

论文

LD泵浦掺铥(Tm³⁺)光纤激光器的数值分析

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摘要:

首先从掺铥光纤激光器的速率方程和光传输方程出发, 建立数学模型, 通过Matlab软件进行数值计算, 分析了泵浦光和激光沿光纤的分布以及各能级离子数的变化。在不同掺杂浓度下, 研究了小信号增益与入纤泵浦功率的关系以及泵浦光和激光功率与增益介质长度的关系。在不同泵浦功率下, 研究了输出功率与输出耦合镜反射率的关系。进一步对不同泵浦吸收系数, 研究了斜率效率和泵浦阈值与光纤长度的关系。分析结果表明: 存在最佳光纤长度和最佳耦合输出透过率, 使得激光输出功率达到最佳值。

关键词: 掺铥光纤激光器 速率方程 Matlab软件 数值分析

Numerical analysis of Tm³⁺-doped silica fiber lasers pumped by LD

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Abstract:

The mathematic mode based on rate equations and power propagation equations of Tm³⁺-doped silica fiber lasers is established and calculated by Matlab software. Output mirror reflectivities of the laser power, optimization of the fiber length and dopant concentrations may significantly improve the slope efficiency of fiber lasers. The evolution of small signal gain coefficient without upconversion and with upconversion is showed for different pump powers. The distributions of the pump light and laser along the fiber and the ion concentrations at every energy level are analyzed. The relation between the small signal gain and incident pumping power, as well as the relation between the pumping light and laser powers with gain medium length are investigated at different dopant concentrations. The relation between output powers and different output coupling mirror reflectivities is studied at different pumping powers. And the further research is also carried out on the relation of slope efficiency and pumping threshold versus fiber lengths for different pump absorption coefficient. The results indicate that there are optimal fiber length and optimal coupling output transmissivity for the maximum of laser output power.

Keywords: Tm³⁺-doped fiber laser rate equation Matlab software numerical analysis

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