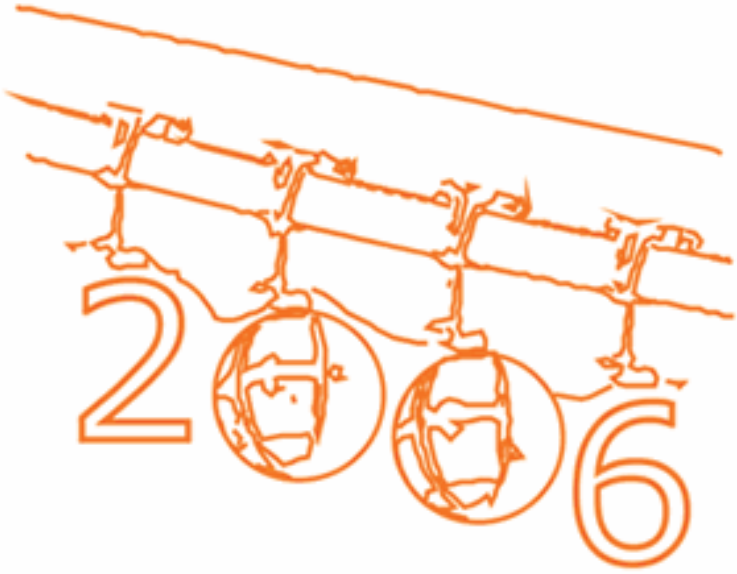
TNT



Trends in NanoTechnology

Grenoble (France) – September 04-08, 2006

PHANTOMS FOUNDATION

Universidad de Oviedo

UAM UNIVERSIDAD AUTONOMA DE MADRID

Georgia Tech

NIMS Nanomaterials Laboratory

DLPG

cea leti

DRFMC

On behalf of the International, Local and Technical Committees, we take great pleasure in welcoming you to Grenoble (France) for the seventh “Trends in NanoTechnology” (TNT2006) International Conference.

TNT2006 is being held in large part due to the overwhelming success of earlier TNT Nanotechnology Conferences and will be organised in a similar way to the six prior TNT conferences. The TNT2006 edition is organised out of Spain for the first time - Grenoble (France) - to stress the importance at the European level of the launch of the Centre of Innovation in Micro and Nanotechnology, MINATEC.

This high-level scientific meeting series aims to present a broad range of current research in Nanoscience and Nanotechnology worldwide, as well as initiatives such as iNANO, EU/IST/FET, GDR-E, FinNano, etc. TNT events have demonstrated that they are particularly effective in transmitting information and promoting interaction and new contacts among workers in this field. Furthemore, this event offers visitors and sponsors an ideal opportunity to interact with each other.

One of the main objectives of the Trends in Nanotechnology conference is to provide a platform where young researchers can present their latest work and also interact with high-level scientists. For this purpose, the Organising Committee provides every year around 60 travel grants for students. In addition, this year, 22 awards (7000 Euros in total) will be given to young PhD students for their contributions presented at TNT. More than 60 senior scientists are involved in the selection process. Grants and awards are funded by the TNT Organisation in collaboration with several governmental and research institutions.

TNT is now one of the premier European conferences devoted to nanoscale science and technology with around 400 participants worldwide.

We are indebted to the following Scientific Institutions, Companies, Individuals and Government Agencies for their help and financial support: PHANTOMS Foundation, Universidad de Oviedo, Universidad Autonoma de Madrid, Universidad Carlos III de Madrid, Universidad Complutense de Madrid, University of Purdue, Georgia Institute of Technology, Donostia International Physics Center (DIPC), CEA/LETI/DRFMC, NIMS (Nanomaterials Laboratory), MINATEC, Consejo Superior de Investigaciones Cientificas, Ecole Centrale Paris, Air Force Office of Scientific Research, The Office of Naval Research International Field Office (ONRIFO), iNANO, NSERC/CRSNG (Nano Innovation Platform), GDR-E/NanoE, Raith GmbH, World Scientific and Imperial College Press, Parque Cientifico de Barcelona (PCB)-CREBEC, Universidad SEK, Parque Científico de Madrid (PCM), Springer, Institute of Physics Publishing, Merck, IJ Cambria Scientific, NanoSciences Rhone Alpes, Ville de Grenoble, INPGrenoble, Universite Joseph Fourier, Delegation Generale pour l’Armement (DGA), Institut de l’Ecole Normale Superieure, P. Van Hove (private donation), Royal Society of Chemistry and Wiley VCH & PSS.

We would also like to thank the following companies for their participation: NanoTec, Raith GmbH, Scientec, Schaefer Techniques, Orsay Physics, Atomic Force, Omicron Nanotechnology, Fondis Electronic, Nanomegas, EPISTEP/Alma Consulting, Atomistix, FinNano, Nanotimes, Institute of Physics Publishing, World Scientific and Imperial College Press and Wiley VCH.

In addition, thanks must be directed to the staff of all the organising institutions whose hard work has helped the planning and organisation of this conference.

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Funded by		**Award**
	NIMS - Nanomaterials Laboratory	400 Euros
	NIMS - Nanomaterials Laboratory	400 Euros
	Parc Cientific de Barcelona (PCB)	350 Euros
	NSERC-CRSNG (NanoIP)	300 Euros
	NSERC-CRSNG (NanoIP)	300 Euros
	Raith GmbH	300 Euros
	PHANTOMS Foundation	300 Euros
	Physica Status Solidi	300 Euros
	Private Donation: Patrick Van Hove	300 Euros
	MINATEC	300 Euros
	GDR-E on Science and Applications of Nanotubes	200 Euros
	Parque Cientifico de Madrid (PCM)	200 Euros
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	IoP	iPod Nano
	TNT2006 Organisation	Free registration to the 2007 Conference
	Springer	Book "Understanding Carbon Nanotubes"
	Springer	Set of Scientific Books (5)
	Wiley-VCH	One Textbook "Nanoelectronics and Information Technology: Advanced Electronic Materials and Novel Devices"
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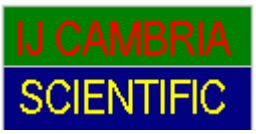

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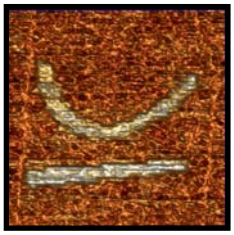

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Nanotec Electronica develops Scanning Probe Microscopes with the best quality and the latest technology in the field, giving easy access to the nanometer scale both to the scientific and industrial communities. Also, Nanotec Electronica manufactures control systems for Scanning Probe Microscopes, develops the free WSxM software for data visualization and processing of Scanning Probe Microscopy images, and distributes the SIESTA DFT software for first principle calculations.

In the 20 years from the installation of the first STM microscope in Madrid, a lot of new ideas came to the Scanning Probe Microscopy world, and Scanning Probe Microscopes assented as one of the main tools for Nanotechnology. While maintaining the idea that the SPM should be not very expensive in order to allow access for the technology to any laboratory in the world, Nanotec Electronica maintains its products in the cut edge of the developments, offering the most flexible and powerful SPM system in the market.

Orsay Physics S.A.

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WEB: http://www.orsayphysics.com

Leader in ion and electron beam technology

Orsay Physics was founded in 1989 by researchers specialised in charged particle optics, with the help of a sponsorship from Paris-Orsay University. Today, Orsay Physics has become **a world leader in the field of focussed ion/electron beam design and production.**

Owing to its experience and flexibility, Orsay Physics works closely with its customers, from both universities and industry, to provide high performance equipment which is conceptually innovative, reliable and elegant in technological design. This is shown most clearly with the CANION series focussed ion beam columns, with a large number of customised optics, ranging from photon/ion coaxial beams design to mass-filtered columns for R&D applications of local implantation.
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Since September 1997, Orsay Physics has moved close to Aix-en-Provence (south of France), to start the FIB production in a clean room environment. In march 2004, new facilities have been built, to increase the manufacturing capability of very high quality FIB columns. This gives more space for production, and also for R&D activity.

Omicron NanoTechnology GmbH

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Nanotechnology has been our everyday business since long before the term ever existed. Founded in 1984 by Norbert Nold, Omicron started business by introducing the SPECTALEED and the legendary Ultra High Vacuum STM 1 as their first and highly successful products. The STM 1, which still delivers state-of-the-art performance even by today's standards in nearly 200 laboratories worldwide, firmly established Omicron's present position as the world market leader in UHV scanning probe microscopy.
Today, our products like, for example, the new NanoESCA or the UHV Gemini Column are right at the forefront of research. We are used to redefining the limits of the technically feasible again and again. More than 500 articles demonstrate this to the full. Many of them were published in leading journals such as Nature, Science, Physical Review Letters or Chemical Review Letters.

Raith GmbH

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For more than two decades Raith GmbH has been developing and selling high-tech systems in the domain of nanotechnology worldwide.

Main areas of operations are designing and manufacturing of systems enabling fabrication of superfine surface structures down to the range of less than 10 nanometers (electron beam lithography) and semiconductor inspection tools for industry (defect review).

Renowned customers such as Infineon Technologies or the Massachusetts Institute of Technology in Boston avail themselves of the know-how Raith has acquired since its early being in business.

With its highly educated staff of physicists, engineers and technicians Raith offers optimum service and support for answers to technical and application related questions.
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Since 1985 Raith has pioneered the way for SEM lithography. Today complete turnkey lithography system solutions complement Raith product portfolio. These systems are used in state-of-the-art research in Physics, Electrical Engineering and other R&D related fields.

Atomic Force F&E GmbH

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Atomic Force F&E GmbH was founded 1998 by employees of Digital Instruments with the objective to develop and distribute highly **sophisticated surface investigation** techniques and instruments. Initially, Atomic Force and Digital Instruments shared the same office. After successful operation in the year 2000 Atomic Force moved then to a new location in Mannheim, Germany on February 1st of 2001.

Atomic Force **continues** to pursue the idea of bringing **new developments** in the field of measurement instrumentation to the laboratories in scientific research and industry, as quickly as possible but always with **sound technical support**. Currently, we offer the MFP Molecular Force Probe, an enhanced Atomic Force Microscope with force resolution in the **piconewton** range and the Q-control module from nanoAnalytics used to improve the AFM performance in **oscillatory AFM** modes. The complete set of Olympus AFM **cantilevers** is also available through Atomic Force F&E, as well as the research oriented **stylus profilers** made by Ambios Technology. E.A. Fischione Inc., supplier of excellent sample preparation equipment for electron microscopy, has also chosen us as their German distributor. If you are located outside Germany, please contact us or E. A. Fischione Inc. for information about your local Fischione representative.

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Institute of Physics Publishing is located in **Bristol**, has an editorial and marketing office in **Philadelphia**, editorial offices in **Tokyo** and **Beijing**, and representatives and agents throughout the world.

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Molecular Imaging is dedicated to providing innovative scanning probe microscopy (SPM) solutions for all academic research and industrial applications. The new PicoPlus microscope is the "all-in-one" solution for applications such as biology, polymers, nanomaterials, electrochemistry...etc, and integrates a number of imaging techniques, such as Scanning Tunneling Microscopy (STM), Low Current STM, Contact Atomic Force Microscopy (AFM), MacMode AFM, including phase imaging, acoustic AC AFM, Lateral Force Microscopy, Current-Sensing AFM, Pulsed Force Mode (PFM), Magnetic Force Microscopy (MFM)...etc.
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Wiley-VCH bundles its publishing activities in the various business areas of natural and engineering sciences as well as economics. The company provides publications with the best possible distribution on an international scale, coupled with a high standard of quality. From providing students with the basic literature needed, via primary research right up to the latest laboratory methods and research results into active substances: company focus on specific areas of expertise covers the entire spectrum of human knowledge.

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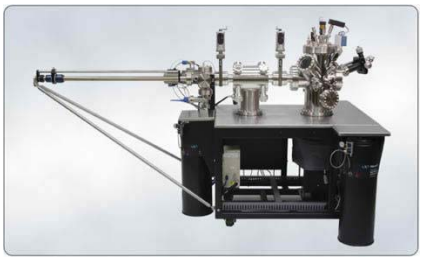

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The Park's AFM XE Series represents breakthroughs in every aspect of AFM technology. The XE Series is the first and only AFM in the market that realizes true non-contact mode in every specification, not just in principle but in practice.
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What is EPISTEP?

EPISTEP is an innovative project supported by the EU "Research and Innovation" strand of the 6th Framework Programme to enhance SME participation in IST European Technology Platforms (ETP) in the Sixth and Seventh Framework Programme. ETPs addressed in the EPISTEP project are:

- Mobile Communications (eMobility)
- Embedded Systems (ARTEMIS)
- Nano-electronics (ENIAC)

What can EPISTEP do for SMEs?

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- learn about new markets and ideas

NanoMEGAS SPRL

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NanoMEGAS was created in 2004 by a team of scientists and experts in the field of electron crystallography and catalysis.

Our tools are dedicated to help ordinary TEM and X-ray users to solve unknown nanocrystal structures using uniquely electron diffraction data in precession mode. Our unique precession interface the **Spinning Star** can be adapted to any commercial TEM (100-300 kV), old as well as brand new, to convert them to powerful structure nanoanalysis tools.

Our scientists have a strong network of collaborations with leading Academic Institutions, including:

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Shubnikov Institute of Crystallography Moscow
University of Stockholm
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Atomistix A/S is a leading provider of software solutions for development of nanotechnology. As the first company in the world, Atomistix has developed a system of integrated software modules based on quantum theory - the Atomistix Virtual NanoLab™ - that can accurately calculate properties associated with electron distribution and transport, and simulate experiments with integrated nanoscale systems. The software is a unique tool to understand, predict and visualize electronic processes in atomic and molecular structures. With the software, nanotechnology scientists and engineers are able to establish competitive advantages by developing materials and designing products with radically new properties and functions.

Since incorporation in October 2003, the company has been working in close collaboration with the Nano-Science Center (http://www.nano.ku.dk) at the Niels Bohr Institute of Copenhagen University, for developing new quantum-chemical algorithms and an intuitive user interface in order to make these methods widely usable.

NanoTimes

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Nanotimes is a French start-up company designing simulation software solutions for **Scanning Probe Microscopy** (SPM).
We wish to help accelerate the development of nanoscience research in order to speed up their transfer to the nanotechnology industry.
Serving the nanoscience community (both private and public), **Nanotimes** markets a range of **software tools** meeting the experimentalists' very specific needs of SPM simulation. Our software tools are designed to reproduce and simulate the information gathered with the SPMs (AFM, STM, NFOM).

Nanotimes' privileged position, very close both to academia and industry, allows the company to supply a **high-value expertise** and consulting service to anyone wishing to get reliable, up-to-date and accurate information on nanotechnology.

FinNano Nanotechnology Programme - TEKES

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Tel. +358-10 521 51.
E-mail: tekes@tekes.fi / WEB: http://www.tekes.fi/finnano/

FinNano technology programme was launched by Tekes in 2005. The total volume of the programme is approx. 70 million euros, including € 25 million in research funding, and € 20 million in corporate financing from Tekes. The duration of the programme is five years, 2005 – 2009. The technology programme is carried out in close collaboration with Academy of Finland's Nanoscience Research Programme .
The FinNano programme studies, exploits and commercialises nanoscale systems and phenomena occurring on a nanoscale. Nanotechnology is horizontal and enabling and is associated with a minimum of three things: scale, functionality and the controllability of nanostructure. The approach is genuinely multidisciplinary.

The objective of the programme is to strengthen Finnish nanotechnology research in selected focus areas and to accelerate the commercial development of nanotechnology in Finland. The programme emphasizes effective use of research results and promotes close collaboration between research and industry.

Enterprises, technology and development centres, educational and research organisations, development companies and organisations serving enterprises participate in the programme.

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SCIENTIFIC PROGRAM - TNT2006		
Sunday - 03 September, 2006		
17h00-19h00	**REGISTRATION: "MINATEC" Congress Centre**	
19h30	**WELCOME RECEPTION** Sponsored by NIMS (Japan)	

TNT2006 - POSTER PRESENTATION DETAILS

Poster size: A0 format (width: 841 mm x Height: 1189 mm)

Session A (PA) - students: From Monday morning to Tuesday evening.
Session B (PB) - seniors: From Wednesday afternoon to Friday lunch time.

Posters from Session A (PA) should be installed on Monday morning and removed on Tuesday between 17h45 - 19h30.

Posters from Session B (PB) should be installed on Wednesday before 13h00 and removed on Friday before 13h00.

K: Keynote Lecture (30 min. including discussion time)
O: Oral Presentation (15 min. including discussion time)
PS: Poster Session

SCIENTIFIC PROGRAM - TNT2006 Monday - 04 September, 2006		
08h00-09h00	**REGISTRATION**	
09h00-09h30	**Welcome and Introduction**	
	Chairman: Masakazu Aono (NIMS, Japan)	
09h30-10h00	**Dan Dahlberg** (University of Minnesota, United States)	**K**
10h00-10h15	**Agustina Asenjo** (CSIC-ICMM, Spain)	**O**
10h15-10h30	**Vitalii Dugaev** (Instituto Superior Tecnico, Portugal)	**O**
10h30-11h30	**Coffee Break - Poster Session A - Instrument Exhibition**	
	Chairman: Dan Dahlberg (University of Minnesota, United States)	
11h30-12h00	**Bernard Dieny** (Spintec, France)	**K**
12h00-12h30	**Juan De La Figuera** (Universidad Autónoma de Madrid, Spain)	**K**
12h30-12h45	**Konstantin Tarasov** (Institute of Solid State Chemistry & Mechanochemistry, Russia)	**O**
12h45-13h00	**Kurt Stokbro** (Copenhagen University, Denmark)	**O**
13h00-15h00	**Lunch**	
	Chairman: Jose-Maria Alameda (Universidad de Oviedo, Spain)	
15h00-15h30	**Flemming Besenbacher** (iNANO, Denmark)	**K**
15h30-16h00	**Mostafa A. El-Sayed** (Georgia Institute of Technology, USA)	**K**
16h00-16h15	**Andrea Csaki** (Institute for Physical High Technology, Germany)	**O**
16h15-16h45	**Duncan Sutherland** (iNANO, Denmark)	**K**
16h45-19h45	**Poster Session A - Instrument Exhibition / Coffee & Refreshments**	**PS**

SCIENTIFIC PROGRAM - TNT2006

Tuesday - 05 September, 2006

"Nanotubes" Session – Sponsored by GDRE

Chairman: Stephan Roche (CEA-DRFMC, France)

08h30-09h00	**Phaedon Avouris** (IBM Research Div., United States)	**K**
09h00-09h30	**Christoph Strunk** (University of Regensburg, Germany)	**K**
09h30-09h45	**Stephen Purcell** (Univ. Lyon 1 CNRS, France)	**O**
09h45-10h00	**Bertrand Bourlon** (California Institute of Technology, United States)	**O**
10h00-10h30	**Laetitia Marty** (University of Montreal, Canada)	**K**
10h30-11h00	**Coffee Break - Poster Session A - Instrument Exhibition**	
	Chairman: Jean-Philippe Bourgoin (CEA Saclay, France)	
11h00-11h30	**Stanley Williams** (HP, United States)	**K**
11h30-12h00	**Thomas Skotnicki** (ST Microelectronics, France)	**K**
12h00-12h30	**Lou Fe Feiner** (Philips Research lab. Netherlands)	**K**
12h30-12h45	**Stephan Egger** (NIMS, Japan)	**O**
12h45-13h00	**Alain Rochefort** (Ecole Polytechnique de Montreal, Canada)	**O**
13h00-15h00	**Lunch**	
	Chairman: Stanley Williams (HP, United States)	
15h00-15h30	**Jean-Philippe Bourgoin** (CEA Saclay, France)	**K**
15h30-16h00	**Pierre Legagneux** (THALES Group, France)	**K**
16h00-16h15	**Imad Arfaoui** (University of Groningen, Netherlands)	**O**
16h15-16h30	**Junji Haruyama** (Aoyama Gakuin University, Japan)	**O**
16h30-16h45	**Claire Berger** (Georgia Institute of Technology, United States)	**O**
16h45-17h00	**Vicenzo Palermo** (ISOF, Italy)	**O**
17h00-17h45	**Coffee Break - Poster Session A - Instrument Exhibition**	

"Nanotechnology in Finland" Session – Sponsored by FinNano

Chairman: Pekka Koponen (Spinverse Consulting, Finland)

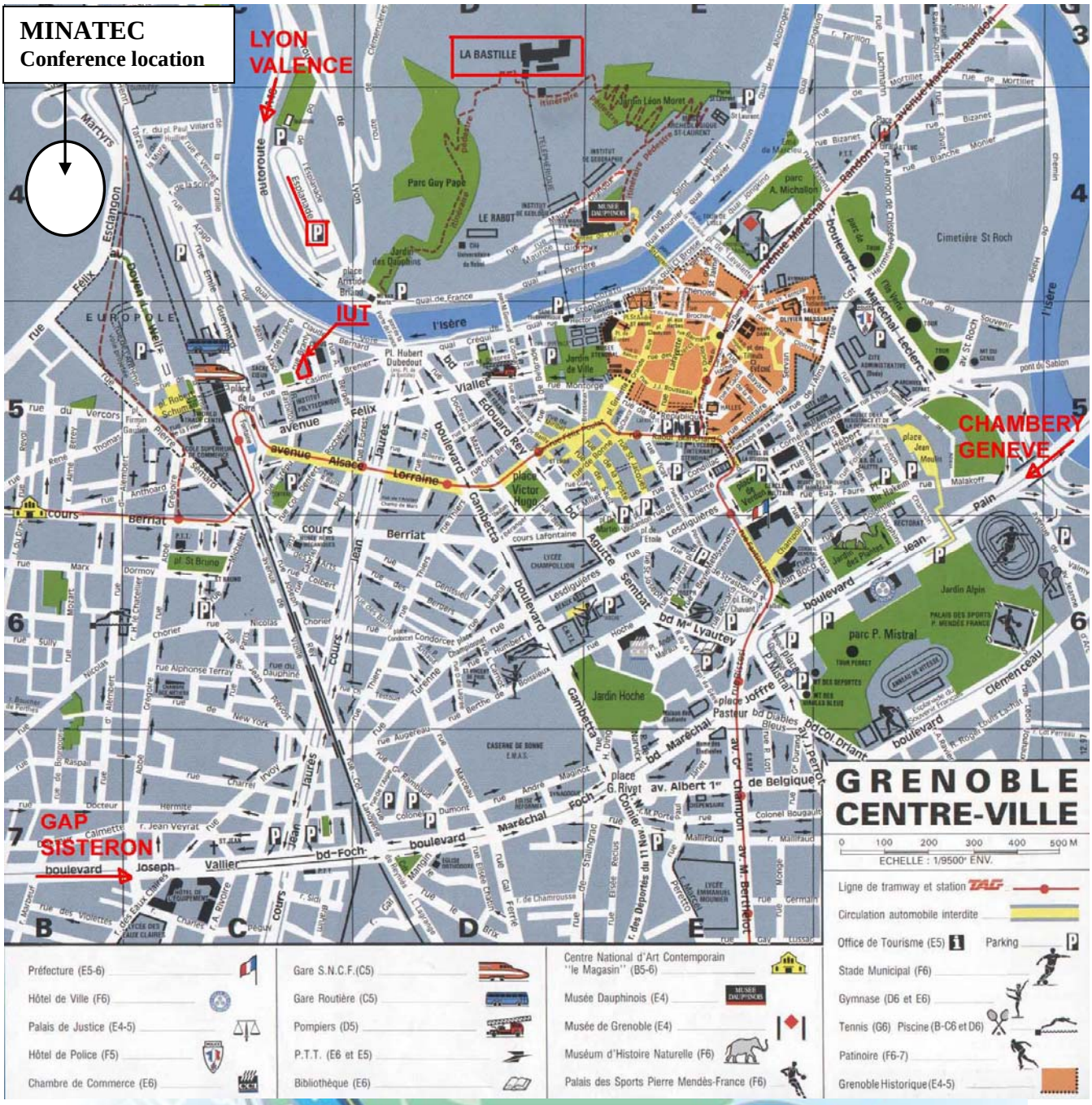
17h45-18h00	**Markku Lämsä** (Tekes, Finland)	**O**
18h00-18h30	**Risto Nieminen** (Helsinki University of Technology, Finland)	**K**
18h30-18h45	**Jari Koskinen** (VTT, Finland)	**O**
18h45-19h00	**Veli-Matti Airaksinen** (Micronova Research Centre - Helsinki University of Technology, Finland)	**O**
19h00-19h15	**Albert Nasibulin** (Helsinki University of Technology & Canatu, Finland)	**O**
19h15-19h30	Speaker to be confirmed (Nokia, Finland)	**O**
19h30	**FinNano Networking Reception (by invitation only)**	

REMINDER: Please note that those posters corresponding to Session A must be removed today between 17:45 and 19:30

SCIENTIFIC PROGRAM - TNT2006		
Wednesday - 06 September, 2006		
Chairman: Juan Jose Saenz (Universidad Autónoma de Madrid, Spain)		
08h30-09h00	**Tsuneya Ando** (Tokyo Institute of Technology, France)	**K**
09h00-09h30	**Jens Norskov** (TU Denmark, Denmark)	**K**
09h30-10h00	**Uzi Landman** (Georgia Tech, United States)	**K**
10h00-10h30	**Coffee Break - Instrument Exhibition** REMINDER: Please note that those posters corresponding to Session B must be installed today before 13:00	
Chairman: Jakob Reichel (Ecole Normale Superieure, France)		
10h30-11h00	**Masakazu Aono** (NIMS, Japan)	**K**
11h00-11h30	**Federico Rosei** (INRS-EMT / Univ. of Quebec, Canada)	**K**
11h30-12h00	**Jun'ichi Sone** (NEC corp., Japan)	**K**
12h00-12h30	**Adrian Bachtold** (ICN-CNM, Spain)	**K**
12h30-13h00	**Cleaton Teague** (NNCO, United States)	**K**
13h00-15h00	**Lunch**	
Chairman: Antonio Garcia Martin (IMM-CSIC, Spain)		
15h00-15h30	**Jakob Reichel** (Ecole Normale Superieure, France)	**K**
15h30-16h00	**Hideaki Takayanagi** (NTT - Tokyo University of Science, Japan)	**K**
16h00-16h15	**Emmanuel Hadji** (CEA-DRFMC, France)	**O**
16h15-16h30	**Juan Jose Saenz** (Universidad Autónoma de Madrid, Spain)	**O**
16h30-16h45	**Peyman Servati** (University of Cambridge, United Kingdom)	**O**
16h45-17h45	**Coffee Break - Poster Session B - Instrument Exhibition**	
Chairman: Robert Baptist (CEA-DRT-LETI, France)		
17h45-18h15	**Ulrich Heiz** (University of Ulm,Germany)	**K**
18h15-18h45	**Alexei Marchenkov** (Georgia Tech, USA)	**K**
18h45-19h15	**Carlos Gonzalez** (NIST, USA)	**K**
21h30	**CONFERENCE DINNER – Domaine Saint-Jean de Chepy**	
00h00	**POSTER AWARDS CEREMONY**	

SCIENTIFIC PROGRAM - TNT2006		
Thursday - 07 September, 2006		
Chairman: Adrian Bachtold (ICN-CNM, Spain)		
09h30-10h00	**Jean-Marc Triscone** (DPMC-University of Geneva, Switzerland)	**K**
10h00-10h30	**Jose Maria Gomez** (Universidad Autónoma de Madrid, Spain)	**K**
10h30-10h45	**Peter Beton** (University of Nottingham, United Kingdom)	**O**
10h45-11h00	**Yan Pennec** (UBC, Canada)	**O**
11h00-12h00	**Coffee Break - Poster Session B - Instrument Exhibition**	
Chairman: Uzi Landman (Georgia Tech, USA)		
12h00-12h30	**Michael Heckmeier** (Merck KGaA, Germany)	**K**
12h30-13h00	**Chad Mirkin** (Northwestern University, United States)	**K**
13h00-15h00	**Lunch**	
"Emerging Nanoelectronics " Session – Organised in collaboration with EU/IST/FET initiative ***Chairman: Patrick Van Hove (European Commission - IST/FET, Belgium)***		
15h00-15h15	**Patrick Van Hove** (European Commission - IST/FET, Belgium)	**O**
15h15-15h45	**Christian Joachim** (CNRS-CEMES, France)	**K**
15h45-16h15	**Lars Samuelson** (Lund University, Sweden)	**K**
16h15-16h30	**Jari Kinaret** (Chalmers University of Technology, Sweden)	**O**
16h30-16h45	**Charles Gould** (Universität Würzburg, Germany)	**O**
16h45-17h15	**Yuji Kuwahara** (Osaka University, Japan)	**K**
17h15-19h30	**Coffee Break - Poster Session B - Instrument Exhibition**	**PS**
20h30	**Reception: Michel Destot (Mayor of Grenoble) & Visit: Grenoble Museum**	

SCIENTIFIC PROGRAM - TNT2006		
Friday - 08 September, 2006		
Chairman: Carlos Gonzalez (NIST, USA)		
08h30-09h00	**Daniel Sanchez-Portal** (CSIC-UPV/EHU - DIPC, Spain)	**K**
09h00-09h15	**Herve Ness** (CEA-Saclay, France)	**O**
09h15-09h30	**Juan Jose Palacios** (Universidad de Alicante, Spain)	**O**
09h30-09h45	**Natalio Mingo** (NASA-Ames Center of Nanotechnology, United States)	**O**
09h45-10h00	**Yoshiyuki Miyamoto** (NEC, Japan)	**O**
10h00-10h30	**Coffee Break - Poster Session B – Instrument Exhibition**	
Chairman: Daniel Sanchez-Portal (CSIC-UPV/EHU - DIPC, Spain)		
10h30-11h00	**Roland Wiesendanger** (University of Hamburg, Germany)	**K**
11h00-11h30	**Gerald Dujardin** (Universite Paris Sud, France)	**K**
11h30-11h45	**Benjamin Grevin** (CNRS-CEA-UJF, France)	**O**
11h45-12h00	**Silvia Karthäuser** (CNI, Germany)	**O**
12h00-12h15	**Dominic Tessier** (CTT Group, Canada)	**O**
12h15-12h30	**Sigrid Weigelt** (University of Aarhus, Denmark)	**O**
12h30-13h00	**Mark Welland** (Cambridge University, United Kingdom)	**K**
13h00-13h15	**CLOSING REMARKS & TNT2007 ANNOUNCEMENT**	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Stade Municipal (F6)
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Tennis (G6) Piscine (B-C6 et D6)
Patinoire (F6-7)
Grenoble Historique (E4-5)


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At this new edition of the Trends in Nanotechnology conference we are pleased to introduce the TNT2006 "Passport to Prizes" program.

How does the "Passport to Prizes" program work?

Each TNT2006 conference attendee will find a passport card inside his TNT2006 conference bag. You will take your card around the exhibit hall on Monday, Tuesday and Wednesday. Take this opportunity to visit the stands that the exhibitors have prepared, and to learn about the companies and their new products. Each exhibiting company has received a stamp with a number. Attendees will be responsible for collecting stamps from the participating exhibitors that are listed on their passport.

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Keynote Contributions

Oral Contributions

Alphabetical Order

ABSTRACTS

KEYNOTE CONTRIBUTIONS

(Only those abstracts received before 8/18 will be included in the abstracts' booklet)

THEORY OF QUANTUM TRANSPORT IN CARBON NANOTUBES

- Absence of Backscattering and Inter-Wall Conductance -

Tsuneya Ando

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A carbon nanotube is a rolled two-dimensional graphite sheets with a nano-meter size diameter discovered by Iijima [1]. Characteristic and essential features of its electronic properties are obtained best in an effective-mass scheme in which the electron motion is equivalent to that of a neutrino or a relativistic Dirac electron with vanishing rest mass [2,3]. In particular, the neutrino description leads to extremely interesting properties of the electron transport.

For potential scattering, in particular, it was shown that in metallic nanotubes there is no backscattering even in the presence of scatterers unless their potential range is smaller than the lattice constant of a two-dimensional graphite [4,5]. When the Fermi level moves away from the energy range where only linear bands are present, interband scattering comes into play because of the presence of several bands at the Fermi level [6]. Even in such a case, a perfectly conducting channel transmitting through the system without being scattered back has been shown to exist and the conductance is always larger than $4e^2/h$.

The absence of backscattering is related to the presence of a topological singularity of Hamiltonian giving rise to Berry's phase under a rotation around the origin in the wave-vector space [5]. It is related also to the special kind of time reversal symmetry present in the effective-mass Hamiltonian [6]. This symmetry can be destroyed by a magnetic field perpendicular to the axis, an Aharonov-Bohm magnetic flux (which is equivalent to finite curvature effects and lattice deformation), the presence of scatterers with potential range much smaller than the lattice constant, a higher-order **k.p** term giving rise to a trigonal warping of the band, inelastic scattering destroying phase coherence, etc.

We performed extensive numerical calculations of the conductance of a metallic nanotube as a function of the length in the presence of such symmetry breaking perturbations such as inelastic scattering [6], a magnetic field and flux [7], short-range scatterers [8], and trigonal warping [9]. The results show that the perfect channel can easily be destroyed even by a very small perturbation when there are several bands at the energy, while it is very robust in the energy range of metallic linear bands. Similar results were obtained for phonon scattering at room temperature [10]. Effects of the symmetry change due to various perturbations were demonstrated also by the study of the degree of the localization in the presence of Aharonov-Bohm magnetic flux [11].

In multi-wall carbon nanotubes the lattice of adjacent tubes is incommensurate as in double-wall tubes [12,13]. One important issue is effects of inter-tube transfer on electronic properties of constituent single-wall nanotubes. Some experimental attempts of the measurement of the inter-tube conductance in telescoping tubes were reported [14,15]. Effects of inter-tube interactions on transport can be studied in model double-wall tubes consisting of metallic outer and inner tubes in a nearest-neighbor tight-binding model including only π orbitals [16-18].

The inter-tube transfer at each lattice site oscillates around zero in a complex plain as a function of position in a quasi-periodic manner and therefore cancels each other when being summed up. The cancellation is not perfect in the presence of sharp edges, giving rise to an inter-tube conductance much smaller than e^2/h (typically 10^{-4} e^2/h) and determined by the structure at edges. The conductance exhibits a wild and almost irregular oscillation as a function of the length with average and fluctuations independent of the length due to the change of the edge structure. The importance of edges can be demonstrated by the fact the conductance decreases rapidly and vanishes when the inter-wall coupling is varied smoothly over the distance of the order of the lattice constant of the two-dimensional graphite. Further, the cancellation becomes incomplete in the presence of scatterers, showing that inter-wall conductance is induced by disorder [19].

This work was supported in part by a 21st Century COE Program at Tokyo Tech “Nanometer-Scale Quantum Physics" and by Grant-in-Aid for Scientific Research from Ministry of Education, Culture, Sports, Science and Technology Japan.

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ELECTRICAL CONDUCTIVITY OF LOW-DIMENSIONAL NANOSTRUCTURES

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Since 1998, the authors and co-workers have developed multi-probe scanning tunneling microscopes (MPSTMs), in which two, three or four probes are operated independently[1)]. All probes of the MPSTMs can observe STM images independently, but the main role of the multiple probes is to be used as nanoscale electrodes that can contact any points selected in an observed STM image. It is therefore possible to measure electrical conductivity at the nanoscale through the multiple probes. By using MPSTMs and related methods, we measured the electrical conductivity of organic and inorganic nanowires, i.e., single-walled carbon nanotubes (SWCNTs), erbium disilicide (ErSi2) metallic nanowires and polymerized short chains of fullerene (C_{60}) molecules. For SWCNTs and $ErSi_2$ nanowires, ballistic conduction was observed at lengths less than about 400 and 20 nm, respectively, at room temperature; at larger lengths, diffusive conduction with conductivities of about 10 and 1 kΩ/nm, respectively, was observed at room temperature. As for polymerized C_{60} short chains, their conductive state can be changed into an insulating state due to depolymerization of C_{60} molecules caused by the application of an appropriate voltage.

1) M. Aono, C.-S. Jiang, T. Nakayama, T. Okuda, S. Qiao, M. Sakurai, C. Thirstrup, Z.-H. Wu: Oyo Butyri (Applied Physics) 67, 1361 (1998) (in Japanese); A brief English abstract is available on INSPEC.

CARBON NANOTUBE ELECTRONICS AND OPTOELECTRONICS

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Carbon nanotubes (CNTs) have properties that strongly recommend them for applications in both nano- and opto-electronics. [1] Although a variety of different electronic devices based on CNTs have been demonstrated, most of the emphasis has been placed on CNT field-effect transistors (CNTFETs). These devices have in many respects characteristics superior to conventional devices. However, they also pose a set of new challenges. These include understanding the new 1D transport physics, the increased electrical noise [2], the Schottky barriers at CNT-metal contacts [3], their ambipolar character [4], the new scaling laws [5], and finding technical solutions [6] to these problems. Both single nanotube devices and multi-component single nanotube circuits [7] will be discussed. Our initial efforts to self-assemble CNTFET devices will also be discussed [8].

We are also evaluating CNTFETs as electro-optical devices. We have used ambipolar (a-) CNTFETs to simultaneously inject electrons and holes from the opposite terminal of the FET. A fraction of these recombines radiatively to produce an electrically-excited, single nanotube molecule light source [9]. Unlike conventional p-n diodes, a-CNTFETs are not doped and there is no fixed p-n interface. Thus, the emitting region can be translated at will along a CNT channel by varying the FET gate voltage [10]. We have found that much stronger localized electroluminescence can be generated at defects or inhomogeneities that introduce potential drops [11]. The emission is the result of intra-molecular impact excitation of electron-hole pairs by the hot carriers. Localized electroluminescence provides a high brightness IR source and a novel probe of defects, charging, and inhomogeneities which are otherwise difficult to observe. The reverse process of recombination, i.e. the photogeneration of carriers in a single nanotube CNTFET channel [12], will also be discussed.

[1] For reviews see: Ph. Avouris, *MRS Bulletin* **29**, 403 (2004); *Proc. IEEE* **91**, 1772 (2003); P.L. McEuen, et al., *IEEE Trans. Nanotechnol*. **1**, 78 (2002).
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FOUR-POINT RESISTANCE OF NANOTUBES

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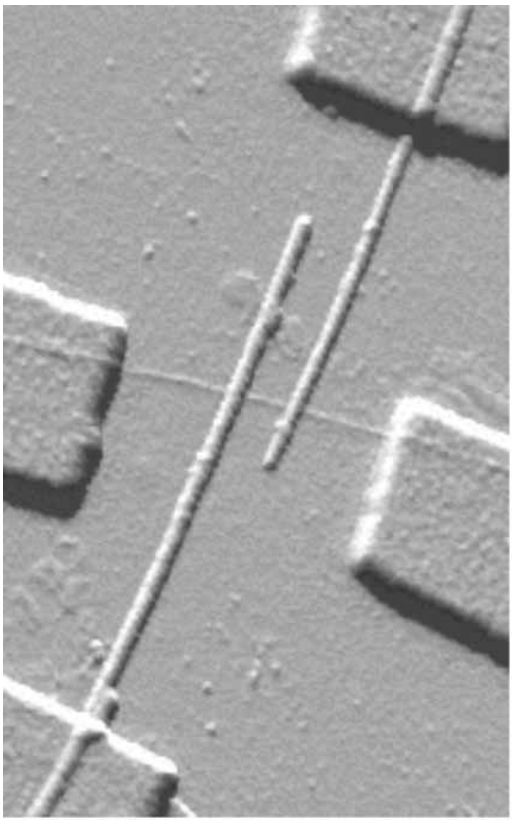
We have studied the resistance of single-wall carbon nanotubes (SWNT) measured in a four-point configuration with noninvasive voltage electrodes [1]. The voltage drop is detected using multiwalled carbon nanotubes while the current is injected through nanofabricated Au electrodes. The resistance at room temperature is shown to be linear with the length as expected for a classical resistor. This changes at cryogenic temperature; the four-point resistance then depends on the resistance at the Au-SWNT interfaces and can even become negative due to quantum-interference effects.

