Synthesis of pure and RE-doped $A(RE)(WO_4)_2$ nanocrystalline powders for photonic applications where A = Na, Li and RE = La, Gd, Yb, Nd

J. R. de Moraes[1], V.L. Mazzocchi[1], C. B. R. Parente[1], S. L. Baldochi[1*] and Z. S. Macedo[2]
[1]*Instituto de Pesquisas Energéticas e Nucleares, IPEN – CNEN/SP, São Paulo/SP, Brazil*
[2]*Universidade Federal de Sergipe - UFS, Aracajú/SE, Brazil*

The development of optoelectronic devices is strongly related to the investigation of more efficient photonic materials and also to the reduction of their production costs. Many works published in the last two decades have reported single-crystalline fibers to be materials of relatively low production costs when compared with bulk crystal [1]. On the other hand, the synthesis of nanocrystalline powders is of low cost if compared with bulk and crystal fiber growth methods because it can be prepared at relatively low temperatures. For that reason, there has been an increasing interest on the production and application of such materials in the last decade. Particularly, a new photonic device can be obtained from nanocrystalline powders: the random laser, where laser action is obtained in disordered structures such as powders and porous glasses [2]. At present, sol-gel method is the most employed technique to prepare nanocrystalline powders. A report of the synthesis of pure $K(RE)(WO_4)_2$ (RE = Yb and Gd) nanostructured compounds by this method can be found in literature [3]; so far this is the only work regarding the synthesis of nanocrystals of alkali rare earth double tungstates for photonic applications. These compounds are promising materials for optical applications due to their excellent luminescence properties, particularly as laser hosts, when doped with rare earth ions [4]. The goal of the present work was to synthesize nanocrystalline powders of pure and Nd and Yb-doped $A(RE)(WO_4)_2$ compounds, where A = Na and Li and RE = La and Gd, through the modified Pechini method for posterior optical studies. The materials were synthesized through two differing processes: a solid state reaction with chemical powders of analytical grade (A_2CO_3, RE_2O_3, WO_3); and through a modified Pechini method from analytical grade powder starting materials (A_2CO_3, RE_2O_3, $(NH_4)_{10}W_{12}O_{41}{\cdot}7H_2O$). XRD patterns of both synthesis methods were compared and cell parameters were determined by the Rietveld method using the GSAS software [5]. Control of the synthesis process was performed through XRD and DTA-TG measurements. Optical characterization is in progress.

Keywords: nanocrystals, double tungstates, rare earths, sol-gel method, photonic materials

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* Corresponding author: baldochi@ipen.br
Author address: Av. Prof. Lineu Prestes, 2242 – Cidade Universitária – CEP 05508-000 - São Paulo/SP - Brazil