光子学报 2012, 41(10) 1145-1148 DOI: 10.3788/gzxb20124110.1145 ISSN: 1004-4213 CN: 61-1235/O4

论文

LD端面泵浦Cr^4:YAG被动调Q激光器输出特性研究

杨晓冬[1], 侯新华[2]

1. 嘉应学院, 物理与光信息科技学院, 广东 梅州 514015;
2. 嘉应学院, 应学院数学学院, 广东 梅州 514015

摘要:

对激光二极管端面泵浦Cr^{4+}:YAG被动调QNd:YAG激光器输出特性进行了实验研究.实验研究发现,激光器输出功率及脉冲重复频率随谐振腔长度增大而增大.为解释这一实验现象,测量了泵浦光斑在激光晶体内尺寸,同时计算了激光晶体及Cr^{4+}:YAG晶体内的基模激光光斑半径随谐振腔长度变化.分析结果表明:激光晶体内泵浦光斑尺寸远小于激光晶体内基模光斑半径,腔模间交叠效率较低;当腔长增加时,激光晶体内的基模激光光斑减小,腔模间交叠效率增加,从而导致输出功率及脉冲重复频率随腔长增加而增加;另外,Cr^{4+}:YAG晶体内光斑半径也随谐振腔长度减小.引起Cr^{4+}:YAG晶体漂白时间缩短.导致脉冲重复频率随腔长增加而增加.

关键词: Cr^{4+}: YAG 交叠效率 被动调Q 脉冲重复频率

Investigation on the Output Characteristics of LD End-pumped Cr^{4+}:YAG Passively Q-switched Laser

YANG Xiao-dong[1], HOU Xin-hua[2]

1. School of Physics and Optical Information Technology, Meizhou, Guangdong 514015, China;
2. School of Math, Jiaying University, Meizhou, Guangdong 514015, China

Abstract:

The output characteristics of a LD end-pumped Cr^{4+}:YAG passively Q-switched Nd:YAG laser are experimentally investigated. The experiment shows that the output power and pulse repetition rate increases with the cavity length. To explain above experiment phenomenon, the pump laser beam sizes in the Nd:YAG crystal are measured, and the fundamental mode laser beam radius in the Nd:YAG crystal and the Cr^{4+}:YAG crystal are calculated. The investigations show that two reasons result in the output power and pulse repetition rate increasing with the cavity length. Firstly, the pump beam size in the Nd:YAG crystal is far less than the fundamental mode laser beam in the Nd:YAG crystal. The overlap efficient between pump and the laser beam is low. With the cavity length increasing, the fundamental mode laser beam in the Nd:YAG crystal decreases, which results in the overlap efficient between pump beam and the laser beam increasing. So the output power and the pulse repetition rate increase with the cavity length increasing. Secondly, the laser beam radius in the Cr^{4+}:YAG crystal also decreases with the cavity length, which shorten the time interval between two bleaching of the Cr^{4+}:YAG crystal. So the pulse repetition rate increases with the cavity length.

Keywords: Cr^{4+}: YAG Overlap efficient Passively Q-switched Pulse repetition rate

收稿日期 2012-04-18 修回日期 2012-06-10 网络版发布日期

DOI: 10.3788/gzxb20124110.1145

基金项目:

广东省自然科学基金(No.8451401501000668)和广东省实验室管理委员会项目资助

通讯作者:

作者简介:

参考文献:

