Preparation of Yb-doped $LiLa(WO_4)_2$ single crystal fibers

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Disordered tetragonal (scheelite-like) alkali rare earth double tungstates, belonging to the family $ARE(WO_4)_2$ (where A = Li, Na, K and RE = La–Lu), are favorable hosts for developing tunable solid state lasers. Their variable crystalline field allows broader optical absorption and emission bands of the dopants compared to other oxide hosts. Such a property is due to the level of disordering that these hosts present since alkali and rare earth cations are distributed statistically in the lattice. In this work single crystal fibers growth and characterization of Yb^{3+}-doped double tungstate $LiLa(WO_4)_2$ (Yb:LLW) are reported. The optimization of the growth conditions were studied concerning the synthesis process of the starting material, defects formation, Yb-doping and crystallographic orientation. The starting materials were previously synthesized by the solid-state reaction method (in Pt crucibles), from raw reagents Li_2CO_3, La_2O_3, Yb_2O_3 and WO_3 (99.99%). The starting materials were characterized by X-ray diffraction (XRD) and Thermal analysis. The single fibers were grown by the micro-pulling down method and characterized by XRD, optical microscopy, scanning electron microscopy and optical spectroscopy. An important requirement for obtaining laser action on single crystal fibers is good optical quality. Transparent and without scattering centers single crystal fibers of Yb:LLW were successfully grown by optimization of the grown conditions. The obtained XRD data showed Yb:LLW fibers as single crystalline phase crystals and as expected the formation of the disordered structure of symmetry I41/a. The SEM results revealed constant fiber diameters with medium value of 1052±28 microns. The similarity between the seed crystal and the final single crystal fiber orientation was evaluated by the Laue method. The authors acknowledge CNPq (573916/2008-0 – INCT Photonics) for the financial support and Dr. Marcia Fantini from IFUSP for the Laue measurements.