Reference:

[1] B. Gao, Y.F. Chen, M.S. Fuhrer, D.C. Glattli, A. Bachtold, Phys. Rev. Lett. **95**, 196802 (2005).

Figure:



ORGANIC MOLECULES ON SURFACES STUDIED BY STM: DYNAMICS, CHIRALITY, ORGANIZATION AND SELF-ASSEMBLY.

Flemming Besenbacher (fbe@inano.dk)

Interdisciplinary Nanoscience Center (iNANO)
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Adsorption and organization of organic molecules on solid surfaces is central to self-assembly and bottom-up fabrication within nanoscience and technology. The Scanning Tunneling Microscope allows exploration of atomic-scale phenomena occurring at surfaces: Dynamic processes can be followed by fast-scanning STM and from data acquired at a range of temperatures; detailed information on kinetic parameters can be extracted. In the talk, a number of studies investigating dynamics and organization of organic molecules on metal surfaces under Ultra-High Vacuum conditions will be described.

First the fundamental process of surface diffusion will be discussed, and the case of metal adatoms [1] will be compared to the considerably more complicated situation arising when molecular adsorbates with many internal degrees of freedom migrate on surfaces. In the latter case, the molecular properties can be tailored to control the molecular diffusion properties [2], and the diffusion can be influenced by the molecular adsoption geometry, as shown by molecules that have assumed metastable adsorption sites either spontaneously [3] or through STM manipulation [4].

Secondly, the fascinating field of chiral adsorption will be addressed. Chirality is the property of molecules to have a handedness, either inherently or due to loss of symmetry elements upon adsorption. In the case of the amino acid cysteine on gold surfaces, STM was used to examine intermolecular chiral recognition [5] and also the interaction of molecules with chiral sites on a metal surface [6].

Finally, the themes of dynamics and chirality will be combined, describing recent results in which we have investigated chiral switching by spontaneous conformational changes in a molecule belonging to a family of oligo-phenylene-ethynelenes [7]. The switching mechanism has implications for chiral ordering on surfaces and various ordered structures formed by this family of molecules will be discussed.

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SELF-ASSEMBLING CARBON NANOTUBES FOR ELECTRONICS

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During the last five years, Carbon Nanotubes have been shown to be very promising building blocks for nanoelectronics. Indeed, they exist as semiconducting or metallic wires and have been used to fabricate nm-scale devices like transistors, diodes, NEMs or SET (single electron transistor) for example. The future of SWNT-based devices in nanoelectronics is to a large extent related to the development of bottom-up self-assembly techniques. In this talk, the focus will be on the self-assembled nanotube devices that were developed recently at the LEM.
I will show how carbon nanotubes(NTs) can be self-assembled at predefined location of a substrate using a localized functionalization of the substrate by a patterned self-assembled monolayer[1,2]. Three examples of application of that technique to the realization of devices will be presented:

- Field effect transistors devices prepared in that way prove functional with state-of-the-art performances[3,4]. Their high frequency (GHz) behaviour was investigated and a high frequency equivalent circuit was derived for the first time[5]. The role played by the environment (including that of the self-assembled monolayer directing the deposition of the NTs and that of molecules adsorbed on the NTs) on the CNTFET devices characteristics will also be discussed. It will be shown in particular how a chemical treatment of the devices can be used to drastically improve the performances of the CNTFET[3,4].
- Further elaborating upon the chemical tailoring of the self-assembled CNTFET devices, a new class of devices consisting of optically gated CNTFET or memories has been developed and will be presented[6].
- New nano electromechanical systems(NEMS) based on nanotubes can also be self-assembled with that technique, that function as very efficient switches with the current changing by several orders of magnitude within a 100mV change of the actuating electrode bias[7]. Nanotubes are indeed quite promising as core elements of NEMS. Clearly, the development of such NEMS requires understanding the interplay between the physical, geometrical and electrical parameters of the system. I will show that these parameters and the deflection efficiency of MWNTs are related through a scaling law of general validity that can be used as an efficient dimensioning tool for nanotube NEMS[8].

Finally, the improvements of the self-assembling technique using the recognition properties of biomolecules will be presented[9].

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MAGNETISM AT THE NANOSCALE: A VOYEUR'S TALE

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There has been a renaissance in magnetism in the last decade or so. In the area of micromagnetics (although in the modern context it should be nanomagnetics), major breakthroughs have resulted from the development of new magnetic imaging techniques [1]. A powerful magnetic microscope is the magnetic force microscope (MFM), a variant of the atomic force microscope.
One of the frontiers in magnetism being pushed back is to understand the domain structure and the magnetization reversal in nanometer sized particles. We have utilized the high resolution MFM (30nm) we developed [2] to increase our fundamental understanding of magnetism on this length scale. First I will present a very elementary introduction to micromagnetics research and a description of MFM with a hands on demonstration of the basic principle. I will then present our recent investigations of the magnetic domain structure in Ni dots with diameters ranging from 40nm to 1700nm [3]. The dots and unpatterned witness films possess a substantial perpendicular-to-the-plane anisotropy which results in the witness films having stripe domains with a period on the order of 200nm for the magnetization perpendicular to the film plane. In the dots, the magnetic domain states fall into two general magnetic domain classifications: stripe domains, and ring domains. The specific stripe and ring structures differ for the different dot diameters. In both the experiments and the simulations, a convenient dimensionless parameter for predicting which of the specific magnetic states will occur is the ratio of the dot diameter to the stripe period. The abundances of each specific domain structure as a function of the dot diameter to stripe width ratio has been experimentally determined. Given the consistency between the experiments and the simulations, one can be confident the simulations accurately provide information on the magnetization well below the HRMFM resolution.

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SPIN-POLARIZED LOW ENERGY ELECTRON STUDIES OF ULTRA-THIN MAGNETIC FILMS

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Low-energy electron microscopy (LEEM) offers the possibility to measure directly and in real time, during in-situ during deposition, properties of films as a function of film thickness. When a spin-polarized electron source is used for illumination [1], a powerful method (SPLEEM) providing detailed view of magnetic properties is obtained. It currently achieves a resolution of 10 nm, and up to video-rate imaging. In this work we will discuss selected studies to highlight some advantages and limitations of this technique.

In this type of microscopes, a beam of electrons is reflected from a surface to form a magnified real space image of the surface [2]. Imaging rate is sufficiently fast for dynamic studies [3]. In addition there is access to local-area diffraction information [4] and dark-field imaging modes mixing real-space and reciprocal space information [5]. The technique is still being extended, both in its application to new physical problems [6] and in terms of improving its capabilities, for example through the planned addition of aberration correction optics in the near future[7].

We will present results in ferromagnetic films, where we imaged defect-free film regions in which thickness is perfectly homogeneous on the atomic scale. We couple the observations to fully relativistic ab-initio calculations.

When we deposit films of Co onto Ru(0001) substrates in the thickness range of up to 3 atomic monolayers, SPLEEM reveals that the easy axis of magnetization switches twice in this range: both one-monolayer and three-monolayer thick regions are magnetized in a direction within the film plane, while two-monolayer thick Co/Ru(0001) regions are magnetized perpendicular to the film plane. By measuring the thickness-dependent relaxation of epitaxial strain in the Co layers and combining the experimental information with ab-initio computations of the magnetic anisotropy energy, we show how the unusual layer-by-layer double-spin-reorientation transition results can be understood in detail [8].

Moreover, we find rather curious, additional possibilities to induce dramatic changes of the magnetism by adding atomic monolayers of non-magnetic material on top of the Co films. When we add just one single atomic Cu layer on top of in-plane magnetized Co/Ru(0001) films of three or four monolayer thickness, the magnetization axis switches to the direction perpendicular to the film plane. Adding just one additional Cu atomic layer flips the magnetization again to an in-plane configuration.

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NEW WRITE SCHEMES FOR MAGNETIC NON-VOLATILE MEMORIES: THERMALLY ASSISTED AND SPIN TRANSFER WRITING

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Magnetic Random Access Memories will probably become a major area of applications of spin electronics. However, the R&D in MRAM started almost 10 years ago and MRAM chips are not yet on the market due to write selectivity issues which still need to be fixed in an efficient way in terms of density and energy consumption. In this study, we have investigated two new ways to selectively write in MRAM cells i.e. switch the magnetization of the soft layer in current perpendicular to plane (CPP) spin-valve nanopillars of the form F/NM/R/AF. F is a ferromagnetic soft layer (typically NiFe 5nm), NM is a non-magnetic spacer layer made of Cu (fully metallic stack) or Alumina (magnetic tunnel junction) typically 4nm thick, R is a reference ferromagnetic layer of pinned magnetization (CoFe 3nm), AF is an antiferromagnetic pinning layer (IrMn 8nm). The diameter of the pillars are in the range 70-150nm.

The first method is based on a thermally assisted write scheme: A short pulse of current (typical width~1ns) is sent through the pillar for the write process. This pulse heats the free layer of the pillar and reduces its switching field (See Fig.1). A weak DC field is simultaneously applied on the structure, which allows switching the magnetization in the desired direction. A particularly interesting embodiment consists in using an exchange biased soft layer with a relatively low Néel temperature (~180°C). The heating allows to unpin the magnetization of the free layer and switch it. The dot then cools down and its magnetization freezes in the new direction (Fig.1). This write technique is very promising for Magnetic Random Access Memories since it offers perfect write selectivity, solves the issue of superparamagetic limit and even allows multilevel storage.

The second method is based on the spin torque exerted by a spin polarized current flowing through a magnetic nanostructure on its magnetization. This effect predicted by Slonczewski and Berger in 1996 was later on observed in Co/Cu/Co sandwiches. We showed that it also exists in much more complex structures such as the CPP spin-valves developed for magnetoresistive heads used in computer disk drives (Fig.2). While in heads this effect is a source of noise and should be reduced, in the context of MRAM or magnetic logic gates, it can be used as a very efficient new write scheme offering also perfect write selectivity.

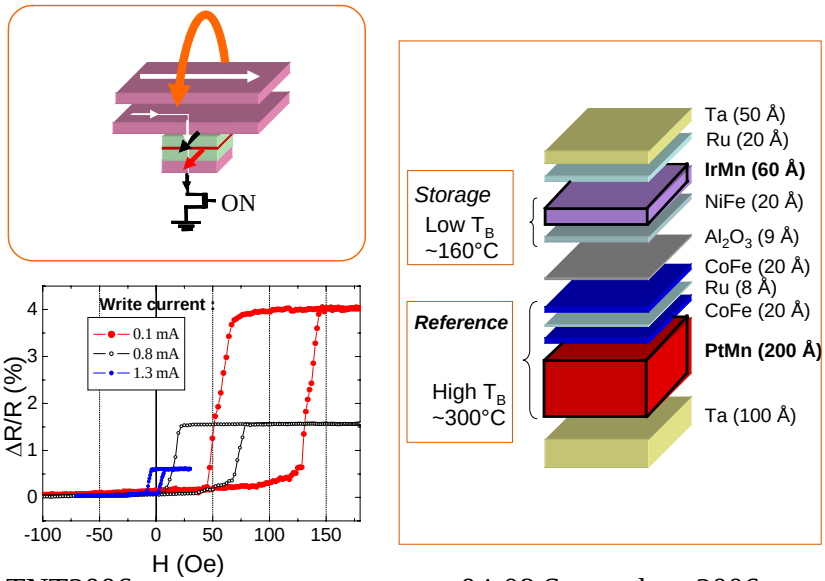

Fig.1 : Illustration of the principle of operation of a Thermally Assisted Magnetic_RAM

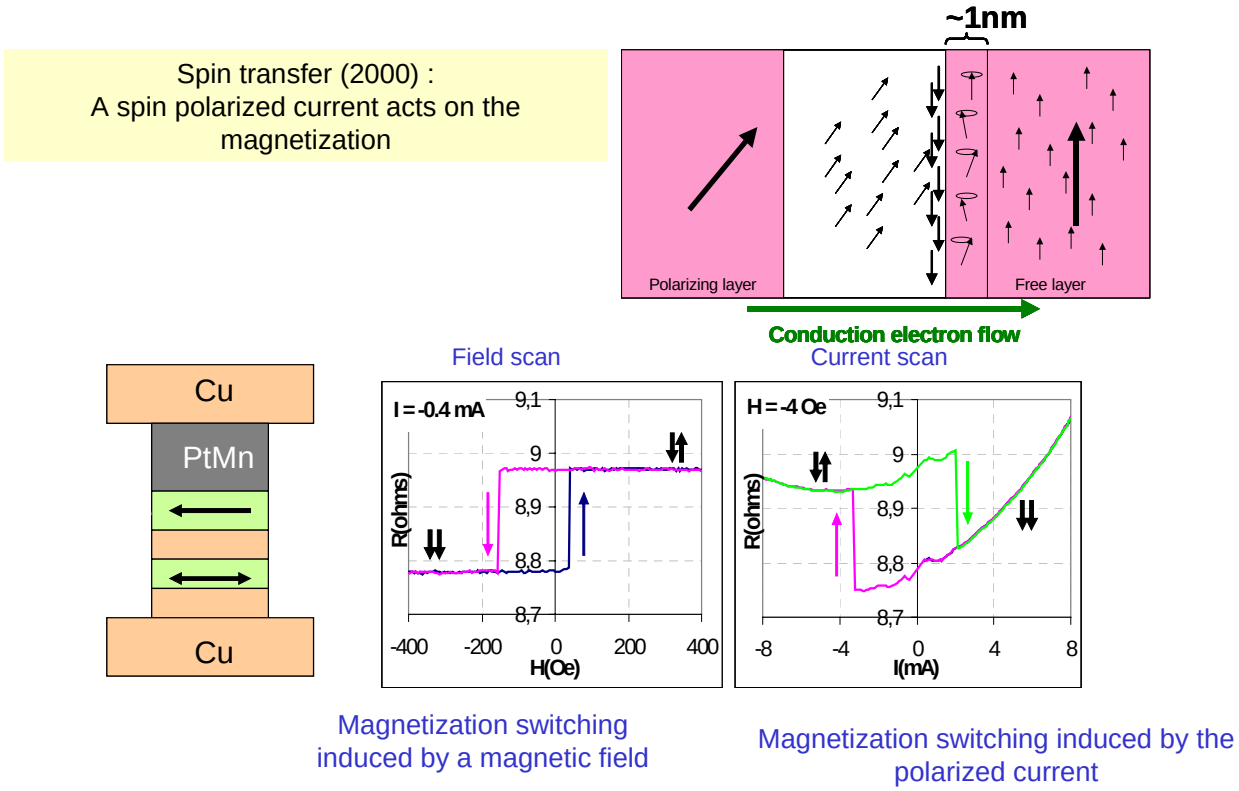

Fig.2 : In a pillar of composition Cu/CoFe 3nm/Cu 4nm/CoFe 2.5nm/PtMn 20nm, the magnetization of the unpinned CoFe layer can be switched either by an external field or by a current flowing perpendicular to the plan of the layers.

ATOM-SCALE ELECTRONIC PROCESSES

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The control of electronic processes is becoming possible not only at the level of a single atom but moreover inside a single atom or inside a single molecule , i.e. with a spatial resolution (≈ 50 pm) smaller than the atomic or molecular size, by using a low temperature STM. Charge injection into a single atom or molecule can activate specific functions such as a reversible bistable movement. We will show that the bistable dynamics can be modified by varying the precise localisation of the charge injection inside the atom or the molecule. This demonstrates that charge injection into a nanoscale device needs to be performed with a very high precision at the atomic-scale for a reliable operation of its electronic properties. However, this opens new perspectives in molecular electronics for controlling the intrinsic performances of a single molecule.

WHY ARE GOLD NANOPARTICLES MORE PRECIOUS THAN PRETTY GOLD: PROPERTIES AND APPLICATIONS IN MAKING NANO-MOTORS & IN CANCER DIAGNOSTICS AND LASER SELECTIVE PHOTO-THERMAL THERAPY

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Abstract

Many new fields such as optoelectronics, sensors, Nanocatalysis, Nanomotors and NANOMEDICINE make use of the exciting properties of gold and silver nanoparticles. They absorb and scatter light orders of magnitudes stronger than other materials. This is due to the coherent surface plasmon oscillation of the free electrons in the conduction band.

We used the enhanced scattering property in imaging and thus detecting single cancer cell once nanoparticles are conjugated to cancer cell antibodies.[4] The enhanced absorbed light energy is rapidly converted into heat in one picosecond)\. This causes rapid temperature rise that leads to heating the surrounding, to melting the surrounding cells, to melting the nanoparticles themselves or to ablating atoms from the nanoparticles. These photothermal properties will be shown to be useful in many applications such as making nano-motors and when conjugated to antibodies, they can be used in selective laser photothermal therapy of cancer.[5] For in-vivo cancer applications[6], gold nanorods that absorb and scatter light in the near IR region is used. Near IR radiation has a better tissue transmission for in-vivo applications.

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III-V NANOWIRES FOR VERTICAL DEVICES ON SILICON

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Integration of III-V semiconductors with silicon has been a longstanding goal, as it would offer an excellent opportunity for fuller exploitation of the attractive (opto)electronic (direct bandgap) and electronic (high mobility) properties of III-V semiconductors by means of the existing reliable and cost-effective silicon-based technology. Until now the mismatch in lattice constants and thermal expansion coefficients have hampered progress. Recently semiconductor nanowires have emerged as the most promising candidates to meet this challenge, since nanowires from various III-V materials (InP, GaAs, GaP and InAs) have been grown epitaxially on germanium[1] as well as on silicon[2] substrates using the vapour-liquid-solid (VLS) growth mechanism.

In this contribution I will report on the exploration of the potential of III-V semiconductor nanowires grown on silicon for the fabrication of electronic devices such as bipolar and field effect transistors. Critical for the device performance is the quality of the interface between the III-V nanowire and the silicon substrate. Therefore detailed structural characterization has been carried out by means of scanning electron microscopy (SEM) and transmission electron microscopy (TEM) in order to asses the epitaxial growth and the quality of the heterointerface.

In order to improve the transport and optical properties within the nanostructure more complex structures including segments of different III-V materials and core/shell structures have been investigated. Of particular interest is the realization of vertical devices as the first step towards the fabrication of arrays of nanowire devices. Results on three-terminal field effect devices with a wrap gate will be presented.

At very small wire diameter quantum effects become important: the nanowires become quasi-onedimensional and deviations from bulk semiconductor physics develop. A brief discussion of the relevant length scales will be given, and implications for optical and transport properties will be pointed out.

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PHASE TRANSITIONS IN PB/SI(111) AND PB/GE(111): TRUE VARIABLE TEMPERATURE STM EXPERIMENTS

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NEW BUSINESS ENABLED BY ADVANCED MATERIALS

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In this presentation we want to give an overview about our activities in the field of advanced materials, which we consider as enabler for new business.
From a business perspective it is important to understand, that the customer or end-user does not at care at all, whether a new product is based on an effect in the nano-, micro- or any different length scale. Important is performance and added value, but not underlying technology details.

Inorganic materials play an important role as performance enhancer in existing and newly emerging products. We highlight some research and development examples in the fields of coatings and optics.
Inorganic materials on carrier substrates provide the basis for interference pigments, which will be introduced briefly. While the major focus here will be colour effects also the functional application for heat reflection will be shown.
Based on a core-shell particle concept we present a method that provides large-scale photonic crystal foils. Unique colour effects are generated for decorative and functional applications.
Size adjusted ZnO particles provide after surface modification and the unique property of optimal UV absorption in combination with full transparency in the visible wavelength range and long- term stability.
A mono-layer anti-reflex coating for photovoltaics applications on the basis of SiO2 sol-gel is presented, which significantly improves the efficiency of solar cells.

Our activities in the development of new organic materials will be presented, comprising mainly materials for Organic Light Emitting Diodes (OLED) and materials for Organic Electronics (OE).
Our OLED developments will be introduced. Specifically the polymer development will be highlighted. Based on polymers for red green and blue emission, we will introduce the concept of polymers for white emission.
Materials for OE are developed for future applications. We will introduce the background of OE from a business perspective and show, how we approach such emerging markets with new materials developments. The current performance status of our semi-conducting polymers will be presented.

CLUSTERS ON SURFACES: MATTER IN THE NON-SCALABLE SIZE-REGIME

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The reactivity and optical properties of nanoscale systems are mainly dominated by quantum-size effects that govern the electronic spectra of clusters, by the structural dynamical fluxionality of clusters, as well as by impurity-doping effects. In this talk these fundamental and unique cluster properties will be illustrated by specific examples obtained from molecular beam experiments in the gas phase and experiments on size-selected clusters on surfaces. Where possible, concepts for their understanding are given.

Specifically, in the first part of the talk results on the optical properties of small gold clusters on amorphous silica will be presented, where Cavity Ringdown Spectroscopy is used to measure optical transitions of clusters at surfaces with extremely high sensitivity. In the second part of the talk an overview of the results on the catalysis of gold clusters is presented.[1-4] By combining these experimental data with ab-initio calculations, a picture of the peculiar catalytic behavior of gold is now emerging.

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LOGIC GATES INTEGRATED IN A SINGLE MOLECULE : THE EUROPEAN PICO-INSIDE INTEGRATED PROJECT

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The integration of a single logic gate inside a single molecule requires 5 different step :

(1) A clear choice of the intramolecular architecture to perform a logic function.
(2) An atomic scale technology to precisely perform the in and out on a single molecule in a multi-access planar technology with a precision better than 0.05 nm.
(3) An interconnection technology from the atomic scale to the macroscopic scale respecting the atomic precision of the measurement performed on the single molecule logic gate.
(4) A good design and chemical synthesis to get the molecular board where the logic gate is integrated but also all the ancillary equipments for the molecule to behave as expected on the surface in the middle of the N atomic wires or pads.
(5) A good molecular surface science theory to be able to predict the conformation and adsorption sites of the large logic gate molecule in the N-electrode planar nano-junction taking into account the electronic band structure of the surface (number of atoms involved larger than 10 000)

With an atomic scale technology perspective, the European Pico-Inside integrated project was set up in September 05 to explore how those 5 steps can be firmly established to invent a new technology of computation away from the Moore's law roadmap. The first results of Pico-inside will be presented.

ELECTRON TRANSPORT PROPERTY IN ORGANIC MOLECULAR WIRES

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Nanoarchitectures of organic molecules, particularly organic molecular layers on solid surfaces, are highly attractive in view of the future applications of nanotechnology. It is important both to control their electrical conduction and to evaluate their conduction mechanism. Polydiacetylene (PDA) is one of the candidate materials for conducting molecular wires used in the interconnection of devices, because it is a fully π-conjugated conducting polymer [1]. In the conjugated conducting polymers, the charges generated upon doping or photoexcitation are stored in localized defects, which are solitons, polarons, or bipolarons. They function as charge carriers and their electronic states appear within the band gap. They degenerate upon further doping and promote the formation of a half-filled metallic band consisting of the polaron lattice [2]. However, in an individual polymer backbone, i.e., an isolated polymer wire, the capability and mechanisms of electrical conduction are still controversial.

We evaluated the electrical conduction of PDA thin films in the region under 20 μm using a laboratory-built independently-driven double-tip scanning tunneling microscope (DT-STM) [3]. The 10,12-nonacosadiynoic acid molecule ($CH_3(CH_2)_{15}C{\equiv}CC{\equiv}C(CH_2)_8COOH_3$) was used as a diacetylene compound. The Langmuir-Blodgett method was used for sample preparation. After the three layers of the polydiacetylene thin film was prepared, the resistance was obtained from the current with fixed applied voltage between two tips when the tip-tip distance is changed under 20 μm using the DT-STM [4]. It was indicated that the resistance of the PDA thin films was proportional to tip-tip distances, suggesting one-dimensional conduction along the PDA backbones. The conductivity of the PDA thin film was estimated to be 4×10^{-6} S/cm, which was 5 orders of magnitude higher than that in the previous report. Moreover, we measured the conductivity of the intentionally iodine-doped PDA thin films using the DT-STM. The obtained results showed that one-dimensional conduction was maintained after iodine doping and a significant increase of the conductivity (3×10^{-3} S/cm) was observed [5]. These results strongly suggested that the intrinsic conductivity of PDA thin films could be observed because the tip-tip distance was sufficiently small for detecting the conductivity of highly ordered regions without domain boundaries.

We have also succeeded in controlling the fabrication of a linear PDA wire using a scanning tunneling microscope (STM) probe tip on a self-assembled monomolecular layer (Fig.1) and evaluated its electronic structure [6,7]. Spectroscopic results of the individual polydiacetylene nanowire revealed the theoretically predicted π-band and band edge singularities, which are characteristics of the one-dimensional π-conjugated polymer. Furthermore, under a high electric field applied on the polymer wire, the spectrum perceives a narrow band gap due to the polaron injection [7]. When much further high field was applied on the wire (> 4.5 V/nm), we observed that an avalanche current flow arised abruptly (Fig.2) [8]. This large current flow in the STM system means a sudden decease of the resistance betwen tip and substrate. We consider that such large current flow is originated from an

electrical property of the polymer wire, which was generated by dynamic modulation of polaron/bipolaron injections. The high density of polaron injection into polymer wires might modulate the wire electronic property into high conductivity like transition to a metallic phase.

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Figures:

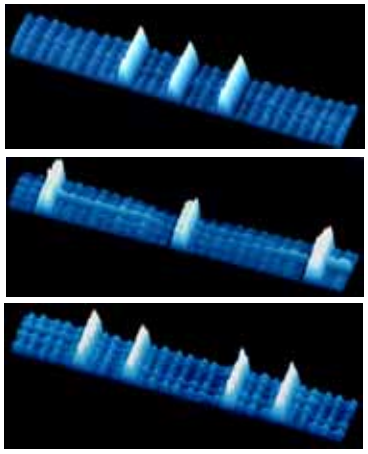

Figure 1. STM images of PDA molecular arrays fabricated with different intervals.

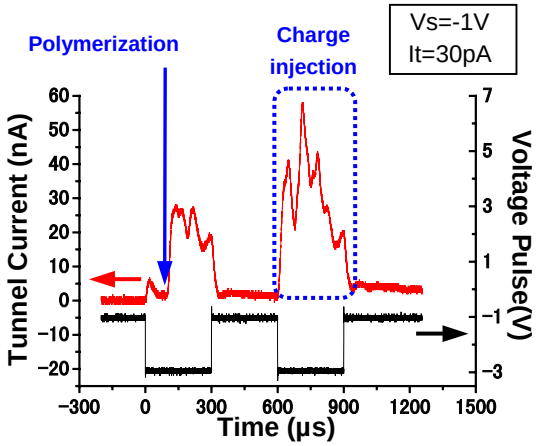

Figure 2. Large current flows by applying high voltage pulses

SMALL IS DIFFERENT: FERMIONIC AND BOSONIC MOLECULES IN QUANTUM DOTS AND TRAPS

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Electrons confined in two-dimensional quantum dots and trapped atoms can form structures with crystalline characteristics. These many body states originate from strong correlations between the constituent particles, and they are called electron (or boson) molecules. Such states allow investigations of fundamental many body phenomena and they are of significance because of the potential use of such systems for the implementation of qubits in quantum computers.

We discuss first two-electron quantum dots (2eQD), that are the simplest man-made structures allowing study of the effect of electron-electron interaction including exchange and correlation. We present recent experimental measurements of the spectrum of a 2eQD. The magnetic field dependent excited state spectrum found experimentally can be described well through exact diagonalization of the hamiltonian, and it can be discussed within a generalized Heitler-London approach. The calculations suggest that correlations are significant at low magnetic fields leading to spatial separation of the electrons – that is, formation of an electron molecule [1

In the second part of the talk we show that a finite system of repelling bosonic atoms in a trap, can develop crystalline features for sufficiently strong inter-atomic repulsion [2]. Furthermore, in rotating traps such crystalline structures, called rotating boson molecules (RBM), made of localized bosons forming polygonal-ring-like arrangements, develop even for weak inter-particle repulsion. For small numbers of neutral bosons, the RBM ground-state energies are found to be always lower than those of the corresponding mean-field (Gross-Pitaevskii, GP) solutions, in particular in the regime of GP vortex formation [3].

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HIGH CURRENT DENSITY (> 1 A/CM^2) CATHODES BASED ON CARBON NANOTUBES FOR VACUUM MICROWAVE AMPLIFIERS

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Most long range telecom systems utilize microwave transmission links. With requirements for higher bandwidth and more channels, these microwave links are increasingly using the 30 GHz and above frequency range. In order to satisfy the power and bandwidth requirements for long range communications, satellites are using (up to 100) travelling wave tubes (TWTs) delivering around 100W.
In a TWT, the amplification process is based on the interaction between a modulated electron beam and an electromagnetic wave. However, up to now, only thermionic cathodes emitting a continuous electron beam are used. The beam has to be post modulated and this increases the size/weight of the TWTs by a factor of around 2. Thus, TWTs are bulky and heavy, and take up a valuable budget in a satellite (particularly for the satellite launch).
The most effective way to reduce the size and weight of a TWT is via direct modulation of the electron beam at the cathode. For this purpose, a cathode-grid assembly can be used. Compared to thermionic cathodes, field emission cathodes operate at high fields and the very low cathode-grid transit time allows then to design high frequency devices. Spindt demonstrated that arrays of Mo tips with integrated and self aligned gate electrodes exhibit excellent field emission performances in a dedicated ultravacuum system (peak current per tip up to 100 µA for a 100-tip array, [1]). Microwave cathodes were successfully modulated in a 10 GHz klystrode (10 µA/tip, modulated current of 4 mA, [2]) and in a 6.8 GHz TWT (0,5 µA/tip, modulated current of 5 mA, [3]). However, no further developments seem to have been done, probably because Mo tips are relatively fragile and also because cathodes with integrated gate electrodes exhibit very high input capacitances (cathode-grid spacing ~ 1µm) which are limiting their high frequency performances.
Arrays of carbon nanotubes are extensively studied as cold cathodes for vacuum nanoelectronic applications because CNs are extremely robust, are able to emit large electron current densities (> 1 A/cm^2) and can be operated with large cathode-grid spacings (eg. 100 µm). In order to evaluate this new technology for microwave amplifiers, we have been studying CN devices which operate at 1.5 and 32 GHz.
5 µm height and 50 nm diameter (at tip apex) multiwall carbon nanotubes/nanofibers (CNs) were grown by plasma enhanced chemical vapour deposition (fig. 1). After growth, a rapid thermal anneal at 850°C was performed to improve both their crystalline quality and their electrical contact to the substrate. This allowed us to fabricate CNs each capable of 60-100 µA emission current in continuous mode (fig. 1 and [4]). A 1.5 GHz diode based on a 0.5 x 0.5 mm array of 2500 CNs delivered a peak current density of 12 A/cm^2 (12 µA/tip, modulated current of 30 mA, fig. 2 and [5]). First results on identical CN arrays integrated in a 32 GHz microwave triode will be presented (fig. 3).
This new type of cold cathode could lead to a breakthrough in vacuum amplifier technology and in particular for TWTs.
This work is currently funded by the European Commission through the NMP integrated project "Canape".

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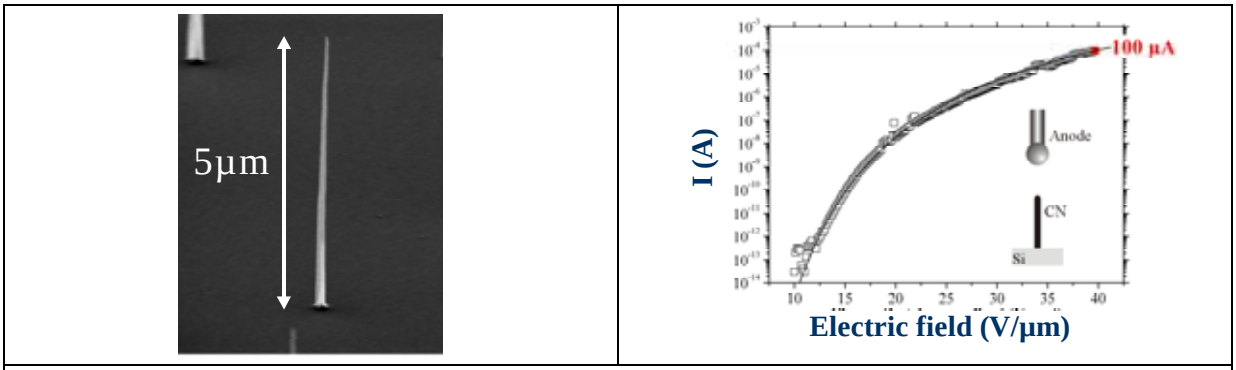

Fig. 1: SEM picture (left) and field emission properties (right) of a 5 µm height and 50 nm diameter CN. E. Minoux et al., Nano letters 5, 2135 (2005).

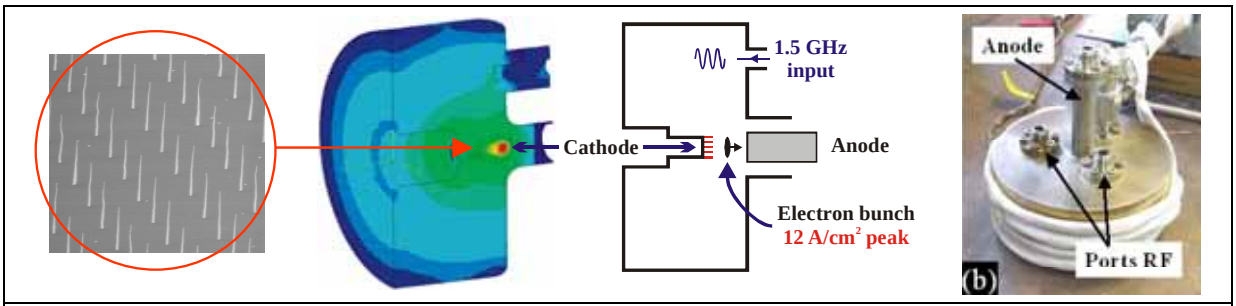

Fig. 2: Array of 2500 CNs (10 µm pitch) integrated in a 1.5 GHz diode.
The peak current density is 12 A/cm^2. K. Teo, E. Minoux et al., Nature 437, 968 (2005)

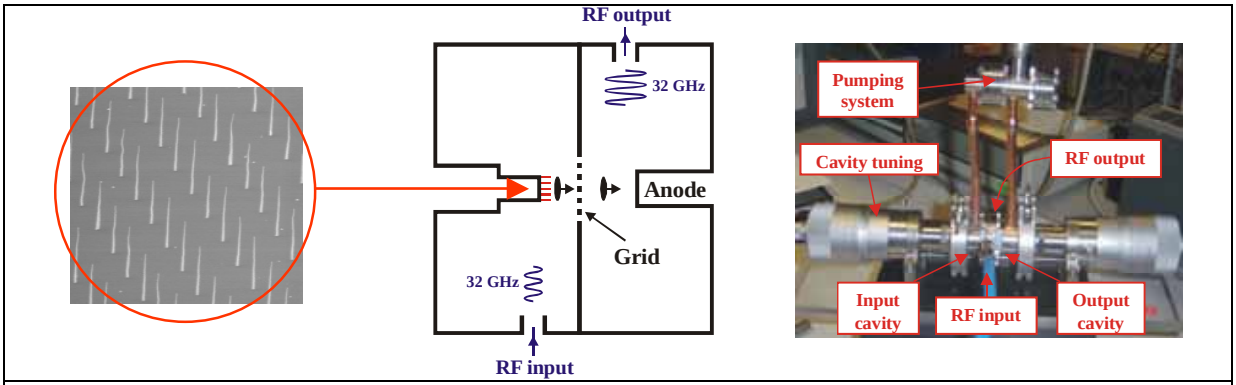

Fig. 3: Array of 2500 CNs (10 µm pitch) integrated in a 32 GHz microtriode.
First experiments will be presented

ELECTRONIC ELASTICITY AND SWITCHING IN ATOMIC-SIZE CONTACTS

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We demonstrate completely reversible mechanical manipulations of the electronic state of the smallest niobium point contacts. This ubiquitous "elastic" regime includes switching between two distinct configurations, which occurs via random telegraph noise. We present detailed Landauer-type description of these configurations derived from transport measurements in the superconducting state. Accompanying first-principles simulations reveals the atomic structures that underlie the conductance properties of these junctions.

CARBON NANOTUBE FIELD EFFECT TRANSISTORS FOR BOTH SINGLE CHARGE DETECTION AND PHOTONICS

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Carbon nanotubes were first integrated as field effect transistors (CNFETs) in 1998 [1,2]. Since then, the predominant role of the Schottky barriers at the metal-nanotube contacts was established [3] and their performances were dramatically improved by contact and gate engineering [4, 5].

Carbon nanotubes have a 1D structure that confers them unique electronic, optical and mechanical properties. These specific properties allow implementing CNFETs for various applications, such as chemical sensors, nano-electro-mechanical systems (NEMS) or opto-electronic devices... This talk will emphasize on the versatility of CNFETs by detailing two completely different regimes of operation, a low bias one allowing single charge detection and a high bias one for light emission.

For charge sensing, CNFETs have been completely self-assembled using the Hot Filament assisted Chemical Vapour Deposition (HFCVD) technique, and then functionalized with a gold nanocrystal by a wet process (Fig. 1). The nanocrystal coupled to the nanotube acts as the storage node of a memory. In the Coulomb blockade regime, the charges trapped on this island induce a detectable field effect on the CNFET, down to a single trapped charge. Moreover, this device behaves as a completely self-assembled single electron memory [6].

When operated under high bias, CNFETs exhibit light emission in the infra-red range (Fig. 2) [7]. This effective electroluminescence originates from impact excitation of excitons in the nanotubes. Optical properties of carbon nanotubes have been recently demonstrated to be dominated by excitonic effects. A spectroscopic study of this electroluminescence will be presented. The spectra give insight into the excitonic processes in the nanotubes, giving rise in particular to a quench of the electroluminescence [8].

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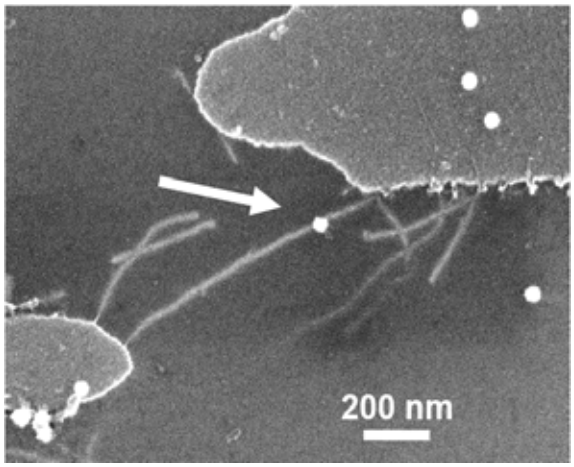

Figure 1: scanning electron micrograph of a self-assembled CNFET implemented as a single electron memory. The nanotube is functionalized with a gold nanocrystal (arrow).

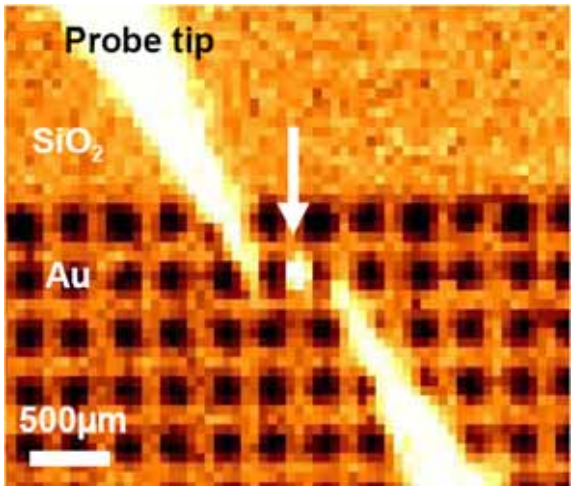

Figure 2: electroluminescence from a CNFET: the light emission from the nanotube is visible on this infra-red image as a bright spot (arrow).

