

光纤传感和光通信

通信波段金属包覆波导传播特性研究

李继军;陈海燕

长江大学物理科学与技术学院, 湖北荆州434023

摘要:

采用等效折射率的方法,以金、银、铜作为金属材料,计算了入射波长为1550nm时,2种不同结构金属包覆波导的几何色散关系、场分布特征及损耗情况。采用金属为衬底的非对称包覆结构进行计算,结果表明TE模的特点与全介质波导的情况类似。采用双面金属对称包覆结构进行计算,计算表明TM0模由金属-介质界面处的表面模对称结合而成,其等效折射率不在导模的范围之中,TE模和TM1模等效折射率的范围大于全介质波导的情况,TM1模由金属-介质界面处的表面模反对称结合而成。

关键词: 金属波导 色散 热损耗

Propagation properties of metal clad waveguide at communication frequency

LI Ji-jun; CHEN Hai-yan

College of Physical Science and Technology, Yangtze University, Jingzhou 434023, China

Abstract:

Dispersion properties, field distribution and propagation loss of symmetric and asymmetric metal clad waveguide at 1500nm were analyzed with effective index method. Simulation was given for Au, Ag and Cu cladding. In asymmetric clad guide simulation, properties of TE modes are the same as those of dielectric waveguide, TM0 mode is the surface mode at metal-dielectric interface with no cut-off. In symmetric clad guide simulation, TM0 mode is even mode which is coupling between surface modes at two metal-dielectric interface, and its effective index is beyond the index range of guide modes. The range of the effective index of TE mode and TM1 mode is larger than guide modes and TM1 mode is odd mode which is coupling between surface modes at two metal-dielectric interface.

Keywords: metal waveguide dispersion thermal loss

收稿日期 修回日期 网络版发布日期

DOI:

基金项目:

通讯作者: 李继军(1972-),男,湖北荆州人,讲师,硕士,主要从事表面等离子光学研究。

作者简介:

作者Email: jjli@yangtzeu.edu.cn

参考文献:

[1] RONALD W W, MARWOOD N E. Electro-optics handbook [M]. 2nd ed. New York: McGraw-Hill, Inc., 2000.

[2] VERSLEGERS L, CATRYSSSE P B, YU Zong-fu, et al. Planar lenses based on nanoscale slit arrays in a metallic film [J]. Nano Lett., 2009, 9(1): 235-238.

[3] OULTON R, SORGER V, GENOV D A, et al. A hybrid plasmonic waveguide for subwavelength confinement and long range propagation [J]. Nature Photonics. 2008, 2: 496-500.

[4] MAIERA S A, ATWATER H A. Plasmonics: localization and guiding of electromagnetic energy in metal/dielectric structures [J]. J. Appl. Phys., 2005, 98(1): 011101-1-011101-10.

[5] BUCKLEY R, BERINI P. Long-range substantially nonradiative metallo-dielectric waveguide [J]. Optics Letters, 2009, 34: 223-225.

[6] BARNES W L, DEREUX A, EBBESEN T W. Surface plasmon subwavelength optics [J]. Nature, 2003, 424: 824-830.

[7] KAMINOW I P, MAMMEL W L, WEBER H P. Metal-clad optical waveguides: analytical and experimental study [J]. Appl. Opt., 1974, 13(2): 396-405.

扩展功能

本文信息

- ▶ Supporting info
- ▶ PDF(1709KB)
- ▶ [HTML全文]
- ▶ 参考文献[PDF]
- ▶ 参考文献

服务与反馈

- ▶ 把本文推荐给朋友
- ▶ 加入我的书架
- ▶ 加入引用管理器
- ▶ 引用本文
- ▶ Email Alert
- ▶ 文章反馈
- ▶ 浏览反馈信息

本文关键词相关文章

- ▶ 金属波导
- ▶ 色散
- ▶ 热损耗

本文作者相关文章

- ▶ 李继军
- ▶ 陈海燕

PubMed

- ▶ Article by Li, J. J.
- ▶ Article by Chen, H. Y.

[8] 周骏, 曹庄琪, 程莫礼, 等. 金属包覆有机聚合物色散特性的实验研究 [J]. 光学学报, 1996, 16(9): 1317-1321.

ZHOU Jun, CAO Zhuang-qi, CHEN Ying-li, et al. Dispersion characteristics of metal clad organic polymer waveguide [J]. Acta Optics Sinica, 1996, 16(9): 1317-1321. (in Chinese with an English abstract)

[9] CHIN L C. Foundations for guided-wave optics [M]. New Jersey: Wiley-Interscience, 2006.

[10] WILLIAM H P, SAUL A T, WILLIAM T V, et al. Numerical Recipes in Fortran 90 [M]. 2nd ed. England: Cambridge University Press, 1996.

[11] PALIK E D. Handbooks of optical constants of solids [M]. San Diego: Academic Press, 1985.

本刊中的类似文章

1. 孟小波; 周骏; 高永锋; 任春阳. 光孤子对的振幅比与相位差对传输的影响[J]. 应用光学, 2009, 30(2): 263-267
2. 刘汉臣; 王秋萍; 张崇辉; 王安祥; 蒋学芳. 光栅扫描光谱仪参数的研究[J]. 应用光学, 2008, 29(4): 595-598
3. 刘毓; 方强; 靳鑫玉.

光纤通信中有色散影响的受激喇曼散射信道特性研究

[J]. 应用光学, 2007, 28(5): 608-613

4. 李红霞; 吴福全; 范吉阳. 冰洲石晶体色散方程解析研究及折射率温度系数表达式[J]. 应用光学, 2004, 25(5): 7-10

5. 王志斌; 李志全; 闫利娟. 偏振模色散影响下飞秒孤子的传输特性研究[J]. 应用光学, 2006, 27(6): 571-575

6. 王宝珠; 赵生禄; 陈炜; 邓宏林. 宽温度范围光纤传输性能温度适应性试验与评价[J]. 应用光学, 2006, 27(6): 588-593

7. 李启成. 光子晶体光纤的原理、结构、制作及潜在应用[J]. 应用光学, 2005, 26(6): 49-52

8. 葛祥友; 李平; 王效杰; 陈晓寒; 刘琳. 新型高双折射及色散平坦光子晶体光纤研究[J]. 应用光学, 2006, 27(4): 332-335

9. 杨晓萍; 王云才; 周希坚. 色散补偿和色散位移光纤实现光脉冲压缩[J]. 应用光学, 2006, 27(3): 232-234

10. 陈志晓; 武风波. 双轴晶体中平面波解在主轴坐标系下的表达[J]. 应用光学, 2009, 30(1): 158-161

11. 谢军华; 秦子雄; 曾庆科; 欧启标; 黄富; 周恒超. 用粒子群优化算法设计光纤布拉格光栅[J]. 应用光学, 2009, 30(4): 674-677

12. 李海兰; 张兴娇; 叶志清. 一种FBG重构算法及其应用[J]. 应用光学, 2010, 31(3): 418-422