TNT2007

Trends in Nanotechnology

San Sebastian (Spain) September, 2007

http://www.tnt2007.org

TNT2007 book edited by:
PHANTOMS Foundation http://www.phantomsnet.net

TNT2007 "Trends in Nanotechnology" San sebastian (Spain) September 03-07, 2007

TNT2007

Trends in NanoTechnology

San Sebastian (Spain)
September 03-07, 2007

PHANTOMS foundation
CIC nanoGUNE nanoscience cooperative research center
UAM UNIVERSIDAD AUTONOMA DE MADRID
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DONOSTIA INTERNATIONAL PHYSICS CENTER D.I.P.C.
NIMS Nanomaterials Laboratory
Georgia Institute of Technology
cea leti
CSIC
Purdue University

On behalf of the Honorary, International, Local and Technical Committees, we take great pleasure in welcoming you to San Sebastian (Spain) for the 8th “Trends in NanoTechnology” (TNT2007) International Conference.

TNT2007 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 seven prior TNT conferences.

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/ICT/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, 15 awards (3750 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, Donostia International Physics Center (DIPC), CIC nanoGUNE Consolider, Consejo Superior de Investigaciones Científicas, Universidad Autónoma de Madrid, Universidad Complutense de Madrid, Universidad de Oviedo, University of Purdue, Georgia Institute of Technology, CEA/LETI, Instituto Español de Comercio Exterior (ICEX), “españa-technology for life” program, CEA/DRFMC, MINATEC, NIMS (Nanomaterials Laboratory), Air Force Office of Scientific Research, The Office of Naval Research International Field Office (ONRIFO), iNANO, Engineering and Physical Sciences Research Council, NSERC/CRSNG (Nano Innovation Platform), GDR-E/NanoE, Raith GmbH, Nanoquanta (NoE), European Theoretical Spectroscopy Facility (ETSF), Parque Científico de Barcelona (PCB), Universidad SEK, Ayuntamiento de San Sebastian, Ministerio de Educación y Ciencia (MEC), Parque Científico de Madrid (PCM), IJ Cambria Scientific, FEI Company, Spanair, Forschungszentrum Jülich, P. Van Hove (private donation) and Wiley-VCH & PSS.

We would also like to thank the following companies and Institutions for their participation: Nanotec, Raith, Scientec, Schaefer Techniques, Biometa, Telstar Instrumat, HWL Scientific Instrument, Omicron Nanotechnology, Nanotimes, Phantoms Foundation, Wiley-VCH, IK4, Tecnalia, DIPC, UPV-EHU/Polymat, UPV-EHU/“Materials+Technologies” Research Group, CIC nanoGUNE, CIC biomaGUNE, CIC microGUNE, UPV-EHU/NanoBioterm Group and Midatech.

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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* Contact person: antonio@phantomsnet.net

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TNT2007 POSTER AWARDS

Funded by		Award
NIMS Nanomaterials Laboratory	**NIMS - Nanomaterials Laboratory**	400 Euros
U B Parc Científic de Barcelona	**Parc Cientific de Barcelona (PCB)**	350 Euros
NSERC CRSNG NanoIP/PIC	**NSERC-CRSNG (NanoIP)**	300 Euros
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GDR-E Nano-E	**GDR-E on Science and Applications of Nanotubes**	200 Euros
Forschungszentrum Jülich in der Helmholtz-Gemeinschaft	**Forschungszentrum Jülich**	One Textbook "Nanoelectronics and Information Technology: Advanced Electronic Materials and Novel Devices"
Forschungszentrum Jülich in der Helmholtz-Gemeinschaft	**Forschungszentrum Jülich**	One Textbook "Nanoelectronics and Information Technology: Advanced Electronic Materials and Novel Devices"
TNT2007 Trends in NanoTechnology San Sebastian (Spain) September 03-07, 2007	**TNT2007 Organisation**	Free registration to the TNT2008 Conference

TNT 2007 PLATINUM SPONSORS

fundación DONOSTIA INTERNATIONAL PHYSICS CENTER D.I.P.C.	CIC nanoGUNE nanoscience cooperative research center	NSERC CRSNG NanoIP/PIC
CSIC	SPANISH INSTITUTE FOR FOREIGN TRADE ICEX	españa, technology for life.

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TNT2007 EXHIBITORS				
Raith	NANOTEC ELECTRONICA	SCIENTEC	biometa tecnología y sistemas	NANO times
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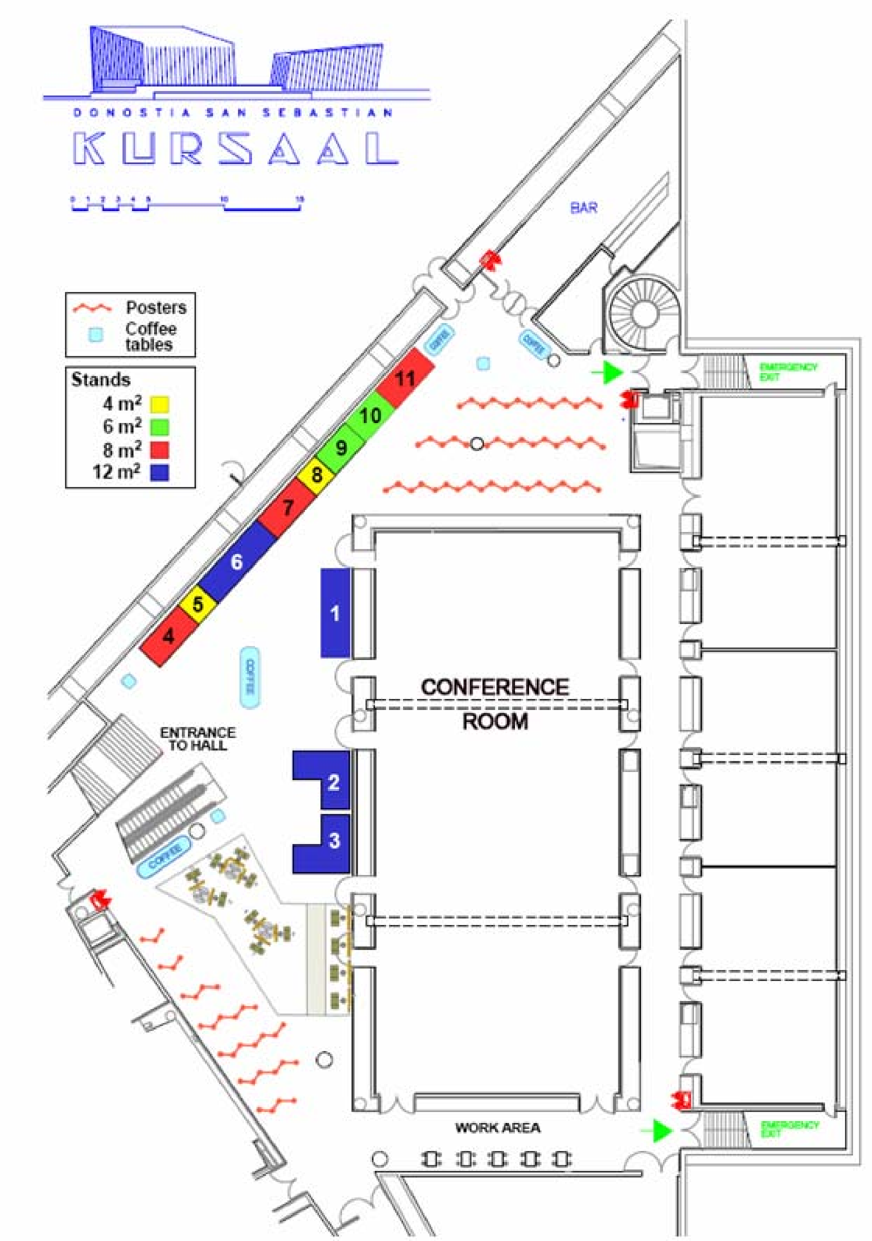
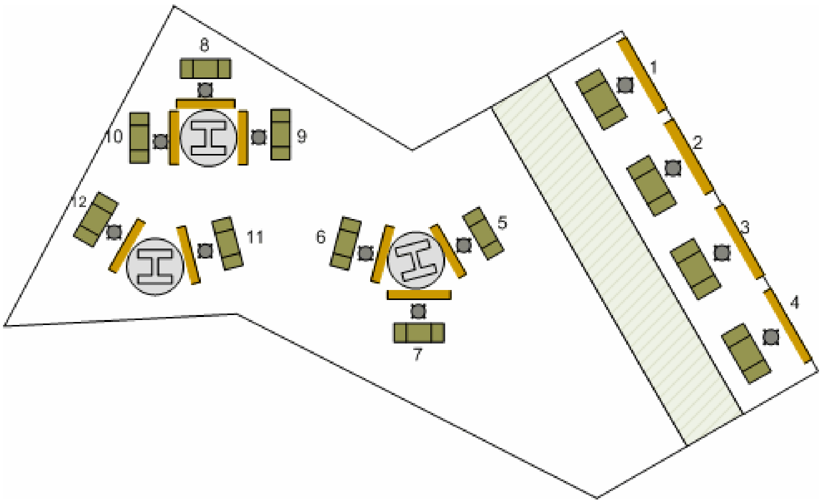
hwl SCIENTIFIC INSTRUMENTS	schaefer	WILEY-VCH	TELSTAR INSTRUMAT	PHANTOMS foundation
Booth nº06	**Booth nº07**	**Booth nº08**	**Booth nº09**	**Booth nº10**
Omicron NanoTechnology				
Booth nº11				



TNT2007 EXHIBITORS (“NanoScience in the Basque Country” macro-stand)

1-2: IK4	**3-4: Tecnalia**	**5: DIPC**	**6: UPV/EHU - Polymat**
7: UPV/EHU - “Materials + Technologies” Research Group	**8: CIC nanoGUNE**	**9: CIC biomaGUNE**	**10: CIC microGUNE**
11: UPV/EHU: NANOBIOTERM Group			**12: Midatech**



TNT2007 EXHIBITORS

Raith GmbH

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eLINE

The First electron-beam lithography Workstation with nano engineering capabilities

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.

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Worldwide Raith qualifies its personnel to provide fast and competent help to its customer requests.
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.

Nanotec Electronica

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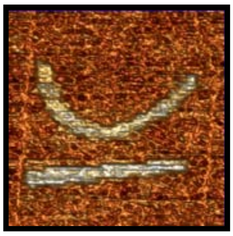

Nanotec Electronica develops Scanning Probe Microscopes with the best quality and the latest technology in the field, giving easy access to the nanometer scale both to the scientific and industrial communities. Also, Nanotec Electronica manufactures control systems for Scanning Probe Microscopes, develops 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.

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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.
Phase Shift is a manufacturer of 3D non-contact surface metrology instruments. The MicroXAM optical interferometer allows to measure step heights, roughness, waviness, flatness and microstructures etc..., and it is dedicated to many applications such as biomedical optics, hard disks and magnetic media, general optics, semi conductors, polymers, MEMS...etc.

Biometa

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BIOMETA was set up in 1998. Its activities are centred on the supply of products and services for research laboratories, industrial quality control and clinical diagnostic. The offices at Parque Tecnológico de Asturias centralize the main services: commercial department, warehouse and technical service. There is an spacious application laboratory where training courses take place quite often, as well as seminars and demos. In order to give the customer the best service there are commercial branches spreaded over the Spanish territory: Vigo, Bilbao, Barcelona, Valencia, Sevilla and Madrid, where the technical service is located as well. The current staff is formed by 21 people, most of them with a high degree and wide experience. Materials Science is one of the most relevant fields in which Biometa participates.
The following are some of the most important companies settled in the nano-field and represented by Biometa in Spain:

- PSIA: Atomic Force Microscopes able to measure in True Non Contact mode.
- Hysitron: Nanoindenters designed to specifically indent in the nano-range and able to perform in-situ SPM images.

Other important companies represented by Biometa are:
BUEHLER: Metallography / GALDABINI: Universal Testing Machine / LENTON: Camera and Tube furnaces up to 1800°C RETSCH: Grinding of samples. Particle size analysis / FLUXANA: Sample preparation and accessories for XRF / PARR: Combustion calorimeters. Laboratory reactors

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.

HWL Scientific Instruments

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HWL is a german company, specialised in consultancy and customized solutions to overcome disturbing vibration problems.
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With excellent know-how in the new and fast growing fields of nanoscience and materials science, **Schaefer Techniques** has become a leading supplier of reliable scientific equipments. The strength of our European Group lies in our capability to propose you the most comprehensive range of **Scanning Probe Microscopes**: from the easy-to-use AFM or STM to the custom UHV system as a total solution for surface analysis research.

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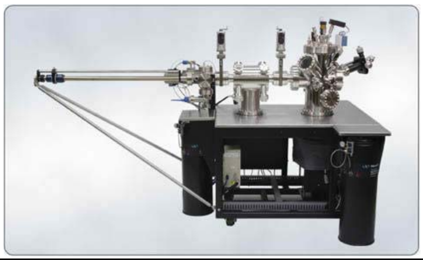
The available key **modes** in this product line are: STM, Contact AFM, Intermittent Contact AFM, Phase contrast, Spreading Resistance, EC-AFM/STM, SECM (Scanning ElectroChemical Microscopy), MFM, EFM, SCM and LFM.

Additional techniques for surface science complete our SPM solutions: optical profilers, topomicroscopes, LEED/AES systems, ion guns & thin film properties measurement devices.

Thanks to our highly qualified team of engineers based in Europe, we are today in position to recommend the optimum system that will meet your **specific requirements** and bring you all the technical support you need. This includes project definition, technical specifications & validation tests, purchasing, training and after sales.



WILEY-VCH

WEB: http://www.wiley-vch.de/

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.

Telstar Instrumat

Telstar-Instrumat S.L.
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E-mail: comercial@instrumat.telstar.es

TELSTAR INSTRUMAT, S.L. is the TELSTAR group's company dedicated to scientific instrumentation, which was born from the union, at the end of 1998, between TELSTAR's Instrumentation and New Technologies Department and INSTRUMAT TÉCNICAS DE MEDICIÓN, S.A., incorporated into the group due to the synergy in their product range. In these last few years, TELSTAR INSTRUMAT has strengthened its activities representing leading companies in Spain, as well as some companies in Portugal, in the following applications:

- Surface and material characterisation
- Vacuum and cryogenics instrumentation and technology
- Radiometry and photometry
- Particle counting

TELSTAR INSTRUMAT, S.L. counts amongst its customers the principal Official Organisation Investigation Centres and private customers in the microelectronic, aerospace, automotive, optical, food and pharmaceutical industries and in innovative fields such as biotechnology and nanofabrication. The company's head office is in Sant Cugat del Vallès (Barcelona) and it also has a branch office in Madrid.

Phantoms Foundation

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The **Phantoms Foundation** (non-profit organisation) was established on November 26, 2002 (in Madrid, Spain) in order to provide high level Management profile to National and European scientific projects such as NAPA (Emerging Nanopatterning Methods – NMP/FP6 Integrated Project), Pico-Inside (Computing Inside a Single Molecule – IST/FP6 Integrated Project) or NanoSpain (Spanish Nanotechnology Network).

The Phantoms Foundation focuses its activities on Nanotechnology and Emerging Nanoelectronics and is now a key actor in structuring and fostering European Excellence and enhancing collaborations in these fields. This non-profit Association is also playing an important role as a dissemination platform in national and European funded projects to spread excellence among a wider audience and help in forming new networks.

The Phantoms Foundation is also working in close collaboration with Spanish and European Governmental Institutions such as FECyT (Spanish Foundation for Science & Technology), ICEX (Instituto Español de Comercio Exterior) or the European Commission to provide focused reports on Nanotechnology related research areas (infrastructure needs, emerging research, etc.).

Omicron Nanotechnology

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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.

TNT2007 - 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 morning to Friday lunch time.

Posters from Session A (PA) should be installed on Monday morning and removed on Tuesday between 17h15 - 19h45.

Posters from Session B (PB) should be installed on Wednesday before 13h00 and removed on Friday before 13h15.

I: Invited Lecture (45 min. including discussion time)
K: Keynote Lecture (30 min. including discussion time)
O: Oral Presentation (15 min. including discussion time)
PS: Poster Session

SCIENTIFIC PROGRAM - TNT2007

Monday – September 03, 2007

08h00-09h00	**REGISTRATION**	
	TNT2007 Opening Ceremony	
09h00-09h15	**Welcome and Introduction**	
09h15-10h00	**Jean-Marie Lehn** (ISIS-ULP, France)	**I**
p.9	"Self-Organization of Functional Supramolecular Devices"	
	Chairman: Pedro Echenique (DIPC, Spain)	
10h00-10h30	**Katsuhiko Ariga** (NIMS, Japan)	**K**
p.15	"Supermolecules as soft materials with dynamic structures and functions in all dimensions: from molecules to nano, micro, and bulk"	
10h30-11h00	**Sanjay Biswas** (Indian Institute of Science, India)	**K**
p.27	"Frictional dissipation in self assembled MONOlayers of organic molecules"	
11h00-11h15	**Werner Hofer** (University of Liverpool, UK)	**O**
p.111	"Perfect ordering of molecular nanostructures"	
11h15-11h45	**Coffee Break - Poster Session A - Instrument Exhibition**	
	Chairman: Jose-Maria Pitarke (CIC nanoGUNE Consolider, Spain)	
11h45-12h15	**Flemming Besenbacher** (iNANO, Denmark)	**K**
p.25	"Enhanced Bonding of Gold Nanoparticles on Oxidized TiO2(110)"	
12h15-12h45	**Wayne Goodman** (Texas A&M University, USA)	**K**
p.41	"Catalysis by Au and Au Alloys: From Single Crystals to Nanoparticles"	
12h45-13h00	**Daniel Farias** (Universidad Autonoma de Madrid, Spain)	**O**
p.103	"Probing reaction dynamics at metal surfaces with H2 diffraction"	
13h00-15h30	**Lunch**	
	Chairman: Flemming Besenbacher (iNANO, Denmark)	
15h30-16h00	**Fernando Moreno** (Institut Català de Nanotecnologia, Spain)	**K**
p.67	"High flexibility of DNA on short length scales probed by atomic force microscopy"	
16h00-16h15	**Jose-Luis Toca Herrera** (CIC biomaGUNE, Spain)	**O**
p.123	"Bacterial protein crystals as pure biomimetic nano-molecules"	
16h15-16h30	**Jorge Ripoll** (Foundation for Research and Technology-Hellas (FORTH), Crete)	**O**
p.117	"Obtaining information at the molecular level with mesoscopic fluorescent measurements"	
16h30-19h30	**Coffee Break - Poster Session A - Instrument Exhibition**	**PS**
21h30	**WELCOME RECEPTION** **HOTEL LONDRES** **Sponsored by DIPC (Spain)**	DONOSTIA INTERNATIONAL PHYSICS CENTER DIPC

SCIENTIFIC PROGRAM - TNT2007

Tuesday – September 04, 2007

	Chairman: Ron Reifenberger (Purdue University, USA)	
08h30-09h00	**Juan Carlos Cuevas** (Universidad Autonoma de Madrid, Spain)	**K**
p.33	"Electronic transport in single-molecule junctions"	
09h00-09h30	**Andre Gourdon** (CEMES/CNRS, France)	**K**
p.43	"Single Molecular Devices"	
09h30-09h45	**Giovanni Cuniberti** (Universität Regensburg, Germany)	**O**
p.99	"Tuning the conductance of a molecular switch"	
09h45-10h00	**Danny Porath** (The Hebrew University of Jerusalem, Israel)	**O**
p.115	"Scanning tunneling spectroscopy and polarizability measurements of DNA and G4-DNA molecules"	
10h00-10h30	**Silvano De Franceschi** (CEA/DRFMC, France)	**K**
p.37	"Electron transport in semiconductor nanowires"	
10h30-10h45	**Douglas Galvao** (State University of Campinas, Brazil)	**O**
p.105	"Metallic nanowires: when is an alloy not an alloy?"	
10h45-11h45	**Coffee Break - Poster Session A - Instrument Exhibition**	
	Chairman: Antonio Garcia-Martin (IMM-CSIC, Spain)	
11h45-12h15	**Yoshiro Hirayama** (Tohoku University, Japan)	**K**
p.53	"Nuclear-spintronics in semiconductor nanostructures"	
12h15-12h45	**Ulrich Zuelicke** (Massey University, New Zealand)	**K**
p.93	"Nanospintronics meets relativistic quantum physics: Ubiquity of Zitterbewegung effects"	
12h45-13h00	**Christian Degen** (IBM Research Div., United States)	**O**
p.101	"Nuclear spin detection enabled by ultra-sensitive cantilevers"	
13h00-15h00	**Lunch**	

Afternoon ☛

SCIENTIFIC PROGRAM - TNT2007

Tuesday – September 04, 2007

Chairman: Daniel Rugar (IBM, USA)

15h00-15h30	**Oscar Custance** (Osaka University, Japan)	**K**
p.35	"Chemical identification of individual surface atoms using dynamic force microscopy"	
15h30-16h00	**Richard Berndt** (Christian-Albrechts-Universität, Germany)	**K**
p.23	"Scanning Tunnelling Microscopy in a Microampere Range"	
16h00-16h30	**Peter Gruetter** (McGill University, Canada)	**K**
p.45	"Electrostatic Force Microscopy of InGa at Cryogenic Temperatures"	
16h30-16h45	**Jose Maria Gomez** (Universidad Autonoma de Madrid, Spain)	**O**
p.107	"Adatom-adatom interaction mediated by an underlying surface phase transition"	
16h45-17h15	**Coffee Break - Poster Session A - Instrument Exhibition**	

Chairman: Oscar Custance (Osaka University, Japan)

17h15-17h45	**Daniel Rugar** (IBM Research Div., United States)	**K**
p.77	"Magnetic resonance force microscopy: the quest for a molecular structure microscope"	
17h45-18h15	**Antonio Hernando** (Universidad Complutense de Madrid, Spain)	**K**
p.49	"Magnetic properties of ZnO Nanoparticles"	
18h15-18h45	**Vladimiro Mujica** (Northwestern University, USA)	**K**
p.69	"Magnetism in Gold Nanoparticles and Gold clusters: The Role of Chemisorption and Size"	
18h45-19h15	**Andreas Berger** (CIC nanoGUNE Consolider, Spain)	**K**
p.21	"Challenges and Opportunities in Nano-Magnetism Research and Technology"	
19h15-19h45	**Harald Brune** (EPFL, Switzerland)	**K**
p.29	"Interface and composition effects determining the magnetic properties of bi-metallic nanostructures"	

REMINDER: Please note that those posters corresponding to Session A must be removed today between 17:15 and 19:45

21h30	**RECEPTION** **RESTAURANT BRANKA** **Sponsored by NIMS (Japan)**	NIMS Nanomaterials Laboratory

SCIENTIFIC PROGRAM - TNT2007

Wednesday – September 05, 2007

	Chairman: John Pendry (Imperial College London, UK)	
08h30-09h00	**Stefan W. Hell** (Max Planck Institute, Germany)	**K**
p.47	"Breaking Abbe's barrier: Diffraction-unlimited resolution in far-field microscopy"	
09h00-09h30	**Niek F. van Hulst** (Institute of Photonic Sciences - ICFO, Spain)	**K**
p.85	"Nano-antennas - Tools for light on the nanoscale"	
09h30-10h00	**Rainer Hillenbrand** (Max-Planck-Institut fur Biochemie, Germany)	**K**
p.51	"Scattering-type Near-Field Microscopy: From Nanoscale Infrared Material Recognition to Superlens Studies"	
10h00-11h00	**Coffee Break - Poster Session B - Instrument Exhibition** REMINDER: Please note that those posters corresponding to Session B must be installed today before 13:00	
	Chairman: Jose-Luis Costa Kramer (IMM-CSIC, Spain)	
11h00-11h45	**Uzi Landman** (Georgia Institute of Technology, USA)	**I**
p.7	"Controlling the Nanoscale: From Nanocatalysis to Nanowires, DNA Damage, and Wigner Molecules"	
11h45-12h15	**Alexei Marchenkov** (Georgia Institute of Technology, USA)	**K**
p.65	"AC Josephson effect and resonant superconducting transport through vibrating Nb nanowires"	
12h15-12h45	**Robert N. Barnett** (Georgia Institute of Technology, USA)	**K**
p.19	"Atomic, Electronic, and Transport Properties of semiconducting and molecular wires and their metallic Contacts"	
12h45-13h00	**Simon Berner** (University of Zurich, Switzerland)	**O**
p.97	"Boron Nitride Nanomesh: Functionality from a Corrugated Monolayer"	
13h00-15h00	**Lunch**	
15h00-17h00	**"NanoScience in the Basque Country" Parallel Session**	☛
	"PhD" Parallel Session	☛
17h00-17h30	**Coffee Break - Poster Session B - Instrument Exhibition**	
	Chairman: Stephan Roche (CEA-DRFMC, France)	
17h30-18h00	**Erio Tosatti** (SISSA, Italy)	**K**
p.83	"Ballistic to diffusive crossover in the sliding of kicked clusters"	
18h00-18h30	**Geert-Jan Kroes** (Leiden University, Netherlands)	**K**
p.61	"Nanocluster DFT studies with applications to production and storage of hydrogen"	
18h30-18h45	**Damien Thompson** (Tyndall National Institute, Ireland)	**O**
p.121	"Computer simulations of nanopatterning"	
18h45-19h00	**Andrey Knizhnik** (Kinetic Technologies Ltd, Russia)	**O**
p.113	"Atomistic modeling of metal/high-k oxide interface properties as function of gas treatment"	
19h00-19h30	**Alexander Shluger** (University College London, UK)	**K**
p.79	"Predicting the properties of new oxides for nano-devices"	
19h30-20h00	**Asen Asenov** (University of Glasgow, UK)	**K**
p.17	"Simulation of atomic scale statistical variability in nano-CMOS devices using DD, MC and QT simulation techniques"	
21h30	**CONFERENCE DINNER – RESTAURANT "REAL CLUB DE TENIS ONDARRETA"**	
00h00	**POSTER AWARDS CEREMONY – RESTAURANT BRANKA**	

SCIENTIFIC PROGRAM - TNT2007

Wednesday – September 05, 2007

"NanoScience in the Basque Country" Parallel Session

15h00-15h15	**Daniel Sanchez Portal** (CSIC-UPV/EHU - DIPC, Spain)	**O**
p.161	"Electronic and structural properties of complex surfaces and nanostructures from first-principles"	
15h15-15h30	**Maite Insausti** (UPV/EHU, Spain)	**O**
p.153	"Fe3O4 nanoparticles for MRI contrast enhancement"	
15h30-15h45	**Marco Marradi** (CIC biomaGUNE, Spain)	**O**
p.155	"Glyconanotechnology: A Method for the Preparation of Biofunctional Nanoparticles with Application in Nanomedicine"	
15h45-16h00	**Sergio Arana Alonso** (CIC microGUNE, Spain)	**O**
p.145	"Microsystem for the immunomagnetic detection of escherichia coli O157:H7"	
16h00-16h15	**David Mecerreyes** (CIDETEC-IK4, Spain)	**O**
p.157	"New amine functional ionic liquid as builiding block in nanotechnology"	
16h15-16h30	**Jorge Sanchez** (Labein-Tecnalia, Spain)	**O**
p.159	"On the formation of cementitious c-s-h nanoparticles: a computational approach"	
16h30-16h45	**Ibon Aranberri** (GAIKER-IK4, Spain)	**O**
p.147	"New polymer nanocomposites for packaging with antimicrobial or barrier properties"	
16h45-17h00	**Sonia Florez** (INASMET-Tecnalia, Spain)	**O**
p.149	"Carbon nanotube based nanocomposites sensors"	
17h00-17h15	**Africa G. Barrientos** (Midatech-bioGUNE, Spain)	**O**
p.151	"Nanoparticules for therapeutics and diagnostics"	

SCIENTIFIC PROGRAM - TNT2007

Wednesday – September 05, 2007

"PhD" Parallel Session

15h00-15h15	**Faisal Aldaye** (McGill University, Canada)	**O**
p.127	"Nanoparticle Organization and Advances in Structural DNA Nanotechnology"	
15h15-15h30	**Marta E. Cañas-Ventura** (EMPA - Materials, Switzerland)	**O**
p.129	"Exploiting template surface and end-group functionalities to guide the self-assembly of specific supramolecular architectures"	
15h30-15h45	**Marianna Casavola** (National Nanotechnology Laboratory of CNR-INFM, Italy)	**O**
p.131	"Topologically controlled growth of magnetic-metal-functionalized semiconductor oxide nanorods"	
15h45-16h00	**Saioa Cobo** (Laboratoire de Chimie de Coordination / CNRS, France)	**O**
p.133	"Thin films and "nano-dots" of spin crossover complexes: Elaboration and physical properties"	
16h00-16h15	**Husan-Ming Huang** (National Chiao Tung University, Taiwan)	**O**
p.135	"Large-Scale “Atomistic” Approach to Discrete-Dopant Fluctuated Si Nanowire FETs"	
16h15-16h30	**Enrique Sahagun** (Universidad Autonoma de Madrid, Spain)	**O**
p.137	"Energy Dissipation due to Capillary Interactions: Hydrophobicity Maps in Force Microscopy"	
16h30-16h45	**Piernicola Spinicelli** (Laboratoire Kastler Brossel, France)	**O**
p.139	"Coherence-time measurements of single photons emitted by CdSe colloidal nanocrystals"	
16h45-17h00	**Nikolai Wintjes** (University of Basel, Switzerland)	**O**
p.141	"Supramolecular Rotor-Stator Systems leading to a Multi-Position Rotary Device"	

SCIENTIFIC PROGRAM - TNT2007

Thursday – September 06, 2007

	Chairman: Juan Jose Saenz (UAM, Spain)	
13h30-14h15	**John Pendry** (Imperial College London, UK)	**I**
p.11	"Transformation Optics: Designing Optics on the Nanoscale"	
14h15-14h45	**Pedro Echenique** (Donostia International Physics Center, Spain)	**K**
p.39	"A novel low energy collective excitation at metal surfaces"	
14h45-15h15	**Diederik S. Wiersma** (LENS, Italy)	**K**
p.89	"Making lasers from dust: The physics and applications of random lasers"	
15h15-15h45	**Remi Carminati** (Ecole Centrale Paris, France)	**K**
p.31	"Local density of states in near-field optics"	
15h45-16h15	**Coffee Break - Poster Session B - Instrument Exhibition**	
	Chairman: Remi Carminati (Ecole Centrale Paris, France)	
16h15-16h45	**Mikael Kall** (Chalmers University of Technology, Sweden)	**K**
p.57	"Nanoplasmonics – from fundamental studies to novel functionalities"	
16h45-17h15	**Jean Francois Roch** (Ecole Normale Superieure, France)	**K**
p.73	"Photoluminescent diamond nanoparticles"	
17h15-19h15	**Coffee Break - Poster Session B - Instrument Exhibition**	**PS**

SCIENTIFIC PROGRAM - TNT2007

Friday – September 07, 2007

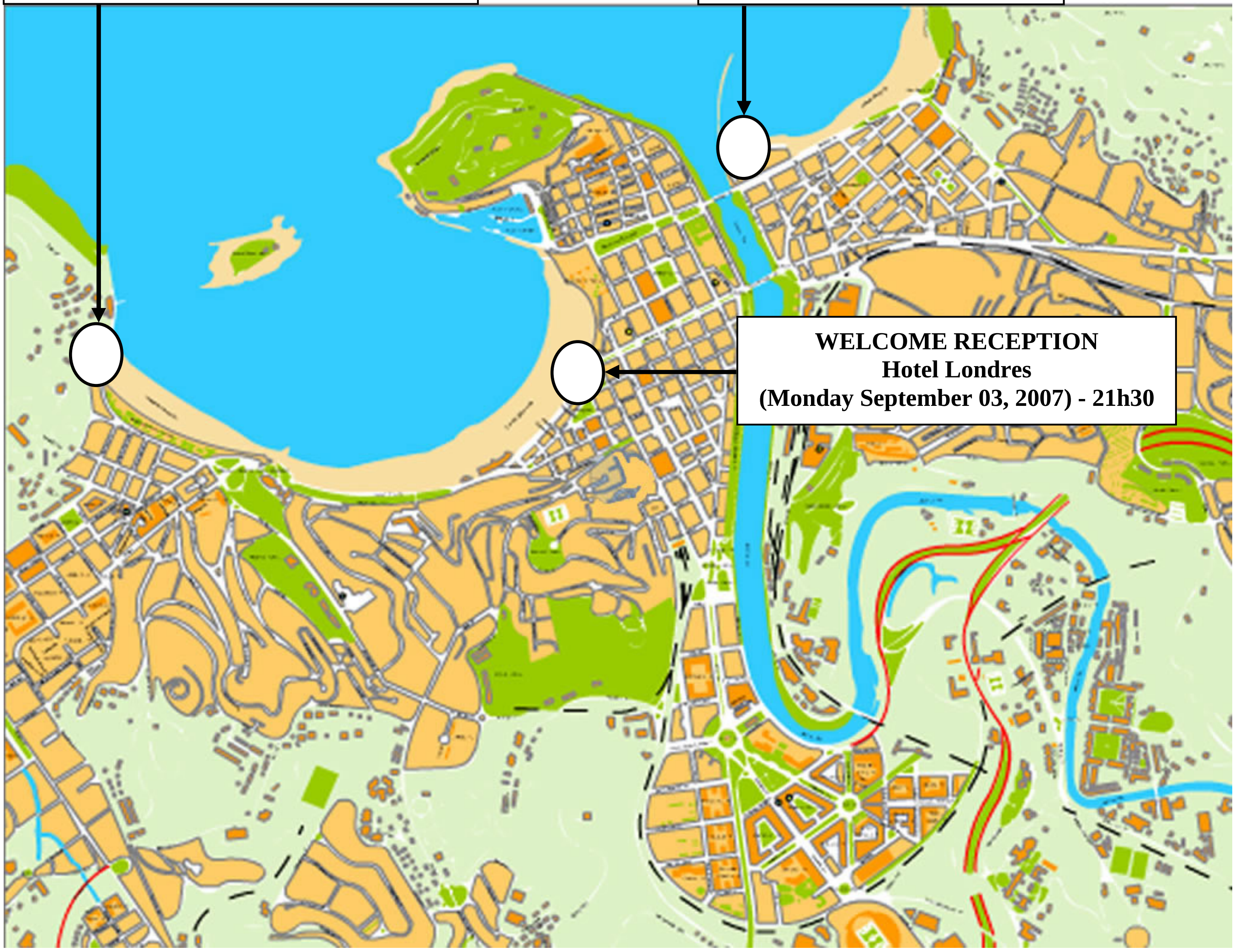
Chairman: Manuel Marques (UAM, Spain)

08h30-09h00	**H. Eugene Stanley** (Boston University, USA)	**K**
p.81	"The Puzzling Behavior of Liquid Water: Some Clues from the Nanoscale"	
09h00-09h30	**Jacob Klein** (Oxford University, UK/Weizmann Institut, Israel)	**K**
p.59	"Hydrated ions as nano-ball-bearings"	
09h30-10h00	**Suzanne Jarvis** (University College Dublin, Ireland)	**K**
p.55	"Biological Water"	
10h00-10h30	**Ichiro Yamashita** (Panasonic, Japan)	**K**
p.91	"Nanofabrication of inorganic functional structures by protein supramolecules WET NANOTECHNOLOGY"	
10h30-11h00	**Coffee Break - Poster Session B – Instrument Exhibition**	

“Nanotubes” Session – Sponsored by GDRE

Chairman: Daniel Sanchez-Portal (CSIC-UPV/EHU - DIPC, Spain)

11h00-11h30	**Stephan Roche** (CEA/DRFMC, France)	**K**
p.75	"Revisiting Charge Transport at the Mesoscopic Scale : Emerging quantum phenomena in the light of advanced Computational Approaches"	
11h30-12h00	**Guglielmo Lanzani** (Politecnico di Milano, Italy)	**K**
p.63	"Dynamics at the nanoscale: Ultrafast Exciton processes in Single Wall Carbon Nanotubes"	
12h00-12h15	**Beatriz Hernandez Juarez** (Institute of Physical Chemistry, Germany)	**O**
p.109	"Quantum dot attachment and morphology control by carbon nanotubes"	
12h15-12h30	**Adam Rycerz** (Jagiellonian University, Poland)	**O**
p.119	"Valley filter and valley valve in graphene"	
12h30-13h15	**Sumio Iijima** (Meijo University, Japan)	**I**
p.5	"Science and Nanotechnology of Nano-carbon materials"	
13h15-13h30	**CLOSING REMARKS & TNT2008 ANNOUNCEMENT**	



RECEPTION
Branka Restaurant
(Tuesday September 04, 2007) - 21h30
-
CONFERENCE DINNER
“Real Club de Tenis” Restaurant
(Wednesday September 05, 2007) - 21h30
-
POSTER AWARDS CEREMONY
Branka Restaurant
(Wednesday September 05, 2007) - 00h00

CONFERENCE LOCATION
Kursaal Conference Center

WELCOME RECEPTION
Hotel Londres
(Monday September 03, 2007) - 21h30

Addresses:

-Kursaal Conference Center
Avda. de Zurriola 1
20002 Donostia-San Sebastián

-Hotel Londres
Zubieta 2
20007 Donostia-San Sebastián

-Branka restaurant
Paseo Eduardo Chillida, 13
20008 Donostia-San Sebastián

-“Real Club de Tenis Ondarreta” restaurant
Paseo Peine de los Vientos, 13
20008 Donostia-San Sebastián

TNT2007
Trends in NanoTechnology
San Sebastian (Spain)

in collaboration with

PHANTOMS foundation

Raith

presents

“PASSPORT TO PRIZES” PROGRAM

At this new edition of the Trends in Nanotechnology conference we are pleased to organise the TNT2007 “Passport to Prizes” program.

How does the “Passport to Prizes” program work?

Each TNT2007 conference attendee will find a passport card inside his TNT2007 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.

Once you have completed your passport card with a minimum of 15 stamps, **fill in your personal data** and take the card to the ticket tumbler located in the Registration Area. Please, do not forget to complete the passport card with your name and institution before you put it into the box.

All completed entries will be eligible for a prize drawing that will be conducted on the evening of Wednesday (5/9/07) during the Poster Award Ceremony.

Do not miss this opportunity to win one of our **two 2Gb MP3 players** (donated by Phantoms Foundation) or one of the **two high-quality Presentation Remotes** (Laser Pointer and Mouse Control) (kindly donated by Raith GmbH)

And remember that winners need to be present to win. So… see you at the conference dinner and the poster award ceremony!

INVITED Contributions

Sumio Iijima (Meijo University, Japan) *"Science and Nanotechnology of Nano-carbon materials"*	**p.5**
Uzi Landman (Georgia Institute of Technology, USA) *"Controlling the Nanoscale: From Nanocatalysis to Nanowires, DNA Damage, and Wigner Molecules"*	**p.7**
Jean-Marie Lehn (ISIS-ULP, France) *"Self-Organization of Functional Supramolecular Devices"*	**p.9**
John Pendry (Imperial College London, UK) *"Transformation Optics: Designing Optics on the Nanoscale"*	**p.11**

KEYNOTE Contributions

Katsuhiko Ariga (NIMS, Japan) *"Supermolecules as soft materials with dynamic structures and functions in all dimensions: from molecules to nano, micro, and bulk"*	**p.15**
Asen Asenov (University of Glasgow, UK) *"Simulation of atomic scale statistical variability in nano-CMOS devices using DD, MC and QT simulation techniques"*	**p.17**
Robert N. Barnett (Georgia Institute of Technology, USA) *"Atomic, Electronic, and Transport Properties of semiconducting and molecular wires and their metallic Contacts"*	**p.19**
Andreas Berger (CIC nanoGUNE Consolider, Spain) *"Challenges and Opportunities in Nano-Magnetism Research and Technology"*	**p.21**
Richard Berndt (Christian-Albrechts-Universität, Germany) *"Scanning Tunnelling Microscopy in a Microampère Range"*	**p.23**
Flemming Besenbacher (iNANO, Denmark) *“Enhanced Bonding of Gold Nanoparticles on Oxidized TiO2(110)"*	**p.25**
Sanjay Biswas (Indian Institute of Science, India) *"Frictional dissipation in self assembled MONOlayers of organic molecules"*	**p.27**
Harald Brune (EPFL, Switzerland) *"Interface and composition effects determining the magnetic properties of bi-metallic nanostructures"*	**p.29**
Remi Carminati (Ecole Centrale Paris, France) *"Local density of states in near-field optics"*	**p.31**
Juan Carlos Cuevas (Universidad Autonoma de Madrid, Spain) *"Electronic transport in single-molecule junctions"*	**p.33**
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Daniel Rugar (IBM Research Division, USA) **p.77**
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"Nanospintronics meets relativistic quantum physics: Ubiquity of Zitterbewegung effects"

ORAL Contributions (Plenary Session)

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Giovanni Cuniberti (Universität Regensburg, Germany) *"Tuning the conductance of a molecular switch"*	**p.99**
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Damien Thompson (Tyndall National Institute, Ireland) *"Computer simulations of nanopatterning"*	**p.121**
Jose Luis Toca-Herrera (CIC biomaGUNE, Spain) *"Bacterial protein crystals as pure biomimetic nano-molecules"*	**p.123**

ORAL Contributions – "PhD" Parallel Session

Faisal Aldaye (McGill University, Canada) *"Nanoparticle Organization and Advances in Structural DNA Nanotechnology"*	**p.127**
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Marianna Casavola (National Nanotechnology Laboratory of CNR-INFM, Italy) *"Topologically controlled growth of magnetic-metal-functionalized semiconductor oxide nanorods"*	**p.131**
Saioa Cobo (Laboratoire de Chimie de Coordination / CNRS, France) *"Thin films and "nano-dots" of spin crossover complexes: Elaboration and physical properties"*	**p.133**
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TNT2007
Trends in NanoTechnology
San Sebastian (Spain)

ABSTRACTS

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INVITED CONTRIBUTIONS

SCIENCE AND NANOTECHNOLOGY OF NANO-CARBON MATERIALS

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Unique properties of CNTs depend on their structures and morphologies, and well-controlled specimens (diameter, length, quantity, chirality, structural perfection, impurity, homogeneity) will be needed for precise experiments and also for their industrial applications. Regarding these requirements, two important breakthroughs in single-wall carbon nanotube (SWCNT) growth were made recently in our laboratories at AIST (1). One is a floating catalyst-assisted CVD method of growing SWCNTs, which can provide controlled tube diameters and extremely high purity tubes with high production yield. Some of industrial use of the product is for transparent and flexible conductive films and threads. Another is the "Super-Growth" of SWCNTs, which grow vertically on various substrates including *metal foils* as high as one centimeter. The method has being developed into a level for the industrial production, which will be used for *high power density capacitors*.

For characterization of the SWCNTs Raman spectroscopy of radial breathing mode (RBM) is a standard method. Another spectroscopic characterization of SWCNTs is *two-D mapping* of photoluminessence particularly for semiconducting tubes which are specified in terms of band gaps and excitation wavelength. The method has been applied to study the band-gap modulation of SWCNTs mostly due to stress, which is induced by doping various molecules inside the central hollows of the tubes.

The importance of characterization of nano-structured materials will be demonstrated by showing the latest results of atomic structures of CNTs and their modifications, which have been revealed by an ultra-high resolution TEM with a spherical aberration corrector. *Individual carbon atoms, local atomic defects* of SWCNTs and individual fullerene molecules were directly recorded. Dynamic behaviors of those atoms and defects as well as doped metal atoms and organic molecules inside the tubes are of interest in terms of sophisticated device application of CNTs (2).

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CONTROLLING THE NANOSCALE: FROM NANOCATALYSIS TO NANOWIRES, DNA DAMAGE, AND WIGNER MOLECULES

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When reduced to nanoscale dimensions materials systems often exhibit new properties that differ from those found for larger sizes. This emergent behavior occurs when upon reduction in size one reaches a situation where the physical size of the system becomes of the same order as a length scale characteristic to the phenomenon being studied. This implies that smallness of a material system may manifest itself at different physical sizes depending on the phenomenon under investigation. For example, a metallic wire may exhibit quantized electronic conductance when it’s diameter is reduced to the order of 1 nm, with the characteristic length being the Fermi wavelength of the electrons, while the mechanical properties of such a nanowire may vary from those of macroscopic wires already for wires with diameters that are of the order of 10 to 50 nm, with the characteristic length associated with the mechanical response being the diameter of a loop dislocation.

In this lecture several methodologies for the control of the physical and chemical properties of materials systems through manipulations of their size, as well as other characteristic parameters, will be discussed. Systems that will be illustrated include: size-control of the dimensionality and chemical catalytic activity of gold nanoclusters supported on a metal oxide surface, control of electronic transport in nanowires via size and composition manipulations, sequence dependence and control of post-ionization damage in DNA, manipulations of the states of electrons in quantum dots via shape control, control of the stability and breakup characteristics of liquid nanobridges and nanojets through manipulations of the background gaseous environment, and control of friction in nanoscale lubricated junctions via externally applied small amplitude mechanical modulation.

SELF-ORGANIZATION OF FUNCTIONAL SUPRAMOLECULAR DEVICES

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Supramolecular chemistry is actively exploring systems undergoing *self-organization*, i.e. systems capable of spontaneously generating well-defined functional supramolecular architectures by self-assembly from their components, on the basis of the *molecular information* stored in the covalent framework of the components and read out at the supramolecular level through specific interactional algorithms, thus behaving as *programmed chemical systems*.

The design of molecular information controlled, "programmed" and functional self-organizing systems allows the spontaneous but controlled generation of well-defined, functional molecular and supramolecular architectures of nanometric size through self-organization. It represents a means of performing programmed *engineering* and *processing* of *functional nanostructures*. It offers a very powerful complement/alternative to nanofabrication and to nanomanipulation for the development of nanoscience and nanotechnology.

This approach has been implemented in the generation of functional organic and inorganic nanostructures for molecular and supramolecular electronics, spintronics and mechanics.

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TRANSFORMATION OPTICS: DESIGNING OPTICS ON THE NANOSCALE

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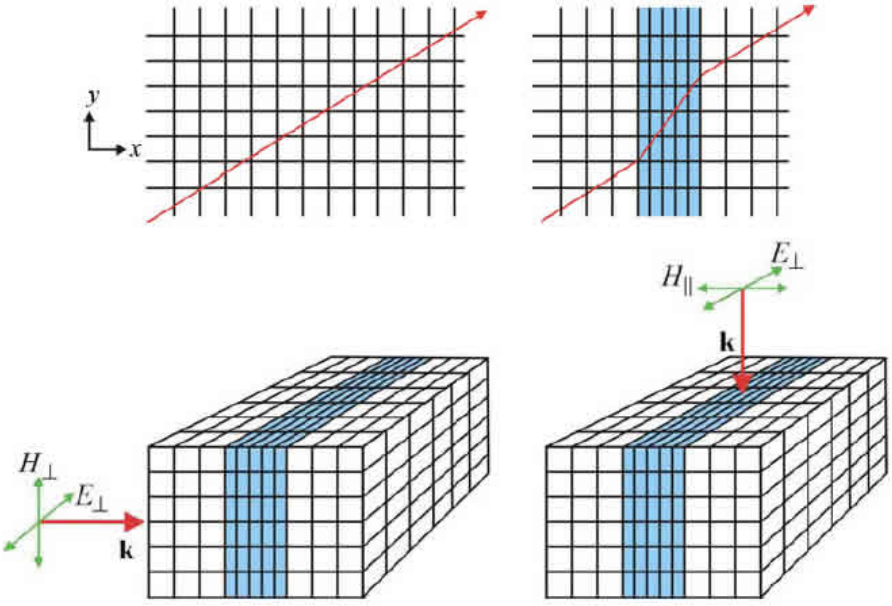
For design of conventional optical devices such as camera lenses we turn to ray tracing programs. Trajectories of rays through a lens give a simple and intuitive appreciation of device performance as well as precise parameters for construction. In contrast optics on the nanoscale is almost exclusively concerned with the near field where rays have no meaning. The complex patterns of resonances seen in metallic nano objects seem to arise in a confusing and counter intuitive fashion. In this talk I shall describe an alternative approach to optical design based on coordinate transformations. The underlying theory is based on Maxwell's equations not on the ray approximation and therefore can be applied to both near and far fields.

The concept is a straightforward one: we start with a simple configuration of fields: a ray propagating in free space, or the magnetic field around a dipole magnet, for example, and then distort the fields until the rays or the field lines follow the trajectories we wish to see. If we imagine that the original fields were embedded in an elastic matrix on which a set of coordinates was inscribed, then the distortion could be described mathematically as a transformation from the old to the new set of distorted coordinates. We can then use some mathematics to discover what values of ε,μ would ensure that Maxwell's equations are obeyed for the desired configuration of fields

To give a flavour of how the scheme operates imagine the simplest possible distortion of space in which a section of the x-axis is compressed.

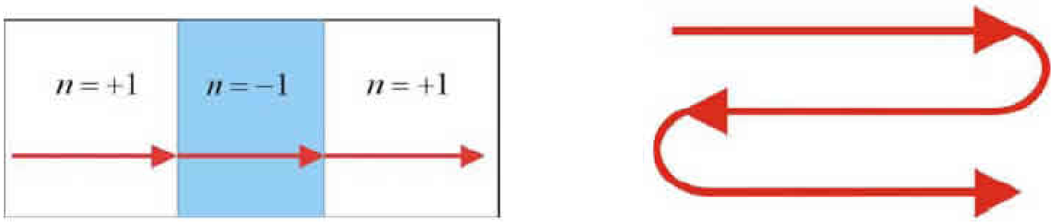


Top: a simple coordinate transformation that compresses a section of the x-axis. As a result rays follow a distorted trajectory shown on the top right but emerge from the compressed region travelling in exactly the same direction with the same phase as before. Bottom: requiring that a ray pass through the compressed region with the same phase change as through uncompressed space enables us to predict the metamaterial properties that would realise this trajectory for a ray.

If m is the compression factor, and ε_y and μ_y are the components of the respective tensors perpendicular to the x−axis, then we deduce that,

$$\varepsilon_y = \mu_y = m^{-1}$$
$$\varepsilon_x = \mu_x = m$$

Transformation optics can also be used to give another interpretation to the Veselago lens shown below.



Left: in the x,y,z coordinate system space is single valued and a ray progresses continuously through the region of negative refraction. Right: an equally legitimate view point is that the refractive index is everywhere positive but space is triple valued, doubling back on itself so that each point within the range of the lens is crossed thrice.

