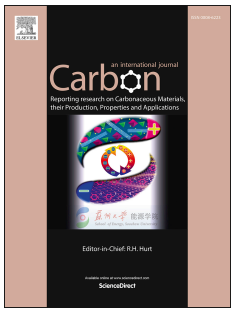
Accepted Manuscript



Gas phase generation of diamond nanoparticles in the hot filament chemical vapor deposition reactor

Jin-Woo Park, Kun-Su Kim, Nong-Moon Hwang

PII: S0008-6223(16)30389-X

DOI: 10.1016/j.carbon.2016.05.035

Reference: CARBON 10999

To appear in: *Carbon*

Received Date: 18 March 2016

Revised Date: 12 May 2016

Accepted Date: 13 May 2016

Please cite this article as: J.-W. Park, K.-S. Kim, N.-M. Hwang, Gas phase generation of diamond nanoparticles in the hot filament chemical vapor deposition reactor, *Carbon* (2016), doi: 10.1016/j.carbon.2016.05.035.

Gas phase generation of diamond nanoparticles in the hot filament chemical vapor deposition reactor

Jin-Woo Park [a], Kun-Su Kim [a], Nong-Moon Hwang *[, a b]

[a] Department of Materials Science and Engineering, College of Engineering at Seoul National University, 1 Gwanak-ro, Gwanak-gu, Seoul, Republic of South Korea.

[b] Research Institute of Advanced Materials, 599 Gwanak-ro, Gwanak-gu, Seoul, Republic of South Korea.

* Corresponding author. E-mail address: nmhwang@snu.ac.kr (N.-M. Hwang).

Abstract

A possibility for the new synthesis method of diamond nanoparticles is studied using a hot filament chemical vapor deposition (HFCVD) reactor. Considering the growth mechanism of diamonds at low pressure from the well-known observation of simultaneous diamond deposition and graphite etching without violating the second law of thermodynamics, diamond nanoparticles should be generated in the gas phase. To confirm the generation of diamond nanoparticles in the gas phase under the synthesis condition of diamond films by HFCVD, the transmission electron microscope (TEM) grid membrane was exposed for 3-15 sec using a capturing apparatus and the grid membrane was observed by TEM. The number density of captured nanoparticles increased with increasing capture time whereas the size of them was changed only slightly. In addition, to confirm whether the nanoparticles are electrically charged or not, the electric bias was applied to the stainless steel plate placed below the holder of the TEM grid. The positive bias increased the number density of nanoparticles whereas the negative bias decreased it, indicating that nanoparticles are negatively charged. The TEM images showed that the captured nanoparticles had a diameter of 4-6 nm and 0.206 nm of crystalline lattice spacing, which indicates the {111} plane of diamond.