

研究论文

掺硼对超纳米金刚石薄膜的影响

王玉乾¹; 王兵²; 孟祥钦²; 甘孔银²

1.西南科技大学材料学院 绵阳 621010

2.中物院应用电子学研究所 绵阳 621900

摘要:

采用微波等离子体化学气相沉积(MPCVD)技术, 利用氩气、甲烷、二氧化碳混合气体, 制备出平均晶粒尺寸在7.480 nm左右、表面粗糙度在15.72 nm左右的高质量的超纳米金刚石薄膜; 在此工艺基础上以硼烷作为掺杂气体, 合成掺硼的金刚石薄膜. 表征结果显示在一定的浓度范围内随着硼烷气体的通入, 金刚石薄膜的晶粒尺寸及表面粗糙度增大、结晶性变好, 不再具有超纳米金刚石膜的显微结构和表面形态; 同时膜材的物相组成也发生改变, 金刚石组份逐渐增多, 并且膜层内出现了更明显的应力以及更好的导电性能.

关键词: 无机非金属材料 掺硼 超纳米金刚石薄膜 化学气相沉积

Effect of B-doping on ultrananocrystalline diamond film

WANG Yuqian¹; WANG Bing²; MENG Xiangqin²; GAN Kongyin²

1.School of Materials Science and Engineering; Southwest University of Science and Technology;

Mianyang 621010

2.Institute of Applied Electronics; CAEP; Mianyang 621900

Abstract:

High-quality ultrananocrystalline diamond film was prepared with Ar/CH₄/CO₂ by using microwave plasma chemical vapor deposition (MPCVD) technology. The average size of the crystalline grains and surface roughness are about 7.480 nm and 15.72 nm, respectively. B-doped diamond thin film was synthesized by adding B₂H₆ into the gas resource. The results showed that within a certain limits along with the addition of B₂H₆, the grains size and surfaces roughness of the diamond thin films increased dramatically, and their crystallinity got better. The diamond thin film no longer had the characteristics of the ultrananocrystalline diamond film. Meanwhile, with the addition of B₂H₆, the diamond phase constitutes in these films increased gradually, and more obvious residual stress and better conductivity appeared at the same time.

Keywords: inorganic non-metallic materials B-doping ultrananocrystalline diamond film CVD

收稿日期 2008-12-09 修回日期 2009-03-03 网络版发布日期 2009-10-10

DOI:

基金项目:

国家自然科学基金10876032和国家863计划强辐射重点实验室基金20070202项目.

通讯作者: 王兵

作者简介:

通讯作者E-mail: wangbing67@163.com

参考文献:

- [1] O.A.Williams, M.Daenen, J.D Haen, Comparison of the growth and properties of ultrananocrystalline diamond

扩展功能

本文信息

- Supporting info
- PDF(850KB)
- [HTML] 下载
- 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