NOVEL APPROACHES TO NANOSTRUCTURE ASSEMBLY AND NANOFABRICATION

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Nanotechnology is a diverse field encompassing not only many disciplines but also many problems. The crux of many of these problems is our inability to design and produce complex nanostructures of desired form and function. Towards that end we have created three systems which allow for the creation of rationally designed nanostructures. In the first system we use a massively parallel two dimensional array of microscopic pens to generate discrete surface features of limitless complexity. These features, generated via Dip-Pen Nanolithography, can be produced with sub-100 nm resolution. Using a 55,000-pen array we are able to generate ~88 million objects in less than 20 minutes over an area of 1 cm x 1 cm. We have also extended our expertise in the area to the problem of generating discrete gaps with dimensions of less than 100 nm. Such gaps, if produced within a good tolerance, could find application in molecular electronics or for surface enhanced Raman scattering (SERS). In that vein we have developed a method of on-wire lithography (OWL) whereby gaps of controllable size from 100 to 3 nm can be consistently generated in gold nanowires. We show that these smaller gaps behave electrically like 3 nm tunneling gaps and could be adapted to molecular electronics. Similarly, we have used them to determine the relationship of gap dimensions to Raman enhancement factors in SERS. In our final example we have chosen to design heterostructures of nanoparticles in which two types of particles are joined in shapes ranging from satellite to dendrimeric to a "cats paw". In this system we make use of DNA hybridization for linking the particles and take advantage of the repulsive force of magnetic particles for the generation of the various shapes. These shapes are generated in high yield and are easily isolated.

NANOSCIENCE IN FINLAND - PERSPECTIVES ON COMPUTATIONAL RESEARCH

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Computational modelling and simulation are a cornerstone in the research of nanoscale phenomena, materials and devices, where physics, chemistry, biology and engineering converge. Several Finnish research groups are active in this area. The capabilities and challenges in this area are described with examples of current projects.

Title not available

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ABSTRACT NOT AVAILABLE

ATOM CHIPS: COLD ATOMS MEET THE NANOWORLD

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ABSTRACT NOT AVAILABLE

STRATEGIES FOR CONTROLLED ASSEMBLY AT THE NANOSCALE

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The bottom–up approach is emerging as a viable alternative for low cost manufacturing of nanostructured materials [1, 2]. It is based on the concept of self–assembly of suitable nanostructures on a substrate. We propose various strategies to control the assembly of nanostructures (both organic and inorganic) at the nanoscale. Our approaches include surface patterning through a nanostencil [3, 4] (i.e. a miniature shadow mask with nanoscale features); deposition on naturally patterned substrates, which take advantage of long–range reconstructions [5–7]; and control of non-covalent bonds by co-adsorption at the liquid-solid interface. The general idea is to create nanoscale features on a substrate, which will act as *surface cues* that guide the deposited material into ordered structures. We jokingly call this approach 'Playing Tetris at the Nanoscale' [9]. Finally, new experimental tools are presented to gain atomic scale insight into the surface processes that govern nucleation, growth and assembly [10]. The controlled assembly of building blocks at the nanoscale will be effective for a variety of applications, ranging from nanoelectronics to chemical and biosensors.

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Figures:

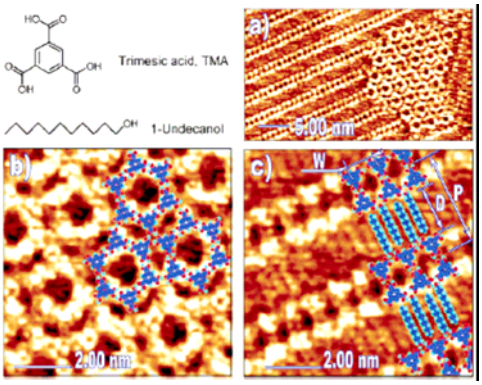

Figure 1. (a) STM image of Self-Assembled Molecular Networks formed by deposition of 1-undecanol and TMA from heptanoic acid solution on HOPG. (b) TMA flower pattern with molecular model. (c) TMA linear pattern with molecular model.

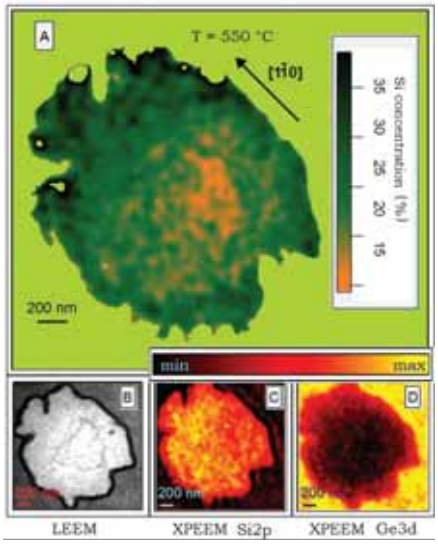

Figure 2. Absolute surface silicon content for a typical Ge(Si) ripened island grown at 550 °C. Sequence (A–D) is as in Figure 1. The Si concentration increases from 15% at the center of the island up to some 40% at the borders. The Si-depleted area tentatively corresponds to the partially eroded region visible in panel (B). This might explain a possible pathway towards the formation of atoll-like morphologies through the removal of the highly strained Ge-richer portions of the island's surface.

Title not available

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ABSTRACT NOT AVAILABLE

FIRST-PRINCIPLES CALCULATIONS OF NANOSTRUCTURED SURFACES

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I will review some of the complex surface reconstructions that have been studied recently in our group. I will mainly focus of the quasi-one-dimensional reconstructions formed by the deposition of submonolayer amounts of gold on Si(111) and vicinal Si(111) surfaces [1]. If possible, I will briefly present preliminary results on the structure and instabilities induced by a monolayer of water on NaCl(001) and its implications in two very different scenarios: AFM visualization of the NaCl(001) surface at 30-40% relative humidity and atmospheric chemistry [2].

The gold atoms on vicinal Si(111) surfaces form very thin wires, and therefore the electronic structure (as measured with angle resolved photoemission, ARP) exhibits a strong one-dimensional behaviour. An example of these systems that has attracted much attention in recent years is the stepped Si(557)-Au surface. In this case the gold atoms are known to form one monatomic wire in the middle of the terrace of each step. The wires run parallel to the step edges. If the structure of other surfaces is similar we can get an interesting playground: increasing or decreasing the miscut angle of the initial silicon substrate and, therefore, the size of the steps, we can change the interaction between the gold chains in neighbouring steps. In this way, it is believe that it would be possible to control de degree of one-dimensionality of these systems, and study the transition between two-dimensional and one-dimensional behaviours. Furthermore, since the silicon substrate is relatively rigid, there is hope that it would be possible to overcome the Peierls distortion and it would be possible to obtain truly one-dimensional metals in these systems. For these reasons these surfaces have attracted a lot of attention, both theoretically and experimentally, in recent years. We have study some of these reconstructions using first-principles electronic structure calculations, and will present some our results for three characteristic systems: the stepped Si(557)-Au and Si(553)-Au surfaces, and the flat Si(111)-(5x2)-Au reconstructions.

The photoemission spectrum of the Si(557)-Au surface is dominated by a one-dimensional band. This band is found to split in two peaks near the Fermi energy. This was initially interpreted as a signature of the spin-charge separation characteristic of a one-dimensional metal [3]. Although new experimental evidence indicated that the bands were not completely consistent with the theoretical predictions for a one-dimensional electron gas, the origin of these *twin* bands was a mystery for several years. Our recent calculations [4] show that it is the spin-orbit splitting what produces these two bands. These spin-splitting may have relevance for future device applications since simple arguments show that such splitting should occur in any surface band formed from heavy atoms. We have also shown that the apparent Peierls-like transition observed in this surface [5] using scanning tunnelling microscopy might be explained as a result of the dynamical fluctuations of the step-edge structure, which are quenched as the temperature is decreased [4]. The implications of the fluctuations for the observed metal-insulator transition [5] will be also discussed in our contributions.

The stepped Si(553)-Au surface has also attracted a lot of attention in recent times. Its ARP spectrum is very similar to that of the Si(557)-Au surface and is dominated by two neighbouring one-dimensional bands with approximately ½ occupation. However, a very peculiar one-dimensional band with a ¼ occupation is also observed [6]. Neither the structure

of this surface, nor the origin of this band is known. We have examined the energetics and the band structure of several structural models constructed from a plausible analogy with the structure of the Si(557)-Au surface [7] and ruled out a model proposed recently from the analysis of X-ray diffraction experiments [8]

Finally we analyze the Si(111)-(5x2)-Au reconstruction with our density functional calculations. In spite of the fact that this reconstruction has been studied with several experimental techniques since the late sixties, its structure is still a matter of debate. Due to the large size of the reconstructions, only very recently the first electronic structure calculations of the surface appeared. Based on this type of calculations, S. C. Erwin has proposed a structural model for this reconstruction [9]. We have studied the relative stability and the electronic band structure of several different models, including the Mark-Plass and Erwin model [10].We have found a new model which, at least within the theoretical approach used, is more stable than any other proposal to date.

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Figures:

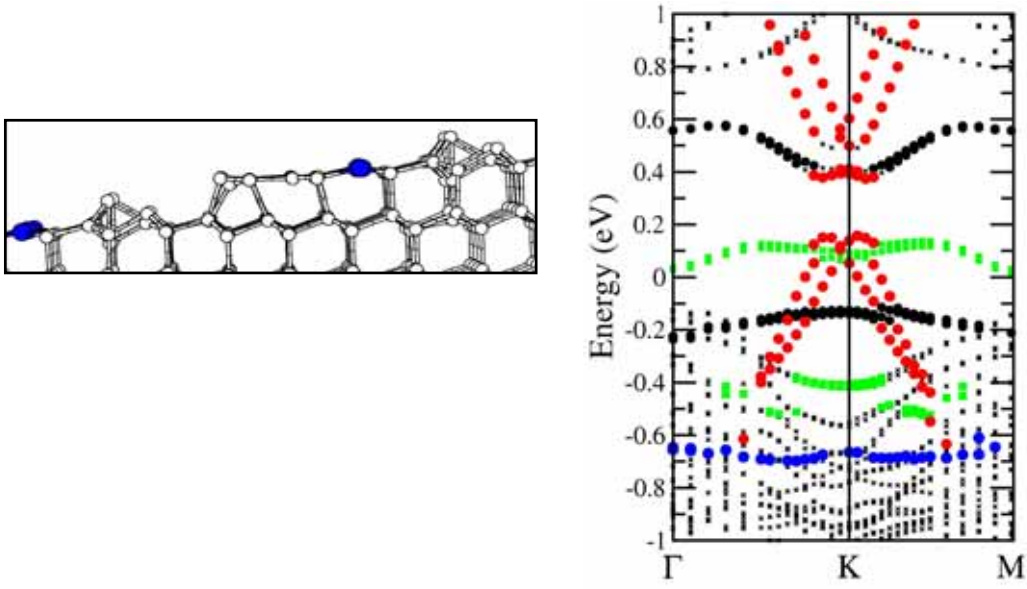

Figure. Predicted structure for the Si(557)-Au along with the calculated band structure once the spin-orbit interaction is included [4]. The large solid circles represent the gold atoms.

Title not available

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ABSTRACT NOT AVAILABLE

SOLID-ELECTROLYTE SWITCH FOR RECONFIGURABLE LSI

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Nanoscale electronic devices such as molecular or atomic devices have been extensively investigated, since they have potentials to complement Si-LSI or overcome its limitations. One of the intriguing device is a solid electrolyte switch which conductance changes when a nanometer-scale metallic bridge is formed [1,2]. The solid-electrolyte switch has a simple structure of potentially $4F^2$ and has a low ON resistance, which is lower than that of MOSFETs by two orders of magnitude.

The device structure is depicted in Fig.1. The top layer is a Ti electrode, which electrically makes contact with the Cu_2S/Cu film via a hole in the insulating layer. The Cu_2S film is a solid electrolyte (and a Cu-ionic conductor). Figure 2 shows the IV characteristics of a switch with a 30-nm contact hole. There are two resistance states, ON and OFF. The switching voltage from OFF to ON is -0.28 V. The switching voltage depends on the sweep rate of the voltage. The ON/OFF ratio is larger than 10^5. This conductance switching is repeatable and each state persists when the voltage is low. This switching behavior is observed up to about $3X10^3$ cycles (Fig. 3). For devices that have a hole diameter of 0.3 μm, the cycle number is in the order of 10^5. The retention time of each state is more than one month.

Conductance switching can be explained by creating and dissolving a metallic bridge inside the Cu_2S film. When a negative voltage is applied to this top electrode, Cu ions in the Cu_2S are electrochemically neutralized and precipitated (Fig. 2). Cu ions are supplied via this electrochemical reaction at the Cu_2S/Cu interface. By applying a positive voltage, the Cu bridge is dissolved into the solid electrolyte, resulting in the OFF state. In the experiments, the ON current did not depend on the hole diameter in the range from 0.3 μm to 30 nm. This result indicates that the conduction area is smaller than 30 nm. When decreasing the ambient temperature, the ON resistance decreases, which shows that the bridge is metallic. These two experimental results support the idea of the Cu bridge.

This novel switch is suitable for use as a programmable switch or memory element in LSI. One of the promising applications is in a field programmable logic (FPL) [3], which has become increasingly attractive because of such advantages as its short turnaround time and low non-recurring expense. The programmable switch in a conventional FPL consists of an SRAM and a pass transistor and occupies a large area (~$120F^2$). Thus, FPL is costly and has poor cell usage efficiency. When the solid electrolyte switch is applied to a programmable switch, the chip size can be reduced to 1/10th compared with a conventional one and its performances (speed and power consumption) is improved (Fig. 4). To show the potentials for FPL application, we have demonstrated the reconfiguration of a crossbar switch and look-up-table, which are fundamental elements of FPL. Figure 5 shows the demonstration of 2-input look-up-table using 4 novel switches.

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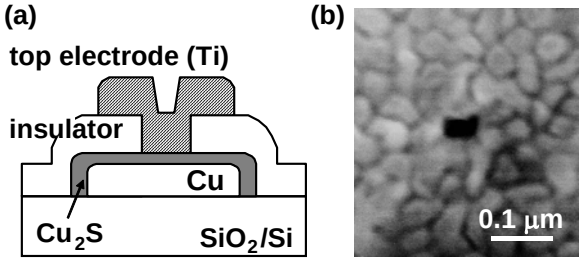

Figure 1. (a) Schematic view of the NanoBridge composed of a Cu_2S film sandwiched between a Cu film and the top electrode. (b) Scanning micrograph from top.

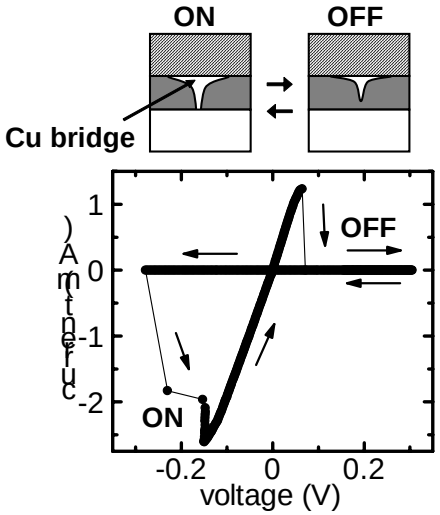

Figure 2. Current-voltage characteristics of novel switch with 0.03 μm contact hole. Top: schematic of operation principle.

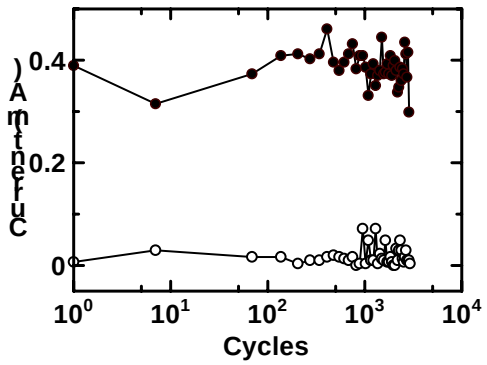

Figure 3. Cycling endurance.

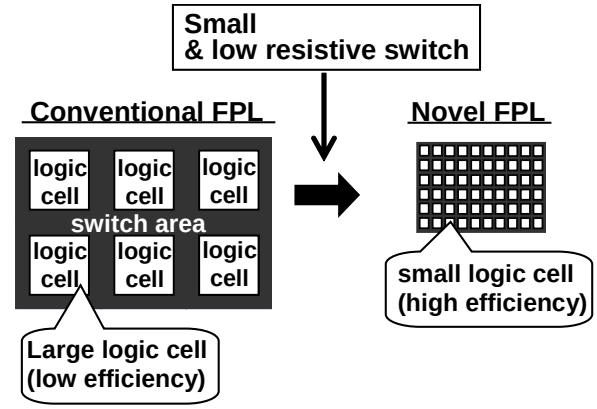

Figure 4. Conventional or novel FPL. White region represents the logic area and the gray one represents the switch area. When our technology is applied, the small logic cell can be used and the logic cell usage efficiency can increase.

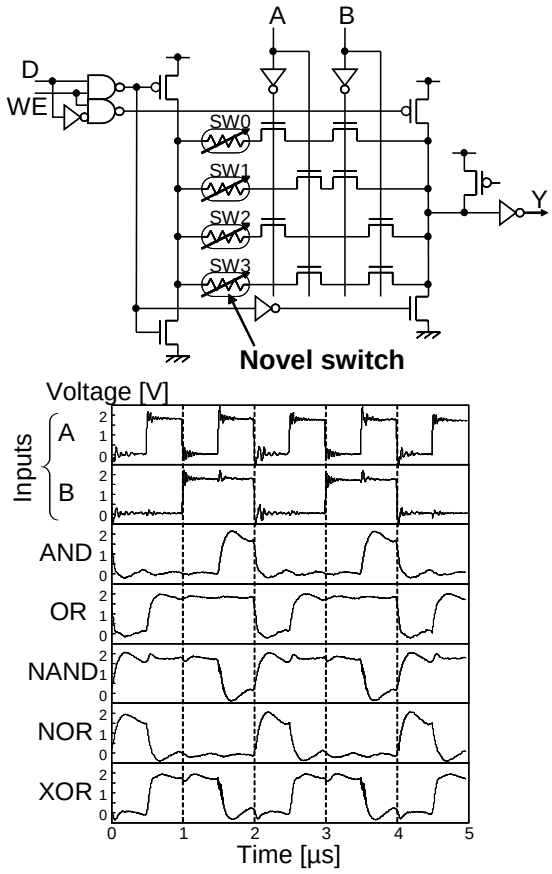

Figure 5. (a) Schematic of two-input look-up table with four novel switches. (b) Measured waveforms. Upper two waveforms are for input signals A and B, and the other waveforms are for output signal Y under AND, OR, NAND, NOR, and XOR configurations.

DISENTANGLING AHARONOV-BOHM EFFECTS IN CARBON NANOTUBES

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Recent low temperature conductance measurements on multiwall carbon nanotubes in perpendicular and parallel magnetic field are reported. An efficient gating technique allows for a considerable tuning of the nanotube doping level. This enables us to study extensively the signature of nanotube bandstructure in electron quantum interference effects like weak localization, universal conductance fluctuations and the Aharonov-Bohm effect. We show that the weak localization is strongly suppressed at peaks at certain gate voltages which can be linked with the bottoms of one-dimensional electronic subbands (see Figure). This assignment allows a detailed comparison of theoretical calculations with the experimental data. In agreement with the theory, we find clear indications for a pronounced energy dependence of the elastic mean free with a strong enhancement close to the charge neutrality point. In large parallel magnetic field, we observe a superposition of h/2e-periodic Altshuler-Aronov-Spivak oscillations and an additional h/e-periodic contribution. The latter contribution shows a diamond-like pattern in the B/V_{gate}-plane, which reflects the magnetic field dependence of the density of states of the outermost shell of the nanotube.

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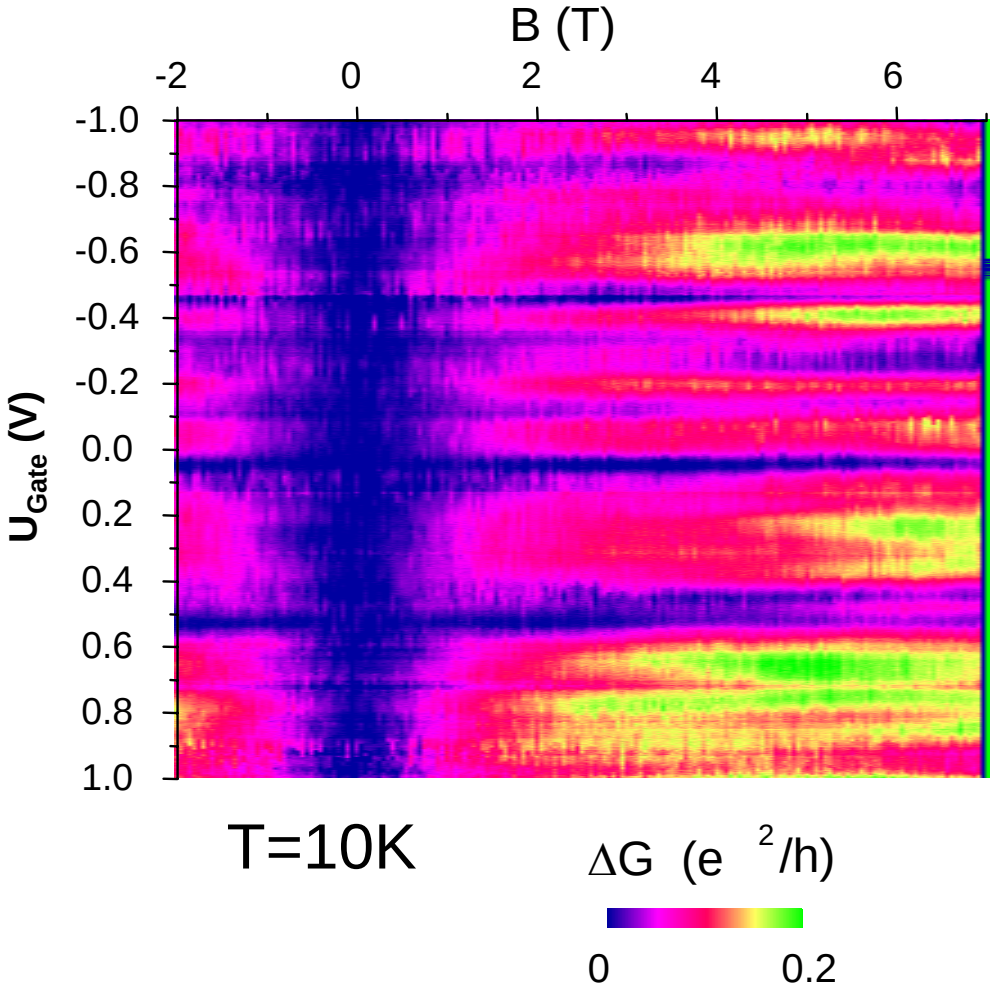

Magneto-conductance of a multiwall carbon nanotube for different gate voltages. The horizontal blue lines correspond to the onset of new conduction subbands.

SURFACE NANOSTRUCTURES TO CONTROL PROTEINS AND CELLS

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Integrating artificial materials with biological systems requires engineering on molecular and macromolecular length scales. In fields such as biomaterials, tissue engineering, optimized substrates for cell culture and sensing applications there is a push towards the use of nanometer scale structured interfaces to mimic components of biological interfaces. Significant technological and scientific challenges exist to producing synthetic analogues of living systems, functional immobolisation of natural biological components or integrating solid state components and biological molecules into hybrid systems. Self assembling systems combined with lithographically produced patterns represent a promising approach. A number of approaches to immobolise, pattern or study biological macromolecules will be presented. The approaches presented are based on the self assembly of atoms [1], molecules/macromolecules (such as lipids [2], polyelectrolytes, block co-polymers and proteins [3]) and colloidal particles [4] making them suitable for producing macroscopic interfaces. Nanoscale topography, as a result of the potential for large scale production and ease of sterilisation, represents an attractive potential route to controlling biological systems. Non-specific protein binding becomes a significant issue and a number of studies of the influence of nanoscale surface topography on the behaviour of surface bound proteins will be outlined [5]. Examples of the response of cellular systems to surface nanotopography will be described [6]. An alternative approach to controlling cellular systems is through the immobolisation of specific biological molecules at interfaces. Approaches to create nanopatterns of functional proteins over large areas will be described and an AFM based approach to quantification of protein binding outlined. The results of a combined AFM/QCM-D study indicate that the immobolisation of laminin into 120nm patches enhance the functional properties of the protein [7]. Similar control of cellular response can be achieved via interfaces with nanotopography or nanopatterned proteins.

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READOUT OF FLUX QUBITS

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In this talk, we report the observation of the readout of a superconducting flux qubit comprising three Josephson junction in a superconducting loop.

We first talk about the observation of multiphoton transition between superposition states of macroscopically distinct states [1]. The observed distinct resonant peaks and dips are attributed to situations, in which the effective energy separation between the ground and the first excited states matches an integer multiple of the RF photon energy. Based on this technique we have achieved multi-photon Rabi ocsillations up to four photons. The Rabi frequency as a function of microwave strength clearly showed Bessel-function dependnences J_n (n=1,2,3,4). We also have succeeded in parametric operations [2]. By using two-frequency microwave pulses, we have observed Rabi oscillations stemming from parametric transitions between the ground state and first excited states when the sum or the difference of the two microwave frequencies matches the Larmor frequency of the qubit (Fig. 1).

Resonant microwave pulse methods induce coherent quantum oscillations between these macroscopic quantum states, e.g., Rabi oscillations or Ramsey fringes**.** We have observed Larmor precession (11.4 GHz) of a flux qubit with the phase shifted double pulse method. This new method provides an arbitrary unitary transformation of a single qubit with a rapid control (~10 GHz) of the flux qubit [3]. Compared with the previous method (detuning one), the new method can save time for each quantum-gate operation and results in a 10-100 times faster gate operation than the previous one.

The operation of a single qubit is almost accomplished for many types of solid state qubit. The next target is of course to achieve entangled state using coupled two qubits. It is very promising to analogically apply the so-called cavity QED to a superconducting device coupled with a microwave cavity. It is because we can use many sophisticated methods established in atom physics. We have achieved the coupling between the flux qubit and a LC-resonator (microwave cavity see Fig. 2) and observed red and blue sideband resonance. We demonstrated Rabi oscillations at the red and blue sidebands. Moreover we have confirmed vacuum Rabi oscillations in time domain [4] (Fig. 3). These clearly indicate that entangle states are generated between two macroscopic quantum systems.

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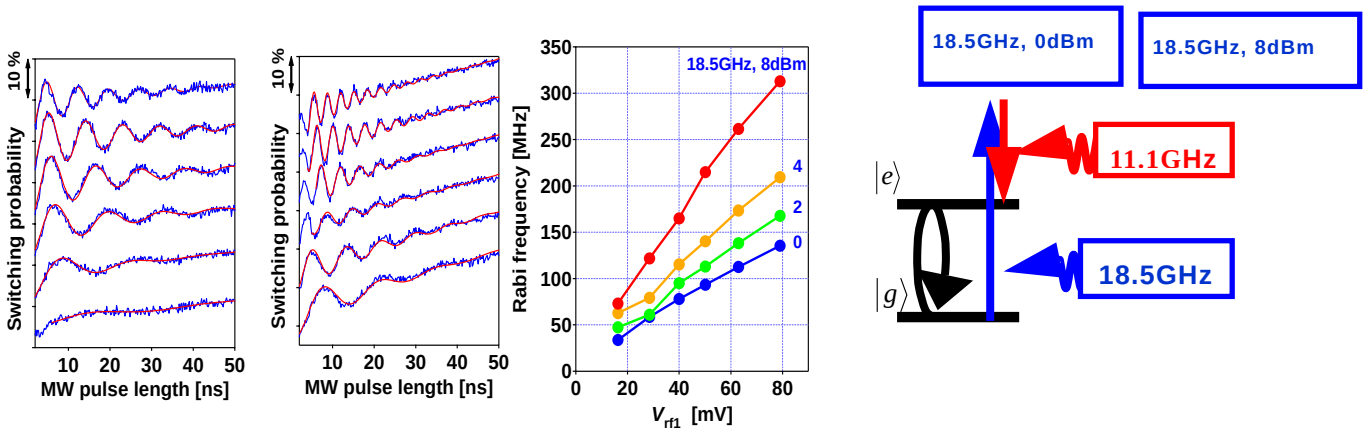

Fig. 1. Observed Rabi oscillations with two colors, two photons and difference frequency.

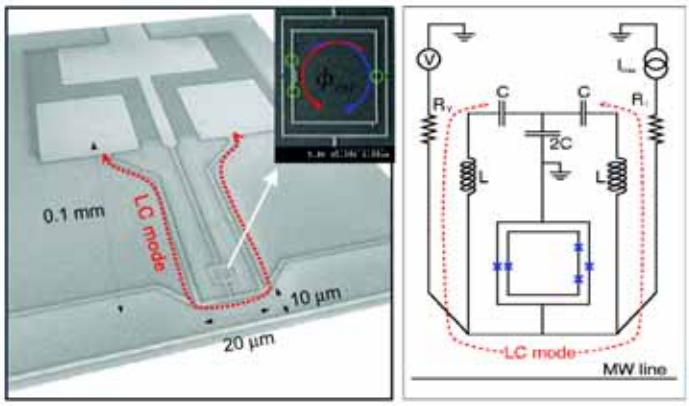

Fig. 2. Flux qubit and a LC-resonator.

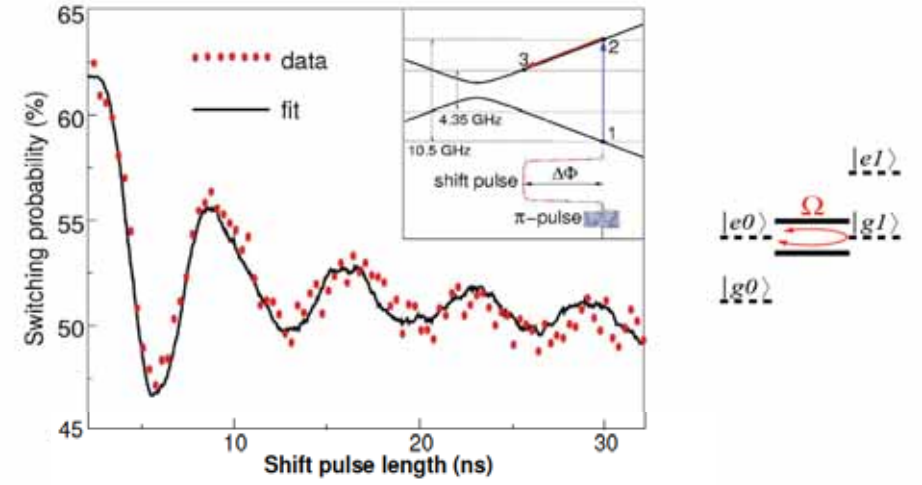

Fig. 3. Observed vacuum Rabi oscillation.

Title not available

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ABSTRACT NOT AVAILABLE

NANOSCOPIC CONTROL OF THE POLARIZATION IN FERROELECTRIC THIN FILMS

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Ferroelectric memories take advantage of the non-volatile reversible nature of the ferroelectric polarization. In this work, we combine high quality materials, epitaxial atomically smooth ferroelectric perovskite films, and atomic force microscopy (AFM) to control and modify the ferroelectric domain structure at nanoscale. This approach allows new fundamental studies of ferroelectrics at nanoscale and might be a way to develop ultra-high density non-volatile memories.

In ferroelectric $Pb(Zr_{0.2}Ti_{0.8})O_3$ thin films, a metallic AFM tip was used as a local electric field source to study individual nanoscale ferroelectric domains. Control of domain size was achieved by varying the strength and duration of the voltage pulses used to polarize the material, permitting the creation of sub-20nm wide lines and ultra-high density arrays reaching ~30 Gbit/cm^2 [1]. The AFM approach developed also allowed us to investigate switching dynamics in ferroelectric thin films. Our data suggest a two step process of domain growth, in which initial nucleation under the AFM tip is followed by radial domain wall motion, perpendicular to the polarization direction. The electric field dependence of the domain wall velocity demonstrates that this motion is a creep process [2]. Our analysis [2,3] shows that the previously proposed bulk nucleation model of domain growth [4] cannot explain the observed behavior in thin films, but rather that disorder is at the origin of ferroelectric domain wall motion.

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AMYLOID DISEASES AND NANOSCIENCE: THE KINETICS OF FIBRILLAR PEPTIDE EVOLUTION

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ABSTRACT NOT AVAILABLE

NEW HORIZONS IN NANOMAGNETISM BY ATOMIC-SCALE MAGNETIC SPM PROBING

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Spin-polarized Scanning Tunneling Microscopy (SP-STM) [1] and Spectroscopy (SP-STS) [2] allow the visualization of atomic-scale spin structures [3,4] and the investigation of the spin-dependent local density of states spatially resolved [5]. Spin-dependent scattering at single atomic impurities was visualized in real-space reflecting the orbital nature of the electronic states involved as well as their spin character [6]. For ferrimagnetic samples [3] the different magnitude of magnetic moments could directly be made visible at the atomic level while for antiferromagnetic samples, the different orientation of magnetic moments showed up in atomically resolved SP-STM data [4].
More recently, we have proven the existence of a novel antiferromagnetic ground state of a single atomic layer of Fe on a W(001) substrate by SP-STM [7] while a single atomic layer of Fe on a W(110) substrate was proven to be in a ferromagnetic ground state [8]. We have even succeeded for the first time to resolve the atomic spin structure of domain walls in antiferromagnetic systems [9]. For a single atomic layer of Fe on Ir(111) we discovered a novel nanomagnetic state with 15 Fe atoms per unit cell by SP-STM [10]. Interestingly, 7 Fe atoms have magnetic moments pointing in one and 8 Fe atoms have magnetic moments pointing in the opposite direction. Therefore, the system exhibits ferromagnetic characteristics locally and antiferromagnetic characteristics macroscopically. To extend the possibility of atomic-scale spin mapping to insulating material systems we have recently succeeded in establishing magnetic exchange force microscopy (MExFM) as a reliable and reproducible technique [11]. We demonstrate for the first time clear atomic-scale spin contrast by MExFM on NiO(001) surfaces and discuss further applications of this novel exciting scanning probe method in the field of nanomagnetism.

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COMPUTING AT THE NANOSCALE

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There is currently a tremendous business incentive to invent new electronic devices and circuits that will have dimensions of the order of nanometers. In addition, new fabrication techniques will be required that can inexpensively produce and connect these devices in vast quantities. The challenges are equivalent to those faced by the inventors of both the transistor and the integrated circuit, who replaced the existing vacuum-tube and wiring technologies with solid-state switches and lithographic fabrication, respectively. In order to satisfy these challenges, we have assembled a trans-disciplinary team of chemists, physicists, engineers, computer scientists and mathematicians at HP Labs to work simultaneously on the architecture, device physics and manufacturing chemistry of nanoscale circuits. The intention of this research is to complement and extend CMOS technology for as long as possible, and to replace transistors when necessary.

Two complementary research areas relevant to future nanocomputing systems are currently under investigation: (a) nano-scale electronic switching devices [1] and circuits [2], and (b) the development of new and inexpensive fabrication techniques [3]. Our approach for the construction of nanoelectronic circuits involves the explicit incorporation of defect tolerance [4], which is the capability to operate perfectly even in the presence of manufacturing mistakes in the circuit, into the design of the system. This prerequisite arises from the realization that it is prohibitively expensive to fabricate a perfect network of billions of nanoscale components. However, by introducing the appropriate amount of redundancy and utilizing concepts from coding theory [5], arbitrary complexity can be programmed into a highly regular structure and at the same time any defects can be mitigated.

Our research group has recently demonstrated the ability to fabricate electronic devices with sub-viral length scales (e.g. ~15 nm) [6] and to build nanoscale devices with the capability to perform signal restoration and inversion [7] (required for universal computing) without the need for transistors or any semiconductor at all. This has led us to understand that there are other computationally complete logic families besides NAND and NOR that are specifically suited to the properties of nanoscale switches and crossbars. We have built and demonstrated memory and logic circuits based on these new ideas that dramatically exceed the density of today's semiconductor circuits.

I will describe how fundamental research in a corporate research laboratory can be a strategic asset for the company, and how it is possible to mix curiosity-driven discovery with invention by the proper choice of research area.

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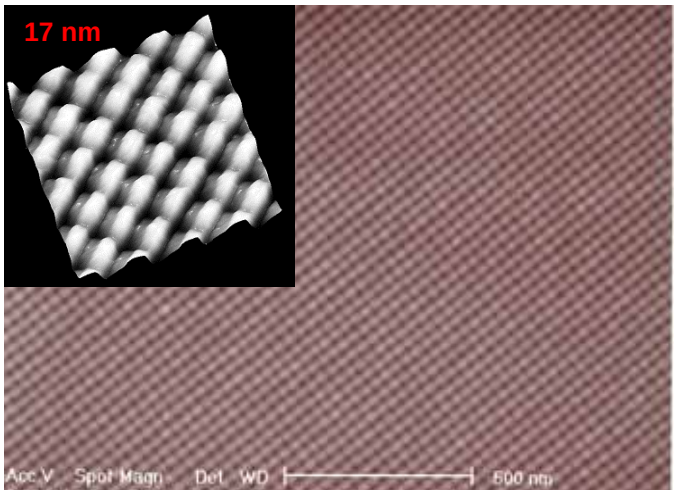
Figure:



(Right) A scanning electron micrograph of the central region of a 13,000 junction metal cross-bar structure fabricated at a half-pitch of 17 nm using the process of imprint lithography. The inset shows an atomic force microscopy (AFM) topograph of a magnified region of the cross-bar. This simple structure is the basis for both high density memory and logic circuits.

ORAL CONTRIBUTIONS

(Only those abstracts received before 8/18 will be included in the abstracts' booklet)

NEW INDUSTRIAL APPLICATIONS FOR ATOMIC LAYER DEPOSITION

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Micronova Research Centre - Helsinki University of Technology
Finland

The atomic layer deposition (ALD) technique has up to now been applied for the manufacturing of electroluminescent displays and silicon integrated circuits. During the past 30 years a broad selection of deposition processes, precursor chemicals and reactors has been developed. This technology base and the remarkable properties of ALD make it one of the key deposition technologies for a range of new industrial applications, including nanofabrication. Some of the new potential industrial applications of ALD are described. The work being done at Micronova for the FinNano technology programme includes new coating solutions for semiconductor lasers, X-ray components, MEMS technology and nanoporous materials.

MICRONOVA
CENTRE FOR MICRO- AND NANOTECHNOLOGY
HELSINKI UNIVERSITY OF TECHNOLOGY

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CARBON NANOTUBES ENCAPSULATING SUPERCONDUCTING SINGLE-CRYSTALLINE TIN NANOWIRES

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Superconducting low dimensional systems are the natural choice for fast and sensitive infrared detection, because of their quantum nature and the low-noise, cryogenic operation environment. On the other hand, monochromatic and coherent electron beams, emitted from superconductors and carbon-based nanostructured materials, respectively, are significant for the development of electron optical systems such as electron microscopes and electron-beam nanofabrication systems.

Here we describe a simple and reproducible method which yields individual μm-long carbon nanotubes filled with highly pure, single crystalline, superconducting tin nanowires [1]. For the first time the catalytic chemical vapour deposition (CCVD) method over solid tin dioxide has been employed to yield carbon nanotubes encapsulating single crystalline superconducting metallic tin nanowires. The surrounding carbon nanotube, consisting of only a few graphite layers (4–5 nm), is closed in both ends and protects the tin nanowire, and thus is protected against atmospheric oxidation. The superconducting tin nanowires, with diameters 15-35 nm, are covered with well-graphitized carbon walls parallel to the tube axis and show, due to their reduced diameters, a critical magnetic field (H_c) more than 30 times higher than the value of bulk metallic tin. Indeed, magnetization measurements show a slight increase in the superconducting temperature and a considerable increase of the critical magnetic field ($H_c = 0.6$ T) compared to bulk metallic tin (0.021 T). Various analytical techniques including HRTEM and SQUID measurements were used to characterize the final product.

