



器件制备及器件物理

一种基于布拉格反射波导的表面等离子体激光光源

陈泳屹^{1,2}, 秦莉¹, 佟存柱¹, 王立军¹, 宁永强¹, 刘云¹, 汪丽杰^{1,2}, 张金龙¹, 单肖楠¹

1. 发光学及应用国家重点实验室 中国科学院长春光学精密机械与物理研究所, 吉林 长春 130033;
2. 中国科学院大学, 北京 100049

PDF 下载

引用本文

摘要：设计了一种基于布拉格反射波导的新型表面等离子体激光光源。这种光源结构简单,便于集成,可以在室温电泵浦的条件下工作,同时可以输出约毫瓦量级的表面等离子体激光,相比于文献报道中纳米尺度的纳瓦级表面等离子体激光光源要高很多。该表面等离子体激光光源发射波长为808 nm,布拉格反射波导所提供的倾斜激光光线在我们设计的准Otto模型中可以直接耦合成为表面等离子体。

关键词：半导体激光 布拉格反射 表面等离子体

A Plasmonic Laser Source Based On Bragg Reflection Waveguide

CHEN Yong-yi^{1,2}, QI NLI¹, TONG Cun-zhu¹, WANG Li-jun¹, NING Yong-qiang¹, LIU Yun¹, WANG Li-jie^{1,2}, ZHANG Jin-long¹, SHAN Xiao-nan¹

1. State Key Laboratory of Luminescence and Applications, Changchun Institute of Optics, Fine Mechanics and Physics, Chinese Academy of Sciences, Changchun 130033, China;

2. University of Chinese Academy of Sciences, Beijing 100049, China

Abstract: We designed a new type of plasmonic laser source based on the Bragg reflection waveguide. This laser source is simple in structure and convenient for integration. It works under room temperature electrical pumping condition and outputs plasmonic laser with more than milliwatt power, which is much larger than those demonstrated plasmonic laser sources with power of nano-watt scale. The proposed laser works at 808 nm. The tilted light beam offered by Bragg reflection waveguide directly couples into surface plasmon polaritons in our quasi-Otto configuration.

Keywords: semiconductor lasers Bragg reflection waveguide plasmonics

收稿日期 2013-05-01 修回日期 2013-07-03 网络版发布日期

基金项目:

国家自然科学基金重点项目(61234004);国家自然科学基金面上项目(61176045);国家自然科学基金青年基金(61106068)资助项目

通讯作者: 秦莉, E-mail: qinl@ciomp.ac.cn

作者简介: 陈泳屹(1986-), 男, 吉林长春人, 主要从事表面等离子体和半导体激光器方面的研究。E-mail: cyy2283@126.com, Tel: (0431)86176335

作者Email: qinl@ciomp.ac.cn

参考文献:

[1] Oulton R F, Sorger V J, Genov D A, *et al.* A hybrid plasmonic waveguide for subwavelength confinement and long-range propagation [J]. *Nat. Photon.*, 2008, 2(8):495-500.

[2] Oulton R F, Sorger V J, Zentgraf T, *et al.* Plasmon lasers at deep subwavelength scale [J]. *Nature*, 2009, 461(7246):629-632 .

[3] Noginov M A, Zhu G, Belgrave A M, *et al.* Demonstration of a spaser-based nanolaser [J]. *Nature*, 2009, 460(7259):1110-1112 .

[4] Ma R M, Oulton R F, Sorger V J, *et al.* Room-temperature sub-diffraction-limited plasmon laser by total internal reflection [J]. *Nat. Mater.*, 2010, 10(2):110-113.

[5] Stipe B C, Strand T C, Poon C C, *et al.* Magnetic recording at 1.5 Pb m⁻² using an integrated plasmonic antenna [J]. *Nat. Photon.*, 2010, 4(7):484-488.

