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激光技术

LD端面泵浦薄片激光器的温度和热应力分布研究

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摘要：

为了分析薄片激光器的热效应，建立了LD端面泵浦薄片激光介质的数值模型。考虑到介质与空气的对流换热和介质材料的热力学参数随温度的变化，根据经典热传导方程和热弹性方程，运用有限单元法，得出了介质内温度和热应力的时空分布，分析了温度和热应力与泵浦功率、换热系数和时间的变化规律。模拟结果表明：热破坏主要为前表面光斑外侧的拉伸破裂；温度和应力的上升时间和热恢复时间随泵浦功率的变化不是很明显，随换热系数的增大而减小，但随着换热系数的增加，温度和应力的变化越来越小。

关键词： 薄片激光器 激光二极管(LD)端面泵浦 有限单元法 温度分布 热应力分布

Temperature and thermal stress distribution in thin disk laser end-pumped by LD

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Abstract:

For analyzing the thermal effect in thin disk laser, a numerical model of the thin disk laser medium end-pumped by LD was set up. Considering the influence of the temperature correlation of the thermodynamic parameters of the material and the heat transfer coefficient between air and medium, based on the thermal conduction equations and the thermal-elastic equations, the transient distributions of temperature and thermal stress in the medium were calculated by a finite element analysis method. The influence disciplinarian of the pump power and heat transfer coefficient and time on transient distributions of temperature and thermal stress in the medium were analyzed. Simulation results indicate that thermal extendable damage appears on the edge of beam of the anterior surface. The change of the rise time and renew time of the temperature and stress is not obvious as the pumping power increase. With the increase of the heat transfer coefficient, the temperature and stress and rise time and renew time decrease, but this rate of the change decreases to zero slowly. The theoretical results agree with interrelated experiment results and it provides a theoretical reference for the design of solid laser pumped by LD and experimental analysis.

Keywords: thin disk laser laser-diode (LD) end-pumping finite element method temperature distribution thermal stress distribution

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