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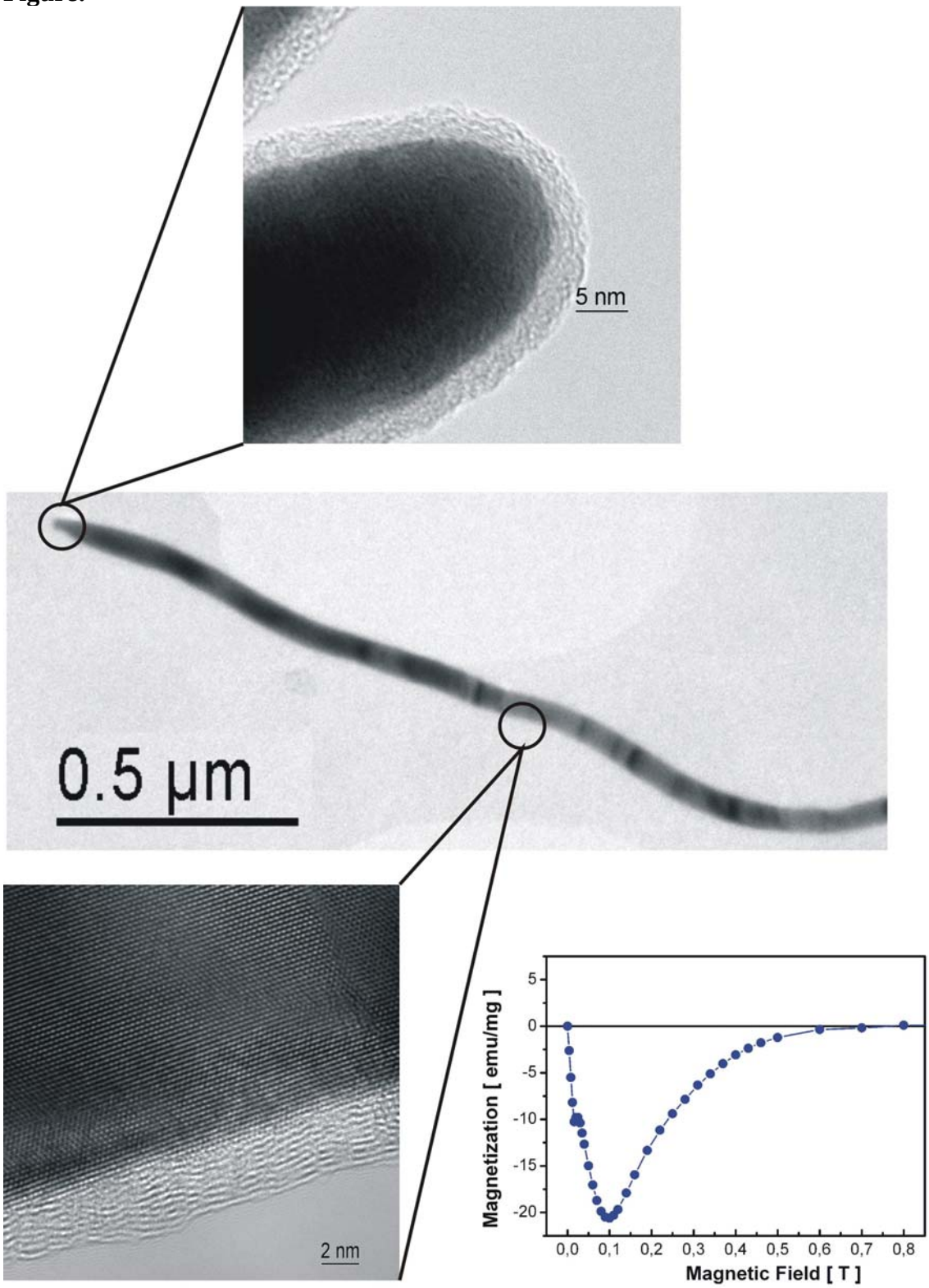
Figure:



CHARACTERIZATION OF Ni MEMBRANES WITH CONTROLLED HIGHLY ORDERED NANOHOLE ARRAYS BY MAGNETIC FORCE MICROSCOPY.

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During the last years a large variety of different nanostructures have been prepared using anodic nanoporous alumina membranes (NAM). Such highly-ordered arrays of nanostructures with hexagonal symmetry can be then obtained by self-organization during the anodization process [1,2]. These NAMs have been widely employed as templates for the fabrication of nanowires or nanotubes arrays and membranes with semiconductor, metallic or polymeric character. Our present work has been focused on the fabrication and characterization of magnetic metallic membranes with well ordered nanoholes. This nanostructures has been achieved by controlled replica/antireplica processes starting from highly ordered nanoporous alumina membranes [1,3,4].

In particular, the objective of this work has been to study the magnetization process of Ni nanohole membranes where we can control the pore diameter and the hexagonal symmetry lattice constant. Samples with an interpore distance of 105 nm and pore diameters between 35 and 70 nm have been prepared (see figure 1).

Hysteresis loops (see figure 2a) have been measured in a vibrating sample magnetometer, VSM, at room temperature, for different orientations of the applied field with regards to the plane of the membrane. From them, the easy magnetization direction can be derived to be inside the plane of the membrane. Moreover, anisotropy and coercive fields are experimentally obtained as a function of the pore diameters, keeping the geometrical hexagonal symmetry constant, and both are compared with the values corresponding to continuous Ni film.

Topography and magnetic characterizations at the surface of the samples have been additionally performed by a combination of AFM and MFM images. The existence of three magnetic privileged directions that coincide with those which join the first neighbours (typical from the centre hexagonally structure) are confirmed. The shape of the magnetic pseudodomain is triangular where each vertex corresponds to a pore (see fig.2b). The domain wall pinning in the pores could be the origin of the magnetic moment distribution measured by MFM. These experimental results are analysed with the help of micromagnetic simulations.

The magnetization process is analysed by macroscopic VSM loops, Kerr magnetometry (hysteresis loops) and Kerr spectroscopy (magneto-optic properties). The magneto-optic measurements have been compared with the results obtained by the simulations.

In summary, this work relates with the design and preparation of Ni membranes with controlled nanohole arrays and with further study of the magnetization process by different combined techniques.

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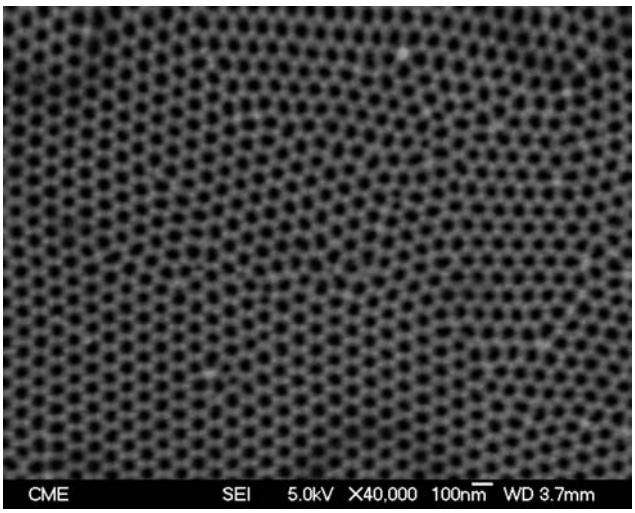

Figure 1.- HRSEM image of a Ni nanohole array with an interpore distance of 105 nm and 60 nm for pore diameter.

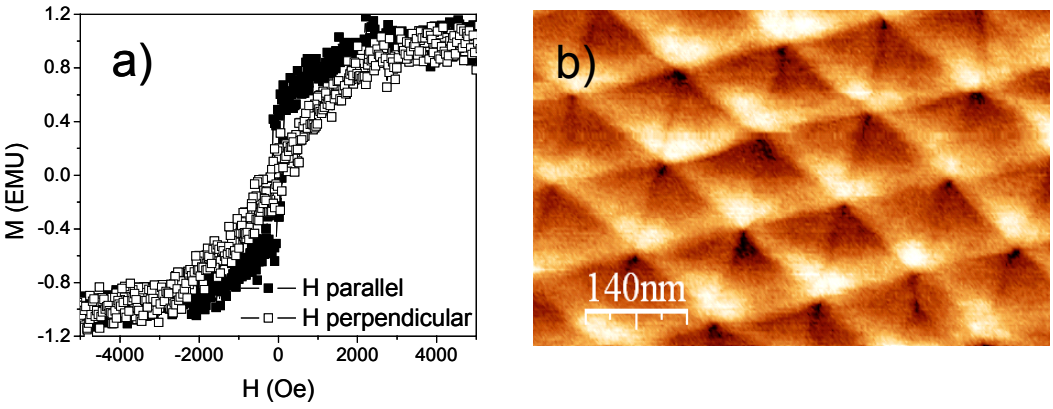

Figure 2.- (a) Hysteresis loops with the magnetic field applied parallel (■) and perpendicular (□) to the membrane plane of a Ni nanohole array with an interpore distance of 105 nm and 60 nm pore diameter and MFM image (b) in remanence state.

ELECTRONIC CONFINEMENT AND COHERENCE IN PATTERNED EPITAXIAL GRAPHENE

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Utrathin epitaxial graphite grown on single-crystal silicon carbide is a promising new two-dimensional electronic material [1-6] showing properties of electronic coherence and quantum confinement at the micron scale well above 4K [1].

Ultrathin graphite layers are grown epitaxialy on millimeter size commercial single-crystal silicon carbide by thermal decomposition in vacuum at high temperature. Epitaxial graphene layers have a structural coherence of a fraction of a micron at least, as shown in detailed structure and composition studies (Auger electron spectroscopy, low energy electron diffraction, X-ray diffraction, transmission electron microscopy, atomic force microscopy, electrostatic force microscopy, scanning tunneling microscopy and tunneling spectroscopy).

Magnetotransport measurements (Shubnikov-de-Haas oscillation) show that the transport properties are dominated by the highly doped graphene layer at the silicon carbide interface. They reveal the Dirac nature of the charge carriers (the energy is proportional to the velocity), as predicted for a single graphene layer, and as recently observed mechanically-exfoliated graphene layers. The properties of Dirac fermions (which are also responsible for transport in carbon nanotubes) can be conveniently explored in epitaxial graphene.

The material can be easily patterned into submicron structures using standard microelectronics lithography techniques. Patterned structures show two-dimensional electron gas properties with long phase coherence lengths l_Φ , even at relatively high temperatures (l_Φ beyond one micron at 4K, and ~500nm at 58K) and mobilities exceeding 2.5 m^2/Vs. The elastic scattering lengths are determined primarily by the micron-scale sample geometry. The magnetoresistance reveals signatures of quantum confinement of electrons in micron wide ribbons at 4K and above. Unusual phase transitions are also observed.

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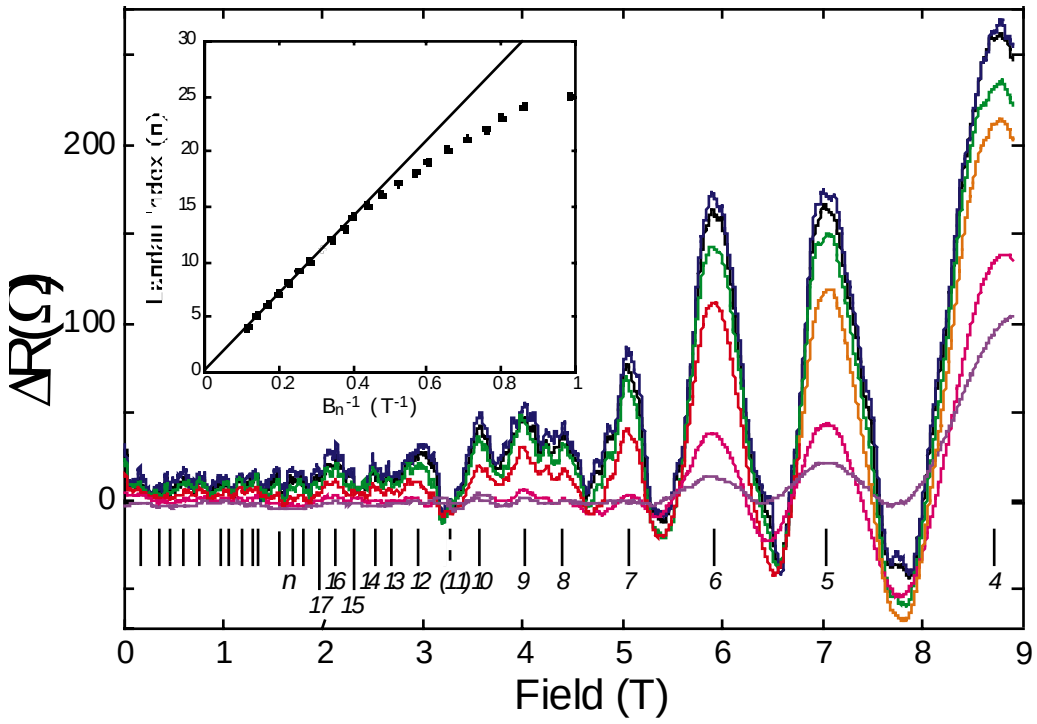

Figure1 : Magnetoresistance (smooth line subtracted) for temperature 4K to 58K showing the Shubnikov de-Haas oscillations in a ribbon 0.5µmx6µm. Landau levels n are indicated and labeled. Inset : Landau level indexes plotted as a function of inverse magnetic field. The slope of the line gives the carrier density (ns=3.4 10^{12}cm^{-2}) and the intercept at zero is consistent with the Berry phase $\Phi=\pi$ of graphene. The deviation from linearity indicates confinement in the ribbon, which becomes important when the cyclotron diameter increases at large 1/B. The fluctuations superimposed on the smooth magnetoresistance oscillations are reproducible universal conductance fluctuations, which indicate the long phase coherence length of the system.

MANIPULATION ON THE 1 – 10NM SCALE USING LOCALISED FORCES AND EXCITATIONS: PROGRESS IN THE EU STRP NANOMAN*

We report progress in the EU funded NanoMan STRP which has as its focus the manipulation of molecules and nanoparticles using an atomic force microscope. The scope of this activity covers the construction of new instruments, controlled manipulation/modification on insulating, semiconductor and metallic surfaces using cantilever and tuning fork AFM probes and the development of theoretical models of the nanoscale processes relevant to manipulation using both AFM and STM.

In the talk we will describe the following:

Molecular switching on the Si(100) surface
The demonstration of the action of a molecular switch made of a biphenyl molecule adsorbed on a Si(100) surface has been achieved by the Orsay partner (Lastapis et.al. *Science* **308** 1000 (2005)). Tunneling electrons from a low temperature (5 Kelvin) scanning tunneling microscope (STM) were used to control, through resonant electronic excitation, the molecular dynamics of an individual biphenyl molecule adsorbed on a Si(100) surface. Different reversible molecular movements were selectively activated by tuning the electron energy and by selecting precise locations for the excitation inside the molecule. Both the spatial selectivity and energy dependence of the electronic control are supported by spectroscopic measurements with the STM. These experiments demonstrate the feasibility of controlling the molecular dynamics of a single molecule through the localization of the electronic excitation inside the molecule.

AFM manipulation of adsorbates on insulating surfaces
The Osnabrück group have used the RHK VT-AFM for a systematic study of the manipulation of water on CaF_2(111) at room temperature. With a simple line by line scanning at high detuning of -35Hz the deliberate translational manipulation of molecular water on the CaF_2(111) surface was achieved and the conditions where the defects were stationary while scanning (figure 1) were also identified.

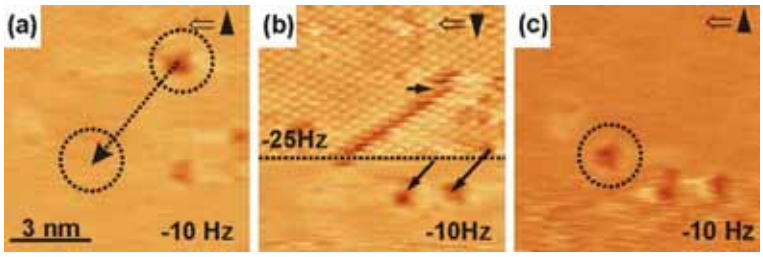

Figure 1 Controlled manipulation of a single water molecule towards two others.

One major result was that manipulation is along the main crystal directions on the surface, consistent with an adsorbate bound to specific surface sites and jumping from one equivalent site to the next neighbouring site. Careful examination of the manipulation path revealed a characteristic shape that was formerly observed in scanning tunnelling microscopy experiments. This so called "saw tooth" function has exactly the periodicity of the underlying calcium-lattice, further supporting our manipulation model. The first results of this work are now published in *Nanotechnology* **17** S148 (2006).

Manipulation of noble metal atoms and ions on thin film NaCl
A combination of low temperature and densty functional calculations has been used to study the properties of Au atoms and ions adsorbed on NaCl bilayers grown on a Cu(111) substrate (IBM Zurich and Chalmers). The charge state of single gold atoms may be controlled using a low temperature STM. The adsorption and diffusion properties of neutral and charged atoms are found to display striking differences showing that such properties may be controlled through the selectively charging atoms (Repp et.al. *Science* 305 493 (2004), *Phys. Rev. Lett.* **95** 225503 (2005)) – see Fig. 2..

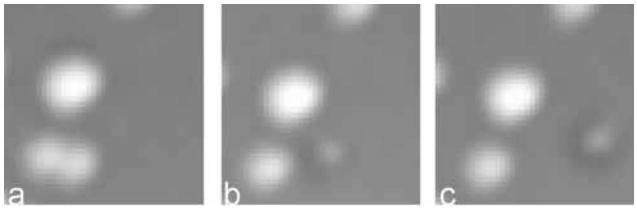

Fig 2. a: STM images of two single Au atoms and a Au dimer on NaCl. b: The Au atom on the right has been charged into a negative Au ion. (Au ion appears darker). c: The Au ion has moved to the right by thermal diffusion.

Vacuum deposition and manipulation of semiconductor nanocrystals

The Orsay group has demonstrated the deposition in vacuum of individual CdSe nanorods and explored their manipulation, i.e. translating or rotating, individual nanorods using the tip of the AFM either in the contact or tapping modes. On the hydrogenated C(100) surface, it has been found to be possible to dissociate or to rotate individual nanorods and these experiments show that the nanorods interact rather strongly with the hydrogenated diamond surface. For CdSe nanorods deposited on the graphite surface, (Orsay/Nottingham collaboration) imaging and manipulation requires relatively soft cantilevers (~ 1 N/m). Examples are shown below.

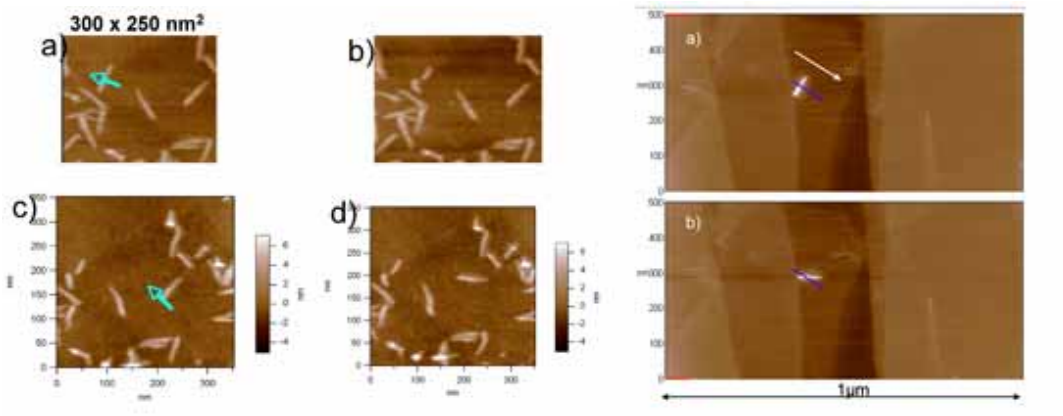

Figure3 : AFM manipulation of CdSe nanorods on a hydrogenated diamond C(100) surface. In figure a) and b) the arrow indicates the translation path of the AFM tip. The results of the AFM tip interaction with the nanorod are shown in b) and c) respectively.

Coupled bond breaking, rotation and translation in molecular rolling

We have identified the experimental signature of a rolling molecule in the manipulation of C_{60} on a Si(100) surface. The process couples bond breaking, rotation and translation and a simple model is verified using extensive density functional calculations. A modified process in which additional bonds are broken resulting molecular skewing will also be discussed. This work has been undertaken by the Nottingham and Kings groups (Keeling et.al., *Phys. Rev. Lett.* **94** 106014 (2005)).

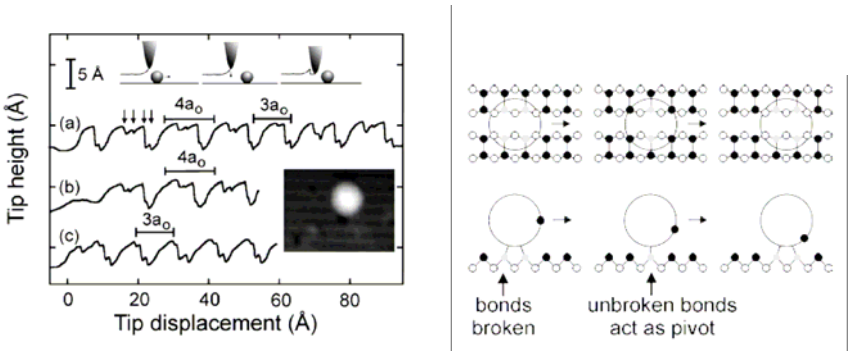

Figure 3 tip trajectories showing evidence for molecular rolling and schematic of the bond pivot process which couples rotation and translation on the Si(100) surface.

Numerical simulations of AFM imaging and tip-adsorbate interactions

Theoretical models for AFM probe-substrate and probe-adsorbate interactions which are relevant to both manipulation and imaging have been developed by the CNRS Toulouse, Kings and University College groups. These have been applied widely to AFM imaging of insulating surfaces such as MgO and CaF_2. Most recently a model based on atomistic modelling and kinetic Monte Carlo calculations has been developed to provide a generic basis for AFM induced manipulation of an oxygen vacancy on the MgO (001) surface (Trevethan et.al. submitted to *Phys. Rev. Lett.*).

*The consortium is co-ordinated by the University of Nottingham (P.H. Beton) and includes the following members: Bilkent University (lead scientist A. Oral), Chalmers University (M. Persson), CNRS Orsay (G. Dujardin), CNRS Toulouse (X. Bouju), IBM Zurich (G. Meyer), University College London (A. Shluger), Kings College London (L. Kantorovich), University of Osnabrück (M. Reichling).

CARBON NANOTUBE BASED FLOW SENSOR

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Carbon nanotubes have been the object of intense study for the last decade with demonstrated capabilities as chemical and biological sensors. Because of their nanoscale dimensions, they also have potential to be used as probes for sensing and investigating fluid properties at very small length scales where new fluidic phenomena may become observable. While S. Ghosh et al. [1] have already reported the use of bulk carbon nanotube mats as flow sensors inside millimeter-scale glass tubes, obtaining individual nanotube devices remains highly desirable. We are exploring this area and we will discuss our latest experimental results on carbon nanotube devices which operate on a different flow sensing mechanism than reported by S. Ghosh et al.

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IMMOBILIZATION AND METALLIZATION OF DNA FRAMEWORK MOLECULES AND DNA-SUPERSTRUCTURES FOR NANOELECTRONICS

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DNA molecules are optimal tools for nanotechnology [1, 2]. These mechanical stable, flexible molecules can build a template for nanoscale structures while also being appropriate for the biological functionalization of different surfaces. This biological matrix has a highly defined structure and its sequence ensures a direct addressability for manipulation on the nanoscale level.
For the construction of nanodevices, we compared immobilization techniques enable a technological implementation in a parallel way. Basic criteria for the immobilization are the addressability, specificity and the defined geometry of the immobilized molecules. The addressability enables the site-directed and assembly of framework molecules in parallel. The specificity ensures their selective binding onto surfaces whereas a defined geometry, i.e. a geometrically convenient arrangement, is required for the following manipulation steps in the nanoconstruction. We therefore tested combined stretching and immobilization methods for framework DNA molecules [3] and DNA superstructures like G-wires [4]. The one or two step binding of these molecules was arranged on microelectrodes, structured by conventional photolithographic techniques. The surfaces were either biologically or chemically modified or only activated prior to binding. Subsequently, the contacting of the molecules to the surfaces was achieved by guided immobilization based on self organization processes. The applied techniques, like immobilization and stretching by hydrodynamic and electrical forces, were presented and tested for their effectivity and ability for the construction of future nanoelectronic devices [5].

A specific metallization of DNA molecules was used for the generation of small nanowires enabling the electrical contacting with the macroscopic periphery (electrodes). On the one hand, we realized this metallization by binding of gold nanoparticles as seeds for a subsequent silver deposition [3]. On the other hand, we arranged this by direct metallization along the DNA backbone [6]. Additionally, a comparison between different metallization methods was implemented.

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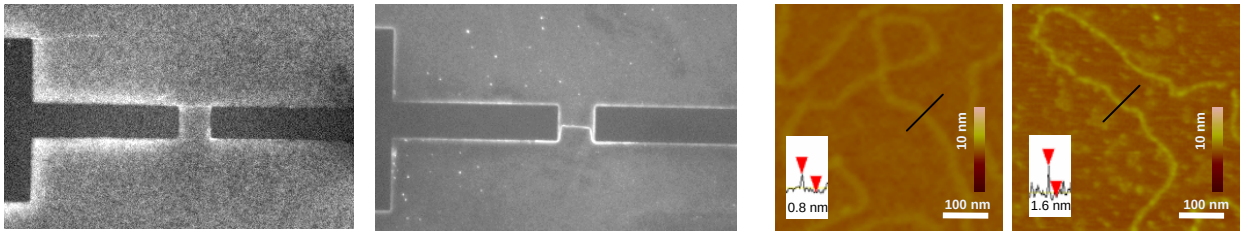

Immobilized single DNA molecule (left) and G-wire (middle) between microelectrodes (fluorescence images). Right: Metallization of DNA-molecules (AFM images).

SPIN WAVE GENERATION IN MAGNETIC NANOJUNCTIONS

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It has been predicted theoretically [1,2] and also confirmed experimentally [3-5] that a sufficiently large electric current flowing through a nanojunction in a magnetic multilayer structure can excite spin waves of a certain resonance frequency about 10 – 50 GHz. It has been also proposed to use this effect as a spin wave generator of high-frequency radiation (swaser). The main idea of the corresponding theory is already well understood, and is related to the current-induced spin torque acting locally on the magnetic layer, leading to the instability of a homegeneous magnetization in the layer.

However, many important details concerning the creation of spin torque and the mechanism of spin wave excitation are not well investigated so far, and they are still a subject of hot discussions. The main problem is that several key factors should be taken into account. These are the heating of electrons by current (in the experiments the density of current is of order of 10^8 A/cm^2), the correct estimation of the spin accumulation and the spin torque acting on magnetic moments, the details of spin wave energy spectrum in the nanolayer, and, finally, the microscopic mechanism of electron-magnon interaction leading to the direct creation of magnons accompanying the usual thermal excitation of low-frequency magnons.

Here we present a theory based on a semiclassical approach to the ballistic transport of electrons through the magnetic multilayer structure. It includes the effects of heating by electric current and the spin accumulation in nanolayers [6,7]. We used the Boltzmann kinetic equation to calculate the distribution function in the approximation nonlinear in electric field. It allows taking into account heating of electrons by current. Both the phonon and magnon-emission relaxation are included. In the ballistic regime of long spin-orbit relaxation length with respect to the characteristic lengths of the structure, we have calculated the profile of electrochemical potentials for spin up and down electrons, and the distribution of the electron spin density in the structure.

Within our approach both mechanisms of magnon generation are included – by electron-magnon scattering and by the thermal excitation. However, the dominating mechanism is the magnon radiation accompanying the transition of electrons between different spin subbands. This mechanism turns out to be of main importance for the case of very thin magnetic nanolayers, which makes possible low-energy transitions of electrons due to the absence of momentum conservation for electrons scattered from a thin barrier.

We have calculated the spectral distribution of the current-generated magnons for the parameters of a five-layer structure with alternating magnetic-nonmagnetic layers of a few nanometer width. The parameters and the geometry correspond to a realistic experimental structure.

The magnons are mostly generated as localized spin-wave modes in the nanojunction region. The frequency of generated waves depends mainly on the dimension of the lateral confinement and current density. The latter dependence is due to the accumulated spin density at the magnetic layer creating the spin torque. Our theoretical results are in good accordance with the existing experiments.

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DYNAMIC SHADOW MASK TECHNIQUE: DEVICE FABRICATION AND CHARACTERIZATION IN UHV

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The dynamic shadow mask technique (or dynamic nano-stenciling) uses a fine perforated shadow mask which is moved with high precision in close proximity to the substrate during exposure to a molecular beam. The mask is, for example, a perforated silicon nitride membrane and the material source can be a thermal evaporator. Using this principle in ultra high vacuum (UHV) allows the fabrication of clean structures, avoiding the use of resist and the contamination with chemicals and air. The principle is very flexible as it can be applied for patterning of various materials (metals, insulators, (in)organic semiconductors) on any kind of substrate (including non-flat or porous surfaces or fragile objects).

This contribution will focus on the fabrication of complex structures and devices. Devices, which consist of different materials, can be fabricated with a small number of process steps entirely in UHV (Fig. 1ab). The dynamic shadow mask technique is an ideal fabrication method for fundamental studies and for testing new device ideas. Additionally the technique can easily be combined with other methods, for example to add electrical contacts or functional elements on prefabricated nano-objects (Fig. 2).

The dynamic shadow mask set-up is similar to a scanning probe microscope; therefore the same components can easily be used for in-situ characterization of the structures, just by replacing the mask with an AFM cantilever or an electrical two tip probe (Fig. 1bc, Fig. 3).

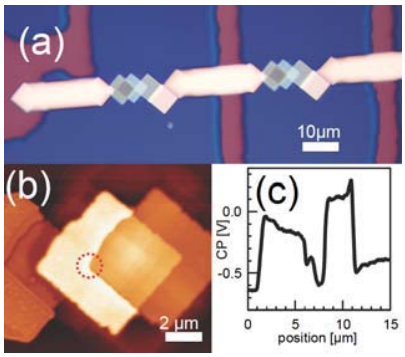


Figure 1. (a) Optical image of two devices. The large connection lines were fabricated with a different shadow mask. (b) Diode device formed in the overlapping region of two squares. The electrode overlap area (marked with a circle) is about 200 nm wide. Note that the active device area can be fabricated much smaller than the mask aperture because it depends mainly from the positioning accuracy. (nc-AFM image recorded in-situ). (c) Contact potential line scan measured on a similar device as shown in (b).

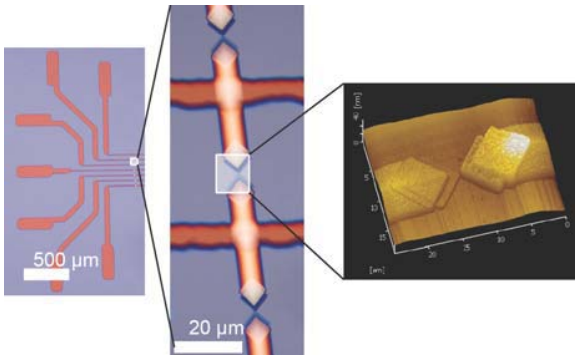
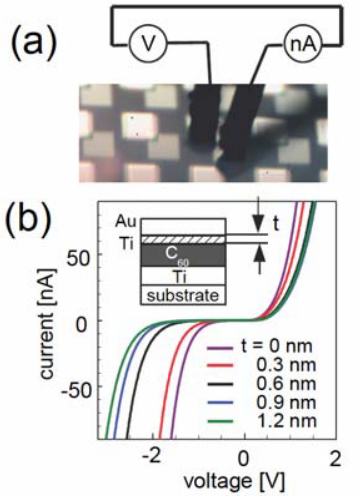


Figure 2. Fabrication method for gap (or point contact) structures. All elements shown are fabricated in UHV, using two different masks. (This type of structure is as well used for connecting prefabricated nano-objects.)

Figure 3. In-situ electrical transport measurements on diode array. When fabricating the array, a second moving shadow mask was used to create an inhomogeneous exposure to the molecular beam: The individual devices (in the overlapping corners of the squares) have a well defined variation in one parameter (*combinatorial device fabrication*). A small part of a device array is shown in (a). The thickness variation of one film leads to changes in the I-V curves (b).



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NANOSPIN: COMBINING THE MAGNETIC AND ELECTRIC PROPERTIES OF FERROMAGNETIC SEMICONDUCTORS INTO FUNCTIONAL DEVICES.

C. Gould

NANOSPIN is a European Commission projected bringing together 8 academic and industrial partners with a strong background in spintronic materials and devices. The project aims at the development of novel multifunctional spintronic nanoscale devices whose mode of operation is designed to take optimum advantage of the specific magneto electric properties of ferromagnetic semiconductors. The devices combine non-volatility, low current consumption, high switching speed and excellent scalability. The project addresses a number of interlinked novel device concepts for the magnetic writing of information, including current induced switching and current induced domain wall motion, combined with novel readout concepts based on tunneling anisotropic magneto resistance and double barrier structures.

Since the project is strongly device oriented, we use the well established and well understood ferromagnetic semiconductor (Ga,Mn)As as a vehicle material. This allows us to focus on device action, rather than on materials issues. While this implies that the prototype devices necessarily operate at low temperatures only, the concepts developed should directly apply to any p-type ferromagnetic semiconductor. The project thus complements ongoing materials research on room temperature ferromagnetic semiconductors. Direct involvement of several industrial and semi-industrial partners permits a constant evaluation of the potential of the developed devices for industrial applicability and commercialization for post CMOS applications.

In this presentation, I will briefly summarize how NANOSPIN aims to harness the interplay between magnetic and transport properties of strongly spin-orbit couple system in order to achieve these novel devices. In particular, I will describe the very sophisticated transport and magnetic anisotropies present in these materials, and show some they lead to the fundamentally novel transport behavior which we aim to convert into device functionalities.

NEAR FIELD INVESTIGATIONS OF MODEL MATERIALS FOR ORGANIC AND MOLECULAR ELECTRONICS

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Controlling the self-organization and electronic properties of molecular and macromolecular systems on surfaces is amongst the most challenging quests of molecular and organic electronics. To date, scanning tunneling microscopy and its spectroscopic modes (STM/STS), and atomic force microscopy (AFM), have been major tools for local investigations on various π-conjugated molecular and organic systems.

These past years, π-conjugated macromolecular systems have also emerged as a new class of materials which can present both self-assembly and novel electronic features, at the interface between organic and molecular electronics. Especially, some self-organized semi-conducting polymers constitute now model systems, for the realization of π-conjugated molecular nanowires and for fundamental STM investigations on surfaces.

In that frame, we have used regio-regular poly(3-alkylthiophene)s (P3ATs) and related materials for STM and STS investigations of the local electronic properties of self-organized π-conjugated polymer chains. P3ATs sub-monolayer films indeed self-organize into 2D polycrystals on HOPG, where chains are fully packed within mono-domains following a three-fold symmetry, and connected by regular, 60° and 120° folds due to the epitaxy of lateral alkyl groups on graphite. This allows studying the local structure and electronic properties of π-conjugated chains on reference samples where the polymer adopts well defined conformations.

In this communication, STM experiments on new self-organized π-conjugated liquid crystalline macro-monomers and related region-regular alternate copolymers designed with specific molecular and macromolecular engineering considerations will be presented. In comparison with the case of P3ATs 2D crystals self-organized on HOPG, the STM images obtained on the alternate copolymer PDOBTF demonstrate that the incorporation of fluorenone sub-units improve significantly the nanostructure by preventing the chain folding process.

On poly(3-alkylthiophene)s (P3ATs) 2D crystals, we have directly investigated the polymer local electronic states, by performing two dimensional STS imaging at the single chain scale, with the support of theoretical calculations combining *ab initio* with semi-empirical approaches. Simulated spectra in very good agreement with the experimental data have been obtained by a method combining *ab initio* and semi-empirical approaches, which allows a careful discussion of the polymer electronic states. From the experimental data, with the support of modeling, we will show that the STS spectra give a direct access to the polymer semi-conducting bandgap without noticeable charge transfer effects from the substrate. The effective gap reduction displayed by the STS conductance spectra, arises from extrinsic charge screening effects in the tunnelling junction. By performing 2D spectroscopic images at

the single chain scale, it becomes possible to scrutinize the electronic consequences of chain folds and π-stacking effects through spectroscopic contrasts. While chain folds do not locally increase the polymer bandgap more than a few tens of meV, a striking widening of the STS conductance gap is observed in case of electronic tunneling through two interacting polymer layers. Scenarios based on non planar configuration of thiophene cycles within the second layer or variations of the charge screening effects are proposed to explain this phenomenon.

Last, our efforts for developing SPM techniques for new investigations on π-conjugated materials will be described. Especially, a frequency modulation atomic force microscopy (FM-AFM) study using rigid tuning fork on polymer thin film will be presented. The ability of high spring constant tuning fork AFM to image polymeric material and to perform 2D dynamic force spectroscopy will be demonstrated on microphase separated block (PS-*b*-PMMA) copolymer films used in this case as reference samples.

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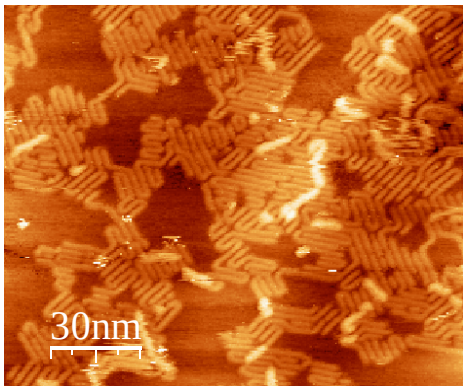

Fig 1. LC-STM image (UHV, 300K) of a sub-monolayer self-organized P3DDT film on HOPG

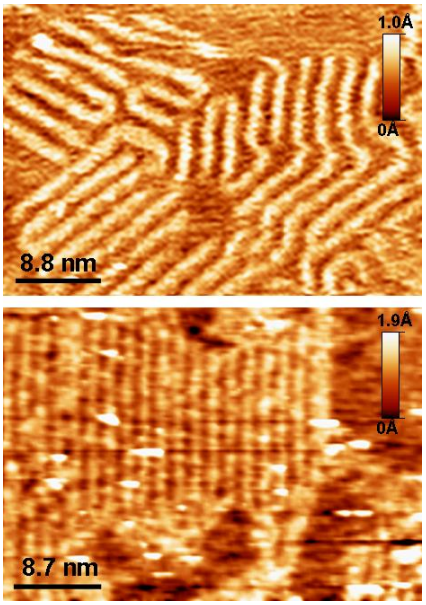

Fig 2. LC-STM images (ambient) of sub-monolayer self-organized P3DDT (top) and PDOBTF (bottom) films on HOPG at the same scale.

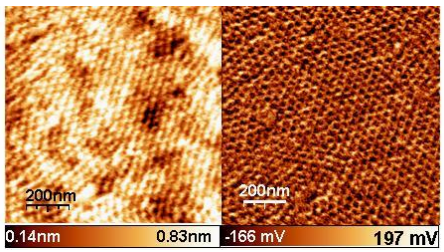

Fig 3. TF-AFM images (HV, 300K) of a PS:PMMA copolymer. Left : topography. Rigth : dissipation.

PHOTONICS AT NANOMETER SCALE : TRACKING LIGHT IN HIGH Q LOW V NANOCAVITIES

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Photonic crystals (PCs) have proven to be an efficient way to tightly confine the electromagnetic field in nanocavities or slow down light propagation within optical waveguides. Very recently it has been proposed to use a nanometric optical probe to observe in near-field the light confinement and propagation within PC devices. In this work we analyze the optical properties of PC nanostructures by using a SNOM probe in collection mode in association with transmission measurements. We also explore the possibility to use the nanometric tip for a new class of Near-field Optics Nanometric Silicon Systems (NONSS) dedicated to on-chip information routing and processing.

