21COE プログラム「機械システム・イノベーション」公開セミナー

21COE プログラム「機械システム・イノベーション」平成 19 年度第 7 回公開セミナーを開催いたします．Sanju Gupta 先生は，カーボンナノチューブやナノダイヤモンドなどの炭素材料とこれらを用いたデバイスの研究分野で非常にアクティブな新進気鋭の先生です．今回，来日の際に東大でのセミナーをいただけることとなりました．ふるってご参加いただきますようどうぞ宜しくお願い申し上げます．

記

講師： **Professor Sanju Gupta**
(Department of Electrical and Computer Engineering, University of Missouri-Columbia)

題目：**Science and Technology of Advanced Multifunctional Nanocarbons for Vacuum Microelectronics**

日時：2007 年 12 月 26 日（水）14:00 ~ 15:30
場所：東京大学工学部 2 号館 3 階機械系会議室(2-31A 号室）
地図：http://www.u-tokyo.ac.jp/campusmap/cam01_04_03_j.html

概要：

Carbon, the sixth most abundant element in the universe, has been known since ancient times and its appeal is due to its versatile nature of chemical bonding results in various forms where diamond (tetragonal) and graphite (trigonal) are the most well-known allotropes. Unprecedented worldwide activity in the investigation of nanostructured forms of carbon was initiated by the discovery of the C_{60} molecule in 1985 and the development of the arc-discharge technique in 1990 producing elongated members of fullerenes (C_{60}) known as nanotubes followed by nanocrystalline diamond in 1999 synthesized by varying the traditional gas phase chemistry used to deposit polycrystalline diamond. The talk will be comprised of two parts presenting the recent activities related to chemical vapor deposited nanodiamond and nanotubes wherein materials science played a vital role in discovering these novel carbons with tailored physical properties for desired technological applications, in general and for vacuum microelectronics, in particular [1,2].

Electron field emitting materials known as *cold cathodes* (*i.e.* emitting electrons at room temperature) are of vital importance enabling a variety of applications such as *flat panel displays*, RF amplifiers for communication and radar, as bright electron beam for microscopes, electric propulsion for microsatellites, and portable X-ray sources for medical and security diagnostics. Nanodiamond (doped and undoped) and carbon nanotubes proved to be the potential candidate materials as *planar cold cathodes* yet having nanoscale heterogeneities for vacuum microelectronics. Starting with a brief introduction on the syntheses of these materials using chemical vapor deposition technique, the traditional field emission (*I-V*) properties and temperature dependent field emission microscopy (*T-FEEM*) enabling real-time imaging of electron emission with high spatial resolution providing evident information on emission site density, temporal variation or flicker of the emission intensity, and insight into the *role of adsorbates* from nanotube films will be presented. Temperature dependent field emission findings will be related to vacuum thermionic energy/ power converters for both the doped nanodiamond and nanotubes. *n*-type doping is a central topic in the development of diamond-based electronics. *Sulfur* doping in diamond will be briefly mentioned in this context providing almost equivalent field emission properties to those of nanotubes [3].

[1] Gupta *et. al.* Appl. Phys. Lett. **86**, 063109 (2005). **[Virtual Journal of Nanoscale Science and Technology, October 11 Issue, 2004].**
[2] Gupta, *et. al.* J. Appl. Phys. **95**, 8314 (2005). **[Virtual Journal of Nanoscale Science and Technology, July 14 Issue, 2004].**
[3] Gupta et. al. J. Mater. Res. **18**, 363 (2003).

連絡先： 東京大学　大学院工学系研究科　機械工学専攻
丸山茂夫 (E-mail: maruyama@photon.t.u-tokyo.ac.jp, Tel: 03-5841-6421)