EPR evaluation of yttrium oxide rods

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1. **INTRODUCTION:** The use of rare earths (RE) as dopant of materials has led the development of advanced materials for many applications such as optical tracers, special alloys, semiconductors, as well as radiation dosimeters. The development of new dosimetric materials based on REs is a great challenge in innovation of materials. Yttrium oxide (Y_2O_3) presents luminescent proprieties[1] and is a promising material for radiation dosimetry**.**

   The present paper aims to evaluate the EPR signal response of Y_2O_3 rods obtained by colloidal processing, and which were exposed to gamma radiation with doses from 1Gy to 100kGy.

2. **EXPERIMENTAL:** The characterization of Y_2O_3 nano powders (Johnson Matthey, 99.99%) was performed by Photon Correlation Spectroscopy (PCS, Zeta Plus - Brookhaven Instruments), Specific Surface Area by BET method (SSA, ASAP 2010), X ray diffraction pattern (XRD, Rigaku Multflex), and Scanning Electron Microscopy (SEM, Incax-act – Oxford Instruments). Ceramic rods (2.33x3.77mm, diameter x height) were obtained by colloidal processing[2], using organic molding[3] and followed by sintering at 1600ºC/4h. Sample groups containing four sintered ceramic rods were irradiated with gamma doses from 1 to 50kGy and evaluated by Electron Paramagnetic Resonance (EPR). The measurements were performed at room temperature with X-band EPR spectrometer (Bruker EMX PLUS). EPR spectra were recorded using the following parameters: field frequency modulation of 100kHz, microwave power of 0.6325mW, center field at 3200G, sweep width of 6000 G, modulation amplitude of 4 G, time constant of 0.01ms and, 10 scans. In order to compare peak- to- peak

amplitudes, the mean spectrum of each sample group was normalized by the mean mass of its respective sample group.

3. **RESULTS AND DISCUTION:** Y_2O_3 powder presents narrow particle size distribution with a mean particle size d_{50} of 121.7nm. Particles of nano sized scale are ruled by surface forces, which ones have to be controlled in order to develop advanced materials for radiation dosimetry[4]. Results from EPR dose-response curve show that Y_2O_3 rods present linear dose response behaviour up to 10kGy. However, significant linear deviation from 10kGy to 50kGy was observed, which was possibly due to formation of more number of defects.

4. **CONCLUSION** Yttrium oxide rods were obtained by colloidal processing, followed by sintering at 1600ºC/4h exhibited EPR linear dose response behaviour up to 10kGy. These preliminary results make Y_2O_3 a promising material for high doses radiation dosimetry.

5. REFERENCES

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