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Optimization of some input parameters of a pulsed TEA CO₂ laser based on the generalized Landau-Teller equations

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Abstract

In this paper, the six-temperature kinetic model based on the generalized Landau-Teller equations is used to optimize a pulsed TEA CO₂ laser input parameters. This model was numerically solved by regarding the equations governing the electrical discharge media to obtain the density of electrons. In this study, for the first time, the dissociation of the CO₂ molecule and the production of CO as a time evaluation equation were dynamically coupled with other rate equations. The time behavior of the discharge current and voltage and laser output pulse power was simulated for CO₂:N₂:He gases mixture ratio, which are 1:1:3, respectively. Also, the optimum values of the input parameters including the reflectivity of the output mirror, the capacity of the pre-ionization capacitor, and the capacity and charging voltage of the storage capacitor were calculated to obtain the maximum output peak power. The obtained results are significant in the optimum design of TEA CO₂ oscillators.

Keywords: TEA CO₂ laser, gas ratio, CO₂ dissociation, six-temperature kinetic model, the Landau-Teller equations

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