Metrology Standardization and Industrial Quality of Graphene and Nanotubes (MSIGN11)

15th & 16th July 2011, Cambridge UK

Cockcroft Lecture Theatre, Cockcroft Building, New Museum site

Program

Friday 15th July 2011

9:00-9:15
Opening Remarks: M.S. Dresselhaus

Physical metrology (9:15-10:30)

Chair: M.S. Dresselhaus
Massachusset Institute of Technology (USA)

9:15 -9:45
(Invited) *Using Raman Spectroscopy and Electron Microscopy as Metrological Tools in the Study of Graphene and Other Carbon Nanostructures*
C. A. Achete

National Institute of Metrology, Materials Metrology Division, (Brazil)

9:45 – 10:00
How to Improve Interference Substrates for the Exploration of Graphene and Nanotubes
V. Tishkova, W. Bacsa

CEMES - CNRS, University of Toulouse (France)

10:00-10:15
Raman Metrology of Uniaxially Strained Graphene
O. Frank[1,2], G. Tsoukleri[2], J. Parthenios[2], K. Papagelis[3], I. Riaz[4], R. Jalil[4], K. Novoselov[4], M. Kalbac[1], L. Kavan[1], C. Galiotis[2,5]
[1]J. Heyrovsky Institute of Physical Chemistry of the AS CR, v.v.i. (Czech Rep), [2]FORTH / ICE-HT (Greece), [3]Materials Science Department, University of Patras (Greece), [4]School of Physics and Astronomy, University of Manchester (UK), [5]Materials Science Department, University of Patras (Greece)

10:15-10:30
Resonant Raman Spectroscopy on 13C Enriched Carbon Nanomaterials
S. Costa[1], C. Fantini[1], A. Righi[1], A. Bachmatiuk[2], M. Rümmeli[2], R. Saito[3], Y. Hao[4], C. Magnuson[4], R.S. Ruoff[4], M. Pimenta[1]
[1]Physics department of Federal University of Minas Gerais (Brazil), [2]Leibniz Institute for Solid State and Materials Research (Germany), [3] Physics department of Tohoku University (Japan), [4]Dept of Mechanical Eng. and Texas Materials Institute, University of Texas (USA)

10:30-11:00

Coffee break

Physical metrology II (11:00-12:30)

Chair: H. Kataura
National Institute of Advanced Industrial Science and Technology (Japan)

11:00-11:30
(Invited) *Molar Extinction Coefficient of Single-Wall Carbon Nanotubes*

T. Hertel
Institute of Physical and Theoretical Chemistry Julius-Maximilians, Würzburg University (Germany)

11:30-11:45
Gate-Induced Blueshift and Quenching of Photoluminescence in Suspended Single-Walled Carbon Nanotubes
S. Yasukochi[1], T. Murai[1], S. Moritsubo[1], T. Shimada[1], S. Chiashi[2], S. Maruyama[2], Y. Kato[1]
[1]Institute of Engineering Innovation, The University of Tokyo (Japan), [2]Department of Mechanical Engineering, The University of Tokyo (Japan)

11:45-12:00

Tip Enhanced Raman Scattering & Multiprobe Scanned Probe Imaging & NanoLithography of Carbon Nanotubes & Graphene
A. Lewis[1], T. Yeshua[1], Y. Bar-David[2], R. Dekhter[2], O. Zinoviev[2]

[1]Hebrew University of Jerusalem, Dept. of Applied Physics (Israel), [2]Nanonics Imaging Ltd (Israel)

12:00-12:30

(Invited) Femtonewton Force Sensing and Optical Trapping of Nanotubes and Graphene

O.M. Maragó

CNR-IPCF sede di Messina (Italy)

12.30-15.00 Lunch + Poster Session 1

The Bowling Green, Pembroke College

Physical metrology III (15:00-16:30)

Chair: T. Hertel
University of Würzburg (Germany)

15:00-15:30

(Invited) *Pristine, Empty Nanotubes Have Enhanced Electronic and Vibrational Properties*
W. Wenseleers
Experimental Condensed Matter Physics Laboratory University of Antwerp (Belgium)

15:30-15:45

In Situ NEXAFS Study of Initial Growth Process of Carbon Nanotube by Surface Decomposition of SiC
T. Maruyama[1], S. Sakakibara[1], H. Itoh[1], S. Naritsuka[1], K. Amemiya[2]

[1]Meijo University, Nagoya (Japan), [2]KEK PF (Japan)

15:45-16:00

Carbon Nanoubes as Substrates for Surface Enhanced Raman Spectroscopy

C. Fantini[1], A. Righi[1], M. Pimenta[1], D. Andrada[2], A. Santos[2], C. Furtado[2], R. Saito[3]

[1]Universidade Federal de Minas Gerias (Brazil), [2]Centro de desenvolvimento da Tecnologia Nuclear (Brazil), [3]Tohoku University (Japan)

