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Dual-wavelength laser of heavily Yb³⁺-doped NaGd(WO₄)₂ crystals

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Abstract

NaGd(WO₄)₂ crystals with 10 at%, 15 at%, 20 at% and 30 at% Yb³⁺-doped concentrations have been grown by the Czochralski method. The spectroscopic properties of Yb³⁺: NaGd(WO₄)₂ with different Yb³⁺ concentrations have been studied detailed in this paper. We found that the emission cross sections and the lifetime increased with the increase of Yb³⁺ concentration. However, by comparing their laser output power, 10 at% Yb³⁺: NaGd(WO₄) is more appropriate for laser operation. Finally, the orthogonally polarized dual-wavelength laser operation of 10% Yb³⁺: NaGd(WO₄)₂ crystal was realized. The maximum output power of the dual-wavelength laser is 1.86 W with T= 3.0 %, which is calculated with the 1000 Hz, 0.3 duty ratio pulses. The dual-polarization and dual-wavelength laser oscillated at 1046 nm in σ polarization and 1053 nm in π polarization. For T= 2, 5, 7 %, the gaps of dual-wavelength are all about 5 nm.

Keywords: Yb³⁺: NaGd(WO₄)₂; Czochralski Method; Spectroscopic Properties; Polarized Dual-wavelength

1. Introduction

Yb³⁺ ion has attracted enormous attention for a few years in the field of laser materials due to its excellent properties. The simple two-state electronic structure (²F_{7/2} and ²F_{5/2}) of Yb³⁺ ion can reduce the excited state absorption and concentration quenching. In addition, the Yb³⁺-doped crystals exhibit

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