Conference Program

Digest

The 9th International Conference on Manipulation, Manufacturing and Measurement on the Nanoscale

IEEE 3M-NANO 2019

Zhenjiang, China

4 – 8 August 2019

Organized by:

Jiangsu University, China

International Society for Nano Manipulation, Manufacturing and Measurement

Changchun University of Science and Technology, China

International Research Centre for Nano Handling and Manufacturing of China, China

IEEE Nanotechnology Council

Tampere University of Technology, Finland

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IFToMM (technically sponsored)

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Greetings

On behalf of the organizing committee, it is our great pleasure and honor to welcome you in Zhenjiang at IEEE 3M-NANO 2019 conference!

3M-NANO is an annual International Conference on Manipulation, Manufacturing and Measurement on the Nanoscale, held for the ninth time in Zhenjiang. 3M-NANO covers advanced technologies for handling and fabrication on the nanoscale. The ultimate ambition of this conference series is to bridge the gap between nanosciences and engineering sciences, aiming at emerging market and technology opportunities. The advanced technologies for manipulation, manufacturing and measurement on the nanoscale promise novel revolutionary products and methods in numerous areas of application. Scientists working in different research fields are invited to discuss theories, technologies and applications related to manipulation, manufacturing and measurement on the nanoscale. IEEE 3M-NANO 2019 is proud to offer an excellent technical program containing 18 keynote talks on major conference topics delivered by distinguished researchers and around 180 presentations in parallel technical program.

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A major goal of the IEEE 3M-NANO conference is to support a sustainable development of the nanohandling research community and to encourage long-term partnerships and collaborative research activities. To underline this dedication and to provide a get-together forum for all the participants, IEEE 3M-NANO 2019 has organized several exciting social events during and after the conference.

We would like to express our most sincere appreciation to all of our sponsoring organizations and all the individuals who have contributed to this conference. Our special thanks go to our colleagues in various conference committees and the volunteers who worked very hard to ensure the success of IEEE 3M-NANO 2019. Last but definitely not least, we thank all the conference participants for their support and contribution. We do hope that IEEE 3M-NANO 2019 will be the next successful step in this series of annual conferences and give home to rapidly growing nanohandling research community.

We wish you a successful conference and enjoyable stay in Zhenjiang!

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Conference Information

Venue and Accommodation

Venue

Crowne Plaza Zhenjiang is located at No. 27 Changjiang Road, Zhenjiang, on the Yangtze River Road in the urban riverside landscape belt. The Hotel is built along the Yangtze River, The architecture is magnificent and magnificent, and the natural landscape around it is fresh and pleasant. The hotel has 306 guest rooms, including 69 Deluxe Room with 46m^2 super size and breathtaking views of Yangtze river; 2,000 square meters of meeting space, and 7 multi-functional conference rooms, including a pillar-free banquet hall for 900 people.

Location: No. 27 Changjiang Road, Zhenjiang, Jiangsu Province

Zip Code: 212002

Tel Number: 0511-88959888

Fax Number: 0511-88959999

Mail Box: hotel@crowneplazazj.com

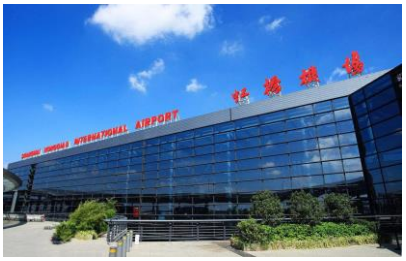
Website: www. crowneplazazj.com

Accommodation

The accommodation of IEEE 3M-NANO 2019 is arranged in the Crowne Plaza Zhenjiang.

How to get to Crowne Plaza Zhenjiang (the venue of IEEE 3M-NANO 2019)

1. From “Shanghai Hongqiao Airport” to “Crowne Plaza Zhenjiang”.



Shanghai Hongqiao Airport

Crowne Plaza Zhenjiang

Take the airport bus (Shanghai Hongqiao Airport - Zhenjiang) and take a taxi to the hotel after arriving at Zhenjiang Terminal (there is no bus direct line for the time being) (about RMB 13, 10-15 minutes to hotel).