16:00-16:15

Metrology of Single Walled Carbon Nanotubes With Engineered Defect

M. Kalbac[1], H. Farhat[2], M. Hoffman[3], L. Kavan[1], J. Kong[3], M. Dresselhaus[3,4]

[1]J. Heyrovský Institute of Physical Chemistry, Academy of Sciences of the Czech Rep., [2]Department of Materials Science and Engineering, MIT (USA), [3]Department of Electrical Engineering and Computer Science, MIT (USA), [4]Department of Physics, MIT (USA)

16:15-16:30

In Situ Raman Spectroscopy of Carbon Nanotubes During Growth by a Local Heating Technique

J. Ek Weis[1], O. Nerushev[1], E. Campbell[1,2]

[1]EaStCHEM, School of Chemistry, Edinburgh University (UK), [2]Division of Quantum Phases and Devices, School of Physics, Konkuk University (Korea)

16.30-17.00

Coffee break

Chemical metrology (17:00-18:30)

Chair: F. Bonaccorso
University of Cambridge (UK)

17:00-17:30

(Invited) *Evaluation of Affinity Between Carbon Nanotubes and Organic Molecules*

J.T. Yoo[1], H. Ozawa[1], T. Fujigaya[1] and N. Nakashima[1,2,3]

[1]Kyushu University (Japan), 2World Premier International (WPI) Research Center International Institute for Carbon-Neutral Energy Research (I_2CNER), Kyushu University, [3]JST -CREST (Japan)

17:30-17:45

Solvents for Nanotubes and Graphene – Why the Difference?

S. Bergin[1], H. Yau[1], A. Goode[2], Y. Hernandez[3], J. N. Coleman[4], M. Shaffer[1]

[1]Dept. of Chemistry, Imperial College London (UK), [2]Dept of Materials, Imperial College London (UK), [3]Max Planck Institute for Polymer Research (Germany), [4]School of Physics & CRANN, Trinity College Dublin (Ireland)

17:45-18:00

Micro-Dielectric Environment Effect on the Band Gaps of (n,m) Single-Walled Carbon Nanotubes

Y. Hirana, Y. Tanak, Y, Niidome, T. Fujigaya, and N. Nakashima
Department of Applied Chemistry, Graduate School of Engineering, Kyushu University, (Japan)

18:00-18:15

High-Resolution Photocurrent Microscopy of Carbon Nanotube Film Photodiodes

M. Engel[1,2,3], M. Steiner[4], Ph. Avouris[4], R. Krupke[1,3]
[1]Institute of Nanotechnology, Karlsruhe Institute of Technology, [2]Physikalisches Institut, Karlsruhe Institute of Technology, [3]DFG-Center for Functional Nanostructures, Karlsruhe Institute of Technology, [4]IBM Thomas J. Watson Research Center (USA)

19.00 Welcome drinks

19.30 Satellite Dinner

Saturday 16th July 2011

Chemical metrology II (9:15-10:30)

Chair: E.H. Martins Ferreira
Inmetro (Brazil)

9:00-9:30

(Invited) *Challenging in Characterizing Modified SWCNT*

Y. Martinez-Rubi, C. T. Kingston[1], J. Guan[1], B. Simard[1], J. M. Gonzalez[2], T. Martinez[2]
[1]National Research Council, Ottawa (Canada), 2Departamento de Nanotecnología. Instituto de Carboquímica, CSIC (Spain)

9:30-9:45

Dispersion and Separation of Single Walled Carbon Nanotubes by Polysaccharides

M. Chan-Park, Y. Chen, L. Yan, S. Hagh, Y. Poon
School of Chemical and Biomolecular Engineering Nanyang Technological University (Singapore)

9:45-10:00

Doping Single-Walled Carbon Nanotubes With Nitrogen: a STM and STS Investigation

Y. Tison[1,2], H. Lin[1,2], J. Lagoute[1,2], V. Repain[1,2], Y. Girard[1,2], C. Chacon[1,2], T. Susi[3], E. Kauppinen[3], A. Loiseau[2], S. Rousset[1]
[1]MPQ, Université Paris Diderot (France), [2]LEM, UMR 104 ONERA-CNRS (France), [3]NMG, Department of applied Physics, Aalto University (Finland)

10:00-10:15

Quantification of the Metallic/Semiconducting Ratio of Bulk SWCNT Samples by Cobalt Porphyrin Probe EPR Spectroscopy

S. Cambré[1], W. Wenseleers[1], E. Goovaerts[1], D. Resasco[2]
[1]Experimental Condensed Matter Physics Laboratory, University of Antwerp (Belgium), [2]School of Chemical, Biological and Materials Engineering, University of Oklahoma (USA)