[1] GOLDBERG L, MCINOSH C, COLE B. VCSEL end-pumped passively Q-switched Nd:YAG laser with adjustable pulse energy[J]. *Optics Express*, 2011, 19(5): 4261-4267.
[2] XU Shi-xiang, LI Wen-xue, HAO Qiang, *et al*.Efficient laser-diode end-pumped passively Q-switched mode-locked Yb:LYSO laser based on SESAM[J]. *Chinese Optics Letters*, 2008, 25(2): 548-551.
[3] NIU Rong-lian, LIU Cheng-cheng, LIU Ying, *et al*.Thermal lensing effect of diode-pumped Yb:$KGd(WO_4)_2$ based on convective heat-transfer on the side surface[J]. *Acta Photonica Sinica*, 2011, 40(1): 79-82. 牛荣莲, 刘成成,刘莹,等.基于侧面热对流的LD泵浦Yb:$BKGd(WO_4)_2$热透镜效应研究[J]. 光子学报, 2011, 40(1): 79-82.
[4] LUAN Fei, FENG Su-ya, CHEN Li, *et al*.Effect of upconversion on Er^{3+}-Yb^{3+} Co-doped phosphate glass passively Q-switched laser[J].*Acta Photonica Sinica*, 2008, 31(sup1): 53-56. 栾飞, 冯素雅, 陈力等, 上转换效应对Er^{3+}-Yb^{3+}共掺磷酸盐玻璃被动调Q激光输出的影响[J]. 光子学报, 2008, 31(sup1): 53-56.
[5] LIU Shao-long, ZHU Shao-lan, ZHAO Wei, *et al*.Investigation on repetition rate stability of Cr^{4+}:YAG passively Q-switched microchip laser[J]. *Acta Photonica Sinica*,2008, 37(9): 1717-1721. 刘少龙, 朱少岚, 赵卫, 等. Cr^{4+}:YAG被动调Q微晶片激光器重复频率稳定性研究[J]. 光子学报, 2008, 37(9): 1717-1721.
[6] YANG X Q, WANG H X, HE J L, *et al*.A compact passively$Q$ switched intra-cavity frequency doubled Nd:YAG/Cr^{4+}:YAG composite crystal green laser[J]. *Laser Physics*,2009, 19(10): 1964-1968.
[7] CHEN Zhu-chong, RUAN Shuang-shen, GUO Chun-yu, *et al*.Passively Mode-locked Erbium doped fiber ring laser[J].

Acta Photonica Sinica,2012, 41(3): 267-270. 陈祖聪, 阮双琛, 郭春雨, 等, 环形腔被动锁模掺饵光纤激光器[J]. 光子学报, 2012, 41(3): 267-270.

[8] MAO Xiao-jie, MI Guo-jiang, DENG Min-fa,*et al*. 200 kHz, 8 ns passively *Q*-switched high peak power Nd:YAG laser[J]. *Chinese Journal of Lasers*,2011, 37(11): 20-23. 毛小杰, 秘国江, 邓明发, 等. 200 kHz, 8 ns被动*调Q*高峰值功率Nd:YAG激光器[J]. 中国激光, 2011, 37(11): 20-23.

[9] YANG Yu-bing, CAI De-fang, WANG Shi-yu,*et al*. Experimental study on output characteristics of passively *Q*-switched laser[J].*Journal of Applied Optics*,2006, 27(1): 46-50. 杨昱冰, 蔡德芳, 王石语, 等. 被动调*Q*激光器输出特性的实验研究[J].应用光学, 2006, 27(1): 46-50.

[10] 周炳琨, 高以智. 激光原理[M]. 6版. 北京:国防工业出版社, 2009: 38-88.

[11] KOECHNER W. Solid state laser engineering[M]. SUN Wen, JIANG Zhe-wen, CHENG Guo-xiang, transl. 2nd ed. Beijing: Science Press, 2003: 88-94. 克希耐尔 W. 固体激光工程[M]. 孙文, 江泽文, 程国祥,译. 2版. 北京:科学出版社, 2003: 88-94.

[12] 郭家喜. 连续LD泵浦调*Q*技术研究. 长春: 长春理工大学, 2010: 36-37.

本刊中的类似文章

1．吕岩;于延宁;万重怡;刘世明;谭荣清;周锦文;吴谨;杨华.印刷电路板预电离3.6 kW TEA CO2激光器[J]. 光子学报, 2005,34(7): 965-970

2．臧博,郭睿,唐禹,邢孟道.逆合成孔径成像激光雷达实包络成像算法[J]. 光子学报, 2010,39(12): 2152-2157

3．宋丽军, 裴为华, 宋晏蓉, 周国生.自锁模Cr^{4+}:YAG激光器的色散补偿研究[J]. 光子学报, 2003,32(10): 1163-1165

4．吴逢铁, 张文珍.抗共振环稳定被动调*Q* 激光的作用[J]. 光子学报, 2001,30(7): 780-800

5．张行愚, 赵圣之, 王青圃.腔内光强空间分布对被动调*Q*激光器速率方程解的影响[J]. 光子学报, 1999,28(7): 651-653

文章评论 (请注意:本站实行文责自负, 请不要发表与学术无关的内容!评论内容不代表本站观点.)

反馈人		邮箱地址	
反馈标题		验证码	1558