

Luminescence Investigation of BaWO₄:R³⁺ (R³⁺: Eu, Tb) nanophosphors prepared by a Soft Chemistry Method

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The BaWO₄ absorb efficiently high energy radiation (UV, X-rays). The doping of trivalent rare earth ions (R³⁺) into tungstate matrices, specially with Eu³⁺ and Tb³⁺, allows applications such as phosphors for fluorescent lamps, high definition displays, optical amplifiers and scintillators for detecting X and γ -rays in medical diagnostics [1-2]. This work reports the synthesis, characterization and photoluminescence study of BaWO₄ doped with Eu³⁺ and Tb³⁺ in concentrations of 0.1 to 10 mole-%. The phosphors were prepared by the coprecipitation method with aqueous solutions of Na₂WO₄, RCl₃ (R³⁺: Eu, Tb) and BaCl₂. The XRD measurements (Fig. 1; left) revealed the phase purity as well as crystalline tetragonal scheelite phase with *I*4₁/*a* (#88) space group where the Ba²⁺ occupies a site of S₄ symmetry. The Tb L_{III} edge X-ray Absorption Near Edge Structure (XANES) measurements of BaWO₄:Tb³⁺ showed Tb³⁺/Tb^{IV}, in calcined materials (Fig. 1; right).

The excitation spectra show broad bands assigned to overlapping O→W and O→Eu³⁺ ligand-to-metal charge transfer (LMCT) and narrow peaks assigned to the 4f-4f transitions of Eu³⁺ (Fig. 2; left) and 4f⁸→4f⁷5d¹ band and narrow peaks assigned to the 4f-4f transitions of Tb³⁺ (Fig. 2; right). The emission spectra are dominated by high intensity ⁵D₀→⁷F₂ hypersensitive transition for Eu and ⁵D₄→⁷F₅ for Tb. The experimental intensity parameters (Ω_2 and Ω_4) were determined for BaWO₄:Eu³⁺. The high value of Ω_2 is most influenced by small angular changes in the local geometry. The high quantum efficiencies suggest that these systems are promising phosphors.

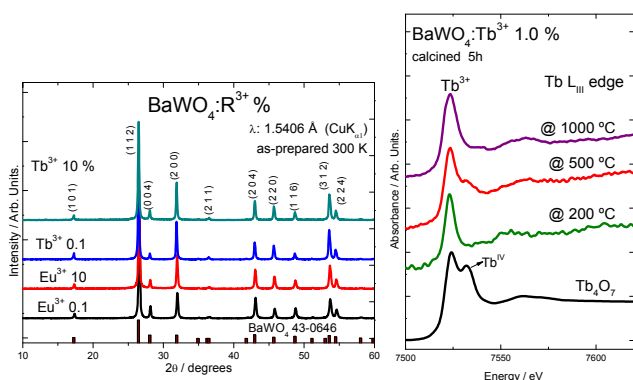


Fig. 1. XRD patterns (left) and Tb L_{III} XANES (right) of BaWO₄:R³⁺ (X %) powders.

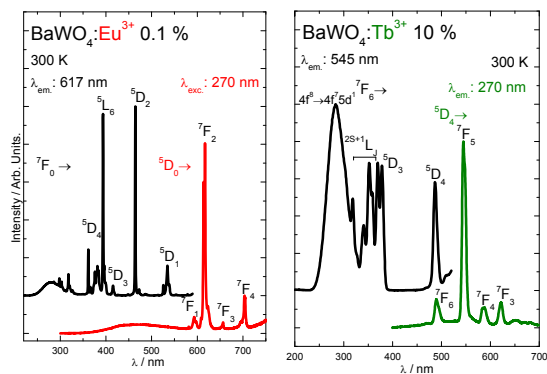


Fig. 2. Excitation and emission spectra of BaWO₄:R³⁺ (X %) Eu³⁺ (left) and Tb³⁺ (right), at room temperature.

Acknowledgments: CNPq, CAPES, FAPESP and inct-INAMI.

References:

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