10:15-10:30

Wall-Selective Probing of Double-Walled Carbon Nanotubes Using Covalent Functionalization

D. Bouilly[1], J. Cabana[1], F. Meunier[1], M. Desjardins-Carrière[2], F. Lapointe[1], P. Gagnon[2], F. L.-Larouche[1], E. Adam[2], M. Paillet[1], R. Martel[1]

[1]Université de Montréal (Canada), [2]École Polytechnique de Montréal (Canada)

10.30-11.00
Coffee break

Standard development (11:00-12:30)

Chair: C. Kingston
National Research Council (Canada)

11:00-11:30

(Invited) *Engineering and Metrology of Epitaxial Graphene*

A. Tzalenchuk
National Physical Laboratory (UK)

11:30-11:45

Direct Measurements of Bending Stiffness and Rippling Phenomena in Free-Standing Carbon Nanotubes

H. Jackman[1], P. Krakhmalev[2], K. Svensson[1]

[1]Department of Physics and Electrical Engineering, Karlstad University, (Sweden) [2]Department of Mechanical and Materials Engineering, Karlstad University (Sweden)

11:45-12:00

STM Images of Carbon-Nanotube Quantum Dots: Seeing a Wigner Molecule of Correlated Electrons

M. Rontani[1], A. Secchi[1,2]

[1]CNR-NANO Research Center S3 (Italy), [2]University of Modena (Italy)

12:00-12:15

Quantum Conductance in Carbon Nanotube Systems

M. Baxendale
Department of Physics Queen Mary, University of London (UK)

12:15-12:30

Combining Independent Measurements on Individual Carbon Nanotubes

O. Herranen[1], J. Rintala[2], P. Mudimela[3], A. Johansson[2], A. Nasibulin[3], H. Jiang[3], E. Macoas[4], M. Pettersson[2], E. Kauppinen[3], M. Ahlskog[1]

[1]Nanoscience Center, Department of Physics, University of Jyväskylä (Finland), [2]Nanoscience Center, Department of Chemistry, University of Jyväskylä (Finland), [3]Department of Applied Physics, Aalto University (Finland), [4]Instituto Superior Técnico, Universidade Técnica de Lisboa (Portugal)

12.30-15.00 Lunch + Poster Session II

The Bowling Green, Pembroke College

Applications (15:00-16:45)

Chair: D. Roy
National Physical Laboratory (UK)

15:00-15:30

(Invited) *Graphene at High Pressure: Dimensionality Transition, Mechanical and Doping Effects Under Biaxial Strain*
P. Poncharal
Université Lyon I et CNRS (France)

15:30-15:45

The Use of Ga^+ Focused Ion Beam to Modify Graphene for Device Applications

B. Fragneaud[1], B. Archanjo[1], E. Martins Ferreira[1], V. Victor Carozo[1], C. Almeida[1], A. Jorio[2], C. A. Achete[1,3]
[1]Materials Metrology Division, National Institute of Metrology, INMETRO (Brazil), [2]Departamento de Fisica, Universidade Federal de Minas Gerais (Brazil), [3]Programa de Engenharia Metalúrgica e de Materiais (PEMM), UFRJ, (Brazil)

15:45-16:00

Isolated and Shape-Defined Graphene Layers in a Single Litographic Step
A. Lombardo, S. Milana, A.C. Ferrari
Department of Engineering, University of Cambridge, (UK)

16:00-16:15

Novel Testing Method of Carbon Nanotube-Array Actuators

S. Geier, T. Mahrholz, J. Riemenschneider, P. Wierach, M. Sinapius
German Aerospace Center, Institute of Composite Structure and Adaptive Systems, Braunschweig (Germany).

16:15-16:30

In Situ TEM Investigations of Electronic and Mechanical Properties of Nanotube Architectures
D. Tang[1,2], Y. Lin[1], C. Ren[1], X. Wei[2], M. Wang[2], H. Cheng[2], Y. Bando[1], C. Liu[2], D. Goldberg[1]
[1]National Institute for Materials Science, Tsukuba (Japan), [2]Institute of Metal Research CAS (China)

16:30-16:45

Optical Heterodyne Detection Visualizes the Spatial Resonance of Multilayer Graphene Cantilevers
Y. Yuasa[1], A. Yoshinaka[1], T Arie[1,2], S. Akita[1,2]
[1]Osaka Prefecture University (Japan), [2]CREST-JST (Japan)

16:45-17:00

Collection-Mode Near-Field Nanoscopy of Individual CNTs

F. Tantussi[1], F. Fuso[1,2], M. Allegrini[1,2]
[1]CNISM (Italy), [2]Dipartimento di Fisica, Universita di Pisa (Italy)

17:00-17:30

Round table discussion: metrological tools for the industrialization of nanotubes and graphene

Moderator: M.S. Dresselhaus,
Massachusset Institute of Technology (USA)