The lens exists in a coordinate system x,y,z but viewed from outside it would appear as though the region between the object plane and the image plane vanishes. This can be expressed as a coordinate transformation,

$$\begin{aligned} &y' = y, \quad z' = z \\ &x' = x, && x < x_1, \\ &x' = (2x_1 - x), && x_1 < x < x_1 + d, \\ &x' = x - 2d, && x_1 + d < x \end{aligned}$$

where the lens is assumed lies in the range $x_1<x<x_1+d$ where the x,y,z space maps on to a triple valued x′,y′,z′ space. Applying the transformation procedure gives,

$$\begin{aligned} &\varepsilon = \mu = +1, && x < x_1, \\ &\varepsilon = \mu = -1, && x_1 < x < x_1 + d, \\ &\varepsilon = \mu = +1, && x_1 + d < x \end{aligned}$$

Now we can give a geometrical interpretation to the lens: it comprises a section of ‘negative’ space that annihilates an equivalent thickness of vacuum.

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KEYNOTE CONTRIBUTIONS

(Only those abstracts received before August 18, 2007 will be included in the abstracts' booklet)

SUPERMOLECULES AS SOFT MATERIALS WITH DYNAMIC STRUCTURES AND FUNCTIONS *IN ALL DIMENSIONS: FROM MOLECULES TO NANO, MICRO, AND BULK*

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Our group has developed new kinds of supramolecular materials whose dimensions are categorized in nano, micro, and bulk scales as summarized in Figure 1. Construction of nanostructures was demonstrated by formation of two-dimensional arrays of functional porphyrins in which molecular pattern shifting was observed by real-time STM observation (A).[1,2] Various mesoscopic morphologies were successfully constructed through self-assembled process from alkyl-substituted fullerene as a shape-shifter (B),[3] which can also provide nanoarray (C)[4] and bulk liquid material (D).[5] Structure transcription of molecular assembly provided well-structured bulk materials such as novel carbon materials "carbon nanocage",[6] which exhibits unique material separation properties (E).

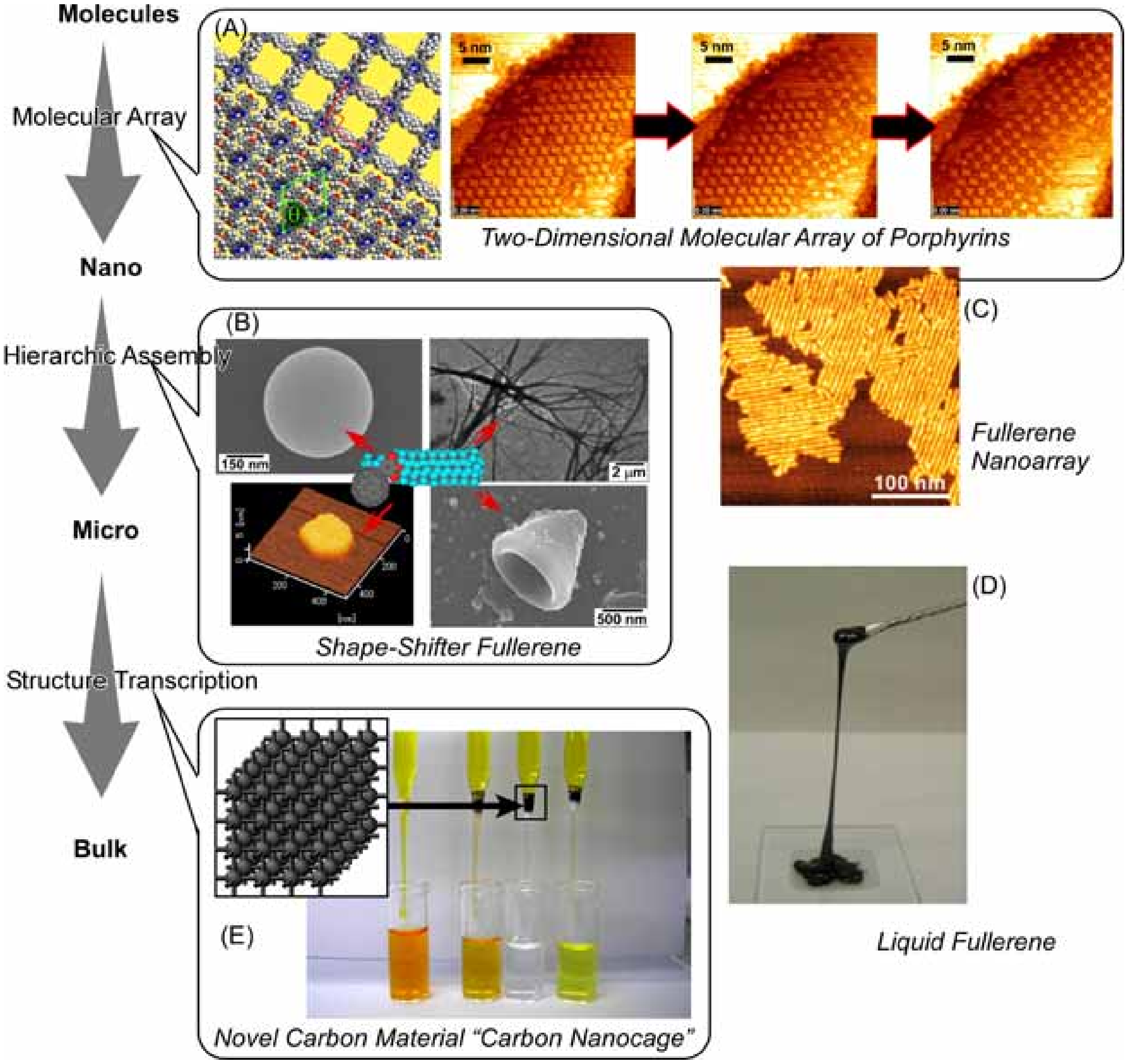

Figure 1. Various supramolecular materials developed in our research group.

In order to develop methodologies to bridge molecular and bulk dimensions, dynamic molecular recognition at the air-water interface has been investigated. Compression and expansion of a Langmuir monolayer of designed host in sub-meter dimension induces change of molecular conformations of the host, resulting in repeated capture and release of aqueous guests (A).[7,8] Upon extending this concept to molecularly twisted host monolayer, chiral recognition of aqueous amino acids can be controlled by applying bulk lateral pressure (B).[9] In these examples, stimuli at then bulk level induces molecular level functions.

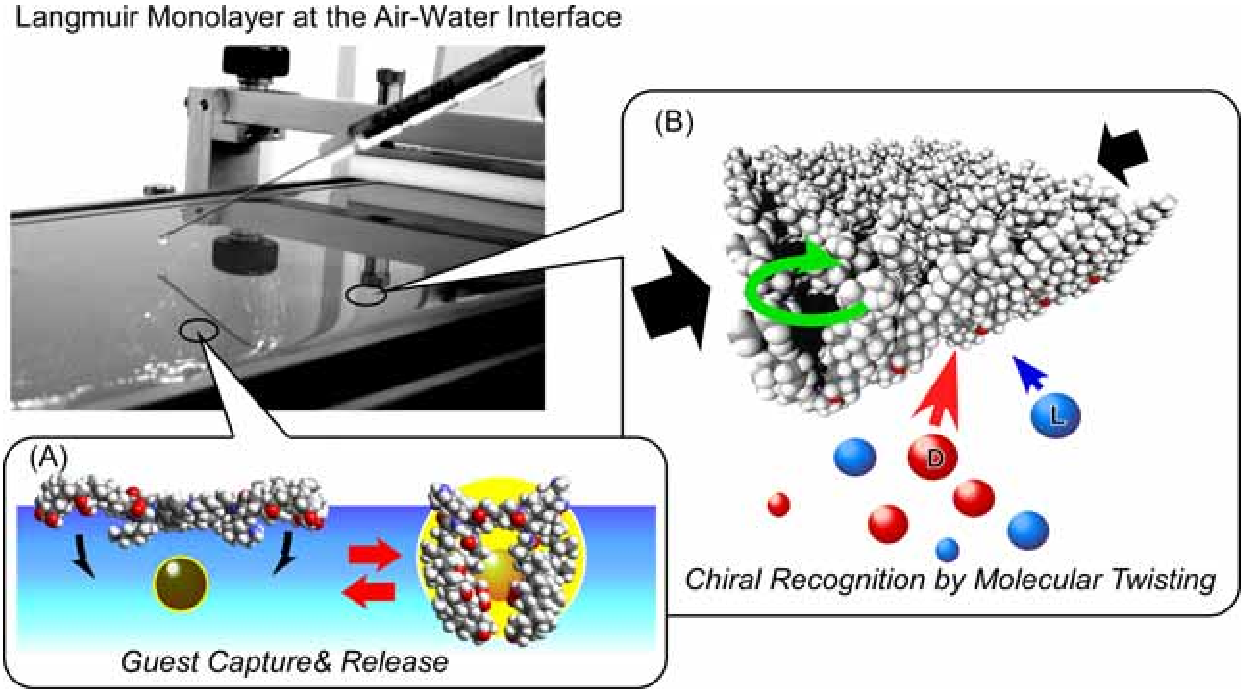

Figure 2. Dynamic molecular recognition for a method bridging molecular and bulk dimensions.

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SIMULATION OF ATOMIC SCALE STATISTICAL VARIABILITY IN NANO-CMOS DEVICES USING DD, MC AND QT SIMULATION TECHNIQUES

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Intrinsic parameter fluctuations associated with discreteness of charge and granularity of matter are now a major factor limiting scaling and integration [1]. The accurate modelling and simulation of such effects is a very important for the development of the present and next generations nano-CMOS device and their integration of giga-transistor count chips. We will present recent advances made by the Glasgow Device Modeling Group in the simulations of intrinsic parameter fluctuations using Drift Diffusion (DD), Monte Carlo (MC) and Quantum Transport (QT) techniques. Examples include:

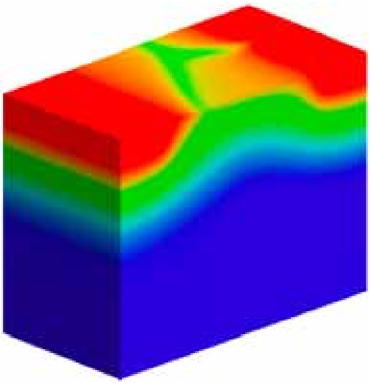

Fig. 1 Impact of the surface potential pinning at poly-Si grain boundaries in the surface potential in the channel of 30x30nm MOSFET.

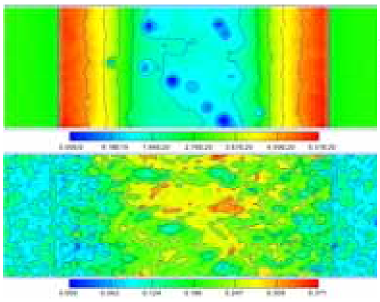

Fig. 2 Surface potential and current distribution obtained from 3D MC simulation featuring 'ab initio' ionized impurity scattering.

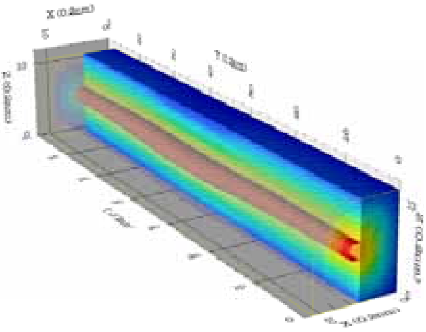

Fig. 3 3D NEGF current density contours in a 6nm nanowire MOSFET subject to interface roughness

- The resolution of discrete dopants in DD simulations [2] and the impact of the surface potential pinning and the doping nonuniformity at the poly-Si grain boundaries on the threshold voltage fluctuations in conventional bulk MOSFETs (Fig. 1).
- The development of 3D Monte Carlo device simulator featuring ab-initio ionised impurity and quantum confinement scattering. The impact of ionised impurity scattering on current fluctuations in bulk MOSFETs. The impact of quantum confinement scattering on current fluctuations in double gate MOSFETs [3] (Fig. 2).
- The development of the first fully 3D real space NEGF simulator. The impact of interface roughness and stray charges on the current variations in nanowire transistors (Fig.3).

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ATOMIC, ELECTRONIC, AND TRANSPORT PROPERTIES OF SEMICONDUCTING AND MOLECULAR NANOWIRES AND THEIR CONTACTS

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Nanowires have been a subject of continuing research efforts due to fundamental interest in their properties, as well as because of their potential technological applications. In this talk we discuss theoretical investigations, using first-principles quantum mechanical methods, pertaining to two classes of nanowires: (1) semiconductor nanowires with metal contacts, and (2) molecular nanowires supported by, or embedded in, metal electrodes.

(1) We review our previous investigations of hydrogen-passivated silicon nanowires supported by aluminum contacts [1], and describe our recent studies of CdSe nanowires passivated by phospho-organic molecules of varying chain length, with gold contacts attached at the ends. In both cases we find formation of Schottky barriers similar to those of extended systems, and development of interfacial dipoles well localized at the interface [1, 2]. Chain length effects of the passivating molecules are discussed.

(2) Spin-density-functional calculations of tip-suspended gold chains, with molecular oxygen, or dissociated oxygen atoms, incorporated in them, reveal structural transitions for varying lengths [3]. The nanowires exhibit enhanced strength for both oxygen incorporation modes, and upon stretching, tip atoms join the wire. With incorporated molecular oxygen the wire conductance is about $1(2e^2/h)$, transforming to an insulating state beyond a critical length. Our results are used to interpret recent experiments on oxygen contating Au nanowires [4]. The nanowire conductance with embedded oxygen atoms is low, $0.2\ (2e^2/h)$, and it develops magnetic moments localized on the oxygens and the neighboring Au atoms.

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CHALLENGES AND OPPORTUNITIES IN NANO-MAGNETISM RESEARCH AND TECHNOLOGY

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Nanotechnology is expected to change and shape our lives in the 21st century. It is, however, not just a far out vision, but actually part of our daily lives already. For instance, the computer hard disk drive (HDD), which is found in all Personal Computers and increasingly in consumer electronics applications, is one of the technologies that already requires and utilizes nm-scale precision today [1]. In the last decade alone, the areal recording density has increased by a factor of 100, bringing today's product level bit size down to $(56\,\mathrm{nm})^2$ [2]. To reach this level of recording density, magnetic media grain sizes of only 8 nm diameter and below are required [3]. At this grain size level, thermal fluctuations can be so strong that the magnetic state becomes unstable. This phenomenon is generally referred to as super-paramagnetism and was anticipated to be the "kiss of death" for HDD technology just 10 years ago with an estimated maximum achievable areal density of 36 $\mathrm{Gbit/in}^2$ [4]. However, recent technical advances enabled this technology to circumvent or at least delay these fundamental limits to take hold and are the reason why HDDs with areal densities in excess of 200 $\mathrm{Gbit/in}^2$ are commercially available today [2].

Figure 1 shows on the left hand side a photograph of an opened-up HDD, exposing the disk that carries the magnetic thin film, in which the information is actually stored as a magnetic bit pattern. The entire disk consists hereby of nano-scale grains with an average diameter of only 8 nm and about 15 nm thickness. A Transmission Electron Micrograph (TEM) of such a structure is shown on the left hand side of fig. 2. One can also see very clearly from this TEM picture that the individual grains are separated from each other by a grain boundary zone of only about 1 nm width, which is engineered to be non-magnetic. By creating such a nano-granular structure, each grain can be addressed individually and single grain level resolution can be achieved. While the resolution of such nano-granular magnetic materials is excellent, it comes at a cost in thermal stability because the individual addressability also requires individual stability, i.e. each grain has to be magnetically stable on its own.

The key parameter characterizing the stability of a magnetic grain in a HDD disk is the product of anisotropy energy K and grain volume V. The main media design limitation is that increasing K also raises the magnetic write field necessary to actively reverse the magnetic state of the grain [3]. Thus, simply increasing the material parameter K would make it ultimately impossible to transfer the information into the magnetic recording media in the first place. It is this simultaneous K dependence of writeability and stability that is driving the presently occurring technology shift from longitudinal to perpendicular recording, both of which are schematically shown on the right hand side of fig. 1. Perpendicular recording has a number of thermal stability advantages when compared to longitudinal recording, one of which is the fact that higher magnetic write fields can be achieved allowing for the use of higher K materials as recording media, which in turn can be utilized to create smaller magnetic grains that are thermally stable. This advantage of perpendicular recording is due to the use of a soft magnetic under layer (SUL), which produces a mirror image of the main recording pole, allows to channel the entire head field flux through the magnetically hard recording layer and results in much higher write fields.

Also in recent years, advanced multilayered media structures with an improved writeability to stability ratio have been designed and were successfully deployed as main-stream product technology [5]. Presently, there is a substantial interest in Exchange Spring Layer (ESL)-media (shown schematically in the center of fig.2), which utilize a combination of soft and hard magnetic materials [6]. An improved writeability is hereby achieved through a non-uniform field reversal mode. This functionality, however, requires that the interlayer coupling in such structures is tuned appropriately. Too strong a coupling will prohibit this non-uniform reversal, while a coupling that is too weak will decouple the reversal of the layers altogether [6]. The crucial importance of the interlayer can be seen on the right hand side of fig. 2. Here, the coupling strength between the soft magnetic ESL and the hard magnetic base recording layer (MAG) was tuned by means of varying the thickness of a suitable coupling layer (CL) in the sub-nm regime. A clear writeability optimum, given as a minimum in the required write head current I_{95}, is visible and demonstrates the viability of this media technology for large-scale industrial applications [7].

While these examples demonstrate that ingenuity enables sustained technological progress in the face of looming physical limits, those limits will not disappear. On the contrary, they require a constant flow of novel ideas and substantial research efforts to allow for further advances in this industrial-scale nanotechnology in particular, as well as the Nano-Scienes overall.

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Figures:

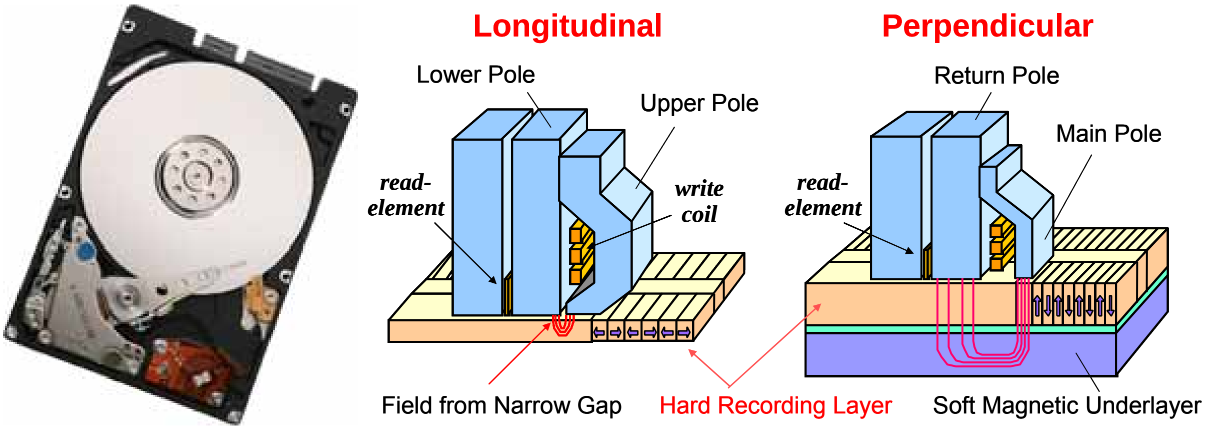

Figure 1:

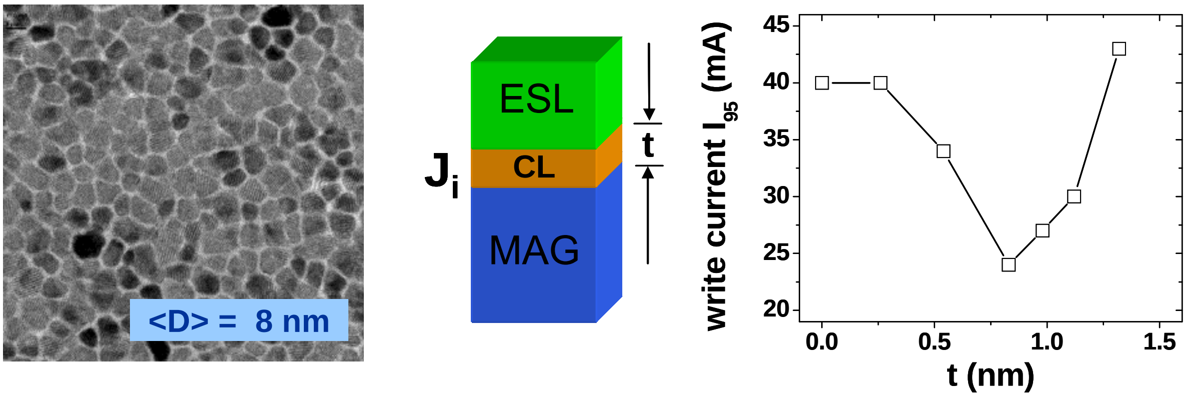

Figure 2:

SCANNING TUNNELLING MICROSCOPY IN A MICROAMPÈRE RANGE

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Scanning tunnelling microscopy is well suited for imaging and spectroscopy of atomic and molecular structures. Usually, small tunnelling currents are used in an attempt to minimize the disturbing influence of the microscope tip. In my talk I will mostly present experiments which are performed — contrary to the above situation — at unusually large currents. These experiments provide information on, e. g., the conductance of a single adatom (be it magnetic or non-magnetic) on a single crystal surface. Microamp currents can also be run through a single C_{60}-molecule in a reproducible manner. The orientation of the molecule is observed to significantly influence the conductance. Under certain conditions we also observe switching phenomena. Finally, I will address the emission of light from a tunnelling microscope. Surprisingly, we detect light at photon energies which exceed the energy of a tunnelling electron.

ENHANCED BONDING OF GOLD NANOPARTICLES ON OXIDIZED TiO_2(110)

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Introduction

Finding of distinctive catalytic properties of dispersed gold nanoparticles on oxide supports [1] has stimulated extensive research activities [2, 3], and a general consensus now exists on several aspects of this system. The size of the gold particles significantly affects the catalytic activity, and the gold clusters must be smaller than 5 nm for high catalytic activity [2, 4]. The choice of the oxide support influences the catalytic activity, so there is a strong 'support effect' in addition to the 'size effect' [2]. However, the relation of the adhesion properties of nanosized gold to catalytic activity is still unresolved.

Here we present a study addressing the fundamental mechanisms of gold–oxide support adhesion by means of scanning tunneling microscopy (STM) and density functional theory (DFT) calculations. We compare the nucleation of Au clusters on one support material that had been prepared in different oxidation states. Rutile TiO_2(110) was chosen as the model support, because Au/TiO_2 is a good catalysts for CO oxidation at low temperatures [4, 5].

Experimental

The experiments were carried out in an ultrahigh vacuum (UHV) chamber with a base pressure of 3×10^{-11} Torr equipped with a homebuilt, temperature-variable STM [6]. The density of bridging oxygen (O_{br}) vacancies on freshly prepared TiO_2(110)–(1 × 1) samples was in the range of 5–8% ML, with 1 ML (monolayer) being the density of the (1 × 1) units, $5.2\times10^{14}/cm^2$. The DFT calculations were performed using the DACAPO package [7] with a plane-wave basis set (E_{cut} = 25 Ry) and ultrasoft pseudopotentials. The TiO_2(110) surface was modelled using periodic slabs of three tri-layers, the first tri-layer being fully relaxed. A (4 × 2) surface unit cell and the theoretically derived lattice constants were used.

Results and discussions

The three TiO_2(110) supports chosen were (i) reduced having bridging oxygen vacancies (*r*-TiO_2(110)), (ii) hydrated having bridging hydroxyl groups (*h*-TiO_2(110)), and (iii) oxidized having oxygen ad-atoms (*o*-TiO_2(110)) [8]. After exposing these three different TiO_2 surfaces to Au (3% of a monolayer (ML)) at room temperature (RT), we observed quite different Au cluster morphologies. In case of the *r*-TiO_2(110) surface, numerous rather small Au clusters are distributed homogeneously on the terraces (Fig. 1a). In contrast, on *h*-TiO_2(110), we found fairly large Au clusters that decorate preferentially the step edges of the substrate, and no small Au clusters on the terraces are seen (Fig. 1b). However, on the *o*-TiO_2(110) surface we again found Au clusters to nucleate homogeneously on the terraces (Fig. 1c). Based on these results, we conclude that stronger Au–TiO_2 interactions exist on *r*- and *o*-TiO_2(110) than on *h*-TiO_2(110).

Given the stronger interactions with the *r*- and the *o*-TiO_2(110) surfaces, we explored the effect of heating on the Au cluster morphologies on these two TiO_2 supports. On *r*-TiO_2(110) we observed the formation of large Au_n clusters with STM heights up to 10 Å after heating to 68 °C, while no such large clusters were identified on *o*-TiO_2(110) after identical thermal treatment. Based on a comparison of the Au height histograms, we propose that many stable

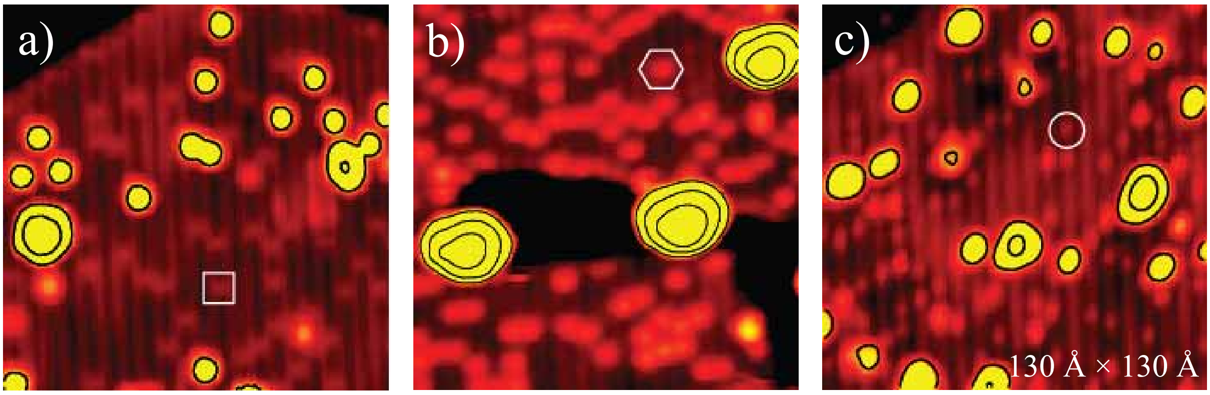

Figure 1. STM images of *r*-$TiO_2(110)$ (a), *h*-$TiO_2(110)$ (b) and *o*-$TiO_2(110)$ (c) surfaces after 3% ML Au exposure at RT (1 ML is defined as 1.387×10^{15} atoms per cm^2 corresponding to Au(111)). Symbols indicate O_{br} vacancies (□), H ad-atoms on O_{br} sites (⎔) and O_{ot} atoms in the Ti troughs (○).

Au_n cluster configurations exist on *o*-$TiO_2(110)$, while there are only few stable Au_n cluster configurations on *r*-$TiO_2(110)$ [9]. The Au–TiO_2 interaction is strongest on *o*-$TiO_2(110)$.
To rationalize the STM results, we conducted DFT calculations addressing (i) the diffusion of Au monomers (Au_1) and (ii) the adhesion potential energies of selected Au_n clusters on the three different $TiO_2(110)$ surfaces of interest [9]. These calculations strongly corroborate the STM results, as we found that trapping of Au_1 is possible at RT on *r*- and *o*-$TiO_2(110)$, but not on *h*-$TiO_2(110)$. Furthermore, we revealed extraordinarily strong bonding of Au_n clusters on the oxidized support, while we found that O_{br} vacancies allow solely for the stabilization of Au_1 and Au_3 clusters. Finally, we analyzed the different Au–TiO_2 bonding mechanisms on the various model supports, and identified partially ionic bonding on *o*-$TiO_2(110)$, i.e. the occurrence of cationic gold at the Au–*o*-$TiO_2(110)$ interface [9].

Conclusions

A much stronger gold–oxide support adhesion exists on O-rich gold–support interfaces than on O-poor oxide support surfaces. This result suggests that in catalytic applications cationic gold at the Au–support interface might be a general feature.

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FRICTIONAL DISSIPATION IN SELF ASSEMBLED ORGANIC MONOLAYERS

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Organic molecules in their monomolecular assemblies are known to provide chemical and mechanical protection to metallic substrates subject to tribological interactions. These molecules of nanometric lengths and hydrophobic terminal ends can be chemiadsorbed to provide good load bearing capacity and low friction dissipation.

These objectives may be achieved by a chemical or a physical route. In the chemical route the frictional dissipation is lowered by the formation of a reaction product of low shear strength. The precursor to such a reaction is the electronic charge coupling of the molecular backbone and the substrate, the contact pressure acts as an activator to bring the two bodies within a proximity to enable such a coupling. The load bearing capacity of these films may not be too high. Making the molecules stiffer or more load bearing cuts off the chemical route and dissipation is achieved by opening up new avenues of molecular deformation whereby the molecules tilt or rotate to do work under tractions. The relaxation behaviour of the molecules influenced by contact pressure and sliding speed determine the accumulation of defect population with sliding. While this mechanism implies that friction and adhesion increases if the molecules are less rigid, it is found experimentally that more rigid and bigger molecules have greater frictional resistance. The issue is addressed considering the barrier energies to be overcome for molecular motion under shear and it is found that the property of an assembly to shear coordinate or to organize a contact coherently, as well as the activation energy related to the molecular repulsion, opposedly control the barrier height and therefore the friction. We end the talk by noting the dramatic effect of environmental humidity on friction of these hydrophobic molecules. We believe that work such as this is of importance to the design of metal cutting and metal working processes as well as to the performance of internal combustion engines.

MAGNETIC ANISOTROPY OF BI-METALLIC NANOSTRUCTURES – INTERFACE *VS*. ALLOY CONTRIBUTION

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We use self-assembly during atomic beam epitaxy to create two-dimensional bi-metallic islands on single crystal metal substrates. Size, morphology, and composition of these islands are determined at the atomic scale with STM, and can be deliberately varied by the growth conditions. The magnetic properties, such as temperature-dependent zero-field susceptibility, are measured for an ensemble of islands with magneto-optical Kerr effect (MOKE). Linking the magnetic properties to the morphology enables one to identify the effect of atomic coordination **[1-3]** and chemical environment **[4]** for instance on the anisotropy energy.

We focus on the interface and alloy contribution to the blocking temperature of FeCo islands grown on a Pt(111) surface. The blocking temperature of Fe_xCo_{1-x} alloy islands is highest for $x = 0.5$ and with $T_b = 160$ K two times higher than for clean Co ($x = 0.0$, $T_b = 90$ K) or clean Fe islands ($x = 1.0$, $T_b = 80$ K) of identical size and shape. Taking the size into account this yields to an alloy contribution to the barrier for thermally induced magnetization reversal of $E_{alloy} = 0.14$ meV/atom on top of the 0.14 meV/atom barrier for the mono-metallic islands. For magnetization reversal by coherent rotation these energies are equivalent to the magnetic anisotropy, composed of shape and magneto-crystalline anisotropy. The shape contribution can easily be calculated thus revealing the magneto-crystalline anisotropy.

Co-core–Fe-shell islands reveal a steep increase of T_b, starting with minute amounts of Fe and coming to an end at a shell being 2 atomic rows wide. Further addition of Fe leads to a much more shallow increase of T_b similar to the one of pure Fe or Co. From this behavior we infer that the interface between Co and Fe contributes by $E_{interface} = 0.9$ meV/pair. Altogether this suggests that abrupt 1D interfaces between two metals have much higher anisotropies than homogeneous alloys.

The experimental findings are discussed in the light of DFT calculations using the spin-polarized relativistic version of the Korringa–Kohn–Rostoker (KKR) multiple scattering formalism. These calculations confirm the experimental findings and give absolute numbers of the anisotropy energies in very good agreement with experiment.

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LOCAL DENSITY OF STATES IN NEAR-FIELD OPTICS

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The local density of states (LDOS) of the electromagnetic field is a fundamental quantity which drives, e.g., the spontaneous emission of atoms or molecules, or thermal radiation. In this talk, we discuss the behavior of the electromagnetic local density of states (EM-LDOS) in the near field.

We describe the LDOS behavior close to metallic nanostructures (nanoparticles or tips) in the context of single-molecule fluorescence. We emphasize the interplay between radiative and non-radiative decay [1], and its consequences in terms of fluorescence enhancement and quenching.

Close to a surface, we show that the EM-LDOS is dominated by surface modes (surface plasmon or surface phonon polaritons) [2]. We discuss the possibility of measuring the LDOS in scanning near-field optical microscopy (SNOM) [3], based on an analogy between SNOM and STM [4]. We present and discuss the first experimental results showing near-field measurements of thermally-emitted light on gold structures [4]. The images can be understood as maps of the EM-LDOS of surface plasmons.

Finally, we describe the EM-LDOS fluctuations in a random cluster of nanoparticles, in the presence of near-field scattering [6]. We discuss the possibility of imaging complex media from measurements of the fluorescence lifetime fluctuations of molecules.

Acknowledgements
I would like to thank the colleagues with whom the works on the EM-LDOS were performed: Y. De Wilde, F. Formanek, L. Froufe, J.J. Greffet, C. Henkel, K. Joulain, J.J. Sáenz.

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ELECTRONIC TRANSPORT IN SINGLE-MOLECULE JUNCTIONS

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Present trends in the miniaturization of electronic devices suggest that ultimately single molecules may be used as electronically active elements in a variety of applications. Recent advances in the manipulation of single molecules now permit to contact an individual molecule between two electrodes and measure its electronic transport properties. In contrast to single-electron transistors based on metallic islands, molecular devices have a more complicated, but in principle tunable, electronic structure. In addition to generic principles of nanoscale physics, such as Coulomb blockade, the chemistry and geometry of the molecular junction emerge as the fundamental tunable characteristics of molecular junctions.

In my talk, I will present our recent efforts to describe theoretically the electronic transport through single-molecule junctions. Our work is based on the combination of ab initio quantum chemistry calculations and Green functions techniques [1]. Such an approach allows us to elucidate the relation between the electronic structure of individual molecules and the electrical conduction of the circuits in which they are embedded. This fact will be illustrated in my talk with the discussion of the following important topics motivated by recent experiments:

1. *Conductance of aluminium break-junction in the presence of oxygen molecules and other absorbates* [2]. In collaboration with the experimental group of Marcelo Goffman (CEA, Saclay), we show how the use of superconducting electrodes can be very valuable to understand the nature of the conduction through simple molecules such as oxygen or hydrogen.
2. *Role of the conjugation in biphenyl single-molecule junctions* [3]. In relation to the recent experiments of Venkataraman *et al.* [4], we show how one can tune the conductance of biphenyl molecules by introducing suitable side-groups which control the degree of conjugation of the π-electron system.
3. *Length dependence of the conductance of oligophenylenes* [5]. In this case, in relation to recent experiments [6], we study how the length of different

oligophenylene molecules determines basic transport properties such as the low-bias conductance and the thermopower.

4. *Huge photoconductances in organic single-molecule contacts* [7]. It is essential to not only understand the conduction through single molecules, but also to find ways to control it using external stimuli. We have recently studied the transport through organic single-molecule contacts in the presence of an electromagnetic radiation and found that it is possible to enhance their low-bias conductance by several orders of magnitude by applying radiation of the appropriate wavelength.

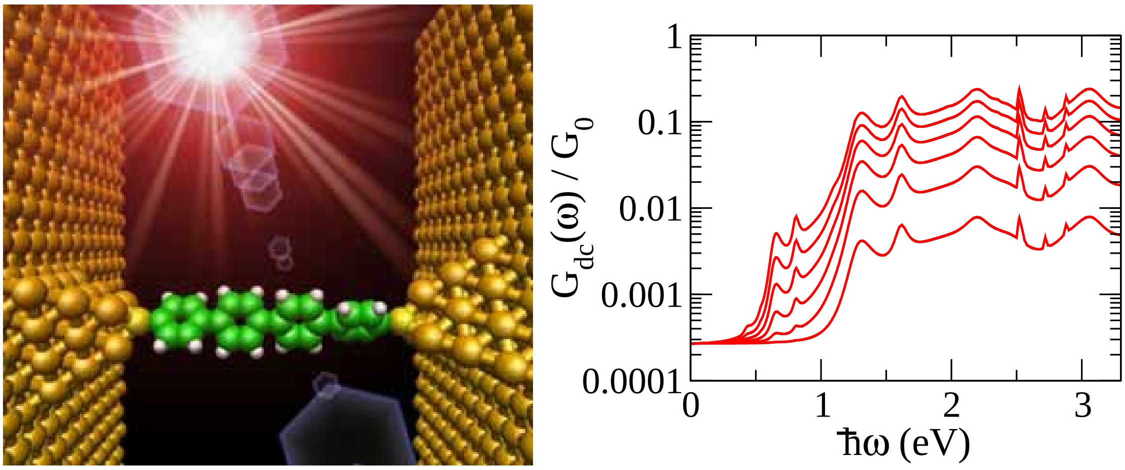

Figure: (Left) Schematic representation of a single-molecule junction subjected to an external electromagnetic radiation. (Right) Photoconductance vs. radiation frequency of an oligophenylene junction for different radiation powers exhibiting a huge enhancement in the infrared and visible range of the electromagnetic spectrum.

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CHEMICAL IDENTIFICATION OF INDIVIDUAL SURFACE ATOMS USING DYNAMIC FORCE MICROSCOPY

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The chemical identification of atoms and molecules at surfaces has been pursued from the invention of both scanning tunnelling microscope and atomic force microscope (AFM). The intrinsic detection nature of these techniques has hindered, however, most of the efforts, and chemical recognition of individual atoms in multi-element systems still remains a challenge.

AFM operated in dynamic mode has become a very powerful technique to explore surfaces at atomic scale [1, 2], allowing one even the manipulation of individual atoms [3, 4] for the creation of sophisticated nanostructures [5]. In the most refined experimental set-ups, dynamic force microscopy (DFM) enables as well the precise quantification of the short-range forces associated with the onset of the chemical bonding between the outermost atom of the AFM tip and the individual surface atoms [6, 7]. Since the chemical bonding force between atoms is closely related to their nature, the short-range forces measured with DFM should contain information about the chemical specificity of the different atoms probed. To extract this information is, however, a knotty problem, as the measured short-range forces show a strong variability upon the structure and chemical termination of the AFM tip apex [8].

In this contribution we present a method for the chemical identification of individual surface atoms based on the precise quantification of short-range chemical interaction forces with DFM [9]. We will show that even when these forces are tip-dependent, the relative interaction ratio of the maximum attractive short-range force registered over the different atoms of a heterogeneous surface for a given tip remains constant almost independently from the tip-apex structure and chemical termination. Through this property, tabulated relative interaction ratios can be used as fingerprints for single-atom chemical recognition. We demonstrate this identification method on a particularly challenging system: an alloy composed by three atomic species (silicon, tin and lead) with very similar chemical properties and identical adsorption positions, where any discrimination attempt based solely on topographic measurements would be impossible to achieve.

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ELECTRON TRANSPORT IN SEMICONDUCTOR NANOWIRES

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The recent development of catalytic methods for the synthesis of wire-shaped semiconductor nanostructures has generated widespread interest in these novel nanomaterials, especially in view of the large variety of their potential applications. Semiconductor nanowires have indeed many attractive properties. An obvious advantage lies in their inherently small diameter (down to a few nm) leading to transversal quantum confinement. In spite of their small diameter, however, semiconductor nanowires can be tens of microns long. Such a conveniently large aspect ratio yields ample freedom for the integration of multiple structures and functionalities in one single nanowire. Other unique features are the versatility in the choice of constituent materials (Si, Ge, and basically any semiconductor compound) and the possibility to form various types of one-dimensional heterostructures via the consecutive growth of different semiconductors, even in the presence of a large mismatch in the respective lattice parameters. Throughout the recent years, a substantial amount of work has been carried out to improve control over the growth of semiconductor nanowires, to understand their structural and electronic properties, and to develop processes for device fabrication. In spite of this large effort and following advances the important amount of knowledge gained, many even rather basic questions are still waiting for a conclusive answer.

In this talk I will present an up-to-date view on electron transport in semiconductor nanowires with an emphasis on the low-temperature regime. Most of the discussion will focus on the following key aspects: 1) Basic electrical properties; 2) Electrical contacting and gating; 3) Low-temperature electron transport: Coulomb blockade effect, size quantization, phase-coherent transport, and superconducting proximity effect. Among the most remarkable results, I shall mention the experimental realization of Josephson junctions formed by individual semiconductor nanowires bridging two superconducting electrodes. Two distinct cases will be discussed: i) The supercurrent is carried by coherent transport of correlated pairs of electrons across the nanowire. In this case the critical current can be tuned by a gate voltage acting on the carrier density in the nanowire; ii) An interacting quantum is defined in the nanowire by means of local gate electrodes. In this case, we have demonstrated that the direction of the supercurrent can be inverted simply by adding (or removing) a single electron to the quantum dot.

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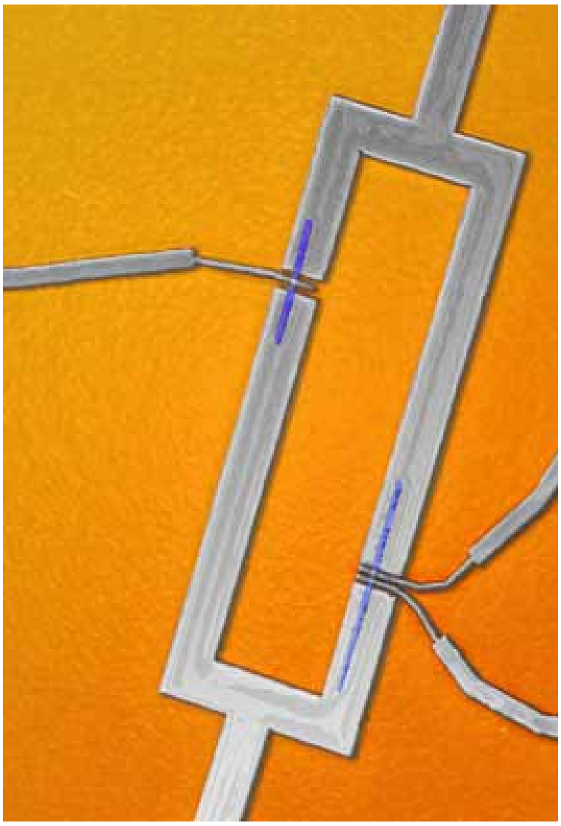
Figures:

Fig. 1. Scanning electron micrograph of a SQUID device fabricated from two Josephson junctions based on InAs semiconducting nanowires. The bottom-right nanowire has two gates ~100nm apart from each other. These two gates are used to define a single quantum dot in the central portion of the nanowire. The corresponding gate voltages control both the electronic state of the dot as well as the tunnel couplings with the remaining portions of the nanowire.



A NOVEL LOW-ENERGY COLLECTIVE EXCITATION AT METAL SURFACES

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Fifty years after the publication of the pioneering work on surface plasmons by Rufus H. Ritchie[1], a new collective excitation at metal surfaces has been theoretically predicted[2,3,4] and measured using angle-resolved electron energy loss spectroscopy[4]. This new mode has an acoustic (linear) dispersion, different to the $q_{\|}^{1/2}$ of a two-dimensional (2D) plasmon.

Nearly 2D metallic systems formed in charge inversion layers and artificial layered materials permit the existence of low-energy collective excitations, called 2D plasmons, which are not found in a three-dimensional (3D) metal. These excitations have caused considerable interest because their low energy allows them to participate in many dynamical processes involving electrons and phonons, and because they might mediate the formation of Cooper pairs in high-transition-temperature superconductors. Metals often support electronic states that are confined to the surface, forming a nearly 2D electron-density layer. However, it was argued that these systems could not support low-energy collective excitations because they would be screened out by the underlying bulk electrons. Rather, metallic surfaces should support only conventional surface plasmons[1]—higher energy modes that depend only on the electron density. Surface plasmons have important applications in microscopy and subwavelength optics, but have no relevance to the low-energy dynamics. Here we show that, in contrast to expectations, a low energy collective excitation mode can be found on bare metal surfaces. The mode has an acoustic (linear) dispersion, different to the $q_{\|}^{1/2}$ of a 2D plasmon, and was observed on Be(0001) using angle-resolved electron energy loss spectroscopy. First-principles calculations show that it is caused by the coexistence of a partially occupied quasi-2D surface-state band with the underlying 3D bulk electron continuum and also that the non-local character of the dielectric function prevents it from being screened out by the 3D states. The acoustic plasmon reported here has a very general character and should be present on many metal surfaces. Furthermore, its acoustic dispersion allows the confinement of light on small surface areas and in a broad frequency range, which is relevant for nano-optics and photonics applications.

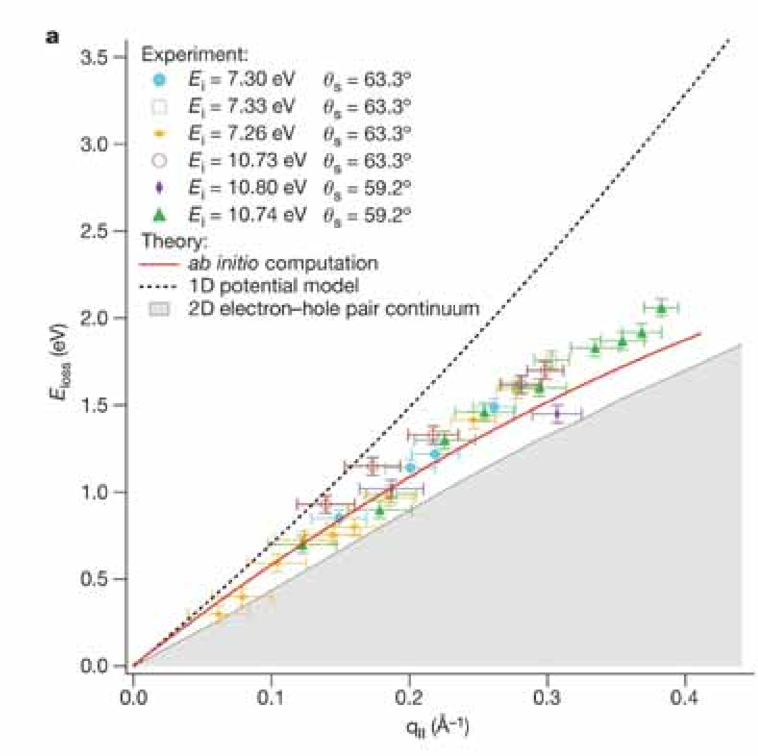

Figure 1. Acoustic surface plasmon energy dispersion. The experimental dispersion was measured at room temperature and various incident electron energies and scattering angles. Energy error bars are due to uncertainties in the multi-peak deconvolution procedure of the EEL spectra, while $q_{||}$ error bars represent the momentum integration window due to the finite angular acceptance of the EEL spectrometer. The theoretical dispersion is indicated by the black dashed line, showing the predicted acoustic surface plasmon dispersion obtained for a free-electron-like surface state, and by the solid red line, which was calculated using an ab initio Be(0001) surface band structure.

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CATALYSIS BY AU AND AU ALLOYS: FROM SINGLE CRYSTALS TO NANOPARTICLES

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The electronic, structural, and chemical properties of unsupported metal and mixed-metal surfaces prepared either as single crystals or thin films have been detailed and contrasted with the corresponding properties of supported metal and mixed-metal nanoclusters. The latter vary in size from a few atoms to many and have been prepared on ultrathin single crystalline oxide supports of TiO_2, Al_2O_3, and SiO_2. An array of surface techniques including reaction kinetics of carbon monoxide oxidation and vinyl acetate synthesis have been used to correlate catalytic function of these surfaces with their physical and electronic properties. Of special interest are the special physical and chemical properties that develop with metal cluster size reduction and/or metal-support interaction.

SINGLE MOLECULAR DEVICES

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Low-temperature UHV Scanning Tunnelling Microscopes are nowadays not only microscopes but tools at the nanoscale allowing manipulation of atoms and molecules, sub-molecular spectroscopy experiments, chemical activation etc…It opens the way to new measurements, new researches on single molecules with exceedingly high accuracy and control. To carry out such experiments, specific molecules have to be designed [1]. In this presentation, we will introduce series of molecular devices devised for studying electronic and mechanical properties at the single molecular level. For instance, molecular devices designed to trap and move metallic atoms (Fig 1) [2], to perform switching and conformational changes [3] or to demonstrate a rack-and-pinion mechanism will be presented [4].

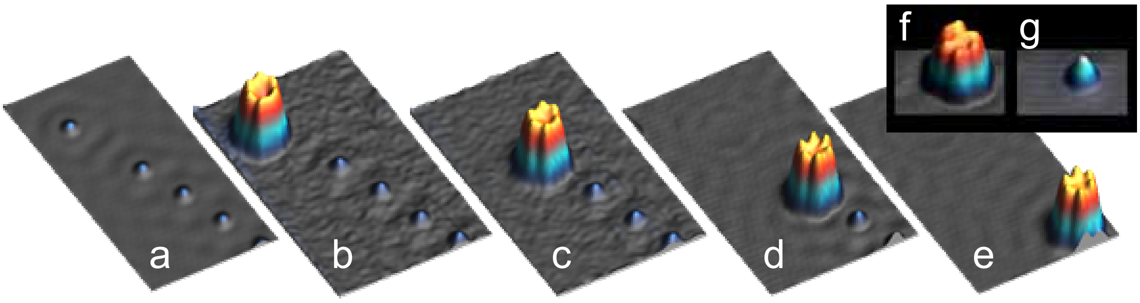

Fig.1. A molecular "Hoover" able to trap and move metallic atoms on a surface

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ELECTROSTATIC FORCE MICROSCOPY OF INGA AT CRYOGENIC TEMPERATURES

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Both nanoelectronic devices as well as ‘classical’ devices such as field effect transistors usually rely on precise control of the electrostatic potential. Clearly the effect of electrostatic potential fluctuation in both space and time becomes critical for their proper operation. Potential fluctuation can lead to decoherence in quantum devices such as quantum dot based transistors or variations of the operation point of scaled down transistors.

Electrostatic force microscopy has the sensitivity to detect charges smaller than that of a single electron, small potential differences can be detected with high spatial and temporal resolution. I will discuss these techniques and present our studies of single electron detection as well as the measurement of spatial and temporal electrostatic potential fluctuation in InAs/InP heterostructure samples characterized with a low-temperature atomic force microscope (AFM).

