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SYNTHESIS OF THULIUM-YTTRIA NANOPARTICLES WITH EPR RESPONSE

SANTOS, S. C.[1], RODRIGUES, O. JR.[2], and CAMPOS, L.L.[3]

[1-3]Instituto de Pesquisas Energéticas e Nucleares, IPEN-CNEN/SP, 05508-000 São Paulo, SP, Brazil, silas.cardoso@alumni.usp.br

Introduction: High dose dosimetry demands a continuous effort towards the development of new materials with the aim to guarantee assurance of activities in which ionizing radiation is used. The present work reports a hydrothermal synthesis based on a relative low temperature and pressure to form thulium-yttria nanoparticles with electron paramagnetic resonance response.

Material and method: Thulium-yttria nanoparticles ($Tm:Y_2O_3$) prepared with 0.1at.%Tm (atomic percentage, at.%) were synthesized by an eco-friendly hydrothermal process as reported in previous study[1]. The nanoparticles were characterized by Photon Correlation Spectroscopy (PCS), X-ray diffraction (XRD), Scanning Electron Microscopy (SEM), and Electron Paramagnetic Resonance (EPR).

Results: According to results, the hydrothermal method provided thulium-yttria nanoparticles with cubic C-type structure, mean particle size (d_{50}) less than 90nm (Fig.1), and EPR response. The EPR spectra of powders exhibited two resonance peaks p_1 and p_2 recorded at 350 and 160mT, respectively (Fig.2).

Conclusions: The enhancement of the EPR response of yttria by the use of thulium as a dopant provide meaningful parameters to advance in the formation of new rare earth based materials for radiation dosimetry.

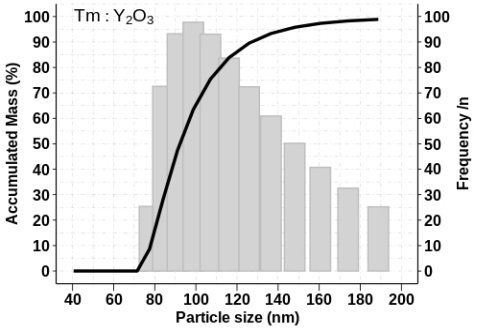

Figure 1. Mean particle size distribution by PCs of thulium-yttria nanoparticles formed by hydrothermal method, followed by annealing at 1100°C for 2h in air atmosphere.

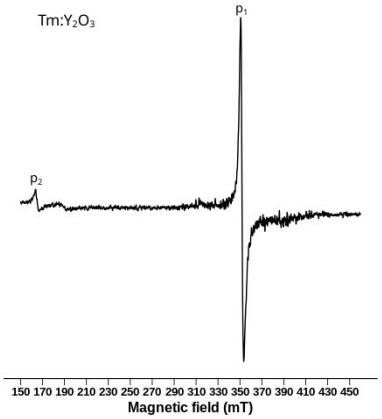

Figure 2. EPR spectra of thulium-yttria nanoparticles recorded under environmental atmosphere and temperature.

References:

1. S. C. Santos, O. Jr. Rodrigues and L.L. Campos, *Mater. Chem. Phys.* **259**, 1-7 (2021).