NUS NANOSCIENCE & NANOTECHNOLOGY INITIATIVE (NUSNNI)

Agenda

Venue: **Faculty of Science, Physics Resource Room, Blk S13, Level 2, Unit 15**

Date: **30 August, 2005 (Tuesday)**

Time: **2pm to 4pm**

Time	Activity
2pm to 2.20pm	Speaker : Wang Haomin Topic : Raman Study of Carbon Nanowalls Q & A
2.20pm to 2.40pm	Speaker : Dr Sow Chorng Haur Topic : Carbon Nanotubes Microactuators Q & A
2.40pm to 3pm	Speaker : Chin Kok Chung Topic: Gold and Silver Coated Carbon Nanotubes: An Improved Broad-band Optical Limiter Q & A
3pm to 3.20pm	Speaker : Dr Saeys Mark Topic: Modeling of the kinetics of carbon growth on Ni catalysts Q & A
3.20pm to 3.40pm	Speaker: Prof Li Baowen Topic: Anomalous energy diffusion and anomalous thermal conductivity in single walled carbon nanotubes. Q & A
3.40pm to 4pm	Speaker: Dr Suresh Valiyaveettil Topic: Functionality comparisons of single and multi-walled nanotubes with graphitic fibers Q & A
4pm to 4.30pm	Refreshment

Presentation Abstracts

Speaker : **Wang Haomin**
Dept of Electrical & Computer Engineering, National University of Singapore.

Topic: Raman Study of Carbon Nanowalls.

Abstract:
Raman spectra of carbon nanowalls (CNWs) vertically grown using RF plasma enhanced chemical vapor deposition (PECVD) were analyzed, The Raman spectra of CNWs exhibit G, D and D' bands at about 1580, 1350 and 1620 cm^{-1}, respectively. The peak intensity ratio of D band to G band (ID/IG) looks very high, sometimes up to 3.1. It is found that the bandwidth of the G-band is relatively narrow, even when ID/IG is significantly high. The total length of CNWs in unit sample area strongly influenced the ratio of ID/IG. That is to say, the longer it is, the higher the ID/IG intensity ratio is. The relative intensity of D' band (ID'/IG) usually increases with that of D band (ID/IG). What's more, the water assisted highly efficient synthesis of CNWs obviously contributes to the relative intensity of D band for inducing H_2O. Thus, we think the defect effects of CNWs influence the ID/IG intensity ratio. The defects effect means some defects introduced or an edge of the graphitic materials introduced when the graphite comes to carbon nanowalls size. Moreover, the raman shift of D band and G band will not obviously change with the excitation energy of incident laser while that of the D' band does so. These spectral features of CNWs are distinguished from those of typical graphitelike carbons reported so far. From the comparison of these spectral features it is shown that CNWs composed of small crystallites with a high degree of graphitization.

Speaker: Dr Sow Chorng Haur
Asst Professor, Department of Physics, National University of Singapore

Topic: Carbon Nanotubes MicroActuators

Abstract:
We have developed a simple focused laser pruning technique to fabricate two and three-dimensional microstructures made of Carbon Nanotubes (CNTs). The same focused laser beam was able to cause mechanical actuation of CNTs microstructures after they are fabricated. Such behavior was exploited in creating micro-opto-mechanical devices comprising of microstructures made of well-aligned CNTs. Using this focused laser beam, were created opto-mechanical micro-devices akin to a simple switch; a simple OR gate and a simple AND gate. The inputs of these devices presence (ON state) and absence (OFF state) of the focused laser beams and the outputs correspond to the electrical response of the device. This technique is convenient and effective, and has potential applications in the fabrication of unique devices.

Speaker: Chin Kok Chung
Research Officer, Nanoscience & Nanotechnology Initiative (NUSNNI) , National University of Singapore

Abstract:

Topic: Gold and Silver Coated Carbon Nanotubes: An Improved Broad-band Optical Limiter

Abstract:

5-nm-thick coatings of polycrystalline gold and polycrystalline silver were deposited on multiwalled carbon nanotubes. Their optical limiting properties were studied as a suspension in water at 532 nm and 1064 nm wavelengths by nanosecond laser pulses. Experiments show that they possess stronger OL performance compared to pure carbon nanotubes at 532 nm, but there were no visible OL enhancements at 1064 nm. We propose surface plasma absorption (SPA) of Au and Ag as the mechanism responsible for the enhancement of nonlinear scattering effects. Our study provides evidence that coating carbon nanotubes with polycrystalline Au or Ag is a simple and effective method for improving OL performance.

Speaker: **Dr Saeys Mark**
Asst Professor, Dept of Chemical & Biomolecular Engineering, National University of Singapore

Topic: **Modeling of the kinetics of carbon growth on Ni catalysts**

First principles based kinetic modeling was used to better understand the deposition of carbon on Ni catalysts. Three forms of carbon were considered: on-surface atomic carbon, bulk carbon and graphene. The kinetic modeling revealed that on-surface atomic carbon is thermodynamically unstable and diffuses to the Ni bulk at low carbon coverages. At higher coverages, the carbon atoms can start to form a graphene overlayer, eventually leading to carbon nanotubes. The first principles calculations indicate that the formation of a critical graphene island has a significant energy cost, similar to the crystallization process.To minimize this energy penalty, graphene most likely starts growing from the steps on the Ni surface. Kinetic and theoretical studies indeed indicate that the formation of graphene can be significantly inhibited by selectively blocking these sites, e.g. with Au or S.

Speaker: **Prof Li Baowen**
Assoc Professor, Dept of Physics, National University of Singapore

Topic: Anomalous energy diffusion and anomalous thermal conductivity in Single walled carbon nanotubes

Abstract:

Carbon nanotube is one of the exciting nanoscale materials discovered in recent years. It reveals many excellent mechanical, thermal, and electronic properties. However, compared with electronic properties, much less is known about thermal conductivity.
In this talk, I will report our recent study on the vibrational energy transport [1] and the thermal conductivity in the nanotube. In particular, I will discuss the effects of chirality, isotope impurity, tube length, and temperature on thermal conductivity [2]. Possible application for heat control at nanoscale will be discussed.

Speaker : **Dr Suresh Valiyaveettil**
Asst Professor, Dept of Chemistry, National University of Singapore

Topic : **Functionality Comparisons of Single and Multi-walled Nanotubes with Graphitic Fibers**

Abstract:

The large surface area of inert carbon nanotubes (CNTs) and carbon fibers (CFs) renders insufficient interaction between the CNTs and organic matrix. The filler-matrix interactions consequently become important to ensure sufficient wetting and filler dispersion in the matrix. The optimized functionalization method for both the CNTs and CFs will improve the viability of the entities for applications. In this presentation, we provide a comparison between single-walled, multi-walled CNTs and pitch-based CFs in terms of the susceptibility to oxidation. The effects of functionalization reactions and extent of reaction are analyzed in terms of morphology, destruction of graphitization and hydrophobicity of the CNTs and CFs.