The InAs/InP samples investigated are epitaxially grown by chemical beam epitaxy and have a InGaAs quantum well below the surface which serves as a two-dimensional electron gas (2DEG). In this system, self-assembled quantum dots (QD) can also be grown due to lattice strain effects by choosing proper growth conditions. Using FM-AFM techniques we were able to observe single charging events due to Coulomb blockade effects of the QD at 4.5K (fig. 1). Using an amplitude-modulation (AM) imaging mode the surface topography was determined at 4.5 K to be atomically flat with mono-atomic steps (fig. 1). An active Q damping technique was applied to reduce the otherwise very high Q factor (several ten thousand) to an appropriate value (about 1000) for AM mode imaging. It turns out that in frequency modulation (FM) mode imaging it was impossible to get such images because the cantilever oscillation stops as the tip-sample distance gets smaller due to the sudden topographic change associated with QDs. At larger tip-sample distances, by operating the AFM in FM mode and employing Kelvin probe techniques we were ale to observe variation of the surface potential in the region with no QDs as high as 0.5 V. We observe fluctuations of this magnitude over distances of 50 nm (fig. 2). Finally, we will present preliminary results showing how we can change these fluctuations by locally shining light on the sample.

Work done in collaboration with R. Stomp, L. Cockins and Y. Miyahara (McGill University) and P. Poole, S. Studenikin andA. Sachrajda (NRC-IMS)

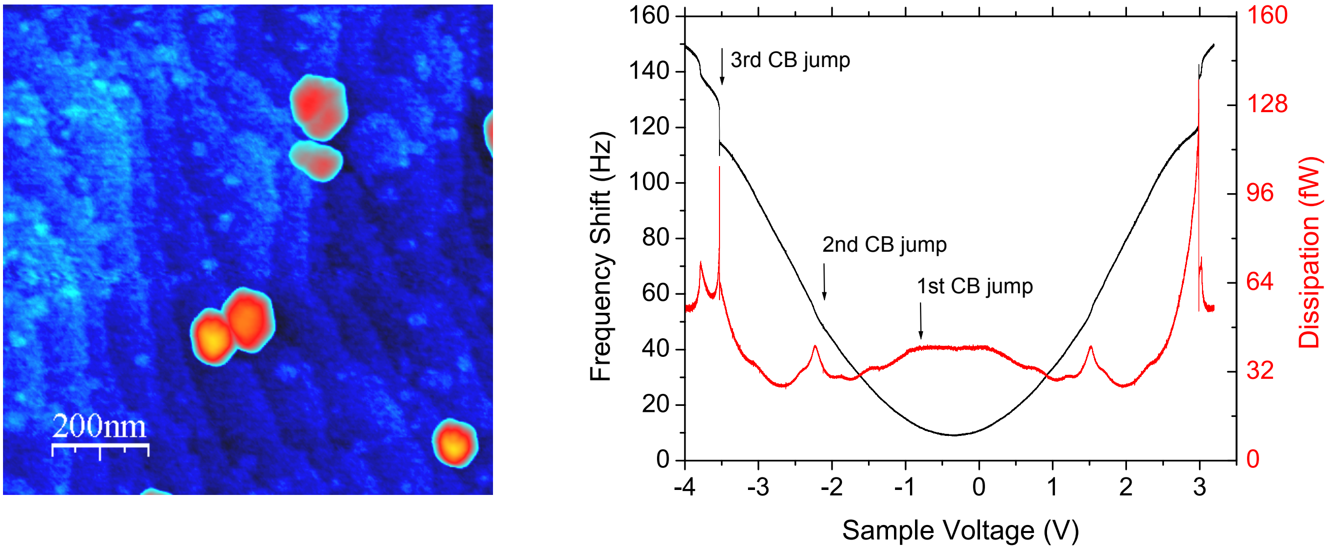

Fig. 1: AM-AFM of QD at 4.5K (left) and detection of Coulomb blockade events by electrostatic force microscopy (Stomp et al. Phys. Rev. Lett., **94**, 056802 (2005))

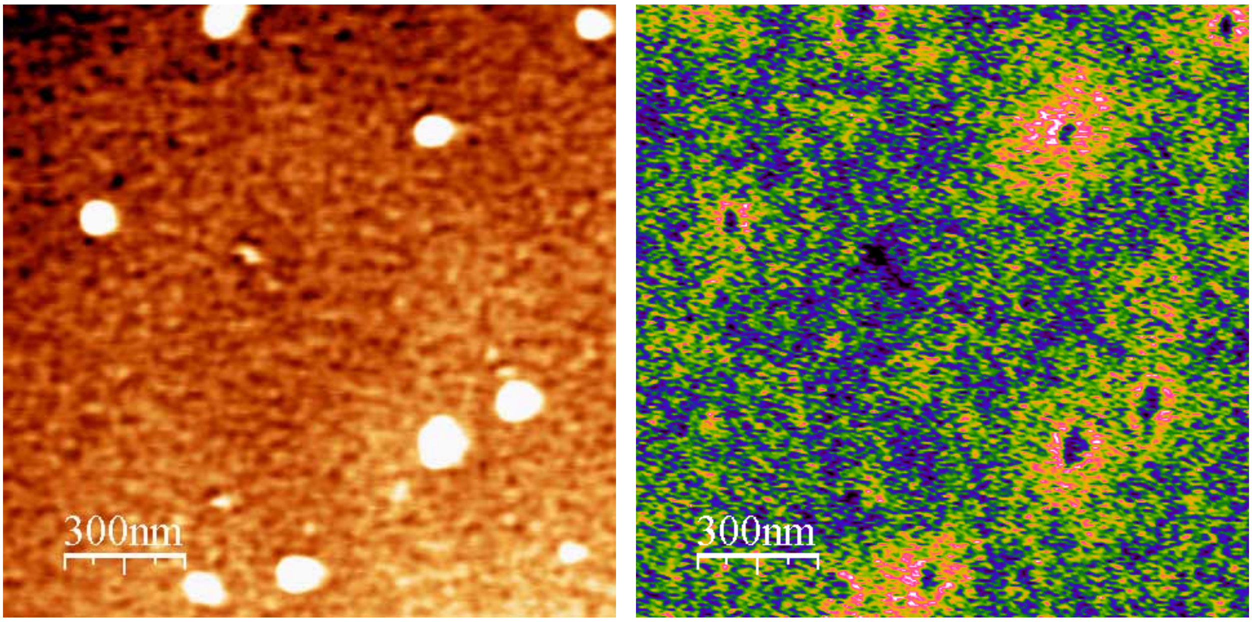

Fig. 2: Topography and contact potential difference measured simultaneously at 4.5 K on InAs/InP sample with QD (contact potential range 1V) (Cockins et al, unpublished)

BREAKING ABBE'S BARRIER: DIFFRACTION-UNLIMITED RESOLUTION IN FAR-FIELD MICROSCOPY

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In 1873, Ernst Abbe discovered that the resolution of focusing ('far-field') optical microscopy is limited to $d = \lambda/(2n\sin\alpha)$ > 200 nm, with $n\sin\alpha$ denoting the numerical aperture of the lens and λ the wavelength of light. While the diffraction barrier has prompted the invention of electron, scanning probe, and x-ray microscopy, in the life sciences 80% of all microscopy studies are still performed with lens-based (fluorescence) microscopy. The reason is that the 3D-imaging of the interior of (live) cells requires the use of focused visible light. Hence, besides being a fascinating physics endeavor, the development of a far-field light microscope with nanoscale resolution would facilitate observing the molecular processes of life.

In this lecture, I will discuss novel physical concepts that radically break the diffraction barrier in focusing fluorescence microscopy. They share a common strategy: exploiting selected molecular transitions of the fluorescent marker to neutralize the limiting role of diffraction[1].

The first viable concept of this kind was Stimulated Emission Depletion (STED) microscopy[2]. In its simplest variant, STED microscopy uses a focused beam for fluorescence excitation, along with a red-shifted doughnut-shaped beam for subsequent quenching of fluorescent molecules by stimulated emission. Placing the doughnut-beam on top of its excitation counterpart in the focal plane confines the fluorescence near its central intensity-zero where stimulated emission is absent. The higher the doughnut intensity, the stronger is the confinement. In fact, the spot diameter follows $d \approx \lambda/\left(2n\sin\alpha\sqrt{1+I/I_s}\right)$, with I denoting the intensity of the quenching (doughnut) beam and I_s giving the value at which fluorescence is reduced to *1/e*. Without the doughnut (I =0) we have Abbe's equation, whereas for $I/I_s \to \infty$ it follows that $d \to 0$, meaning that the fluorescence spot can be arbitrarily reduced in size[3,4]. Scanning this subdiffraction spot across the specimen delivers images with a subdiffraction spatial resolution that can, in principle, be molecular! Thus, the resolution of a STED microscope is no longer limited by λ, but on the perfection of its implementation. We will demonstrate a resolution down to λ/45 ≈ 15-20 nm with nanoparticles and biological samples, i.e., 10-12 times below the diffraction barrier[5].

The concept underlying STED microscopy can be expanded by employing other molecular transitions that control or switch fluorescence emission, such as (i) shelving the fluorophore in a metastable triplet state[4,6], and (ii) photoswitching (optically bistable) marker molecules between a 'fluorescence on' and a 'fluorescence off' conformational state[3]. Examples for the latter include photochromic organic compounds, and fluorescent proteins which undergo a photoinduced cis-trans isomerization or cyclization reaction. Due to their optical bistabilty/metastabilty, these molecules entail comparatively low values I_s, meaning that the diffraction barrier can be broken at low I. A complementary approach is to switch the marker molecules individually and assemble the image molecule by molecule. By providing molecular markers with the appropriate transitions, synthetic organic chemistry and protein biotechnology plays a key role in overcoming the diffraction barrier.

Finally, I discuss more recent work of my group showing that the advent of far-field 'nanoscopy' has already solved fundamental problems in (neuro)biology, such as the fate of synaptic vesicle proteins after synaptic transmission[7]. Besides, the emerging far-field 'optical nanoscopy' also has the potential to advance nanolithography, the colloidal sciences, and to help elucidate the self-assembly of nanosized materials.

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MAGNETIC PROPERTIES OF ZnO NANOPARTICLES

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We experimentally show that it is possible to induce room temperature ferromagnetic-like behaviour in ZnO nanoparticles without doping with magnetic impurities but simply inducing an alteration of its electronic configuration. Capping ZnO nanoparticles (˜10nm size) different organic molecules induce an alteration of their electronic configuration that depends on the particular molecule, as evidenced by photoluminescence and X-ray absorption spectroscopies and altering their magnetic properties that varies from diamagnetic to ferromagnetic-like behaviour.

The origin of permanent magnetism in metal oxides semiconductors is explained as due lo localised blocked magnetic moments not necessarily coupled among them. For the case of transition metals as Mn and Ti it was found that double exchange between ions located at interfaces promoted the appearance of local magnetic moments. However, the lack of magnetic percolation indicates that the origin of the permanent magnetism evidenced by the hysteresis loop may be associated with local anisotropy rather than with exchange interactions. It is shown that spin-orbit coupling can give rise to orbital magnetic moments that originates giant anisotropies as large as 0.05 eV. This result can be generalised for compensating charges confined to jump between molecular orbitals on the nearest neighbors of point defects.

SCATTERING-TYPE NEAR-FIELD MICROSCOPY: FROM NANOSCALE INFRARED MATERIAL RECOGNITION TO SUPERLENS STUDIES

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The development of novel nanoelectronic and photonic structures requires ultrahigh-resolution optical microscopy for characterization and mapping of local material properties and nanoscale confined light fields. I will demonstrate such an optical microscopy technique providing a spatial resolution of about 10-20 nm independent of the wavelength. It is based on elastic light scattering from the probing tip of an atomic force microscope (scattering-type near-field optical microscopy, s-SNOM [1]). Besides a short introduction of the technique, I will demonstrate some s-SNOM applications such as mid-infrared mapping of material [2,3] and doping contrasts in semiconductor devices [4], single nanoparticle mapping [5,6] and near-field characterization of a SiC superlens [7].

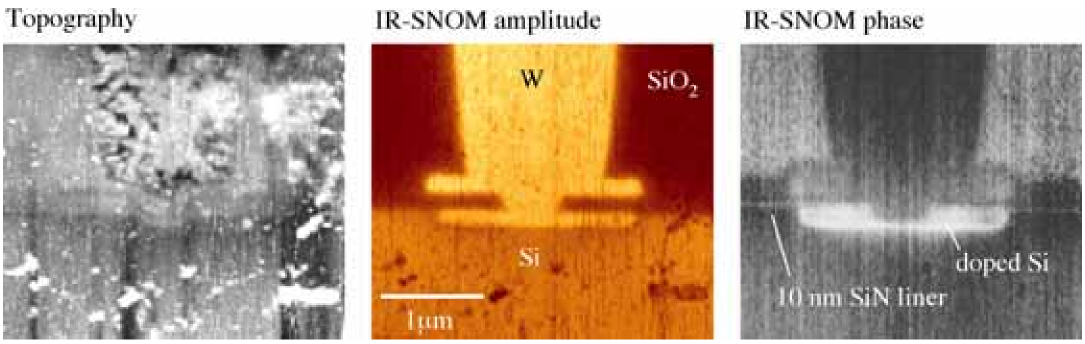

Fig. 1: Nanometer-scale resolved s-SNOM images of a cross section of a MOS-transistor drain contact recorded at a wavelength of about 10.8 μm. Pseudoheterodyne infrared detection yields amplitude and phase images showing distinct material and doping contrasts simultaneously to topography.

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Nuclear-spintronics in semiconductors

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Nuclear magnetic resonance (NMR) is widely used in the physical, chemical and biological science. They are also attracted much attention from the viewpoint of quantum computation. However, conventional NMR technique based on induction-detection has a drawback of low-sensitivity and needs a relatively large sample so that it is not suitable to investigate a single layer (or a nanostructure), which is essential for nanotechnologies. In this presentation, I will discuss new possibilities where nuclear spins play an essential role in semiconductor hetero and nanostructures. To overcome low-sensitivity limitation of conventional NMR, we have developed novel NMR technique based on resistance-detection.

Resistance of semiconductor systems is usually determined by the characteristics of carriers and independent of nuclear-spin polarization. However, if we set semiconductor samples to the special situation where different electron-spin states are degenerate, interactions between electron and nuclear spins are enhanced. This interesting situation is realized at ν=2/3 degenerate point in AlGaAs/GaAs system [1-3]. In such situation, nuclear-spin polarization far beyond the thermal equilibrium is realized by current flow (dynamic nuclear-spin polarization) and nuclear-spin polarization can be detected as enhanced resistance, which is proportional to the magnetization, Mz, of nuclear spins [2,4]. This resistance-detection scheme gives us a novel way where nuclear-spin polarization is controlled and detected in a single quantum layer or even in a nanoscale device.

It should be stressed that we need special states at ν=2/3 for dynamic nuclear-spin polarization, but we can apply NMR spectrum and nuclear-spin relaxation (T_1 time) measurements for any states we want to estimate. These measurements were successfully applied to bilayer systems, and exciting phase like canted antiferromagnetic phase was unveiled [5,6]. The low-frequency mode, which is difficult to detect in conventional transport and optical measurements, has been sensitively detected by monitoring T_1, reflecting correlated electron spin features [6].

The nuclear spin control was also extended to a point contact device [4]. From a viewpoint of quantum computation, it is desirable to control small quantity of nuclear spins in small-size solid-state systems. Nuclear spin polarization is realized only in the point contact region and nuclear spin magnetization is detected with the resistance between both ends of the point contact. When an alternating current is applied to the antenna integrated on the point contact, the quantum-mechanic manipulation of Ga and As nuclear spins is achieved by controlling frequency and duration of the applied current pulse. The quantum-mechanic superposition has been successfully manipulated between four separated nuclear-spin states [4]. Full coherent control of quantum four-level system is equivalent to the two-qubit (quantum bit) operation [7]. NMR spectra are also detected with point contact devices and the obtained results are used to analyze population distribution among four nuclear-spin states [8]. The NMR spectra are also helpful to understand strain and spin features at the nanoscale.

In the future semiconductor studies, nuclear spins may play an important role not only as a key player in coherent control but also as a versatile and powerful tool in characterization.

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BIOLOGICAL WATER

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Water is a prerequisite for life and by far the largest single component in the living organism. Water should therefore be considered as an integral component of biomolecular function. Virtually all cellular processes including protein folding, immune response and membrane assembly are influenced by the delicate interplay between hydrophilic and hydrophobic interactions yet hydration forces are probably the least understood of all fundamental intermolecular forces and the subject of much scientific debate.

In close proximity to a surface, water cannot be treated as a structureless continuous medium due to its unique ability to form strong and highly oriented hydrogen bonds. The morphological structure and chemical nature of the adjacent surface is critical in determining the resulting water structure in the near surface region. The surface of a biomolecule is particularly complex as it is typically covered with domains of polar and non-polar groups and is surrounded not only by water but also solvated ions. At present the influence of water and ions on such systems are not well understood, primarily due to the difficulty in experimentally accessing the local nature of the hydration force under physiological conditions.

We have combined the dynamic and quantitative detection technique of frequency modulation with a low noise atomic force microscope (AFM) capable of operation close to the theoretical noise limit [1] in order to make highly sensitive force measurements in liquid. Using this system we have explored the influence of water and ions on interactions between an AFM tip and the surface of a dipalmitoylphosphatidylcholine (DPPC) lipid bilayer under physiological conditions.

Lipid bilayers mediate numerous biological processes at the cellular level, with the initial interaction of many biochemical processes such as membrane insertion, transport and fusion occurring at the membrane-fluid interface. Thus, when a biological molecule approaches a cell membrane, it is important to consider that aqueous environment must first be displaced before the biomolecule can interact directly with the membrane.

Our findings reveal that stable intrinsic hydration layers are often present at this interface [2]. Further, the prevalence and stability of these hydration layers is highly dependent on the presence of ions in solution. We have also observed that ions can actually modify the mechanical properties of the membrane itself. Based on sub-Ånstrom resolution images of the surface of the lipid bilayer we attribute the observed change in mechanical properties to the sharing of cations between headgroups, effectively joining them together in a co-operative and mechanically stronger arrangement [3].

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NANOPLASMONICS – FROM FUNDAMENTAL STUDIES TO NOVEL FUNCTIONALITIES

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Surface plasmon polaritons (SPP's) were "discovered" by Ritchie[1] in the 50's, while Localized Surface Plasmons (LSP's) have been known, in practice, since ancient times. Both phenomena involve collective excitations of conduction electrons in a confined metal volume through resonant coupling to an external optical field. In contrast to bulk plasmons, surface plasmons are bound to the metal surface. This means that the electromagnetic field that accompanies the collective electron motion is in general of near-field (evanescent) character, and that special requirements need to be fulfilled in order couple far-field radiation to or from surface plasmons. Furthermore, because of their spatial confinement, plasmonic fields are enhanced compared to the excitation field. It is the resonantly enhanced near-field that make surface plasmons the key element for *nano-optics* and the basis for the emerging field of *plasmonics*. Surface plasmons in metal nanostructures are therefore of high current interest due to a range of potential applications, including miniaturized photonic circuits, surface-enhanced spectroscopy, nanoscale biosensors and metamaterials.

In this presentation, I will discuss some of our recent work on localized plasmons in gold and silver nanostructures manufactured through electron-beam lithography, colloidal lithography and focused ion-beam etching. I will describe how to tune the plasmon resonance and it's associated optical near field through a variation in the size and shape of a single nanoparticle or nanohole[2] and through a variation of the electromagnetic interaction between nearby particles[3]. The latter effect may lead to a large enhancement of the induced electric field, which is crucial for Surface-enhanced Raman Spectroscopy[4], or of the induced magnetic field[5], which may be a route towards metamaterials that exhibit negative refraction. I will also discuss the possibility to use isolated or coupled nanoplasmonic structures for molecular biosensing[6]. Finally, I will discuss the possibility to manipulate individual plasmonic nanoparticles using optical forces[7].

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HYDRATED IONS AS NANO-BALL-BEARINGS

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The combination of tenacious attachment of hydration layers to ions in aqueous salt solutions, together with the possible lability of these layers (covering some 14 orders of magnitude in exchange/relaxation rates) leads to interesting nanomechanical properties, including the long-known hydration repulsion. In recent years the central role of such hydrated ions in lubrication phenomena in both synthetic and especially biological systems has been pointed out[1-3]. The talk will focus on recent developments, including the effect on confined water and hydrated ions of large electric fields.

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NANOCLUSTER DFT STUDIES WITH APPLICATIONS TO PRODUCTION AND STORAGE OF HYDROGEN.

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Cluster studies employing density functional theory (DFT) and relevant to production and storage of hydrogen will be presented.

$NaAlH_4$ is a promising material for hydrogen storage. Experiments performed by Bogdanovic and Schwickardi (*1*) have shown that doping the material with Ti makes the uptake and release of hydrogen reversible, also improving the kinetics. However, it is still not clear in which way(s) Ti catalyses the release from and uptake in this material.

We have performed DFT calculations at the generalised gradient approximation (GGA) level to determine what constitutes a good model cluster. A large, geometry optimised semi-spherical cluster exhibiting a (001) surface and consisting of 23 formula units was found to be energetically, electronically, and structurally close to surface and bulk $NaAlH_4$ (*2*). Studies on adsorption on and absorption in the cluster of one Ti atom (*2*), two Ti atoms (*3*), and TiH_2 (*4*) show a consistent picture. The energetically preferred situation is obtained if a Ti atom (or Ti atoms) or a TiH_2 "molecule" is exchanged with a surface Na ion (see also Fig.1). This suggests a "zipper model" for Ti-catalysed hydrogen release: Ti (or TiH_2) can eat its way into $NaAlH_4$ by exchanging with surface Na ions, leading to hydrogen desorption and the formation of the intermediate Na_3AlH_6 and final NaH and Al products.

TiO_2 is a benchmark material for photolytic water splitting, although the band gap of the bulk material (3.0 eV for rutile and 3.2 eV for anatase) is too large to make the bulk material of practical interest for conversion of solar energy to chemical energy in hydrogen (*5*). We have performed hybrid DFT studies using the B3LYP functional of $(TiO_2)_n$ clusters with n=1-16, Clusters with n=10-16 have a size of approximately 1 nm (6,7). The stablest clusters with n=2-9 generally have terminal Ti=O bonds (singly co-ordinated oxygen atoms) characterised by infrared absorption frequencies in the range 988-1020 cm^{-1}. However, for n=10-16 we have been able to find a number of stable clusters which do not have these Ti=O "defects". This should be relevant for model studies of photochemistry on TiO_2: our studies of $(TiO_2)_n^+$ cations suggest that the hole tends to localise on the least co-ordinated O-atom of the cluster. Clusters with terminal Ti=O bonds would therefore be inappropriate for studies of photochemistry on rutile (110) surfaces, which only exhibit twofold and threefold co-ordinated O-atoms. The clusters with n=10-16 show odd-even oscillations of their electronic properties (see Fig.2). Interestingly, for the clusters with odd n strong interatomic O(2p) lone pair interactions can significantly reduce the lowest vertical excitation energy, to values significantly below the band gap of bulk TiO_2. If materials can be engineered to incorporate such $(TiO_2)_n$ nano-particles, they could exhibit visible light photoactivity.

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Figures:

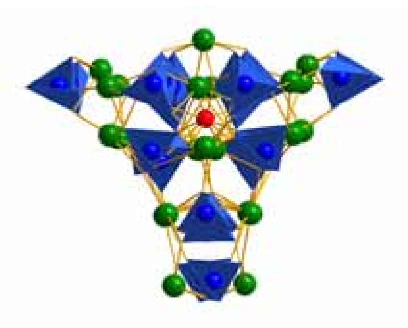

Figure 1.(Color) TiH_2 absorbed in the Z=23 cluster: TiH_2 unit exchanged with surface Na ion.

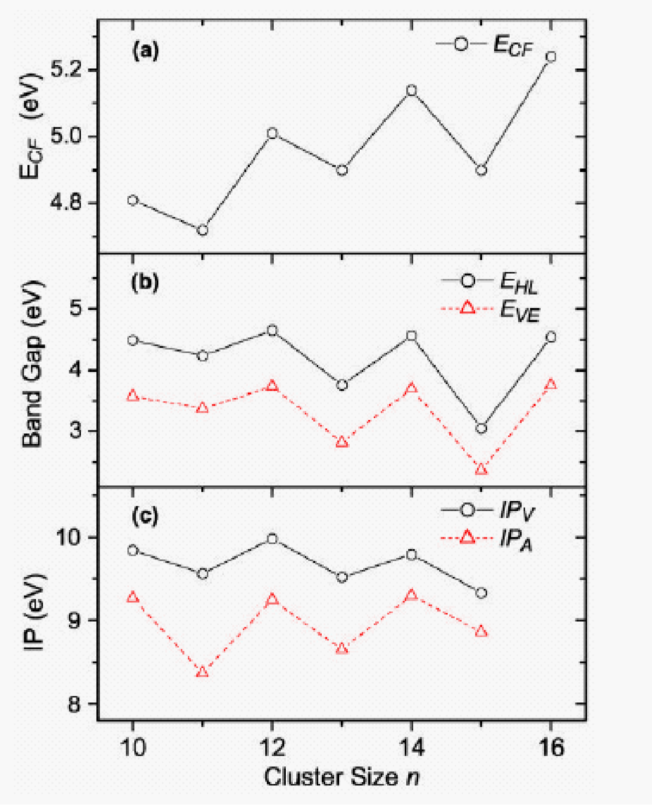

Figure 2. (Color) Electronic properties of $(TiO_2)_n$ clusters as a function of cluster size: (a) Cluster formation energies, (b) band gaps estimated from the HOMO-LUMO gap E_{HL} (using DFT with the B3LYP functional) and from the vertical excitation energy E_{VE} (using TDDFT with the B3LYP functional, and (c) vertical and adiabatic ionization potentials (I_{PV} and I_{PA}).

DYNAMICS AT THE NANOSCALE: ULTRAFAST EXCITON PROCESSES IN SINGLE WALL CARBON NANOTUBES

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The extreme aspect ratio of single wall carbon nanotubes makes them perfect candidates for investigating ultrafast exciton processes in the 1D confined space. A rich phenomenology is appearing, which is the ground for rationalize nanotubes photonic properties and possibly better exploit them. We report on results obtained by applying a variety of ultrafast non-linear optical spectroscopies, such as pump-probe, pump-push-probe, coherent phonons and saturation spectroscopy to carbon nanotubes ensembles in solid matrix. Photo-excitation dynamics is studied in chiral enriched samples which contain a large fraction of (6,5) tubes. We use sub-20 fs optical pulses and cw excitation for probing short and long lived states. The sizable reduction in homogenous broadening allows extracting a well defined scenario of energy relaxation for semiconducting single wall carbon nanotubes (CNT). The excitation with sub-20 fs pulses in resonance with the first exciton transition provides a way for determining the exciton size in (6,5) CNT by exploiting the phase space filling model. Pump intensity dependent measurements of the nascent photobleaching show saturation linear with pump intensity, according to the simple saturation law predicted by the model and suggest a characteristic length of the exciton envelope wavefunction in the order of 10 nm. Pumping both first and second exciton resonances we get information onto the initial dynamics, which points to the several processes occurring in competition, namely non radiative exciton deactivation and exciton-exciton interaction (Auger-like process), followed by second-exciton regeneration and ultrafast internal conversion back to first exciton. Time scale and characteristics of all processes are obtained. Impulsive excitation induces coherent phonons in both inhomogeneous and more homogeneous films. Wavelength dependence and phase relationship are investigated and quantum mechanical modelling is carried out in order to rationalize the finding. Anharmonicity of phonon dynamics, leading to non adiabatic mode coupling is directly detected in the time domain. CW photomodulation spectroscopy reveals long lived states are formed in CNT samples, possibly associated to trapped charges which induced the electro-optic effect.

AC Josephson effect and resonant superconducting transport through vibrating Nb nanowires

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The generation of high-frequency current oscillations when a constant voltage is applied across an insulating tunnel gap separating two superconductors was one of the celebrated predictions made by Brian Josephson in 1962 [1]. These oscillations are ubiquitous to superconducting weak links of various geometries, and their analogues have also been found in other macroscopic quantum systems, such as superfluids [2-4] and gaseous Bose-Einstein condensates [5]. The phenomenon has been confirmed by studying changes in the current-voltage characteristics of superconducting tunnel junctions caused by the interplay of the oscillating current with externally applied microwave radiation of matching frequency (Shapiro steps [6]) or with internal electrodynamic resonances (Fiske effect [7]). We report measurements and theoretical studies suggesting that Josephson current oscillations interact with atomic-scale mechanical motion as well. We generated a niobium dimer (Nb_2) that acts as a weak-link between two superconducting (bulk) niobium electrodes [8]. We find features in the differential conductance through the dimer which correspond to excitations of the dimer vibrational eigenmodes by Josephson oscillations and support our results with theoretical simulations [9].

Research of superconducting transport through microscopic objects with intrinsic vibrational degrees of freedom provides a new research avenue, with the details of the microscopic coupling mechanism between the vibrational degrees of freedom in the weak links and the ac Josephson currents remaining a subject for further experimental and theoretical investigations. Additionally, such systems offer a sensitive spectroscopic method for probing molecular dynamical properties.

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HIGH FLEXIBILITY OF DNA ON SHORT LENGTH SCALES PROBED BY ATOMIC FORCE MICROSCOPY

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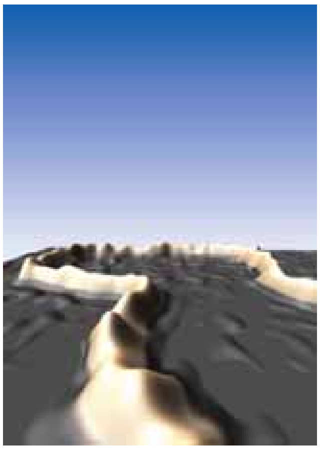
DNA bending on length scales of 5–100 nm plays a key role in many cellular processes [1]. The wormlike chain model (WLC) has come to dominate physical discussions of DNA mechanics [2]. We argue, however, that WLC's success depends on the long length scales probed by classic experiments such as force spectroscopy on single DNA molecules. Using high-resolution atomic force microscopy (AFM) on single DNA molecules of random sequence, we deduce the energy versus bending angle relationship appropriate for biologically relevant length scales (down to 5 nm). We formulate a very different, but equally simple, mathematical model of DNA mechanics that unlike WLC, simultaneously succeeds at describing all our AFM data across a wide range of length scales. Our measurements imply that the configurational free energy of highly bent DNA conformations, for example those observed in protein-DNA complexes, is significantly lower than predicted by harmonic elasticity models such as WLC [3].



Additional work, done on unusual but natural hyperperiodic DNA sequences, shows that sequence also plays a role in the mechanical properties of DNA. Hyperperiodic sequences from *C.elegans* adopt a more compact coil structure and, while their flexibility is retained, hyperperiodic DNA shows long-scale intrinsic bending[4]. It appears, therefore, that regions of the *C.elegans* genome display a significant correlation between DNA sequence and unusual mechanical properties.

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MAGNETISM IN GOLD NANOPARTICLES AND GOLD CLUSTERS: THE ROLE OF CHEMISORPTION AND SIZE

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Abstract

The understanding of the onset of magnetism in gold nanoparticles is of practical and theoretical importance. Bulk gold is diamagnetic but nanogold displays a rather complex magnetic behavior that is both size and shape-dependent. On the practical side, there is considerable interest in different therapies based on the use of gold nanoparticles where both magnetic and optical properties can be of importance in, for example, cancer treatment.

We present quantum mechanical calculations of the electronic structure and the magnetic properties of both bare and ligand-capped gold clusters. Our results indicate that the nature of the ligand, size and shape may strongly modify the magnetic behavior of nanogold. We also found, as size increases, the emergence of a core-shell structure, where the magnetism is essentially associated to the surface atoms whereas the core is diamagnetic. Both results are of importance in interpreting recent experimental work.

We also present a mean-field, semi-classical model, that takes into account the magnetic core-shell structure of gold nanoparticles, which we found in the quantum description, and incorporates it into a statistical model. The main result that emerges from this modeling is that the magnetic moment increases up to a maximum and then decreases as a function of size, a result that has also been observed experimentally.

INKJET PRINTING: A VIABLE TOOL FOR PROCESSING POLYMER CARBON NANOTUBE COMPOSITES

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Carbon nanotubes possess unique electrical and mechanical properties that make them desirable components in a range of potential applications.[1] However, their difficulty in processing represents one of the key challenges to researchers working in this area. Wet or solution based approaches for processing CNT involve two steps: dispersion of carbon nanotubes in common solvents using stabilizing agents, e.g. surfactants and polymers (Figure 1A-B).[2-6] This is followed by techniques such as drop casting, filtration or spray painting allowing for the fabrication of nanotube containing materials with enhanced electrical, mechanical or optical properties.[1]

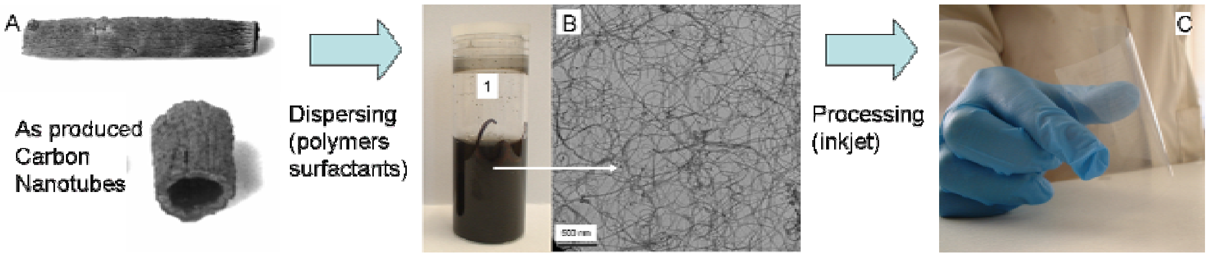

Figure 1. Access the properties of carbon nanotubes (CNT). (A) As-produced CNT material, (B) image of stable CNT dispersion, and transmission electron microscopy image, and (C) inkjet processing into transparent conducting thin film (see reference 9 for full details).

A new and exciting processing method is based on inkjet deposition of water based CNT inks. Recent developments include the deposition of conducting films from single-wall carbon nanotubes (SWNT) and functionalized multi-wall carbon nanotubes (MWNT), as well as deposition of transparent water sensitive SWNT and MWNT films (Figure 1C) [7-9].

In particular I will demonstrate that the unique combination of (conducting electroactive or natural) polymers with conducting carbon nanotubes has been proven to be an ideal formulation with all of the demanding characteristics needed for inkjet printing. These materials could be readily deposited onto a wide variety of substrates such as photo paper, PET, Pt-ITO and Au-PVDF. Several important characteristics, such as optical, electrical, and electrochromic behaviour will discussed in detail.

In conclusion, this presentation will discuss the development of inkjet printing as a viable tool for the fabrication of transparent conducting electroactive materials.[10]

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PHOTOLUMINESCENT DIAMOND NANOPARTICLES

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The Nitrogen-Vacancy [N-V] colour centre in diamond, consisting of a substitional Nitrogen atom associated to a Vacancy in an adjacent lattice site, has fascinating luminescence properties like its photostability at room temperature [1]. NV color centers can be efficiently produced by high-energy electron or ion irradiation of diamond crystallites followed by thermal annealing [2].

Nevertheless, strong limitation of defect photoemission in diamond arises from the high index of refraction of the bulk diamond material which makes difficult an efficient extraction of the photoluminescence. Refraction at the sample interface leads to a small collection solid angle, limited by total internal refraction, and to strong optical aberrations. An efficient way to circumvent these problems is to consider the emission of defects in diamond nanocrystals, which size is much smaller than the wavelength of the radiated light [3] (see figure-a). The sub-wavelength size of the nanocrystals renders refraction irrelevant and one can then simply assimilate the embedded color defects as point sources radiating in air.

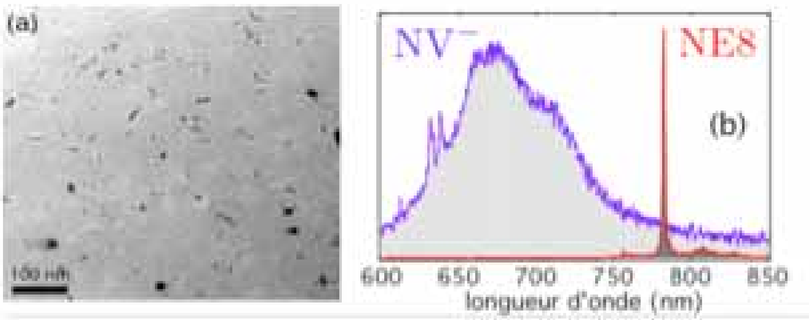

Figure : (a) TEM image of diamond nanocrystals dispersed on an electronic microscope grid (see Ref. [3]). Angular shape of most of the nanocrystals is due to crushing in the fabrication process leading to diamond powder suited for abrasive applications. Irradiation with an electron beam of the powder induces formation of N-V color centers in the nanocrystals. (b) Photoluminescence spectra of a single N-V color center and a single Nickel-related defect. The two spectra are recorded respectively with laser excitation at 532 nm and 687 nm wavelength (see Ref. [12]).

Photoluminescent nanodiamonds have a wide range of applications, going from quantum optics to biotechnology. At the single-emitter level which can be reached by appropriate irradiation dose, they are remarkable sources for producing single-photon light pulses on demand [4]. They have been used to implement single-photon quantum key distribution within realistic operating conditions [5] and to observe single-photon interference [6,7]. Diamond is also a biocompatible, non toxic and chemically inert material [8]. Since the surface of nanoscale diamond particles can be chemically functionalized with for instance carboxyl groups [9], luminescent nanodiamonds can be envisioned for targeted drug delivery in biotechnology.

The wide variety of color centers in diamond also offers an unique opportunity to optimize the photoluminescence properties [10]. Recently, Nickel-related point defects in diamond arose strong interest. These defects can be found in some natural type II-a diamonds and also in high-pressure high-temperature diamonds where Nickel is used as a solvent/catalyst for the crystal growth. Compared to the broadband NV colour centre emission (approximately 100 nm centered around 700 nm), the photoluminescence of individual Ni-related colour centre has several striking features [11,12]: a narrow band emission around 800 nm almost entirely concentrated in the zero-phonon line (ZPL), corresponding to a spectral width of the order of 1 nm (see figure-b); a nanosecond excited-level lifetime ; and a linearly polarized light emission. It was also shown that these color centers can be fabricated in a controlled way inside chemical vapor deposited (CVD) diamond thin films [13]. Such diamond defect control opens numerous possibilities and I will report the observation of individual Ni-related color centers in well isolated CVD-grown nanodiamonds.

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REVISITING CHARGE TRANSPORT AT THE MESOSCOPIC SCALE : *EMERGING QUANTUM PHENOMENA IN THE LIGHT OF ADVANCED COMPUTATIONAL APPROACHES*

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In this contribution, we theoretically investigate in-depth the quantum transport properties of two fundamental quasi-1D objects of modern nanoscience and nanotechnologies, namely the carbon nanotubes [1] and the Silicon-based semiconducting nanowires.

In the first part, quantum transport phenomena in chemically doped carbon nanotubes is presented [2], exploring for the first time the transition from weak to strong localization regime at a quantitative level, for a realistic modeling of low dimensional systems. The extraction of transport length scales such as elastic mean free path and localization lengths are efficiently achieved by a computational strategy based on both the Kubo and the Landauer-Buttiker transport formalisms. The fundamental Thouless relationship between both quantities is shown to be well reproduced. Differently, the analysis of surface roughness in semiconducting nanowires evidences the limitations of conventional semi-classical 'effective mass"-based transport approaches [3]. The charge mobility of rough silicon nanowires are quantitatively evaluated, while the limitations of the Thouless relationship are discussed.

The second part of the talk focuses on the effects of electron-(optic) phonon interaction on transport through metallic carbon nanotubes. By using a full quantum description of the joined processes of tunneling and phonon-assisted transport, the interaction between electrons and optical phonons is shown to result in *nonequilibrium energy-gaps* opening at half the phonon energy above (below) the charge neutrality point, owing to phonon emission (absorption) [4].

As a result, an onset of current saturation develops as soon as incoming electrons in the nanotubes gain sufficient kinetic energy to explore the electron-phonon Fock space. This novel inelastic backscattering mechanism yields a novel explanation of the high-bias current saturation, beyond typical semiclassical arguments based on the application of the Fermi golden rule approximation. In the case of semiconducting nanotubes, similar inelastic backscattering phenomena take place, but become strongly diameter-dependent [4].

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MAGNETIC RESONANCE FORCE MICROSCOPY: THE QUEST FOR A MOLECULAR STRUCTURE MICROSCOPE

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Is it possible to build a microscope that can look below surfaces and image molecules and materials with atomic resolution in three dimensions? Magnetic resonance force microscopy (MRFM) is an attempt to address this ambitious goal. We describe the basic principles of MRFM, with an emphasis on the detection of small ensembles of nuclear spins. As part of this work, we have developed magnetic tips that produce field gradients in excess of 1.4 million tesla per meter (14 gauss per nanometer), developed improved methods for manipulating nuclear spins and implemented a method of mitigating spin noise in statistically polarized spin ensembles. Prospects and challenges of extending MRFM to single nuclear spins will also be discussed.

PREDICTING THE PROPERTIES OF NEW OXIDES FOR NANO-DEVICES

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As microelectronics tends towards nanoelectronics, new materials issues affect device performance. Current transistor dimensions already fall below 40 nm and a CMOS transistor with a mere 6 nm channel length has been demonstrated. The sub 10 nm length scale creates new materials challenges for which modelling of materials, interfaces, dopants, and defects will be crucial to process design and device performance enhancement. The integrated circuit components will soon comprise tens of thousands of atoms or less, so approaching molecular scales. Therefore developing accurate and efficient theoretical tools and models is vital for defect metrology of these complex systems.

To cope with some of these issues, during the last several years the microelectronics has undergone the most significant materials revolution in 40 years by changing gate oxide from silicon oxide to a much more complex materials combination, including a stack of thin layers of oxides with a higher dielectric constant than SiO_2 (high-k oxides), e.g. HfO_2 and Hf silicates. Recent advances in film deposition techniques dramatically improved quality of hafnia films grown on silicon as well as quality of interfaces with both silicon substrate and metal gate. However, the performance of prototype high-k transistors is still affected by large concentrations of various defects. Oxygen vacancies and interstitial ions as well as other defects in HfO_2 and SiO_2 films and at $HfO_2/SiO_2/Si$ interface are often implicated in causing problems.

We will discuss challenges faced by defect detection and metrology, which are common to all nano-devices, and will present the results of calculations of the electronic structure and spectroscopic properties of oxygen vacancies in different charge states in the monoclinic phase of HfO_2, in amorphous SiO_2 and at the $HfO_2/SiO_2/Si$ interface. Our calculations predict the existence of five charge states of the vacancy and position the corresponding energy levels in the band gap. We have calculated the optical transition energies as well as optical and thermal ionization energies for all vacancy charge states and g-tensor for ESR active states. We will discuss the relation of the calculated properties to the experimental results on spectroscopic ellipsometry, ESR and electrical stress measurements.

All simple models indicate that materials with high dielectric constants are likely to show significant *polaron* effects, however, both experimental and theoretical proof of polaron self-trapping remains extremely challenging. We shall illustrate some of the wealth of such behavior in m-HfO_2 and closely-related systems. The examples will include negatively charged oxygen vacancy in m-HfO_2 and electron and hole self-trapping in the perfect m-HfO_2 lattice. We predict the existence of both hole and electron small polarons in m-HfO_2. Holes can self-trap on a single oxygen atom in HfO_2, and electrons can self-trap on three Hf ions sharing an oxygen atom. Our results suggest that both hole and electron polarons in m-HfO_2 could be observed as stable immobile defects at low temperatures and should remain localized and exhibit hopping mobility at relatively high temperatures. Therefore the hole and electron conductivity of pure m-HfO_2 samples should exhibit characteristic temperature dependence.

We will then turn to modeling $HfO_2/SiO_2/Si$ interfaces and predicting defect types at the interfaces and in thin SiO_2 layers. We will discuss the interface structure and the band alignment in this system, some effects of HfO_2 amorphization and electrical properties of defects located in various regions of the interface. Our results demonstrate the importance of interfaces in determining the properties of these nano-scale layered systems.

THE PUZZLING BEHAVIOR OF LIQUID WATER: SOME CLUES FROM THE NANOSCALE

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23 July 2007 — marques.tex

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Abstract

Despite decades of research water's puzzling properties are not understood and 63 anomalies that distinguish water from other liquids remain unsolved. We introduce some of these unsolved mysteries, and demonstrate recent progress in solving them. We present recent evidence from experiments and computer simulations on bulk and on nanoconfined water supporting the hypothesis that water displays a special transition point (which is not unlike the "tipping point" immortalized by Malcolm Gladwell). The general idea is that when the liquid is near this "tipping point," it suddenly separates into two distinct liquid phases. This concept of a new critical point is finding application to other liquids as well as water, such as silicon and silica. We also discuss related puzzles, such as the mysterious behavior of water near a protein.

BALLISTIC TO DIFFUSIVE CROSSOVER IN THE SLIDING OF KICKED CLUSTERS

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Some deposited metal clusters deposited on particularly smooth surfaces -- in particular Au/graphite -- are known, despite a size of as many as 100-1000 atoms, to diffuse thermally as rigid bodies. That free cluster diffusion has been well understood and also reproduced by molecular dynamics (MD) simulations. However, no work has been devoted yet to the interesting possibility that these clusters could be pushed around, either inertially as in a quartz crystal microbalance (QCM)experimental setup, or even laterally kicked by e.g., a fast moving tip. when forced to slide over the substrate the clusters will cause a friction, which can be characterized by a velocity and temperature dependent slip time \tau. Under the hypothesis of viscous friction, the slip time in principle measures at each temperature T the exponential decay time of the initially imparted velocity v. In this work we will present theoretical arguments and MD simulations demonstrating two very different regimes in the sliding of a cluster. At sufficiently low velocities, such as those attained in a QCM, the clusters will drift diffusively. In this regime and within linear response the drift mobility -- and thus the slip time -- is simply proportional to the two-dimensional diffusion coefficient D through Einstein's relation. Since, as is generally the case, D is thermally activated and exponentially increasing with T, so will the slip time.[1] At the opposite limit of a strongly kicked cluster and for sufficiently high lateral kick velocities, the diffusive picture no longer applies and the cluster sliding will turn ballistic. In that regime friction should arise primarily from collisions of the cluster contact surface against the thermally excited vibrational rugosity of the substrate. Since the high temperature instantaneous surface square vibration amplitude increases roughly linearly with T, the ballistic slip time of sliding clusters is predicted to drop as 1/T. We will present MD simulations of Au clusters on graphite demonstrating this behavior for large velocities around 100 m/s, and also demonstrate a very gradual ballistic-diffusive crossover for lower velocities.

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NANO-ANTENNAS - TOOLS FOR LIGHT ON THE NANOSCALE

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“NanoPhotonics” is a young and active direction in the science of light, with the goal to control the generation, confinement and flow of light energy on the nanometerscale, i.e. far below the wavelength of light, for applications in high resolution optical imaging, nanosensing, nanolasing, super-compact photonic circuitry, ultra-sensitive biochemical analysis, data storage and quantum information. First, I will shortly present an overview of the key elements that facilitate nanoscale optics and particularly show examples of recent achievements, relevant methods and applications.

We present the optical monopole antenna, a novel nano-antenna positioned at the end of a metal-coated glass fiber near-field probe. Antenna resonances, excitation conditions and field localization are directly probed in the near field by single fluorescent molecules and compared to finite integration technique simulations. It is shown that the antenna is indeed equivalent to its radio frequency analogue, the monopole antenna. For the right antenna length and local excitation conditions, antenna resonances occur that lead to an enhanced localized field near the antenna apex. Direct mapping of this field with single fluorescent molecules reveals a spatial localization of 25 nm, demonstrating the importance of such antennas for nanometer resolution optical microscopy. [1, 2]

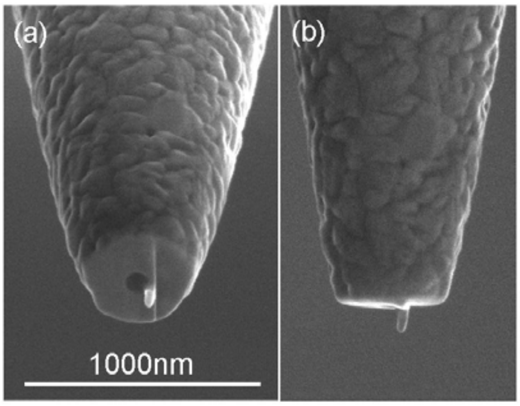

Figure.
An optical monopole antenna
(a) viewed from a 52° angle
(b) side view.

At radio frequencies metallic antennas are employed to control the emission and reception of radiation. At optical energies, where electronic transitions take place, antennas have been recently demonstrated to strongly modify the emitter excitation and lifetime. However, the main function of traditional antennas, the direction of radiation, has hardly been explored. Here we demonstrate experimentally that the angular emission of a single photon can be controlled by an optical antenna. A single fluorescent molecule is coupled to the optical monopole antenna by precisely manipulating its position. We give a simple, yet powerful, interpretation for the resulting emission; the antenna mode determines the emission. Such control of angular emission is important for all light emitting devices, including single photon sources for quantum information, light detection and harvesting. [3]

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Acknowledgements

It is nice to give a keynote lecture but I really like to thank particularly my colleagues: Tim Taminiau and Fernando Stefani at ICFO for the major experimental and conceptual advances made throughout this Nano-antenna project; Frans Segerink at MESA+ Institute for NanoTechnology in Enschede, the Netherlands, for dedicated FIB milling actions. This work benefits from support by the Specific Target Research Project ASPRINT (NMP-CT-2003-001601) in the FP6 of the European Community, and the European Science prize of the Koerber foundation. Finally it should be mentioned that the novel Spanish Consolider-Ingenio program *NanoLight.es* targets several of the subjects sketched above.

