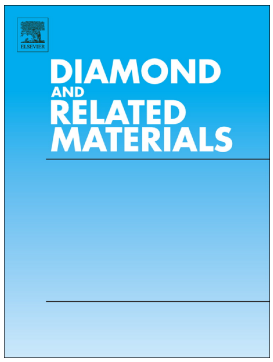

Growth evolution of carbon film on the hydrocooling copper substrate by DC arc plasma jet

Jianchao Guo, Chenyi Hua, Jinlong Liu, Junjun Wei, Liangxian Chen, Lifu Hei, Zhihong Feng, Chengming Li

PII: S0925-9635(16)30250-3
DOI: doi: 10.1016/j.diamond.2017.04.006
Reference: DIAMAT 6857

To appear in: *Diamond & Related Materials*

Received date: 29 June 2016
Revised date: 1 April 2017
Accepted date: 4 April 2017

Please cite this article as: Jianchao Guo, Chenyi Hua, Jinlong Liu, Junjun Wei, Liangxian Chen, Lifu Hei, Zhihong Feng, Chengming Li , Growth evolution of carbon film on the hydrocooling copper substrate by DC arc plasma jet. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Diamat(2017), doi: 10.1016/j.diamond.2017.04.006

Growth Evolution of Carbon Film on the Hydrocooling Copper Substrate by DC Arc Plasma Jet

Jianchao Guo[a,b], Chenyi Hua[a], Jinlong Liu[a], Junjun Wei[a], Liangxian Chen[a], Lifu Hei[a], Zhihong Feng[b], Chengming Li[a*]

[a] *Institute of Advanced Materials and Technology, University of Science and Technology Beijing, Beijing, P. R. China*
[b] *National Key Laboratory of ASIC, Hebei Semiconductor Research Institute, Shijiazhuang P. R. China*

Abstract: The growth process of carbon film on the surface of hydrocooling copper substrate in high-density direct current (DC) arc plasma was studied. Scanning electron microscopy, Fourier transform infrared spectroscopy, X-ray diffraction, nuclear magnetic resonance spectroscopy, and UV confocal Raman spectroscopy were used to analyze the structural constituents of the intermediate products generated at different growth periods. Results show that despite the remarkable heating effect of DC arc plasma to the copper substrate, one layer of cauliflower saturated carbon and double carbon bond as main component loose matter are first formed because of water-cooled copper substrate. With the increase in thickness of carbon film, the surface temperature gradually increases, the etching ability of the atomic hydrogen is enhanced and high concentration reactive units are maintained on the surface of carbon film. The cauliflower structure may effectively reduce the diamond nucleation barrier and promote the generation of nano-diamond. The diamond grains gradually grow up to the micron scale by the continuing influence of carbon-based active group and plasma. The growth pattern of carbon film on the hydrocooling copper substrate in high-density DC arc plasma may provide a new way to prepare large crack-free diamond films.

Keywords: DC arc plasma jet; hydrocooling copper substrate; carbon film; cauliflower surface

* Corresponding author.
E-mail address: chengmli@mater.ustb.edu.cn (C. M. Li); guojian.chao@163.com (J.C. Guo)