- 无机非金属材料
- 掺硼
- 超纳米金刚石薄膜
- 化学气相沉积

本文作者相关文章

- 王玉乾
- 王兵
- 孟祥钦

PubMed

- Article by Yu,Y.Q
- Article by Yu,b
- Article by Meng,X.Q

- [2] and nanocrystalline diamond, *Diamond & Related Materials*, 15(4-8), 654(2006)
- [3] N.Jiang, K.Sugimoto, K.Nishimura, Synthesis and structural study of nano/micro diamond overlayer films, *Journal of Crystal Growth*, 242(3-4), 362(2002)
- [4] Bernard Humbert, Nesrine Hellala, Jean Jacques Ehrhardt, X-ray photoelectron and Raman studies of
- [5] microwave plasma assisted chemical vapour deposition (PACVD) diamond films, *Applied Surface Science*,
- [6] 4(20), 6400(2008)
- [7] Sung-Gi Ri, Daisuke Takeuchi, Christoph E.Nebel, Surface electronic properties on boron doped (111) cvd homoepitaxial diamond films after oxidation treatments, *Diamond & Related Materials*, 16(4-7), 831(2007) [crossref](#)
- [8] P.W.May,W.J.Ludlow, M.Hannaway, Raman and conductivity studies of boron-doped microcrystalline diamond,
- [9] faceted nanocrystalline diamond and cauliflower diamond films, *Diamond & Related Materials*, 17(2), 105(2008)
- [10] C.Tavares, F.Omnes, J.Pernot, Electronic properties of boron-doped { 111 }-oriented homoepitaxial diamond layers, *Diamond & Related Materials*, 15(4-8), 582(2006) [crossref](#)
- [11] R.E.Stallcup II, Y.Mo, T.W.Scharf, Formation of nanometer-size high-density pits on epitaxial diamond
- [12] films, , *Diamond & Related Materials*, 16(9, , (1727) [crossref](#)
- [13] Luming Shen, Zhen Chen, An investigation of grain size and nitrogen-doping effects on the mechanical properties of ultrananocrystalline diamond films, *International Journal of Solids and Structures*, 44, 3379(2007) [crossref](#)
- [14] M.G.Fyta, G.C.Hadjisavvas, P.C.Kelires, Probing the sp² dependence of elastic moduli in ultrahard diamond films, *Diamond & Related Materials*, 16(8), 1643(2007) [crossref](#)
- [15] R.J.Zhang, S.T.Lee, Y.W.Lam, Characterization of heavily boron-doped diamond films, *Diamond and Related Materials*, 5(11), 1288(1996)
- [16] A.F.Azevedo, , R.C.Mendes de Barros, S.H.P.Serrano, SEM and Raman analysis of boron-doped diamond coating on spherical textured substrates, *Surface & Coatings Technology*, 200(20-21, , (5973) [crossref](#)
- [17] N.G.Ferreiraa, E.Abramofb, E.J.Coratb, Residual stresses and crystalline quality of heavily boron- doped diamond films analysed by micro-Raman spectroscopy and X-ray diffraction, *Carbon*, 41(6), 1301(2003)
- [18] M.Mermoux, F.Jomard, C.Tavares, Raman characterization of boron-doped { 111 } homoepitaxial diamond layers, *Diamond & Related Materials*, 15(4-8), 572(2006) [crossref](#)

本刊中的类似文章

1. 周华锋 杨永进 张劲松.杂原子MCM--41分子筛的合成和催化性能[J]. 材料研究学报, 2009,23(2): 199-204
2. 连肖南 陈鸣才 许凯.使用硅油--水体系制备纳米氢氧化镁[J]. 材料研究学报, 2009,23(6): 663-667
3. 武彩霞 刘罡 方海涛 李峰 史鹏飞.杂质离子对非晶态水合氧化钨电化学超电容性能的影响[J]. 材料研究学报, 2009,23(6): 628-634
4. 康晓雪 田彦文 邵忠宝 袁万颂.掺杂对LiFePO₄电化学性能的影响[J]. 材料研究学报, 2009,23(6): 646-651
5. 代伟 吴国松 孙丽丽 汪爱英.衬底偏压对线性离子束DLC膜微结构和物性的影响[J]. 材料研究学报, 2009,23(6): 598-603
6. 邓福铭 卢学军 刘瑞平 徐国军 陈启武 李文铸.在多壁碳纳米管表面高压生长纳米聚晶金刚石纤维[J]. 材料研究学报, 2009,23(6): 604-609
7. 郑传伟 杨振明 张劲松.反应烧结多孔碳化硅的高温氧化行为[J]. 材料研究学报, 2010,24(1): 103-107
8. 王乙潜 梁文双 G.G.ROSS.二氧化硅基质包埋硅纳米晶的微观结构和发光性能[J]. 材料研究学报, 2009,23(4): 352-356
9. 祝元坤 朱嘉琦 韩杰才 梁军 张元纯.磁控溅射制备SiC薄膜的高温热稳定性[J]. 材料研究学报, 2009,23(4): 410-414
10. 王怀义 刁训刚 王武育 郝维昌 王聪 王天民.基于磁控溅射制备纳米微晶NiOx薄膜的方法[J]. 材料研究学报, 2009,23(4): 426-430