光子学报 2011, **40**(7) 1096-1100 **DOI**: 10.3788/gzxb20114007.1096 **ISSN**: 1004-4213 **CN**: 61-1235/O4

论文

基于反射和透射光谱的氢化非晶硅薄膜厚度及光学常量计算

丁文革,苑静,李文博,李彬,于威,傅广生

（河北大学 物理科学与技术学院 河北省光电信息材料重点实验室,河北 保定 071002）

摘要:

采用紫外-可见透射光谱仪测量了对靶磁控溅射沉积法制备的氢化非晶硅（a-Si:H）薄膜的透射光谱和反射光谱.利用T/(1-R)方法来确定薄膜的吸收系数,进而得到薄膜的消光系数|通过拟合薄膜透射光谱干涉极大值和极小值的包络线来确定薄膜折射率和厚度的初始值,并利用干涉极值公式进一步优化薄膜的厚度值和折射率|利用柯西公式对得到的薄膜折射率进行拟合,给出了a-Si:H薄膜的色散关系曲线.为了验证该方法确定的薄膜厚度和光学常量的可靠性,将理论计算得到的透射光谱与实验数据进行了比较,结果显示两条曲线基本重合,可见这是确定a-Si:H薄膜厚度及光学常量的一种有效方法.

关键词: 氢化非晶硅 透射谱 薄膜厚度 光学常量

Thickness and Optical Constants Calculation of Hydrogenated Amorphous Silicon Film Based on Transmission and Reflectance Spectra

DING Wen-ge,YUAN Jing,LI Wen-bo,LI Bin,YU Wei,FU Guang-sheng

(Hebei Key Laboratory of Optic-electronic Information Materials,College of Physics Science and Technology,Hebei University,Baoding,Hebei |071002,China)

Abstract:

Hydrogenated amorphous silicon (a-Si:H) films were deposited on quartz substrates by reactive facing target sputtering technique.The transmission and reflectance spectra of a-Si:H thin films measured by UV-VIS transmittance measurement were studied.The absorption coefficient α,therefore extinction coefficient κ,were determined by T/(1－R) method.The refractive index n and film average thickness d were determined from the upper and lower envelopes of the transmission spectra,and further modified by the basic equation for interference fringes.The dispersion curve of a-Si:H film fitted by Cauchy dispersion relationship of refractive index was given.In order to illuminate the reliability of the determined parameters,the calculated transmission curve was compared to experimental one,the results show the two curves almost match together.Therefore the method is effective to determine a-Si:H thin film thickness and optical constants.

Keywords: Hydrogenated amorphous silicon Transmission spectra Film thickness Optical constants

收稿日期 2011-01-25 **修回日期** 2011-04-01 **网络版发布日期** 2011-07-25

DOI: 10.3788/gzxb20114007.1096

基金项目:

国家自然科学基金（No.60940020）资助

通讯作者: 丁文革

作者简介:

参考文献:

[1]CAI Hong-kun,TAO Ke,WANG Lin-shen,et al.Interface treatment of amorphous silicon thin film solar cells on flexible sbustrate[J].Acta Physica Sinica,2009,58(11):7921- 7925.
蔡宏琨,陶科,王林申,等.柔性衬底非晶硅薄膜太阳电池界面处理的研究[J].物理学报,2009,58(11):7921- 7925.
[2]QIAN Xiang-zhong.Study of high image quality amorphous-silicon thin film transistor liquid crystal displays[D].Chengdu:University of Electronic Science and Technology of China,2003.
钱祥忠,高像质非晶硅薄膜晶体管液晶显示器的研究[D].成都:电子科技大学,2003.
[3]LI Shi-bin,WU Zhi-ming,YUAN Kai,et al.Study on thermal conductivity of hydrogenated amorphous silicon films[J].Acta Physica Sinica,2008,57(05):3126-3131.
李世彬,吴志明,袁凯,等.氢化非晶硅薄膜的热导率研究[J].物理学报,2008,57(05):3126-3131.
[4]MORENO M,KOSAREV A,TORRES A,et al.Fabrication and performance comparison of planar and sandwich structures of micro-bolometers with Ge thermo-sensing layer[J].Thin Solid Films,2007,515(19):7607- 7610.
[5]TISSOT J L,160×120 uncooled amorphous silicon TEC-less detector with 25μm pixel-pitch[J].Journal of Applied Optics,2007,28(1):1-6.
[6]MA Tie-ying.Study on the material,design,fabrication and measurement of an amorphous silicon microbolometer[D].Shanghai:Shanghai Institute of Microsystem and Technology,Chinese Acadamy of Sciences,2007.
马铁英.非晶硅微测辐射热计的材料、设计、制备和测试研究[D].上海:中国科学院上海微系统与信息技术研究所,2007.
[7]AFIFUDDIN,BUTCHER K S A,TIMMERS H,et al.Optical and structural analysis of GaN grown by remote plasma enhanced laser induced chemical vapour deposition[J].Physica Status Solidi C,2002(1):499-503.
[8]MEENAKSHI K.Error minimization in the evelope method for the determination of optical constants of a thin film [J].Surface and Interface,2010,42(3):145-150.
[9]ZHANG Jin-cheng,HAO Yue,LI Pei-xian,et al.Thickness measurement of GaN film based on transmission spectra[J].Acta Physica Sinica,2004,53(4):1243-12461.
张进城,郝跃,李培咸,等.基于透射谱的GaN薄膜厚度测量[J].物理学报,2004,53(4):1243-12461.
[10]CARICATO A P,FAZZI A,LEGGIERI G.A computer program for determination of thin flms thickness and optical constants[J].Applied Surface Science,2005,248(1-4):440-445.
[11]SHAABAN E R.Calculation of the optical constants of amorphous semiconducting As40s60,As40s35se25 and As40se60 thin film from transmittance and reflectance measurements[J].Journal of Applied Sciences,2006,6(2):340-346.

本刊中的类似文章

1．钱祥忠.

铁电液晶缺陷光子晶体调谐滤波器的设计

[J]. 光子学报, 2007,36(3): 425-428

2．颜国君;陈光德;邱复生;Zhaoyan;Fan.氮化铝薄膜的光学性能[J]. 光子学报, 2006,35(2): 221-223

3．潘永强.射频等离子体增强化学气相沉积SiNx薄膜的研究[J]. 光子学报, 2007,36(6): 1097-1101

4．汤炳书 沈廷根 王刚.二维光子晶体层状超晶格透射特性研究[J]. 光子学报, 2008,37(5): 948-951

5．赵培 刘定权 徐晓峰 张凤山.溅射条件对ZnS薄膜的光学常量和微结构的影响[J]. 光子学报, 2008,37(12): 2482-2485

6．陈凯 崔明启 郑雷 赵屹东 .软X射线反射法测量金属W的光学常量[J]. 光子学报, 2007,36(10): 1903-1908

7．苏伟涛 李斌 刘定权 李大琪 张凤山.红外光学薄膜材料光学常量计算和在宽带增透膜中的应用[J]. 光子学报, 2008,37(3): 490-493

扩展功能

本文信息

- Supporting info
- PDF(589KB)
- HTML
- 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

- 氢化非晶硅
- 透射谱
- 薄膜厚度
- 光学常量

本文作者相关文章

- 丁文革
- 苑静
- 李文博
- 李彬
- 于威
- 傅广生

8. 黄水平 徐剑 王占山 鲁大学 苑同锁.基于双振子模型在线Low-E玻璃功能层光学常量的确定[J]. 光子学报, 2008,37(3): 473-477

9. 邓传鲁,顾铮先一,张江涛.镀含弱吸收膜两层膜系长周期光纤光栅谐振特性及其优化 [J]. 光子学报, 2009,38(11): 2873-2879

10. 张璇,田慧平,纪越峰.半径位置微扰对于不同光子晶体波导结构的影响[J]. 光子学报, 2011,40(5): 728-734

文章评论 (请注意:本站实行文责自负, 请不要发表与学术无关的内容!评论内容不代表本站观点.)

反馈人 邮箱地址

反馈标题 验证码 2438

反馈内容

提交