Keynote

Participation cancelled

Title not available

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ABSTRACT NOT AVAILABLE

MAKING LASERS FROM DUST:
THE PHYSICS AND APPLICATIONS OF RANDOM LASERS

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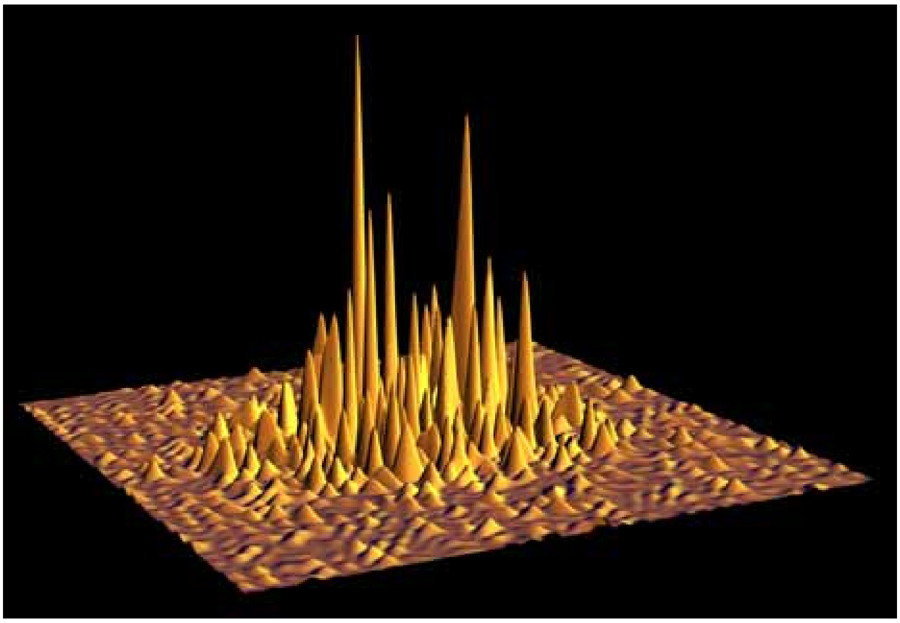

The transport of light in complex dielectric structures, ranging from photonic crystals to disordered dielectrics, exhibits a fascinating and sometimes unexpected behaviour. Disordered systems come in many forms like colloidal suspensions and various powders. In these materials, light waves follow a diffusive type of propagation in analogy to the diffusion of electrons in a resistor. Interference effects can survive this diffusive propagation, giving rise to, only recently observed, interference phenomena like weak and strong (Anderson) localization. If optical gain is added to a random material, a unique light source can be obtained called a random laser. Such random laser sources combine the emission properties of a regular light bulb with that of a normal laser and use multiple scattering of light to reach a laser threshold. A random laser can be realized in practice by grinding a laser crystal into a fine powder.

In this seminar we will give an overview of the recent developments in this rapidly growing field of research. In particular, we will discuss the possibility of observing coherent effects from random laser sources and make the connection between interference effects, like Anderson localization, and random lasing. Also we will discuss possible applications of random laser materials obtained by infiltrating a liquid crystal – laser dye solution into porous random systems and by synthesis of optically active polymer dispersed liquid crystals. In the latter case we observe that, due to extremely anisotropic light transport, a fascinating anomalous transport regime can be reached for light waves.

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NANOFABRICATION OF INORGANIC FUNCTIONAL STRUCTURES BY PROTEIN SUPRAMOELCUELS WET-NANOTECHNOLOGY

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Introduction

The assessment of the proteins from the nanotechnology and nano-electronics points of view reveals that proteins are ideal nano-blocks for fabricating inorganic functional nano-structures. First, most of protein molecules have the same structure down to atomic scale. Secondly, they can self-assemble to form functional nano-structures. Thirdly, some protein has the surface so designed to selectively sequester inorganic materials (biomineralization) and recent research made it possible to biomineralize metal complexes and semiconductor materials. Lastly proteins are vulnerable compared to the inorganic material which makes it possible to eliminate protein portion of the complex of protein and inorganic material.

Taking advantages of these four characteristics, I proposed making inorganic nanostructures by proteins, the Bio Nano Process (BNP) (1). Namely, utilizing the protein cavity as a spatially restricted biomineralization space, nanoparticle (NP) or nanowire (NW) with identical size is produced and proteins accommodating NP/NW self-assemble into hetero nanostructure of protein with NP/NW on the silicon substrate. After selective elimination of protein portion of the hetero nanostructures, nanometric inorganic structures will be obtained. The appropriate designing of this process can produce inorganic structures with nanometric accuracy. To consolidate the foundation of the BNP, basic research has been conducted.

Biomineralization and nanostructure fabrication

We employed cage-shaped protein, apoferritin to synthesize several kinds of NPs. The structure of apoferritin was solved by X-ray crystallography (Fig. 1) The protein shell is composed of 24 subunits and the outer and inner diameters are 12 nm and 7 nm, respectively. There are narrow hydrophilic and hydrophobic channels connecting the outside and inner cavity. We have successfully introduced source ions through the hydrophilic channels and synthesized Fe-, Ni- and Cr-hydroxide, In-oxide, Co_3O_4, CdSe, CdS, ZnSe, ZnS, Au_2S and several other compound semiconductors (for example see reference 2,3). Fig. 2 shows aurothioglucose-stained TEM images of synthesized CdSe NPs (4).

To use NPs as nanoelectric device components, the placement of NPs was controlled. Genetically modifying the outer surface of apoferritin with short peptides with specific affinity to the carbonaceous surface, we have succeeded to control the protein-protein and protein-substrate interactions so that apoferritin self-assemble into hexagonally close-packed array directly on silicon substrate (Fig. 3). We also demonstrated that mutant ferritin with target specific peptides can be selectively placed on the patterned area (5). Another method which utilizes electrostatic interaction with nanometeric accuracy was developed to place single ferritin onto the positively charged disk (ϕ15nm) made on the Si substrate (6).

The protein portion of ferritin molecule or array was proven to be selectively eliminated by heat- or UV/Ozone-treatment (7). The elimination was confirmed by AFM, FTIR and XPS. The position of the NPs without protein shell observed before and after heat-treatment using high resolution SEM indicated that their positions did not change throughout the heat-treatment and there were no aggregations of NPs.

Making Floating Nanodot-Gate Memory (FNGM) Using Apoferritin

A monolayer of Co-NPs was made on the 3 nm tunnel SiO_2 layer just above the MOSFET n-channel by apoferritin. The protein shell was eliminated and Co-NP array was embedded in the control SiO_2 layer (FNGM, Fig. 4). The high density monolayer of Co-NPs functioned as floating nanodot gate electrode and the I_D-V_G curves (Drain current – Gate voltage) measured with sweeping gate voltage ±10V, showed a clear hysteresis (8). (Fig. 5). With the narrow gate voltage sweep, the intact MOS I_D-V_G curve was obtained. The hysteresis showed the bi-directional shift of I_D-V_G curve which indicated the electron and hole charging to the embedded Co-NPs. Charge retention characteristic of Co-NPs embedded MOSFET retained good memory window width after 10^4 sec. The endurance of the FNGM up to 10^5 times was confirmed. This result was the same with the Fe-NP embedded FNGM.

Conclusion

We experimentally demonstrated that proteins can make functional inorganic nanostructures in the semiconductor device for the first time through the FNGM prototype production. (8). In the next stage, the BNP will introduce artificial protein and chemical modification of bio-molecules to expand the range of production. As the first try, we are now designing and making large-scale artificial protein supra molecules which will be the template for the fabrication of nanoelectric devices (9). The BNP proposed by our group will open up a new biological path to the fabrication of nano-chips.

This work is partially supported by MEXT Leading project.

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Figures:

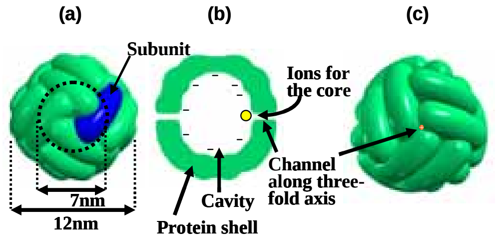

Fig.1 Schematic drawings of apoferritin molecule, (a) looking down along four fold axis (b) cross-section of apoferritin (c) looking down along three fold axis.

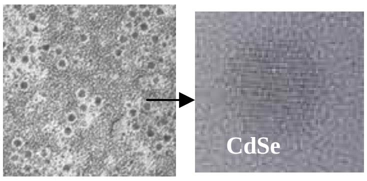

Fig.2 TEM images of CdSe NPs synthesized in the apoferritin cavity. The sample was negatively stained by aurothioglucose which does not stain the cavity.

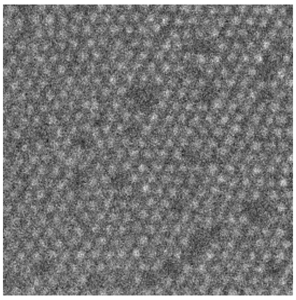

Fig.3 2D hexagonally close packed array of mutant ferritin with NP core directly formed on the Si substrate.

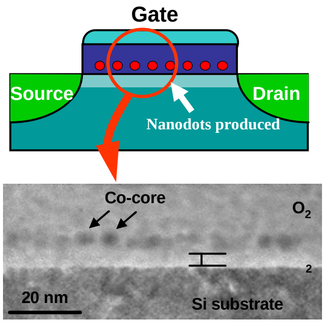

Fig.4 Schematic drawing of cross-section of bio-nanocore embedded n-channel FNGM and the real cross-sectional TEM image.

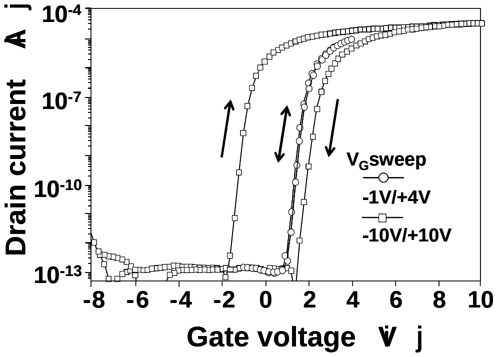

Fig.5 I_D-V_G characteristics of FNGM with the embedded Co-NPs which were synthesized and arrayed by apoferritins.

NANOSPINTRONICS MEETS RELATIVISTIC QUANTUM PHYSICS: UBIQUITY OF *ZITTERBEWEGUNG* EFFECTS

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Zitterbewegung (German for *trembling motion*) is a highly oscillatory component in the orbital motion of free electrons in vacuum, which is commonly considered to be a quirk of the very successful Dirac theory of relativistic electron dynamics. Its physical significance has been discussed controversially over the years. Suggestions [1-3] for a possibly observable *Zitterbewegung*-like dynamics of band electrons in solids have lifted this discussion onto a new level. Motivated by this recent interest in the subject, we have analysed theoretically the orbital motion of electrons in coupled bands for a variety of solid-state situations and find that all exhibit remarkable analogies with the *Zitterbewegung* of relativistic quantum mechanics [4]. It turns out to be a universal feature of *Zitterbewegung*-like dynamics that the spin degree of freedom performs an oscillatory motion, too. An example is the well-known and experimentally observable [5,6] spin precession of electrons in asymmetric 2D semiconductor heterostructures. We find that the oscillatory orbital motion is intrinsically linked with spin precession in all models studied. The relation of *Zitterbewegung* phenomena to novel spin-transport effects such as spin-dependent magnetic focusing [7,8] will also be discussed.

This work was performed in collaboration with R. Winkler (Northern Illinois University & Argonne National Laboratory, USA) and J. Bolte (Universität Ulm, Germany).

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TNT2007
Trends in NanoTechnology
San Sebastian (Spain)

ORAL CONTRIBUTIONS

(Plenary Session)

(Only those abstracts received before August 18, 2007 will be included in the abstracts' booklet)

BORON NITRIDE NANOMESH: FUNCTIONALITY FROM A CORRUGATED MONOLAYER

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The decomposition of borazine $(HBNH)_3$ precursor molecules on the hot rhodium (111) surface leads to the spontaneous formation of a highly regular hexagonal structure with a periodicity of 3.2 nm and with the appearance of a mesh with pores of about 2 nm in diameter: the so-called nanomesh [1]. This nanomesh is identified as a single, complete monolayer [2,3]. The 2 nm sized pores are formed by regions where the layer binds strongly to the underlying metal, while the regular network of mesh wires represents regions where the layer is not bonded to the substrate, resulting in a corrugation of about 0.5Å in the layer [2]. The nanomesh exhibits a remarkable thermal stability and chemical inertness: it is robust against immersion in water and electrolyte solution [3]. Moreover, it shows the functionality of a regular array of trapping potentials as it is demonstrated by the stable and site selective adsorption of different kinds of planar molecules as observed in scanning tunneling microscopy and ultraviolet photoelectron spectroscopy [3]. Depending on the size of the molecules and the molecular coverage, individual molecules or molecular assemblies are trapped in the pores.

Naphthalocyanine (Nc) molecules were vapor-deposited onto the nanomesh kept at room temperature. These planar molecules have a conjugated pi-electron system and their diameter of about 2 nm is comparable to the nanomesh pore size. The Nc molecules form a well-ordered array with the periodicity of the nanomesh pores (3.22 nm) as observed in STM images (Fig. 1A). High-resolution images reveal that individual Nc molecules are trapped inside the pores, indicating a highly site-selective adsorption. Increasing molecular coverage leads to the continuous filling of all the nanomesh pores. Molecule-substrate interactions are therefore dominating the adsorption behavior and intermolecular interactions are weak. This behavior is in contrast to Nc on flat graphite layers where the structure formation within the molecular layer is dominated by intermolecular interactions. A completely different pattern (almost quadratic) is observed in that case, with a much smaller periodicity of 1.7 nm [4]. Thus, the Nc molecules form an array of equally spaced and well-separated indvidual molecules on the nanomesh [3].

The selective adsorption into the pores is also reflected in the normal emission UPS spectra (Fig. 1B). The spectrum of the clean *h*-BN layer on Rh(111) shows the appearance of two pairs of BN-related peaks and indicates the presence of two species of *h*-BN that have their binding energies for the σ and π band shifted by about 1 eV. Adsorption of the molecules on the nanomesh leads to an attenuation of the intensity of the σ_β component, whereas the other one (σ_α) remains unchanged for coverages up to one monolayer [5] (Fig. 1B). The σ_β component is associated to the nanomesh pores and the selective attenuation thus represents the trapping of the Nc molecules in the pores. Further increasing the coverage leads also to attenuation of the σ_α component that is related to the mesh wires.

In summary, the nanomesh paves the way for applications as a template for the growth of ordered nanostructures, based on methods that rely on ultrahigh vacuum deposition techniques as well as on deposition from aqueous solutions.

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Figures:

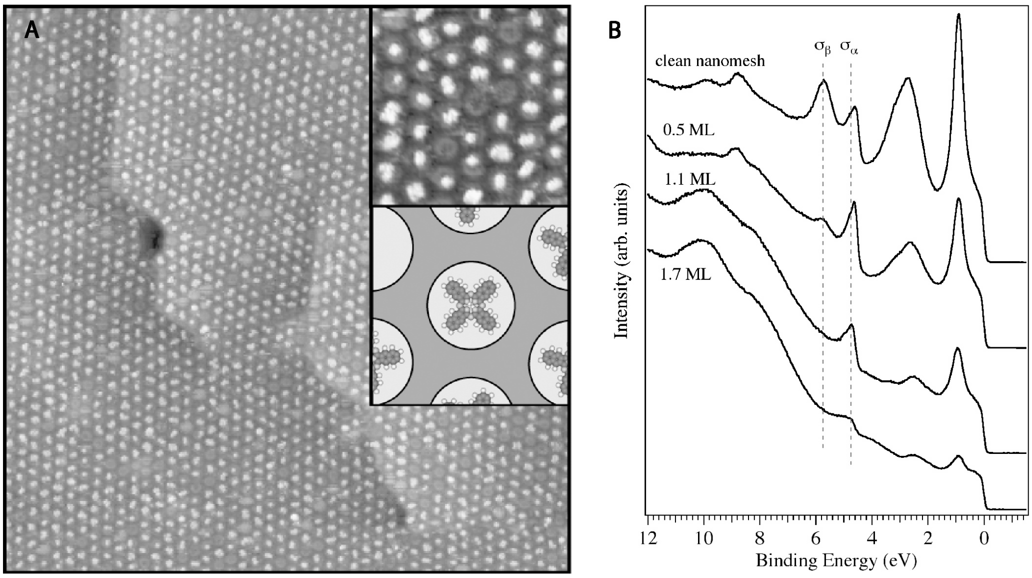

Figure 1: *Site-selective adsorption of naphthalocyanine ($C_{48}H_{26}N_8$) molecules in the nanomesh pores. A) STM image (120 nm x 120 nm, I = 0.3 nA, U = 1.3 V) showing a nearly complete monolayer [5] of Nc molecules on the nanomesh. The inset on the top right shows an enlargement (19 nm x 19 nm) and gives a high-resolution view that shows the trapping of the Nc molecules inside the nanomesh pores. The inset on the right shows a schematic representation of the molecular structure of naphthalocyanine (Nc) plotted on top of a nanomesh pore. B) Normal emission UPS spectra for increasing Nc coverage on the nanomesh. The site-selective adsorption of the Nc is reflected in the selective attenuation up to the first monolayer [5] of the σ_β component that is associated with the nanomesh pores. Further increasing the coverage leads also to attenuation of the σ_α component that is related to the mesh wires.*

TUNING THE CONDUCTANCE OF A MOLECULAR SWITCH

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One key element to realize nanoscale electronics is the ability to manipulate in a controlled way the conductance of single molecules. Azobenzene, which undergoes a trans-cis isomerization transition upon irradiation, offers the possibility to realize a conformational, light-driven molecular switch. It is thus crucial to clarify the electrical transport characteristics of this molecule. Here, we investigate theoretically charge transport in a system consisting of carbon nanotubes (CNTs) acting as electrodes which are bridged by cis/trans azobenzene. In clear contrast to Au-electrodes, CNTs can act as true nanoscale electrodes, inducing a strong chirality-dependent renormalization of electronic states near the Fermi level. The low energy conduction properties may thus be dramatically modified by changing the molecule-CNT contact topology and/or the tubes chirality. We propose some possible experimental ways to realize a controlled electrical switching with CNT electrodes.

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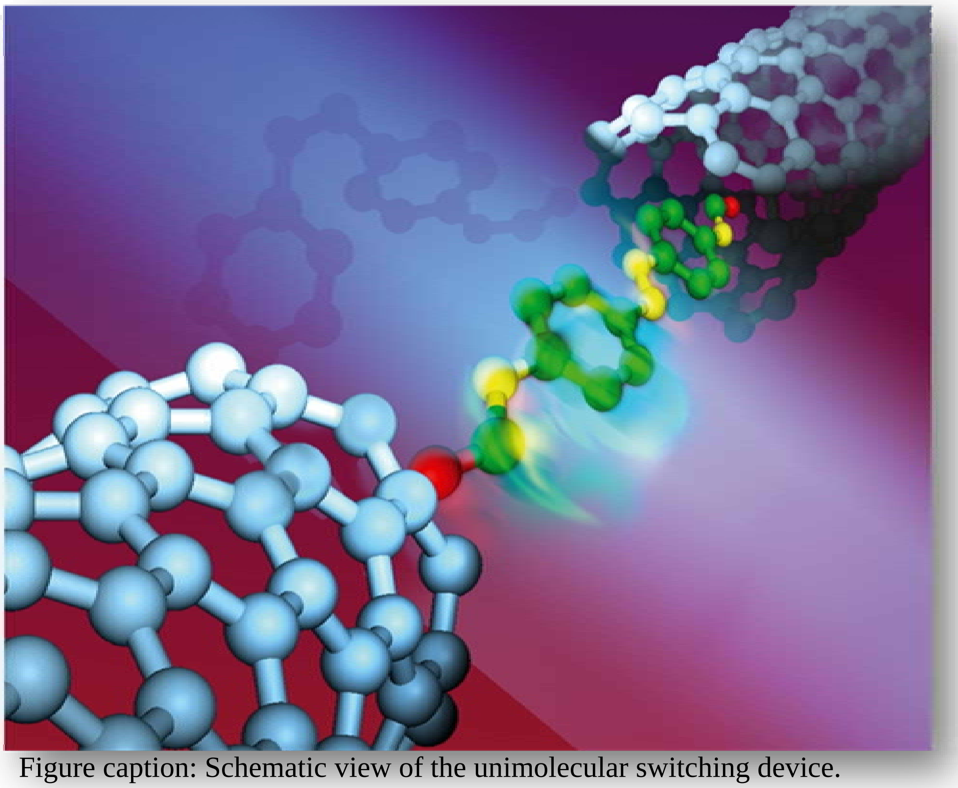

Figure caption: Schematic view of the unimolecular switching device.

NUCLEAR SPIN DETECTION ENABLED BY ULTRA-SENSITIVE CANTILEVERS

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Force sensors that can achieve attonewton force resolution are key for a number of applications. For magnetic resonance force microscopy (MRFM), we use ultra-sensitive cantilevers to detect magnetic resonance in small ensembles of nuclear spins, measured through the magnetic force between them and a nearby nanoscale ferromagnetic tip [1]. Scaling down the technique to the level of single nuclear spins would enable 3D-magnetic resonance imaging with atomic resolution, with revolutionary impact for structure determination in molecular biology. Reaching this goal, however, crucially depends on our ability to further enhance the force sensitivity and to understand and control the behavior of the nuclear spins. In this contribution, we focus on our recent progress in using ultra-sensitive cantilevers for real-time tracking and control of nuclear spin fluctuations [2]. We discuss the role of statistics in estimating the number of spins from the fluctuating magnetization, and show that our estimation can be much improved by rapidly randomizing the spins using RF pulses. We also consider the issue of energy dissipation occurring mutually between spins and cantilever. Finally, we discuss a possible alternative path using ultra-small cantilevers for high-frequency (1 MHz) detection of nuclear spin precession (Fig. 1).

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Figures:

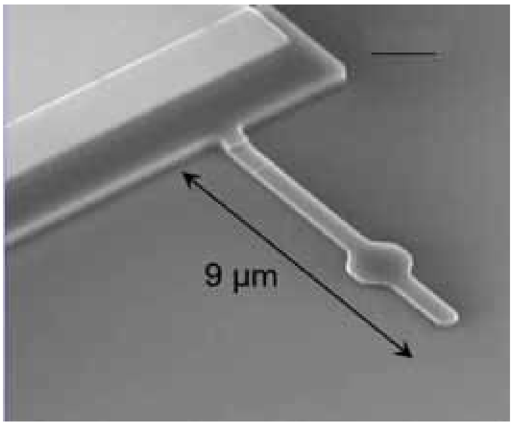

Fig. 1: Ultrasmall cantilever (340 kHz resonance frequency, 2.6 mN/m spring constant) for high-frequency detection of nuclear spin precession.

PROBING REACTION DYNAMICS AT METAL SURFACES WITH H_2 DIFFRACTION

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Studies of elementary collision processes of H_2 with metal surfaces can provide benchmark tests[1] of theoretical methods that are increasingly used to aid the design of new heterogeneous catalysts. Molecular beam and associative desorption experiments have been carried out to understand the main factors that govern H_2 dissociation at the surface. In addition, vibrationally inelastic and rotationally inelastic scattering experiments have provided useful information on how certain features of the potential energy surface (PES) control the experimental observations.

A different point of view is provided by diffraction experiments. H_2 diffraction from metal surfaces is more complex than He diffraction, since the PES is six-dimensional and the coupling with the dissociative adsorption channels comes into play[2]. Thus, H_2 diffraction is a very a promising technique to gauge the molecule-surface PES and dynamics. We have recently shown that this is possible by performing H_2 diffraction experiments on reactive Pd(111) and non reactive NiAl(110) surfaces at 70-150 meV. By comparing with six-dimensional quantum dynamics and classical trajectory calculations we showed for the first time that accurate diffraction patterns can be obtained from state-of-the-art PES based on density functional theory[3]. Once the PESs are validated, they can be used to study in detail the relationship between the trajectories followed by the H_2 molecules and the different channels involved in reactivity, like direct dissociation and dynamic trapping.

Finally, I will address the problem of the validity of the Born-Oppenheimer approximation for molecule-metal surface reactions, which has been recently questioned due to the possibility of electron-hole pair excitations[4]. We have performed experiments and six-dimensional quantum dynamics calculations on the scattering of molecular hydrogen from Pt(111), obtaining absolute diffraction probabilities. The comparison for in-plane and out-of-plane scattering, and results for dissociative chemisorption in the same system, show that for hydrogen-metal systems, reaction and diffractive scattering can be accurately described using the Born-Oppenheimer approximation[5].

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METALLIC NANOWIRES: WHEN IS AN ALLOY NOT AN ALLOY ?

Douglas S. Galvão[1], *Jefferson Bettini*[2], *Fernando Sato*[1], *Pablo Z. Coura*[3],
Socrates O. Dantas[3], *and Daniel Ugarte*[1,2]

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In recent years a large amount of theoretical and experimental work has been carried out on the subject of atomic-size pure metal nanowires (NWs) generated by mechanical stretching. However, it is essential to extend these studies to metal alloy NWs in order to gather information on the mechanical and electrical properties of alloy nanosystems. At the moment rather limited results have been obtained for these structures. In this work we present results for Nws obtained from Au-Ag alloys.

NWs were produced *in situ* in the HRTEM (JEM-3010 URP 300 kV, 0.17 nm point resolution) using the methodology proposed by Kondo and Takayanagi. The Au-Ag alloy thin films (10-30 nm in thickness) were prepared by thermal co-evaporation of both metals in a standard vacuum evaporator (10^{-7} mbar). A quartz crystal monitor was used to set the evaporation rate of each metal source and, subsequently, to measure the equivalent thickness of the alloy films.

In order to obtain more insights about the atomistic aspects associated with the structural evolution of metal alloy NWs, we have also carried out tight-binding molecular dynamics simulations using second-moment approximation (TB-SMA). This methodology has recently proved to be very efficient to study NWs.

In general terms our studies of metal alloy NWs revealed that, unlike pure metals, structural defects (mainly twins and stacking faults) are sometimes present at the apexes and very close to the narrowest wire constriction, or even in the NW themselves. Similarly to pure NWs we have observed the occurrence of linear atomic suspended chains (LACs) (Figs. 1 and 2). These are the first experimental evidences that LAC formation is possible from metallic alloys [1]. HRTEM data analysis suggests that these atomic chains are composed of atoms of different types (Au and Ag). Molecular dynamics simulations also present these configurations.

Another interesting aspect inferred from experiments and simulations is that the atomic-size Au-Ag alloy NWs exhibit a spontaneous gold enrichment of the nanojunction region during the wire thinning process. This leads to a dominant gold-like behavior, even for alloys with minor gold content. This can allow the spontaneous generation of organized Ag core-Au shell structured nanowires or even, in some cases, pure Ag surface enclosing a gold mono-atomic wire (Fig. 3). These phenomena open new opportunities to control the stability or length of the atomic chains by a suitable alloy composition.

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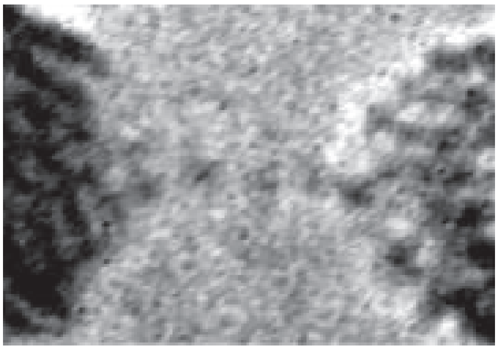
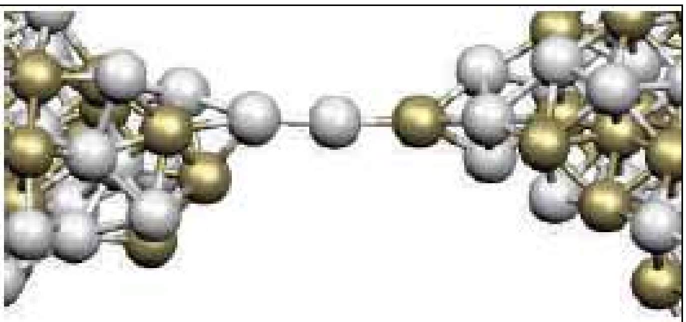
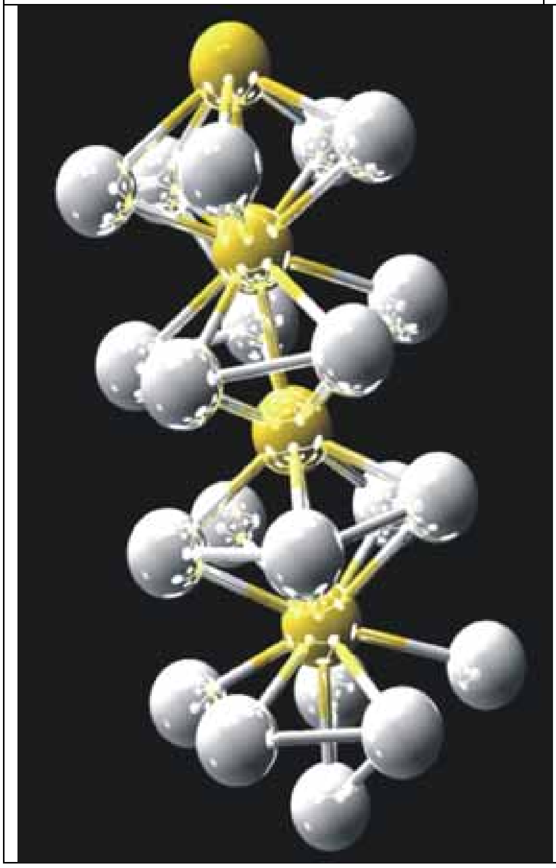
Figures:

 **Figure** 1 - Atom-resolved HRTEM snapshots of suspended atomic chains composed of gold and silver atoms.	 **Figure 2** - Snapshots from molecular dynamics simulations showing suspended atomic chains composed of gold and silver atoms.
	**Figure 3** - Snapshots from molecular dynamics simulations showing the existence of a 'core-shell' structure composed of an inner gold wire enclosed by an Ag layer.

Work supported in part by the Brazilian Agencies FAPESP, CNPq, and CAPES.

ADATOM-ADATOM INTERACTION MEDIATED BY AN UNDERLYING SURFACE PHASE TRANSITION

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Substrate-mediated interactions between adsorbed atoms play a key role in determining the static and dynamic properties of surfaces. Understanding these interactions is of high interest in a large variety of fundamental and technological problems ranging from epitaxial growth to heterogeneous catalysis. These interactions have been usually associated to the adatom coupling with the substrate elastic or electronic degrees of freedom. The coupling with the additional degrees of freedom behind a phase transition in the substrate could provide a new significant contribution to the adatom-adatom interaction. In this work [1] we present experimental and theoretical results showing the existence of such an interaction between adatoms mediated by an underlying surface phase transition. The interaction results from the system softening at wavevectors close to those associated with the corresponding order parameter of the transition, i.e., via the corresponding “soft-phonon”.

By means of variable temperature scanning tunneling microscopy (VT-STM) we have analyzed the adsorption and diffusion of additional Pb adatoms on Si(111)-($\sqrt{3}$x$\sqrt{3}$)R30º-Pb surfaces at temperatures well below room temperature but above the critical temperature ($T_c \sim$ 86 K) [2] of the ($\sqrt{3}$x$\sqrt{3}$)R30º-Pb ↔ (3x3)-Pb phase transition. These VT-STM results have allowed to reveal the vertical displacement patterns induced on the substrate by the adsorption of single Pb adatoms (see Fig. 1). Our theoretical analysis of the displacement patterns on the Pb/Si(111) surface –based on a phenomenological Landau-type approach- shows that the main contribution comes from the “soft-phonon” [3,4] of the phase transition. Moreover, we show that, indeed, a novel non monotonic adatom-adatom interaction mediated by the underlying phase transition can be detected in the present case by comparing thorough quantitative STM measurements of the pair interactions between the additional Pb adatoms with theoretical interaction maps based on the “soft-phonon” contribution. This interaction differs from all other previously discussed in being a temperature dependent “tunable” interaction: the closer the transition is, the more important the interaction should become.

Our prediction that this new “soft-phonon” contribution to the adatom-adatom interaction should be the leading term, overwhelming any other, at temperatures very close to the transition represents an exciting challenge for further experimental research of adatom-adatom interactions on other surfaces undergoing structural phase transitions.

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Figures:

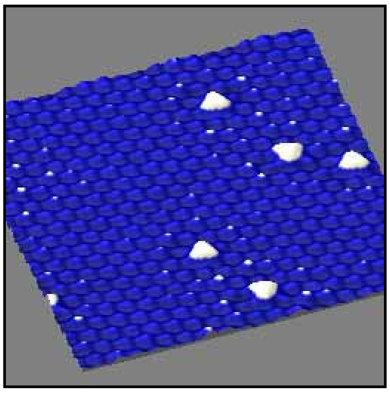

Figure 1: 12x12 nm^2 STM image measured at 140 K showing additional single Pb adatoms (triangular features) adsorbed on a Si(111)-(√3x√3)R30º-Pb surface. It can be observed the substrate perturbation induced on the substrate around each additional single adatom [1]. Tunnel parameters:-0.5 V, 0.1 nA.

QUANTUM DOT ATTACHMENT AND MORPHOLOGY CONTROL BY CARBON NANOTUBES

Beatriz H. Juárez[‡], Christian Klinke[‡], Mona Nagel[‡], Andreas Kornowski[‡], A. B. Hungría[‡‡],
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Novel applications in nanotechnology rely on the design of tailored nano-architectures. For this purpose, carbon nanotubes (CNTs) and nanoparticles (NPs) are intensively investigated. Metallic particles can serve as catalysts to create branches on CNTs[1], while semiconducting NPs (or so called quantum dots) can act as light absorbing sites to increase the photoconductivity of CNTs. [2] In previous studies, semiconductor NPs have been grown on CNTs by generation of defects in the CNT lattice by means of covalent functionalisation.[3] This treatment modifies the response of the CNTs in terms of conductivity, optical behaviour, and mechanical stability, a disadvantage for further applications. Other strategies consist in an adsorption of surface active molecules[4,5] or the insertion of some NPs into bundles of CNT.[6]

Here, we present a novel approach in which semiconductor NPs can be specifically attached to non-functionalised and non-pretreated CNTs at a very high degree of coverage, and which, in addition lead to well defined morphological transformations of the NPs. [7]A new property of CNTs has been observed for the first time during the synthesis in which CNTs trigger a morphological transformation of CdSe nanorods into pyramidal-shaped nanoparticles and a tight attachment to the CNTs as shown in figure 1. The morphology of the NPs has been elucidated in 3D by means of high-resolution transmission electron microscopy (HRTEM) and three-dimensional electron tomography (3D-ET).[8] The method is not limited to CdSe but seems to be rather universally applicable to other nanoparticle systems like PbS. The presented non-covalent attachment (according to Raman spectroscopy) should, furthermore, be most advantageous in order to combine the outstanding electrical properties of CNTs with the unique possibility of bandgap tuning of quantum dots. The attachment is observed on both, singlewall and multiwall CNTs and the obtained composite materials exhibit promising photoelectrical response. These nanocomposites may have a strong impact in optoelectronics and photovoltaics.

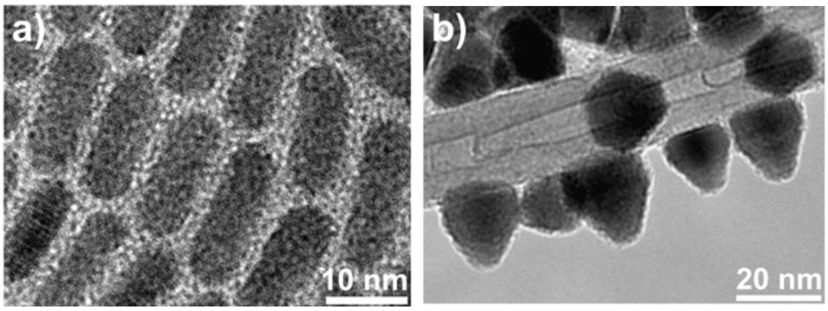

Figure 1. CdSe particles obtained (a) in absence and (b) in the presence of multiwall CNTs.

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PERFECT ORDERING OF MOLECULAR NANOSTRUCTURES

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The ability to create arrays of organic nanostructures on surfaces with long-range order and uniform size could have applications in micro- and optoelectronic devices. One of the most promising methods for making such arrays is to rely on the self-assembly of molecules on 'vicinal' surfaces that already possess long-range order in, for example, the form of terraces and steps. We present two different model systems showing the potential of the approach.

On Au(11,12,12) we demonstrate the ability to grow ordered arrays of fullerene nanochains. Each nanochain consists of just four or five fullerene molecules. Using scanning tunnelling microscopy and low-energy electron diffraction, we observed that the nanochains only formed at the lower step edges of the gold surface. The electron-rich regions near these edges preferentially adsorb the fullerene molecules, which are electron acceptors, leading to the formation of arrays that perfectly reproduce the periodicity of the gold template [1,2]. It is found that the actual position of the fullerene molecules in STM images appears shifted with respect to the geometrical position of the step edges due to electronic relaxation effects.

On Au(111) we constructed a regular array of hexa-peri-hexabenzocoronene at very low coverage. Scanning Tunneling Microscopy reveals a selective adsorption on monatomic steps in the fcc stacking regions with a specific orientation of 18° between the molecular axis and the step normal. Ab initio calculations for various adsorption sites reveal the lowest total energy for adsorption on a kink-site. Energy considerations and the excellent agreement between experimental and simulated images show that adsorption on kink-sites is responsible for the specific adsorption angle [3].

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ATOMISTIC MODELING OF METAL/HIGH-K OXIDE INTERFACE PROPERTIES AS FUNCTION OF GAS TREATMENT

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The depletion length in the current polysilicon gate technology increases the effective oxide thickness and thus reduces the advantages of using high-k dielectrics in the future generations of CMOS technology. Moreover, it was recognized that new high-k materials can react with the polySi gate causing undesirable changes in the electrical properties. All these problems can be solved by using a combination of a high-k ceramics with a suitable metal gate as a replacement for SiO_2 and polySi. In this work we considered dependence of metal / high-k oxide interface properties on the gas treatment conditions.

We present an atomistic investigation of the structure and properties of the interfaces between metal and high-k oxide materials, considering as an example metal/HfO_2 interface.

The dependence of Pt/HfO_2 interface structures and properties (the adhesion and the band offset at the interface) on the interfacial oxygen concentration is determined (see Fig. 1). Using calculated energies for series of structures with different interfacial oxygen concentration we predicted equilibrium interface structure dependence on partial pressure of oxygen and temperature. The predicted oxygen-pressure dependence of the interface composition provides a satisfactory explanation of the known dependence [1] of electrical properties on the gate deposition conditions (see Fig. 2).

It is also shown by calculated results that oxygen chemical potential strongly influences on the segregation trends at the oxide/metal alloy interface, in particular, for the Mo–Pt/HfO_2 interface large oxygen chemical potential leads to Mo segregation to the interface.

The possibility of tuning electrical properties by interface doping with impurity atoms such as N, F, or Cl is discussed. We found that N doping of the Pt/HfO_2 interface is unstable with respect to thermodynamics of desorption to gas phase, while doping with Cl is thermoneutral and doping with F atoms is exothermic. F atoms at the Pt/HfO_2 results in increasing of valence band offset at the interface with respect to oxygen-free Pt/HfO_2 interface. Doping of Mo/HfO_2 interface with nitrogen is stable with respect to nitrogen desorption to gas phase and results in increasing of effective work function of Mo.

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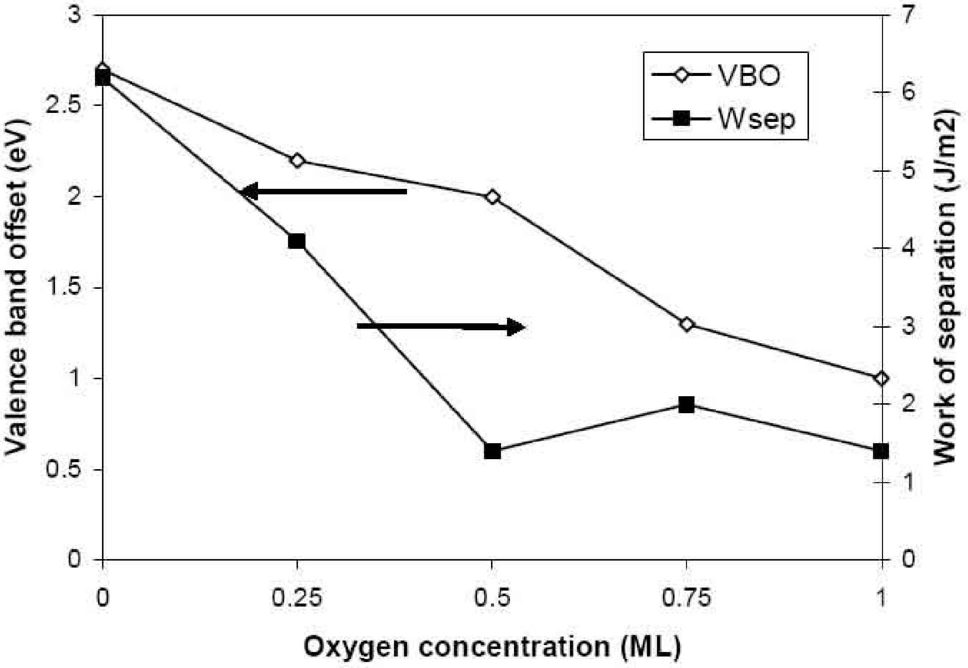

Fig. 1. Calculated valence band offset (VBO) and work of separation (Wsep) for the Pt/HfO2 interface as a function of interfacial oxygen concentration.

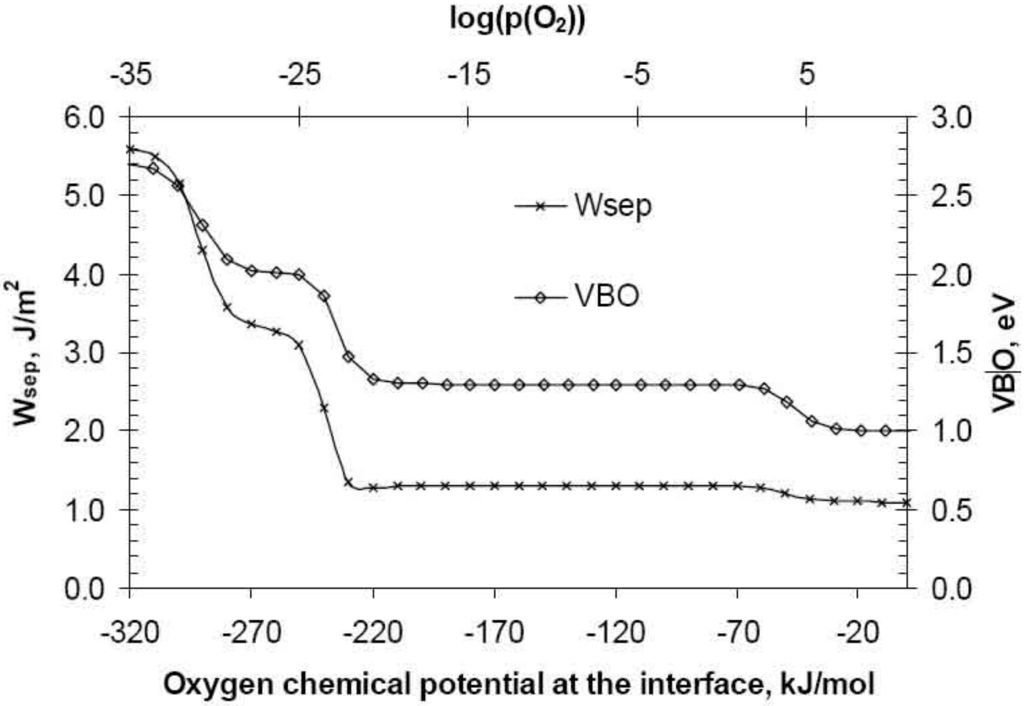

Fig. 2. Work of separation and valence band offset (VBO) for the Pt/HfO2 interface as a function of the oxygen chemical potential at 500°C.

SCANNING TUNNELING SPECTROSCOPY AND POLARIZABILITY MEASUREMENTS OF DNA AND G4-DNA MOLECULES

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1- *The Hebrew University of Jerusalem, Israel* 2-*Tel Aviv University, Israel,* 3-*INFM-Modena*
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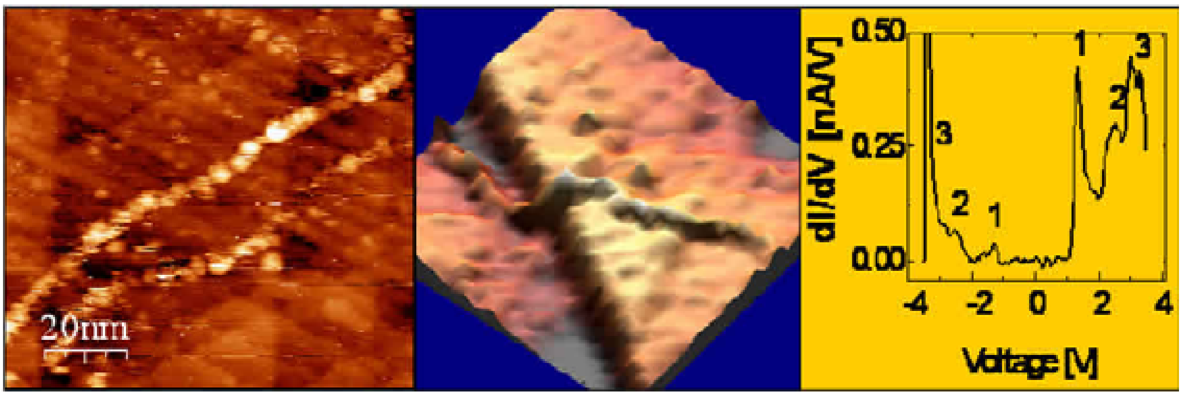
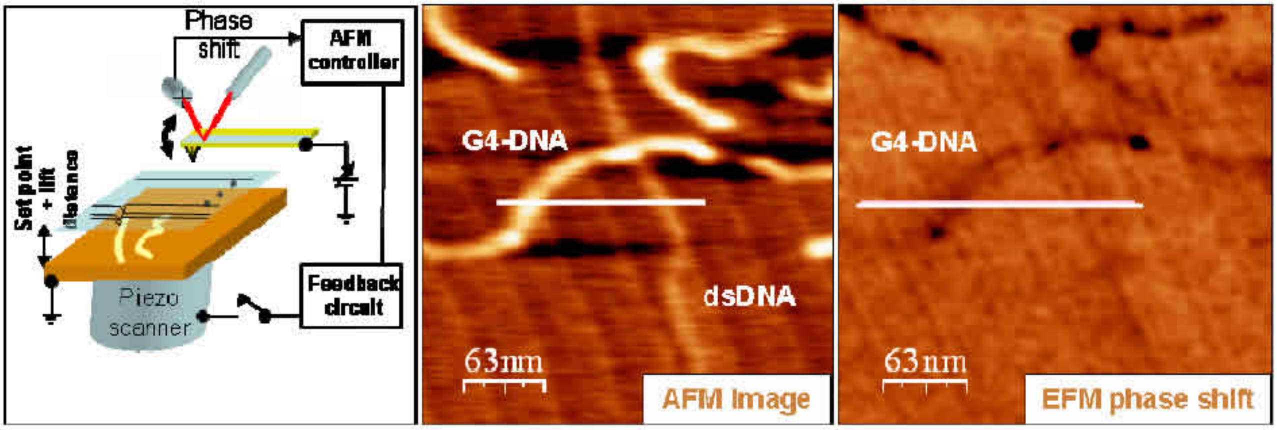


STM and STS of poly(G)-poly(C) DNA. (a) Topography image of the DNA on Gold (b). 3D presentation of the same image (c) STS on the molecule.

DNA, the most important bio-molecule, has been in the center of the scientific research for decades. In particular, DNA was considered as one of the attractive candidates for molecular electronics. DNA was, therefore, naturally chosen as one of the first investigation targets[1,2] following the invention in 1982 of the scanning tunneling microscope (STM) — the first tool for direct space morphological and electrical investigation of single objects on surfaces. Attempts to resolve the energy level structure of single DNA molecules span over the last two decades[3,4,5,6] thanks to the unique ability of scanning tunneling spectroscopy (STS) to probe the local density of states of deposited objects.[7,8,9] Nevertheless, success was hindered by extreme technical difficulties in stable deposition and reproducibility.[10] By measuring STS on DNA at cryogenic temperature[11] for the first time we disclosed the energy spectrum of poly(G)-poly(C) DNA12 and G4-DNA[13] molecules deposited on gold.[14] The tunneling current-voltage (*I-V*) characteristics and their derivatives (*dI/dV-V*) exhibit a clear gap and a peak structure around the gap. Limited fluctuations in the I-V curves are observed and statistically characterized. The character of the observed *dI/dV-V* peaks is assigned to orbitals originating from the different molecular components, namely the nucleobases, the backbone and the counterions, by means of *ab initio* Density Functional Theory calculations.



EFM of G4-DNA crossing dsDNA. (a) Scheme of the measurement method. (b). Topography image of the G4-DNA (bright) and the dsDNA. (c) EFM of the molecules in (b), showing that the G4-DNA is polarizable.

Double-stranded DNA (dsDNA) was marked as one of the leading candidates for molecular wires in nano-electronics. Conductivity measurements in DNA provided, however, diverse results, mainly due to the variability in the measured systems: single molecules, bundles, networks, various length and compositions, and due to the different measurements conditions: on surfaces, free standing, chemically or physically connected etc. In most of the measurements the contacts played a major influencing role and indeed some of the measurements were done by contactless methods.[15,16] It became clear that dsDNA is very sensitive to the environmental conditions and to the measurement technique and that long dsDNA adsorbed on hard surfaces is electrically insulating and non-polarizable. As a remedy to these two issues we have developed a new type of DNA-based molecule: G4-DNA,[16] a DNA derivative with a quadruple helical motif of stacked guanine tetrads’[17] which is stiffer, more rigid and more resistant to surface forces. It has a high "surface area" in each tetrad (the molecule cross-section) for π-stacking and rich guanine content. We report measurements of this novel molecule using sensitive contactless electrostatic force microscopy (EFM) methods[18] that enable to detect polarizability – a strong indication for possible conductivity.

In these measurements we find that the long G4-DNA molecules adsorbed on mica surface are polarizable whereas co-adsorbed long dsDNA are electrically silent, as was previously reported. This evidence may be interpreted as an indication that the conductivity of G4-DNA is potentially better than that of dsDNA, making G4-DNA a valid alternative to dsDNA to develop DNA-based nano-electronics.

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OBTAINING INFORMATION AT THE MOLECULAR LEVEL WITH MESOSCOPIC FLUORESCENT MEASUREMENTS

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ABSTRACT NOT AVAILABLE

VALLEY FILTER AND VALLEY VALVE IN GRAPHENE

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It is known that the lowest propagating mode in a narrow ballistic ribbon of graphene may lack the twofold valley degeneracy of higher modes. Depending on the crystallographic orientation of the ribbon axis, the lowest mode mixes both valleys or lies predominantly in a single valley (chosen by the direction of propagation). We show, using a tight-binding model calculation, that a nonequilibrium valley polarization can be realized in a sheet of graphene, upon injection of current through a ballistic point contact with zigzag edges. The polarity can be inverted by local application of a gate voltage to the point contact region. Two valley filters in series may function as an electrostatically controlled ``valley valve", representing a zero-magnetic-field counterpart to the familiar spin valve.