In a first step, we show that with to the SNOM probe it is possible to evidence different light behaviours depending on optical mode profile. Mode coupling in PC waveguides and quality factor changes in PC nanocavities will be discussed.
Then in a second step, we show that strong field confinement enhancement can be achieved in nanocavities by proper mirror designs including mode matching and losses recycling. A quality factor (Q) enhancement by two orders of magnitude is observed. These experimental results are discussed in light of numerical calculations.
Finally, in a third step, we fabricated a nanocavity in a monomode SOI ridge waveguide with an ultimately low microcavity modal volume of $0.6(\lambda/n)^3$. We use this high-Q low-V nanocavity to explore the nanocavity - nanometric optical probe interaction.

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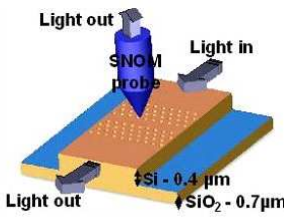
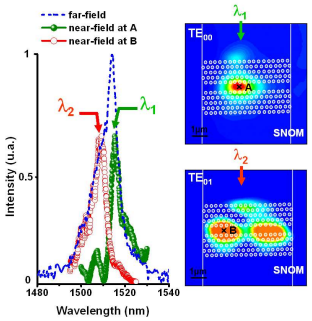
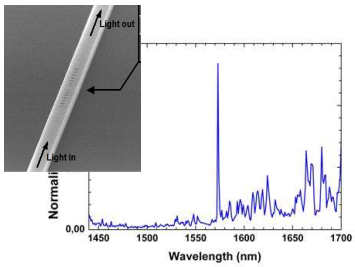


Near-field analysis





HIGH-TC SUPERCONDUCTIVITY IN ENTIRELY END-BONDED CARBON NANOTUBES

One-dimensional (1D) systems face some obstructions that prevent the emergence of superconductivity, such as Tomonaga-Luttinger liquid states and Peierls transition. Carbon nanotubes (CNs) are one of the best candidates for investigating the possibility of 1D superconductivity and its interplay with such obstructions. Only two groups to our knowledge, however, have experimentally reported superconductivity [1], [2]. In contrast, interestingly B-doped diamond and CaC6 could exhibit superconductivity with T_c of about 11K [3].

Here, we report that entirely end-bonded multi-walled carbon nanotubes (MWNTs) can exhibit superconductivity with a T_c as high as 12 K [4], which is approximately 30 times greater than T_c reported in [1]. We also find that the emergence of this superconductivity is very sensitive to the junction structures of the Au electrode/MWNTs. This reveals that only MWNTs with optimal numbers of electrically activated shells can allow superconductivity due to intershell effects.

Application of this superconductive MWNT to quantum computation (flux-controlled qu-bit) will be also shown.

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ELECTRON TRANSPORT AND MOLECULAR STRUCTURE OF SELF-ASSEMBLED MONOLAYERS OF ORGANOTHIOLS

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Self assembled monolayers (SAMs) of organothiols on gold bottom electrodes are fascinating test systems to study the electron transport through single molecules by scanning tunneling microscopy (STM). Such studies require a high control over the structure of the SAMs down to molecular dimensions [1,2]. Here we focus our studies on aromatic thiols, which are supposed to show more interesting electron transport properties than simple aliphatic thiols because of the conjugation along the aromatic backbone.

In terms of understanding of how an aromatic headgroup influences the structure of the formed SAMs, investigations concerning the deposition of various 4´-methyl-1,1´-biphenyl-4-alkanethiols (BPs) have moved into the focus of current research interest [3,4]. We have grown SAMs of BPs and of mixed monolayers with alkanes from solution (Fig. 1) and compared the structure of the formed SAMs in terms of topography and electron transport properties via UHV-STM. Using asymmetric tunnel junctions, W(tip) / BP-SAM / Au(substrat), the dependence of the tunnelling current on the tip-substrate distance and the I/V characteristics of the BP-SAMs have been obtained. From these data the decay constants of biphenyls, alkanes and vacuum are extracted and discussed [5].

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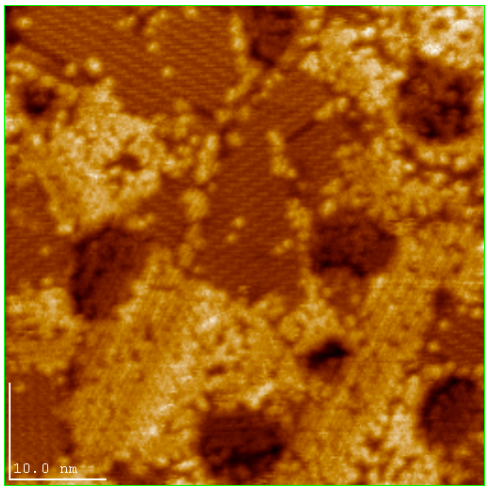

Figure1: Mixed monolayer of dodecane-thiol (C12) and biphenylbutanethiol (BP4). Single molecules of BP4 can be identified in the highly ordered C12 monolayer.

CARBON NANOTUBE BASED NANOELECTROMECHANICS

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Abstract

In this presentation I will discuss the recent theoretical and experimental work on a carbon-based nanoelectromechanics carried out within the CANEL project. I will focus on the work on carbon-nanotube-based nanoelectromechanics and present results by my colleagues and myself on singly and double clamped suspended nanotubes. I will discuss the basic properties of nanorelays comprising singly clamped CNTs in terms of a physical model, report on the experimental realizations of the nanorelay by my colleagues at Göteborg University, and consider possible applications of the device in digital and analog electronics. I will also report some recent results from Delft University of Technology on nanoelectromechanical single electron transistors comprising doubly clamped nanotubes.

NANOMATERIALS RESEARCH AT VTT TECHNICAL RESEARCH CENTRE OF FILAND

Jari Koskinen
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Finland

ABSTRACT NOT AVAILABLE

OVERVIEW OF NANOTECHNOLOGY RESEARCH AND DEVELOPMENT IN FINLAND

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Finland has been regularly rated as one of the world's most competitive economies in recent years. Key factors contributing to this success, according to various studies, have been the country's excellent innovation environment and its strategic investments in science and technology. Governmental efficiency, a good social infrastructure and educational system, and efficient management have been identified as other strengths [1].

Recently Finnish success in ICT is increasingly being overshadowed by new challenges linked to globalisation and the slow response of traditional industries to change. Nanotechnology is often highlighted as a possible source of future national economic renewal and growth, especially as Nokia and many other large companies are now multinationals with steadily less ties to their home base [2]. The three largest industrial sectors in Finland - electronics, pulp and paper, and chemicals - all see nanotechnology as a key enabler for future innovation and renewal. The greatest potential offered by nanotechnology at the moment is seen as lying in new material solutions, developing new advanced features for existing products, and increasing the cost-efficiency of industrial processes.

Tekes, Finnish Funding Agency for Technology and Innovation (www.tekes.fi) finances and activates R&D projects aiming to promote the competitiveness of Finnish industry. Nanotechnology has been chosen as one of key technology focus areas by Tekes. Tekes uses technology programmes to areas that are important for business and society, and allocates about half of the annual budget of 420 million euros through technology programmes [3].

FinNano, the Finnish Nanoscience and Nanotechnology Programme (www.tekes.fi/finnano) is a multi-annual public funding programme for nanoscience and nanotechnology. It coordinates different action lines at national level. The FinNano technology programme activity focuses are: 1) innovative nanostructured materials, 2) new solutions for nanoelectronics and 3) nanosensors and nanoactuators. The duration of the programme is five years, spanning 2005 – 2010. The total budget is approx. 70 million euros. Tekes funding of the programme covers € 45 million. Presently more than 85 companies and research units are participating in the FinNano nanotechnology programme. Tekes FinNano technology programme will be carried out in close cooperation with the Academy's FinNano research programme (www.aka.fi/finnanoeng). The research programme has three thematic areas: 1) directed self-assembly, 2) functionality in nanoscience and 3) properties of single nanoscale objects.

In accordance with the strategic objectives of the FinNano programme, international co-operation is of major relevance to the programme. It is particularly needed for nanotechnology where scientific and technical challenges are huge and a wider critical mass is beneficial. The objectives of FinNano programme is to support national and international networking and researcher mobility and to promote participation by Finnish researchers, research institutions and enterprises in the European Union's nanotechnology research and development programmes. Excellent examples of ongoing networking include the European MNT and NanoSci ERA-Nets. Other ERA-NETs, such as ERA-Chemistry and MATERA (Materials), also have nanotechnology elements, and Finns are working actively in these, as

they are in the Nordic MINT initiative, looking at the problems of commercialising micro- and nanotechnology. The programme activates and supports collaboration between Finland and the two top nanotechnology countries USA and Japan, too. Emerging economies such as China will be among those most influential in determining how the coming era of nanoscience and nanotechnology unfolds - and Finland will need to address contacts with these countries.

Together with Tekes' programme, the Academy of Finland's nanoscience funding and the special action of the Ministry of Education (http://www.minedu.fi) the total Finnish investment in nanoscience and nanotechnology is secured up to € 100 million before the end of this decade (2005-2010). The national actions will strengthen research and development prerequisites in the spearhead domains in Finland, which are nanomaterials, nanoelectronics and -photonics and nanobiotechnology [4]. Public investment together with additional private funding will create a strong and fruitful ground for new nanotechnology innovations and strengthens Finland's position as an innovative high-tech country.

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THE FLOW OF INTERACTING PHONONS THROUGH NANOWIRES, NANOTUBES, AND MOLECULAR JUNCTIONS

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Understanding thermal transport at the nanoscale is a very important problem. With the continued miniaturization of electronic devices, heat dissipation is a major limiting issue for future technological developments [1]. At the same time, nanostructuring can lead to materials with desirable thermoelectric transport properties, a fundamental one being their thermal conductivity [2].

But technology is not the only driving force behind research in this area. A lot of interesting fundamental physics emerges in the study of the thermal conduction properties of these systems. In this talk, we will focus on phonon conduction, and the effect of many-body phonon interactions on the thermal conductivity and conductance of suspended nanowires, nanotubes and molecular junctions. For each of these systems, a different theoretical approach has been developed to explain and in some cases predict experimental results.

We will start from the simplest of these approaches [3,4], which gives a good account of experimental measurements in semiconductor nanowires [5]. Then we will discuss the more complex problem of thermal conduction in single walled carbon nanotubes, graphene, and graphite. We will see how the character of the 3-phonon scattering process in these systems results in extremely long phonon mean free paths and thermal conductivities [6,7]. Subsequent experimental results have confirmed findings from the theoretical study [8,9].

Finally, we will introduce a new technique, based on non-equilibrium Green's functions, that allows to study the quantum mechanical many-body problem of interacting phonons flowing through generic, atomically described, anharmonic structures. This technique is applied to investigate a simple model molecular junction. We will show important quantum mechanical effects taking place in the anharmonic scattering process, which are very different from classical predictions.

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FEMTOSECOND ELECTRON-ION DYNAMICS IN EXCITED NANO-MATERIALS

Real-time propagation based on the time-dependent density functional theory

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Electronic excitations induce very fast phenomena like as photo-induced chemical reactions, energy shake up by ion impacts, decay of hot-carriers, and so on. Such fast dynamics typically take few hundreds femtoseconds (fs = 10^{-15} seconds), where the application of conventional Fermi-Golden rule and Boltzmann transport equation are no longer valid. Yet such fast phenomena play crucial roles in current nano-technology where precise control and design of materials are highly demanded. To challenge such very fast phenomena, direct treatment of time-propagation of electron wave functions is made being coupled with the molecular dynamics (MD) simulation. This is an alternative approach to conventional first-principles MD simulation where the diagonalization of the Hamiltonian is performed to obtain electronic steady state.

In this paper, I will discuss first-principles approach being applied to such fast dynamics. The basic ideas of the first-principles approach are the following two. The first is obtaining an approximated excited state within constraint density functional theory (DFT), in which artificial promotion of occupation numbers of electrons is made throughout the self-consistent field (SCF) iteration in diagonalizing the Kohn-Sham Hamiltonian. The second is to perform electron ion dynamics respectively based on the time-dependent DFT (TDDFT) [1] and on classical Newton's equations for ions starting from the approximated excited state. In solving the time-dependent Kohn-Sham equations, the Suzuki-Trotter split operator method [2], which conserves orthonormality of time-evolving wave functions and guarantees higher order of accuracy with respect to the interval of simulation-time-step, is applied. The numerical stability throughout long-time TDDFT and molecular dynamics (MD) simulations has been achieved by using the computer code FPSEID (First-Principles Simulation tool for Electron Ion Dynamics) [3].

Validation of this TDDFT-MD approach is guaranteed when the simulation follows a particular adiabatic potential energy surface (PES) since the Hellmann-Feynman theorem can be explicitly applied in computing forces on ions. On the other hand, in case of non-adiabatic transition, the simulation shows us appearance of off-diagonal elements of the time-dependent Kohn-Sham Hamiltonian with respect to the time-dependent Kohn-Sham wave functions. At this moment, we have an ambiguity in obtaining the forces on ions. I will discuss this problem in cases of molecules and condensed matters. An important note is that the famous approach of 'surface-hopping' [4] is basically not valid for DFT-based theories.

The displayed figure expresses one of applications of TDDFT-MD method: hot-carrier decay in photo-excited carbon nanotube which demonstrates the benefit of solving the time-evolution of many wave functions for tracing one particular PES even when the level crossing among the state with different electronic occupation occurs. This figure shows time-evolution of single-particle energy levels for excited electron and hole under lattice motions initiated at the room temperature. Rapid reduction of electron-hole energy gap can be seen, denoting non-radiative decay of hot-carrier in carbon nanotube within sub-picosecond time-constant.

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Figures:

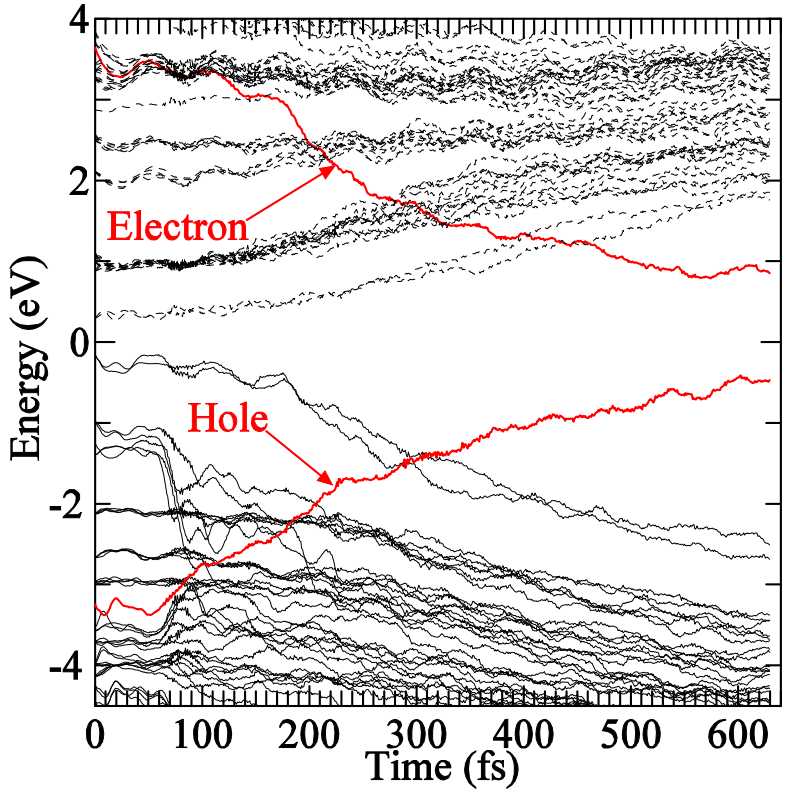

Figure 1. Time evolution of hot-carrier in a (3,3) carbon nanotube. Excited electron and hole states are indicated by arrows. Solid and dotted lines are valence and conduction bands, respectively. This plot is for a Γ point with use of a supercell as eight-times longer than that of primitive cell of the (3,3) nanotube.

NOVEL HYBRID CARBON NANOMATERIAL: FULLERENE-FUNCTIONALISED CARBON NANOTUBES

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Both fullerenes and single-walled carbon nanotubes (CNTs) are of great interest since they exhibit unique and useful chemical and physical properties. We have discovered a novel hybrid nanomaterial combining these structures, i.e. consisting of fullerenes covalently attached to the outside surface of CNTs, called fullerene-functionalised CNTs. Two one-step continuous methods for their selective synthesis have been developed: using pre-made iron catalyst particles by a hot wire generator method and particles grown *in situ* via ferrocene vapour decomposition in the presence of CO and trace amounts of H_2O and CO_2 etching agents. Fullerenes are formed on the surfaces of aerosol iron particles together with CNTs during carbon monoxide catalytic disproportionation under the influence of trace concentrations of CO_2 and H_2O. TEM images at low magnifications originally suggested that most synthesised nanotubes have an "amorphous coating". However, careful investigations revealed that much of the coating is, in fact, composed of fullerenes (FIG. 1). Their spherical nature has been confirmed by tilting samples within a HR-TEM. Statistical size measurements of fullerenes performed on the basis of HR-TEM images revealed that the majority of fullerenes consists of C_{42} and C_{60} (FIG. 2). Interestingly, evidence of C_{20} fullerenes, the smallest possible dodecahedra is found. For an independent characterization of the structures in question, we performed Ultraviolet-visible (UV-vis), Raman, and Fourier Transform Infrared (FT-IR) spectroscopic and Matrix-Assisted Laser Desorption Ionization Time-of-Flight (MALDI-TOF) mass spectrometric measurements. Raman spectra show a pronounced G-band at 1600 cm^{-1} associated with CNTs, and a weak D-band at 1320-1350 cm^{-1}. In addition, characteristic features at 1400 cm^{-1} and 1370 cm^{-1} are likely associated with fullerenes even though they are considerably shifted compared to the 1469 cm^{-1} peak of the $A_g(2)$ pentagonal mode and 1427 cm^{-1} peak of the first-order Raman $H_g(2)$ mode of pure C_{60}. The main peaks in MALDI-TOF spectrum are attributed to C_{60} ($C_{60}H_2$, $C_{60}H_2O$) and C_{42} ($C_{42}COO$) fullerenes. Accordingly, fullerenes are attached to CNTs via either oxygen (preferable for fullerenes larger than C_{54}) or carboxylic (for smaller fullerenes) bridges, which was confirmed by FT-IR measurements. Atomistic density-functional-theory based calculations showed that (FIG. 3) systems composed of fullerenes and nanotubes with single vacancies covalently functionalized through ester groups can indeed exist, although being metastable with respect to forming a perfect tube and oxidized fullerenes. Calculations indicate that in addition to oxygen-based bridges, some fullerenes might be directly covalently bonded to CNTs or even make hybrid structures. This novel material showed very high cold electron field emission efficiency with a current density of 189 A/cm^2 at 1.26 V/m.

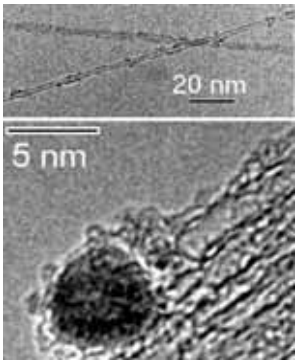

FIG. 1. A HREM image showing fullerenes on the surface of the CNTs.

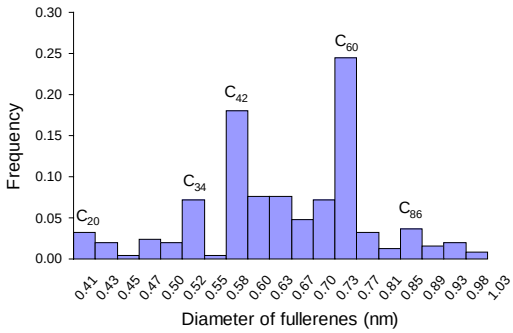

FIG. 2. Statistical size distributions of fullerenes showing the majority of fullerenes consisting of C_{42} and C_{60}.

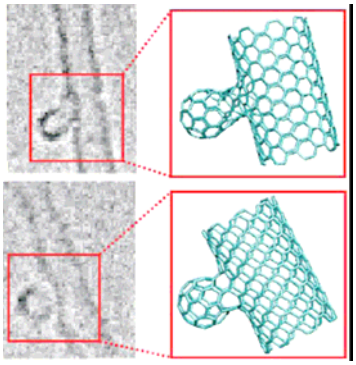

FIG. 3. An atomistic computer simu-lation model by COMP and ALSIM illustr-ating the covalent bonds at the nanotube-fullerene.

THEORY OF ELECTRONIC TRANSPORT THROUGH SINGLE MOLECULE: EFFECTS OF ELECTRON-VIBRATION COUPLING

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We describe how to treat the interaction between travelling electrons and localised or extended vibrational modes in molecular nanodevices [1]. We present a multichannel scattering technique which can be applied to calculate the transport properties for realistic systems, and show how
it is related to other methods (other scattering and non-equilibrium Green's functions techniques) [2]. We apply the technique to describe recent experiments on molecular junctions: the effects of the temperature on the conductance of molecular break-junctions are studied for a model system; we also show that it is necessary to go beyond the single-vibration mode analysis to understand the features observed in inelastic electron tunnelling spectroscopy [1]. Finally, we briefly discuss the effects of electron-vibration coupling in the presence of electron-electron interaction in single-molecule transistors [3].

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SCHOTTKY BARRIER IN Au- AND Pd-CONTACTED SEMICONDUCTING CARBON NANOTUBES

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Work on semiconducting carbon nanotubes (CNT's) has intensified over the past few years in connection with their potential use as nanoscopic field-effect transistors [1]. Progress is, however, still hampered by the difficulties in understanding the contact between the metal electrodes and the CNT. Several groups are stepping up their efforts on the experimental side [2], progressively reaching a high degree of control on the contact formation and progressively gaining insight on this issue. To date, however, theoretical work lags behind, mostly focusing on developing simple microscopic models that can be handled at a reasonable computational cost [3], but with questionable prediction power.

Here we present work on the transport properties of semiconducting CNT coupled to commonly used metallic electrodes such as Au and Pd from a fully first-principles point of view. To this end we employ our code ALACANT (ALicante Ab initio Computation Applied to NanoTransport) [4]. The role of the chemistry at the contact, the geometry, and the atomic relaxation on the Schottky barrier and thus on the transport properties (n-type vs. p-type) is analyzed. Our preliminary results show that for simple but realistic contact geometries (see Figure 1) the Fermi level lies roughly in the middle of the gap for Au-contacted CNT's, while this one is pinned close to the top of the valence band for Pd-contacted CNT's. No appreciable band bending is observed for neither type of metal, although the charge transfer at the interface is larger in the case of Pd.

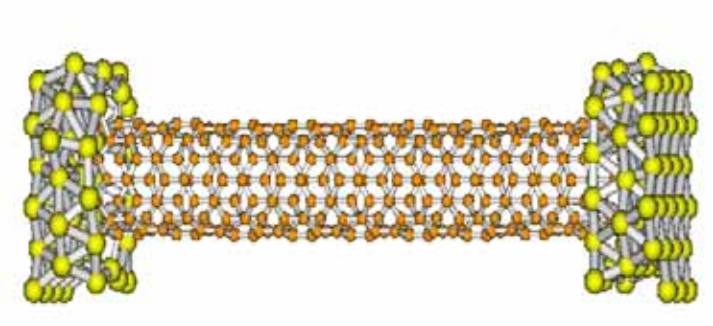

Figure 1. Relaxed structure of a semiconducting CNT contacted by the open ends to Pd electrodes.

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FABRICATION OF LARGE CRYSTALLINE MONOLAYERS OF NANOGRAPHENES BY "SOFT LANDING" TECHNIQUE

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The processing of giant macromolecules into ultrapure and highly ordered structures at surfaces is of fundamental importance to study chemical, physical and biological phenomena, as well as for their use as active units in the fabrication of hybrid devices. The possibility of handling larger and larger molecules grants access to increasingly complex functions. Unfortunately, larger molecules usually imply lower processability due to either their low solubility in liquid media or the occurrence of thermal cracking during vacuum sublimation. The search for new strategies to process and characterise giant molecules is thus a key goal in materials science. Here we report a new general route to process at surfaces extraordinarily large molecules, i.e. synthetic nanographenes, into ultrapure crystalline architectures.[1] Our method relies on the soft-landing of ions generated by solvent-free matrix assisted laser desorption/ionization (see figure 1). The nanographenes are transferred to the gas phase, purified and adsorbed at surfaces. Scanning tunnelling microscopy (figure 2) revealed the formation of ordered nanoscale semiconducting supramolecular architectures. The unique flexibility of this method allows growth of ultrapure crystalline films of various systems, as organic, inorganic and biological molecules, hence it can be of interest for applications in electronics, (bio)catalysis and nanomedicine.

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Figures:

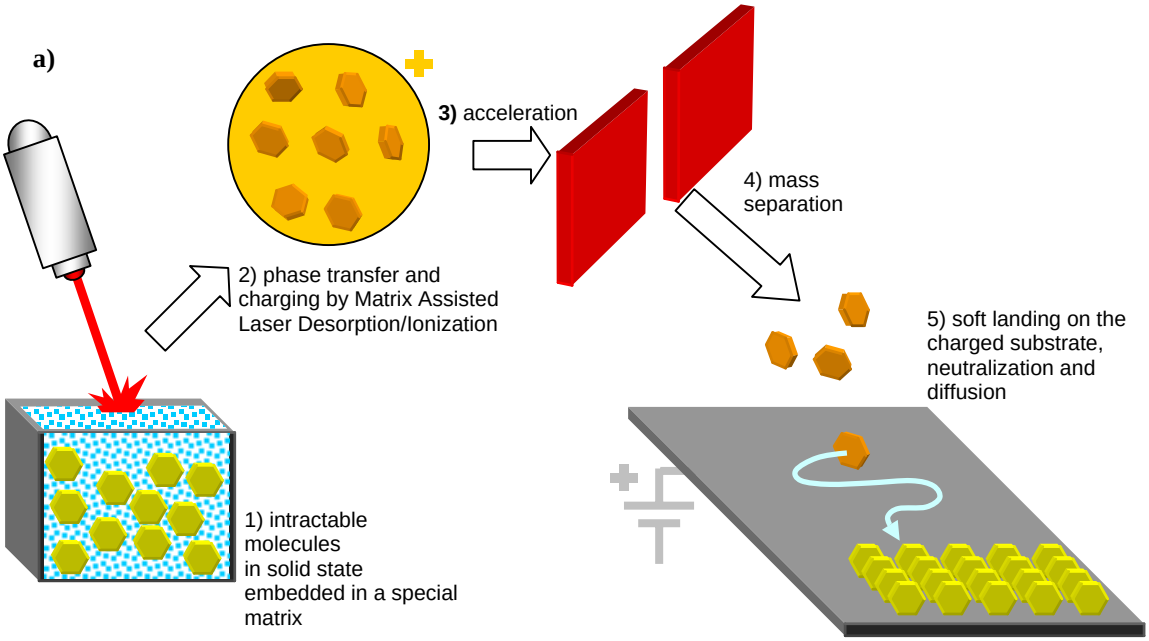

Fig. 1 The soft landing technique.

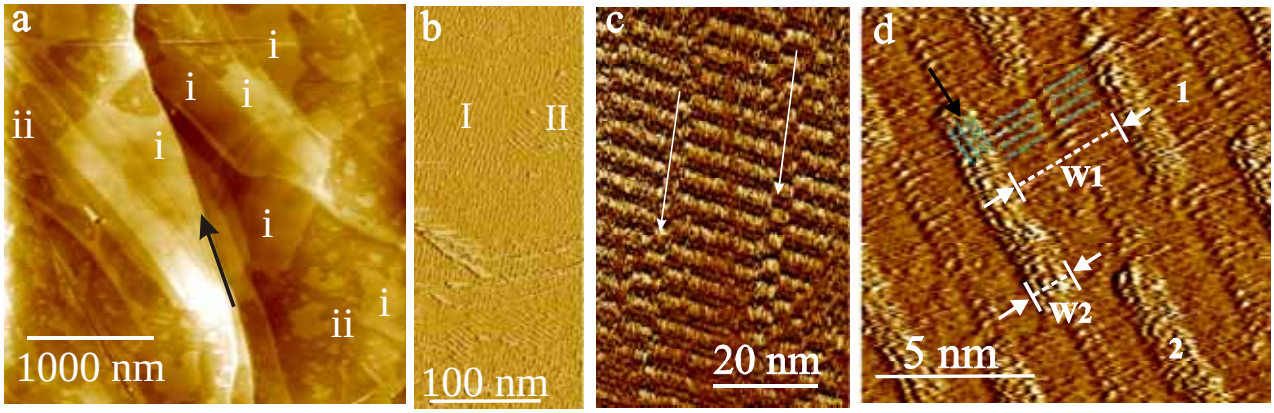

Fig. 2 $C_{42}H_{18}$ layer soft-landed on HOPG: (a) SFM topographical image. Z-scale of the image amounts to 8.6 nm. (b-d) Current STM images: (b) Polycrystalline structures composed of different domains with a given lamellar orientation are marked with different numbers. (c) Magnified region of domain I from (b). The image in (d) has been corrected for the piezo drift. The two types of phases (1,2) are indicated. The molecular structure from the CPK representation has been drawn on the top of the STM image. Tunneling parameters: (b,c) bias tip voltage U_t=446 mv, average tunneling current I_t= 8 pA. (d) U_t=653 mv, I_t= 12 pA.

TUNING THE Ag(111) SURFACE ELECTRONIC STRUCTURE WITH SELF-ASSEMBLED MOLECULAR NANOGRATINGS

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We report a low-temperature scanning tunneling microscopy (STM) and spectroscopy (STS) study aiming on the confinement of the 2-D electron gas of Ag(111) surface state electrons using molecular self-assembly. In particular, we employed the amino acid methionine to systematically fabricate regular 1-D nanogratings whose periodicity can be tuned by the molecular coverage in the ~2–10 nm range. The gratings comprise paired methionine rows separated by extended stripes of pristine Ag. The molecular rows locally quench the Shockley surface state of the substrate and represent highly regular 1-D reflectors for the 2-D electron gas in the adjacent Ag areas. The resulting 1-D confinement is recognized by the characteristic modification of the surface electronic structure in STS measurements.

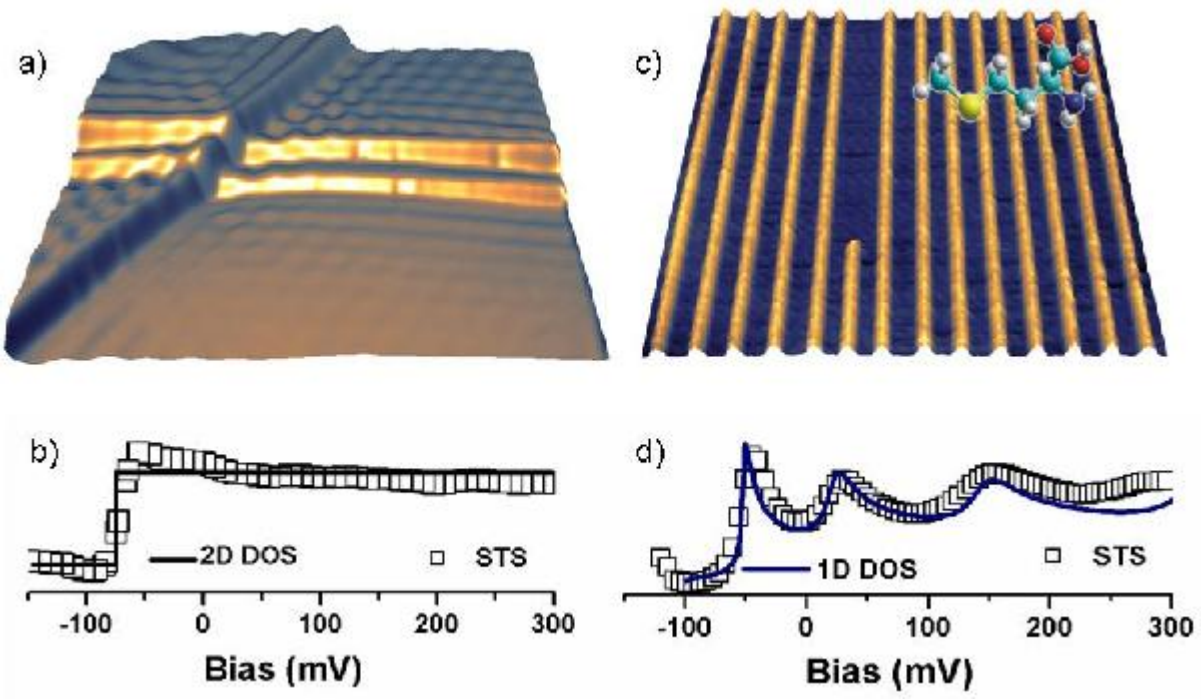

Fig 1: a) Topography of Ag(111) surface with atomic steps resolved overlaid with a dI/dV STS map in order to enhance the standing wave pattern of the surface state electrons reflected at the step edges. b) STS of the Ag surface state revealing the stepwise onset in the density of states typical for a 2-D electron gas. c) Regular methionine nanograting self-assembled on Ag(111); its periodicity can be easily controled by the molecular coverage. d) Tunneling spectra taken in between the molecular rows demonstrating the 1-D confinement of surface state electrons.

Moreover, it leads to a shift of the surface state band onset, which depends sensitively on the grating periodicity. As a consequence a systematic control of the surface electronic structure becomes possible, and the surface state band onset can be tuned in an energy range exceeding 100 meV (with the highest energies there is partial 2-D condensation of the methionine surface nanostructures). For the particular case of a grating corresponding to a confinement length of 7 nm a detailed analysis of the local density of states through spatially resolved STS shows that the molecular resonator can be described within the framework of the Fabry-Perot model, i.e., the self-assembled methionine rows act as excellent mirrors (r=0.7) for electrons at the Fermi level. Moreover, U-shaped arrangements where a resonator is closed at one side allow for an analysis of the standing wave pattern of the surface state electron gas subject to further confinement. Our results suggest that the engineering of molecular nanostructures on surfaces opens a new route to control electron confinement in low dimensions.

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MECHANICAL RESONANCES OF NANOTUBES AND NANOWIRES

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Nanotubes and nanowires (NNs) may be considered to be the ultimate cantilevers for active elements in nano-electro-mechanical systems (NEMS). Their small size and low weight make them highly sensitive as sensors and open new perspectives for switches, oscillators and different RF applications.

In this talk I will present the basic research our group is carrying out on the excitation and detection of mechanical resonances of individual NNs in two types of experimental environments: an ultra high vacuum (UHV) field emission (FE) system and a scanning electron microscope (see Fig. 1(a)). The resonances are mostly excited by harmonic electric fields and detected by the FE current, variations in the emitted pattern and SEM imaging. Some of the phenomena related to the nanometric scale of these objects we are exploring are tuning the resonance frequencies by electrical field pulling, detection by FE tunnel current (Fig. 1(b)), high order parametric resonances, splitting of vibrations into two polarisations by asymmetric applied fields, mode-locking, etc. Using the two environments allows understanding the complicated mix of parametric and higher order resonances that give rise to dozens of resonances. Excitation by harmonic voltages as low as 1 mV can be detected by the FE pattern and show that the Q factor of a SiC nanowire reached 40,000 at room temperature in UHV.

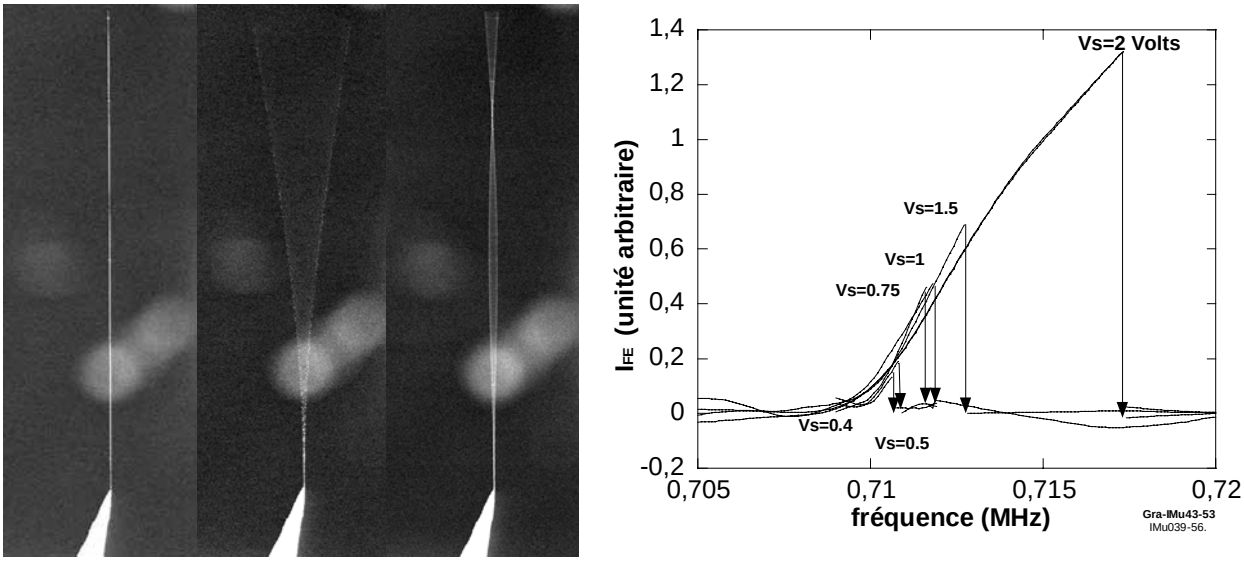

Fig 1(a). First two mechanical resonances of a SiC Nanowire. (b) Variation of the field emission current from a carbon nanotube passing through a parametric resonances for varying amplitudes of electrical excitation.

Oral

RESONANT TUNNELING IN HIGHLY ORGANIZED MOLECULAR ASSEMBLY

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The control of supramolecular architecture constitutes a major challenge in the development of high mobility organic semiconductor devices.[1] A promising class of organic materials exploits the stacking of conjugated polymers and molecules in which significant intermolecular π-electron coupling exists.[2] Different approaches for creating low-dimensional assemblies with tailored structural properties favoring π-stacking are emerging.[3] One promising approach is self-directed assembly on a hydrogen-passivated Si(100) surface where molecular lines of styrene have already been created through a chain reaction growth mechanism. The main interest for this semiconducting surface is clearly the distance separating surface Si atoms (3.8 Å) on which the molecules are covalently attached which favors a significant π-electron coupling between molecules (see Figure 1).

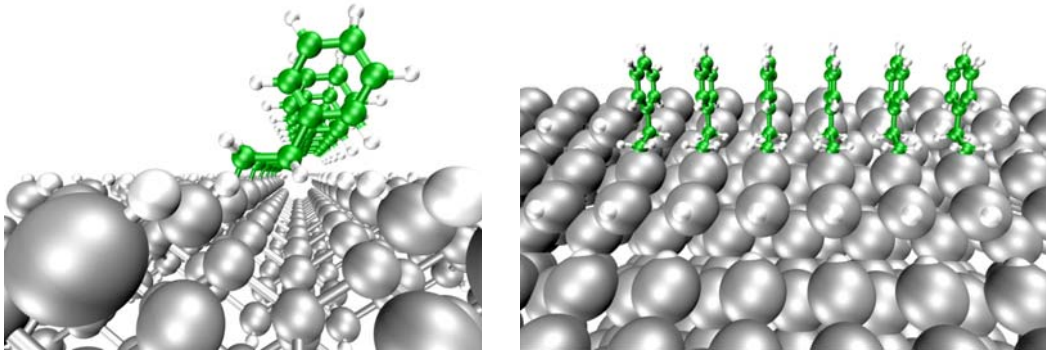

Figure 1. Formation of low-dimensional organic nanostructures on the reconstructed [2x1]Si(100) surface through a self-directed reaction.

