



发光学报 2013, 34(6) 803-806 ISSN: 1000-7032 CN: 22-1116/O4

发光学应用及交叉前沿

太赫兹表面等离子激元在轴向均匀三层波导系统中的单向传输

韩缙^{1,2}, 樊元成², 张正仁², 金亮², 杨勇¹, 尹兆益¹, 周大成¹

1. 昆明理工大学材料科学与工程学院, 云南 昆明 650093;
2. 同济大学物理系, 上海 200092

PDF 下载

引用本文

摘要：理论和数值研究了轴向均匀的三层波导系统中太赫兹表面等离子激元的单向传输行为,三层系统由厚度为 d 的高介电常数介质层插入到低介电常数介质层和磁光半导体层中间组成。计算结果表明,在外加磁场的作用下,系统存在单向传输的频段。通过金属微米粒子的耦合及调节磁光半导体区域的磁场方向,可以有效控制表面等离子体激元在三端口系统中的传播。

关键词：单向传输 表面等离子激元 太赫兹

One-way Action of Terahertz Surface Plasmons in A Three Layers Axially Uniform Waveguide System

HAN Jin^{1,2}, FAN Yuan-cheng², ZHANG Zheng-ren², JIN Liang², YANG Yong¹, YIN Zhao-yi¹, ZHOU Da-cheng¹

1. College of Materials Science and Engineering, Kunming University of Science and Technology, Kunming 650093, China;
2. Department of Physics, Tongji University, Shanghai 200092, China

Abstract: We theoretically and numerically demonstrate one-way action of terahertz surface plasmon polaritons in an axially uniform waveguide system that comprises of ϵ_{high} -dielectric layer of thickness d inset between a ϵ_{low} -dielectric layer and magneto-optical semiconductor. The calculation shows that the system exist one-way action under an external magnetic field. The propagation of surface plasmon polaritons in a three ports system can be controlled by the coupling of micron size metal particles and the external magnetic fields.

Keywords: one-way action surface plasmon polaritons terahertz

收稿日期 2013-04-02 修回日期 2013-05-02 网络版发布日期

基金项目:

国家自然科学基金(10974144)资助项目

通讯作者: 韩缙

作者简介: 韩缙(1982-),男,云南曲靖人,主要从事表面等离子激元光学研究。E-mail: jaakaa@163.com

作者Email: jaakaa@163.com

参考文献:

- [1] Raether H. Surface Plasmons [M]. Berlin: Springer-Verlag, 1988.
- [2] Ritchie R H. Plasma losses by fast electrons in thin films [J].Phys. Rev..1957, 106(5):874-881 [crossref](#)
- [3] Ebbesen T W, Lezec H J, Ghaemi H F, et al. Extraordinary optical transmission through sub-wavelength hole arrays [J].Nature.1998, 391(6668):667-669 [crossref](#)
- [4] Yin L, Vlasko-Vlasov V K, Pearson J, et al. Subwavelength focusing and guiding of surface plasmons [J].Nano Lett..2005, 5(7): 1399-1402 [crossref](#)
- [5] Minovich A, Klein A E, Janunts N, et al. Generation and near-field imaging of airy surface plasmons [J].Phys. Rev.Lett..2011, 107(11):116802-1 [crossref](#)
- [6] Li L, Li T, Wang S M, et al. Plasmonic airy beam generated by in-plane diffraction [J].Phys. Rev. Lett..2011,107(12):126804-1 [crossref](#)
- [7] Zheludev N I, Prosvirnin S L, Papasimakis N, et al. Lasing spaser [J].Nat. Photon..2008, 2(6): 351-354 [crossref](#)
- [8] Liu L, Yang Q Y, Wang D X, et al. Dielectric barrier discharge deposition of porous silicon based nanoparticle films: Theoptical emission spectrum and fourier transform infrared spectrum [J]. Chin. J. Lumin. (发光学报), 2010, 31(6):904-907 (in Chinese).
- [9] Ao X, Lin Z, Chan C T. One-way edge mode in a magneto-optical honeycomb photonic crystal [J].Phys. Rev. B.2009,80(3):033105-1 [crossref](#)
- [10] Yu Z, Veronis G, Wang Z, et al. One-way electromagnetic waveguide formed at the interface between a plasmonic metalunder a static magnetic field and a photonic crystal [J].Phys. Rev. Lett..2008, 100(2):023902-1 [crossref](#)

本刊中的类似文章

1. 激发光的表面等离子激元增强效应导致的双光子荧光增强[J]. 2013,34(2): 240-244
2. THz波段光子晶体带隙影响因素研究[J]. 2012,33(8): 883-887
3. 金纳米颗粒等离子激元对不同形貌氧化锌薄膜发光性能的调控[J]. 2012,33(12): 1299-1303
4. 太赫兹波段三角晶格二维光子晶体的传输特性[J]. 2009,30(1): 35-39
5. 表面等离子激元对氮化硅薄膜中 Tb^{3+} 离子荧光寿命的影响[J]. 2008,29(4): 684-688
6. Tunable photoluminescence of ZnO films by the coating of Au nanoparticles [J]. (): 0-0

- [11] Khurgin J B. Optical isolating action in surface plasmon polaritons [J]. Appl. Phys. Lett..2006, 89 (25):51115-1 [crossref](#)
- [12] Wang Z, Chong Y, Joannopoulos J D, et al. Observation of unidirectional backscattering-immune topological electromagnetic states [J]. Nature. 2009, 461(7265): 772-775 [crossref](#)
- [13] Poo Y, Wu R X, Lin Z, et al. Experimental realization of self-guiding unidirectional electromagnetic edge states [J]. Phys. Rev. Lett..2011, 106(9):093903-1 [crossref](#)
- [14] Karalis A, Lidorikis E, Ibanescu M, et al. Surface-plasmon-assisted guiding of broadband slow and subwavelength light in air [J]. Phys. Rev. Lett..2005, 95(6):063901-1 [crossref](#)
- [15] Stockman M I. Slow propagation, anomalous absorption, and total external reflection of surface plasmon polaritons in nano-layer systems [J]. Nano Lett..2006, 6(11):2604-2608 [crossref](#)
- [16] Hu B, Wang Q J, Zhang Y. Broadly tunable one-way terahertz plasmonic waveguide based on nonreciprocal surface magnetoplasmons [J]. Opt. Lett..2012, 37(11):1895-1897 [crossref](#)
- [17] Manolatou C, Johnson S G, Fan S, et al. High-density integrated optics [J]. J. Lightwave Technol..1999, 17 (9):1682-1692 [crossref](#)
- [18] Maier S A, Brongersma M L, Kik P G, et al. Observation of near-field coupling in metal nanoparticle chains using far-field polarization spectroscopy [J]. Phys. Rev. B.2002, 65(19):193408-1 [crossref](#)