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COMPUTER SIMULATIONS OF NANOPATTERNING SYSTEMS

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Anchoring of functionalised ink molecules to self-assembled monolayers (SAMs) is key to the development of molecular printboards for nanopatterning. One very promising system involves ink binding to immobilised β-cyclodextrin (β-CD) hosts, with molecular recognition facilitated by a hydrophobic interaction between uncharged anchor groups on the ink molecule and β-CD cavities at the surface of the printboard [1]. We use molecular dynamics free energy (MDFE) [2] simulations to describe the specificity of ink:printboard association, a crucial parameter for controlling patterning. We find good agreement with experimental thermodynamic measurements for binding enthalpy differences between three commonly-used ink anchors: benzene, toluene and tbutylbenzene (Figure 1). van der Waals interaction with the inside of the host cavity accounts for almost all of the net stabilisation of the larger phenyl guests in β-CD, while partial and full methylation of the secondary rim of β-CD decreases host rigidity and significantly impairs binding of both phenyl and larger adamantane guest molecules. The β-CD cavity is also very intolerant of guest charging, penalising the oxidised state of ferrocene by at least 7 kcal/mol. β-CD hence expresses moderate specificity towards uncharged organic guest molecules by van der Waals recognition, with a much higher specificity calculated for electrostatic recognition of organometallic guests [3].

Multivalent, or multi-site, binding strengthens the attachment of large inks to the printboard, yielding more robust patterns [4]. We performed fully-atomistic molecular dynamics (MD) simulations in bulk explicit solvent to probe the conformational space available to dendrimer and dendrite ink molecules, in both free and bound environments. We show that accurate treatment of both pH effects and binding conformations gives calculated binding modes in line with known binding multivalencies [5]. We identify and quantify the steric frustration causing small, low-generation dendrimer inks to bind to the printboard using just a subset of the available anchor groups and show that the enhanced binding energy of multi-site attachment offsets the steric strain, the feasibility of a given binding mode thus determined by the relative magnitudes of the unfavorable steric strain and favorable multi-site binding free energies (Figure 2). We use our experimentally-validated model of dendrimer binding to predict the binding mode of novel fluorophoric dendrites and find behavior consistent with confocal microscopy imaging of pattern formation at molecular printboards [6].

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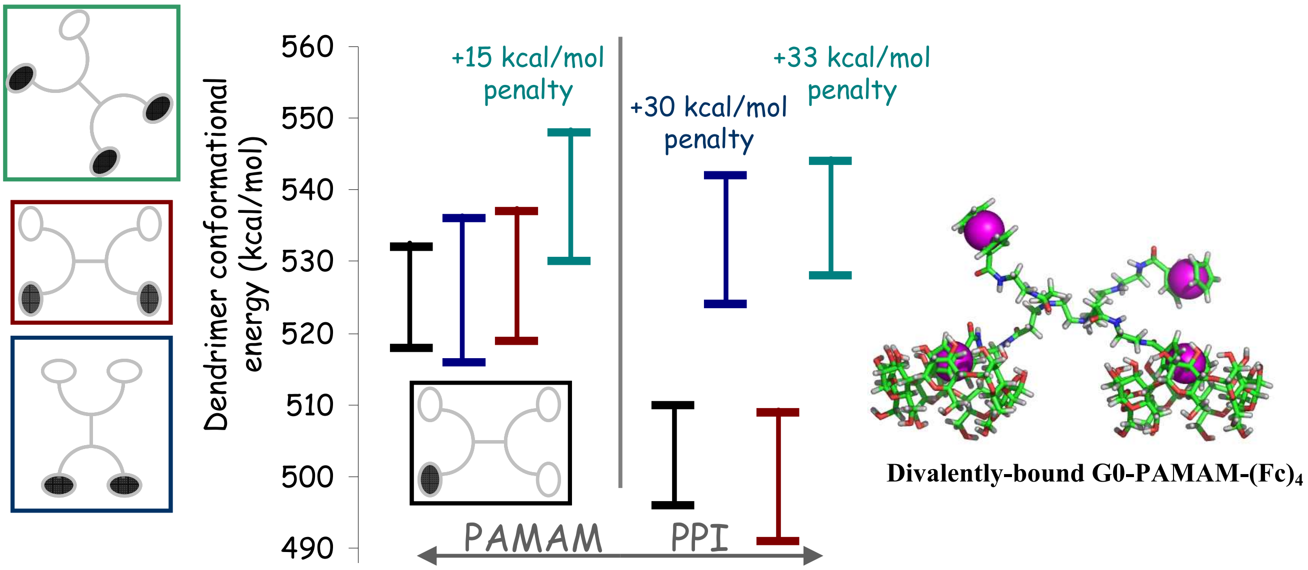
Figures:

Figure 1 – Thermodynamic cycle for the computation of ink binding specificity at the molecular printboard. $\Delta\Delta G$ quantifies the binding free energy difference between ink molecules Ink1 and Ink2.

$$\Delta\Delta G = \Delta G_1 - \Delta G_2 = \Delta G_3 - \Delta G_4$$

$$\begin{tikzcd}
\beta\text{-CD} + \text{Ink1} \arrow[r, "\Delta G_1"'] \arrow[d, "\Delta G_3"'] & \beta\text{-CD:Ink1} \arrow[d, "\Delta G_4"'] \\
\beta\text{-CD} + \text{Ink2} \arrow[r, "\Delta G_2"] & \beta\text{-CD:Ink2}
\end{tikzcd}$$

Figure 2 – Free energy balance, the sum of favourable anchor:printboard complexation and unfavourable dendrimer steric strain, predicates dendrimer binding multivalency at molecular printboards. Binding modes with a high, uncompensated, conformational energy penalty are not observed experimentally.



BACTERIAL PROTEIN CRYSTALS AS PURE BIOMIMETIC NANO-MOLECULES

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S-layers, one of the most common cell envelope components of prokaryotic organisms, represent the simplest biological membrane developed during evolution [1]. Once these glyco(proteins) are in solution they have the ability to self-assemble into 2-D crystalline structures at the air-water interface [2], on lipid films [3], on liposomes [4], and on solid supports [5]. These protein layer crystals, which have a relevant role protecting cells from external stimuli, are becoming of growing importance in nanotechnology due to the possibility of engineering functional bacterial fusion proteins [6-8], as well as of immobilizing nanoparticles [9] and *in situ* nucleation of ordered two-dimensional arrays of (cadmium sulphide) nanocrystals [10], in the pores of the 2-D protein crystal.

In this communication, we introduce three different aspects of the applications of the S-proteins in nanotechnology:

i) The functionalization of polyelectrolyte covered flat surfaces and hollow polyelectrolyte capsules with bacterial wild-type and fusion proteins [11]. We show that wild-type SbpA and the fusion protein SbpA-GFP recrystallized on cationic and anionic polyelectrolyte through a self-assembly process.

ii) The building of bacterial patterning with wild-type SbpA and two different bacterial fusion proteins (with GFP and streptavidine as functional biomolecules). We find that the proteins preserve their functionality [12].

iii) The manipulation of the protein-sample interaction by changing in a controlled manner the number of methylene units of the OH and CH_3 terminated branches of self-assembled monolayers (SAMs). We will show that difference in chain length leads to a phase transition from a protein bilayer to a protein monolayer, induces preferential side adsorption of a protein, and increases the crystal lattice parameters (a process that is not observed in bacteria) [13].

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ORAL CONTRIBUTIONS

"PhD" Parallel Session

NANOPARTICLE ORGANIZATION AND ADVANCES IN STRUCTURAL DNA NANOTECHNOLOGY

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One of the central challenges of nanoscience is the organization of functional components according to a deliberately designed pattern, and the ability to modify this pattern at will. Because of its molecular recognition specificity and structural features, DNA presents a unique opportunity to address the above goal. Our research group has been examining the creation of branched DNA molecules containing organic vertices, and the study of their self-assembly into discrete, as well as extended DNA nanostructures.

(a) We discuss a method in which six gold nanoparticles are assembled into a well-defined discrete hexagonal arrangement. The approach involves labeling the individual nanoparticles with DNA containing building blocks that dictate their final location within the constructs.[1]

(b) We also report a straightforward method to selectively organize gold nanoparticles into libraries of discrete and well-defined structures, using a small number of single-stranded, dynamic DNA templates.[2] This approach not only provides the ability to finely control the geometry of the assembly, and the precise position of each nanoparticle, but it also allows for the modification and tuning of these structural features post- assembly. As such, the resulting nanoparticle groupings can undergo structural switching and write/erase functions in response to specific external agents. Access to libraries of precisely positioned particle groupings will allow for the systematic examination of their optical, electronic and catalytic properties as a function of their structure, and will also lead to advances in the use of these particles as components of nanoelectronic and nanophotonic circuitry, plasmonic tools, and surface-enhanced Raman scattering substrates.

(c) As the structural size and complexity of such artificial DNA architectures increases, so will the number of coding DNA sequences that will need to be designed. This inevitably results in overlapping, degenerate sequences that may assemble into undesirable products. We report the first example of guest mediated access to a *single DNA nanostructure*, from building blocks containing identical DNA strands that otherwise generate a complex library of multiple DNA assemblies. This guest template also re-equilibrates every other member of this self-assembled mixture into the same single nanostructure. The addition of a small DNA-binding molecule to alter and refine product outcome in DNA self-assembly not only allows for the incorporation of symmetry to construct more complex systems, but also presents the immediate advantage of auto-correcting errors that may form during the initial self-assembly process. We further applied this approach to predictably construct well-defined one-dimensional DNA fibers extending over tens of microns using two trifunctional DNA building blocks that otherwise generate ill-defined oligomeric networks. Considering the wealth of DNA-binding molecules which can be employed to tune, modify and correct the assembly of DNA structures, this finding promises to lead to significant advances in the field of DNA nanotechnology.

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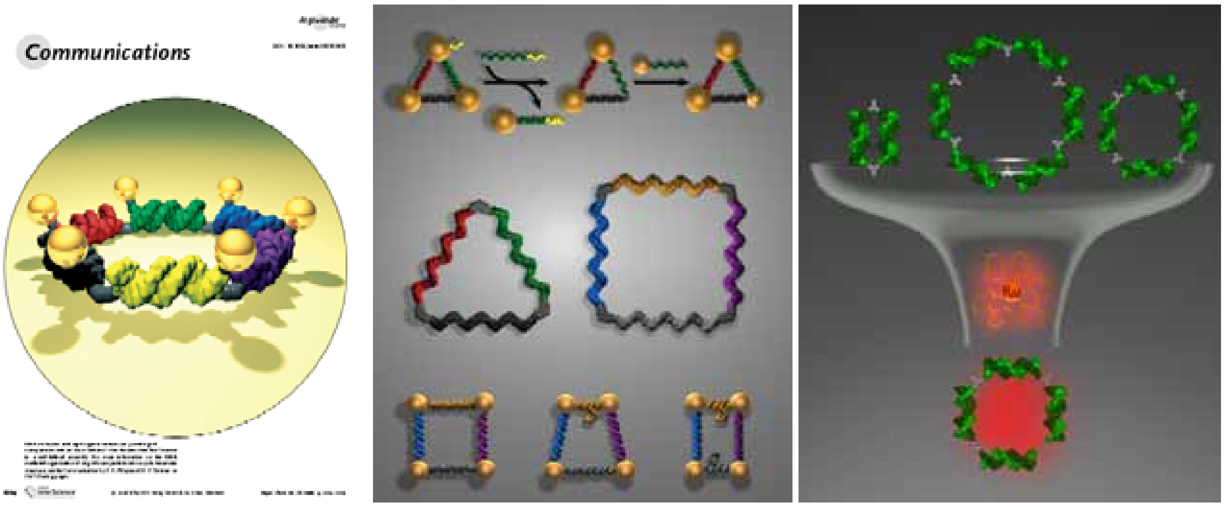
Figures:



(a) (b) (c)

EXPLOITING TEMPLATE SURFACE AND END-GROUP FUNCTIONALITIES TO GUIDE THE SELF-ASSEMBLY OF SPECIFIC SUPRAMOLECULAR ARCHITECTURES

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The future fabrication of nanoscale devices will critically depend on the controlled self-assembly of surface-supported functional supramolecular structures. A well-established procedure is the tailoring of intermolecular interactions by an appropriate choice of molecular building blocks with suitable and complementary end-group functionalities [1]. Another approach is the use of nanostructured template surfaces exhibiting preferential adsorption sites [2-4]. A promising strategy is to use a combination of these approaches to guide the self-assembly. The challenge, however, is to modify and apply the recipe depending on the targeted specific structure.

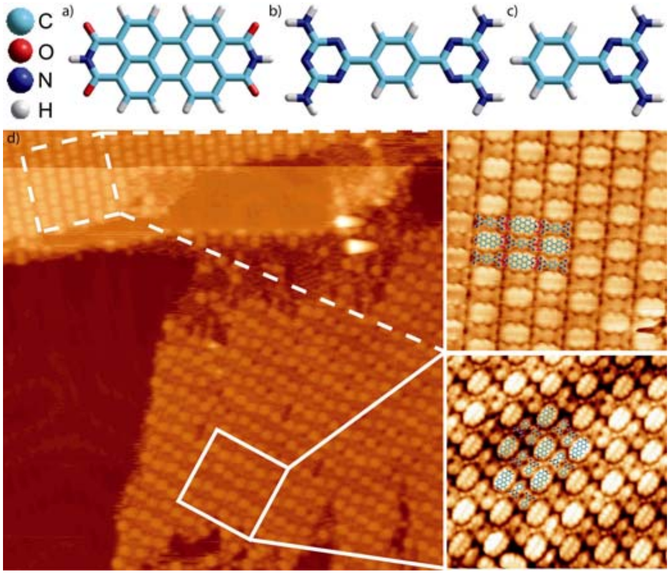

Figure 1 a), b) and c): Chemical structures of PTCDI, BDATB and DATB, respectively. d) Low temperature (50 K) STM image of the resulting bi-component structures after codeposition of the 3 molecular species on the Au(111) surface (-2.0 V, 0.10 nA, 50x50 nm^2). Upper inset: Supramolecular structure within a BDATB + PTCDI domain. (-2.5 V, 0.11 nA, 10x10 nm^2). Lower inset: Supramolecular structure within a DATB + PTCDI domain (-2.0 V, 0.13 nA, 13x13 nm^2). Suggested structural models are superimposed.

We recently reported on the successful fabrication of surface-supported bimolecular wires and ribbons by complementary hydrogen-bonding of the two-fold symmetric 1,4-bis-(4,6-diamino-1,3,5-triazine)-benzene (BDATB) (Fig.1a) and perylene tetra-carboxylic di-imide (PTCDI) (Fig.1b) moieties on a vicinal gold template surface [5]. Here we discuss how the co-deposition on a Au(111) surface of a similar, but non-symmetric species; (4,6-diamino-1,3,5-triazine)-benzene (DATB) (Fig.1c) affects the self-assembly and leads to significantly different supramolecular structures. By means of scanning tunneling microscopy (STM) we have investigated the superlattice structures of bi-component domains containing either BDATB and PTCDI, or DATB and PTCDI (Fig.1d). The structures of these domains present distinct properties. We find that co-deposition of the two closely related DATB and BDATB species leads to phase separation (Fig. 2a). Each of the two species self-assembles into different, rather complex, temperature-dependent, single-component supramolecular structures (Fig. 2). The electronic properties of the diverse entities will be discussed based on data derived from scanning tunneling spectroscopy experiments.

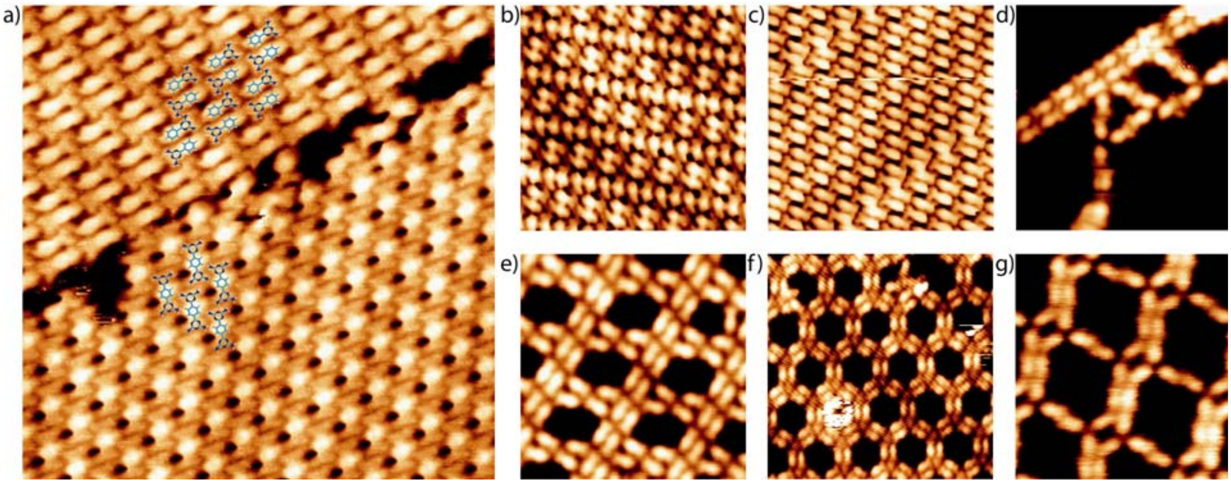

Figure 2 STM images of the supramolecular structures formed by BDATB and DATB on Au(111). a) Zoom into a region with a boundary between a pure DATB domain and a pure BDATB domain (-2.0 V, 0.13 nA, 13x13 nm^2). Suggested models are superimposed. b) to g): STM images illustrating the various supramolecular structures formed by DATB on Au(111). (all STM images: 10 x 10 nm^2).

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TOPOLOGICALLY CONTROLLED GROWTH OF MAGNETIC-METAL-FUNCTIONALIZED SEMICONDUCTOR OXIDE NANORODS

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The development of colloidal hybrid nanocrystals (HNCs), in which two or more material sections with peculiar chemical, optical, magnetic and/or catalytic properties are connected by epitaxial interfaces, represents an emerging field of great interest in nanoscience.[1] Nanocrystal heterostructures, characterized by a topologically controlled distribution of their chemical composition, are extremely attractive as advanced generations of nano-objects potentially able to perform multiple tasks in optoelectronic devices, biomedical engineering, diagnostics, sensing, and catalysis.(2-10) To date, the chemical fabrication of HNCs remains a challenging task, as the ability to tailor the size and shape of the individual material domains has to be integrated with the control over additional parameters at the nanoscale, such as inter-compound miscibility, interfacial strain, and facet-specific chemical reactivity.

Here we present a seeded growth approach to synthesize a novel type of colloidal semiconductor/magnetic-metal HNCs, each made of spherical ε-Co domains epitaxially attached to one anatase TiO_2 rod-shaped portion.(10) We have been able to control the heterogeneous nucleation of spherical ε-Co domains onto preformed TiO_2 nanorods in suitable surfactant mixture, achieving metal deposition on either the tips or on multiple locations along the longitudinal sidewalls of the oxide seeds. A detailed compositional, structural, and magnetic characterization of the as-prepared heterostructures has been carried out by combining powder X-ray Diffraction, high angle annular dark field (HAADF) imaging, and high-resolution transmission electron microscopy (HRTEM) analyses, superconducting quantum interference device (SQUID) magnetic measurements. Our results suggest that the possibility of switching between either TiO_2-Co HNC topologies arises from the facet-dependent chemical reactivity of the TiO_2 seeds, which is mainly governed by surface selective adhesion of the surfactants, rather than by misfit-related interfacial strain at the relevant junction points. These TiO_2-Co HNCs could find relevant applications as bi-functional, magnetically recoverable (photo)catalysts and as active elements in novel magneto-optical applications.

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THIN FILMS AND "NANO-DOTS" OF SPIN CROSSOVER COMPLEXES: ELABORATION AND PHYSICAL PROPERTIES

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The phenomenon of spin crossover between high-spin (HS) and low-spin (LS) states of $3d^4$-$3d^7$ transition metal ions represents an important area of coordination chemistry. Beside its interesting fundamental aspects, the potential applications of this phenomenon draw much attention as well. In this context, we have recently shown that the spin-state change is accompanied also by a variation in the dielectric constant of the material and we could observe even a room temperature hysteresis of ε' [1]. We suggested that this dielectric hysteresis property might be useful to build memory devices, which can store information by high and low capacitance states. Further work allowed us to demonstrate that switching between the two spin states may be accomplished using short (ns) laser pulses within the hysteresis region even at room temperature [2].

However, these appealing properties cannot be readily exploited in bulk materials. In this presentation we describe therefore an original method for fabricating micro- and nanometric patterns of thin films of the spin crossover compound $Fe(pyrazine)[Pt(CN)_4]$ using a combination of lift-off and multilayer sequential assembly methods [3,4]. We have shown that these patterns still exhibit bistability and represent thus a novel platform for a wide array of potential applications.

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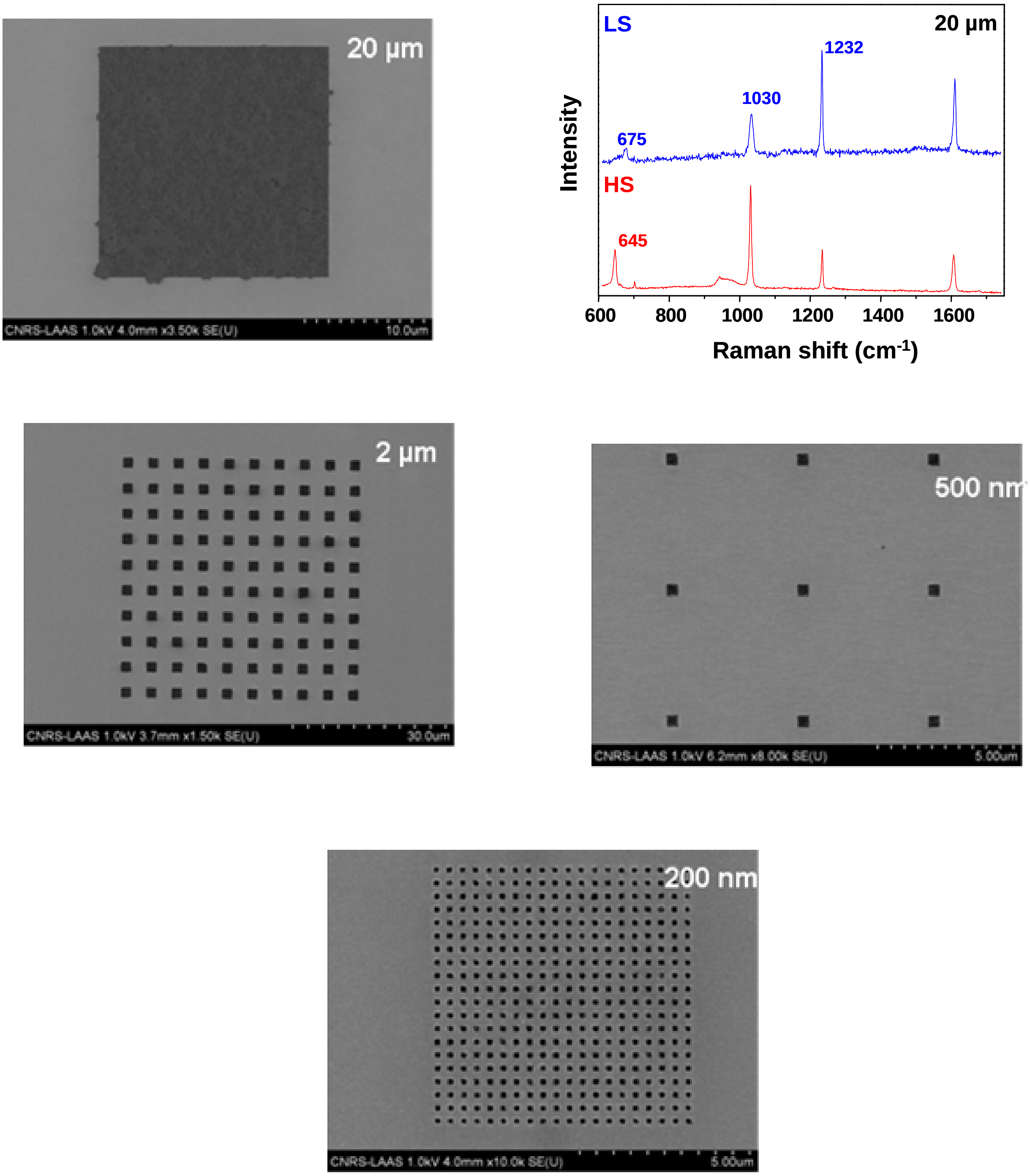
Figure 1. SEM images (left) of patterns of Fe(pyrazine)[Pt(CN)$_4$] following 15 deposition cycles and their Raman spectra (right) recorded at 295 K (HS) and 80 K (LS)



LARGE-SCALE “ATOMISTIC” APPROACH TO DISCRETE-DOPANT FLUCTUATED SI NANOWIRE FETS

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Silicon (Si) field effect transistors (FETs) with vertical channel structures are promising candidates for next generation VLSI devices [1,2]. Impact of the discrete-dopant number and position on device performance is crucial for ultimate Si technologies [3,4]. In this paper, we for the first time study the electrical characteristic fluctuations in 16nm Si nanowire FETs. Discrete dopants are statistically positioned in the 3D channel region to examine associated carrier transportation characteristics, concurrently capturing “dopant concentration variation” and “dopant position fluctuation”. The cylindrical-shaped-surrounding-gate nanowire FET shows its superior fluctuation immunity against discrete dopants over the square-shaped-surrounding-gate one. Even the latter exhibits similar threshold voltage (Vth) fluctuation with the former; the latter still has larger on- and off-state current fluctuations (about 2.2 and 8.8 times) than the former due to nonuniform (fringing) fields and current crowding phenomena.

All statistically generated discrete dopants, shown in Fig. 1, are incorporated into the large-scale 3D “atomistic” device simulation under parallel computing system, where a quantum mechanical transport simulation is performed [1]. Figure 1(a) shows 149 discrete dopants randomly distributed in 2000nm length cylinder (radius = 4nm) with an average concentration of $1.48\times10^{18}\text{cm}^{-3}$. The dopants may vary from 0 to 5, where the average number is 1, within its 125 sub-cylinders of 16nm length, (plots of (b), (c), and (d)). These sub-cylinders are then equivalently mapped into the channel region of nanowire devices for dopant position/number-sensitive simulation. Figure 2 shows a comparison of the 3D simulated on-state potential between the nominal (continuously doped) and discrete-dopant fluctuated cases. The discrete dopants positioned in the channel induce a relatively negative electric field and thus disturbs the current path. Figure 3 shows the Vth fluctuations and on-off-state current (I_{on} and I_{off}) of the 16nm cylindrical- and square-shaped-surrounding-gate devices, where Vth’s fluctuation of the two nanowire devices is 4 times smaller than the single-gate FET, shown in Fig. 3(a). The latter has similar Vth fluctuation with the former; however, I_{on} and I_{off}’s fluctuations of the latter are 2.2 and 8.8 times larger than the former due to sensitively nonuniform field distribution and current crowding. Figure 4 shows the I_{on}-I_{off} characteristics. For cases with similar I_{on}, a maximum fluctuation of I_{off} is within 0.05 nA/um. Figures 4(b)-4(b’’), 4(c)-4(c’), and 4(d)-4(d’’) disclose three different discrete-dopant channels, having similar values of I_{on} or I_{off} but with various dopant positions. The cross-sectional on-state current density and off-state potential distributions extracting from the center of channel are examined. Figures 4(b’)-4(b’’) and 4(c’)-4(c’’) show the distribution of the on-state current. For the three different cases of the dopant, shown in Figs. 4(b)-4(d), Figs. 4(b’)-4(d’) exhibit different current distributions due to the discrete dopants appearing on the channel. The different conducting paths of devices result in different I_{on} even we have very similar I_{off}, shown in Fig. 4(a). For the device having very similar on- (or off-) state current with different off- (or on-) state situations, Figs. 4(b’’)-4(d’’) are the off-state potential distributions at the center of the device channel. As shown in Fig. 4(a), the device possesses very similar I_{on} (the vertical ellipse circled), but with different I_{off} (> 3 times) resulting from the different randomness of the dopant number and position, shown in Figs. 4(c’’) and 4(d’’).

In summary, we have explored the discrete-dopant-induced characteristic fluctuations of the 16nm nanowire devices using a large-scale 3D “atomistic” simulation technique. For the nanowire devices having similar Vth fluctuation, the on- and off-state current fluctuations of the square-shaped-surrounding-gate device are 2.2 and 8.8 times larger than the cylindrical-shaped- surrounding-gate nanowire FET. This study provides an insight into the problem of discrete-dopant-induced characteristic fluctuations in Si nanowire FETs.

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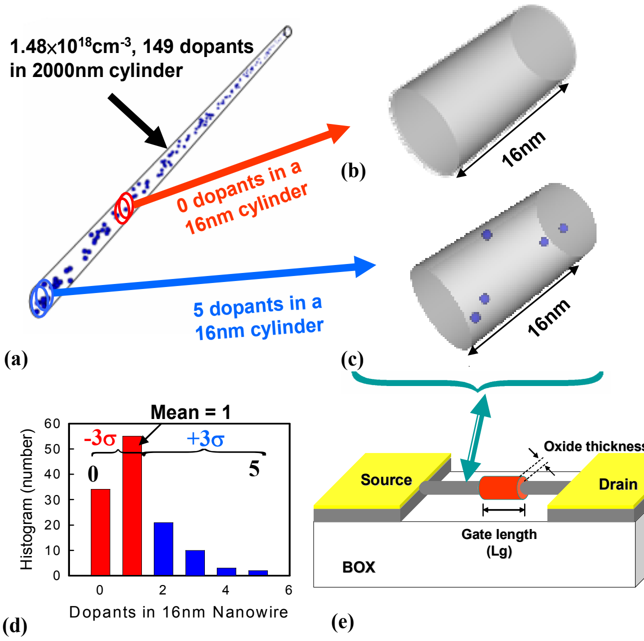
Figures:



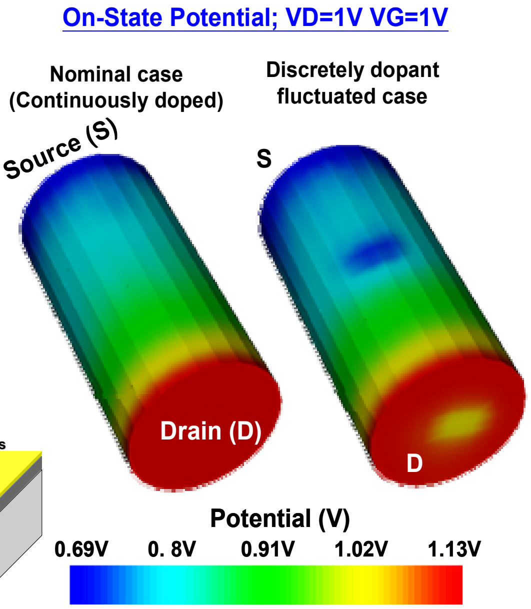


Figure 1. (a) Discrete dopants randomly distributed in 2000nm length cylinder (radius = 4nm) with the average concentration of 1.48x10^{18}cm^{-3}. There will be 149 dopants within the cylinder and dopants vary from 0 to 5 (the average number is 1) within its 125 sub-cylinders of 16nm length, (plots of (b), (c), and (d)). These sub-cylinders are then equivalently mapped into the channel region of nanowire FET for dopant position/number-sensitive simulation.

Figure 2. Comparison of the 3D simulated on-state potentials, the left distribution shows the result of nominal (continuously doped) case and the right one is discretely doped one.

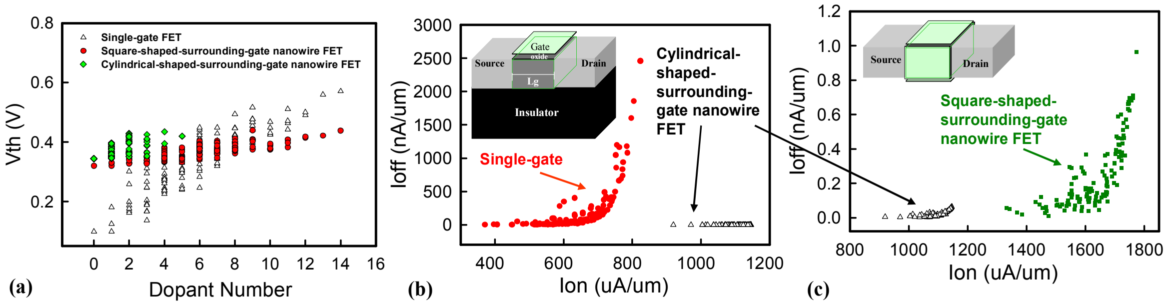


Figure 3. The fluctuations of (a) threshold voltage (Vth), and (b) and (c) on/off state current of the discrete-dopant fluctuated 16nm single-gate FET, square- and cylindrical-shaped-surrounding-gate nanowire FETs. The structure of single-gate and square-shaped-surrounding-gate are shown in the insets of (b) and (c) , respectively.

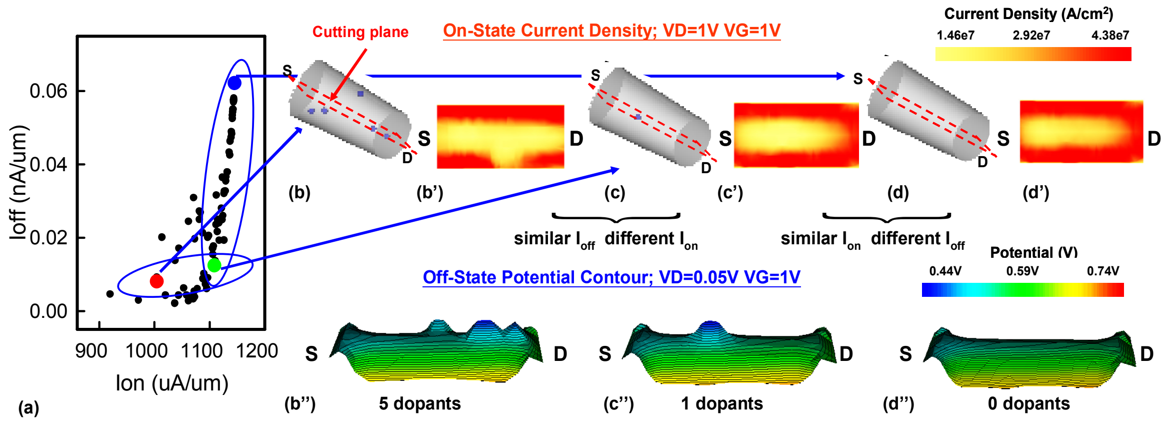


Figure 4. (a) Ion-Ioff characteristics of the 125 discrete-dopant 16nm cylindrical-shaped-surrounding-gate nanowire FETs. Three cases are selected to evaluate similar Ioff but different Ion ((b) and (c)) and similar Ion but different Ioff ((c) and (d). ((b)-(d)) and ((b')-(d')) show the cross-sectional on-state current density. ((b'')-(d'')) show the off-state potential contours. All of them are extracted at the center of the channel.

ENERGY DISSIPATION DUE TO CAPILLARY INTERACTIONS: HYDROPHOBICITY MAPS IN FORCE MICROSCOPY

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In this paper, the energy dissipation process involved in the formation and rupture of a nanometer-sized capillary-condensed water bridge is theoretically analyzed [1]. With the help of numerical simulations, the dissipation contrast in amplitude-modulated (AM) atomic force microscopy is shown to be a result of a non-trivial interplay between the energy dissipated [2] in each rupture process and the bi-stable motion of the cantilever [3,4]. In the repulsive high amplitude regime, the dissipated power is a function of the tip and sample contact angles being independent of the elastic properties of the system. Working in this regime, energy dissipation images in air can be regarded as surface hydrophobicity maps.

Atomic Force Microscopy (AFM) has become a standard tool to image and manipulate surfaces with nanometer resolution. In order to minimize sample deformations due to the tip interaction, AFM images are usually taken by using different dynamic operation modes [5]. Phase contrast images, obtained by recording the phase lag of the cantilever oscillation relative to the driving signal, often provides significantly more contrast than the topographic image. At fixed feedback amplitude, phase shift variations are directly linked to energy dissipation processes [6,7]. However, most of the phase and energy dissipation images are purely qualitative, mainly due to the absence of simple relationships relating phase changes and energy dissipation with specific surface properties.

In air ambient condition, the phase contrast is strongly influenced by capillary forces [8]. When the tip approaches the sample, water condensation can induce the formation of a nanometer-sized water bridge. The relevance of liquid bridges for both imaging and nanofabrication have driven numerous experimental and theoretical [8-15] efforts to understand nanometer-sized systems involving capillaries. Understanding capillary contrast in AFM maps would be particularly interesting for biological applications, where the recognition of different species is frequently based on their hydrophilic or hydrophobic nature.

In this paper we present a theoretical analysis of the energy dissipation involved in the formation and rupture of capillary-condensed water bridges. Based on a simple model sketched in figure 1, we predict a quantitative relation between the energy dissipated and tip and sample contact angles and relative humidity (RH).

Our theoretical approach can be divided in two parts. First, the calculation of the water neck geometry for each experimental configuration through the minimization of condensation energy. The second is the simulation of an AFM device in AM mode together with a substrate plus the capillary interaction calculated in previous part.

Main findings are depicted in figure 2. We show that capillary dissipation contrast in AM-AFM strongly depends on the operation regime. In the attractive regime (phase shift $\phi>90$) the dissipated power changes as a consequence of the beating phenomena [9]. Only in the repulsive regime ($\phi<90$) the energy dissipated per oscillation is independent on the amplitude and elastic properties of the system. For a given tip and RH, the dissipated power is just a function of the sample contact angle. As a consequence, only when working in the repulsive regime, energy dissipation images of biological samples in air can be regarded as surface hydrophobicity maps.

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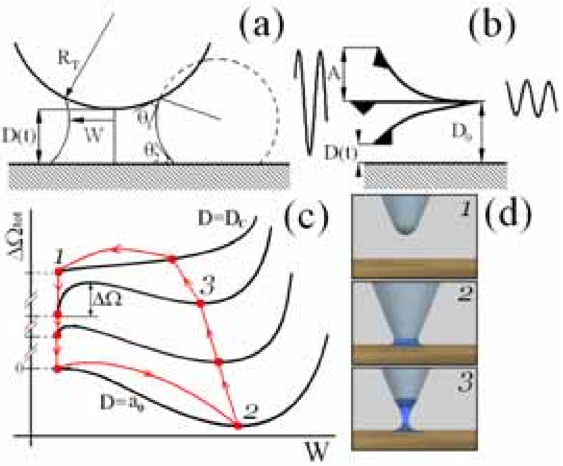

Fig 1. (1a) Sketch of the water bridge geometry. (1b) Tip-cantilever-driver system. (1c) Schematic represent-tation of the formation/rupture process in tapping mode. (1d) Graphic representation of water neck formation/rupture.

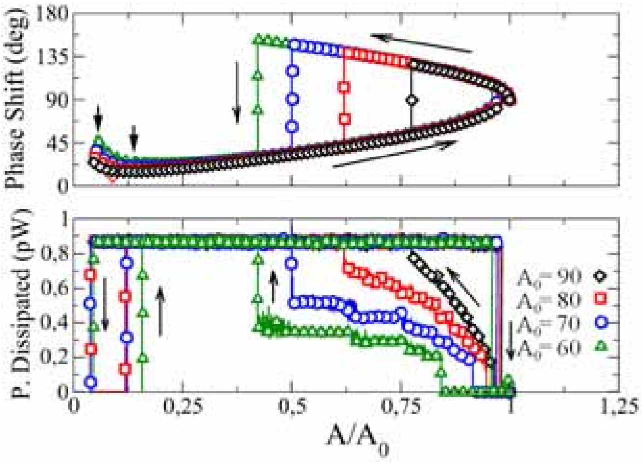

Fig 2. Phase (a) and power dissipated (b) vs normalized amplitude from simulated tapping mode operated AFM including capillary interactions.

COHERENCE-TIME MEASUREMENTS OF SINGLE PHOTONS EMITTED BY CDSE COLLOIDAL NANOCRYSTALS

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CdSe nanocrystals are often studied as prototypical colloidal quantum dots. They can be easily manipulated and exhibit many promising optical properties, like a broad absorption spectrum and a sharp emission line. Their emission wavelength can also be tuned between 450 et 600 nm by controlling the nanocrystals synthesis parameters. They have found a wide range of applications from optoelectronic devices to biological labelling or imaging. In the field of quantum optics, triggered single photon emission under pulsed excitation has been demonstrated recently [1].

The realization of a single photon source is of great interest for quantum cryptography. In this case, the coherence of the single photons emitted is not required. However, single photons could also be used for quantum information processing. A recent proposal is based on the interferences between various photons. For such an application, the coherence of the single photons becomes crucial. One idea to obtain coherent photons is to use single quantum systems the emission linewidth of which is not enlarged by dephasing mechanism. The dipole coherence time is then equal to twice the radiative lifetime. Interferometric studies for single self-assembled InAs/GaAs quantum dots at low temperature have shown decoherence times as long as 650 ps, and two-photon interferences have been demonstrated.

Spectroscopic studies of single CdSe nanocrystals have shown the diffusion of the wavelength emission over a few meV, related to changes in the electronic environment [1]. At low temperature, the emission spectra measured by standard spectroscopy or interferometry should be sharper than 0.2 meV but they are broadened by this spectral diffusion. Faster spectroscopic measurements are not possible because of weak emission intensity (at most 20.000 counts/s collected at low temperature).

In this paper, we first present an original method which we call photon correlation Fourier spectroscopy (PCFS), which allows us to achieve a high resolution in both the temporal and spectral domain, and measure the emission coherence in spite of weak emission and fast spectral diffusion. It is based on the time-correlation between the photons detected at the outputs of a Michelson interferometer. We explain how this method allows one to measure the coherence time of a single emitter fluorescence despite wavelength fluctuations at short time scale. We investigate theoretically the behavior of intensity correlations at very short timescales, and determine general expressions for the spectral resolution of PCFS. For a spectral diffusion of 25 0̆3bceV on a 0.1 ms timescale, as reported in the literature [2], we predict a resolution of a few 0̆3bceV, three orders of magnitude better than standard spectroscopic or interferometric measurements.

This method is particularly fitted for the study of CdSe nanocrystals. We present the precise measurement of the time coherence of the CdSe QD fluorescence. A previous spectroscopic study of single CdSe nanocrystals has shown the diffusion of the wavelength emission over a few meV, related to changes in the electronic environment [5]. At low temperature, where emission linewidth are expected to be below 0.2 meV, direct linewidth measurements are not possible, due to insufficient spectrometer resolution and spectral diffusion during the duration of the measurement.

The experimental setup consists in a standard confocal microscope and a Michelson interferometer. By proper normalization, we obtain the Fourier transform of the emission spectrum broadened on a time 0̆3c4, yielding information (1) on spectral diffusion and (2) on the emission linewidth (by taking 0̆3c4 below the spectral diffusion timescale).

Interferometric measurements at room temperature have led to linewidth values around 130 meV. At

4 K, first measurements show typical linewidths of around 3 meV. This high value may result from non-resonant excitation. We also present the temperature dependance of the coherence time and the lineshape study.

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SUPRAMOLECULAR ROTOR-STATOR SYSTEMS LEADING TO A MULTI-POSITION ROTARY DEVICE

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In recent years, attempts to build artificial functional devices from single molecules were strongly in the focus of nanoscience. The majority of these resulted in large thermodynamic ensembles of functional systems within fluids or the 3D bulk. Nevertheless, for technological applications, a simple way to produce vast amounts of supramolecular devices in an ordered and easily accessible structure, like a two-dimensional lattice, is needed.

Herein we report on highly complex supramolecular host-guest systems, that allow the guest to rotate. These are fabricated on an atomically clean surface following a "bottom-up" approach. Two distinctively different synthetic pathways to form porous host networks are demonstrated: On the one hand a functionalised porphryin [1] and on the other hand a thermally activated perylene compound [2] form extended porous layers. Within one network, the formed cavities are identical by their atomic arrangement and their characteristics, but the two networks differ in the pore size and their borders. Therefore, they serve as specific hosts for molecular guests of different types. These guests can rotate inside their cells and this rotation can be studied in its thermodynamic activation. The systems reveal the basis for the architecture of addressable multi-position rotary switching systems [3, 4].

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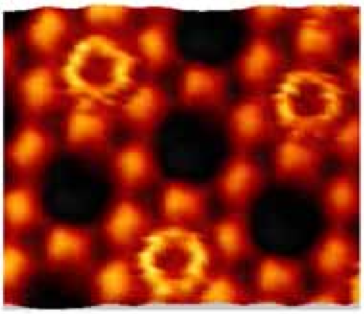

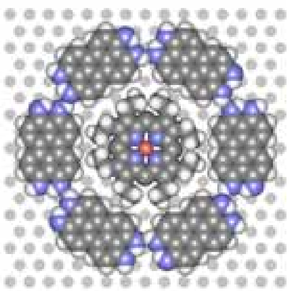

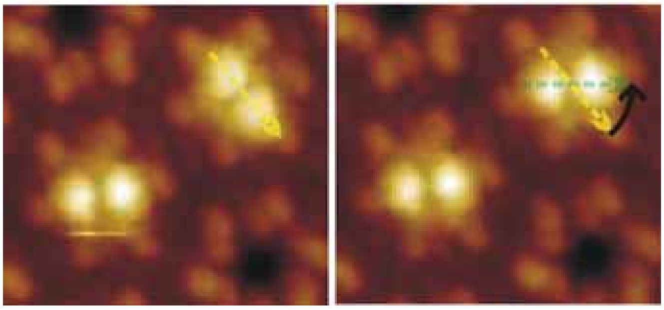

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San Sebastian (Spain)

ORAL CONTRIBUTIONS

"NanoScience in the Basque Country" Parallel Session

MICROSYSTEM FOR THE IMMUNOMAGNETIC DETECTION OF ESCHERICHIA COLI O157:H7

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A hand held microsystem has been designed for the immunomagnetic detection and quantification of the pathogen Escherichia Coli O157:H7 in food and clinical samples (Fig. 1). The followed main aims have been the design of the microfluidic circuitry, the sensing film and the packaging needed to carry out the assays in a safe and straightforward way. This work describes a technology that facilitates the integration of 3D microfluidic networks with any microfabricated biosensor to manufacture a Lab on a Chip. The sensor layout is a redundant measuring system which consists on two pairs of microfluidic channels, where four different magnetoresistances per channel have been placed. Two different microfluidic network designs have been analysed: one, with one inlet and one outlet, and the other one, with two inlets and two outlets (see Fig. 2). The first one, allows a more redundant measurement, but no reference is available to discriminate between the signal and the noise. On the other hand, the second Y shaped design allows the use of a reference channel, and assures that the same flow of sample goes through all channels. This equal flow rate is necessary in order to get a reliable sensor measurement. Flow rate tests have been performed inserting a blue dyed liquid with a syringe at a constant pressure of 0.5bar. Figure 3 shows the liquid advances at the same rate in all channels without leaks. The structural material used for the development of the microfluidic channels is the epoxy negative photoresist SU8, which has been chosen because of its excellent electrical, mechanical and fluidic properties, and its biocompability [1]. The fabrication process is based on successive photolithographic and bonding of SU8 layers at low temperature [2]. This process allows the fabrication of a 3D microfluidic network, with perfectly sealed channels and reservoirs with heights up to 180µm. The biosensor must be capable to detect and quantify small magnetic field variations caused by the presence of superparamagnetic beads bound to a biological species previously immobilised on the sensor surface via an antibody-antigen reaction. Therefore, a copper-permalloy multilayered structure [3] has been chosen as sensing layer, which reports a highly sensitive magnetic response at low magnetic fields (Fig. 4). Figure 5 shows the fabrication process of the sensing thin film. As a packaging prototype a plastic capsule with external flexible tubes and an o-ring per reservoir has been fabricated by means of stereolithography. All the pieces are aligned and pressed together by screws, allowing an easy replacement of the tested chip (Fig.6). The package allows the user to insert the sample by a simple syringe (Fig. 7).

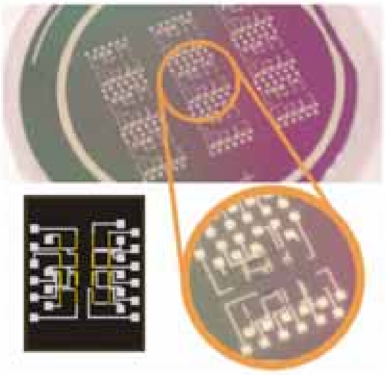

Figure 1. Microfluidic channels and sensors design

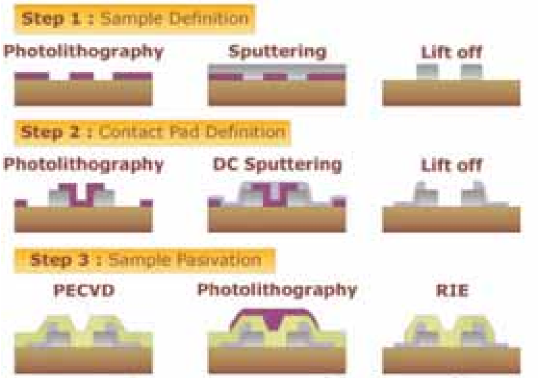

Figure 5. Fabrication process of the sensing film

Figure 2. Microfluidic networks with 1 inlet/outlet (left) and 2 inlets/outlets(right).

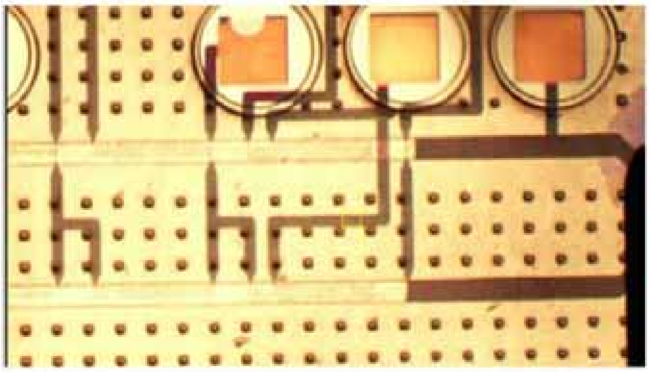

Figure 3. Microfluidic test with blue dyed liquid

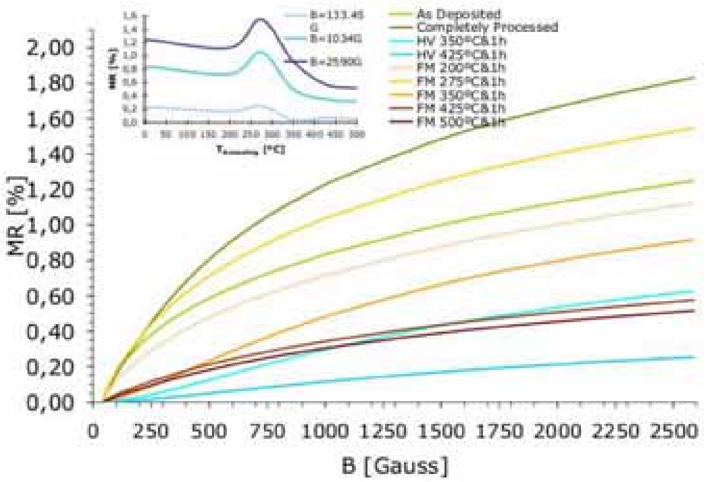

Figure 4. Magnetic response at different conditions.