The simplest and probably the richest existing molecular species to investigate fundamental aspects of π-stacking are small acenes such as naphthalene, anthracene, tetracene, and pentacene assemblies. Most of the previous experimental and theoretical studies on oligoacenes addressed issues related to the electronic structure and transport properties of very good or even perfect crystalline phases in which most of the molecules adopt a herringbone-like structure. Due to the relatively weak intermolecular π-electron coupling, these systems usually have a rather low mobility (10^{-6}- 10^{-2} cm^2/ V s) and demonstrate relatively poor switching abilities. Recent interest for pentacene-based systems originates from the significant improvement in the production of good quality single crystals that give much higher mobility (0.1 - 10 cm^2/ V s) than those of polycrystalline samples. In this presentation, we will present the results of tight-binding and DFT calculations on the electronic and electron transport properties of perfect π-stacked oligoacene wires that could possibly be synthesized on Si(100).

In a first attempt, we studied the variation of electronic properties of isolated acene-based molecules (benzene, naphthalene, anthracene, etc.) where the number of π-electron increases. Then, we investigated the variation of electronic and transport properties for the molecular species upon their assembling into a low dimensional nanostructure which mimics a self-directed assembly on the Si(100)[2x1] surface. On isolated molecules, we observed a drastic decrease of the band gap by more than 4.5 eV for acene molecules containing up to 15 members rings. An additional band gap decrease observed upon molecular assembling does not depend on the nature of the molecules but more on the separation between them. Oligoacene assemblies with intermolecular spacing $d_{mol} \leq$ 3.8 Å are characterized by improved π-electron coupling that facilitates the electrical transport through a resonant tunneling mechanism. For such molecular arrangement, we have computed significant band dispersion (≈ 340 meV), high transmittance (T(E) ~ 1), and relatively high mobility for holes and electrons (0.1-0.9 cm^2/Vs) in both resonant π-valence and π*-conduction bands.

In a second effort, we have focused on the possibility to control the charge density of low energy π-electron in naphthalene-based molecule through a judicious choice of functional groups. We have considered the presence of methyl (CH_3) and chloride (Cl) groups for their donor-acceptor abilities. If one assumes that the charge density of π-electron can be modulated by functional groups, a mixture of two different functionalized molecules could, in principle, lead to the creation of a n-p molecular junction. Our results indicate that the most striking characteristic of this heterogeneous system is a partial localization of the frontier π-orbitals on either side of the molecular junction. The extent of the evanescent wavefunction that escapes across the interface near E_F is shorter when chloride groups are used to modify the π-electron distribution of the naphthalene core than when methyl groups are used. Consequently, the tunneling of carriers in CH_3-heterojunction is significantly larger than for systems containing chloride groups. This shows that specific electronic properties can be tailored on naphthalene-based assemblies in which a judicious combination of functional groups is considered.

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CONTROLLING THERMAL EMISSION AND OPTICAL ABSORPTION RESONANCES FROM NANOCYLINDER ARRAYS

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Understanding the absorption and thermal emission of electromagnetic radiation in nanostructured systems is a key issue in nanoscience and technology. Emission and absorption processes, closely connected from the well known Kirchhoff's law, are of considerable interest in very different applications. Tailoring the thermal emission is especially relevant for thermophotovoltaic (TPV) applications and for the design of efficient light and infrared sources.

In this work, we show that a simple subwavelength cylinder array can be tuned to present striking emission and absorption characteristics. This system, that resembles a nanowire toaster grille, presents two different kinds of emission/absorption resonances. Close to the Rayleigh anomalies, the diffractive coupling with the lattice periodicity [1,2] can generate coherent, quasi-monochromatic and highly directional, thermal emission/absorption even in absence of any material or surface plasmon/polariton resonance (SPR). These geometric resonances [3] lead to sharp peaks in the extinction spectra with characteristic Fano line shapes. Another kind of absorption resonances, with wider and symmetric line shapes, appears when the ma-
terial exhibits an absorption line or in the presence of localized SPRs. At the resonant wavelength, the emission is isotropic which may be important for TPV applications. We analytically derive the conditions for resonant emission/absorption as a function of the geometry and material's parameters. We will demonstrate that for s-polarization there is a theoretical limit of 50% of absorption. Interestingly, we will show that, for p-polarized light and an appropriate choice of parameters, an array of nano-cylinders can present perfect (100%) absorption. This study provides new tools for the nanoengineering of biological and chemical sensors based on nanoparticle arrays.

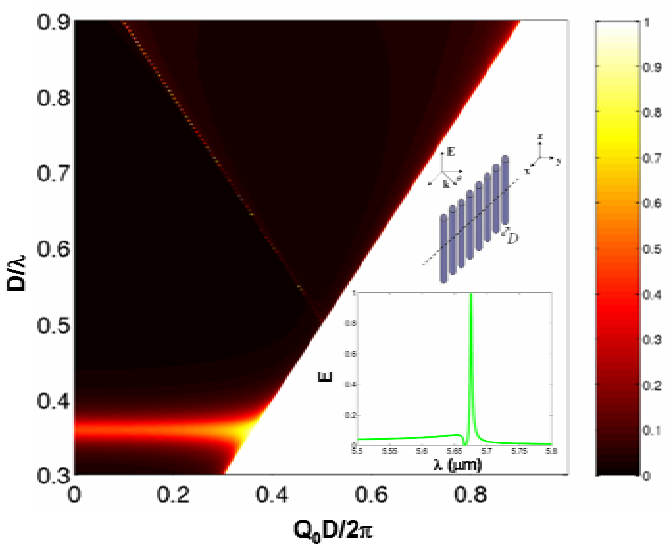

Fig. 1: Extinction spectrum in s-polarization in the plane D/ versus Q_0 (x-component of the incident wavevector), for an array of SiC nanocylinders with parameters : period D = 4.5 m and radii a=0.2 m. Around D/ =0.36 (l = 12.5 m), there is an isotropic extinction peak due to the absorption line of SiC. The inset shows the extinction spectrum, which exhibits a typical Fano line shape, for an incident angle =15° around the geometric resonance (close to Rayleigh frequency).

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SILICON NANOWIRES FOR PHOTODETECTOR ARRAYS

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There is a growing interest in the use of semiconductor nanocrystals and nanowires (NWs) for photodetectors and solar cells due to their tuneable feature size and large surface area [1-3]. McDonald et al. [2] have shown that nanocrystal-based photodetectors can be tuned for enhanced infrared response by controlling the feature size of the crystals, which is attractive for potential biomolecular studies [4]. In addition, Law et al. [1] have shown the use of aligned NWs in dye-synthesized solar cells to enhance extraction of photo-generated carriers, leading to higher external quantum efficiencies of ~50% [1]. While the surface and feature size of NWs can provide the benefits of nanocrystals, they can lead to better extraction of photo-generated carriers along the high mobility NW core. However, carrier extraction in dye-synthesized solar cells [1,3] is hampered by electrode separation of more than 20 μm in view of the limited lifetime of the generated carriers.

This paper presents photodetectors (see Fig. 1(a)) having vertically stacked electrodes with sub-micron (~ 200-400 nm) separation based on silicon nanowire (SiNW) nanocomposites. The thin-film-like photodetector devices are made using standard photolithography instead of electron beam lithography and thus are amenable to scalable array fabrication. Fig. 1(b) depicts a microscope picture of a row of the photodetectors fabricated on a strip of grown SiNWs. The SiNWs are grown using PECVD [5] on photolithography located catalyst areas (see Fig. 2(a) and (b)). The fabrication method of SiNW/oxide nanocomposites, shown in Fig. 2(c) and (d), is not limited to SiNWs and can be extended to different NWs (e.g., ZnO and CdSe) and substrates. As seen in Fig. 1(c), the current-voltage characteristics show Schottky behaviour and are dependent on the properties of the contact metal (ITO, Al, Au) and that of the pristine SiNWs. This makes these devices also suitable for examination of electronic transport in SiNWs. Preliminary results for light sensitivity show promising quantum efficiency that is a function of effective NW density and diameter.

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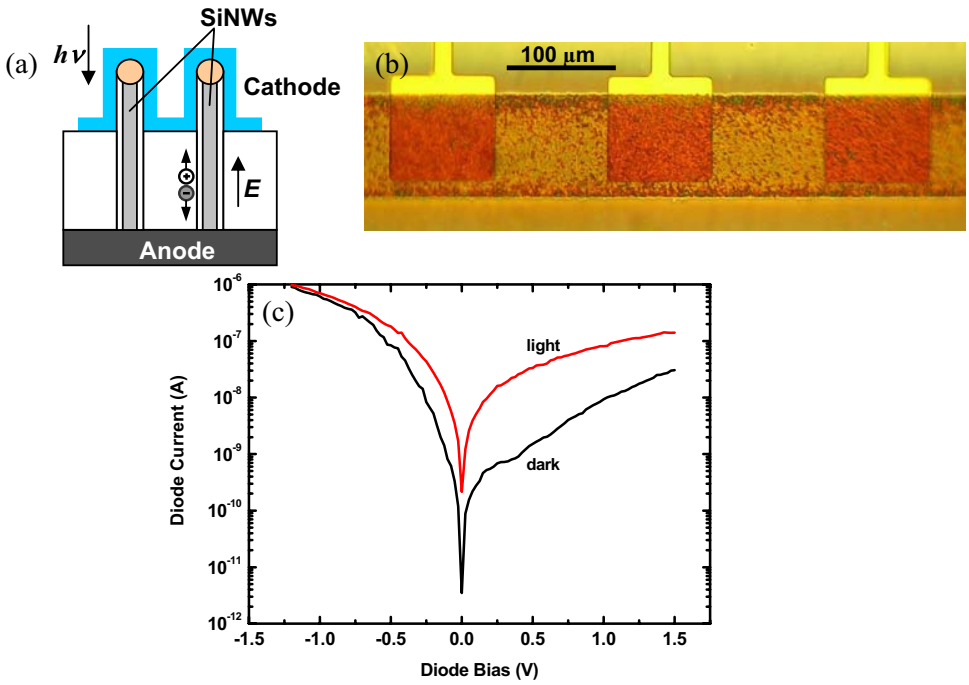

Fig. 1. (a) Schematic cross-section, (b) photomicrograph, (c) measured current-voltage characteristics of the ITO/SiNW photodiodes under dark and light conditions.

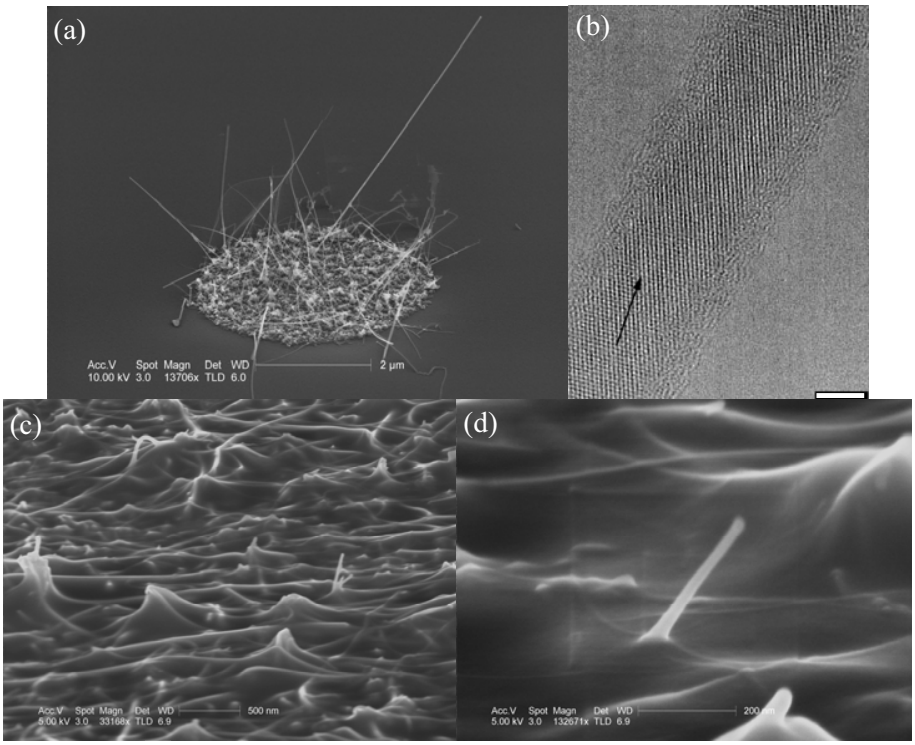

Fig. 2. (a) SEM image of SiNWs grown from a catalyst island, (b) HRTEM image of PECVD grown SiNWs (scale bar: 3 nm, arrow: <111> direction), (c), (d) SEM images of SiNW nanocomposite.

FIRST PRINCIPLES MODELLING OF SPIN-DEPENDENT ELECTRON TRANSPORT IN NANOSCALE DEVICES

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Recently there has been a large effort to develop new electronic devices that use the electron spin to store or process information. The basic physical phenomenon that is utilized is that some materials display a difference in the resistance for transport of majority and minority spin electrons. Thus, there is a great technological interest to find new materials which have strong spin-dependent transport properties.

The spin-dependent transport properties of materials can be accurately modelled using first principles quantum transport methods. Based on such calculations, Butler *et. al.* [1] suggested that an MgO crystal sandwiched between Fe electrodes should display a giant magneto-resistance, i.e. the resistance of junctions with parallel alignment of the electrode spins was found to be orders of magnitude smaller than the resistance of junctions with anti-parallel alignment. Subsequently, there has been a number of experiments that try to realize such materials, however, so far the measured magneto-resistances have been much smaller than predicted by theoretical studies[2].

We have used the Atomistix ToolKit (ATK)[3,4] to model the spin-dependent transport across MgO layers coupled with Fe electrodes, and investigated how the interface structure and defects in the MgO layers affect the spin transport. The results of the calculations will be discussed, and compared with experimental studies.

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Figures:

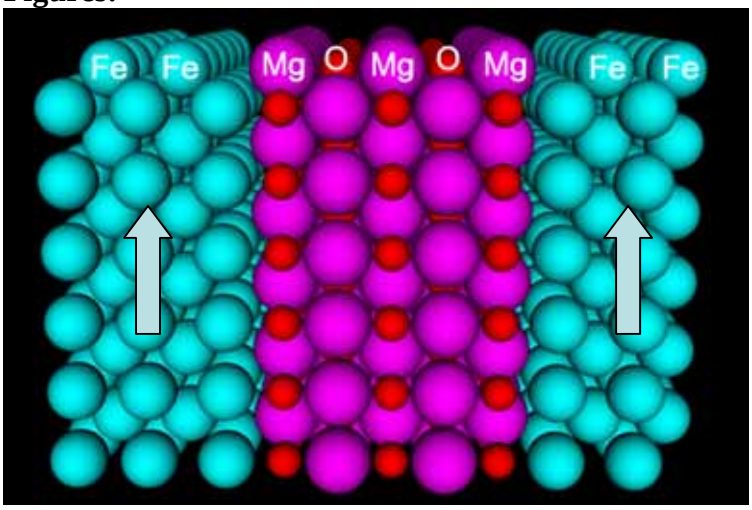

Figure 1: The geometry of an ideal Fe-MgO-Fe interface

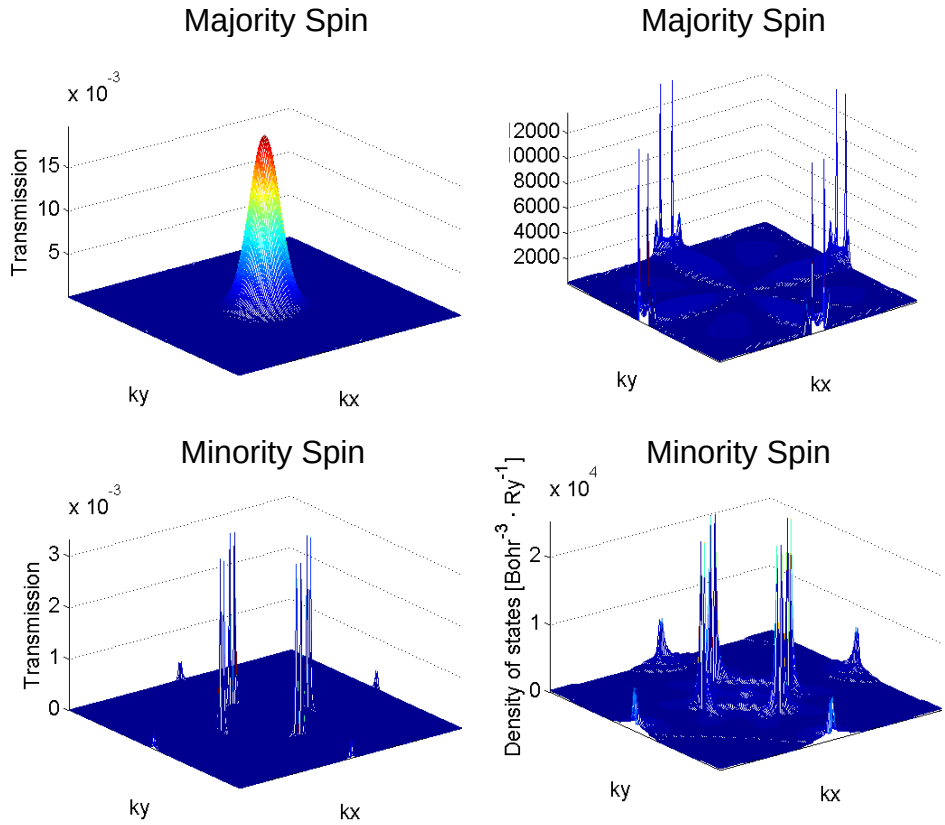

Figure 2: The dependence of the transmission coefficient and DOS on the spin and the k-vector of the electron. Note the large difference in the transmission between majority and minority electrons.

TAILORING PARTICLE SIZE VIA CHEMICAL COMPOSITION: STRUCTURAL AND MAGNETIC CHARACTERISATION OF NANOCRYSTALLINE Ni-Co ALLOYS

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Ferromagnets embedded in a dielectric matrix display in many cases enhanced chemical and physical properties and, therefore, have potential technological applications. From this point of view, nanoparticles of ferromagnetic alloys are of particular interest since their magnetic properties can be altered by varying both chemical composition and particle size [1]. In our opinion, a promising approach to fabrication of such composites lies in the filed of intercalation chemistry.

In this work, nanoparticles of cobalt-nickel alloys encapsulated in a matrix of mixed lithium-aluminum oxides have been investigated. They were prepared by heating a precursor compound, layered double hydroxide, containing co-intercalated complexes of two metals $[LiAl_2(OH)_6]_2\{(Ni_{1-x}Co_x(EDTA)\}\cdot 4H_2O$ (where *EDTA* – ethylenediaminetetraacetate, x = 0 ÷ 1). The homogeneity of the Co-Ni composition in the obtained alloys was proved by the Vegard linear dependences of the *fcc*-cell parameter as well as by supplementary examinations using EDX.

In order to characterise the microstructure and morphology thoroughly we used different methods, which provide local (HRTEM-LAED-EDX) and statistical (XRD and SAXS) information from a sample (Fig.1-2). The data obtained by these methods turned to be in good agreement with each other. It has been found that upon enrichment of $Ni_{1-x}Co_x$-alloy by cobalt up to x = 0.86, the particles gradually enlarge from d_{TEM} = 6 to 16 nm preserving their shape and size distribution. This notably differs from our previous results obtained for pure Co particles prepared in the same manner which were found to be of much larger sizes and wide size distribution [2].

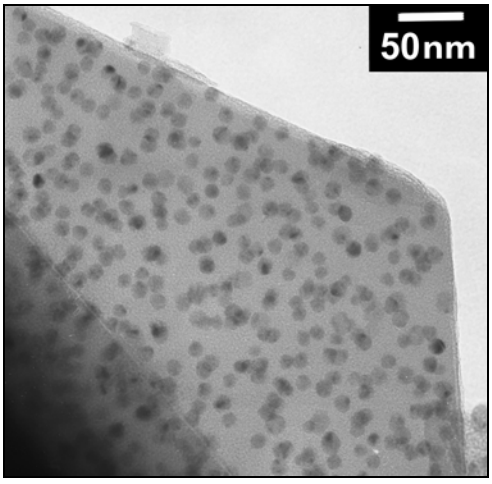

Figure 1. TEM image of nanoparticles of $Ni_{0.34}Co_{0.66}$-alloy encapsulated in a lamellar matrix of $Li_2O{\cdot}2Al_2O_3$ (view along *c*-axis).

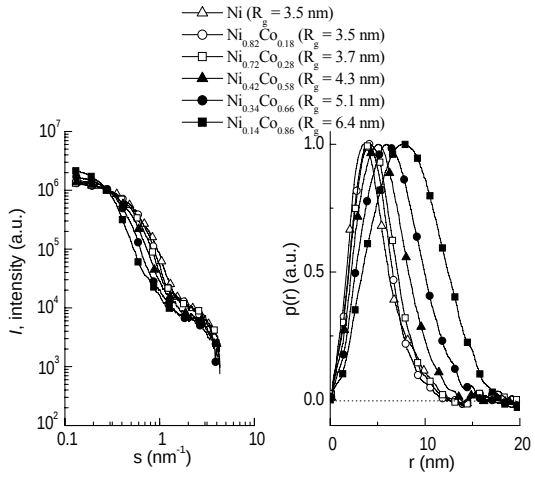

Figure 2. SAXS patterns (left) and distance distribution probability functions (right) of nanoparticles of $Ni_{1-x}Co_x$ alloys. (In parentheses: gyration radius R_g)

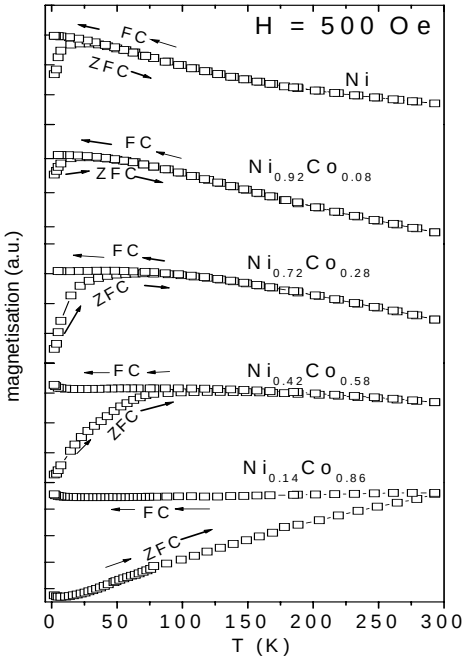

Figure 3. Magnetisation dependences *M(T)* obtained using a SQUID magnetometer in ZFC-FC regimes.

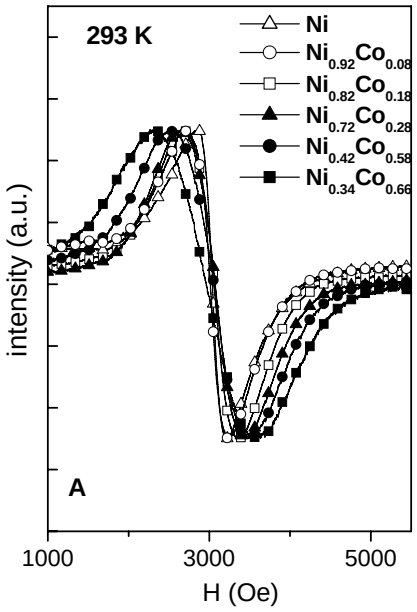

Figure 4. Ferromagnetic resonance spectra

We used FMR and SQUID magnetometry to characterize magnetic properties of the alloy nanoparticles (Fig.3-4). It has been found that $Ni_{0.14}Co_{0.86}$ ($d_{TEM} \approx 16$ nm) is ferromagnetic whereas alloys $Ni_{1-x}Co_x$ ($0 \le x \le 0.66$, $6 \lesssim d_{TEM} \lesssim 9$) are superparamagnetic at room temperature. The blocking temperatures of the latter measured in ZFC-ZC regimes occur in the range 22 K < T_b < 250 K depending on particle size. It has been also revealed that the particles form antiferromagnetic oxide shells of $Ni_{1-x}Co_xO$ that was proved by observation of bias-exchange coupling at low temperatures. The effective anisotropy constants were estimated to be $0.6\text{-}1.7\cdot10^5$ J·m^{-3} at low temperatures and $\le 2\cdot10^4$ J·m^{-3} at 20^{o}C.

Varying the alloy chemical composition can be a promising way of tailoring the particle size and target magnetic properties. The approach studied in this work is also of interest in designing efficient bi-functional catalysts for concurrent basic and hydrogenation reactions. The comparison and peculiarities of utilisation of different instrumental methods used in this work will be also discussed.

The support of the "Federal agency of science and innovations of Russia" (grant # 2006-RI-111.0/002/110) to K.A.T. is thankfully acknowledged.

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Oral

ANTIMICROBIAL, NANO-SIZED SILVER SALT CRYSTALS ENCAPSULATED IN A POLYMER COATING.

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Silver-based antimicrobial coatings are progressively used for different finishing/coating processes in medical device, textile, filtration, paper, and packaging industries. For example, in the technical/ functional textile business unit, antimicrobial fabrics find many applications in medical, hygiene, protection (bio-hazard protective clothings), sport, health care, personal care, filtration, and other markets. Some popular products include high value silver-coated fabrics for use as wound dressings.

Silver is a well known antimicrobial metal capable to inhibit and kill bacteria and fungi. Today, many different forms of silver are proposed such as metallic silver nanoparticles, silver-oxide nanoparticles, silver-complex zeolites, soluble silver salts and slightly soluble silver salts. Silver at the nanoscale or silver-based nanoparticles have the main advantage of providing a greater surface area than microparticles; then, nanoparticles provide higher availability of biocidal silver ions for improved antimicrobial effect. While these nanoparticles are used to control or limit the growth of bacteria or fungi (inhibition), most of them do not provide sufficient silver ions to kill effectively and, therefore, to act as a biocide. In addition, for many applications, nanoparticles must be encapsulated in order to provide durability of antimicrobial properties. The encapsulation process must be carefully choosen and optimized in order to obtain durability of antimicrobial properties and provide sufficient silver ions to achieve significant kill rates.

This paper presents a new, non-toxic, antimicrobial silver solution made of nano-sized, slightly soluble, silver salt crystals which can be applied in different finishing/coating processes such as spraying, dip-coating, padding and thin film deposition to form a durable antimicrobial/ biocidal polymer coating. Figure 1 presents SEM image of these nano-sized silver salt crystals deposited on a fabric made of microfibers. The dimension of such nanoparticles varies between 20 and 150 nm approximately.

Figure 2 shows kill rate against Clostridium Difficile (C. Difficile) on polycotton and polyester fabrics (PC-GRSC and PE-GRSC respectively) [1]. The nano-silver salt treatment allows to kill 99.99% of C. Difficile very rapidly, within 1 min. In addition, Figure 3 shows cytotoxicity agar overlay (cellular damage or cytopathics effects) test results [2]. GLP-Cytotoxicity test was conducted for USFDA (21 CFR PART 58) certification. The silver-treated sample has an average score of 2, which meets the requirement for acceptability. Therefore, this test result demonstrates the non-toxicity of the treatment resulting from the application of nano-sized silver salt crystals.

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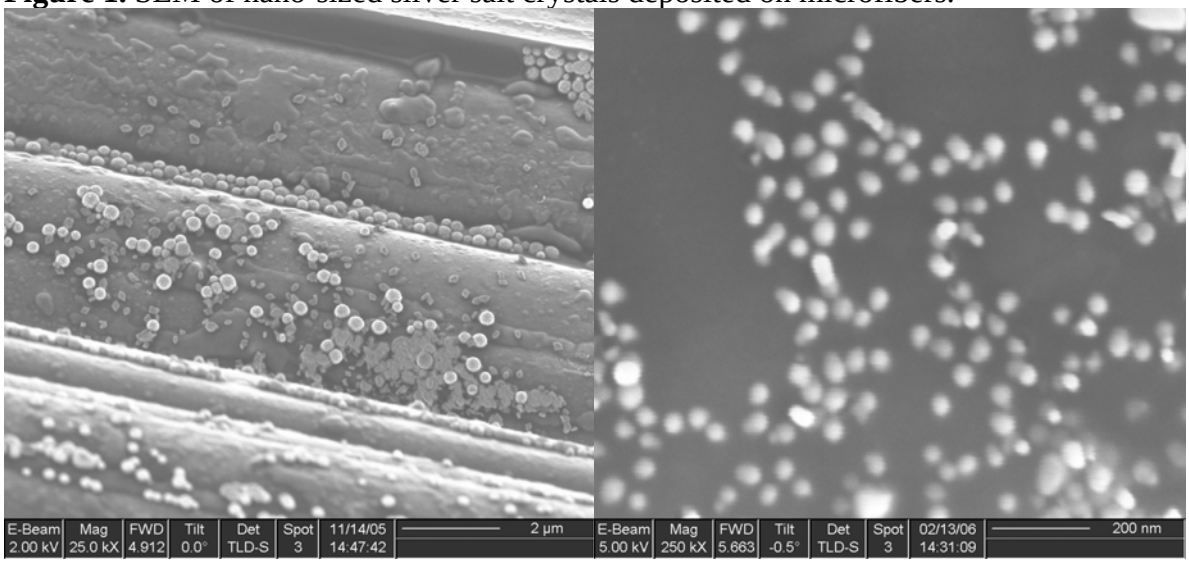
Figure 1. SEM of nano-sized silver salt crystals deposited on microfibers.



a) 2 microns scale. b) 200 nanometers scale.

Figure 2. C. Difficile kill rate test results (AATCC 100) with different fabrics treated by silver salt crystals encapsulated in a polymer coating.

Sample identification	Bacterial counts of sample ioculated at t=0 (UFC/ sample)	Bacterial counts of sample ioculated at t=1 minute (UFC/ sample)	Bacterial counts of sample ioculated at t=1 hour (UFC/ sample)	Bacterial counts of sample ioculated at t=24 hours (UFC/ sample)	% reduction after 1 hour
PC-GRSC	$4{,}6 \times 10^6$	$1{,}6 \times 10^6$	<100	<100	>99,99
PE-GRSC	$4{,}6 \times 10^6$	$1{,}0 \times 10^6$	<100	<100	>99,99
Control	$4{,}6 \times 10^6$	$4{,}6 \times 10^6$	$6{,}0 \times 10^6$	---	0

Figure 3. Cytotoxicity agar overlay test results for virgin and nanosilver-treated fabrics.

Sample identification	Score #1	Score #2	Score #3	Average
Negative control	0	0	0	0
Positive control	4	4	4	4
1135-8-01 (virgin)	0	0	0	0
1135-8-02 (treated)	2	2	2	2

Legend: 0 –No damage to cells; 1 –Some damaged cells under sample; 2 –Damage limited to area under sample; 3 –Damage extend 0.5 to 1.0 cm beyond sample; 4 –Damage greater than 1.0 cm in extension from sample.

EMERGING NANOELECTRONICS: AN INFSO FUTURE AND EMERGING TECHNOLOGIES INITIATIVE

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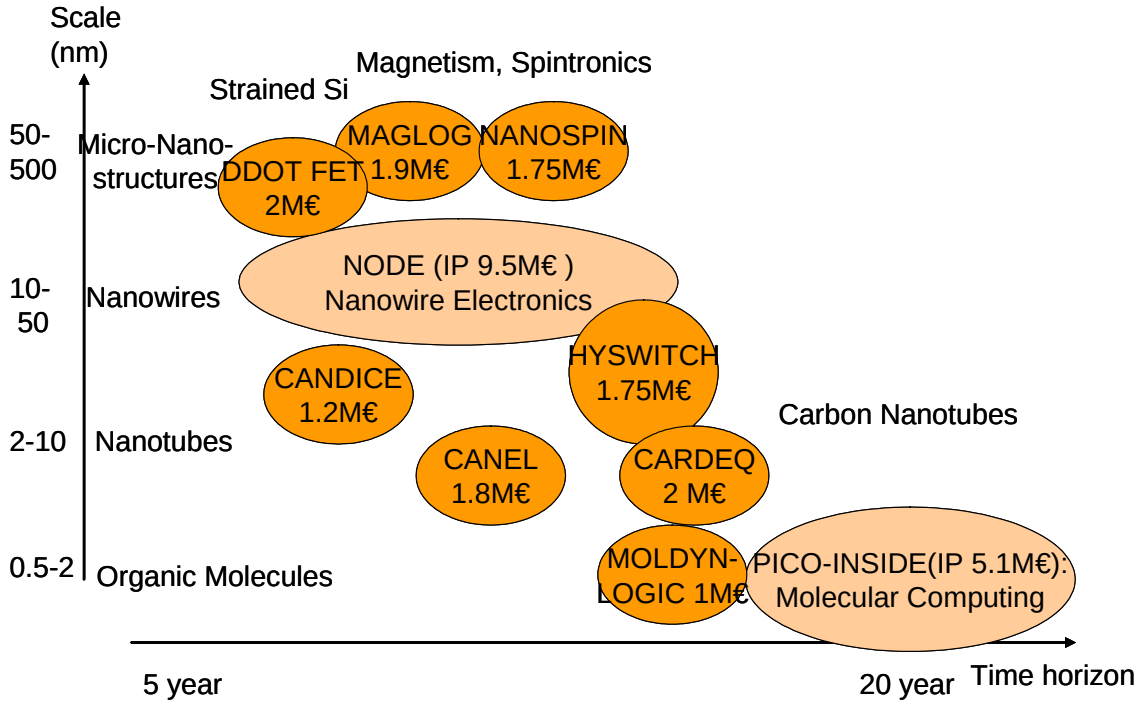
A call for proposals for Emerging Nanoelectronics was published on 15 June 2004 as part of the IST priority of the 6th Framework Programme of Research of the EU. It was clearly set in the context of the Emerging Research Devices section of the ITRS roadmap, and identified a number of important research topics to be pursued at European level. The call aimed to advance research in hybrid and molecular electronics, and prepare the bases for an extension of integrated circuit technology beyond the limits of CMOS scaling. It was implementing the new Integrated Project contracts to help create wide European partnerships and build a European Research Area in the field.

Two large projects were started in 2005 as a result of the call. The NODE project concentrates on nanowires, which are self-assembled crystalline structures with practical sizes of 10 to a few tens of nanometres, and on their applications in electronics and optoelectronics. Nanowires could be seen as a bridging technology that extends the concept of traditional semiconductor technology to new structures and materials while still being based on transistors and the transport of information by electron charges. The second project, PICO-INSIDE, supports disruptive technologies that operate at the atomic scale. These two projects are complemented by a number of smaller projects arising from the FET Open call for proposals. The smaller projects also cover research on nanotubes, which can be seen as a different bridging technology, and on different approaches including nanomechanics, magnetic logic, spintronics, or strained silicon. All these projects started only recently. An early status of four of these projects is presented in the special session on EU projects. Figure 5 depicts these projects with an approximate time scale on the horizontal axis and with the characteristic size of the active structures on the vertical axis.



Domains covered by the FP6 E-Nano initiative (2004-2009)

The FP6 Initiative and its projects are described in more detail on the web site of the action: http://cordis.europa.eu/ist/fet/nid.htm#projects

The 7th Framework Programme for Research and Technology Development that would cover the period 2007 – 2013 is currently being discussed. As part of the preparations for the contents of this programme, a wide consultation on future ICT challenges was organised through the "Beyond The Horizon" action and coordinated by ERCIM. This action selected nanoelectronics and nanotechnology as one of 6 strategic research areas. Six challenges were identified in this area as follows:

- System-ability of Emerging ICT Technologies and Devices;
- Interfacing Cell-Level Biology with Nanoelectronics;
- Future interconnects for System Integration;
- Post-CMOS Devices and Storage
- Nano ElectroMechanical Systems (NEMS)
- Atomic Scale Information Technology

Further details of the consultation can be found on the web site of the initiative. http://www.beyond-the-horizon.net/

ORGANIC REACTION BETWEEN ADSORBED MOLECULAR BUILDING BLOCKS AS DESIGN PARADIGM FOR FORMATION OF SURFACE NANOSTRUCTURES.

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Molecular self-organization on solid surfaces is a promising tool for the controlled formation of nanostructures. Extensive studies into molecular self-assembly based on reversible interactions such as Van der Waals forces, hydrogen bonding, or metal complexation have by now been performed. However, the resulting structures often express poor thermal stability due to comparatively weak intermolecular interactions. Chemical reaction between molecules adsorbed on surfaces, leading to covalent bonding between the building blocks, is expected to result in more stable structures, but has received much less attention. Here we present the first study on self-organization by spontaneous chemical reactions between co-adsorbed organic molecules under Ultra-High Vacuum (UHV) conditions. Fundamentally, the key differences compared to bulk chemistry is the confinement of the molecules in two dimensions with associated steric constrains and the absence of a solution phase which often directly or indirectly participates in the reaction

In our experiments, we have studied the reversible imine formation reaction, in which an aldehyde is linked to an amine via the formation of a covalent imine-bond. As the aldehyde containing educt we focused on a family of highly conjugated rigid molecules with varying geometry (both di- and tri-aldehydes) and as reactant partner we used aliphatic mono- and diamines. The molecules were co-deposited onto the inert gold(111) substrate under UHV conditions in the sub-saturation coverage regime and chemical reaction occurred upon thermal activation. In the case of the mono-amines we found well-ordered molecular islands formed by the reaction products as visualized with STM. To explore stereo- and topochemical effects, the surface reaction product was compared with the structure formed by the same educts reacted ex-situ and deposited directly onto the substrate. The reaction with the diamines led to two-dimensional polymeric networks in which the individual building blocks and the local bonding pattern could clearly be resolved. Formation of covalent bonds is evidenced from the geometry of the reaction products, as determined by STM, and is also supported by XPS and NEXAFS measurements. Theoretical modeling elucidating details of the reaction mechanism is currently being performed.

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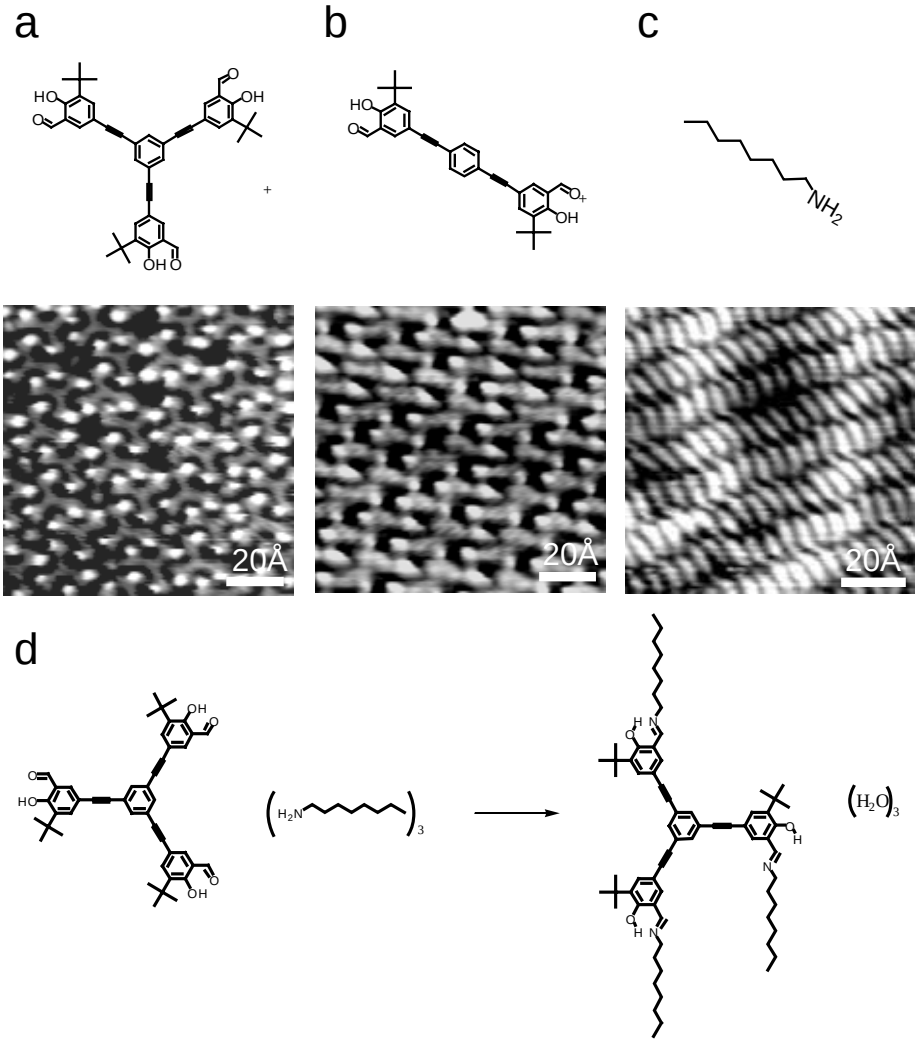
Figures:



Some educts with STM images: Tri-aldehyde (a), Di-aldehyde (b), Octylamine (c) and a reaction model (d).

