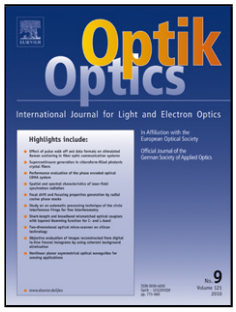

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Optical parametric oscillator based on LBO crystal at degeneracy

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Abstract

A pulsed doubly resonant LiB_3O_5 (LBO) optical parametric oscillator design (OPO) at degenerate case pumped with a frequency doubled Q-switched Nd: YAG laser was built-up. The LBO crystal was designed for collinear phasematching. The threshold power density at degenerate case was 141.4MW/cm^2. The linewidth of the amplified output at degenerate case due to both signal and idler beams was found to be 10 ns. The effect of crystal rotation in the horizontal plane on the output energy per pulse of both signal and idler were studied. The OPO maximum output energy per pulse at degeneracy was assessed, it was 54 μJ for 20 mJ pumping energy at optimum phasematching angle $\theta_{pm} = 11.2^{\circ}$. The theoretical calculations that describe the output energy per pulse at different input pumping energy for the LBO-OPO linear cavity are numerically simulated and compared with the experimental results as well as conversion efficiency calculations at optimum phasematching.

Key words: LBO crystal; nonlinear crystal; optical parametric oscillator; OPO; collinear phasematching; down conversion energy.

1. Introduction

OPO systems are considered as powerful tunable laser sources so, several pulsed OPO's were demonstrated that used LBO crystal as the nonlinear crystal with high coherence and conversion efficiency and used pump sources as frequency doubled Nd: YAG laser[1], frequency tripled Nd: YAG laser[2], frequency quadrupled Nd: YAG laser[3], frequency doubled all-solid state Q-switched Nd: YLF[4], self-mode-locked Ti: sapphire laser[5], frequency doubled diode pumped mode-locked Nd: YVO_4 laser[6], excimer laser[7]. Tunable laser pulses in the infrared are interest for various applications in modern