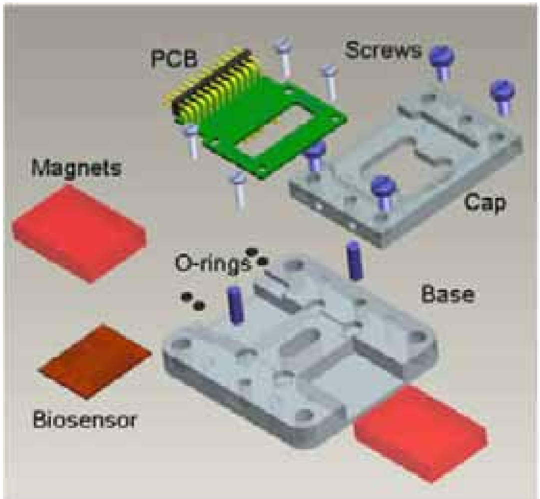

Figure 6. 3D schematic of device packaging design.

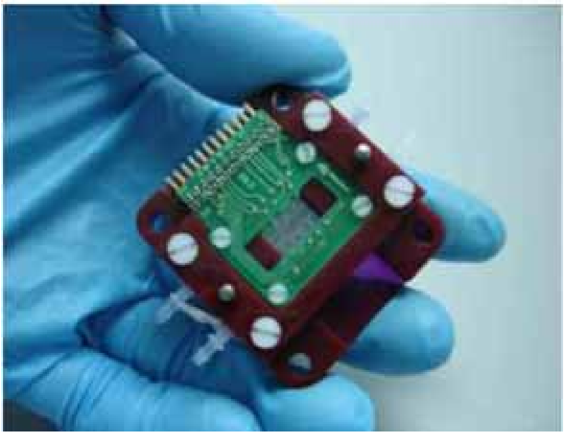

Figure 7. Packaged microsystem

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NEW POLYMER NANOCOMPOSITES FOR PACKAGING WITH ANTIMICROBIAL OR BARRIER PROPERTIES

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Nanotechnology involves the study and use of materials at an extremely small scale -at sizes of millionths of a millimetre- and exploits the fact that some materials have different properties at this ultra small scale from those at a larger scale. In fact, the reinforcement of polymer matrices with nano-size particles of different geometries has become very important for a wide range of applications and improved properties such as, electrical, mechanical, barrier and antimicrobial properties of the plastics.

Nanocomposite technology paves the way for packaging innovation in the flexible film and plastic container industries, offering enhanced properties such as greater barrier protection, increased shelf life and lighter-weight materials. Nanoparticles allow for much lower loading levels than traditional fillers to achieve optimum performance. Usually, additional levels of nanofillers are less than 5 percent, which significantly impacts the weight reduction of nanocomposite films. This dispersion process results in a high aspect ratio and surface area, creating higher-performance plastics than with conventional fillers.

The barrier properties improvement that can result from incorporation of relatively small quantities of nanoclay materials is shown to be substantial. Such excellent barrier characteristics have resulted in considerable interest in nanoclay composites in food packaging applications, both flexible and rigid. Specific examples include packaging for processed meats, cheese, cereals and boil-in-the-bag foods, also extrusion-coating applications in association with paperboard for fruit juice and dairy products, together with co-extrusion processes for the manufacture of beer and carbonated drinks bottles. The use of nanocomposite formulations would be expected to enhance considerably the shelf life of many types of food.

An antimicrobial property is also an outstanding property of some reinforced plastics. Metal particles and metal oxides have been used in packaging for some years. Antimicrobial protection has long been imparted by coating the surface of a material with a liquid or powder disinfectant. More recently, antimicrobial plastics have been used in consumer products such as toothbrushes, mattress pads and children's toys. Antimicrobial plastics are composed of polymers mixed with special disinfectants. The plastic slowly releases the disinfectant over time, killing pathogens that come in contact with its surface.

Over the last years GAIKER-IK4 has been working in the development of new polymer nanocomposites produced by melt compounding with barrier and antimicrobial properties for packaging. In this review, new advanced thermoplastic composites with specific functionalities will be shown: i) for nanocomposites with antimicrobial properties, ZnO nanoparticles content as low as 0.5 wt% of in the plastics show good antibacterial activity against *E. coli* and *St. Aureus* but no antifungal activity is observed.

Results also show better biocide behaviour of ZnO nanoparticles in PA if compared with in PE and ii) nanocomposites based in PP and reinforced with nanoclays show enhanced barrier properties up to 20 % compared to neat polymer [1].

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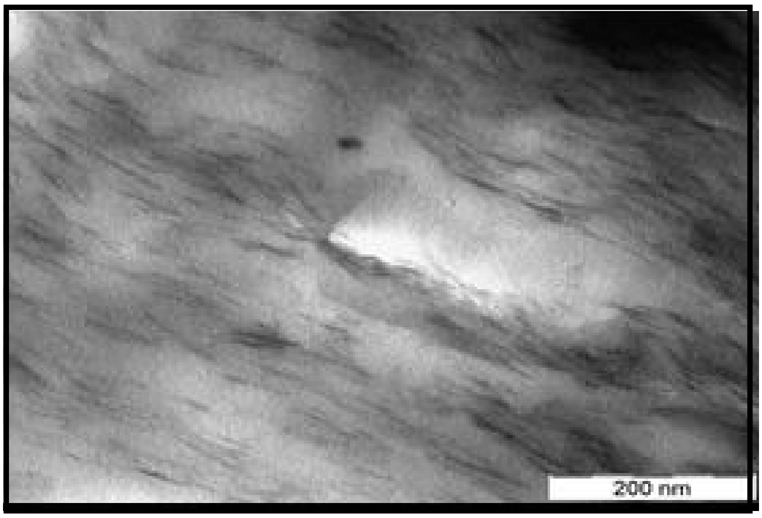

Figure1. Exfoliated nanoclays

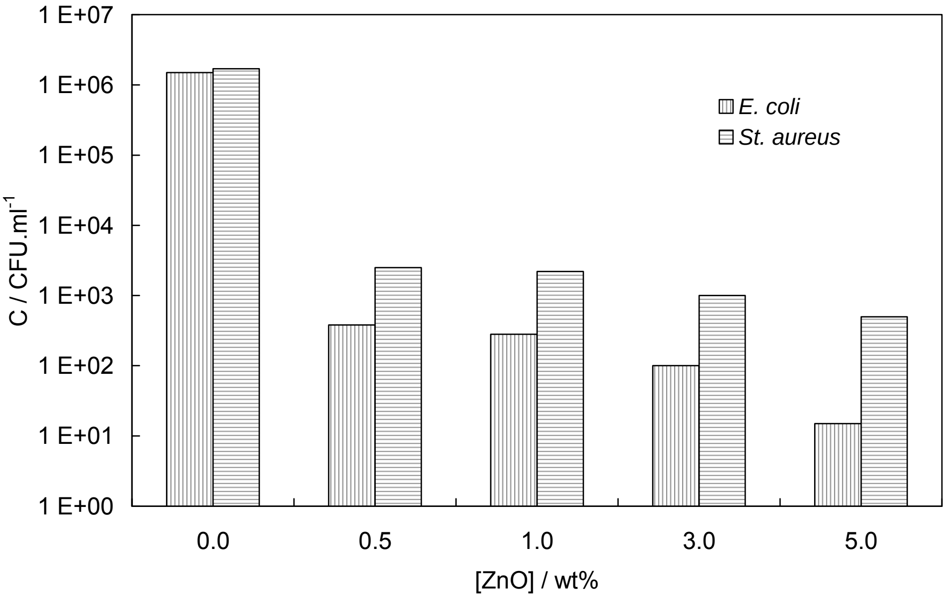

Figure 2. The effect of ZnO nanoparticles in the antimicrobial activity of PA/ZnO nanocomposites after 48 h.

CARBON NANOTUBE BASED NANOCOMPOSITE SENSORS

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Polymer nanocomposites, PNCs, have emerged as a new class of materials in the past decades and attracted considerable interest and investment in research and development worldwide. This is largely due to their new and often much improved mechanical, thermal, electrical and optical properties as compared to the conventional filled polymer or polymer blends.

One of the most promising nanofillers to dope polymers are the Carbon Nanotubes, CNTs; their structural and electrical characteristics make them promising for developing unique and revolutionary smart composite materials. Several smart material properties like piezoresistance and electrochemical effect have been reported. Furthermore, CNT based sensors possess a number of advantages including extreme sensitivity, good selectivity and fast response.

INASMET-Tecnalia is working on new functionalities based on the sensing properties of CNTs; the non-destructive monitoring of damage within polymer based composite structures and the capabilities of gas sensing when exposing to VOCs are two specific examples.

For the first application, the control of the electrical resistance in composite laminates is being studied as the property that could alert in possible failure or mechanical damage of critical structural parts in planes, building constructions, bridges, etc.. Although smart sensors like piezoelectric elements, optic fibres or shape memory alloys are being developed and applied for monitoring the damage tolerance of composite structural components, these systems are frequently expensive and complex, even the system can generate sometimes a possible failure point. So a new idea where the own structure has self-sensing capability without additional sensors is being investigated.

For the second application, the electrical resistivity of the nanocomposites is being studied upon exposure to vapor atmospheres. Conventional gas sensors usually operate at high temperatures but chemiresistor sensors based on carbon nanotubes display high sensitivities and fast response time even at room temperature. Besides, carbon nanotube sensors are more stable than metal oxide sensor since they are not affected by chemical changes on the surface. Finally, the robustness of the sensor is ensured when protected by polymer.

In both applications, several nanocomposites have been fabricated incorporating different types of CNTs into several polymeric matrices; the challenge has been to obtain a good dispersion of them inside the matrix and a perfect interface between both. Different concentrations of nanotubes have been studied to know the percolation threshold. The influence of the functionalization on the conductivity values of the nanocomposites has been also studied. Finally, the manufactured nanocomposites have been exposed to several strains or solvents in order to evaluate the electrical response and to understand the sensing mechanism.

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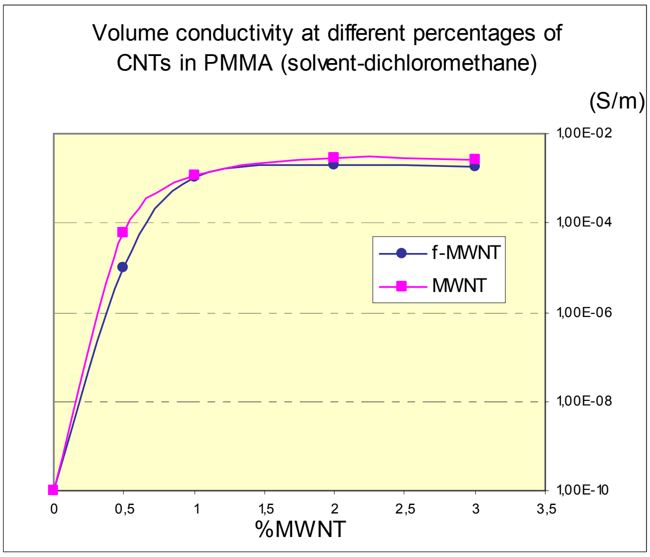

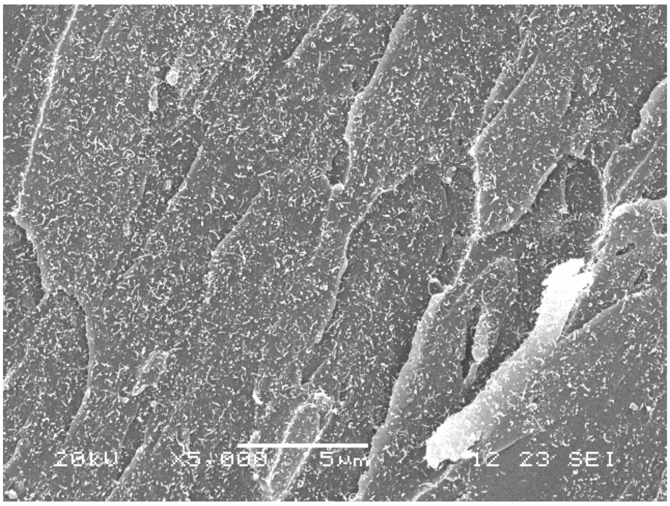

SEM micrograph of 1% functionalized MWNTs in epoxy

NANOPARTICLES FOR THERAPEUTICS AND DIAGNOSTICS

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During the last years, there has been a great deal of interest in the self-assembly fabrication of hybrid materials from inorganic nanoparticles and biomolecules[1] Gold glyconanoparticles are constituted by a gold core and a self-assembled monolayer of carbohydrates. They are the most stable metal nanoparticles and present interesting properties which include a wide array of assembling model and size-related electronic, magnetic and optical properties. The glyconanoparticles constitute a good bio-mimetic model of carbohydrate presentation at the cell surface [2], so they can be considered as nanocells.

At Midatech we design and manufacture nanoparticles for therapeutics, diagnostics and coatings for devices including microchips.

Our biocompatible nanocells are manufactured through a one-step current Good Manufacturing Practise (cGMP) process in which the nanocells self-assemble. Manufacture is therefore simple, safe, scaleable and low cost.

Our nanocells have properties that make them ideal as drug delivery vehicles:

- They are water soluble and can be designed to either diffuse freely in vivo, or to target specific cells.
- A class of our nanocells have been shown to cross the Blood Brain Barrier.
- With a diameter of less than 5nm, unbound nanoparticles are freely excreted from the kidneys, reducing the likelihood of non-specific in vivo accumulation.
- Multiple ligands can be attached to a single nanoparticle, so multivalent drug delivery or receptor binding is possible, as well as heterogeneous ligand delivery.

Owing to these properties, nanocell vaccines have been made incorporating all components required to simultaneously stimulate the multiple arms of the immune system as well as the antigenic structures.

Nanocells are superparamagnetic, enabling them to be used as both non-invasive imaging agents (MRI), and as vehicles for inducing cell suicide by hysteresis heating (apoptosis caused by heating of an intracellular or cell-surface bound nanoparticle with an alternating magnetic field), a procedure being exploited as thermotherapy for both bacterial infections and cancers.

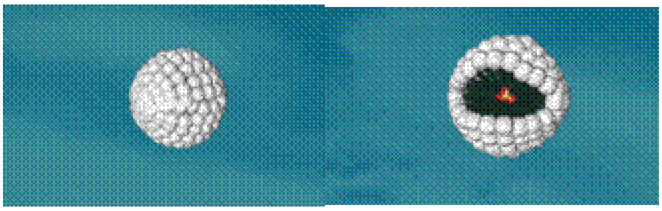

Figure 1.- *Representative picture of nanocells.*

Our vision is to harness the vast potential of our nanocells to improve therapies for human diseases, (including cancer and infectious disease).

We seek to apply and partner this exciting technology in areas of unmet medical need, and to improve current drugs and vaccines.

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Fe_3O_4 NANOPARTICLES FOR MRI CONTRAST ENHANCEMENT.

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The great interest of magnetic nanomaterials arises from their novel mesoscopic properties, which are associated with their large surface-to-volume ratio [1]. Magnetic nanoparticles have attracted great attention in the field of medicine for many reasons [2]. They can be functionalized with biological molecules to make them interact with or bind to a biological entity. They can be manipulated by an external magnetic field, which opens up many applications involving the transport and/or immobilization of the nanoparticles. Finally, they can be made to resonantly respond to a time-varying magnetic field, leading to its use as hyperthermia agents. What is more, superparamagnetic nanoparticles have also been developed as contrast agents for both standard and functional MR imaging [3].

Taking into account these facts, the aim of our study is to optimize the preparation of Fe_3O_4 and core-shell Fe_3O_4@Au nanoparticles in order to concentrate them inside tumorous tissue in the liver and make them heat through energy absorption. Indeed, in this communication we present the preparation and magnetic study of Fe_3O_4 nanoparticles and their application in *in vivo* experiments as contrast agents.

The synthesis of the magnetic nanoparticles has been developed from $Fe(acac)_3$ in the presence of 1,2-hexadecanodiol, oleic acid and oleylamine [4]. The synthesis method, the iron concentration and the nature of the solvents used for separation have been changed in order to optimize the preparation method. In this way, nanoparticles with sizes in the 3.8(6) – 7.1(9) nm range, surrounded by the organic ligands have been obtained. The characterization of the samples was performed by means of X-ray diffraction (XRD), transmission electron microscopy (TEM) and thermogravimetric analysis (TGA). Magnetic properties have been investigated using electron paramagnetic spectroscopy (EPR) and SQUID magnetometer.

Depending on the synthesis method the content of organic ligands surrounding the nanoparticles varies from 18% to 40%, mainly composed by oleic acid. TEM micrographs show nanoparticles with a narrow size distribution (Fig. 1). The smaller size of the nanoparticles seems to be related with the larger content of the organic ligand. X-ray diffraction and electron diffraction confirmed the presence of Fe_3O_4 in all cases.

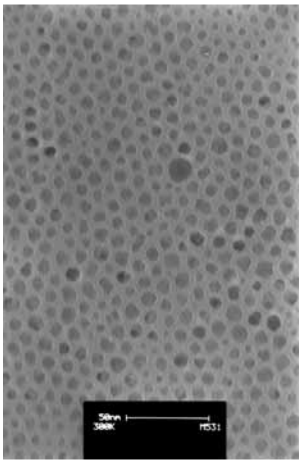

Fig. 1. TEM picture of Fe_3O_4 NPs.

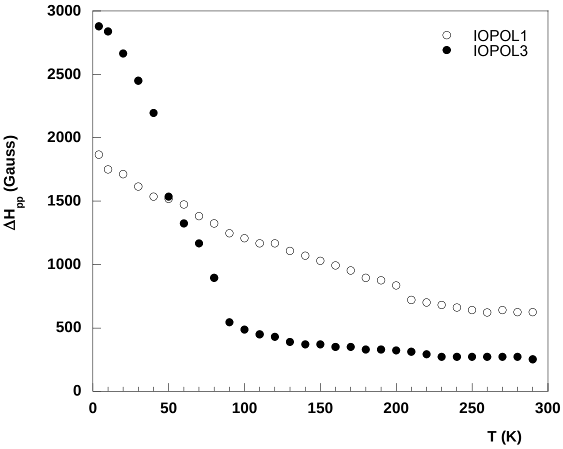

Fig. 2. EPR resonance field versus temperature for two different samples.

The expected superparamagnetic behaviour for nanoparticles below the critical size has not been observed in all cases. In fact, at room temperature, coercive fields between 30 and 130 Oe characteristic of ferromagnetic behavior have been calculated from hysteresis cycles. In order to complete this study, electron paramagnetic resonance spectra with temperature have been performed.

The spectra show strong and broad signals with effective g values from 2.0 to 2.38, depending on the sample. In all samples, while the linewidth increases, the resonance field decreases with temperature. However, the behavior of $\Delta H_{p.p.}$ and Hr vs T is rather different for the samples (Fig. 2). A relative smooth increase of $\Delta H_{p.p.}$ (decrease of Hr) with decreasing temperature is typical of ferromagnetic samples while for superparamagnetic ones a change in the slope is observed at the blocking temperature, T_B, of the nanoparticles.

Finally, Fe_3O_4 samples were dissolved in lipiodol and injected into the liver to WAG rats in order to register MR images. These samples were supplied through ileo-colic vein, and no vascular embolic phenomena were developed. It has been proved that very small quantities are enough to visualize the images (Fig. 3). Finally, in pathologic analysis of liver specimens, only few inflammatory changes were detected.

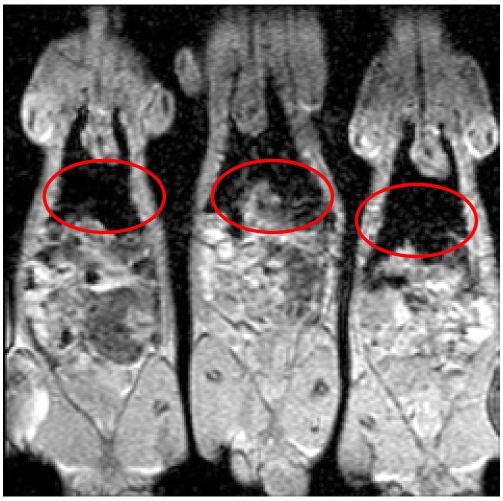

Fig. 3. Magnetic resonance image of rats' coronal planes showing the localization of magnetite nanoparticles in the liver.

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GLYCONANOTECHNOLOGY: A METHOD FOR THE PREPARATION OF BIOFUNCTIONAL NANOPARTICLES WITH APPLICATION IN NANOMEDICINE

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Our laboratory has developed an integrated strategy to study and intervene in carbohydrate-mediated interactions, named Glyconanotechnology [1,2,3]. It allows the preparation, in a simple way, of a great variety of sugar functionalized self assembled monolayers on 3D-gold nanoclusters (Glyconanoparticles, GNPs) [3,4]. The biofunctional GNPs are water soluble, globular shaped and with well defined composition. They present in a multivalent way the ligands, thus constituting a good biomimetic model of carbohydrate presentation at cell surface. The preparation of multifunctional GNPs incorporating, in a control manner, not only carbohydrates, but also a selected set of ligands (DNA, RNA, peptides, fluorescent probes, etc) on the same cluster is comprised within the potential of this technology. These tools allow us to intervene in cell adhesion and recognition processes.

Based on this technology, three main projects are being developed in our laboratory:
- GNPs as microbicides against HIV infection
- Magnetic GNPs as contrast agents in Magnetic Resonance Imaging (MRI)
- GNPs as non-viral transfection agents

This lecture will focus on the presentation of our results and applications of GNPs as potential microbicides for blocking HIV-1 infection and as contrast agents in MRI for brain tumor targeting.

One of the mechanisms of HIV vaginal infection is mediated by the interaction between the envelope glycoprotein gp120 of the HIV-1 and the DC-SIGN receptor of dendritic cells [5]. DC-SIGN recognizes high-mannose oligosaccharides which are present in the glycoprotein gp120. GNPs capped with the mannose structural motives present in the gp120 were prepared and tested by Surface Plasmon Resonance (SPR) as inhibitors of the binding of DC-SIGN to gp120. Free oligomannosides need millimolar concentrations to give 100% inhibition; mannose GNPs increase effectiveness requiring micromoles concentrations. The best inhibitor, with an effective concentration at nanomolar scale, was a GNP capped with the disaccharide Manα1-2ManαGNP (Figure 1). The evaluation of this inhibition *in vitro* with cell based models and the effect in dissemination of HIV-1 from cells bearing DC-SIGN to T-cell populations will be also illustrated.

Gd(III) chelates are in use in medical diagnostic as MRI contrast agents [6]. The construction of novel paramagnetic GNPs functionalised with different sugars (glucose, lactose, galactose) and containing Gd(III) complexes of a DOTA derivative (in ~ 10% proportion) was achieved. Aliphatic linkers of different lengths (two, five or eleven carbon atoms) were used to study the influence of the presentation and rigidity on the relaxivity of the system. Relaxation times T_1 and T_2 were measured with a Minispec at 1.5 T to calculate r_1 and r_2 relaxivity values. Phantoms containing solutions of the compounds were also imaged at 7.0 T. *In vivo* imaging of intracerebral glioma in mice was run and the images were compared with the ones obtained with commercial Magnevist® (gadolinium DTPA) (Figure 2).

Details on the synthesis, characterization, cytotoxicity of the GNPs will be also given.

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Figures:

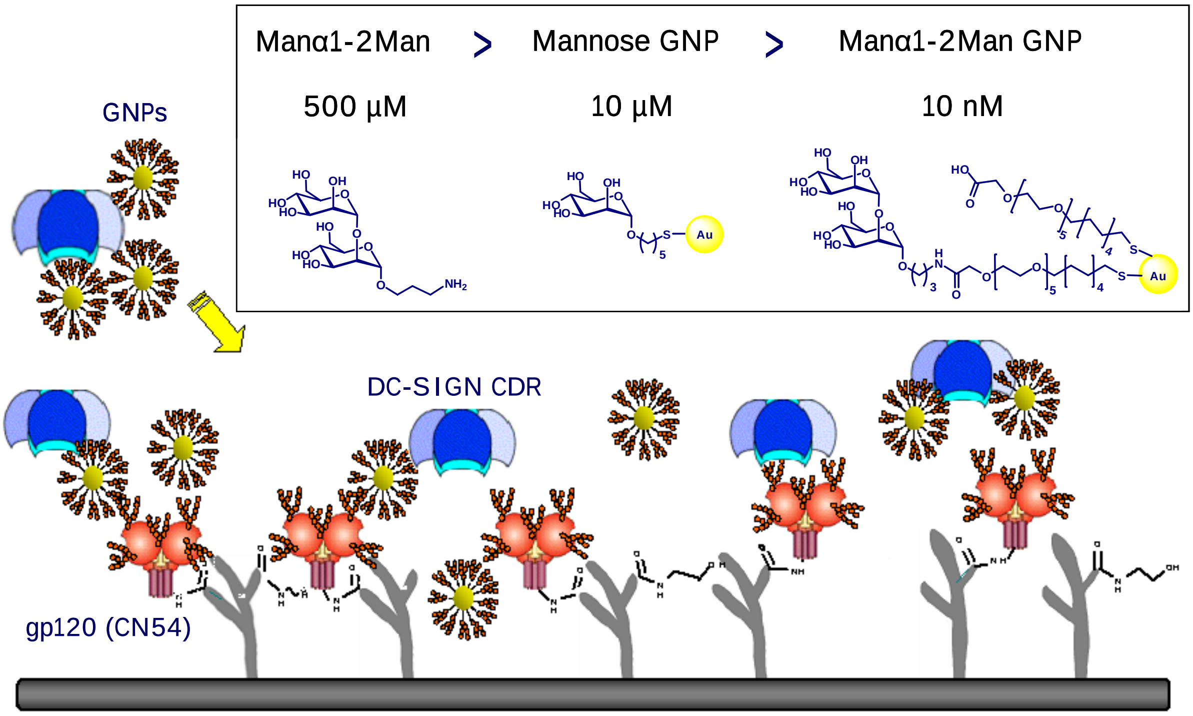
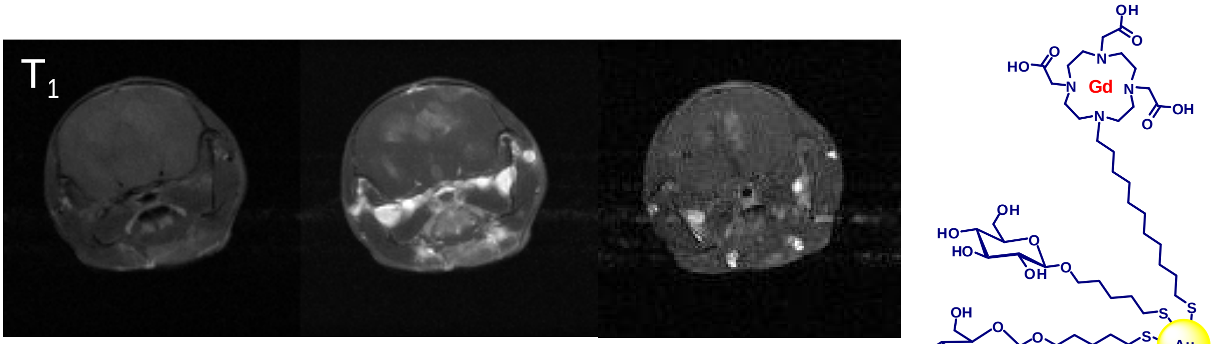


Figure 1. Dose dependent inhibition of GNPs on the binding of DC-SIGN to gp120 as measured in a BIACORE (DC-SIGN and GNPs fluid phase over immobilized gp120 on surface)



Before injection

After injection Glc-DOTA-Gd^{3+} GNPs

After injection Gd^{3+}-DTPA (Magnevist@)

Glc-DOTA-Gd^{3+} GNPs

Figure 2. Precontrast and postcontrast T$_1$-weighted images of intracerebral glioma in mice: comparison between Glc-DOTA-Gd^{3+} GNPs and Magnevist® (in collaboration with IIB “Alberto Sols” of Madrid)

NEW AMINE FUNCTIONAL IONIC LIQUID AS BUILIDING BLOCK IN NANOTECHNOLOGY

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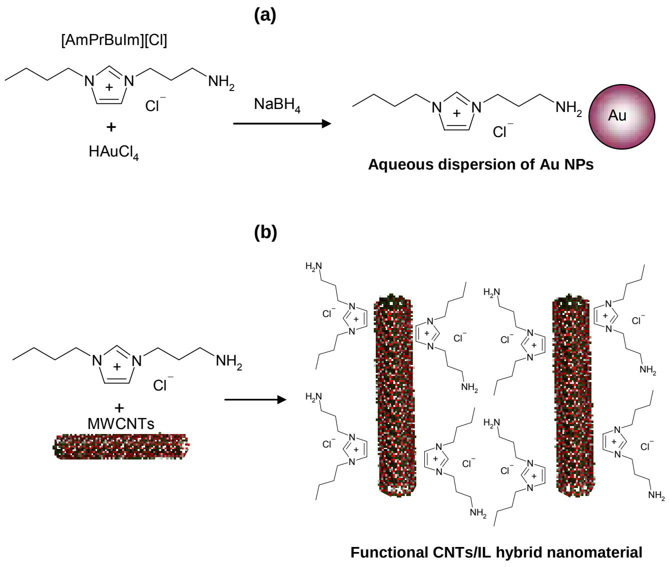
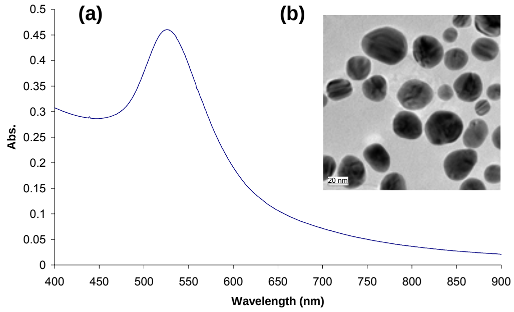
In the last few years, ionic liquids (ILs) have been the focus of numerous investigations in diverse fields like organic and analytical chemistry, biochemistry, electrochemistry, catalysis, and more recently in nanotechnology. Interestingly, the use of ILs in nanotechnology is having an exponential increase in the last years .[1] Most of the activities are related to the potential offered by the combination of ILs with different kinds of nanoobjects such as metal nanoparticles (NPs) and carbon nanotubes (CNTs). For instance, ILs have been used as solvents in organic chemical reactions catalyzed by metallic NPs as well as in the development of synthetic procedures with a good control of the NPs size. On the other hand, ILs and CNTs show also a great affinity and interesting possibilities. As an example, pioneering works by Aida et al. reported the synthesis of CNTs/IL hybrids, that they named “bucky gels”, by mixing IL and CNTs[2]. This CNT/IL combination resulted in much finer bundles in the heavily entangled nanotubes. Recently, ILs have also been used to functionalize the surface of the CNTs and to develop new phase transfer methods[3-5].

In this communication we will show our recent results in the use of Ionic Liquids and Polymeric Ionic Liquids in the development of nanomaterials. As an example we report here the synthesis of a new amine-functional ionic liquid (AFIL) 1-(3-aminopropyl)-3-butylimidazolium chloride [AmPrBuIm][Cl] and its application as “building block” in nanotechnology. The AFIL molecule could be used both as stabilizer in the synthesis of gold NPs and in the development of functional CNTs/IL hybrid nanomaterials by mixing with MWCNTs (Scheme 1).



Scheme 1. (a) Synthesis of Au NPs with AFIL. (b) Modification of MWCNTs with AFIL resulting in functional CNTs/IL hybrid nanomaterials

Thus, Figure 2a shows the UV-vis spectrum of the aqueous dispersion which exhibited a surface plasmon resonance band at 525.5 nm. Moreover, the size, shape and dispersity of the Au NPs were determined with transmission electron microscopy (TEM). TEM image of Au NPs stabilized by AFIL is shown in Fig. 1 (b) which illustrates the formation of spherical particles with average diameters of 33 nm. On the other hand, Figre 2b shows AFM (atomic force microscope) phase images of unmodified MWCNTs and the obtained functional CNTs/IL hybrid nanomaterials. Unmodified MWCNTs are heavily entangled in bundles with diameter of ~ 80 nm. Interestingly, functional CNTs/IL hybrid nanomaterials resulted in isolated MWCNTs forming much finer bundles with a diameter of ~ 30 nm. MWCNTs, that normally exist as 3-D networks of heavily entangled bundles, were untangled to much finer bundles or individual nanotubes due to the cation-π interactions between the IL and the surface of the CNT.



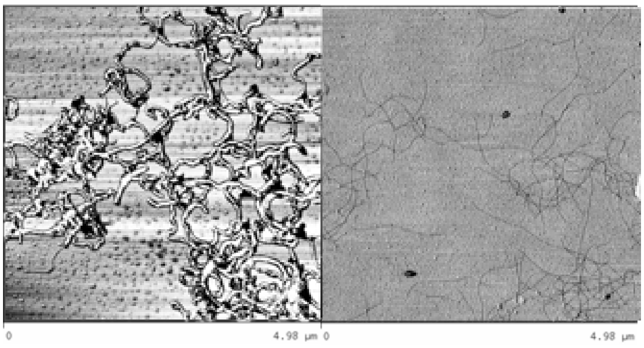


Figure 2a (left). (a) UV-vis absorption spectrum of Au NPs in aqueous dispersion stabilized with an AFIL. (b) TEM image of the AFIL stabilized Au NPs.Fig. **Figure 2b (right)** AFM phase images of (a) unmodified MWCNTs and (b) functional MWCNTs/AFIL hybrid nanomaterials.

These new functional Ionic Liquid leads to more complex nanomaterials, bearing an amine group, which offers the possibility to interact with biological compounds opening new opportunities. Bioactive functional hybrid nanomaterials, biosensors and conductive nanocomposites are envisaged as new applications.

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ON THE FORMATION OF CEMENTITIOUS C-S-H NANOPARTICLES: A COMPUTATIONAL APPROACH

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Abstract:

Much of the existing knowledge on the nanostructure of cementitious Calcium Silicate Hydrate (C-S-H) nanoparticles has been gained from structural comparisons with crystalline calcium silicate hydrates. In fact, several models [1-5] have been proposed so far that draw structural analogies with tobermorite and jennite crystals and/or with distorted semi-crystalline variations of them (the so called C-S-H (I) and C-S-H (II) phases respectively). From these models, C-S-H gels can be approximately viewed as layered structures, in which calcium oxide sheets are ribbed on either side with silicate chains, and free calcium ions and water molecules are present in the interlayer space (see Figure).

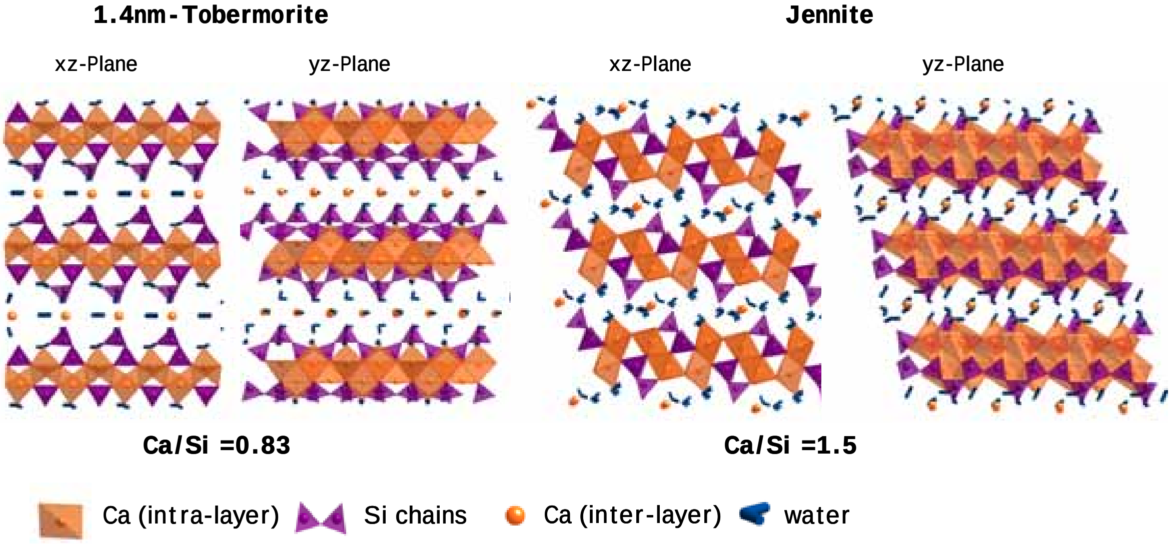

Figure: Schematic representation of the structure of the 1.4-nm tobermorite and jennite crystals.

However, and though intensively characterized by techniques like SEM, TEM, NMR, etc [6], many features of the nanostructure of C-S-H gel remain unravelled. The debate about the short-range ordering of cementitious C-S-H gel is still unsettled.

This work aims to highlight the importance of atomistic computational approaches to shed light on the nanostructure of the C-S-H gels. To this end two complementary ongoing studies will be presented. Firstly, the dependence of the mechanical properties upon the length of the silicate chains will be discussed with help of force-field calculations [7]. Secondly, the underlying growth mechanisms which govern the formation of C-S-H nanoparticles will be studied by means of *ab-initio* [8] and Molecular Dynamic calculations [9].

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ELECTRONIC AND STRUCTURAL PROPERTIES OF COMPLEX SURFACES AND NANOSTRUCTURES FROM FIRST-PRINCIPLES

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First, I will briefly introduce some of the work that has been performed recently in the DIPC and the joint CSIC-UPV/EHU Materials Science Research Centre on the physics of surfaces and nanostructures. Particularly, I will present some of the theoretical work in the field of the dynamics of electronic excitations and adsorbates: lifetimes of surface and image states [1], plasmons [2,3], charge transfer from adsorbates [4,5,6], chemical reactions of molecules and catalysis [7,8], etc…

Then I will describe with more detail two particular examples: i) water absorption on the surface of NaCl and the oxygen covered Ru(0001) surface [9,10,11], and ii) the electronic, magnetic and structural properties of Ni substitutional impurities in carbon nanotubes [12].

Thin films of water molecules cover most surfaces under ambient conditions. This phenomenon is crucial in biology, material sciences and chemistry. For example, chemical reactions occurring at the wet surface of sea salt aerosols, which are mainly composed by NaCl particles, play a fundamental role in tropospheric chemistry. Our calculations [9] show that a significant amount of the surface chlorine ions are very likely to emerge in the presence of only one monolayer of water adsorbed on the NaCl(100) surface already at low temperatures. These findings support the AFM measurements that show a strong negative surface dipole along flat NaCl terraces already at this coverage [9]. The energy associated with the Cl^- rising is governed by electrostatic interactions. Thus, the low energy cost for the anion emergence is a consequence of the efficient screening provided by the highly polarizable water monolayer. This process is important to understand the catalytic activity of the NaCl surfaces at low relative humidity, with implications for surface reactions in salt aerosols, where chloride anions play a key role.

We have also investigated the structure and energetics of the first hydration layer on NaCl(100) at larger coverages [10]. We have analyzed in detail the role of the hydrogen bond between the adsorbed molecules for the determination of the most favourable structures. Using water dimers as basic building blocks two very stable and approximately degenerate structures can be constructed: i) a model with (1x1) periodicity at 2 ML coverage, ii) ice-like bilayers with a c(4x2) unit cell at 1.5 ML. Based on these findings, we propose an interpretation for the experimental observed transition of the periodicity the first hydration layer on NaCl(100) from (1x1) to c(4x2) upon electron irradiation. According to our model, the transition would be driven by the partial desorption of (1x1) bilayer structures corresponding to a local coverage of 2ML and the further rearrangement of the remaining water molecules to form a quasi-hexagonal structure with c(4x2).

We have also studied the adsorption configuration of water on O(2x2)/Ru(0001) combining STM experimental information with first-principles combinations [11]. Substantial differences in the adsorption energies and geometries are found when compared to the clean metallic Ru(0001) surface.

Finally, I will present some our results for the electronic, magnetic and structural properties of Ni substitutional impurities in carbon nanotubes. Interestingly the magnetic properties of these impurities are shown to strongly depend on the metallic or insulating properties of the host nanotube and on the Ni concentration. Only for metallic carbon nanotubes and low impurity concentration the Ni atoms develop an appreciable magnetic moment. The interaction between this moments seems to be ferromagnetic.

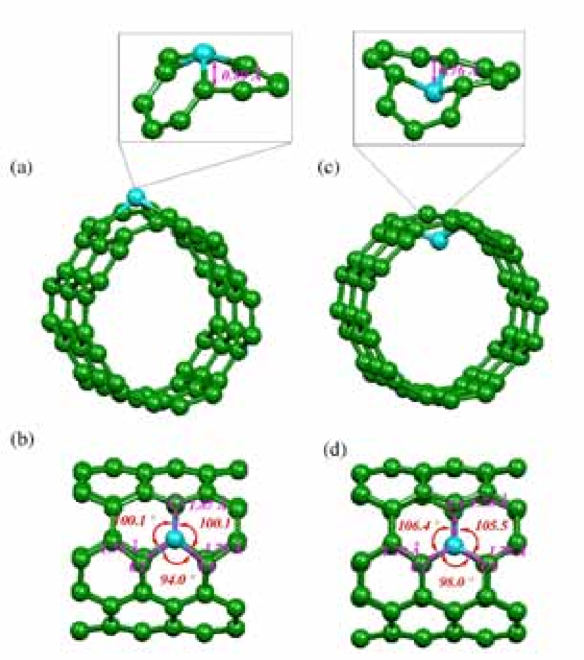

Figure. Two stable geometries for a Ni substitutional impurity in a (5,5) metallic nanotube. *Outward* geometries are always more stable than *inward* relaxed structures.

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TNT2007
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PA61	**Burbridge**	Daniel	United Kingdom	Nanofabrication tools & nanoscale integration	*Nanowelding and nanotool fabrication using electron-beam-induced deposition*
PA109	**Burke**	Sarah	Canada	SPM	*Uncovering molecular morphologies of C60 and PTCDA on insulators: Dewetting in two prototypical organic semiconductors*
PB116	**Cabrera-Sanfelix**	Pepa	Spain	Theory and modelling at the nanoscale	*First-principles investigation of electron-induced cross-linking of aromatic self-assembled monolayers on Au(111)*
PA74	**Capdevila Cascante**	Santiago	Spain	Nanostructured and nanoparticle based materials	*Microwave characterization of a cnt bucky paper transmission line*
PA5	**Cardin Saint-Antoine**	Benoit	Canada	Carbon nanotubes	*Carbon Nanotube Networks: Exceptional Electrical Properties*
PB102	**Carr**	Bob	United Kingdom	Other	*Single Nanoparticle detection and analysis*
PA110	**Carrasco Pulido**	Carolina	Spain	SPM	*Resolving single kinesin motors in motion by atomic force microscopy*

PB6	**Cartoixa**	Xavier	Spain	Carbon nanotubes	*Pyridine- and C10H10BN-based nanotubes: A route to always semiconducting NTs*
PB17	**Cefalas**	Alkiviadis-Constantinos	Greece	Low dimensional materials	*Clustering and growth of intermetallic alloy nanodroplets*
PB69	**Cerny**	Frantisek	Czech Republic	Nanostructured and nanoparticle based materials based materials	*Preparation of coloured DLC nanolayers and their nanoindentation testing*
PB117	**Chang**	Hyunju	Korea	Theory and modelling at the nanoscale	*First Principles Studies of Interaction between DNA and Carbon Nanotubes for the potential DNA sensor applications*
PA1	**Chaves Romero**	Ferney A.	Spain	Atomic Scale Effects in nano-CMOS Electronics	*Simulation of the Gate Leakage Current in Surrounding Gate (SG) MOSFETs Based on an Analytic Potential Model*
PB38	**Chilibon**	Irinela	Romania	NanoChemistry	*Thermal Analysis of PT Ceramics Obtained by Sol-Gel Processing*
PA21	**Chiu**	Sheng-Cheng	Taiwan	Low dimensional materials	*Direct synthesis of SiC nanorods by annealing carbon nanocapsules and SiO2 spheres*
PA6	**Cid**	Cristina	Spain	Carbon nanotubes	*Carbon Nanotube based Ion Selective Field Effect Transistors*
PA56	**Ciesa**	Flavio	Italy	NanoChemistry	*Sub-nanometer Au MPCs Synthesized by Multipodand Calixarene Protection*
PA37	**Clarke**	Samuel	Canada	Nanobiotechnologies	*Optical and Biological Characterization of Surface Modified Quantum Dots*
PA7	**Coiffic**	Jean-christophe	France	Carbon nanotubes	*Carbon nanotube based interconnects*
PB118	**Coluci**	Vitor	Brazil	Theory and modelling at the nanoscale	*Mechanical Properties of Ordered Single Walled Carbon Nanotube Networks*
PA22	**Cordón Vélaz**	Javier	Spain	Low dimensional materials	*Engineering electron bands in dislocation networks*
PB18	**Cornelius**	Thomas	Germany	Low dimensional materials	*Quantum-size and finite-size effects in the electrical transport properties of single bismuth nanowires*
PB19	**Corso**	Martina	Spain	Low dimensional materials	*Modification of the Ag/Cu(111) dislocation network dy doping*
PB20	**Cotta**	Monica	Brazil	Low dimensional materials	*Spatial correlations of self-assembled nanostructures using a squared lattice InP/InGaP template*
PA75	**Cranston**	Emily	Canada	Nanostructured and nanoparticle based materials	*Birefringent Thin Films of Nanocrystalline Cellulose*
PB21	**Critchley**	Kevin	United States	Low dimensional materials	*The Self-Assembly of Cadmium Telluride Nanowires from Nanoparticles*
PA106	**Dadvand**	Afshin	Canada	Other	*High performance organic light emitting transistor based on hexylstyryl tetracene*
PB48	**Dallaporta**	Hervé	France	Nanofabrication tools & nanoscale integration	*Study of structures deposited by focused ion beam induced deposition on membrane*
PB70	**De los Arcos**	Teresa	Switzerland	Nanostructured and nanoparticle based materials based materials	*C60/Si and C60/SiO2 composite thin films: A photoelectron spectroscopy study of their matrix-dependent thermal stability*
PB50	**Del Val**	Juan José	Spain	Nanomagnetism and Spintronics	*Soft Magnetic Properties of Nanocrystalline (Co77Si13.5B9.5)90Fe7Nb3 Alloy*

PA38	**Delcea**	Mihaela	Spain	Nanobiotechnologies	*Hybrid polyelectrolyte/bacterial protein (nano)biomimetic surfaces: a model to study bacterial surface layer recovery and bacterial affinity*
PA39	**Díaz García**	Elena	Spain	Nanobiotechnologies	*Absence of extended states in a ladder model of DNA*
PB119	**Diez-Muiño**	Ricardo	Spain	Theory and modelling at the nanoscale	*How to improve the dissociative reactivity of O2 on clean Ag(100) surfaces*
PB71	**Dil**	Hugo	Switzerland	Nanostructured and nanoparticle based materials based materials	*Determination of the nano scale energy landscape of h-BN/Rh(111) nanomesh by photoemission from adsorbed Xenon*
PB72	**Dinu**	Elena	Romania	Nanostructured and nanoparticle based materials based materials	*Nanocristallites obtained through the pyrosol method*
PA40	**Dontsova**	Ekaterina	Russia	Nanobiotechnologies	*Investigation of nanostructured films of antibodies and polymers*
PB35	**Dumitru**	Anca	Romania	Nanobiotechnologies	*Biofilm growth form waste water on MWNTs and carbon aerogels*
PA64	**Echeverría Arrondo**	Carlos	Spain	Nanomagnetism and Spintronics	*Nanocrystals of Mn-doped CdTe: A theoretical approach on the magnetic properties*
PA41	**Eleta**	Aitziber	Spain	Nanobiotechnologies	*Recrystallization of bacterial surface layers: how fast S-proteins self assemble to build 2-D nanobiostructures*
PB120	**Enkovaara**	Jussi	Finland	Theory and modelling at the nanoscale	*GPAW: Real space implementation of projector augmented wave method*
PA126	**Ershova**	Olga	Russia	Theory and modelling at the nanoscale	*Simulation of nanotube-based NEMS controlled by nonuniform electric field*
PB51	**Escobedo**	Ramón	Spain	Nanomagnetism and Spintronics	*Self-sustained current oscillations in a multiquantum well spin polarized structure with normal contacts*
PA62	**Fernandez**	Ivan	Spain	Nanofabrication tools & nanoscale integration	*Unstrained magnetostrictive Fe80B20 films for MEMS/NEMS actuators.*
PB22	**Fernández**	Laura	Spain	Low dimensional materials	*Self-assembly of silicide quantum dots on stepped silicon surfaces by reactive epitaxy*
PA111	**Fernández Torrente**	Isabel	Germany	SPM	*Growth of TTF-TCNQ on metal surfaces*
PA42	**Firkowska**	Izabela	Germany	Nanobiotechnologies	*Bioinspired nano-architectures based on chemically functionalized carbon nanotubes*
PB121	**Frederiksen**	Thomas	Spain	Theory and modelling at the nanoscale	*Inelastic transport theory for nanoscale systems: Local heating in a Cu–C60–Cu junction*
PB106	**Frolov**	Vadim	Russia	SPM	*Electrical field-induced nanolithography of thin ta-C films under ambient conditions*
PB58	**Froufe**	Luis	France	NanoOptics & NanoPhotonics	*Controlling Single Molecule Fluorescence Lifetime Through Slabs of Metallic and Negative Index Materials*
PA76	**Fukui**	Toshiyuki	Japan	Nanostructured and nanoparticle based materials	*Temperature-Dependent Chiroptical Responses of Chiral Monolayer-Protected Gold Nanoclusters*
PA43	**Fuss**	Martina	Spain	Nanobiotechnologies	*Characterization of supramolecular assemblies of maltose neoglycoconjugates and glyconanoparticles by non-contact afm*