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POSTERS

SESSION PA / SESSION PB

Session A (PA) is dedicated to students and **Session B (PB)** to seniors (Doctors)

Only Posters submitted by fully registered (payment processed) participants are listed below. Last update (18/08/2006)

(Please, find your final **poster number** by looking up your name in the **Author Index** displayed in the Registration Area and the Poster Exhibition Area.)

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Adessi	Christophe	France	Theory and modelling at the nanoscale	Simulation of carbon nanotube field effect transistors Simulation of carbon nanotube field effect transistor with Palladium contacts
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Carrasco	Esther	Spain	SPM	Dislocation generation and motion in Au(001) at the nanometric scale
Clement	Nicolas	France	Low dimensional materials	Electrical transport measurements on self-assembled organic molecular wires
Coiffic	Jean Christophe	France	Carbon nanotubes	Realization and characterization of vertical self-both-ends-bonded SW nanotubes grown at 550°C in a via-like metal/insulator/metal structure by in situ PECVD
Cojocaru	Cristian-Victor	Canada	Nanofabrication tools & nanoscale integration	Nanostenciling and Pulsed Laser Deposition: a Versatile Combination for Parallel Patterning and Prototyping of Functional Materials
Colera	Inmaculada	Spain	Nanostructured and nanoparticle based materials	Improvement of surface hardness in nitrogen implanted v-5%ti alloys: influence of the preferential sputtering in the elemental composition determination.
Cornelius	Thomas	Germany	Low dimensional materials	Finite-size effects in the electrical resistance of single bismuth nanowires
Corral-Flores	Veronica	Mexico	Nanomagnetism and Spintronics	Magnetic Properties of Nickel-Zinc Ferrite Nanoparticles Synthesized by Coprecipitation
Cresti	Alessandro	Italy	Theory and modelling at the nanoscale	Currents imaging in open quantum dots in the integer quantum Hall transport regime
Chabli	Amal	France	Other	The Influence of Surface Preparation and Probe Configuration on the Reliability of Work Function Measurement using Kelvin Probe Microscopy
Chancolon	Jérôme	France	NanoChemistry	Electrochemical grafting of polymers on aligned multi-walled carbon nanotubes
Chayka	Oleksandr	Czech Republic	Nanomagnetism and Spintronics	AC magnetic properties of nanogranular FeCoAlN films
Chenevier	Pascale	France	Carbon nanotubes	Carbone nanotube mat sensors for toxic gas detection

Chernyheva	Marina	Russia	Carbon nanotubes	Functional nanocomposites based on single-walled carbon nanotubes – synthesis and investigation
Cho	Yousuk	Korea	Carbon nanotubes	Transparent carbon nanotube field emission devices for display and lamp
Dallaporta	Hervé	France	Nanofabrication tools & nanoscale integration	Fabrication of nano objects using focused ion beam induced deposition.
Den Hertog	Martien Ilse	France	Low dimensional materials	Evidence of Gold on lateral surfaces of gold catalyzed silicon nanowires
Diesinger	Heinrich	France	SPM	Kelvin force microscopy with simultaneous non-contact topography imaging - interaction between the two involved cantilever resonances
Donderowicz	Wojciech	Poland	Low dimensional materials	Gaussian quantum dots of type II in in-plane electric field
Dubé	David	Canada	Other	Aluminium Chloride on Silica Mesoporous Molecular Sieves as Alkylation Catalysts
Dubois	Lionel	France	NanoChemistry	Porphyrins for molecular electronics
Dubois	Mathieu	France	Theory and modelling at the nanoscale	STM induced molecular dynamics of biphenyl on Si(100) : a theoretical analysis
Duclairoir	Florence	France	NanoChemistry	Tailor-made metalloporphyrins for hybrid molecular electronics
Dujardin	Romain	France	Low dimensional materials	Growth of Si and SiGe nanowhiskers by Molecular Beam Epitaxy; X-ray scattering and electron microscopy investigations
Fabre-Francke	Isabelle	France	NanoChemistry	Synthesis and characterization of electropolymerizable derivatives of N-salicyldene (anil) functionalized bis EDOT-carbazole
Fernandez-Serra	Marivi	France	Theory and modelling at the nanoscale	Conductance, surface traps and passivation in doped silicon nanowires
Fiori	Angelamaria	Italy	Carbon nanotubes	Field emission energy distributions from nanodiamond-covered single wall carbon nanotubes
Foa Torres	Luis E. F.	France	Carbon nanotubes	Electron-Phonon interaction in Carbon-Nanotubes: A full many-body treatment
Fogler	Michael	USA	Low dimensional materials	Conductance of a one-dimensional wire with strong random impurities
Fortin	Marc.A.	Sweden	Low dimensional materials	Synthesis of gadolinium oxide nanoparticles as a contrast agent in MRI
Froufe	Luis	France	Theory and modelling at the nanoscale	Single molecule fluorescence decay rate statistics in nanoscopic environments
Gaass	Markus	Germany	Nanofabrication tools & nanoscale integration	Magnetic response of micro-SQUIDs containing a semifluxon
Gago-Fernandez	Raul	Spain	Nanofabrication tools & nanoscale integration	Nanodot patterning of silicon surfaces by ion beam sputtering
Gandhi	Abbasi	Ireland	Nanostructured and nanoparticle based materials	Study of Dynamic Magnetization Reversal Process in Ni Nanowires
Garcia-Martinez	Yamila	Spain	Theory and modelling at the nanoscale	Electronic transport through molecular bridges within ab-initio methodologies
Gentile	Pascal	France	Low dimensional materials	Growth and study of Silicon Nanowires by Catalyst Assisted LPCVD

Geuquet	Nicolas	Belgium	Theory and modelling at the nanoscale	Monopole-dipole interaction model for carbon onions
Gierak	Jacques	France	Nanofabrication tools & nanoscale integration	Nano-fabrication with Focused Ion Beams - Where are the resolution limits?
Gómez Medina	Raquel	Switzerland	Theory and modelling at the nanoscale	Optical forces in plasmonic systems
Gómez Medina	Raquel	Switzerland	Theory and modelling at the nanoscale	Finite size effects on the optical resonances of nanocylinder arrays
Gonzalez-Arrabal	Raquel	Spain	Nanofabrication tools & nanoscale integration	Nitrided FeB amorphous thin films for Nano Electromechanical Systems (NEMS)
Guillot	Fabien	France	Nanostructured and nanoparticle based materials	GaN/AlN nanostructures for intersubband optoelectronics at telecommunication wavelength
Haghi	Akbar Khodaparast	Iran	Other	Trends in electrospinning of natural nanofibers
Harding Lepage	Patricia	Canada	Nanobiotechnologies	New Amplification Strategy for Electrochemical Detection of DNA Using Cationic Polymers Aggregates
Henrard	Luc	Belgium	Carbon nanotubes	Charge Carriers in Few Layer Graphite
Herrera	Bárbara	Chile	Theory and modelling at the nanoscale	A DFT Study on Zirconia Oligomers and the influence of Cu-Doping
Hobara	Daisuke	Japan	Nanostructured and nanoparticle based materials	Novel method to construct a two-dimensional molecule-nanoparticle network by organometallic complex formation
Hsu	Ching-Ling	Taiwan	Nanostructured and nanoparticle based materials	Percolation in 2D Nanoparticle Films from Colloidal Self-Assembly
Huang	Kai	France	NanoChemistry	Synthesis of Molecular Memory Using Metallporphyrins Monolayer on Silicon Surface
Isambert	Antoine	France	Low dimensional materials	Probing single molecule transport with superconducting electrodes
Jaafar	Miriam	Spain	Nanomagnetism and Spintronics	Magnetic anisotropy changes induced by high energy ion bombardment
Jaroenworaluck	Angkhana	Thailand	Nanostructured and nanoparticle based materials	Effect of water and hydrolysis catalyst on the morphology and crystal structure of TiO2 photocatalyst prepared by sol-gel method
Järvekülg	Martin	Estonia	Other	Micro- and nano-scale tubular oxide structures
Jiménez	David	Spain	Low dimensional materials	Physics-based model of disilicide/silicon nanowire heterostructure transistors
Jodar	Esther	Spain	Carbon nanotubes	Electronic Transport in Nanotubes with Resonant Cavities
Jourdan	Thomas	France	Nanomagnetism and Spintronics	Magnetism at nanoscopic scale : numerical simulation and applications
Jousselme	Bruno	France	Other	New diazonium salts of metal complexes for electrochemical modification of carbon nanotubes
Karim	Shafqat	Germany	Nanostructured and nanoparticle based materials	Experimental study on the Rayleigh instability of gold nanowires
Khaddem - Mousavi	Mir - Vadood	Ireland	Nanostructured and nanoparticle based materials	Synthesis and Characterization of Dy-Ni-Fe Alloy Thin Films using Electrodeposition Technique
Kim	Dojin	Korea	Carbon nanotubes	SWNTs and SnO2 composite as a high performance ammonia gas sensor

Kim	Hyun-Ju	Korea	Carbon nanotubes	Preparation of CNT electrodes for enhanced electrochemical properties
Kobe	Spomenka	Slovenia	Theory and modelling at the nanoscale	Nanocrystalization of calcium carbonate in magnetic field.
Kokado	Satoshi	Japan	Nanomagnetism and Spintronics	Localized spin reversal by spin injection in a spin quantum dot: A model calculation
Kollia	Zoe	Greece	NanoChemistry	Hieharchical self-assembled structures from block copolymer/metal nanoparticles hybrid materials induced by vuv light
Köstler	Stefan	Austria	Nanostructured and nanoparticle based materials	Nanoparticle Dispersions of Organic Luminescent and Semiconducting Materials
Krasnyj	Jurij	Poland	Theory and modelling at the nanoscale	Laser action in electrically driven quantum dot matrix
Kuchuk	Andrian	Ukraine	Nanostructured and nanoparticle based materials	Nanocomposite Ta-,Ti-SiN Thin Films: Synthesis, Properties, and Applications in High Temperature Electronics
Laliberté	Marc-André	Canada	NanoChemistry	Evidence of Strong C-H--O Bonds in 2D Assemblies
Lamy	Jean-Michel	France	Low dimensional materials	Characterization of InAs quantum wires on (001) InP : toward the realization of VCSEL structures with a stabilized polarisation
Lassagne	Benjamin	France	Carbon nanotubes	Unconventionnal Magneconductance Oscillations in quasi-ballistic MWCNTs
Laza	Simona Cristina	Italy	Low dimensional materials	Colloidal Gold Nanoparticles Production By Laser Ablation In Liquids
Le Poche	Hélène	France	Carbon nanotubes	Towards CMOS compatible: integration of in-situ grown individual vertical carbon nanotubes into field emission devices
Leconte	Sylvain	France	Low dimensional materials	Electronic structure and vertical transport in GaN/AlN/GaN single-barrier structures
Lenfant	Stéphane	France	Other	Organic transistors based on self assembled monolayers
Leszczynska	Beata	Poland	Nanostructured and nanoparticle based materials	Ultrafine-grained and nano–structure aluminium alloys produced by cyclic extrusion compression
Lin	Hong-Ching	Taiwan	Nanostructured and nanoparticle based materials	Formation of Ni-Cu-Ag Termination Using Metallo-Organic Decomposition (MOD) Technology at Low-Temperatures
Lin	Hong-Ching	Taiwan	Nanostructured and nanoparticle based materials	The effects of silver oxalate and nano silver powder additions on the performances of the metallo-organic decomposition silver paste
Ling	Hong Shi	Taiwan	Low dimensional materials	Size dependent energy level positions of InAs quantum dots determined by selective excitation photoluminescence
Lo	Ming Cheng	Taiwan	Low dimensional materials	Photoluminescence study of high density InAs/GaAs quantum dots
Lu	Chun An	Taiwan	Nanostructured and nanoparticle based materials	The effects of silver oxide additions on the electrical properties and microstructure of low-curing-temperature silver paste with MOD added
Luo	Yi	France	Nanostructured and nanoparticle based materials	AFM and SEM Study of Rubrene Micro-crystal Thin Film and Nanowires Growth
Macanas	Jorge	Spain	Nanostructured and nanoparticle based materials	Preparation and Characterization of Metal-Polymer Nanocomposite Membranes for Electrocatalytic Applications

Mace	Christian	USA	Other	Use of nanoscale zero valent iron for groundwater remediation
Mackiewicz	Nicolas	France	Nanobiotechnologies	Non-covalent functionalization of carbon nanotubes toward biosensing applications
Macucci	Massimo	Italy	Carbon nanotubes	Optimized technique for the calculation of carbon nanotube dispersion relationships
Maier	Markus	Germany	SPM	Atomic resolution AFM at low temperatures using the QPlus sensor
Maier	Markus	Germany	Nanofabrication tools & nanoscale integration	Ultimate Nanoprobing in UHV: Four independent Scanning Tunneling Microscopes navigated by High Resolution UHV SEM
Manzano	Hegoi	Spain	Nanostructured and nanoparticle based materials	Computational study of the mechanical properties of Tobermorite and Jennite crystals in comparison with C-S-H gel
Marques	Manuel I.	Spain	Low dimensional materials	Relaxor-based thin films memories and the depolarizing field problem
Martins	Manuel	Portugal	Nanobiotechnologies	Synthesis and characterization of polymer-embedded CoPt3 nanoparticles for bioanalytical applications
Mishra	Yogendra Kumar	India	Nanostructured and nanoparticle based materials	Swift heavy ion induced dissolution of gold nanoparticles embedded in silica matrix grown by co-evaporation
Miwa	Jill	Canada	Other	Adsorption Site-Dependent Diffusion of Azobenzene on Cu(110)
Moon	Won Ha	Korea	Theory and modelling at the nanoscale	Melting Behavior of GaN Nanowires : Molecular Dynamics Study
Morozan	Adina	Romania	Nanobiotechnologies	The biocompatibility microorganisms-carbon nanostructures for applications in microbial fuel cells
Mouchet	Céline	France	Low dimensional materials	Synthesis of Si/SiGe nanowires for application in thermoelectric systems
Muraviev	Dmitri	Spain	Nanostructured and nanoparticle based materials	Simple Route for Intermatrix Synthesis of Polymer Stabilized Core-Shell Metal Nanoparticles for Sensor Applications
Navab	Shiva	USA	Theory and modelling at the nanoscale	Nano-scale Reconfigurable chips for Image Processing
Neretina	Svetlana	Canada	Low dimensional materials	Wurtzite Cadmium Telluride Nanowires Grown by Pulsed Laser Deposition
Nihey	Fumiyuki	Japan	Carbon nanotubes	RF Performance of Multiple-Channel Carbon Nanotube Transistors
Niquet	Yann Michel	France	Theory and modelling at the nanoscale	Electronic properties of strained nanowire heterostructures
Nishiyama	Kiyohisa	United Kingdom	Theory and modelling at the nanoscale	Theory and Experimental Verification of Micro Switch Group Sensor (MSGS)
Noe	Pierre	France	Low dimensional materials	Room-temperature green photoluminescence of silicon nanowires covered by deposited silicon oxide layers
Okotrub	Alexander	Russia	Carbon nanotubes	Electronic structure and ion-electron emission of nanodiamonds and carbon nanotubes
Osváth	Zoltán	Hungary	SPM	STM imaging of carbon nanotube point defects

Pace	Giuseppina	France	NanoChemistry	Photo-induced interconversion of conjugated azobenzenes on metal surfaces
Palacin	Serge	France	NanoChemistry	Adhesion of electrografted nitrobenzene films on silicon surfaces as a function of the applied potential: an AFM study
Palacin	Serge	France	NanoChemistry	Interfacial signature of the polymer-to-metal bonding
Pallecchi	Emiliano	Germany	Carbon nanotubes	Experiments on Carbon nanotubes with ferromagnetic contacts
Patrone	Lionel	France	Nanostructured and nanoparticle based materials	Growth of molecular nanostructures on Si using SAMs of long-chain alkyltrichlorosilanes
Pereira	Angela Sofia	Portugal	NanoChemistry	Lanthanide doped ZnO nanocrystals: synthesis, surface modification and optical behaviour
Persson	Martin	France	Theory and modelling at the nanoscale	Charge transport properties of semiconductor nanowires within the Kubo-Greenwood and Landauer-Büttiker approaches.
Petkov	Nikolay	Ireland	Low dimensional materials	Gold-seeded growth of Ge nanostructures inside channelled substrates by supercritical fluid-liquid-solid (SFLS) method
Picco	Loren	United Kingdom	SPM	High speed atomic force microscopy of biological systems: Achieving millisecond temporal resolution
Pontoni	Diego	USA	Nanostructured and nanoparticle based materials	Synchrotron studies of solvent mediated nanocrystal thin film self-assembly
Popov	Andrei	Russia	Carbon nanotubes	Nanoelectromechanical Systems Based on Multi-walled Nanotubes: Nanothermometer, Nanorelay and Nanomotor
Porcher	Arnaud	France	Nanostructured and nanoparticle based materials	Nanostructured porous silicon as thick electrical insulator for rf applications
Pourfath	Mahdi	Austria	Carbon nanotubes	On the Effect of Electron-Phonon Interaction Parameters on the Performance of Carbon Nanotube Based Transistors
Pro	Tiziana	France	NanoChemistry	Study of Hybrid Porphyrin-based Monolayer / Silicon Memory Devices
Qi	Zhi-mei	Japan	Other	Determination of refractive index and thickness of TiO2 nanoparticle-polymer composite thin film coated on a sputtered gold layer by broadband spectral surface plasmon resonance spectroscopy
Quirós	Carlos	Spain	Nanomagnetism and Spintronics	Interlayer exchange coupling temperature dependence in antiferromagnetically coupled multilayers
Reedo	Valter	Estonia	Low dimensional materials	Formation of micro- and nano-dimensional disk-shape TiO2 and ZrO2 particles at air-water interface
Regonini	Domenico	United Kingdom	Nanostructured and nanoparticle based materials	Anodised TiO2 nano-tubes: voltage ramp influence on the oxide morphology and investigation of phase changes in the crystal structure promoted by thermal treatments
Reguer	Alan	France	Nanofabrication tools & nanoscale integration	Structural and electrical studies of tungsten nano-electrodes prepared by FIBID (focused ion beam induced deposition)
Rellinghaus	Bernd	Germany	Nanostructured and nanoparticle based materials	In-flight optical annealing of FePt nanoparticles.
Reyes	Diego	Colombia	Low dimensional materials	Phonon Multiplexing Through 1D Chains
Riabinina	Daria	Canada	Nanostructured and nanoparticle based materials	Synthesis of Photoluminescent Silicon Nanocrystals by Reactive Laser Ablation

Riikonen	Sampsa	Spain	Low dimensional materials	Systematic search for the Si(553)-Au reconstruction
Rodríguez Domínguez	Andrés	Spain	Nanostructured and nanoparticle based materials	Optimization of the luminescence emission in nanocrystalline SiGe/SiO2 multilayers
Rodriguez Puerta	Juan Manuel	Spain	Low dimensional materials	Initial stages of the growth of Cobalt on Ru(0001) studied by LEEM
Rogero	Celia	Spain	Nanostructured and nanoparticle based materials	Synthesis and characterization of mixed monolayers on hydrogen-terminated silicon surfaces.
Royal	Guy	France	NanoChemistry	Molecular switches and coordination polymers based on the cyclam framework
Ryzhkov	Pavel	Germany	Nanobiotechnologies	Formation of nanotemplates by genetically engineered truncated S-layer proteins with preserved self-assembly potential.
Salhi	Billel	France	Nanostructured and nanoparticle based materials	Nanostructured surface as EWOD counter electrode for matrix-free mass spectrometry analysis
Salhi	Billel	France	Nanofabrication tools & nanoscale integration	Fabrication of 3D silicon nanostructures using ion implantation and wet chemical etching
Salomon	Antoine	France	Other	Optical losses control by finely tuning the distance between a Bragg mirror and a 2D PC.
Sánchez-Pomales	Germarie	Puerto Rico	NanoChemistry	DNA-assisted purification and self-assembly of single-walled carbon nanotubes on gold
Santalla	Silvia	Spain	Low dimensional materials	On te lattice parameter and height profiles in the Stranski-Krastanov growth mode
Santiago	Diana	Puerto Rico	Nanostructured and nanoparticle based materials	Characterization of Ru/Pt/C nanocatalyst prepared by rotating disk-electrode (RoDSE) technique
Sarantopoulou	Evangelia	Greece	Nanofabrication tools & nanoscale integration	Nano- depth control over self assembled structures on bio-compatible polymeric thin films for bio-array applications.
Scifo	Lorette	France	SPM	STM study of pi-conjugated fluorenone-based self-assembled organic semiconductors
Schäffel	Franziska	Germany	Nanostructured and nanoparticle based materials	Carbon Nanotubes Grown From Gas Phase Prepared Iron Catalyst Particles
Schüler	Thomas	Germany	Nanobiotechnologies	Potential of enzymatic silver deposition
Segura del Río	Rodrigo	Chile	Low dimensional materials	Synthesis of Carbon Nanotubes, Nanofibers and carbon encapsulated Nanoparticles by decomposition of acetylene over Pd and Pd-Ge catalysts
Selomulya	Cordelia	Australia	Nanostructured and nanoparticle based materials	Designing magnetic nanoparticles for protein separation – a comparative study between flame spray pyrolysis and sol-gel synthesis
Shekhar	Shashank	India	Nanostructured and nanoparticle based materials	Transport, magnetotransport and magnetic properties of composites of polymer and carbon encapsulated iron carbide nanoparticles.
Shemer	Gabriel	Israel	Nanostructured and nanoparticle based materials	Size and Quality Control of Cobalt Ferrite Nanocrystal Synthesis Using a Magneto-Optical Probe
Shemer	Gabriel	Israel	Nanostructured and nanoparticle based materials	Chirality of silver nanoparticles synthesized on DNA
Siengchin	Suchart	Germany	Nanostructured and nanoparticle based materials	Structure-Property Relationships of Polystyrene/layered Silicate Nanocomposites as a

				Function of their Preparation
Simha Martynkova	Grazyna	Czech Republic	NanoChemistry	Organo-vermiculite structure ordering after PVAc introduction: Experiment and modeling
Singh	Sukhvinder	India	Nanostructured and nanoparticle based materials	ZnO Nanocrystallites obtained by Oxidation of Zinc Arachidate – Arachidic Acid LB Multilayers
Suzuki	Yoshikazu	Japan	Nanostructured and nanoparticle based materials	Preparation and Microstructure of TiO2-Nanowire Dispersed
Sztrum	Claudia	Israel	Theory and modelling at the nanoscale	Out-of-Equilibrium Self-Assembly of Binary Mixtures of Nanoparticles
Tanaka	Shukichi	Japan	Nanofabrication tools & nanoscale integration	FM-NCAFM Investigation of Individual Organic Molecules on Insulating Substrates
Temprano	Israel	Canada	NanoChemistry	New types of Nanoelectronics Contacts
Toset	Jordi	Spain	Nanobiotechnologies	DC electrostatic manipulation of gold nanoparticles with Atomic Force Microscopy
Trevethan	Thomas	United Kingdom	Theory and modelling at the nanoscale	Simulations of controlled single atom manipulation in non-contact atomic force microscopy
Uhlik	Filip	Czech Republic	Low dimensional materials	Computational Design of Metallofullerene Production: X@C74
Untiedt	Carlos	Spain	Nanomagnetism and Spintronics	Electronic transport and magnetism in atomic-sized structures
Us	Svitlana	Ukraine	Other	Science and Technology Center in Ukraine - More than 10 Years of Successful Cooperation
Valášková	Marta	Czech Republic	Nanostructured and nanoparticle based materials	Preparation of vermiculite particles for utilization in clay/polymer nanocomposites
Vandescuren	Matthieu	Belgium	Theory and modelling at the nanoscale	Characterization of single-walled carbon nanotubes containing defects from their local vibrational densities of states
Vantsyan	Mikhail	Russia	Nanobiotechnologies	Biomimetic Hybrids for Multifunctional Nanoreactor Creation
Velazquez	Jose J.	Spain	Nanostructured and nanoparticle based materials	Optical properties of Ho3+-Yb3+ and Nd3+ doped SiO2-LaF3 glass-ceramics by sol-gel method
Vetrone	Fiorenzo	Canada	Nanostructured and nanoparticle based materials	Nanostructured Materials with Applications in Biosensing and Biocompatibility
Wang	Likui	Singapore	Nanostructured and nanoparticle based materials	Fabrication of Opals and Inverse Opals with a Planar Defect
Weber-Bargioni	Alexander	Canada	SPM	Temperature induced conformational change of tetrapyridylporphyrin on Cu(111)
Wei	Mingdeng	Japan	Low dimensional materials	Formation of single-crystallized nanowires of manganese and vanadium oxides by a soft chemical process
Yang	Sung	Korea	NanoChemistry	Shape controlled synthesis of Au nanoparticles
Yarovsky	Irene	Australia	Theory and modelling at the nanoscale	Atomistic Simulation of Interactions of Carbon Nanoparticles with Organic Coatings
Zdrojek	Mariusz	Poland	Carbon nanotubes	Charging effects in carbon nanotubes

SESSION PA (100) (*) poster not eligible for competition			
Presenting Author		**Country**	**Poster Title**
TOPIC: Nanofabrication Tools and Nanoscale Integration			
Abed	Hichem	France	Growth of silicon nanowires by CVD of silane on micronscale metallic resistance heated by Joule effect
Calvo Urbina	Reyes	Spain	Electrochemical fabrication and characterization of gold nanowires.
Cojocaru	Cristian-Victor	Canada	Nanostenciling and Pulsed Laser Deposition: a Versatile Combination for Parallel Patterning and Prototyping of Functional Materials
Gaass	Markus	Germany	Magnetic response of micro-SQUIDs containing a semifluxon
Reguer	Alan	France	Structural and electrical studies of tungsten nano-electrodes prepared by FIBID (focused ion beam induced deposition)
Salhi	Billel	France	Fabrication of 3D silicon nanostructures using ion implantation and wet chemical etching
TOPIC: Scanning Probes Methods			
Osváth	Zoltán	Hungary	STM imaging of carbon nanotube point defects
Picco	Loren	United Kingdom	High speed atomic force microscopy of biological systems: Achieving millisecond temporal resolution
Scifo	Lorette	France	STM study of pi-conjugated fluorenone-based self-assembled organic semiconductors
Weber-Bargioni	Alexander	Canada	Temperature induced conformational change of tetrapyridylporphyrin on Cu(111)
TOPIC: Carbon Nanotubes Based Nanoelectronics and Field Emission			
Avriller	Rémi	France	Investigating Chemical Disorder Strength in Carbon Nanotubes : Magnetic Tuning of Quantum Transport Regimes
Borghetti	Julien	France	Optoelectronic switch and memory devices based on polymer fuctionalized carbon nanotube transitors
Brewer	Jonathan	Denmark	Second harmonic generation and imaging of functionalized crystalline nanoaggregates
Coiffic	Jean Christophe	France	Realization and characterization of vertical self-both-ends-bonded SW nanotubes grown at 550°C in a via-like metal/insulator/metal structure by in situ PECVD
Chernyheva	Marina	Russia	Functional nanocomposites based on single-walled carbon nanotubes – synthesis and investigation
Cho	Yousuk	Korea	Transparent carbon nanotube field emission devices for display and lamp
Fiori	Angelamaria	Italy	Field emission energy distributions from nanodiamond-covered single wall carbon nanotubes

Jodar	Esther	Spain	Electronic Transport in Nanotubes with Resonant Cavities
Lassagne	Benjamin	France	Unconventionnal Magneconductance Oscillations in quasi-ballistic MWCNTs
Pallecchi	Emiliano	Germany	Experiments on Carbon nanotubes with ferromagnetic contacts
Pourfath	Mahdi	Austria	On the Effect of Electron-Phonon Interaction Parameters on the Performance of Carbon Nanotube Based Transistors
Zdrojek	Mariusz	Poland	Charging effects in carbon nanotubes
TOPIC: Low-Dimensional Materials			
Angus	Susan	Australia	Development of a Silicon-based Single Electron Transistor
Bercu	Bogdan	France	Mechanical modulation of tunnel junction as an ultra sensitive NEMS
Callegari	Victor	Switzerland	Spontaneous growth of uniformly distributed In nanodots and InI3 nanowires on InP induced by a focused ion beam
Den Hertog	Martien Ilse	France	Evidence of Gold on lateral surfaces of gold catalyzed silicon nanowires
Donderowicz	Wojciech	Poland	Gaussian quantum dots of type II in in-plane electric field
Dujardin	Romain	France	Growth of Si and SiGe nanowhiskers by Molecular Beam Epitaxy; X-ray scattering and electron microscopy investigations
Isambert	Antoine	France	Probing single molecule transport with superconducting electrodes
Lamy	Jean-Michel	France	Characterization of InAs quantum wires on (001) InP : toward the realization of VCSEL structures with a stabilized polarisation
Laza	Simona Cristina	Italy	Colloidal Gold Nanoparticles Production By Laser Ablation In Liquids
Leconte	Sylvain	France	Electronic structure and vertical transport in GaN/AlN/GaN single-barrier structures
Ling	Hong Shi	Taiwan	Size dependent energy level positions of InAs quantum dots determined by selective excitation photoluminescence
Lo	Ming Cheng	Taiwan	Photoluminescence study of high density InAs/GaAs quantum dots
Mouchet	Céline	France	Synthesis of Si/SiGe nanowires for application in thermoelectric systems
Neretina	Svetlana	Canada	Wurtzite Cadmium Telluride Nanowires Grown by Pulsed Laser Deposition
Reedo	Valter	Estonia	Formation of micro- and nano-dimensional disk-shape TiO2 and ZrO2 particles at air-water interface
Riikonen	Sampsa	Spain	Systematic search for the Si(553)-Au reconstruction
Rodriguez Puerta	Juan Manuel	Spain	Initial stages of the growth of Cobalt on Ru(0001) studied by LEEM
Santalla	Silvia	Spain	On te lattice parameter and height profiles in the Stranski-Krastanov growth mode

TOPIC: Nanobiotechnologies			
Harding Lepage	Patricia	Canada	New Amplification Strategy for Electrochemical Detection of DNA Using Cationic Polymers Aggregates
Mackiewicz	Nicolas	France	Non-covalent functionalization of carbon nanotubes toward biosensing applications
Martins	Manuel	Portugal	Synthesis and characterization of polymer-embedded CoPt3 nanoparticles for bioanalytical applications
Morozan	Adina	Romania	The biocompatibility microorganisms-carbon nanostructures for applications in microbial fuel cells
Ryzhkov	Pavel	Germany	Formation of nanotemplates by genetically engineered truncated S-layer proteins with preserved self-assembly potential.
Schüler	Thomas	Germany	Potential of enzymatic silver deposition
Toset	Jordi	Spain	DC electrostatic manipulation of gold nanoparticles with Atomic Force Microscopy
Vantsyan	Mikhail	Russia	Biomimetic Hybrids for Multifunctional Nanoreactor Creation
TOPIC: Nanochemistry			
Bellomuno	Carla	Italy	Flame Synthesis and Diagnostics of Titania, Vanadia and Silica nanopowders
Laliberté	Marc-André	Canada	Evidence of Strong C-H--O Bonds in 2D Assemblies
Pace	Giuseppina	France	Photo-induced interconversion of conjugated azobenzenes on metal surfaces
Pereira	Angela Sofia	Portugal	Lanthanide doped ZnO nanocrystals: synthesis, surface modification and optical behaviour
Pro	Tiziana	France	Study of Hybrid Porphyrin-based Monolayer / Silicon Memory Devices
Sánchez-Pomales	Germarie	Puerto Rico	DNA-assisted purification and self-assembly of single-walled carbon nanotubes on gold
Temprano	Israel	Canada	New types of Nanoelectronics Contacts
TOPIC: Nanomagnetism and Spintronics			
Corral-Flores	Veronica	Mexico	Magnetic Properties of Nickel-Zinc Ferrite Nanoparticles Synthesized by Coprecipitation
Jaafar	Miriam	Spain	Magnetic anisotropy changes induced by high energy ion bombardment
Jourdan	Thomas	France	Magnetism at nanoscopic scale : numerical simulation and applications
TOPIC: Nanostructured and Nanoparticle Based Materials			
Alagoz	Arif Sinan	Turkey	Synthesizing Silicon Nanocrystals in Silicon Dioxide Matrix by Magnetron Sputtering Technique for Optical and Electrical Applications
Alvarez	Edgar	Mexico	Phototransformation of C60 thin films by UV pulsed laser irradiation: Comparative Photoacoustic, AFM, and Raman studies
Berson	Solenn	France	Poly(3-hexylthiophene) Fibres For Photovoltaic Applications

Gandhi	Abbasi	Ireland	Study of Dynamic Magnetization Reversal Process in Ni Nanowires
Guillot	Fabien	France	GaN/AlN nanostructures for intersubband optoelectronics at telecommunication wavelength
Karim	Shafqat	Germany	Experimental study on the Rayleigh instability of gold nanowires
Khaddem - Mousavi	Mir - Vadood	Ireland	Synthesis and Characterization of Dy-Ni-Fe Alloy Thin Films using Electrodeposition Technique
Köstler	Stefan	Austria	Nanoparticle Dispersions of Organic Luminescent and Semiconducting Materials
Kuchuk	Andrian	Ukraine	Nanocomposite Ta-,Ti-SiN Thin Films: Synthesis, Properties, and Applications in High Temperature Electronics
Leszczynska	Beata	Poland	Ultrafine-grained and nano–structure aluminium alloys produced by cyclic extrusion compression
Lin (*)	Hong-Ching	Taiwan	Formation of Ni-Cu-Ag Termination Using Metallo-Organic Decomposition (MOD) Technology at Low-Temperatures
Lin	Hong-Ching	Taiwan	The effects of silver oxalate and nano silver powder additions on the performances of the metallo-organic decomposition silver paste
Lu	Chun An	Taiwan	The effects of silver oxide additions on the electrical properties and microstructure of low-curing-temperature silver paste with MOD added
Macanas	Jorge	Spain	Preparation and Characterization of Metal-Polymer Nanocomposite Membranes for Electrocatalytic Applications
Manzano	Hegoi	Spain	Computational study of the mechanical properties of Tobermorite and Jennite crystals in comparison with C-S-H gel
Mishra	Yogendra Kumar	India	Swift heavy ion induced dissolution of gold nanoparticles embedded in silica matrix grown by co-evaporation
Porcher	Arnaud	France	Nanostructured porous silicon as thick electrical insulator for rf applications
Regonini	Domenico	United Kingdom	Anodised TiO2 nano-tubes: voltage ramp influence on the oxide morphology and investigation of phase changes in the crystal structure promoted by thermal treatments
Riabinina	Daria	Canada	Synthesis of Photoluminescent Silicon Nanocrystals by Reactive Laser Ablation
Salhi (*)	Billel	France	Nanostructured surface as EWOD counter electrode for matrix-free mass spectrometry analysis
Santiago	Diana	Puerto Rico	Characterization of Ru/Pt/C nanocatalyst prepared by rotating disk-electrode (RoDSE) technique
Schäffel	Franziska	Germany	Carbon Nanotubes Grown From Gas Phase Prepared Iron Catalyst Particles
Shekhar	Shashank	India	Transport, magnetotransport and magnetic properties of composites of polymer and carbon encapsulated iron carbide nanoparticles.
Shemer (*)	Gabriel	Israel	Size and Quality Control of Cobalt Ferrite Nanocrystal Synthesis Using a Magneto-Optical Probe
Shemer	Gabriel	Israel	Chirality of silver nanoparticles synthesized on DNA
Siengchin	Suchart	Germany	Structure-Property Relationships of Polystyrene/layered Silicate Nanocomposites as a Function of their Preparation
Singh	Sukhvinder	India	ZnO Nanocrystallites obtained by Oxidation of Zinc Arachidate – Arachidic Acid LB Multilayers
Velazquez	Jose J.	Spain	Optical properties of Ho3+-Yb3+ and Nd3+ doped SiO2-LaF3 glass-ceramics by sol-gel method

Vetrone	Fiorenzo	Canada	Nanostructured Materials with Applications in Biosensing and Biocompatibility
Wang	Likui	Singapore	Fabrication of Opals and Inverse Opals with a Planar Defect
TOPIC: Other			
Ahmed Pahlovy	Shahjada	Japan	Ion beams Irradiation effect on nanohardess of Silicon
Bernier	Martin	Canada	Photoinduced periodic nanostructures in glass by femtosecond pulses
Dubé	David	Canada	Aluminium Chloride on Silica Mesoporous Molecular Sieves as Alkylation Catalysts
Järvekülg	Martin	Estonia	Micro- and nano-scale tubular oxide structures
Miwa	Jill	Canada	Adsorption Site-Dependent Diffusion of Azobenzene on Cu(110)
Salomon	Antoine	France	Optical losses control by finely tuning the distance between a Bragg mirror and a 2D PC.
TOPIC: Theory and Modelling at the Nanoscale			
Bedwani	Stephane	Canada	Adaptive Algorithms for Real-Time STM Imaging
Garcia-Martinez	Yamila	Spain	Electronic transport through molecular bridges within ab-initio methodologies
Geuquet	Nicolas	Belgium	Monopole-dipole interaction model for carbon onions
Navab	Shiva	USA	Nano-scale Reconfigurable chips for Image Processing
Nishiyama	Kiyohisa	United Kingdom	Theory and Experimental Verification of Micro Switch Group Sensor (MSGS)
Sztrum	Claudia	Israel	Out-of-Equilibrium Self-Assembly of Binary Mixtures of Nanoparticles
Vandescuren	Matthieu	Belgium	Characterization of single-walled carbon nanotubes containing defects from their local vibrational densities of states

SESSION PB (98)			
Presenting Author		**Country**	**Poster Title**
TOPIC: Nanofabrication Tools and Nanoscale Integration			
Bauerdick	Sven	Germany	Three-dimensional electron beam induced deposition to overcome edge effects in wiring of nano structures
Bonnot	Anne Marie	France	Wafer scale CNT tip grafting growth process by Hot Filament assisted CVD
Brun	Mickael	France	Tuning fork based nano-toolbox for molecular and organic electronic
Dallaporta	Hervé	France	Fabrication of nano objects using focused ion beam induced deposition.
Gago-Fernandez	Raul	Spain	Nanodot patterning of silicon surfaces by ion beam sputtering
Gierak	Jacques	France	Nano-fabrication with Focused Ion Beams - Where are the resolution limits?
Gonzalez-Arrabal	Raquel	Spain	Nitrided FeB amorphous thin films for Nano Electromechanical Systems (NEMS)
Maier	Markus	Germany	Ultimate Nanoprobing in UHV: Four independent Scanning Tunneling Microscopes navigated by High Resolution UHV SEM
Sarantopoulou	Evangelia	Greece	Nano- depth control over self assembled structures on bio-compatible polymeric thin films for bio-array applications.
Tanaka	Shukichi	Japan	FM-NCAFM Investigation of Individual Organic Molecules on Insulating Substrates
TOPIC: Scanning Probes Methods			
Carrasco	Esther	Spain	Dislocation generation and motion in Au(001) at the nanometric scale
Diesinger	Heinrich	France	Kelvin force microscopy with simultaneous non-contact topography imaging - interaction between the two involved cantilever resonances
Maier	Markus	Germany	Atomic resolution AFM at low temperatures using the QPlus sensor
TOPIC: Carbon Nanotubes Based Nanoelectronics and Field Emission			
Ahlskog	Markus	Finland	Coiled multiwalled carbon nanotubes as electromechanical resonators
Chenevier	Pascale	France	Carbone nanotube mat sensors for toxic gas detection
Foa Torres	Luis E. F.	France	Electron-Phonon interaction in Carbon-Nanotubes: A full many-body treatment
Henrard	Luc	Belgium	Charge Carriers in Few Layer Graphite
Kim	Hyun-Ju	Korea	Preparation of CNT electrodes for enhanced electrochemical properties
Kim	Dojin	Korea	SWNTs and SnO2 composite as a high performance ammonia gas sensor

