Synthesis and characterization of nanocrystalline Yb:Lu$_2$O$_3$ by modified Pechini method

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Abstract

Lately the research on cubic sesquioxides RE$_2$O$_3$ as an excellent laser host materials has emerged rapidly. The Yb:Lu$_2$O$_3$ exhibit higher thermal conductivity and stronger Stark splitting than Yb:YAG.

The synthesis of the RE-doped nanocrystalline materials has been a major research interest in the last years due to expectations of enhanced optical properties[1]. Recently several methods to obtain RE$_2$O$_3$ nanocrystals were developed. Yb:Lu$_2$O$_3$ ceramics based on nanocrystalline technology was successfully lased at 1079nm achieving 0.95W as output power[2].

In the present study, the modified Pechini method[3] has been used an alternative to the conventional sol-gel because of several advantages such as low temperature process, low cost and simplicity. In this method, the chelates are formed between metals ions and an $\alpha$-hydroxycarboxylic acid. Later, a polyhydroxyl alcohol is added and heated to obtain a polymerization process.

Nanocrystalline Yb:Lu$_2$O$_3$ were synthesized by modified Pechini method. The differential thermal and thermogravimetric analysis were used to study the thermal evolution of the precursor powder. X-Ray powder diffraction studies indicated that the nanocrystals began to crystallize at 773K. The morphology and the size particle were determined by electronic microscopy. The spectroscopy of Yb:Lu$_2$O$_3$ nanocrystals was discussed.