PA8	**Gaass**	Markus	Germany	Carbon nanotubes	*Supercurrent and Coulomb blockade in multiwall CNTs with Nb contacts*
PB23	**Garcia de Oteyza**	Dimas	Germany	Low dimensional materials	*Towards controlled bottom-up architectures in organic heterostructures*
PA69	**Garcia Etxarri**	Aitzol	Spain	NanoOptics & NanoPhotonics	*Plasmons in nanospears*
PA57	**García Gallastegi**	Ainara	Spain	NanoChemistry	*Synthesis of Dendrimer-Carbon Nanotube Conjugates*
PB122	**Garcia-Lekue**	Arantzazu	Spain	Theory and modelling at the nanoscale	*Elastic quantum transport for molecular nanoswitches using plane waves*
PB59	**Garcia-Martin**	Antonio	Spain	NanoOptics & NanoPhotonics	*Surface plasmon resonance effects in the Magneto Optical activity of noble metal-ferromagnet ultrathin films*
PA23	**Gence**	Loïk	Belgium	Low dimensional materials	*Electrical and Thermal Characterization of Hybrid Metal/Polymer Nanowires*
PB73	**Ghitulica**	Cristina	Romania	Nanostructured and nanoparticle based materials based materials	*Synthesis and characterization of hydroxyapatite nanopowders with high stability*
PB74	**Giménez**	Sixto	Spain	Nanostructured and nanoparticle based materials based materials	*Development of nanostructured magnetic materials for high frequency applications through powder metallurgy*
PB123	**Godoy**	Andres	Spain	Theory and modelling at the nanoscale	*Numerical simulation of electron transport in nanoscaled silicon-on-insulator*
PB7	**Goel**	Ashok	United States	Carbon nanotubes	*Nanotube-Based Interconnects for Nanotechnology Circuits: An Introspection*
PA58	**Goikolea**	Eider	Spain	NanoChemistry	*X-ray magnetic circular dichroism styudy of magnetic dodecanethiol-capped Au nanoparticles*
PA9	**Gomes Santos**	Elton Jose	Spain	Carbon nanotubes	*Ab initio study of substitutionally Ni-dopedsingle wall carbon nanotubes: structural and electronic properties*
PB8	**Gomez**	Julio	Spain	Carbon nanotubes	*Voltage and length-dependent phase diagram of the electronic transport in carbon nanotubes*
PB39	**Gonzalez**	Julian	Spain	NanoChemistry	*Magnetic characterization of Manganese oxide nanofibres*
PB52	**Gonzalez**	Julian	Spain	Nanomagnetism and Spintronics	*Magnetocaloric effect in nanogranular glass coated microwires*
PA77	**González**	Imanol	Spain	Nanostructured and nanoparticle based materials	*Effects of processing sequence and critical interparticle distance in PA6/clay/mSEBS nanocomposites*
PA24	**Gorzny**	Marcin	United Kingdom	Low dimensional materials	*Electrical characterization of tmv-based nanostructures*
PB9	**Granitzer**	Petra	Austria	Carbon nanotubes	*Formation of self-assembled metal/silicon nanocomposites*
PA44	**Hajizadeh**	Solmaz	Iran	Nanobiotechnologies	*Gelatin nanoparticles fabrication and evaluation effectiveness parameters*
PA10	**Hajizadeh**	Solmaz	Iran	Carbon nanotubes	*Synthesis and purification of produced Carbon Nanotubes in NaCl solution*
PA70	**Hoa**	Xuyen Dai	Canada	NanoOptics & NanoPhotonics	*Guided Immobilization of Quantum Dots on Gold Nanogratings for Enhanced Surface Plasmon Resonance Biosensing*
PB75	**Hoppe**	Cristina Elena	Spain	Nanostructured and nanoparticle based materials based materials	*One-Pot Preparation of Gold-Elastomer Nanocomposites Using PDMS-graft-PEO Copolymer Micelles as Nanoreactors*

PA78	**Hortiguela**	Maria Jesus	Spain	Nanostructured and nanoparticle based materials	*Macroporous 3D Architectures of Self-Assembled MWCNTs Surface Decorated with Pt Nanoparticles as Anodes for a Direct Methanol Fuel Cell*
PA79	**Hsu**	Li-Chieh	Taiwan	Nanostructured and nanoparticle based materials	*Growth of the α-Fe2O3 nanowires by oxidation of iron films*
PB107	**Hsu**	Ching-Ling	Taiwan	SPM	*The effects of surface functionalization and temperature in AFM lithography on silicon*
PB24	**Hubalek**	Jaromir	Czech Republic	Low dimensional materials	*Vertically Aligned Arrays of Metal Nanostructures Fabricated by Direct Galvanostatic Electrodeposition Using Anodic Alumina Templates*
PA11	**Hudziak**	Steve	United Kingdom	Carbon nanotubes	*Mössbauer Spectroscopy Studies of Iron-Filled Carbon Nanotubes*
PA80	**Ieva**	Eliana	Italy	Nanostructured and nanoparticle based materials	*An analytical spectroscopy study of Chitosan nanoparticles for drug delivery applications*
PB124	**Iñarrea**	Jesus	Spain	Theory and modelling at the nanoscale	*Magnetoresistivity response of microwave excited 2D*
PB25	**Iñarrea**	Jesus	Spain	Low dimensional materials	*Overhauser field-induced electron transport through weakly coupled double quantum dots*
PA65	**Ipatov**	Mihail	Spain	Nanomagnetism and Spintronics	*Development of ultra-thin glass-coated amorphous microwires for HF magnetic sensors applications*
PA81	**Ivanova**	Yuliya	Belarus	Nanostructured and nanoparticle based materials	*Electrodeposition of PbSe nanoparticles onto n- and p-Si wafers and into nanoporous SiO2/Si template*
PA25	**Jabeen**	Fauzia	Italy	Low dimensional materials	*Ga-catalysed and self-catalysed growth of GaAs nanowires by molecular beam epitaxy.*
PB40	**Jancar**	Bostjan	Slovenia	NanoChemistry	*Nanostructures forming during the synthesis of perovskite CaTiO3 under hydrothermal conditions*
PB10	**Jiménez**	David	Spain	Carbon nanotubes	*Exploring the magnetically induced field effect in carbon nanotube based devices*
PB125	**Jiménez Sáez**	José Carlos	Spain	Theory and modelling at the nanoscale	*epitaxy of softly deposited small Co nanoclusters on Cu(001) surfaces*
PA12	**Jodar**	Esther	Spain	Carbon nanotubes	*Electron confinement in Cavities of Carbon Nanotubes.*
PA45	**Karami**	Fatemeh	Iran	Nanobiotechnologies	*The posibility of superparamagnetic character in nanomagnetic structure of FexCo1-x*
PA26	**Karim**	Shafqat	Germany	Low dimensional materials	*Electrical transport properties and thermal instability of gold nanowires*
PA82	**Kim**	Sooho	Korea	Nanostructured and nanoparticle based materials	*Morphology control of self-catalytic Indium tin oxide nanowires by oxygen*
PB76	**Kimura**	Keisaku	Japan	Nanostructured and nanoparticle based materials based materials	*Atomic Alignment over Superlattices of Water Soluble Au Nanoparticles*
PA27	**Klosova**	Katerina	Czech Republic	Low dimensional materials	*Advanced Electrodes with Nanostructured Surfaces for Electrochemical Microsensors*

PA112	**Köber**	Mariana	Spain	SPM	*Energy dissipation at the nano-scale due to contact forces: A theoretical and experimental study by means of dynamic AFM*
PB77	**Kortaberria**	Galder	Spain	Nanostructured and nanoparticle based materials based materials	*Self-assembled nanocomposites based on block copolymers containing magnetic nanoparticles*
PA113	**Kowalzik**	Peter	Germany	SPM	*STM and STS explorations of self-assembled dodecakis(phenylthio)coronene films on HOPG*
PB11	**Kulnitskiy**	Boris	Russia	Carbon nanotubes	*The crystallography of iron carbides formation in the process of catalytic growth of carbon nanostructures: HRTEM studies.*
PB26	**Labunov**	Vladimir	Belarus	Low dimensional materials	*Synthesis of vertically aligned arrays of mixed Single-Multi Wall Carbon Nanotubes by CVD method with the volatile catalist*
PB78	**Lacerda-Arôso**	Teresa	Portugal	Nanostructured and nanoparticle based materials based materials	*Phosforous and antimonium doped-ZnO thin films*
PA114	**Lahiji**	Roya	United States	SPM	*SPM studies of SWCNTs decorated by Oligodeoxyribonucleotides*
PA28	**Lange**	Holger	Germany	Low dimensional materials	*Effect of ZnS shell on the Raman spectra from CdSe nanorods*
PA83	**Lebedeva**	Irina	Russia	Nanostructured and nanoparticle based materials	*Kinetics of 2D-3D transformations of carbon nanostructures*
PB108	**LeDue**	Jeffrey	Canada	SPM	*Fabrication and Optimization of Bent Fiber Probes*
PA115	**Lennartz**	Maria Christina	Germany	SPM	*A New Structure of Benzoic Acid on Cu(110) Including Copper adatoms - STM Investigations and DFT Calculations*
PB79	**Levichev**	Sergey	Portugal	Nanostructured and nanoparticle based materials based materials	*Confinement effect in CdTe nanocrystals embedded in silica thin films*
PB126	**Lopez**	Maria J.	Spain	Theory and modelling at the nanoscale	*Adsorption of neutral and charged nitrogen dioxide molecules on carbon nanotubes: the selective removal of the metallic tubes*
PB80	**Lopez Arbeloa**	Fernando	Spain	Nanostructured and nanoparticle based materials based materials	*Anisotropy of Fluorescence Dyes Intercalated into Nanostructured Interlayer Space of Clay Films*
PA13	**Lopez Fernandez**	Vicente	Spain	Carbon nanotubes	*Studies of the dependence of the swnts lenght with the growth temperature by cvd*
PA84	**Lorite**	Israel	Spain	Nanostructured and nanoparticle based materials	*Formation in situ Mn-doped structures by rapid heating method*
PB27	**Lu**	Wei	Japan	Low dimensional materials	*Study of energy transfer in mixed system of two different sized quantum dots*
PB81	**Lujun**	Pan	Japan	Nanostructured and nanoparticle based materials based materials	*Multiwalled carbon nanocoils synthesized by the catalyst of uniformly composed Fe-Sn*
PA127	**Maassen**	Jesse	Canada	Theory and modelling at the nanoscale	*Dephasing Effect in Ab Initio Modeling of Quantum Transport through Molecular Devices*
PA128	**Maletta**	Stefano	Italy	Theory and modelling at the nanoscale	*Study of Auger CVV lineshapes from single walled carbon nanotubes*

PB12	**Mañanes**	Angel	Spain	Carbon nanotubes	*Electronic properties of single wall carbon nanotubes bonded to Al13H cluster*
PB28	**Mañanes**	Angel	Spain	Low dimensional materials	*Theoretical study of the reactivity of icosahedral C@Al12 cluster with a graphene sheet*
PB127	**Marconi**	Veronica I.	Spain	Theory and modelling at the nanoscale	*Domain wall rectification in thin magnetic films with arrays of asymmetric holes*
PB82	**Marin**	Pilar	Spain	Nanostructured and nanoparticle based materials based materials	*Magnetic domains observations of custom assembled FeCo nanograins microstructures tailored by means of cobalt percentage and annealing magnetic field direction*
PA85	**Marín**	Jose Ramon	Spain	Nanostructured and nanoparticle based materials	*Iron-gold core-shell nanoparticle formation utilizing nonionic surfactants and reverse micelles*
PA86	**Marquardt**	Bernd	France	Nanostructured and nanoparticle based materials	*Alumina membranes as etching mask*
PB36	**Marradi**	Marco	Spain	Nanobiotechnologies	*Magnetic Glyconanoparticles as Contrast Agents Against Brain Tumor Targeting by MRI*
PB83	**Marsal**	Lluis	Spain	Nanostructured and nanoparticle based materials based materials	*Ordered arrays of polymer microfibers obtained using macroporous silicon as template*
PB53	**Martín**	José	Spain	Nanomagnetism and Spintronics	*Neel wall attractive and repulsive pinning in amorphous Co-Si films with diluted arrays of empty or filled antidots*
PB29	**Martín Gago**	Jose A.	Spain	Low dimensional materials	*Fisrt stages of the growth of Pt-clusters on Quasi-metallic 1D rows of TiO2(110)-(1x2) surfaces.*
PA116	**Martinez**	David	Spain	SPM	*Surface potential dynamic on highly oriented pyrolytic graphite*
PA71	**Martinez**	Luis Javier	Spain	NanoOptics & NanoPhotonics	*Two-dimensional surface emitting photonic crystal laser with hybrid triangular-graphite structure*
PA46	**Martínez Ávila**	Olga María	Spain	Nanobiotechnologies	*Gold Manno-nanoparticles as Potential Microbicides Against HIV Infection*
PA117	**Martinez Galera**	Antonio Javier	Spain	SPM	*Scanning tunneling microscopy study of PTCDA growth on Ge(111)-c(2x8) surfaces*
PB3	**Martinez Muñiz**	Antonio Enrique	United Kingdom	Atomic Scale Effects in nano-CMOS Electronics	*NEGF Simulations of Scaled Double Gate MOSFETs using extracted masses from DFT calculations*
PA59	**Martinez Otero**	Alberto	Spain	NanoChemistry	*A New 3-State Catechol-Based Fluorescent Switch on Surface*
PA129	**Martinez Parra**	Juan Jose	Spain	Theory and modelling at the nanoscale	*Behavior of the UFM signal in different known samples and comparison with computer simulations*
PB109	**Martsinovich**	Natalia	United Kingdom	SPM	*Manipulation of covalently bound molecules with STM and AFM: a comparative theoretical study*
PB41	**Mateo-Marti**	Eva	Spain	NanoChemistry	*An atomic scale model for the self-organization of S-cysteine on Au(111) surfaces.*
PB54	**Matxain**	Jon	Spain	Nanomagnetism and Spintronics	*Endohedral stannaspherenes: Mn@Sn12 and its dimer. Ferromagnetic or antiferromagnetic?*

PB13	**Mayya**	Subramanya	Korea	Carbon nanotubes	*Selective growth of carbon nanotubes using preformed cobalt nanoparticle catalysts*
PA87	**McKendry**	Jonathan	United Kingdom	Nanostructured and nanoparticle based materials	*Magnetic Field Enhanced Tip Fabrication for Four-Probe STM Studies*
PA88	**Medalsy**	Izhar	Israel	Nanostructured and nanoparticle based materials	*Controlled fabrication of nanostructures using SP1 protein-nanoparticle hybrids*
PA47	**Mertz**	Damien	France	Nanobiotechnologies	*Mechanically responding nanovalves based on polyelectrolyte multilayers*
PA89	**Mihoc**	Carmen	Germany	Nanostructured and nanoparticle based materials	*Synthesis of quasicrystal/polymer composites*
PB55	**Millo**	Oded	Israel	Nanomagnetism and Spintronics	*Anomalous proximity effects in ferromagnet-superconductor SrRuO3-YBa2Cu3O7 bilayers*
PB4	**Miranda**	Enrique	Spain	Atomic Scale Effects in nano-CMOS Electronics	*A mesoscopic approach to the progressive breakdown dynamics in ultra-thin SiO2 films*
PA90	**Mishra**	Yogendra Kumar	India	Nanostructured and nanoparticle based materials	*Synthesis and ion beam induced modification of fractal percolating network of Ag nanoparticles in polymer matrix*
PA48	**Miura**	Atsushi	Japan	Nanobiotechnologies	*Characterization and application of biochemically fabricated inorganic nanoparticle*
PA130	**Monturet**	Serge	France	Theory and modelling at the nanoscale	*Inelastic effects in electronic currents : a time-dependent approach*
PA66	**Moralejo**	Sonia	Spain	Nanomagnetism and Spintronics	*Magnetic behaviour of arrays of NiFe and CoFe sub-micron ellipses fabricated by interference lithography*
PA14	**Moreno**	Miriam	Spain	Carbon nanotubes	*Voltage and length-dependent phase diagram of the electronic transport in carbon nanotubes*
PA118	**Moreno**	Miguel	Spain	SPM	*Point defects and the (Ö3xÖ3)Û(3x3) surface phase transition in the pb/ge(111) system*
PA15	**Morgan**	Chris	United Kingdom	Carbon nanotubes	*Gas sensing with carbon nanotube networks*
PB84	**Morozan**	Adina	Romania	Nanostructured and nanoparticle based materials based materials	*Super acid-polymer nanocomposites for fuel cell applications*
PB85	**Mosiniewicz-Szablewska**	Ewa	Poland	Nanostructured and nanoparticle based materials based materials	*Magnetic Studies of Ferrofluid Modified Fodder Yeast Cells*
PA29	**Mouchet**	Celine	France	Low dimensional materials	*Growth of Si and Si/SiGe nanowires for thermoelectricity*
PB110	**Mugarza**	Aitor	Spain	SPM	*Water adsorption on O(2x2)/Ru(0001)*
PB86	**Munz**	Martin	United Kingdom	Nanostructured and nanoparticle based materials based materials	*Testing the Nanoparticle-Support Adhesion using Scanning Force Microscopy*
PA131	**Mura**	Manuela	United Kingdom	Theory and modelling at the nanoscale	*Theoretical Modelling of Self-Assembly of Molecular Networks*

PB42	**Muraviev**	Dmitri	Spain	NanoChemistry	*Synthesis, Stability and Electrocatalytic Activity of Polymer Stabilized Monometallic Pd and Pt and Bimetallic Pd@Cu and Pt@Cu Core-shell Nanoparticles*
PA91	**Nassar**	Nashaat	Canada	Nanostructured and nanoparticle based materials	*Stabilization of Copper Oxide Nanoparticles in (w/o) Microemulsions: Experimental and Modeling Results*
PB88	**Nastase**	Claudia	Romania	Nanostructured and nanoparticle based materials based materials	*Synthesis of Nanocomposite Materials Using Plasma Polymerization*
PB87	**Nastase**	Florin	Rumania	Nanostructured and nanoparticle based materials based materials	*Plasma Polymerizations Process - Recent Advances in Polymer Thin Films*
PA63	**Neethirajan**	Suresh Raja	Canada	Nanofabrication tools & nanoscale integration	*Characterization of SiCN by Catalytic Chemical Vapor Deposition Film Coatings*
PA119	**Nicoara**	Nicoleta	Spain	SPM	*One-dimensional growth of PTCDA molecular rows on Sn/Si(111) surfaces*
PA92	**Nicola**	Oana	Romania	Nanostructured and nanoparticle based materials	*Preparation and characterization of a nanostructured dental composite*
PA93	**Nishida**	Naoki	Japan	Nanostructured and nanoparticle based materials	*Synthesis and Chiroptical Study of Optically Active Thiolate-Capped Silver Nanoclusters*
PB128	**Nobusada**	Katsuyuki	Japan	Theory and modelling at the nanoscale	*Vertex-sharing polyicosahedral gold clusters: a first step toward cluster-assembled materials*
PB89	**Odriozola**	Arantza	Spain	Nanostructured and nanoparticle based materials based materials	*Inkjet printing of nanomaterials for manufacturing electronic devices*
PA94	**Oh**	Seyoung	Korea	Nanostructured and nanoparticle based materials	*Single-Walled Carbon Nanotube Reinforced Copper Matrix Nanocomposites*
PB111	**Osváth**	Zoltán	Hungary	SPM	*Thermal oxidation of few-layer graphite plates: an SPM study*
PB43	**Otero**	Roberto	Spain	NanoChemistry	*On-Surface Synthesis of Metallo-Porphyrin Nano-tubes by Vacuum Sublimation onto Noble Metals Substrates*
PB90	**Otero**	Roberto	Spain	Nanostructured and nanoparticle based materials based materials	*An Organic Donor/Acceptor Lateral Superlattice at the Nanoscale: Towards an Optimum Morphology for Photovoltaic Applications*
PA16	**Pallecchi**	Emiliano	Germany	Carbon nanotubes	*Spin transport and structural characterization of carbon nanotubes*
PB129	**Paredes**	Ricardo	Spain	Theory and modelling at the nanoscale	*Ni nanocontacts ruptures: dependence on stretching directions*
PB103	**Partridge**	Jim	Australia	Other	*Fabrication of Al/AlO optically absorbing films using a Filtered Cathodic Vacuum Arc*
PA95	**Pérez**	Noemí	Spain	Nanostructured and nanoparticle based materials	*Optimization of the process temperature for the fabrication of self-assembled colloidal crystals*
PA120	**Perez Garcia**	Beatriz	Spain	SPM	*Rougness and fractal dimension measurements in the nanoscale by SFM.*
PA17	**Pingitore**	Valentino	Italy	Carbon nanotubes	*Cathodoluminescence Emission from carbon nanotubes and its sensitivity with contaminant concentration*

PB91	**Piris**	Mario	Spain	Nanostructured and nanoparticle based materials based materials	*New solids based on B12N12 fullerenes*
PA132	**Poissier**	Adrien	France	Theory and modelling at the nanoscale	*Adsorption of Ice on top of a Pd <111> surface : Neural Network mapping of the ab-initio Potential Energy Surface*
PB130	**Polak**	Micha	Israel	Theory and modelling at the nanoscale	*Alloy nano-cluster surface phenomena modeled using DFT-based coordination-dependent bond-energy variations*
PB60	**Postigo**	Pablo Aitor	Spain	NanoOptics & NanoPhotonics	*Fabrication of two dimensional photonic crystal micro and nanocavities: from ultra low threshold lasers to solid state based optical quantum logic*
PB14	**Pouillon**	Yann	Spain	Carbon nanotubes	*Functionalised carbon nanotubes for integrated nano-electronic sensors*
PA18	**Prieto Gonzalez**	Ivan	Spain	Carbon nanotubes	*Fabrication and characterization of photonic crystals infiltrated with single wall carbon nanotubes for new optoelectronic devices*
PB30	**Puente**	Antonio	Spain	Low dimensional materials	*Controlling entanglement in a double quantum dot*
PA30	**Quijada**	Marina	Spain	Low dimensional materials	*Energy loss of charged projectiles interacting with metallic nanoparticles*
PA31	**Reedo**	Valter	Estonia	Low dimensional materials	*Novel route for preparation of micro- and nano-scale tubular oxide structures*
PB44	**Rodriguez Pierna**	Angel	Spain	NanoChemistry	*Electro-oxidation of carbon monoxide and methanol on carbon-supported Ni59Nb40Pt(1-x)Yx (Y =Sn, Ru; x =0, 0.4% at.) nanoparticles as anodic in a DMFC.*
PB92	**Rodriguez-Abreu**	Carlos	Spain	Nanostructured and nanoparticle based materials based materials	*Self-assembled fluorocarbon-silica nanocomposites:structure and properties*
PB37	**Rogero**	Celia	Spain	Nanobiotechnologies	*Biosensors based on bio-nanostructures immobilized on Silicon chips*
PA107	**Románszki**	Loránd	Hungary	Other	*Protective Nanolayers on Metal Surfaces Fabricated by Langmuir-Blodgett and Self-Assembly Techniques*
PB45	**Rotger**	Maria del Carmen	Spain	NanoChemistry	*Formation of nanospheres from self-assembled oligosquaramides.*
PA133	**Rudi**	Sarah Anna	Italy	Theory and modelling at the nanoscale	*Fermi edge singularity in XRay studies of Graphene.*
PA49	**Rüdiger**	Olaf	Spain	Nanobiotechnologies	*Direct electrochemistry of Desulfovibrio Gigas [NiFe]-Hydrogenase covalently bound and oriented on carbon nanotube electrodes.*
PA96	**Ruiz**	Carlos	Spain	Nanostructured and nanoparticle based materials	*Optical fiber pH sensor formed by Neutral Red and Poly(acrylic acid) nanostructurated films*
PA97	**Ruiz Nicolás**	Patricia	Spain	Nanostructured and nanoparticle based materials	*Polymer-Stabilized Monometallic Pd and Pd@Cu Core-Shell Nanoparticles: Preparation, Characterization and Electroanalytical Applications*
PA32	**Ruiz-Osés**	Miguel	Spain	Low dimensional materials	*Self-assembly of binary supramolecular networks on Au(111): geometry and electronic states*
PB46	**Rummeli**	Mark	Germany	NanoChemistry	*Catalyst size and carbon feed-rate constraints for carbon nanotube synthesis*

PB61	**Rumpf**	Klemens	Austria	NanoOptics & NanoPhotonics	*Ferromagnetic nanoparticles embedded in self-arranged matrices*
PA121	**Sáenz-Arce**	Giovanni	Spain	SPM	*A Tuning-fork low-temperature nanotribometer*
PA60	**Salado**	Javier	Spain	NanoChemistry	*Synthesis Control and Magnetic Properties of Core-Shell Fe3O4@Au Nanoparticles*
PA98	**Salsamendi**	Maitane	Spain	Nanostructured and nanoparticle based materials	*Nanolayers for optoelectronic devices based on Pedot formulations in organic medium*
PB93	**Samardak**	Alexander	United Kingdom	Nanostructured and nanoparticle based materials based materials	*pulse-induced spiking in artificial nerve nanofibres*
PA99	**San Sebastian**	Idoia	Spain	Nanostructured and nanoparticle based materials	*Influence of phase separation on the room temperature mechanical properties of pm 2000 ods alloy*
PB94	**Sanchez-Dolado**	Jorge	Spain	Nanostructured and nanoparticle based materials based materials	*Molecular Dynamic study of the N-A-S-H gel in alkali-activated fly-ashes cements.*
PA19	**Santoro**	Gonzalo	Spain	Carbon nanotubes	*Characterization of Plasma-Functionalized Buckypapers*
PB47	**Sarantopoulou**	Evangelia	Greece	NanoChemistry	*Surface relief nano-micro structures from Rayleight's instabilities in block copolymers*
PA134	**Savini**	Gianluca	United Kingdom	Theory and modelling at the nanoscale	*Mesoscale Elastic Theory in Graphite*
PA100	**Schaeffel**	Franziska	Germany	Nanostructured and nanoparticle based materials	*Tailoring the diameter, density and number of walls of carbon nanotubes through predefined catalyst particles*
PA122	**Schiffrin**	Agustin	Canada	SPM	*Self-assembly of methionine on noble metal surfaces: steering biomolecular nanostructures by substrate reactivity and thermal activation*
PB31	**Schiller**	Frederik	Spain	Low dimensional materials	*Electronic structure of highly ordered C60 clusters on Au(887)*
PB95	**Secchi**	Andrea	Italy	Nanostructured and nanoparticle based materials based materials	*Molecular Recognition by Calix[4]arene-Modified Gold Nanoparticles in Aqueous Solution*
PA101	**Serantes**	David	Spain	Nanostructured and nanoparticle based materials	*Magnetic field-dependence study of the magnetocaloric properties of a superparamagnetic nanoparticle system: a Monte Carlo simulation.*
PA102	**Shadrokh**	Zohre	Iran	Nanostructured and nanoparticle based materials	*Controlling the size of Cdse-nano particles by simultaneous application of high Ar/He gas pressure and fast evacuation*
PB131	**Shih**	Chi-Tin	Taiwan	Theory and modelling at the nanoscale	*Electric Transport Properties of the p53 Gene and the Effects of Point Mutations*
PA103	**Shultz**	Michael	United States	Nanostructured and nanoparticle based materials	*Poly(styrene-co-vinylbenzylchloride-co-divinylbenzene) coated iron oxide: synthesis and effects on size and morphology*
PB132	**Silanes**	Iñaki	Spain	Theory and modelling at the nanoscale	*Self-assembly of NC-PH3-CN molecules on Ag(111): Formation of 2D hydrogen-bonded and organometallic networks*
PB96	**Sonoda**	Tsutomu	Japan	Nanostructured and nanoparticle based materials based materials	*Improvement of Porous-Structure Controllability for Fabrication of Sintered Porous Aluminum Materials by Coating Al Powder with Tin*

PA33	**Steiner**	Dov	Israel	Low dimensional materials	*Electronic structure and self-assembly of semiconductor nanocrystals arrays*
PB97	**Strat**	Mitachi	Romania	Nanostructured and nanoparticle based materials based materials	*Structure and mechanical properties of nanocomposites based on polypropilene*
PB62	**Tanaka**	Kenichiro	Japan	NanoOptics & NanoPhotonics	*Electric field modulation optical spectroscopy using field enhancement near optical antennas*
PA50	**Tellechea**	Edurne	Spain	Nanobiotechnologies	*The effect of the bilayer bending modulus on the extent of deformation of surface adsorbed vesicles.*
PA51	**Tomankova**	Katerina	Czech Republic	Nanobiotechnologies	*Biological Application of Atomic Force Microscopy Use on Cancer Cell Line*
PA135	**Torrado**	Jorge F.	Spain	Theory and modelling at the nanoscale	*Theoretical treatment of the TMOKE in magneto-plasmonic patterned nanostructrures: a scattering matrix approach*
PA136	**Torrado**	Jorge F.	Spain	Theory and modelling at the nanoscale	*Scattering matrix approach for the analysis of Magneto-plasmonic periodic lattices*
PB32	**Torrent-Burgués**	Juan	Spain	Low dimensional materials	*Characterization of modified solid electrodes with organized thin films of a zinc phthalocyanine*
PA104	**Torres**	Ricardo	Spain	Nanostructured and nanoparticle based materials	*Dispersion of inorganic WS2 fullerene-like particles and its incorporation into carbon CVD films for production of nanocomposite coatings*
PB33	**Tsukamoto**	Rikako	Japan	Low dimensional materials	*Biotemplated Co-Pt nanowire synthesis in TMV*
PA105	**Valtsifer**	Igor	Russia	Nanostructured and nanoparticle based materials	*Influence of technological factors on processes of structurization of carbon nanoparticles in oligomer medium*
PA52	**Van de Waterbeemd**	Marion	United Kingdom	Nanobiotechnologies	*Silanes and surface activation with active -NH2 groups for applications in biosciences*
PB133	**Vazifehshenas**	Taraneh	Iran	Theory and modelling at the nanoscale	*Plasmon dispersion in quantum wires at finite-temperature*
PB56	**Vázquez-Vázquez**	Carlos	Spain	Nanomagnetism and Spintronics	*Magnetocaloric effect and size-dependent study of the magnetic properties of cobalt ferrite nanoparticles prepared by solvothermal synthesis*
PA34	**Walton**	Alex	United Kingdom	Low dimensional materials	*Fabrication and four probe electrical characterization of nanowires*
PA35	**Welte Hidalgo**	Lorena	Spain	Low dimensional materials	*Direct evidence of nanowires formation from a Cu(II) coordination polymer*
PA123	**Wu**	Ho-Chien	Taiwan	SPM	*STM study of azobenzene self-organized on the Ag/Ge(111)-(r3xr3)R30° surface*
PA67	**Wu**	Mingche	United Kingdom	Nanomagnetism and Spintronics	*Spin-transfer torque switching in exchanged-biased spin valve nano-pillar fabricated by 3-D focused-ion beam lithography*
PB98	**Yao**	Hiroshi	Japan	Nanostructured and nanoparticle based materials based materials	*Three-Dimensional Superlattices of N-Acetylglutathione-Protected Gold Nanoparticles: Emergence of Fivefold Symmetry*
PB99	**Yazdani**	Ahmad	Iran	Nanostructured and nanoparticle based materials based materials	*How small how large the magnetic particle should be in the fixed drug dosage*

PB100	**Zanoni**	Robertino	Italy	Nanostructured and nanoparticle based materials based materials	*Tuning the redox potential in molecular monolayers covalently bound to H-Si(100) electrodes via distinct C-C tethering arms*
PA68	**Zhao**	Weisheng	France	Nanomagnetism and Spintronics	*New non-volatile Logic based on Spin-MTJ*
PB134	**Zhukov**	Vladlen	Spain	Theory and modelling at the nanoscale	*First-principle GW+SO approach to the study of spin relaxation times of excited electrons in metals*
PB101	**Zubitur**	Maria Manuela	Spain	Nanostructured and nanoparticle based materials based materials	*Nanocomposites Based on Poly (p-dioxanone) and Organically Modified Clays*
PB112	**Zypman**	Fredy	United States	SPM	*Effect of tip shape on Electrostatic Force Microscopy*

Session PA (136)

(*) poster not eligible for competition

PA/PB	Last Name	Name	Country	Poster Title
TOPIC: Atomic Scale Effects in nano-CMOS Electronics				
PA1	Chaves Romero	Ferney A.	Spain	*Simulation of the Gate Leakage Current in Surrounding Gate (SG) MOSFETs Based on an Analytic Potential Model*
TOPIC: Carbon nanotubes based nanoelectronics and field emission				
PA2	Adam	Élyse	Canada	*Strong Electroluminescence from Carbon Nanotube Field-Effect Transistors*
PA3	Barreiro	Amelia	Spain	*Chirality effect on the mechanical motion between MWNT shells*
PA4	Brunel	David	France	*Single Carbon Nanotube electrical connexion by Electron Beam and Ion Beam Platinum Deposition*
PA5	Cardin Saint-Antoine	Benoit	Canada	*Carbon Nanotube Networks: Exceptional Electrical Properties*
PA6	Cid	Cristina	Spain	*Carbon Nanotube based Ion Selective Field Effect Transistors*
PA7	Coiffic	Jean-christophe	France	*Carbon nanotube based interconnects*
PA8	Gaass	Markus	Germany	*Supercurrent and Coulomb blockade in multiwall CNTs with Nb contacts*
PA9	Gomes Santos	Elton Jose	Spain	*Ab initio study of substitutionally Ni-dopedsingle wall carbon nanotubes: structural and electronic properties*
PA10	Hajizadeh (*)	Solmaz	Iran	*Synthesis and purification of produced Carbon Nanotubes in NaCl solution*
PA11	Hudziak	Steve	United Kingdom	*Mössbauer Spectroscopy Studies of Iron-Filled Carbon Nanotubes*
PA12	Jodar	Esther	Spain	*Electron confinement in Cavities of Carbon Nanotubes.*
PA13	Lopez Fernandez	Vicente	Spain	*Studies of the dependence of the swnts lenght with the growth temperature by cvd*
PA14	Moreno	Miriam	Spain	*Voltage and length-dependent phase diagram of the electronic transport in carbon nanotubes*
PA15	Morgan	Chris	United Kingdom	*Gas sensing with carbon nanotube networks*
PA16	Pallecchi	Emiliano	Germany	*Spin transport and structural characterization of carbon nanotubes*
PA17	Pingitore	Valentino	Italy	*Cathodoluminescence Emission from carbon nanotubes and its sensitivity with contaminant concentration*
PA18	Prieto Gonzalez	Ivan	Spain	*Fabrication and characterization of photonic crystals infiltrated with single wall carbon nanotubes for new optoelectronic devices*
PA19	Santoro	Gonzalo	Spain	*Characterization of Plasma-Functionalized Buckypapers*
TOPIC: Low dimensional materials (nanowires, clusters, quantum dots, etc.)				
PA20	Alet	Pierre-Jean	France	*Transition from thin gold layers to nano-islands on ITO: Influence of the annealing temperature and the initial thickness*
PA21	Chiu	Sheng-Cheng	Taiwan	*Direct synthesis of SiC nanorods by annealing carbon nanocapsules and SiO2 spheres*
PA22	Cordón Vélaz	Javier	Spain	*Engineering electron bands in dislocation networks*

PA23	Gence	Loïk	Belgium	*Electrical and Thermal Characterization of Hybrid Metal/Polymer Nanowires*
PA24	Gorzny	Marcin	United Kingdom	*Electrical characterization of tmv-based nanostructures*
PA25	Jabeen	Fauzia	Italy	*Ga-catalysed and self-catalysed growth of GaAs nanowires by molecular beam epitaxy.*
PA26	Karim	Shafqat	Germany	*Electrical transport properties and thermal instability of gold nanowires*
PA27	Klosova	Katerina	Czech Republic	*Advanced Electrodes with Nanostructured Surfaces for Electrochemical Microsensors*
PA28	Lange	Holger	Germany	*Effect of ZnS shell on the Raman spectra from CdSe nanorods*
PA29	Mouchet	Celine	France	*Growth of Si and Si/SiGe nanowires for thermoelectricity*
PA30	Quijada	Marina	Spain	*Energy loss of charged projectiles interacting with metallic nanoparticles*
PA31	Reedo	Valter	Estonia	*Novel route for preparation of micro- and nano-scale tubular oxide structures*
PA32	Ruiz-Osés	Miguel	Spain	*Self-assembly of binary supramolecular networks on Au(111): geometry and electronic states*
PA33	Steiner	Dov	Israel	*Electronic structure and self-assembly of semiconductor nanocrystals arrays*
PA34	Walton	Alex	United Kingdom	*Fabrication and four probe electrical characterization of nanowires*
PA35	Welte Hidalgo	Lorena	Spain	*Direct evidence of nanowires formation from a Cu(II) coordination polymer*

TOPIC: Nanobiotechnologies

PA36	Bibari	Olivier	France	*Characterization of nanostructured electrodes for neural implant*
PA37	Clarke	Samuel	Canada	*Optical and Biological Characterization of Surface Modified Quantum Dots*
PA38	Delcea	Mihaela	Spain	*Hybrid polyelectrolyte/bacterial protein (nano)biomimetic surfaces: a model to study bacterial surface layer recovery and bacterial affinity*
PA39	Díaz García	Elena	Spain	*Absence of extended states in a ladder model of DNA*
PA40	Dontsova	Ekaterina	Russia	*Investigation of nanostructured films of antibodies and polymers*
PA41	Eleta	Aitziber	Spain	*Recrystallization of bacterial surface layers: how fast S-proteins self assemble to build 2-D nanobiostructures*
PA42	Firkowska	Izabela	Germany	*Bioinspired nano-architectures based on chemically functionalized carbon nanotubes*
PA43	Fuss	Martina	Spain	*Characterization of supramolecular assemblies of maltose neoglycoconjugates and glyconanoparticles by non-contact afm*
PA44	Hajizadeh	Solmaz	Iran	*Gelatin nanoparticles fabrication and evaluation effectiveness parameters*
PA45	Karami	Fatemeh	Iran	*The posibility of superparamagnetic character in nanomagnetic structure of FexCo1-x*
PA46	Martínez Ávila	Olga María	Spain	*Gold Manno-nanoparticles as Potential Microbicides Against HIV Infection*
PA47	Mertz	Damien	France	*Mechanically responding nanovalves based on polyelectrolyte multilayers*
PA48	Miura (*)	Atsushi	Japan	*Characterization and application of biochemically fabricated inorganic nanoparticle*

PA49	Rüdiger	Olaf	Spain	*Direct electrochemistry of Desulfovibrio Gigas [NiFe]-Hydrogenase covalently bound and oriented on carbon nanotube electrodes.*
PA50	Tellechea	Edurne	Spain	*The effect of the bilayer bending modulus on the extent of deformation of surface adsorbed vesicles.*
PA51	Tomankova	Katerina	Czech Republic	*Biological Application of Atomic Force Microscopy Use on Cancer Cell Line*
PA52	Van de Waterbeemd	Marion	United Kingdom	*Silanes and surface activation with active -NH2 groups for applications in biosciences*

TOPIC: NanoChemistry

PA53	Akbari	Mojtaba	Iran	*New Trends and Achievements in Production of Nanofibers-Based Filter Media*
PA54	Alet (*)	Pierre-Jean	France	*Grafting organic polymer films on surfaces from aqueous solutions*
PA55	Barrio	Aranzazu	Spain	*Fabrication of a mea from metal-polymer nanocomposite membranes for fuel cells applications*
PA56	Ciesa	Flavio	Italy	*Sub-nanometer Au MPCs Synthesized by Multipodand Calixarene Protection*
PA57	García Gallastegi	Ainara	Spain	*Synthesis of Dendrimer-Carbon Nanotube Conjugates*
PA58	Goikolea	Eider	Spain	*X-ray magnetic circular dichroism styudy of magnetic dodecanethiol-capped Au nanoparticles*
PA59	Martinez Otero	Alberto	Spain	*A New 3-State Catechol-Based Fluorescent Switch on Surface*
PA60	Salado	Javier	Spain	*Synthesis Control and Magnetic Properties of Core-Shell Fe3O4@Au Nanoparticles*

TOPIC: Nanofabrication tools & nanoscale integration

PA61	Burbridge	Daniel	University of Bath	*Nanowelding and nanotool fabrication using electron-beam-induced deposition*
PA62	Fernandez	Ivan	IMM-CSIC	*Unstrained magnetostrictive Fe80B20 films for MEMS/NEMS actuators.*
PA63	Neethirajan	Suresh Raja	University of Manitoba	*Characterization of SiCN by Catalytic Chemical Vapor Deposition Film Coatings*

TOPIC: Nanomagnetism and Spintronics

PA64	Echeverría Arrondo	Carlos	Spain	*Nanocrystals of Mn-doped CdTe: A theoretical approach on the magnetic properties*
PA65	Ipatov	Mihail	Spain	*Development of ultra-thin glass-coated amorphous microwires for HF magnetic sensors applications*
PA66	Moralejo	Sonia	Spain	*Magnetic behaviour of arrays of NiFe and CoFe sub-micron ellipses fabricated by interference lithography*
PA67	Wu	Mingche	United Kingdom	*Spin-transfer torque switching in exchanged-biased spin valve nano-pillar fabricated by 3-D focused-ion beam lithography*
PA68	Zhao	Weisheng	France	*New non-volatile Logic based on Spin-MTJ*

TOPIC: NanoOptics & NanoPhotonics

PA69	Garcia Etxarri	Aitzol	Spain	*Plasmons in nanospears*
PA70	Hoa	Xuyen Dai	Canada	*Guided Immobilization of Quantum Dots on Gold Nanogratings for Enhanced Surface Plasmon Resonance Biosensing*
PA71	Martinez	Luis Javier	Spain	*Two-dimensional surface emitting photonic crystal laser with hybrid triangular-graphite structure*

TOPIC: Nanostructured and nanoparticle based materials				
PA72	Aldaye	Faisal A.	Canada	*Nanoparticle Organization and Advances in Structural DNA Nanotechnology*
PA73	Arroyo-Ramírez	Lisandra	Puerto Rico	*Nanostructures Formation from Palladium-Cobalt Precursor on Highly Ordered Pyrolytic Graphite Surfaces*
PA74	Capdevila Cascante	Santiago	Spain	*Microwave characterization of a cnt bucky paper transmission line*
PA75	Cranston	Emily	Canada	*Birefringent Thin Films of Nanocrystalline Cellulose*
PA76	Fukui	Toshiyuki	Japan	*Temperature-Dependent Chiroptical Responses of Chiral Monolayer-Protected Gold Nanoclusters*
PA77	González	Imanol	Spain	*Effects of processing sequence and critical interparticle distance in PA6/clay/mSEBS nanocomposites*
PA78	Hortiguela	Maria Jesus	Spain	*Macroporous 3D Architectures of Self-Assembled MWCNTs Surface Decorated with Pt Nanoparticles as Anodes for a Direct Methanol Fuel Cell*
PA79	Hsu	Li-Chieh	Taiwan	*Growth of the α-Fe2O3 nanowires by oxidation of iron films*
PA80	Ieva	Eliana	Italy	*An analytical spectroscopy study of Chitosan nanoparticles for drug delivery applications*
PA81	Ivanova	Yuliya	Belarus	*Electrodeposition of PbSe nanoparticles onto n- and p-Si wafers and into nanoporous SiO2/Si template*
PA82	Kim	Sooho	Korea	*Morphology control of self-catalytic Indium tin oxide nanowires by oxygen*
PA83	Lebedeva	Irina	Russia	*Kinetics of 2D-3D transformations of carbon nanostructures*
PA84	Lorite	Israel	Spain	*Formation in situ Mn-doped structures by rapid heating method*
PA85	Marín	Jose Ramon	Spain	*Iron-gold core-shell nanoparticle formation utilizing nonionic surfactants and reverse micelles*
PA86	Marquardt	Bernd	France	*Alumina membranes as etching mask*
PA87	McKendry	Jonathan	United Kingdom	*Magnetic Field Enhanced Tip Fabrication for Four-Probe STM Studies*
PA88	Medalsy	Izhar	Israel	*Controlled fabrication of nanostructures using SP1 protein-nanoparticle hybrids*
PA89	Mihoc	Carmen	Germany	*Synthesis of quasicrystal/polymer composites*
PA90	Mishra	Yogendra Kumar	India	*Synthesis and ion beam induced modification of fractal percolating network of Ag nanoparticles in polymer matrix*
PA91	Nassar	Nashaat	Canada	*Stabilization of Copper Oxide Nanoparticles in (w/o) Microemulsions: Experimental and Modeling Results*
PA92	Nicola	Oana	Romania	*Preparation and characterization of a nanostructured dental composite*
PA93	Nishida	Naoki	Japan	*Synthesis and Chiroptical Study of Optically Active Thiolate-Capped Silver Nanoclusters*
PA94	Oh	Seyoung	Korea	*Single-Walled Carbon Nanotube Reinforced Copper Matrix Nanocomposites*
PA95	Pérez	Noemí	Spain	*Optimization of the process temperature for the fabrication of self-assembled colloidal crystals*
PA96	Ruiz	Carlos	Spain	*Optical fiber pH sensor formed by Neutral Red and Poly(acrylic acid) nanostructurated films*
PA97	Ruiz Nicolás	Patricia	Spain	*Polymer-Stabilized Monometallic Pd and Pd@Cu Core-Shell Nanoparticles: Preparation, Characterization and Electroanalytical Applications*

PA98	Salsamendi	Maitane	Spain	*Nanolayers for optoelectronic devices based on Pedot formulations in organic medium*
PA99	San Sebastian	Idoia	Spain	*Influence of phase separation on the room temperature mechanical properties of pm 2000 ods alloy*
PA100	Schaeffel	Franziska	Germany	*Tailoring the diameter, density and number of walls of carbon nanotubes through predefined catalyst particles*
PA101	Serantes	David	Spain	*Magnetic field-dependence study of the magnetocaloric properties of a superparamagnetic nanoparticle system: a Monte Carlo simulation.*
PA102	Shadrokh	Zohre	Iran	*Controlling the size of Cdse-nano particles by simultaneous application of high Ar/He gas pressure and fast evacuation*
PA103	Shultz	Michael	United States	*Poly(styrene-co-vinylbenzylchloride-co-divinylbenzene) coated iron oxide: synthesis and effects on size and morphology*
PA104	Torres	Ricardo	Spain	*Dispersion of inorganic WS2 fullerene-like particles and its incorporation into carbon CVD films for production of nanocomposite coatings*
PA105	Valtsifer	Igor	Russia	*Influence of technological factors on processes of structurization of carbon nanoparticles in oligomer medium*

TOPIC: Other

PA106	Dadvand	Afshin	Canada	*High performance organic light emitting transistor based on hexylstyryl tetracene*
PA107	Románszki	Loránd	Hungary	*Protective Nanolayers on Metal Surfaces Fabricated by Langmuir-Blodgett and Self-Assembly Techniques*

TOPIC: SPM

PA108	Aguilera	Lidia	Spain	*Influence of Vacuum Environment in Conductive AFM measurements on advanced MOS Gate dielectrics*
PA109	Burke	Sarah	Canada	*Uncovering molecular morphologies of C60 and PTCDA on insulators: Dewetting in two prototypical organic semiconductors*
PA110	Carrasco Pulido	Carolina	Spain	*Resolving single kinesin motors in motion by atomic force microscopy*
PA111	Fernández Torrente	Isabel	Germany	*Growth of TTF-TCNQ on metal surfaces*
PA112	Köber	Mariana	Spain	*Energy dissipation at the nano-scale due to contact forces: A theoretical and experimental study by means of dynamic AFM*
PA113	Kowalzik	Peter	Germany	*STM and STS explorations of self-assembled dodecakis(phenylthio)coronene films on HOPG*
PA114	Lahiji	Roya	United States	*SPM studies of SWCNTs decorated by Oligodeoxyribonucleotides*
PA115	Lennartz	Maria Christina	Germany	*A New Structure of Benzoic Acid on Cu(110) Including Copper adatoms - STM Investigations and DFT Calculations*
PA116	Martinez	David	Spain	*Surface potential dynamic on highly oriented pyrolytic graphite*
PA117	Martinez Galera	Antonio Javier	Spain	*Scanning tunneling microscopy study of PTCDA growth on Ge(111)-c(2x8) surfaces*
PA118	Moreno	Miguel	Spain	*Point defects and the (Ö3xÖ3)Û(3x3) surface phase transition in the pb/ge(111) system*
PA119	Nicoara	Nicoleta	Spain	*One-dimensional growth of PTCDA molecular rows on Sn/Si(111) surfaces*
PA120	Perez Garcia	Beatriz	Spain	*Rougness and fractal dimension measurements in the nanoscale by SFM.*
PA121	Sáenz-Arce	Giovanni	Spain	*A Tuning-fork low-temperature nanotribometer*

PA122	Schiffrin	Agustin	Canada	*Self-assembly of methionine on noble metal surfaces: steering biomolecular nanostructures by substrate reactivity and thermal activation*
PA123	Wu	Ho-Chien	Taiwan	*STM study of azobenzene self-organized on the Ag/Ge(111)-(r3xr3)R30° surface*
TOPIC: Theory and modelling at the nanoscale				
PA124	Amado Montero	Mario	Spain	*Donor-bound electrons in quantum rings under magnetic fields*
PA125	Bevan	Kirk	United States	*First-principles analysis of STM image heights on Si(100)*
PA126	Ershova	Olga	Russia	*Simulation of nanotube-based NEMS controlled by nonuniform electric field*
PA127	Maassen	Jesse	Canada	*Dephasing Effect in Ab Initio Modeling of Quantum Transport through Molecular Devices*
PA128	Maletta	Stefano	Italy	*Study of Auger CVV lineshapes from single walled carbon nanotubes*
PA129	Martinez Parra	Juan Jose	Spain	*Behavior of the UFM signal in different known samples and comparison with computer simulations*
PA130	Monturet	Serge	France	*Inelastic effects in electronic currents : a time-dependent approach*
PA131	Mura	Manuela	United Kingdom	*Theoretical Modelling of Self-Assembly of Molecular Networks*
PA132	Poissier	Adrien	France	*Adsorption of Ice on top of a Pd <111> surface : Neural Network mapping of the ab-initio Potential Energy Surface*
PA133	Rudi	Sarah Anna	Italy	*Fermi edge singularity in XRay studies of Graphene.*
PA134	Savini	Gianluca	United Kingdom	*Mesoscale Elastic Theory in Graphite*
PA135	Torrado	Jorge F.	Spain	*Theoretical treatment of the TMOKE in magneto-plasmonic patterned nanostructrures: a scattering matrix approach*
PA136	Torrado (*)	Jorge F.	Spain	*Scattering matrix approach for the analysis of Magneto-plasmonic periodic lattices*

Session PB (134)

