双端泵浦宽带中红外光学谐振腔设计及其特性研究

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摘要：中红外光源一直是国内外研究的热点课题，在激光制导、红外遥感和生物医药等军用民需领域有着广泛的应用。本论文主要研究如何利用双端泵浦实现宽带中红外激光的输出。基于准相位匹配技术，通过双端泵浦三镜组合结构的谐振腔的设计，选择合适的非线性晶体的周期性极化反转，实现信号光和闲频光的相干输出。本论文采用 1064nm 激光器为泵浦源，对双端泵浦光学参量振荡器的结构进行了优化，搭建光路实现了信号光和闲频光的输出。并研究了温度对信号光波长和输出功率的影响，实现带宽可调谐。实验测出当掺氧化镁周期极化铌酸锂晶体的极化周期为 31.5um 时，温度变化范围为 30-200℃，闲频光波长范围为 4182-4198nm。在 35℃时，信号光波长为 1315nm，闲频光波长为 4193nm，输出功率达可达 0.29mW。

关键词：中红外；光学参量振荡器；准相位匹配；双端泵浦

Research on design and output character of double-end-pumped broadband mid-infrared optical resonator

Abstract: Mid-infrared light source has been a hot research topic at home and abroad, and has a wide range of applications in the laser-guided infrared remote sensing and biomedical fields of munitions civil. This thesis studied how to use the double-end-pumped to produce broadband mid-infrared laser. Based on quasi-phase matching, through the design of double-end-pumped resonator composed of three mirrors, the appropriate periodically poled inversion of nonlinear crystal is selected, which realizes the coherent output of signal and idler light. By using the 1064nm laser as the pump source and optimizing the structure of double-end-pumped optical parametric oscillator, the output of signal and idler light can be realized. And the temperature effect on both the signal wavelength and output power was also analyzed, which realizes the broadly tunable bandwidth. The results show that the idler light wavelength ranges from 4182 to 4198nm when the polarization period of MgO-doped periodically poled lithium niobate is 31.5um and temperature changes in a range of 30-200℃. At 35℃, the signal light wavelength is 1315nm, the idler light wavelength is 4193nm and the output power is 0.29mW.

Key Words: mid-infrared; quasi-phase-matched; optical parametric oscillator; double-end pumped

教师点评：本设计主要研究双端泵浦宽带中红外光学谐振腔设计及其输出特性。利用 Matlab 软件模拟，优化设计双端泵浦宽带中红外光学谐振腔结构。利用双端泵浦结构和控温炉，在实验上得到带宽可调谐输出信号光和闲频光。本毕业设计具有一定创新性，工作量大，能在这么短时间内完成资料查阅、理论分析、实验设计、光路准直等任务，反映了该同学具有很强的自学能力以及实际动手能力。论文内容完整，结构安排合理，书写格式规范，是一篇优秀的毕业论文。