

研究论文

基片温度对微晶硅薄膜微观结构和光学性能的影响

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摘要: 以Ar+SiH₄作为反应气体,采用电子回旋共振等离子体增强化学气相沉积(ECR--PECVD)方法制备微晶硅薄膜,研究了基片温度对薄膜微观结构、吸收系数、光学禁带宽度的影响。结果表明,随着基片温度的升高,薄膜的微观组织逐渐由非晶转化为微晶,薄膜的粗糙度单调增大,而H含量则单调减小。薄膜的光学吸收系数随基片温度的升高而增大,禁带宽度由1.89 eV降低到1.75 eV。

关键词: 材料合成与加工工艺 微晶硅薄膜 ECR--PECVD 吸收系数 光学带隙

Influence of Substrate Temperature on Microstructure and Optical Properties of Microcrystalline Si Films

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Abstract: Microcrystalline silicon films were deposited using Ar diluted SiH₄ gaseous mixture by electron cyclotron resonance plasma-enhanced chemical vapor deposition (ECR-PECVD). The effects of the substrate temperature on microstructure and optical properties of microcrystalline silicon films were investigated. The results show that, with the increasing of the substrate temperature, the crystallinity and roughness increased, but the concentration of hydrogen decreased monotonously. Furthermore, the absorption coefficient of the films increased monotonously, and the optical bandgap changed from 1.89 eV to 1.75 eV with the substrate temperature ranging from 200 # to 500 #.

Keywords: synthesizing and processing technics microcrystalline silicon film ECR-PECVD absorption coefficient optical bandgap

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参考文献:

- [1] N.H.Nickel, N.M.Johnson, J.Walker, Hydrogen induced generation of acceptorlike defects in polycrystalline silicon, Physical Review Letters, 75(20), 3720(1995)
- [2] G.Tureban, Y.Catherine, B.Grolleau, Mass spectrometry of a silane glow discharge during plasma deposition of a-Si: H films, Thin Solid Films, 67, 309(1980) 
- [3] Cheng Hua, Wu Aimin, Shi Nanlin, Wen Lishi, Effect of Ar on polycrystalline Si films

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- deposited by ECR-PECVD using SiH₄, Journal of Material Science and Technology, 24 (5), 690(2008)
- [4] Cheng Hua, Wu Aimin, Xiao Jinqun, Shi Nanlin, Wen Lishi, Effect of substrate temperature on the growth of polycrystalline Si films deposited with SiH₄+Ar, Journal of Material Science and Technology, 25(3), 489(2009)
- [5] CHENG Hua, ZHANG Xin, ZHANG Guangcheng, LIU Ruhong, WU Aimin, SHI Nanlin, The preparation of microcrystalline Si films deposited by ECR-PECVD using SiH₄+Ar, Chinese Journal of Materials Research, 24(5), 547(2010)
- [6] LI Shibin, WU Zhiming, ZHU Kuipeng, Effect of substrate temperature on the optical properties of a-Si:H films by RF-PECVD, Acta Phys. Chim. Sin., 23(8), 1252(2007)
- [7] Madhusudan Jana, Debajyoti Das, A.K. Barua, Promotion of microcrystallization by argon in moderately hydrogen diluted silane plasma, Solar Energy Materials and Solar Cells, 74, 407(2002) 
- [8] Debajyoti Das, Madhusudan Jana, A.K.Barua, Heterogeneity in microcrystalline-transition state: Origin of Sinucleation and microcrystallization at higher rf power from Ar-diluted SiH₄ plasma, Journal of Applied Physics, 89, 3041(2001) 
- [9] M.Zhu, Y.Cao, X.Guo, Microstructure of poly-Si thin films prepared at low temperatures, Solar Energy Materials and Solar Cells, 62, 109(2000) 
- [10] Wen-Chu Hsiao, Chuan-Pu Liua, Ying-Lang Wang, Thermal properties of hydrogenated amorphous silicon prepared by high-density plasma chemical vapor deposition, Journal of Physics and Chemistry of Solids, 69, 648(2008) 
- [11] E.Vallat-Sauvain, U.Kroll, J. Meier, Microstructure and surface roughness of microcrystalline silicon prepared by very high frequency-glow discharge using hydrogen dilution, Journal of Non-crystalline Solids, 266-269, 125(2000) 
- [12] M.Vaneek, Optical properties of microcrystalline materials, Journal of Non-crystalline Solids, 227-230, 967(1998) 
- [13] N.Beck, J.Meier, J.Fric, Enhanced optical absorption in microcrystalline silicon, Journal of Non-crystalline Solids, 198-200, 903(1996) 
- [14] Wataru Futako, Kunihiko Yoshino, Charles M. Fortmann, Wide band gap amorphous silicon thin films prepared by chemical annealing, Journal of Applied Physics, 85, 812 (1999) 
- [15] O.Vetterl, A.Groß, T.Jana, Changes in electric and optical properties of intrinsic microcrystalline silicon upon variation of the structural composition, Journal of Non-Crystalline Solids, 299-302, 772(2002) 
- [16] Purabi Gogoi, Pratima Agarwal, Structural and optical studies on hot wire chemical vapour deposited hydrogenated silicon films at low substrate temperature, Solar Energy Materials and Solar Cells, 93, 199(2009) 

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1. 申轶男 陈华辉 胡宇.原料颗粒级配多孔陶瓷性能的影响[J]. 材料研究学报, 2011,25(5): 550-556
2. 刘艳辉 邵忠财 刘新院 高景龙.用半连续法制备高交联度三维有序聚苯乙烯微球[J]. 材料研究学报, 2011,25 (4): 417-421
3. 季金苟 杨 斌 夏之宁 蒋兴良 舒立春.纳米复合氟改性丙烯酸树脂超疏水自清洁涂层的制备[J]. 材料研究学报, 2011,25(4): 422-426
4. 田俐 黄可龙.纳米LiFePO₄/C复合正极材料的溶剂热合成[J]. 材料研究学报, 2011,25(3): 321-326
5. 管仁国 赵占勇 曹富荣 张秋生 黄红乾.6201合金管材连续流变扩展挤压成形过程的数值模拟和实验研究[J]. 材料研究学报, 2011,25(1): 25-31
6. 郑良福 彭晓 王福会.脉冲周期和糖精添加剂对电沉积Ni镀层微观结构的影响[J]. 材料研究学报, 2010,24(5):

501-507

7. 程华 张昕 张广城 刘汝宏.用等离子体增强化学气相沉积制备微晶硅薄膜[J]. 材料研究学报, 2010,24(5):

547-549

8. 赵占勇 管仁国 曹富荣 崔彤 黄红乾.工艺条件对Mg-3Sn-Mn合金连续流变成形组织的影响机理[J]. 材料研究学报, 2010,24(5): 513-454

9. 李萍 薛克敏 周明智.铝粉烧结材料等通道转角挤压的性能演变[J]. 材料研究学报, 2009,23(6): 577-581

10. 宋萃 陈敏 马莹 马淳安 郑小明.制备参数对不锈钢丝网催化剂结构和性能的影响[J]. 材料研究学报, 2009,23(5): 508-512

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