PA/PB	Last Name	Name	Country	Poster Title
TOPIC: Atomic Scale Effects in nano-CMOS Electronics				
PB1	Asenov	Asen	United Kingdom	*Si-SiO2 interface band-gap transition: effects on MOS inversion layer characteristics*
PB2	Bagaturyants	Alexander	Russia	*Comparative study of the structure and electronic properties of bilayer CdSe-CdS and CdTe-CdS quantum dots and quantum wells by ab initio cluster and first-principles slab calculations*
PB3	Martinez Muñiz	Antonio Enrique	United Kingdom	*NEGF Simulations of Scaled Double Gate MOSFETs using extracted masses from DFT calculations*
PB4	Miranda	Enrique	Spain	*A mesoscopic approach to the progressive breakdown dynamics in ultra-thin SiO2 films*
TOPIC: Carbon nanotubes based nanoelectronics and field emission				
PB5	Baik	Seunghyun	Korea	*Dielectrophoresis of Single-Walled Carbon Nanotubes : Surface Conductance Control*
PB6	Cartoixa	Xavier	Spain	*Pyridine- and C10H10BN-based nanotubes: A route to always semiconducting NTs*
PB7	Goel	Ashok	United States	*Nanotube-Based Interconnects for Nanotechnology Circuits: An Introspection*
PB8	Gomez	Julio	Spain	*Voltage and length-dependent phase diagram of the electronic transport in carbon nanotubes*
PB9	Granitzer	Petra	Austria	*Formation of self-assembled metal/silicon nanocomposites*
PB10	Jiménez	David	Spain	*Exploring the magnetically induced field effect in carbon nanotube based devices*
PB11	Kulnitskiy	Boris	Russia	*The crystallography of iron carbides formation in the process of catalytic growth of carbon nanostructures: HRTEM studies.*
PB12	Mañanes	Angel	Spain	*Electronic properties of single wall carbon nanotubes bonded to Al13H cluster*
PB13	Mayya	Subramanya	Korea	*Selective growth of carbon nanotubes using preformed cobalt nanoparticle catalysts*
PB14	Pouillon	Yann	Spain	*Functionalised carbon nanotubes for integrated nano-electronic sensors*
TOPIC: Low dimensional materials (nanowires, clusters, quantum dots, etc.)				
PB15	Ayuela	Andres	Spain	*Optimized Geometry of the Cluster Gd2O3 and Proposed Antiferromagnetic Alignment of f-electron Magnetic Moment*
PB16	Bendall	James	United Kingdom	*The growth and characterisation of zinc oxide nanomaterials for optoelectronic devices.*
PB17	Cefalas	Alkiviadis-Constantinos	Greece	*Clustering and growth of intermetallic alloy nanodroplets*
PB18	Cornelius	Thomas	Germany	*Quantum-size and finite-size effects in the electrical transport properties of single bismuth nanowires*
PB19	Corso	Martina	Spain	*Modification of the Ag/Cu(111) dislocation network dy doping*
PB20	Cotta	Monica	Brazil	*Spatial correlations of self-assembled nanostructures using a squared lattice InP/InGaP template*
PB21	Critchley	Kevin	United States	*The Self-Assembly of Cadmium Telluride Nanowires from Nanoparticles*

PB22	Fernández	Laura	Spain	*Self-assembly of silicide quantum dots on stepped silicon surfaces by reactive epitaxy*
PB23	Garcia de Oteyza	Dimas	Germany	*Towards controlled bottom-up architectures in organic heterostructures*
PB24	Hubalek	Jaromir	Czech Republic	*Vertically Aligned Arrays of Metal Nanostructures Fabricated by Direct Galvanostatic Electrodeposition Using Anodic Alumina Templates*
PB25	Iñarrea	Jesus	Spain	*Overhauser field-induced electron transport through weakly coupled double quantum dots*
PB26	Labunov	Vladimir	Belarus	*Synthesis of vertically aligned arrays of mixed Single-Multi Wall Carbon Nanotubes by CVD method with the volatile catalist*
PB27	Lu	Wei	Japan	*Study of energy transfer in mixed system of two different sized quantum dots*
PB28	Mañanes	Angel	Spain	*Theoretical study of the reactivity of icosahedral C@Al12 cluster with a graphene sheet*
PB29	Martín Gago	Jose A.	Spain	*Fisrt stages of the growth of Pt-clusters on Quasi-metallic 1D rows of TiO2(110)-(1x2) surfaces.*
PB30	Puente	Antonio	Spain	*Controlling entanglement in a double quantum dot*
PB31	Schiller	Frederik	Spain	*Electronic structure of highly ordered C60 clusters on Au(887)*
PB32	Torrent-Burgués	Juan	Spain	*Characterization of modified solid electrodes with organized thin films of a zinc phthalocyanine*
PB33	Tsukamoto	Rikako	Japan	*Biotemplated Co-Pt nanowire synthesis in TMV*

TOPIC: Nanobiotechnologies

PB34	Alava Marquinez	Jose Iñaki	Spain	*Calcium uptake by nanohydroxyapatite crystals, in composite materials will change cell culture medium properties.*
PB35	Dumitru	Anca	Romania	*Biofilm growth form waste water on MWNTs and carbon aerogels*
PB36	Marradi	Marco	Spain	*Magnetic Glyconanoparticles as Contrast Agents Against Brain Tumor Targeting by MRI*
PB37	Rogero	Celia	Spain	*Biosensors based on bio-nanostructures immobilized on Silicon chips*

TOPIC: NanoChemistry

PB38	Chilibon	Irinela	Romania	*Thermal Analysis of PT Ceramics Obtained by Sol-Gel Processing*
PB39	Gonzalez	Julian	Spain	*Magnetic characterization of Manganese oxide nanofibres*
PB40	Jancar	Bostjan	Slovenia	*Nanostructures forming during the synthesis of perovskite CaTiO3 under hydrothermal conditions*
PB41	Mateo-Marti	Eva	Spain	*An atomic scale model for the self-organization of S-cysteine on Au(111) surfaces.*
PB42	Muraviev	Dmitri	Spain	*Synthesis, Stability and Electrocatalytic Activity of Polymer Stabilized Monometallic Pd and Pt and Bimetallic Pd@Cu and Pt@Cu Core-shell Nanoparticles*
PB43	Otero	Roberto	Spain	*On-Surface Synthesis of Metallo-Porphyrin Nano-tubes by Vacuum Sublimation onto Noble Metals Substrates*
PB44	Rodriguez Pierna	Angel	Spain	*Electro-oxidation of carbon monoxide and methanol on carbon-supported Ni59Nb40Pt(1-x)Yx (Y =Sn, Ru; x =0, 0.4% at.) nanoparticles as anodic in a DMFC.*
PB45	Rotger	Maria del Carmen	Spain	*Formation of nanospheres from self-assembled oligosquaramides.*

PB46	Rummeli	Mark	Germany	*Catalyst size and carbon feed-rate constraints for carbon nanotube synthesis*
PB47	Sarantopoulou	Evangelia	Greece	*Surface relief nano-micro structures from Rayleight's instabilities in block copolymers*

TOPIC: Nanofabrication tools & nanoscale integration

PB48	Dallaporta	Hervé	France	*Study of structures deposited by focused ion beam induced deposition on membrane*

TOPIC: Nanomagnetism and Spintronics

PB49	Botta	Pablo M	Spain	*Synthesis and magnetic properties of Co nanoparticles embedded in a zeolite matrix*
PB50	Del Val	Juan José	Spain	*Soft Magnetic Properties of Nanocrystalline (Co77Si13.5B9.5)90Fe7Nb3 Alloy*
PB51	Escobedo	Ramón	Spain	*Self-sustained current oscillations in a multiquantum well spin polarized structure with normal contacts*
PB52	Gonzalez	Julian	Spain	*Magnetocaloric effect in nanogranular glass coated microwires*
PB53	Martín	José	Spain	*Neel wall attractive and repulsive pinning in amorphous Co-Si films with diluted arrays of empty or filled antidots*
PB54	Matxain	Jon	Spain	*Endohedral stannaspherenes: Mn@Sn12 and its dimer. Ferromagnetic or antiferromagnetic?*
PB55	Millo	Oded	Israel	*Anomalous proximity effects in ferromagnet-superconductor SrRuO3-YBa2Cu3O7 bilayers*
PB56	Vázquez-Vázquez	Carlos	Spain	*Magnetocaloric effect and size-dependent study of the magnetic properties of cobalt ferrite nanoparticles prepared by solvothermal synthesis*

TOPIC: NanoOptics & NanoPhotonics

PB57	Aroua	Walid	Tunisia	*Superprism Effect on 2D-Photonic Crystals*
PB58	Froufe	Luis	France	*Controlling Single Molecule Fluorescence Lifetime Through Slabs of Metallic and Negative Index Materials*
PB59	Garcia-Martin	Antonio	Spain	*Surface plasmon resonance effects in the Magneto Optical activity of noble metal-ferromagnet ultrathin films*
PB60	Postigo	Pablo Aitor	Spain	*Fabrication of two dimensional photonic crystal micro and nanocavities: from ultra low threshold lasers to solid state based optical quantum logic*
PB61	Rumpf	Klemens	Austria	*Ferromagnetic nanoparticles embedded in self-arranged matrices*
PB62	Tanaka	Kenichiro	Japan	*Electric field modulation optical spectroscopy using field enhancement near optical antennas*

TOPIC: Nanostructured and nanoparticle based materials

PB63	Alcaide	Francisco	Spain	*Pt and PtRu nanoparticles supported on ordered mesoporous carbons as electrocatalysts for Direct Methanol Fuel Cell anodes*
PB64	Alegria	Angel	Spain	*Effect of Confinement in Segregated Block Copolymer on the Polymer Components Molecular Motions*
PB65	Arruebo	Manuel	Spain	*Biomedical applications of nanoporous silica particles and silica-based coatings*
PB66	Baldomir	Daniel	Spain	*Role of the magnetic anisotropy in the magnetocaloric effect for a superparamagnetic nanoparticle system: a Monte Carlo study.*
PB67	Blanco	Alvaro	Spain	*Colour reveals stacking order in ultra thin self-assembled photonic crystals*

PB68	Boulahya	Khalid	Spain	*Size-Manipulable Synthesis and structural characterization of TiO2 nanoparticules*
PB69	Cerny	Frantisek	Czech Republic	*Preparation of coloured DLC nanolayers and their nanoindentation testing*
PB70	de los Arcos	Teresa	Switzerland	*C60/Si and C60/SiO2 composite thin films: A photoelectron spectroscopy study of their matrix-dependent thermal stability*
PB71	Dil	Hugo	Switzerland	*Determination of the nano scale energy landscape of h-BN/Rh(111) nanomesh by photoemission from adsorbed Xenon*
PB72	Dinu	Elena	Romania	*Nanocristallites obtained through the pyrosol method*
PB73	Ghitulica	Cristina	Romania	*Synthesis and characterization of hydroxyapatite nanopowders with high stability*
PB74	Giménez	Sixto	Spain	*Development of nanostructured magnetic materials for high frequency applications through powder metallurgy*
PB75	Hoppe	Cristina Elena	Spain	*One-Pot Preparation of Gold-Elastomer Nanocomposites Using PDMS-graft-PEO Copolymer Micelles as Nanoreactors*
PB76	Kimura	Keisaku	Japan	*Atomic Alignment over Superlattices of Water Soluble Au Nanoparticles*
PB77	Kortaberria	Galder	Spain	*Self-assembled nanocomposites based on block copolymers containing magnetic nanoparticles*
PB78	Lacerda-Arôso	Teresa	Portugal	*Phosforous and antimonium doped-ZnO thin films*
PB79	Levichev	Sergey	Portugal	*Confinement effect in CdTe nanocrystals embedded in silica thin films*
PB80	Lopez Arbeloa	Fernando	Spain	*Anisotropy of Fluorescence Dyes Intercalated into Nanostructured Interlayer Space of Clay Films*
PB81	Lujun	Pan	Japan	*Multiwalled carbon nanocoils synthesized by the catalyst of uniformly composed Fe-Sn*
PB82	Marin	Pilar	Spain	*Magnetic domains observations of custom assembled FeCo nanograins microstructures tailored by means of cobalt percentage and annealing magnetic field direction*
PB83	Marsal	Lluis	Spain	*Ordered arrays of polymer microfibers obtained using macroporous silicon as template*
PB84	Morozan	Adina	Romania	*Super acid-polymer nanocomposites for fuel cell applications*
PB85	Mosiniewicz-Szablewska	Ewa	Poland	*Magnetic Studies of Ferrofluid Modified Fodder Yeast Cells*
PB86	Munz	Martin	United Kingdom	*Testing the Nanoparticle-Support Adhesion using Scanning Force Microscopy*
PB87	Nastase	Florin	Rumania	*Plasma Polymerizations Process - Recent Advances in Polymer Thin Films*
PB88	Nastase	Claudia	Romania	*Synthesis of Nanocomposite Materials Using Plasma Polymerization*
PB89	Odriozola	Arantza	Spain	*Inkjet printing of nanomaterials for manufacturing electronic devices*
PB90	Otero	Roberto	Spain	*An Organic Donor/Acceptor Lateral Superlattice at the Nanoscale: Towards an Optimum Morphology for Photovoltaic Applications*
PB91	Piris	Mario	Spain	*New solids based on B12N12 fullerenes*
PB92	Rodriguez-Abreu	Carlos	Spain	*Self-assembled fluorocarbon-silica nanocomposites:structure and properties*
PB93	Samardak	Alexander	United Kingdom	*pulse-induced spiking in artificial nerve nanofibres*
PB94	Sanchez-Dolado	Jorge	Spain	*Molecular Dynamic study of the N-A-S-H gel in alkali-activated fly-ashes cements.*
PB95	Secchi	Andrea	Italy	*Molecular Recognition by Calix[4]arene-Modified Gold Nanoparticles in Aqueous Solution*

PB96	Sonoda	Tsutomu	Japan	*Improvement of Porous-Structure Controllability for Fabrication of Sintered Porous Aluminum Materials by Coating Al Powder with Tin*
PB97	Strat	Mitachi	Romania	*Structure and mechanical properties of nanocomposites based on polypropilene*
PB98	Yao	Hiroshi	Japan	*Three-Dimensional Superlattices of N-Acetylglutathione-Protected Gold Nanoparticles: Emergence of Fivefold Symmetry*
PB99	Yazdani	Ahmad	Iran	*How small how large the magnetic particle should be in the fixed drug dosage*
PB100	Zanoni	Robertino	Italy	*Tuning the redox potential in molecular monolayers covalently bound to H-Si(100) electrodes via distinct C-C tethering arms*
PB101	Zubitur	Maria Manuela	Spain	*Nanocomposites Based on Poly (p-dioxanone) and Organically Modified Clays*
TOPIC: Other				
PB102	Carr	Bob	United Kingdom	*Single Nanoparticle detection and analysis*
PB103	Partridge	Jim	Australia	*Fabrication of Al/AlO optically absorbing films using a Filtered Cathodic Vacuum Arc*
TOPIC: SPM				
PB104	Bobrov	Kirill	France	*A chemical reaction as a trigger for nanostructure formation on a silver surface.*
PB105	Bobrov	Kirill	France	*Formation of new phases during thermal re-arrangement on the Cu(110)-(2x1):O surface.*
PB106	Frolov	Vadim	Russia	*Electrical field-induced nanolithography of thin ta-C films under ambient conditions*
PB107	Hsu	Ching-Ling	Taiwan	*The effects of surface functionalization and temperature in AFM lithography on silicon*
PB108	LeDue	Jeffrey	Canada	*Fabrication and Optimization of Bent Fiber Probes*
PB109	Martsinovich	Natalia	United Kingdom	*Manipulation of covalently bound molecules with STM and AFM: a comparative theoretical study*
PB110	Mugarza	Aitor	Spain	*Water adsorption on O(2x2)/Ru(0001)*
PB111	Osváth	Zoltán	Hungary	*Thermal oxidation of few-layer graphite plates: an SPM study*
PB112	Zypman	Fredy	United States	*Effect of tip shape on Electrostatic Force Microscopy*
TOPIC: Theory and modelling at the nanoscale				
PB113	Aldazabal	Javier	Spain	*Simulation of effective atomic movements of substitutional impurities in cs, fcc and bcc lattices using a random walk algorithm*
PB114	Aldazabal	Javier	Spain	*Diffusion simulation of Cr-Fe bcc systems at atomic level using a random walk algorithm*
PB115	Alducin	Maite	Spain	*What rules the reactivity of thermal N2 molecules on W surfaces?*
PB116	Cabrera-Sanfelix	Pepa	Spain	*First-principles investigation of electron-induced cross-linking of aromatic self-assembled monolayers on Au(111)*
PB117	Chang	Hyunju	Korea	*First Principles Studies of Interaction between DNA and Carbon Nanotubes for the potential DNA sensor applications*
PB118	Coluci	Vitor	Brazil	*Mechanical Properties of Ordered Single Walled Carbon Nanotube Networks*
PB119	Diez-Muiño	Ricardo	Spain	*How to improve the dissociative reactivity of O2 on clean Ag(100) surfaces*
PB120	Enkovaara	Jussi	Finland	*GPAW: Real space implementation of projector augmented wave method*

PB121	Frederiksen	Thomas	Spain	*Inelastic transport theory for nanoscale systems: Local heating in a Cu–C60–Cu junction*
PB122	Garcia-Lekue	Arantzazu	Spain	*Elastic quantum transport for molecular nanoswitches using plane waves*
PB123	Godoy	Andres	Spain	*Numerical simulation of electron transport in nanoscaled silicon-on-insulator*
PB124	Iñarrea	Jesus	Spain	*Magnetoresistivity response of microwave excited 2D*
PB125	Jiménez Sáez	José Carlos	Spain	*epitaxy of softly deposited small Co nanoclusters on Cu(001) surfaces*
PB126	Lopez	Maria J.	Spain	*Adsorption of neutral and charged nitrogen dioxide molecules on carbon nanotubes: the selective removal of the metallic tubes*
PB127	Marconi	Veronica I.	Spain	*Domain wall rectification in thin magnetic films with arrays of asymmetric holes*
PB128	Nobusada	Katsuyuki	Japan	*Vertex-sharing polyicosahedral gold clusters: a first step toward cluster-assembled materials*
PB129	Paredes	Ricardo	Spain	*Ni nanocontacts ruptures: dependence on stretching directions*
PB130	Polak	Micha	Israel	*Alloy nano-cluster surface phenomena modeled using DFT-based coordination-dependent bond-energy variations*
PB131	Shih	Chi-Tin	Taiwan	*Electric Transport Properties of the p53 Gene and the Effects of Point Mutations*
PB132	Silanes	Iñaki	Spain	*Self-assembly of NC-PH3-CN molecules on Ag(111): Formation of 2D hydrogen-bonded and organometallic networks*
PB133	Vazifehshenas	Taraneh	Iran	*Plasmon dispersion in quantum wires at finite-temperature*
PB134	Zhukov	Vladlen	Spain	*First-principle GW+SO approach to the study of spin relaxation times of excited electrons in metals*

TNT2007
Trends in NanoTechnology
San Sebastian (Spain)

LIST OF PARTICIPANTS

ALPHABETICAL ORDER

TNT2007 Participants (401)

Only fully registered (payment processed) participants are listed.
Last update (23/08/2007)

Last Name	Name	Institution	Country	Invited/Keynote/Oral/ Poster/Attendee
Adam	Elyse	École Polytechnique de Montréal	Canada	Poster Session A
Aguilera	Lidia	Universitat Autònoma de Barcelona	Spain	Poster Session A
Aizpurua	Javier	Donostia International Physics Center	Spain	Attendee
Akbari	Mojtaba	Guilan University	Iran	Poster Session A
Alava Marquinez	Jose Iñaki	INASMET-Tecnalia	Spain	Poster Session B
Albaladejo	Silvia	Universidad Autonoma de Madrid	Spain	Organiser
Alcaide	Francisco	CIDETEC - IK4	Spain	Poster Session B
Aldaye	Faisal	McGill University	Canada	Oral
Aldazabal Mensa	Javier	CEIT	Spain	Poster Session B
Alducin	Maite	Donostia International Physics Center	Spain	Poster Session B
Alegría	Angel	Universidad del Pais Vasco	Spain	Poster Session B
Alet	Pierre-Jean	CEA/DSM/DRECAM/SPCSI	France	Poster Session A
Amado Montero	Mario	Universidad Complutense de Madrid.	Spain	Poster Session A
Andronescu	Ecaterina	University Politehnica from Bucharest	Romania	Poster Session B
Aranberri	Ibon	GAIKER	Spain	Oral
Ares Garcia	Pablo	Nanotec Electronica S.L.	Spain	Attendee
Ariga	Katsuhiko	National Institute for Materials Science	Japan	Keynote
Arnau	Andres	Universidad del Pais Vasco	Spain	Attendee
Arroyo-Ramírez	Lisandra	University of Puerto Rico	Puerto Rico	Poster Session A
Arruebo	Manuel	Aragon Nanoscience Institute	Spain	Poster Session B
Asenov	Asen	University of Glasgow	UK	Keynote
Atienza	César	TECNOVAC, S.L.	Spain	Attendee
Ayuela	Andres	Donostia International Physics Center	Spain	Poster Session B
Azulay	Doron	Hebrew University of Jerusalem	Israel	Attendee
Bagaturyants	Alexander	Russian Academy of Science	Russia	Poster Session B
Bahrs	Sabine	Wiley-VCH Verlag GmbH & Co. KGaA	Germany	Attendee
Baik	Seunghyun	Advanced Institute of Nanotechnology (SAINT)	Korea	Poster Session B
Baldomir	Daniel	Univ. Santiago de Compostela	Spain	Poster Session B
Baptist	Robert	CEA-MINATEC, LETI	France	Attendee
Barnett	Robert	Georgia Institute of Technology	USA	Keynote
Bar-Noy	Tuvia	Consultant	Israel	Attendee
Baroja Lasa	Iñaki	BIOMETA	Spain	Attendee
Barreiro Megino	Amelia	Institut Catala de Nanotecnologia	Spain	Poster Session A
Barrio	Aranzazu	Universidad del Pais Vasco	Spain	Poster Session A
Barry	Justin	MIDATECH Biogune	Spain	Attendee
Bates	Jeff	McGill University	Canada	Attendee
Bendall	James	University of Cambridge	UK	Poster Session B
Benito	Ana	Instituto de Carboquimica (CSIC)	Spain	Attendee
Berger	Andreas	CIC nanoGUNE Consolider	Spain	Keynote
Berndt	Richard	Universität Kiel	Germany	Keynote
Berner	Simon	University of Zurich	Switzerland	Oral
Besenbacher	Flemming	University of Aarhus	Denmark	Keynote
Bevan	Kirk	Purdue University	USA	Poster Session A
Bibari	Olivier	cea grenoble/LETI	France	Poster Session A
Biswas	Sanjay K.	Indian Institute of Science	India	Keynote
Blanco Montes	Alvaro	ICMM-CSIC	Spain	Poster Session B
Bobrov	Kirill	CNRS	France	Poster Session B
Boulahya	Khalid	Universidad Complutense de Madrid	Spain	Attendee

Boz	Serpil	University of Basel	Switzerland	Attendee
Briones	Fernando	IMM-CSIC	Spain	Attendee
Brune	Harald	EPFL	Switzerland	Keynote
Brunel	David	CNRS - IEMN Département ISEN	France	Poster Session A
Burbridge	Daniel	University of Bath	UK	Poster Session A
Burke	Sarah	McGill University	Canada	Poster Session A
Cabrera Sanfelix	Pepa	Donostia International Physics Center	Spain	Poster Session B
Campillo	Igor	CIC nanoGUNE Consolider	Spain	Organiser
Cañas-Ventura	Marta E.	EMPA Materials Science & Technology	Switzerland	Oral
Capdevila	Santiago	Universitat Politècnica de Catalunya	Spain	Attendee
Cardin St-Antoine	Benoit	Ecole Polytechnique de Montreal	Canada	Poster Session A
Carminati	Remi	Ecole Centrale Paris	France	Keynote
Carr	Bob	NanoSight Ltd	UK	Poster Session B
Carrasco Pulido	Carolina	Universidad Autonoma de Madrid	Spain	Poster Session A
Cartoixa	Xavier	Universitat Autonoma de Barcelona	Spain	Poster Session B
Casavola	Marianna	Scuola Superiore ISUFI	Italy	Oral
Cefalas	Alkiviadis C.	National Hellenic Research Foundation/TPCI	Greece	Poster Session B
Chacon	Carmen	Phantoms Foundation	Spain	Organiser
Chang	Hyunju	Korea Research Institute of Chemical Technology	Korea	Poster Session B
Chaves	Ferney	Universitat Autònoma de Barcelona	Spain	Poster Session A
Chilibon	Irinela	National Institute of Research and Development for Optoelectronics	Romania	Poster Session B
Chiu	Sheng-Cheng	National Chung Cheng University	Taiwan	Poster Session A
Cid	Cristina C.	Universitat Rovira i Virgili	Spain	Poster Session A
Ciesa	Flavio	Università di Parma	Italy	Attendee
Clarke	Samuel	McGill University	Canada	Poster Session A
Cobo	Saioa	Laboratoire de Chimie de Coordination/ CNRS	France	Oral
Coiffic	Jean-Christophe	CEA/LETI-MINATEC	France	Poster Session A
Colmenero	Juan	Centro Mixto CSIC/UPV	Spain	Attendee
Colmenero	Juan	Centro Mixto CSIC/UPV	Spain	Attendee
Coluci	Vitor Rafael	State University of Campinas	Brazil	Poster Session B
Comoy	Marianne	Nanotimes	France	Attendee
Cordón Vélaz	Javier	Universidad del Pais Vasco	Spain	Poster Session A
Cornelius	Thomas	GSI Darmstadt	Germany	Poster Session B
Correia	Antonio	Phantoms Foundation	Spain	Organiser
Corso	Martina	Donostia International Physics Center	Spain	Poster Session B
Costa-Krämer	Jose L	IMM-CSIC	Spain	Attendee
Cotta	Monica	UNICAMP - IFGW	Brazil	Poster Session B
Cranston	Emily	McGill University	Canada	Poster Session A
Critchley	Kevin	University of Michigan	UK	Poster Session B
Cuevas	Juan Carlos	Universidad Autónoma de Madrid	Spain	Keynote
Custance	Oscar	Osaka University	Japan	Keynote
Dadvand	Afshin	EMT-INRS	Canada	Poster Session A
Dallaporta	Hervé	CRMCN-CNRS	France	Poster Session B
De Franceschi	Silvano	CEA/DSM-DRFMC-SPSMS	France	Keynote
de Lacerda-Arôso	Teresa	Universidade do Minho	Portugal	Poster Session B
de los Arcos	Teresa	University of Basel	Switzerland	Poster Session B
De Miguel	Yolanda	LABEIN-Tecnalia (Nanomaterials)	Spain	Poster Session B
de Torres	Esther	MIDATECH BIOGUNE	Spain	Attendee

Degen	Christian	IBM Almaden Research Center	USA	Oral
Del Val	Juan José	Universidad del Pais Vasco	Spain	Poster Session B
Delcea	Mihaela	CIC BiomaGUNE	Spain	Poster Session A
Díaz	Elena	Universidad Complutense de Madrid.	Spain	Poster Session A
Diez Muino	Ricardo	Universidad del Pais Vasco	Spain	Attendee
Dil	Hugo	University Zurich	Switzerland	Poster Session B
Dinu	Elena	University Politehnica from Bucharest	Romania	Poster Session B
Dios	José Ramón	GAIKER - IK4	Spain	Attendee
Dontsova	Ekaterina	M.V. Lomonosov Moscow State University	Russia	Poster Session A
Drubi Vega	Ismael	BIOMETA	Spain	Attendee
Dumitru	Anca	University of Bucharest	Romania	Poster Session B
Echenique	Pedro	Donostia International Physics Center	Spain	Keynote
Echeverría	Carlos	Universidad Pública de Navarra	Spain	Poster Session A
Eguiazabal	José Ignacio	POLYMAT	Spain	Attendee
Eleta	Aitziber	CIC BiomaGUNE	Spain	Poster Session A
Ellman Nevado	Miguel	CEIT	Spain	Attendee
Enkovaara	Jussi	CSC - Scientific Computing Ltd.	Finland	Poster Session B
Erkizia	Edurne	Labein-Tecnalia	Spain	Attendee
Ershova	Olga	Moscow Institute of Physics and Technology	Russia	Poster Session B
Evans	Stephen	University of Leeds	UK	Attendee
Farías	Daniel	Universidad Autonoma de Madrid	Spain	Oral
Fernandez	Ivan	IMM-CSIC	Spain	Poster Session A
Fernandez	Rafael	Nanotec Electronica S.L.	Spain	Attendee
Fernandez	Ana	Instituto de Carboquimica (CSIC)	Spain	Attendee
Fernandez	Laura	Universidad del Pais Vasco	Spain	Poster Session B
Fernández	Isabel	Freie Universität Berlin	Germany	Poster Session A
Firkowska	Izabela	Caesar Research Center	Germany	Poster Session A
Florez	Sonia	INASMET-Tecnalia	Spain	Attendee
Formentin	Pilar	Universitat Rovira i Virgili	Spain	Attendee
Frederiksen	Thomas	Donostia International Physics Center	Spain	Poster Session B
Frolov	Vadim	A.M. Prokhorov General Physics Institute	Russia	Poster Session B
Froufe	Luis	Ecole Centrale Paris	France	Organiser
Fukui	Toshiyuki	University of Hyogo	Japan	Poster Session A
Fuss	Martina	IMM -CSIC	Spain	Poster Session A
Gaass	Markus	University of Regensburg	Germany	Poster Session A
Galvao	Douglas	State University of Campinas	Brazil	Oral
García Barrientos	Africa	Midatech Biogune S.L.	Spain	Oral
Garcia de Oteyza	Dimas	Max-Planck-Institut fuer Metallforschung	Germany	Poster Session B
Garcia Escorial	Paloma	Parque Cientifico de Madrid	Spain	Organiser
Garcia Etxarri	Aitzol	Donostia International Physics Center	Spain	Poster Session A
García Gallastegi	Ainara	INASMET Foundation	Spain	Poster Session A
Garcia Martin	Antonio	IMM-CSIC	Spain	Poster Session B
Garcia Mochales	Pedro	Universidad Autonoma de Madrid	Spain	Organiser
Garcia Vergniory	Maia	Donostia International Physics Center	Spain	Attendee
Garcia-Lekue	Arantzazu	Donostia International Physics Center	Spain	Poster Session B
Gence	Loïk	UCL-FSA/ DICE Lab	Belgium	Poster Session A
Ghitulica	Cristina	University Politehnica from Bucharest	Romania	Poster Session B
Gil	Adriana	Nanotec Electronica S.L.	Spain	Attendee
Goel	Ashok	Michigan Tech/Electrical & Computer Engineering	USA	Poster Session B

Goikolea	Eider	Universidad del Pais Vasco	Spain	Poster Session A
Gomes Santos	Elton Jose	Donostia International Physics Center	Spain	Attendee
Gomez Herrero	Julio	Universidad Autonoma de Madrid	Spain	Poster Session B
Gomez Medina	Raquel	ICMM -CSIC	Spain	Attendee
Gomez Rodriguez	Jose Maria	Universidad Autonoma de Madrid	Spain	Oral
Gonzalez	Julián	Universidad del Pais Vasco	Spain	Poster Session B
Gonzalez	Nora	Universidad del Pais Vasco	Spain	Poster Session A
González	Imanol	Universidad del Pais Vasco	Spain	Poster Session A
González Valle	Beatriz	Universidad del Pais Vasco	Spain	Attendee
Goodman	D. Wayne	Texas A&M University	USA	Keynote
Gorzny	Marcin	University of Leeds	UK	Poster Session A
Gourdon	Andre	CNRS-CEMES	France	Keynote
Granitzer	Petra	Karl Franzens University Graz	Austria	Poster Session B
Grutter	Peter	McGill University	Canada	Keynote
Hajizadeh	Solmaz	Noshirvani University of Technology	Iran	Poster Session A
Hell	Stefan W.	Max Planck Institut for Biophysical Chemistry	Germany	Keynote
Heras Aznar	Ana	ICEX	Spain	Attendee
Hernández Juárez	Beatriz	Institute of Physical Chemistry	Germany	Oral
Hernando	Antonio	Instituto de Magnetismo Aplicado	Spain	Keynote
Hernando	Mercedes	Universidad Autonoma de Madrid	Spain	Attendee
Herrero Chamorro	Maria A.	Universidad de Castilla La Mancha	Spain	Poster Session B
Hillenbrand	Rainer	Max-Planck-Institut für Biochemie	Germany	Keynote
Hirayama	Yoshiro	Tohoku University	Japan	Keynote
Hoa	Xuyen Dai	McGill University	Canada	Poster Session A
Hofer	Werner	University of Liverpool	UK	Oral
Hoppe	Cristina E.	Universidad de Santiago de Compostela	Spain	Poster Session B
Hortiguela	Maria Jesus	ICMM-CSIC	Spain	Poster Session A
Hsu	Li Chieh	National Chung Cheng University	Taiwan	Poster Session A
Hsu	Ching-Ling	Chung Yuan Christian University	Taiwan	Poster Session B
Huang	Hsuan Ming	National Chiao Tung University	Taiwan	Oral
Hubalek	Jaromir	Brno University of Technology	Czech Republic	Poster Session B
Hudziack	Steve	University of London	UK	Poster Session A
Ibáñez	José A.	Labein-Tecnalia	Spain	Attendee
Ieva	Eliana	Università degli studi di Bari	Italy	Poster Session A
Iijima	Sumio	Meijo University	Japan	Invited Speaker
Imaz	Inhar	Institut català de nanotecnologia	Spain	Attendee
Iñarrea	Jesus	Universidad Carlos III	Spain	Poster Session B
Ipatov	Mihail	Universidad del Pais Vasco	Spain	Poster Session A
Ivanova	Yuliya	Belarusian State University	Belarus	Poster Session B
Jabeen	Fauzia	University of Trieste	Italy	Poster Session A
Jancar	Bostjan	Jozef Stefan Institute	Slovenia	Poster Session B
Jarvis	Suzanne	University College Dublin	Ireland	Keynote
Jimenez	Pablo	Instituto de Carboquimica (CSIC)	Spain	Attendee
Jiménez	David	Universitat Autònoma de Barcelona	Spain	Poster Session B
Jiménez Sáez	José Carlos	Universidad Politecnica de Madrid	Spain	Poster Session B
Jódar	Esther	Universidad Politécnica de Cartagena	Spain	Poster Session A
Jofre	Marc	UPC - Department TSC	Spain	Attendee
Jones	Colin	Simon Fraser University	Canada	Attendee
Kada	Gerald	Agilent AFM - Nano Measurements Division	Austria	Attendee

Käll	Mikael	Chalmers University of Technology	Sweden	Keynote
Kameyama	Masaomi	Nikon	Japan	Attendee
Karami	Fateme	Tarbiat Modares University	Iran	Poster Session A
Karim	Shafqat	University of Marburg	Germany	Poster Session A
Kim	Chong-Tai	Korea Food Research Institute	Korea	Attendee
Kim	Do-Hyung Kim	Kyungpook National University	Korea	Poster Session B
Kim	Sooho	Kyungpook National University	Korea	Attendee
Kimura	Keisaku	University of Hyogo	Japan	Poster Session B
Klein	Jacob	Oxford University/Weizmann Institute	Israel	Keynote
Klosova	Katerina	Brno University of Technology	Czech Republic	Poster Session A
Knizhnik	Andrey	Kintech	Russia	Oral
Koeber	Mariana	IMM -CSIC	Spain	Poster Session A
Kortaberria	Galder	GRUPO GMT UPV/EHU	Spain	Poster Session B
Kowalzik	Peter	Research Center Juelich	Germany	Poster Session A
Kroes	Geert-Jan	Leiden University	Netherlands	Keynote
Kuelz	Uwe	HWL Scientific Instruments GmbH	Germany	Attendee
Kulnitskiy	Boris	TISNCM Technological Institute for Superhard and Novel Carbon Materials	Russia	Poster Session B
Lahiji	Roya	Purdue University	USA	Poster Session A
Landman	Uzi	Georgia Tech	USA	Invited Speaker
Lange	Holger	Technische Universitaet Berlin	Germany	Poster Session A
Lanzani	Guglielmo	Politecnico di Milano	Italy	Keynote
Lebedeva	Irina	Moscow Institute of Physics and Technology	Russia	Poster Session A
Ledesma	Javier	ScienTec Ibérica	Spain	Attendee
LeDue	Jeffrey	McGill University	Canada	Poster Session B
Lehn	Jean-Marie	ISIS - ULP	France	Invited Speaker
Lennartz	Maria C.	Institute of Solid State Research (IFF)	Germany	Poster Session A
Levichev	Sergey	University of Minho	Portugal	Poster Session B
Liebsch	Hans-Werner	HWL Scientific Instruments GmbH	Germany	Attendee
Llarena	Irantzu	CIC BiomaGUNE	Spain	Attendee
Lopez	Maria J.	Universidad de Valladolid	Spain	Poster Session B
López Arbeloa	Fernando	Universidad del Pais Vasco	Spain	Poster Session B
Lopez Fernandez	Vicente	Universidad Autonoma de Madrid	Spain	Poster Session A
Lorite	Israel	Instituto de ceramica y vidrio	Spain	Poster Session A
Lu	Wei	Konan University	Japan	Poster Session B
Lujun	Pan	Osaka Prefecture University	Japan	Poster Session B
Luna	Monica	IMM -CSIC	Spain	Attendee
Maassen	Jesse	McGill University	Canada	Poster Session A
Maletta	Stefano	Università degli Studi della Calabria	Italy	Poster Session A
Mañanes	Angel	Universidad de Cantabria	Spain	Poster Session B
Marchenkov	Alexei	Georgia Institute of Technology	USA	Keynote
Marconi	Veronica I.	Universidad Complutense de Madrid	Spain	Poster Session B
Marin	Jose Ramon	Universidad del Pais Vasco	Spain	Poster Session A
Marín Palacios	Pilar	Instituto de Magnetismo Aplicado	Spain	Poster Session B
Marquardt	Bernd	Ecole Polytechnique	France	Poster Session A
Marques	Manuel	Universidad Autonoma de Madrid	Spain	Attendee
Marradi	Marco	CIC BiomaGUNE	Spain	Poster Session B
Marsal	Lluis	Universitat Rovira i Virgili	Spain	Attendee

Martín	José	Universidad de Oviedo	Spain	Poster Session B
Martín Gago	Jose A.	Centro de Astrobiologia	Spain	Poster Session B
Martines	Elena	CIC BiomaGUNE	Spain	Attendee
Martinez	Luis Javier	IMM -CSIC	Spain	Poster Session A
Martinez	David	Universidad Autonoma de Madrid	Spain	Poster Session A
Martinez Galera	Antonio J.	Universidad Autonoma de Madrid	Spain	Poster Session A
Martinez Otero	Alberto	Institut català de nanotecnologia	Spain	Poster Session A
Martínez-Ávila	Olga	CIC BiomaGUNE	Spain	Poster Session A
Martsinovich	Natalia	King's College London	UK	Poster Session B
Maser	Wolfgang	Instituto de Carboquimica (CSIC)	Spain	Attendee
Maspoch	Daniel	Institut català de nanotecnologia	Spain	Attendee
Mateo-Marti	Eva	Centro de Astrobiologia (CAB)	Spain	Poster Session B
Matxain	Jon Mattin	Universidad del Pais Vasco	Spain	Poster Session B
Mayya	Subramanya	Advanced Process development Team, Memory Divison	Korea	Poster Session B
McKendry	Jonathan	University of Leeds	UK	Poster Session A
Mecerreyes	David	CIDETEC - IK4	Spain	Oral
Medalsy	Izhar	Hebrew University of Jerusalem	Israel	Attendee
Mertz	Damien	Inserm U595	France	Attendee
Mihoc	Carmen	Rostock University	Germany	Poster Session A
Mijangos	Federico	Universidad del Pais Vasco	Spain	Poster Session B
Millo	Oded	Hebrew University of Jerusalem	Israel	Poster Session B
Miura	Atsushi	Nara Institute of Science and Technology	Japan	Poster Session B
Moncada Moro	Eduardo	BIOMETA	Spain	Attendee
Monturet	Serge	Université Paul Sabatier	France	Attendee
Moragues Cánovas	María	LABEIN - NANOC	Spain	Attendee
Moralejo	Sonia	Universidad del Pais Vasco	Spain	Poster Session A
Moreno	Miguel	Universidad Autonoma de Madrid	Spain	Poster Session A
Moreno	Miriam	Universidad Autonoma de Madrid	Spain	Poster Session A
Moreno-Herrero	Fernando	Catalan Institute of Nanotechnology	Spain	Keynote
Morgan	Chris	University of London	UK	Poster Session A
Morozan	Adina	University of Bucharest	Romania	Poster Session B
Mosiniewicz-Szablewska	Ewa	Polish Academy of Sciences	Poland	Poster Session B
Mugarza	Aitor	Instituto de Ciencia de Materials de Barcelona	Spain	Poster Session B
Mujica	Maite	CEIT	Spain	Attendee
Mujica	Vladimiro	Northwestern University	USA	Keynote
Munz	Martin	National Physical Laboratory (NPL)	UK	Poster Session B
Mura	Manuela	King´s College London	UK	Poster Session A
Muraviev	Dmitri	Universitat Autònoma de Barcelona	Spain	Poster Session B
Narros Hernandez	Concepcion	Universidad SEK	Spain	Organiser
Nassar	Nashaat	University of Calgary	Canada	Poster Session A
Nastase	Florin	University of Bucharest	Romania	Poster Session B
Nastase	Claudia	University of Bucharest	Romania	Poster Session B
Nazabal	Jon	Universidad del Pais Vasco	Spain	Poster Session B
Neethirajan	Suresh Raja	University of Manitoba	Canada	Poster Session A
Nicoara	Nicoleta	Universidad Autonoma Madrid	Spain	Poster Session A
Nicola	Oana	University Politehnica from Bucharest	Romania	Poster Session B
Nicolessi	Gaston	Nanotimes	France	Attendee
Nishida	Naoki	University of Hyogo	Japan	Poster Session A

Nouvertne	Frank	Raith GmbH	Germany	Attendee
Odriozola	Arantza	CEMITEC (Fundación CETENA)	Spain	Poster Session A
Oh	Seyoung	Advanced Institute of Nanotechnology (SAINT)	Korea	Poster Session B
Olea	David	Universidad Auónoma de Madrid	Spain	Poster Session B
O'Mahony	Joe	Waterford Institute of Technology	Ireland	Attendee
Ordoñez	Luis	TELSTAR INSTRUMAT S.L.	Spain	Attendee
Osváth	Zoltán	Res. Inst. for Techn. Phys. & Mater. Sci. (MFA)	Hungary	Poster Session B
Otero	Roberto	Universidad Autónoma de Madrid,	Spain	Poster Session B
Pallecchi	Emiliano	Regensburg University	Germany	Poster Session A
Paredes	Ricardo	ICMM-CSIC	Spain	Poster Session B
Partridge	Jim	Applied PhysicsRMIT	Australia	Poster Session B
Pendry	John	Imperial College London	UK	Invited Speaker
Pérez	Noemí	CEIT	Spain	Poster Session A
Perez Garcia	Beatriz	Universidad de Murcia	Spain	Poster Session A
Pingitore	Valentino	Università degli Studi della Calabria	Italy	Poster Session A
Pinilla	Elena	Nanotec Electronica S.L.	Spain	Attendee
Pires	Véronique	SCHAEFER Techniques	France	Attendee
Piris	Mario	Universidad del Pais Vasco	Spain	Poster Session B
Pitarke	Jose Maria	CIC nanoGUNE Consolider	Spain	Organiser
Plazaola Muguruza	Fernando	Universidad del Pais Vasco	Spain	Oral
Pohlenz	Dieter	Omicron NanoTechnology GmbH	Germany	Attendee
Poissier	Adrien	CECAM	France	Poster Session A
Polak	Micha	Ben-Gurion University	Israel	Poster Session B
Porath	Danny	Hebrew University Physical Chemistry	Israel	Oral
Porro	Antonio	LABEIN-Tecnalia	Spain	Oral
Postigo	Pablo Aitor	IMM-CSIC	Spain	Poster Session B
Pouillon	Yann	Universidad del Pais Vasco	Spain	Poster Session B
Prieto	Ivan	IMM-CSIC	Spain	Poster Session A
Puente	Antonio	Universitat de les Illes Balears	Spain	Poster Session B
Quijada	Marina	Donostia International Physics Center	Spain	Poster Session A
Reedo	Valter	University of Tartu	Estonia	Poster Session A
Reifenberger	Ron	Birck Nanotechnology Center	USA	Attendee
Ripoll	Jorge	IESL-FORTH	Greece	Oral
Roch	Jean-Francois	Ecole Normale Superieure de Cachan	France	Keynote
Roche	Stephan	Commissariat à l'Energie Atomique, DRFMC/SPSMS/GT	France	Keynote
Rodgers	Peter	Nature Nanotechnology	UK	Attendee
Rodríguez Abreu	Carlos	IIQAB-CSIC	Spain	Poster Session B
Rodriguez Pierna	Angel	Universidad del Pais Vasco	Spain	Poster Session B
Rogero	Celia	Centro de Astrobiologia	Spain	Poster Session B
Roldan	Jose Luis	Phantoms Foundation	Spain	Organiser
Románszki	Loránd	Hungarian Academy of Sciences	Hungary	Poster Session A
Rosenblum	Steven	Corning Incorporated, New Business Development	USA	Attendee
Rotger Pons	Mª del Carmen	Universitat de les Illes Balears	Spain	Poster Session B
Rudi	Sara Anna	Università degli Studi della Calabria	Italy	Poster Session A
Rüdiger	Olaf	Instituto de Catálisis y Petroleoquimica (CSIC)	Spain	Attendee
Rugar	Daniel	IBM	USA	Keynote
Ruiz Nicolás	Patricia	Universitat Autònoma de Barcelona	Spain	Poster Session A
Ruiz Osés	Miguel	Universidad del Pais Vasco	Spain	Attendee

Ruiz Zamarreño	Carlos	Public University of Navarra	Spain	Poster Session A
Rummeli	Mark	IFW-Dresden	Germany	Poster Session B
Rumpf	Klemens	Karl Franzens University Graz	Austria	Poster Session B
Rycerz	Adam	Jagiellonian University	Poland	Oral
Saenz	Juan Jose	Universidad Autonoma de Madrid	Spain	Organiser
Sáenz-Arce	Giovanni	Universidad de Alicante	Spain	Poster Session A
Sahagun	Enrique	Universidad Autonoma de Madrid	Spain	Oral
Sala	Mar	TELSTAR INSTRUMAT, S.L.	Spain	Attendee
Salado	Javier	Universidad del Pais Vasco	Spain	Poster Session A
Salsamendi	Maitane	Fundacion Cidetec	Spain	Poster Session A
San Sebastian	Idoia	CEIT	Spain	Poster Session A
Sanchez Dolado	Jorge	NANOC-LABEIN	Spain	Attendee
Sanchez Portal	Daniel	Donostia International Physics Center	Spain	Oral
Santoro	Gonzalo	Instituto de Ciencia y Tecnología de Polímeros	Spain	Poster Session A
Sarantopoulou	Evangelia	National Hellenic Research Foundation/TPCI	Greece	Poster Session B
Savini	Gianluca	University of Sussex	UK	Poster Session A
Schaeffel	Franziska	IFW Dresden	Germany	Poster Session A
Schiffrin	Agustin	University of British Columbia	Canada	Poster Session A
Schiller	Frederik	Universidad del Pais Vasco	Spain	Poster Session B
Secchi	Andrea	Universita degli studi di Parma	Italy	Poster Session B
Serantes Abalo	David	Univ. Santiago de Compostela	Spain	Poster Session A
Serikov	Vladimir	NSG America Inc.	USA	Attendee
Serrano	Soraya	Phantoms Foundation	Spain	Organiser
Shadrokh	Zohreh	Tarbiat Modares University	Iran	Poster Session B
Shih	Chi-Tin	Tunghai University	Taiwan	Poster Session B
Shluger	Alexander	University College London	UK	Keynote
Shultz	Michael	Virginia Commonwealth University	USA	Poster Session A
Silanes	Iñaki	Donostia International Physics Center	Spain	Poster Session B
Spinicelli	Piernicola	Laboratoire Kastler Brossel - ENS - CNRS - UPMC	France	Oral
Stanley	Eugene	Boston University	USA	Keynote
Steiner	Dov	Hebrew University of Jerusalem	Israel	Attendee
Steplecaru	Cristiana S.	IMM-CNM-CSIC	Spain	Attendee
Stomp	Romain	Nanonis GmbH	Switzerland	Attendee
Tanaka	Kenichiro	Nanoscience and Development Support Team, RIKEN	Japan	Poster Session B
Teran	Francisco	GAIKER	Spain	Attendee
Tettamanzi	Giuseppe	University of Melbourne	Australia	Poster Session A
Thompson	Damien	Tyndall National Institute	Ireland	Oral
Toca-Herrera	Jose Luis	CIC BiomaGUNE	Spain	Oral
Tomankova	Katerina	Palacky University	Czech Republic	Poster Session A
Topple	Jessica	McGill University	Canada	Attendee
Torrado	Jorge F.	IMM-CSIC	Spain	Poster Session A
Torrent-Burgués	Juan	Universitat Politècnica de Catalunya	Spain	Poster Session B
Torres	Ricardo	ICMM-CSIC	Spain	Poster Session A
Tosatti	Erio	SISSA/ICTP/Democritos	Italy	Keynote
Tsukamoto	Rikako	CREST, Japan Science and Technology Agency	Japan	Attendee
Tuboltsev	Vladimir	University of Helsinki	Finland	Attendee
Uresandi	María	Universidad del Pais Vasco	Spain	Attendee

Valtsifer	Igor	Institute of Technical Chemistry	Russia	Poster Session A
Van De Waterbeemd	Marion	University of Kent	UK	Poster Session A
Van Hulst	Niek	ICFO - The Institute of Photonic Sciences	Spain	Keynote
Van Zee	Roger	NIST	USA	Poster Session B
Vazifehshenas	Taraneh	Shahid Beheshti University	Iran	Poster Session B
Vázquez Vázquez	Carlos	Univ. Santiago de Compostela	Spain	Poster Session B
Viviente	José Luis	Fundación INASMET	Spain	Attendee
Walton	Alex	University of Leeds	UK	Poster Session A
Welte Hidalgo	Lorena	Universidad Autonoma de Madrid	Spain	Poster Session A
Wiersma	Diederik	European laboratory for non-linear spectroscopy (LENS)	Italy	Keynote
Wintjes	Nikolai	University of Basel	Switzerland	Oral
Wu	Ming-Che	University of Cambridge	UK	Poster Session A
Wu	Ho-Chien	Institute of Atomic and Molecular Sciences	Taiwan	Poster Session A
Yamashita	Ichiro	Nara Institute of Science and Technology	Japan	Keynote
Yao	Hiroshi	University of Hyogo	Japan	Poster Session B
Zhao	Weisheng	université paris sud	France	Poster Session A
Zhukov	Vladlen	Donostia International Physics Center	Spain	Poster Session B
Zubitur	Maria M.	Universidad del Pais Vasco	Spain	Poster Session B
Zuelicke	Ulrich	Massey University	New Zealand	Keynote
Zypman	Fredy	Yeshiva University	USA	Poster Session B