[6] Han J, Fan Y C, Zhang Z R. Propagation of surface plasmon polaritons in a ring resonator with PT-symmetry [J]. *Chin. J. Lumin.*(发光学报.2012, 33(8):901-904

[7] Yang Z L, Fang W, Yang Y Q. Two-photon-excited fluorescence enhancement caused by surface plasmon enhanced exciting light [J]. *Chin. J. Lumin.*(发光学报.2013, 34(2):240-244

[8] Zheng L, Zhao Y P. Identification of Pu'er teas with different fermentation time by surface-enhanced Raman scattering technology [J]. *Chin. J. Lumin.*(发光学报.2013, 34(2):230-234

[9] Anker J N, Hall W P, Lyandres O, *et al.* Biosensing with plasmonic nanosensors [J]. *Nat. Mater.*, 2008, 7(6):442-453.

本刊中的类似文章

1. 布拉格反射波导激光器的光谱特性[J]. 2013,34(9): 1227-1232

2. 基于ZEMAX高功率半导体激光器光纤耦合[J]. 2013,34(9): 1208-1212

3. 金属光栅的非对称透射现象研究[J]. 2013,34(8): 1040-1045

4. 聚合物波导型表面等离子体共振传感器的特性研究[J]. 2013,34(7): 948-951

5. 亚波长金属光栅结构的制备与矢量衍射理论[J]. 2013,34(7): 935-939

6. Au/Ag纳米颗粒的成像技术与应用[J]. 2013,34(6): 792-796

7. 高亮度布拉格反射波导激光器[J]. 2013,34(5): 787-791

8. 利用金属纳米颗粒改善有机光电器件性能[J]. 2013,34(5): 535-541

9. Al/ZnO:Al薄膜结构的荧光增强效应[J]. 2013,34(3): 356-360

10. 2 kW 半导体激光加工光源[J]. 2013,34(3): 334-339

11. 无损耗型及损耗型分布布拉格反射镜光学特性传输矩阵理论分析及优化[J]. 2013,34(2): 184-191

12. 基于光声光谱技术的1.5 μm波段 NH₃ 吸收测量与分析[J]. 2012,33(9): 1025-1028

13. 适用于金属薄板焊接的柔性光纤耦合半导体激光加工光源[J]. 2012,33(8): 895-900

14. 1.06 μm InGaAs/InGaAsP量子阱半导体激光器的温度特性[J]. 2012,(6): 647-650

15. 百瓦级高亮度光纤耦合半导体激光模块的研究[J]. 2012,(6): 651-659

16. 980 nm 半导体激光器腔面膜钝化新技术[J]. 2012,(5): 525-528

17. 光泵浦双反射带半导体激光器的热效应有限元分析[J]. 2012,33(3): 309-313

18. 百瓦级半导体激光器模块的风冷散热系统[J]. 2012,33(2): 187-191

19. 高亮度半导体激光阵列光纤耦合模块[J]. 2012,33(12): 1335-1341

20. 基于银纳米线的类熊猫型微结构光纤传感器的研究[J]. 2012,(10): 1120-1126

- [10] Dionne J A, Diest K, Sweatlock L, *et al.* Plasmostor: A metal-oxide-Si field effect plasmonic modulator [J]. *Nano Lett.*, 2009, 9(2):897-902 .
- [11] Zijlstra P, Chon J W M, Gu M. Five-dimensional optical recording mediated by surface plasmons in gold nanorods [J]. *Nature*, 2009, 459(7245): 410-413.
- [12] Otto A. New method for exciting non-radioactive surface plasma oscillations [J]. *Phys. Stat. Sol.*, 1968, 26: K99-K101.
- [13] Otto A. Excitation of nonradiative surface plasma waves in silver by the method of frustrated total reflection [J]. *Zeitschrift für Physik*, 1968, 216(4): 398-410.
- [14] Kretschmann E, Reather H. Radiative decay of nonradiative surface plasmon excited by light [J]. *Z. Naturf.*, 1968, 23A: 2135-2136 .
- [15] Maier S A. *Plasmonics: Fundamentals and Applications* [M]. United Kingdom: Springer, 2007: 21.
- [16] Taflove A, Hagness S C. *Computational Electrodynamics: The Finite-Difference Time-Domain Method* [M]. New York: Artech House, 2005.