

论文

甲烷浓度对CVD金刚石薄膜晶体生长过程的影响

朱宏喜¹, 毛卫民^{1,2}, 冯惠平¹, 吕反修¹, Vlasov I I⁴, Ralchenko V G⁴, Khomich A V⁵

1. 北京科技大学材料学系, 北京 100083; 2. 北京科技大学新金属材料国家重点实验室, 北京 100083; 3. 北京科技大学功能材料研究所, 北京 100083; 4. General Physics Institute, Russia Academy of Sciences, Moscow 119991 Russia; 5. Institute of Radio Engineering & Electronics, Russia Academy of Sciences, Fryazino 141190 Russia
收稿日期 2006-7-4 修回日期 2006-8-28 网络版发布日期 2007-4-30 接受日期

摘要

采用X射线衍射技术、电子背散射衍射技术和扫描电镜分别观察了不同甲烷浓度条件下沉积的CVD自支撑金刚石薄膜的宏观织构、微区晶界分布和表面形貌. 研究了金刚石晶体{100}面和{111}面生长的晶体学过程. 研究表明, {100}面通过吸附活性基团CH₂²⁻, 而{111}面通过交替吸附活性基团CH₃⁻和CH₃⁻后脱氢堆积碳原子. 低甲烷浓度时, {111}面表面能低于{100}面, 使{111}面生长略快于{100}面. 甲烷浓度升高, 动力学作用增强使{100}面生长明显快于{111}面, 使金刚石薄膜产生{100}纤维织构; 同时显露的{100}面平行于薄膜表面, 竞争生长使位于晶体侧面的{111}面由于相互覆盖而减小, 形成了不同于单晶体自由生长的薄膜表面形貌组织.

关键词 [金刚石薄膜](#) [织构](#) [晶体生长](#) [表面形貌组织](#)

分类号 [TB43](#)

Influence of Methane Concentration on Crystal Growing Process in CVD Free Standing Diamond Films

ZHU Hong-Xi¹, MAO Wei-Min^{1,2}, FENG Hui-Ping¹, LU Fan-Xiu¹, Vlasov I I⁴, Ralchenko V G⁴, Khomich A V⁵

1. Department of Materials, University of Science and Technology Beijing, Beijing 100083, China; 2. State Key Laboratory of Advanced Metals and Materials, University of Science and Technology Beijing, Beijing 100083, China; 3. Institute of Functional Materials, University of Science and Technology Beijing, Beijing 100083, China; 4. General Physics Institute, Russia Academy of Sciences, Moscow 119991, Russia; 5. Institute of Radio Engineering & Electronics, Russia Academy of Sciences, Fryazino 141190, Russia

Abstract

The Macro-texture, grain boundary distribution and surface morphology in CVD free standing diamond films deposited with different methane concentrations were observed by X ray diffraction technology, electron backscatter diffraction and SEM. The crystal growing process of {100} and {111} planes in diamond crystal was studied. It is shown that diamond films adsorb activated radical CH₂²⁻ on {100} plane or adsorb CH₃⁻ and CH₃⁻ on {111} plane alternately. Carbon atoms stack on the film surface during dehydrogenation. At low methane concentration, the expansion ratio of {111} planes is close to, but faster than that of {100} planes because of their relative lower surface energy. The enhanced driving force induced by the increased methane concentration results in faster growth of {100} plane than that of {111} plane, which promotes the formation of {100} texture. The film surface morphology consists of the exposed {100} planes that are parallel to the film surface and the exposed {111} planes area as the side surface that decrease during the competition growth, which is different from that of single crystal growth.

Key words [diamond film](#) [texture](#) [crystalgrowing](#) [surface structure](#)

DOI:

通讯作者 朱宏喜 zhuhx2004@126.com

扩展功能	
本文信息	
▶ Supporting info	
▶ PDF(818KB)	
▶ [HTML全文](0KB)	
▶ 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	
▶ 复制索引	
▶ Email Alert	
▶ 文章反馈	
▶ 浏览反馈信息	
相关信息	
▶ 本刊中 包含“金刚石薄膜”的相关文章	
▶ 本文作者相关文章	
· 朱宏喜	
· 毛卫民	
·	
· 冯惠平	
· 吕反修	
· Vlasov I I	
· Ralchenko V G	
· Khomich A V	