Le Poche	Hélène	France	Towards CMOS compatible: integration of in-situ grown individual vertical carbon nanotubes into field emission devices
Macucci	Massimo	Italy	Optimized technique for the calculation of carbon nanotube dispersion relationships
Nihey	Fumiyuki	Japan	RF Performance of Multiple-Channel Carbon Nanotube Transistors
Okotrub	Alexander	Russia	Electronic structure and ion-electron emission of nanodiamonds and carbon nanotubes
Popov	Andrei	Russia	Nanoelectromechanical Systems Based on Multi-walled Nanotubes: Nanothermometer, Nanorelay and Nanomotor
TOPIC: Low-Dimensional Materials			
Buttard	Denis	France	Silicon nanowires growth in a nanoporous alumina template
Clement	Nicolas	France	Electrical transport measurements on self-assembled organic molecular wires
Cornelius	Thomas	Germany	Finite-size effects in the electrical resistance of single bismuth nanowires
Fogler	Michael	USA	Conductance of a one-dimensional wire with strong random impurities
Fortin	Marc.A.	Sweden	Synthesis of gadolinium oxide nanoparticles as a contrast agent in MRI
Gentile	Pascal	France	Growth and study of Silicon Nanowires by Catalyst Assisted LPCVD
Jiménez	David	Spain	Physics-based model of disilicide/silicon nanowire heterostructure transistors
Marques	Manuel I.	Spain	Relaxor-based thin films memories and the depolarizing field problem
Noe	Pierre	France	Room-temperature green photoluminescence of silicon nanowires covered by deposited silicon oxide layers
Petkov	Nikolay	Ireland	Gold-seeded growth of Ge nanostructures inside channelled substrates by supercritical fluid-liquid-solid (SFLS) method
Reyes	Diego	Colombia	Phonon Multiplexing Through 1D Chains
Segura del Río	Rodrigo	Chile	Synthesis of Carbon Nanotubes, Nanofibers and carbon encapsulated Nanoparticles by decomposition of acetylene over Pd and Pd-Ge catalysts
Uhlik	Filip	Czech Republic	Computational Design of Metallofullerene Production: X@C74
Wei	Mingdeng	Japan	Formation of single-crystallized nanowires of manganese and vanadium oxides by a soft chemical process
TOPIC: Nanobiotechnologies			
Ashammakhi	Nureddin	Finland	Investigation of cell attachment on the scaffolds manufactured by electrospun PCL-hyaluronan blends
Ashammakhi	Nureddin	Finland	Electrospun nanofibrous scaffold with drug releasing properties

TOPIC: Nanochemistry			
Bai	Ping	Singapore	Molecular Wires Composed of Thiphene Oligomers
Chancolon	Jérôme	France	Electrochemical grafting of polymers on aligned multi-walled carbon nanotubes
Dubois	Lionel	France	Porphyrins for molecular electronics
Duclairoir	Florence	France	Tailor-made metalloporphyrins for hybrid molecular electronics
Fabre-Francke	Isabelle	France	Synthesis and characterization of electropolymerizable derivatives of N-salicyldene (anil) functionalized bis EDOT-carbazole
Huang	Kai	France	Synthesis of Molecular Memory Using Metallporphyrins Monolayer on Silicon Surface
Kollia	Zoe	Greece	Hieharchical self-assembled structures from block copolymer/metal nanoparticles hybrid materials induced by vuv light
Palacin	Serge	France	Interfacial signature of the polymer-to-metal bonding
Palacin	Serge	France	Adhesion of electrografted nitrobenzene films on silicon surfaces as a function of the applied potential: an AFM study
Pro	Tiziana	France	Study of Hybrid Porphyrin-based Monolayer / Silicon Memory Devices
Royal	Guy	France	Molecular switches and coordination polymers based on the cyclam framework
Simha Martynkova	Grazyna	Czech Republic	Organo-vermiculite structure ordering after PVAc introduction: Experiment and modeling
Yang	Sung	Korea	Shape controlled synthesis of Au nanoparticles
TOPIC: Nanomagnetism and Spintronics			
Chayka	Oleksandr	Czech Republic	AC magnetic properties of nanogranular FeCoAlN films
Kokado	Satoshi	Japan	Localized spin reversal by spin injection in a spin quantum dot: A model calculation
Quirós	Carlos	Spain	Interlayer exchange coupling temperature dependence in antiferromagnetically coupled multilayers
Untiedt	Carlos	Spain	Electronic transport and magnetism in atomic-sized structures
TOPIC: Nanostructured and Nanoparticle Based Materials			
Alpuim	Pedro	Portugal	Visible and ir photoluminescence study of erbium-doped silicon nanocrystals produced by rf sputtering
Barbosa	José	Portugal	Structural characterization of nanogranular BatiO3-Cofe2O4 thin films deposited by laser ablation on Si/Pt substrates
Bueno-Baques	Dario	Mexico	Magnetic properties of screen-printed (Y0.5sm0.5)Co5 magnet arrays

Colera	Inmaculada	Spain	Improvement of surface hardness in nitrogen implanted v-5%ti alloys: influence of the preferential sputtering in the elemental composition determination.
Hobara	Daisuke	Japan	Novel method to construct a two-dimensional molecule-nanoparticle network by organometallic complex formation
Hsu	Ching-Ling	Taiwan	Percolation in 2D Nanoparticle Films from Colloidal Self-Assembly
Jaroenworaluck	Angkhana	Thailand	Effect of water and hydrolysis catalyst on the morphology and crystal structure of TiO2 photocatalyst prepared by sol-gel method
Luo	Yi	France	AFM and SEM Study of Rubrene Micro-crystal Thin Film and Nanowires Growth
Muraviev	Dmitri	Spain	Simple Route for Intermatrix Synthesis of Polymer Stabilized Core-Shell Metal Nanoparticles for Sensor Applications
Patrone	Lionel	France	Growth of molecular nanostructures on Si using SAMs of long-chain alkyltrichlorosilanes
Pontoni	Diego	USA	Synchrotron studies of solvent mediated nanocrystal thin film self-assembly
Rellinghaus	Bernd	Germany	In-flight optical annealing of FePt nanoparticles.
Rodríguez Domínguez	Andrés	Spain	Optimization of the luminescence emission in nanocrystalline SiGe/SiO2 multilayers
Rogero	Celia	Spain	Synthesis and characterization of mixed monolayers on hydrogen-terminated silicon surfaces.
Selomulya	Cordelia	Australia	Designing magnetic nanoparticles for protein separation – a comparative study between flame spray pyrolysis and sol-gel synthesis
Suzuki	Yoshikazu	Japan	Preparation and Microstructure of TiO2-Nanowire Dispersed
Valášková	Marta	Czech Republic	Preparation of vermiculite particles for utilization in clay/polymer nanocomposites
TOPIC: Other			
Anthore	Anne	France	Double-gate organic field effect transistors
Chabli	Amal	France	The Influence of Surface Preparation and Probe Configuration on the Reliability of Work Function Measurement using Kelvin Probe Microscopy
Haghi	Akbar Khodaparast	Iran	Trends in electrospinning of natural nanofibers
Jousselme	Bruno	France	New diazonium salts of metal complexes for electrochemical modification of carbon nanotubes
Lenfant	Stéphane	France	Organic transistors based on self assembled monolayers
Mace	Christian	USA	Use of nanoscale zero valent iron for groundwater remediation
Qi	Zhi-mei	Japan	Determination of refractive index and thickness of TiO2 nanoparticle-polymer composite thin film coated on a sputtered gold layer by broadband spectral surface plasmon resonance spectroscopy

Us	Svitlana	Ukraine	Science and Technology Center in Ukraine - More than 10 Years of Successful Cooperation
TOPIC: Theory and Modelling at the Nanoscale			
Adessi	Christophe	France	Simulation of carbon nanotube field effect transistors Simulation of carbon nanotube field effect transistor with Palladium contacts
Akdim	Brahim	United States	Switching behavior in Silicon-Molecule-SWCNT Devices: A Density Functional Theory Study
Alvarez-Prado	Luis Manuel	Oviedo	Probing the transversal magneto-optical Kerr effect at the nanometric scale
Amara	Hakim	Belgium	Imaging defects in carbon nanotubes with an STM
Cresti	Alessandro	Italy	Currents imaging in open quantum dots in the integer quantum Hall transport regime
Dubois	Mathieu	France	STM induced molecular dynamics of biphenyl on Si(100) : a theoretical analysis
Fernandez-Serra	Marivi	France	Conductance, surface traps and passivation in doped silicon nanowires
Froufe	Luis	France	Single molecule fluorescence decay rate statistics in nanoscopic environments
Gómez Medina	Raquel	Switzerland	Finite size effects on the optical resonances of nanocylinder arrays
Gómez Medina	Raquel	Switzerland	Optical forces in plasmonic systems
Herrera	Bárbara	Chile	A DFT Study on Zirconia Oligomers and the influence of Cu-Doping
Kobe	Spomenka	Slovenia	Nanocrystalization of calcium carbonate in magnetic field.
Krasnyj	Jurij	Poland	Laser action in electrically driven quantum dot matrix
Moon	Won Ha	Korea	Melting Behavior of GaN Nanowires : Molecular Dynamics Study
Niquet	Yann Michel	France	Electronic properties of strained nanowire heterostructures
Persson	Martin	France	Charge transport properties of semiconductor nanowires within the Kubo-Greenwood and Landauer-Büttiker approaches.
Trevethan	Thomas	United Kingdom	Simulations of controlled single atom manipulation in non-contact atomic force microscopy
Yarovsky	Irene	Australia	Atomistic Simulation of Interactions of Carbon Nanoparticles with Organic Coatings

LIST OF PARTICIPANTS

TNT2006

ALPHABETICAL ORDER

TNT2006 Participants (351)

Only fully registered (payment processed) participants are listed below.
Last update (18/08/2006)

Last Name	Name	Institution	Country	Keynote/Oral/ Poster/Attendee
Abed	Hichem	CRMCN	France	Poster Sesion A
Adessi	Christophe	LPMCN, Université Claude Bernard Lyon1 et CNRS	France	Poster Sesion B
Adolphi	Barbara	Technische Universität Dresden	Germany	Attendee
Ahlskog	Markus	RHONE ALPES NUMERIQUE	Finland	Poster Sesion B
Airaksinen	Veli-Matti	Helsinki University of Technology / Micronova	Finland	Attendee
Akdim	Brahim	Air Force Research Laboratory	United States	Poster Sesion B
Alagoz	Arif Sinan	Middle East Technical University	Turkey	Poster Sesion A
Alameda	Jose María	Universidad de Oviedo	Spain	Attendee
Albrecht	Wolfgang	Research Center Jülich/Center of Nanoelectronic Systems	Germany	Attendee
Alpuim	Pedro	University of Minho	Portugal	Poster Sesion B
Alvarez	Edgar	CCADET-UNAM	Mexico	Poster Sesion A
Álvarez-Prado	Luis Manuel	Universidad de Oviedo	Spain	Poster Sesion B
Allovon	Michel	France Telecom	France	Attendee
Amara	Hakim	FUNDP/LPS	Belgium	Poster Sesion B
Ando	Tsuneya	Tokyo Institute of Technology	Japan	Keynote
Angus	Susan	University of New South Wales	Australia	Poster Sesion A
Aniulis	Aurimas	University of Central Lancashire	United Kingdom	Attendee
Anthore	Anne	Universite Paris 7	France	Poster Sesion B
Aono	Masakazu	NIMS	Japan	Keynote
Ares Garcia	Pablo	NANOTEC ELECTRONICA S.L.	Spain	Attendee
Arfaoui	Imad Eddine	University of Groningen	Netherlands	Oral
Ascheron	Claus	Springer	Germany	Attendee
Asenjo	Agustina	ICMM-CSIC	Spain	Oral
Ashammakhi	Ashammakhi	Institute of Orthopaedics	Finland	Poster Sesion B
Avouris	Phaedon	IBM T.J. Watson Research Center	United States	Keynote
Avriller	Remi	CEA/DRFMC/SPSMS/GT	France	Poster Sesion A
Ayari	Anthony	LPMCN	France	Attendee
Bachtold	Adrian	ICN / CNM	Spain	Keynote
Bai	Ping	Institute of High Performance Computing	Singapore	Poster Sesion B
Balestra	Francis	IMEP	France	Attendee
Baptist	Robert	CEA-LETI	France	Organiser
Barbosa	Jose	Univertity of Minho	Portugal	Poster Sesion B
Bauerdick	Sven	Raith	Germany	Poster Sesion B
Bedwani	Stéphane	École Polytechnique de Montréal	Canada	Poster Sesion A
Bellomunno	Carla	CNR IENI SECT. MILANO	Italy	Poster Sesion A
Bercu	Bogdan	Institute of Microelectronics, Electromagnetism and Photonics	France	Poster Sesion A
Berger	Claire	Georgia Institute of Technology	United States	Oral
Bernier	Martin	COPL, Laval University	Canada	Poster Sesion A
Berson	Solenn	CEA Grenoble	France	Poster Sesion A
Besenbacher	Flemming	University of Aarhus	Denmark	Keynote
Beton	Peter	University of Nottingham	United kingdom	Oral
Blaise	Philippe	CEA/LETI/D2NT	France	Poster Sesion B
Blase	Xavier	Université Claude-Bernard Lyon I and CNRS	France	Attendee
Boddaert	Xavier	Centre de Microélectronique de Provence	France	Attendee

Bonnot	Anne Marie	LEPES/CNRS	France	Poster Sesion A
Borghetti	Julien	CEA Saclay	France	Poster Sesion A
Bouchiat	Vincent	CNRS/CRTBT	France	Attendee
Bourgoin	Jean-Philippe	CEA/Physical Sciences Division	France	Keynote
Bourlon	Bertrand	California Institute of Technology	United States	Oral
Brewer	Jonathan	University of Southern Denmark	Denmark	Poster Sesion A
Bruel	Michel	CEA/LETI	France	Attendee
Brun	Mickael	CEA/DRT-LETI	France	Poster Sesion B
Bueno-Baques	Dario	Centro de Investigacion en Materiales Avanzados, S.C.	Mexico	Poster Sesion B
Burghard	Marko	Max-Planck-Institute for Solid State Research	Germany	Attendee
Buttard	Denis	CEA-Grenoble/DRFMC/SP2M/SINAPS	France	Poster Sesion B
Calvo Urbina	Maria Reyes	Universidad de Alicante.	Spain	Poster Sesion A
Callegari	Victor	EMPA	Switzerland	Poster Sesion A
Carrasco Burgos	Esther	Universidad Complutense de Madrid	Spain	Poster Sesion B
Cerdá	Jorge Iribas	ICMM-CSIC	Spain	Attendee
Cignoli	Francesco	CNR-IENI SECT. MILANO	Italy	Attendee
Clement	Nicolas	IEMN / NCM	France	Poster Sesion B
Coiffic	Jean-Christophe	CEA-LETI	France	Poster Sesion A
Cojocaru	Costel Sorin	Laboratoire Physique des Interfaces et Couches Minces, (LAB-PICM) École Polytechnique, (UMR 7647) CNRS	France	Attendee
Cojocaru	Cristian-Victor	INRS-Énergie, Matériaux et Télécommunications	Canada	Poster Sesion A
Colera	Inmaculada	Universidad Carlos III	Spain	Poster Sesion B
Conche	Pascal	MINATEC/MMNT	France	Attendee
Cornelius	Thomas	GSI	Germany	Poster Sesion B
Corral-Flores	Veronica	Centro de Investigación en Materiales Avanzados	Mexico	Poster Sesion A
Correia	Antonio	Phantoms Foundation	Spain	Organiser
Costa-Krämer	Jose L	U of MN, USA - IMM, CSIC	United States	Attendee
Cresti	Alessandro	NEST-CNR-INFM	Italy	Poster Sesion B
Csaki	Andrea	Institute for physical high technology	Germany	Oral
Chabli	Amal	CEA-DRT-LETI	France	Poster Sesion B
Chancolon	Jérôme	DRECAM/SPAM	France	Poster Sesion B
Charvolin	Thomas	CEA/DRFMC	France	Attendee
Chenevier	Pascale	CEA / DRECAM/SPEC	France	Poster Sesion B
Chernysheva	Marina	Moscow State University	Russia	Poster Sesion A
Cho	Yu suk	Chungnam Nat Univ	Korea	Poster Sesion A
Chroboczek	Jan	IMEP	France	Attendee
Chupin	Cedric	ALMA CONSULTING GROUP	France	Attendee
Dahlberg	E Dan	University of Minnesota	United States	Keynote
Dallaporta	Herve	CRMCN-CNRS	France	Poster Sesion B
Dansou-Eloy	Joel	IMEP MINATEC 3 parvis Louis Neel BP257	France	Attendee
D'Anterroches	Loc	Atomistix	Denmark	Attendee
D'Anterroches	Cécile	FT R&D MAPS/AMS	France	Attendee
Danto	Yves	Université Bordeaux1, IXL	France	Attendee
David	Thomas	CEA-Grenoble/DRFMC/SP2M/SINAPS	France	Poster Sesion A

De la Cruz	Rosa María	Universidad Carlos III de Madrid	Spain	Attendee
de la Figuera	Juan	Universidad Autonoma de Madrid	Spain	Keynote
De Salvo	Barbara	CEA/LETI/D2NT	France	Attendee
Delaunay	Marc	CEA	France	Poster Sesion B
Den Hertog	Martien	LEMMA/SP2M/DRFMC/CEA	France	Poster Sesion A
Dettlaff-Weglikowska	Urszula	Max-Planck-Institute for Solid State Research	Germany	Attendee
Dieny	Bernard	SPINTEC URA CEA/CNRS	France	Keynote
Diesinger	Heinrich	IEMN Département ISEN	France	Poster Sesion B
Donderowicz	Wojciech	Wrocław University of Technology, Intitute of Physics	Poland	Poster Sesion A
Dubé	David	Université Laval	Canada	Poster Sesion A
Dubegny	Christophe	SCHAEFER TECHNIQUES	France	Attendee
Dubois	Lionel	CEA - Grenoble / DFRMC/SCIB	France	Poster Sesion B
Dubois	Mathieu	CEA / DRFMC / SPrAM	France	Poster Sesion B
Dubuc	Nathalie	LAVAL University	Canada	Poster Sesion B
Duclairoir	Florence	CEA-Grenoble	France	Poster Sesion B
Dugaev	Vitalii	Instituto Superior Tecnico - CFIF	Portugal	Oral
Dujardin	Romain	cea/Grenoble/DRFMC	France	Poster Sesion A
Durand	Christophe	INRS-EMT	Canada	Poster Sesion B
Egger	Stefan	National Institute for Materials Science	Japan	Oral
El-Sayed	Mostafa A.	Georgia Tech	United States	Keynote
Eymery	Joel	CEA DRFMC SP2M PSC	France	Poster Sesion B
Fabre-Francke	Isabelle	CEA GRENOBLE DRT/LETI/DIHS/LIMN	France	Poster Sesion B
Fanet	Hervé	CEA	France	Attendee
Faure-Vincent	Jerome	LETI	France	Attendee
Fayolle	Murielle	CEA-LETI	France	Attendee
Feiner	Lou-Fe'	Philips Research Labs	Netherlands	Keynote
Fernandez Garcia	Rafael	NANOTEC ELECTRONICA S.L.	Spain	Attendee
Fernandez-Serra	Marivi	LPMCN, University Lyon 1	France	Poster Sesion B
Fiori	Angelamaria	University of Rome Tor Vergata	Italy	Poster Sesion A
Foa Torres	Luis	DRFMC/SPSMS/GT and LETI/DIHS/LMNO, CEA-Grenoble	France	Poster Sesion B
Fogler	Michael	University of California San Diego	United States	Poster Sesion B
Forbes	Ian	Institute Of Physics Publishing (IOPP)	Bristol	Attendee
Fortin	Marc-André	Linköpings Universitet	Sweden	Poster Sesion B
Fournier Wirth	Chantal	Etablissement francais du sang pyrenees mediterranee	France	Attendee
Froufe	Luis	Ecole Centrale Paris	France	Poster Sesion B
Gaas	Markus	University of Regensburg	Germany	Poster Sesion A
Gago-Fernandez	Raul	Universidad Autonoma de Madrid	Spain	Poster Sesion B
Gandhi	Abbasi	University of Limerick	Ireland	Poster Sesion A
Garcia Escorial	Paloma	Parque Científico de Madrid	Spain	Organiser
Garcia-Martin	Antonio	Instituto de Microeleconica de Madrid	Spain	Attendee
Garcia-Martinez	Yamila	Universidad de Alicante	Spain	Poster Sesion A
Garcia-Mochales	Pedro	Universidad Autónoma de Madrid	Spain	Attendee
Gautier	Jacques	CEA-LETI	France	Attendee
Gentile	Pascal	CEA Grenoble DRFMC/SP2M	France	Poster Sesion B
Geuquet	Nicolas	FUNDP, LPS	Belgium	Poster Sesion A

Gierak	Jacques	LPN-CNRS	France	Poster Sesion B
Gil	Adriana	Nanotec Electronica	Spain	Attendee
Goldschmidt	Paula	Intel Corp	Israel	Attendee
Gómez Medina	Raquel	École Polytechnique Fédérale de Lausanne	Switzerland	Poster Sesion B
Gomez Rodriguez	Jose Mª	Universidad Autonoma de Madrid	Spain	Keynote
Gonzalez Arrabal	Raquel	IMM-CSIC	Spain	Poster Sesion B
Gould	Charles	University of Wuerzburg	Germany	Oral
Grevin	Benjamin	CEA-Grenoble\\DRFMC\\SPrAM\\LEMOH	France	Oral
Guibert	Jean Charles	DIR VALO	France	Attendee
Guillot	Fabien	CEA Grenoble - DRFMC/SP2M/PSC	France	Poster Sesion A
Hadji	Emmanuel	CEA DRFMC	France	Oral
Harding Lepage	Patricia	Université Laval	Canada	Poster Sesion A
Haruyama	Junji	Aoyama Gakuin University	Japan	Oral
Heckmeier	Michael	Merck OLED Materials GmbH	Germany	Keynote
Heiz	Ulrich	Technical University of Munich	Germany	Keynote
Henrard	Luc	University of Namur	Belgium	Poster Sesion B
Hering	Katharina	Institute for Physical High Technology (IPHT)	Germany	Attendee
Hernández Cuadra	Fernando	Fundación Phantoms	Spain	Organiser
Herrera	Barbara	Pontificia Universidad Católica de Chile Facultad de Química	Chile	Poster Sesion B
Hobara	Daisuke	Fusion Domain Laboratory, Materials Laboratories, Sony Corporation	Japan	Poster Sesion B
Hollingworth	Nigel	William Andrew Publishing Inc	United Kingdom	Attendee
Hsu	Ching-Ling	Chung Yuan Christian University	Taiwan	Poster Sesion B
Huang	Kal	CEA / LETI / DTBS	France	Attendee
Isambert	Antoine	CEA Saclay / DRECAM-SPEC-LEM	France	Poster Sesion A
Jaafar	Miriam	ICMM - CSIC	Spain	Poster Sesion A
Jaffrennou	Périne	LEM - ONERA	France	Poster Sesion A
Jager	Jean-Baptiste	CEA Grenoble DRFMC/SP2M/Sinaps	France	Attendee
Jalabert	Antoine	CEA-LETI	France	Attendee
Jalaguier	Eric	CEA/LETI/D2NT	France	Attendee
Jacquier	Bernard	Université de Lyon/CNRS	France	Attendee
Jaroenworaluck	Angkhana	National Metal and Materials Technology Center	Thailand	Poster Sesion B
Järvekülg	Martin	University of Tartu	Estonia	Poster Sesion A
Jiménez	David	Universitat Autònoma de Barcelona	Spain	Poster Sesion B
Joachim	Christian	CEMES/CNRS	France	Keynote
Jodar	Esther	Universidad Politecnica de Cartagena	Spain	Poster Sesion A
Joubert	Olivier	CNRS	France	Attendee
Jourdan	Thomas	CEA Grenoble / DRFMC / SP2M	France	Poster Sesion A
Jousselme	Bruno	CEA Grenoble / Leti/DIHS/LIMN	France	Poster Sesion B
Juvonen	Laura	Spinverse Consulting	Finland	Attendee
karim	Shafqat	University of Marburg	Germany	Poster Sesion A
Karthäuser	Silvia	Research Center Jülich	Germany	Oral
Khaddem Mousavi	Mir Vadood	University of Limerick	Ireland	Poster Sesion A
Khodaparast Haghi	Akbar	Guilan University	Iran	Poster Sesion B
Kim	Hyun-Ju	Korea Electrotechnology Research Institute	Korea	Poster Sesion B
Kim	Dojin	Chungnam Nat Univ	Korea	Poster Sesion B

Kinaret	Jari	Chalmers University of Technology	Sweden	Oral
Kobe	Spomenka	Jozef Stefan Institute	Slovenia	Poster Sesion B
Koestler	Stefan	Joanneum Research	Austria	Poster Sesion A
Kokado	Satoshi	Shizuoka University	Japan	Poster Sesion B
Kollia	Zoe	National Hellenic Research Foundation	Greece	Poster Sesion B
Koponen	Pekka	Spinverse Consulting	Finland	Attendee
Krasnyj	Jurij	Institute of Mathematics	Poland	Poster Sesion B
Kuchuk	Andrian	V. Lashkaryov Institute of Semiconductor Physics	Ukraine	Poster Sesion A
Kuwahara	Yuji	Osaka University	Japan	Keynote
Laliberté	Marc-André	Laval University	Canada	Poster Sesion A
Lämsä	Markku	Tekes	Finland	Oral
Lamy	Jean-Michel	laboratoire LENS UMR CNRS 6082 FOTON	France	Poster Sesion A
Lancok	Jan	Institute of Physics AS CR	Czech Republic	Poster Sesion B
Landman	Uzi	Georgia Tech	United States	Keynote
Lassagne	Benjamin	LNCMP - CNRS	France	Poster Sesion A
Laza	Simona C.	University of Pisa	Italy	Poster Sesion A
Le Poche	Hélène	CEA Grenoble - LITEN	France	Poster Sesion B
Leconte	Sylvain	CEA-Grenoble	France	Attendee
Ledesma	Javier	SCIENTEC	France	Attendee
Legagneux	Pierre	Thales R&T	France	Keynote
Lenfant	Stéphane	IEMN/NCM	France	Poster Sesion B
Leszczynska	Beata	University of Science and Technology	Poland	Attendee
Lherbier	Aurelien	CNRS/LTM & CEA/DRFMC/SP2M	France	Attendee
Lin	Hong-Ching	National Chiao Tung University	Taiwan	Poster Sesion A
Ling	Hong Shi	National Chiao Tung University	Taiwan	Poster Sesion A
Lo	Ming Cheng	National Chiao Tung University	Taiwan	Poster Sesion A
Lu	Chun-An	Industrial Technology Research Institute	Taiwan	Poster Sesion B
Luo	Yi	CEA-Grenoble\\DRFMC\\SPrAM\\LEMOH	France	Poster Sesion B
Macanás	Jorge	Universitat Autònoma de Barcelona	Spain	Poster Sesion A
Mace	Christian	GOLDER ASSOCIATES	United States	Poster Sesion B
Mackiewicz	Nicolas	CEA-Saclay/SMMCB Bât.547	France	Poster Sesion A
Macucci	Massimo	Dipartimento di Ingegneria dell\'Informazione	Italy	Attendee
Magnea	Noel	CEA Grenoble/DRFMC	France	Attendee
Magoga	Michael	NANOTIMES	France	Attendee
Maier	Markus	Omicron NanoTechnology GmbH	Germany	Attendee
Malier	Laurent	CEA/LETI	France	Attendee
Mallet	Pierre	LEPES - CNRS	France	Attendee
Manzano Moro	Hegoi	Labein-Tecnalia	Spain	Poster Sesion A
Marchenkov	Alexei	Georgia Institute of Technology	United States	Keynote
Marques	Manuel I.	Universidad Autonoma de Madrid	Spain	Poster Sesion B
Martins	Manuel	University of Aveiro	Portugal	Poster Sesion A
Marty	Laetitia	Université de Montréal	Canada	Keynote
Mingo	Natalio	Center for Nanotechnology	United States	Oral
Mirkin	Chad	Northwestern University	United States	Keynote
Mishra	Yogendra Kumar	Materials Science Division	India	Poster Sesion A
Miwa	Jill	University of Quebec	Canada	Poster Sesion A
Miyamoto	Yoshiyuki	NEC	Japan	Oral

Molko	Didier	CEA / DRT / Dir-Valo	France	Attendee
Molva	Engin	CEA/DRFMC	France	Attendee
Morin	Vincent	Orsay Physics SA	France	Attendee
Moriyama	Shigeo	Institute of Technologists	Japan	Attendee
Morozan	Adina	University of Bucharest	Romania	Poster Sesion A
Mouchet	Céline	CEA Grenoble DRT/LITEN/DTNM/LCH	France	Poster Sesion A
Mouis	Mireille	IMEP (CNRS/INPG/UJF)	France	Attendee
Moulinet	Michel	ALMA CONSULTING GROUP	France	Attendee
Muraviev	Dmitri	Autonomous University of Barcelona	Spain	Poster Sesion B
Navab	Shiva	UCLA	United States	Poster Sesion A
Neretina	Svetlana	McMaster University	Canada	Poster Sesion A
Ness	Herve	CEA-Saclay	France	Oral
Nicolessi	Gaston	NANOTIMES	France	Attendee
Nihey	Fumiyuki	NEC	Japan	Attendee
Niquet	Yann Michel	CEA/DRFMC/SP2M/L_Sim	France	Poster Sesion B
Nishiyama	Kiyohisa	University of Birmingham	United Kingdom	Poster Sesion A
Noe	Pierre	CEA Grenoble DRFMC/SP2M	France	Poster Sesion B
Nørskov	Jens K.	Technical University of Denmark	Denmark	Attendee
Nouvertne	Frank	Raith	Germany	Attendee
Okotrub	Alexander	Nikolaev Institute of Inorganic Chemistry SB RAS	Russia	Poster Sesion B
Osváth	Zoltán	Research institute for technical physics and materials science (mfa)	Hungary	Poster Sesion A
Pace	Giuseppina	Université Louis Pasteur	France	Poster Sesion A
Palacin	Serge	CEA/DRECAM	France	Poster Sesion B
Palacios	Juan José	Universidad de Alicante	Spain	Oral
Palermo	Vincenzo	ISOF	Italy	Oral
Pallecchi	Emiliano	University of Regensburg	Germany	Poster Sesion A
Pantigny	Philippe	CEA Liten	France	Poster Sesion B
Patrone	Lionel	CNRS-L2MP/ISEN	France	Poster Sesion B
Payot	François	RHONE ALPES NUMERIQUE	France	Attendee
Pennec	Yan	University of British Columbia	Canada	Oral
Pereira	Angela Sofia	CICECO	Portugal	Poster Sesion A
Perez	Mar	Fundación Phantoms	Spain	Organiser
Persson	Martin	CEA/DRFMC/SP2M/L_Sim	France	Poster Sesion B
Petkov	Nikolay	University College Cork	Ireland	Attendee
Picco	Loren	University of Bristol	United Kingdom	Poster Sesion A
Pinilla	Elena	NANOTEC ELECTRÓNICA S.L.	Spain	Attendee
Pontoni	Diego	Harvard University	United States	Poster Sesion B
Popov	Andrei	Institute of Spectroscopy of RAS	Russia	Poster Sesion B
Porcher	Arnaud	Laboratoire de Physique de la Matière	France	Poster Sesion A
Pourfath	Mahdi	Institute for Microelectronics, TU Wien	Austria	Poster Sesion A
Pro	Tiziana	CEA/LETI/D2NT	France	Attendee
Purcell	Stephen	Université Lyon1, LPMCN	France	Oral
Qi	Zhi-mei	PRESTO, Japan Science and Technology Agency	Japan	Poster Sesion B
Quirós	Carlos	Universidad de Oviedo	Spain	Poster Sesion B
Reedo	Valter	University of Tartu	Estonia	Poster Sesion A
Regonini	Domenico	University of Bath	United Kingdom	Poster Sesion A

Reguer	Alan	CRMCN	France	Poster Sesion A
Reichel	Jakob	Laboratoire Kastler Brossel de l´ENS	France	Keynote
Rellinghaus	Bernd	IFW Dresden	Germany	Poster Sesion B
Reyes Romero	Diego Fernando	Universidad de los Andes	Colombia	Poster Sesion B
Riabinina	Daria	University of Quebec	Canada	Poster Sesion A
Riikonen	Sampsa	Universidad del Pais Vasco	Spain	Poster Sesion A
Roche	Stephan	CEA	France	Organiser
Rochefort	Alain	Ecole Polytechnique de Montreal	Canada	Oral
Rodriguez Dominguez	Andres	Universidad Politecnica de Madrid	Spain	Poster Sesion B
Rodriguez Puerta	Juan M.	ICMM-CSIC	Spain	Poster Sesion A
Rogero	Celia	CSIC-INTA	Spain	Poster Sesion B
Roldan Hernandez	Jose Luis	Fundación Phantoms	Spain	Organiser
Rosei	Federico	INRS-EMT, Univ of Quebec	Canada	Keynote
Rousset	Cecile	INNOVATION	France	Attendee
Rouviere	Emmanuelle	CEA/DTNM	France	Attendee
Royal	Guy	University of Grenoble	France	Poster Sesion B
Ryzhkov	Pavel	Technische Universität Dresden	Germany	Poster Sesion A
Saba	Maria C.	Petroleo Brasileiro S.A. - Petrobras/Cenpes	Brazil	Attendee
Saenz	Juan Jose	Universidad Autonoma de Madrid	Spain	Oral
Saez	Jean Pierre	FONDIS ELECTRONIC	France	Attendee
Salem	Bassem	DRFMC/SP2M/SiNaPS	France	Attendee
Salhi	Billel	Interdisciplinary Research Institut	France	Poster Sesion A
Salomon	Antoine	CEA / Leti / DIHS	France	Poster Sesion A
Samuelson	Lars	Lund University	Sweden	Keynote
Sanchez Portal	Daniel	Centro Mixto CSIC-UPV/EHU	Spain	Keynote
Sanchez-Pomales	Germarie	University of Puerto Rico	Puerto Rico	Poster Sesion A
Santalla	Silvia	Universidad Carlos III de Madrid	Spain	Poster Sesion A
Santiago	Diana	University of Puerto Rico	Puerto Rico	Poster Sesion A
Sarantopoulou	Evangelia	National Hellenic Research Foundation	Greece	Poster Sesion B
Scifo	Lorette	Cea-Grenoble\\DRFMC\\SPrAM\\LEMOH	France	Poster Sesion A
Schäffel	Franziska	IFW Dresden	Germany	Poster Sesion A
Scheffold	Frank	Fribourg University	Switzerland	Attendee
Schueler	Thomas	Institute for Physical High Technology (IPHT)	Germany	Poster Sesion A
Segura del Río	Rodrigo A.	Universidad Técnica Federico Santa María	Chile	Poster Sesion B
Selomulya	Cordelia	Monash University	Australia	Poster Sesion B
Séméria	Marie-Noëlle	CEA/LETI	France	Attendee
Serikov	Vladimir	NSG America, Inc.	United States	Attendee
Servati	Peyman	Electrical Engineering Division	United Kingdom	Attendee
Shemer	Gabriel	Tel-Aviv University	Israel	Poster Sesion A
Shibata	Akihiko	Dai Nippon Printing Co., Ltd. / Corporate R&D	Germany	Attendee
Siengchin	Suchart	University of Kaiserslautern	Germany	Poster Sesion A
Simha Martynkova	Grazyna	730- IMACH VSB-TUO	Czech Republic	Attendee
Simonato	Jean-Pierre	CEA / DTNM / LCH	France	Attendee
Singh	Sukhvinder	Indian Institute of Technology Bombay	India	Poster Sesion A
Sone	Jun'ichi	Fundamental and Environmental Research Laboratories	Japan	Keynote

Steliou	Vrettos	NanoMEGAS	Belgium	Attendee
Stokbro	Kurt	Nanoscience center	Denmark	Oral
Strunk	Christoph	University of Regensburg	Germany	Keynote
Sutherland	Duncan	Interdisciplinary Nanonscience Center	Denmark	Keynote
Suzuki	Yoshikazu	Kyoto University	Japan	Poster Sesion B
Takayanagi	Hideaki	Tokyo University of Science	Japan	Keynote
Tanaka	Shukichi	National Institute of Information and Communications Technology, KARC-NiCT	Japan	Poster Sesion B
Tarasov	Konstantin	Institute of Solid State Chemistry and Mechanochemistry SB RAS	Russia	Oral
Temprano	Israel	Université Laval	Canada	Poster Sesion A
Tessier	Dominic	CTT Group	Canada	Oral
Thomas	Jessica	Nature Publishing Group/Nature Nanotechnology	United Kingdom	Attendee
Toset	Jordi	Universitat de Barcelona	Spain	Poster Sesion A
Travers	Jean-Pierre	UMR SPrAM (CEA-CNRS-UJF)	France	Attendee
Trevethan	Thomas	University College London	United Kingdom	Poster Sesion B
Triozon	Francois	CEA-LETI	France	Poster Sesion B
Triscone	Jean-Marc	University of Geneva / DPMC	Switzerland	Attendee
Uhlik	Filip	Dept. of physical chemistry	Czech Republic	Poster Sesion B
Untiedt Lecuona	Carlos	Universidad de Alicante	Spain	Poster Sesion B
Us	Svitlana	Science and Technology Center in Ukraine	Ukraine	Poster Sesion B
Valaskova	Marta	730 IMACH VSB-TUO	Czech Republic	Poster Sesion B
Van Hove	Patrick	European Commission	Belgium	Oral
Vandescuren	Matthieu	FUNDP, LPS	Belgium	Poster Sesion A
Vantsyan	Mikhail	Mendeleyev University of Chemical Technology of Russia	Russia	Poster Sesion A
Velázquez García	José Joaquín	Universidad de La Laguna	Spain	Poster Sesion A
Vetrone	Fiorenzo	INRS-EMT	Canada	Poster Sesion B
Viguier	Claude	Omicron NanoTechnology	France	Attendee
Vuillaume	Dominique	CNRS-IEMN	France	Poster Sesion B
Wang	Likui	Department of Chemical and Biomolecular Engineering	Singapore	Poster Sesion A
Weber-Bargioni	Alexander	University of British Columbia	Canada	Poster Sesion A
Wei	Mingdeng	Japan Science and Technology Agency (JST)	Japan	Poster Sesion B
Weigelt	Sigrid	iNano, Department of Physics and Astronomy	Denmark	Oral
Weisser	Ludger	Atomic Force F&E GmbH	Germany	Attendee
Williams	R. Stanley	Hewlett-Packard Company - QSR	United States	Keynote
Yang	Sung I	Kyung Hee University	Korea	Poster Sesion B
Yarovsky	Irene	School of Applied Sciences	Australia	Poster Sesion B
Zdrojek	Mariusz	IEMN Département ISEN	France	Poster Sesion A