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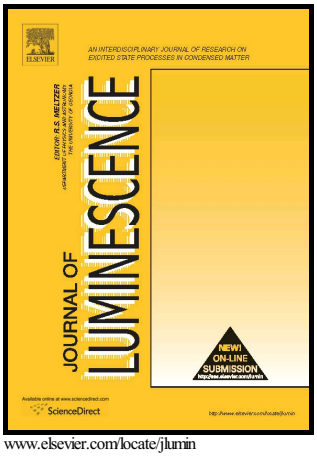

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Czochralski growth and spectral investigations of Er:GSAG laser crystal

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Abstract: Er^{3+} doped GSAG laser crystal with high optical quality was grown successfully by the Czochralski method for the first time. The structural parameters and the high crystalline quality of this crystal were determined. Judd-ofelt (J-O) parameterization scheme was applied to analyze the absorption spectra at room temperature. Accordingly, the lines strengths, oscillator strengths, transition probabilities, fluorescence branching ratios, and radiative lifetimes were calculated to characterize the laser properties of Er:GSAG crystal. Additionally, the fluorescence spectra and lifetimes of Er:GSAG crystal were measured and studied. The stimulated emission cross-section spectra and gain cross-section spectra were evaluated for $^4I_{13/2} \rightarrow {}^4I_{15/2}$ (1.5-1.6 μm) transitions which indicate high potential of 1 at.% Er:GSAG for laser emissions at 1567 and 1605 nm. Furthermore, the possibility of Er:GSAG crystal to realize the visible laser output pumped by the GaN LDs were initially studied and analyzed.

Keywords: Er: GSAG; Crystal growth; J-O theory; Laser; Fluorescence lifetime.

1 Introduction

Er^{3+} is a well-known active ion for solid-state lasers due to its emissions in the visible (at 550nm and 670nm) and infrared (at 1.5-1.6μm and 2.7μm) wavelengths. With the development of solid-state lasers based on Er^{3+}-doped materials, visible and infrared lasers have initiated many new researches. Laser at 550 and 670nm corresponding to $^4S_{3/2} \rightarrow {}^4I_{15/2}$ and $^4F_{9/2} \rightarrow {}^4I_{15/2}$ transitions attract much more attentions because of the search for all-solid compact laser devices operating in the

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