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Investigation of factors affecting on the efficiency of second harmonic generation of the continuous-wave focused Gaussian beam of 1064 nm inside the periodically poled nonlinear crystals

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Abstract

In this research, the nonlinear propagation equations of the fundamental and second harmonic waves coupled to the heat equation are solved for a focused Gaussian beam inside two quasi-phase matched periodically poled MgO: PPLN and MgO: PPLT crystals; the optimum focal length and radius of the continuous-wave laser beam with the wavelength of 1064 nm and with Gaussian profile, as well as the optimal phase-mismatched parameter, are calculated and the dependence of the second harmonic efficiency on these parameters is shown. Also, the effects of the thermal distribution inside the crystal on the second harmonic generation efficiency are investigated, showing how the thermal distribution reduces the second harmonic efficiency; accordingly, the optimal crystal length for different incident powers is determined, showing that the lower crystal lengths should be selected for the higher incident powers. Finally, a comparison between the second harmonic efficiencies in the two crystals of MgO: PPLN and MgO: PPLT is made considering the thermal distribution for different incident powers; it is shown that for the incident power than the lower/ higher 21 watts, the crystal of MgO: PPLN / MgO: PPLT is more suitable and more efficient for the second harmonic generation.

Keywords: second harmonic generation, quasi phase matching, thermal distribution, periodically poled crystal, phase mismatch

For full article, refer to the Persian section

