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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

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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

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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
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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.

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[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.

[17] Coldren L A, Corzine S W. *Diode Lasers and Photonic Integrated Circuits* [M]. New York: John-Wiley, 1995.

[18] Manolatou C, Rana F. Nanoscale surface-emitting semiconductor plasmon lasers [J]. *SPIE,* 2008, 7033:70331P-1-12.

[19] Babic D I, Piprek J, Streubel K, *et al.* Design and analysis of double-fused 1.55-μm vertical-cavity Lasers [J]. *IEEE J. Quant. Elect.,* 1997, 33(8):1369-1383.

[20] Zhang Y, Ning Y Q, Zhang L, *et al.* Design and comparison of GaAs, GaAsP and InGaAlAs quantum-well active regions for 808-nm VCSELs [J]. *Opt. Exp.,* 2011, 19(13):12569-12581.

[21] Baliga A, Agahi F, Anderson N G, *et al.* Tensile strain and threshold currents in GaAsP-AlGaAs single-quantum-well lasers [J]. *IEEE J. Quant. Elect.,* 1996, 32(1):29-37.