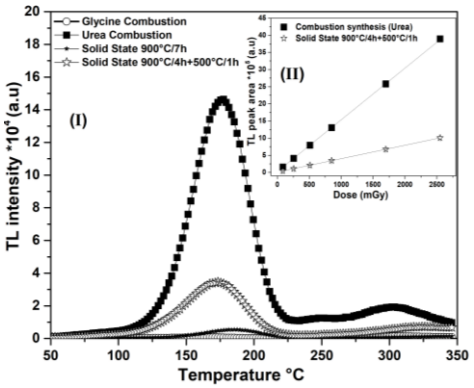

Figure 1: (I) TL intensity curve of $MBO:Dy_{0.1\%}$ produced by solid state synthesis and combustion synthesis, irradiated with 2550mGy (R-β). (II) Dose-response curve TL of the compost produced by the combustion (urea) and solid state (900°C/4h+500°/1h).

Conclusions: The results showed that the MBO:Dy produced by the combustion (urea) route has greater TL sensitivity than the material produced by the solid state technique. The OSL response was observed only for blue stimulation and for the samples produced by compustion technique using urea as a fuel. These results indicate that further studies related to the concentration of the dopant still have to be done to determine the most sensitive TL and OSL response of MBO:Dy

References:

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