论文

晶体材料电光系数和压电系数的同时测量

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摘要：

利用双面金属包覆波导结构激发的高阶导模是导波层折射率的灵敏函数这一特性提出了一种测量非线性材料电光系数和压电系数的新方法. 该方法利用反射率曲线在不同电压下的移动参量可以直接计算出被测样品的电光系数和压电系数. 理论与实验研究表明, 该方法具有结构紧凑、插入损耗小、整个装置无运动部件、可靠性能高等诸多优点. 预计这一研究在应用压电效应和电光效应制备光电子器件的诸多领域中有极其广泛的应用前景.

关键词： 衰减全反射　镁银酸铅-钛酸铅　压电系数　电光系数

Simultaneous Measurement of Piezoelectric and Electro-optical Coefficients of Crystal Material Utilizing Ultrahigh Modes

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Abstract:

A novel method for simultaneous measuring piezoelectric coefficient and electro-optical coefficients of crystal material is proposed by utilizing the ultrahigh modes excitation from a symmetrical metal-cladding optical waveguide. The method can be directly used to calculate the electro-optic coefficient and piezoelectric coefficient by shift of the reflectance curves at different voltages. The theoretics and experiment results all indicate that this method has an excellent performance, such as high compact, low insert loss, no moving parts, high reliability and so on, which promises an application prospect in optical devices in electro-optic coefficient and piezoelectric coefficient.

Keywords: Attenuated total reflection(ATR)　PMN-PT　Piezoelectric coefficient　Electro-optical coefficient

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参考文献：

[1] KUITIAR P, PRAKASHB C, THAKUR O P, et al. Dielectric ferroelectric and pyroelectric properties of PMNT ceramics

[J]. Physica B: Condensed Matter, 2006, 371(2): 313-316.

[2] LAPPALAINEN J, HILTUNEN J, LANTTO V. Characterization of optical properties of nanocrystalline doped PZT thin films

[J]. Journal of the European Ceramic Society, 2005, 25(12): 2273-2276.

[3] ZHANG R, JIANG B, CAO W W. Elastic, piezoelectric, and dielectric properties of multidomain 0.67Pb(Mg1/3Nb2/3)O-3-0.33PbTiO(3) single crystals
[J]. Journal of Applied Physics, 2001, 90(7): 3471-3475.

[4] NOHEDA B, COX D E, SHIRANE G, et al. Phase diagram of the ferroelectric (1-x) PbMg1/3Nb2/3O3-xPbTiO3
[J]. Physical Review B, 2002, 66(5): 054104.

[5] LU Y L, GAO C. Optical limiting in lead magnesium niobate-lead titanate multilayers
[J]. Applied Physics Letters, 2008, 92(12): 121109.

[6] LIM B C, PHUA P B, LAI W J, et al. Fast switchable electro-optic radial polarization retarder
[J]. Optics Letters, 2008, 33(9): 950-952.

[7] RAN Mao-wu, CHEN Xian-feng, CAO Zhuang-qi. Measurement of quadratic electro-optic coefficient of PMN-PT transparent ceramics based on ultrahigh-order guide modes
[J]. Acta Optica Sinica, 2011, 31(10): 111-114. 冉茂武,陈险峰,曹庄琪.利用超高阶导模测量PMN-PT透明陶瓷二次电光系数
[J].光学学报,2011,31(10):111-114.

[8] LIN Y T, REN B, ZHAO X Y, et al. Large quadratic electro-optic properties of ferroelectric base 0.92Pb(Mg1/3Nb2/3)O$_3$-0.08PbTiO$_3$ single crystal
[J]. Journal of Alloys and Compounds, 2010, 507(2): 425-428.

[9] HE C J, GE W W, ZHAO X Y, et al. Wavelength dependence of electro-optic effect in tetragonal lead magnesium niobate lead titanate single crystals
[J]. Journal of Applied Physics, 2006, 100(11): 113119.

[10] HE C J, ZHOU Z X, LIU D J, et al. Photorefractive effect in relaxor ferroelectric 0.62Pb (Mg1/3Nb2/3)O3-0.38PbTiO$_3$ single crystal
[J]. Applied Physics Letters, 2006, 89(26): 261111.

[11] PARK S E, SHROUT T R. Ultrahigh strain and piezoelectric behavior in relaxor based ferroelectric single crystals
[J]. Journal of Applied Physics, 1997, 84(4): 1804-1811.

[12] XIAO P P. Beam reshaping in the occurrence of the Goos-Hänchen shift
[J]. JOSA B, 2011, 28(8):1895- 1898.

[13] XIAO Ping-ping, HU Hong-wu. Wavelength sensing based on the Goos-Hnchen effect
[J]. Acta Photonica Sinica, 2011, 40(10): 1595-1598. 肖平平,胡红武.基于古斯-汉欣位移效应的波长传感的研究
[J].光子学报,2011,40(10):1595-1598.

[14] CHEN W P, CHEN J M. Use of surface plasma waves for determination of the thickness and optical constants of thin metallic films
[J]. JOSA, 1981, 71(2): 189-191.

[15] LI K K, LU Y, WANG Q. Electro-optic ceramic material and device. U.S. 6 890 874B1, 2005.

[16] RAN Mao-wu, CHEN Xian-feng, CAO Zhuang-qi. Measurement of quadratic electro optic coefficent of PMN-PT transparent ceramica based on ultrahigh-order guide mode
[J]. Acta Optica Sinica, 2011, 30(10): 1012002. 冉茂武,陈险峰,曹庄琪.利用超高阶导模测量PMN-PT透明陶瓷二次电光系数
[J].光学学报,2011,30(10):1012002.

[17] PONSARD M C, DESVIGNES J M, BELLEMAIN A, et al. Simulatneous characterization of the electro-optic, converse-piezoelectirc, and electroabsorptive effects in epitaxial (Sr, Ba)Nb_2O_6 thin films
[J]. Journal of Applied Physics, 2011, 109(4): 014107.

[18] KURIHARA K, SUZUKI K. Theoretical understanding of an absorption-based surface plasmon resonance sensor based on Kretchmann's theory
[J]. Analytical Chemistry, 2002, 74(3): 696-701. cross ref

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2．刘军民.用衰减全反射(ATR)及拟合法对固体表面物理性质的研究[J]. 光子学报, 2000,29(2): 161-165

3．徐建东, 刘树田, 李淳飞.光谱法测量极化聚合物的电光系数[J]. 光子学报, 1996,25(10): 876-878

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