2. From “ Lukou Airport” to “Crowne Plaza Zhenjiang”.

By Taxi

Nanjing Lukou Airport

Crowne Plaza Zhenjiang

By Airport Bus

a. By Taxi (around RMB 350-400 , 1.0-1.5 hours).

b. Take the airport bus (Lukou Airport - Zhenjiang) and take a taxi to the hotel after arriving at Zhenjiang Terminal (there is no bus direct line for the time being) (about RMB 13, 10-15 minutes to hotel).

3. From “ Zhenjiang Station north Square (High-speed Railway Station)” to “Crowne Plaza Zhenjiang”.

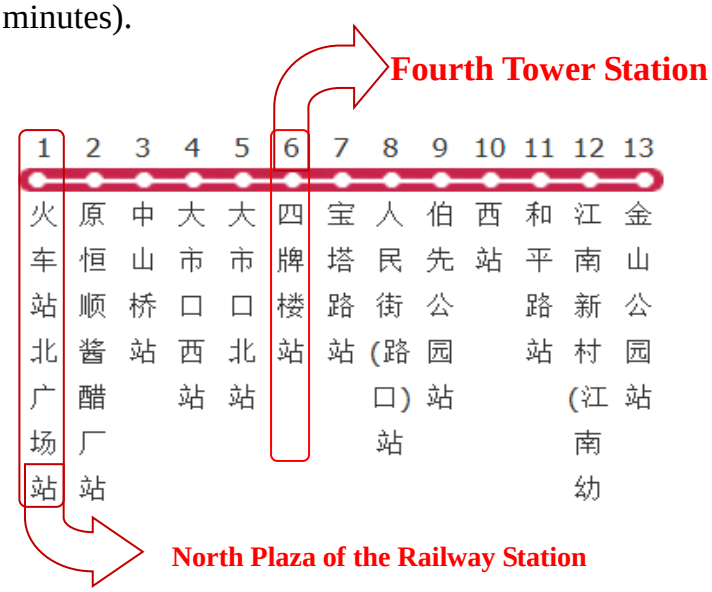
Zhenjiang Station north Square

By Bus No. 2

By Airport Bus

Crowne Plaza Zhenjiang

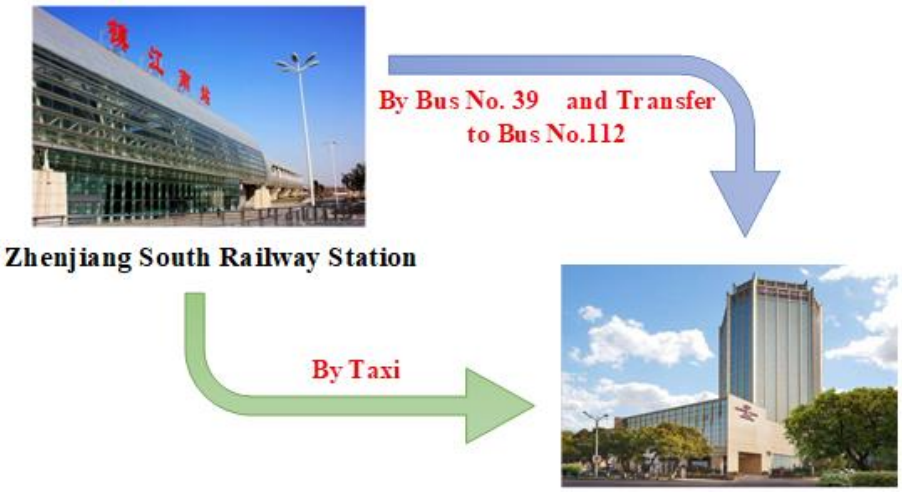
a. Walk 138 meters to the North Plaza of the Railway Station, take Bus No. 2, get off at the Fourth Tower Station, and walk 668 meters to Zhenjiang Crown Plaza Hotel (about 20 minutes).



b. Take the airport bus (Lukou Airport - Zhenjiang) and take a taxi to the hotel after arriving at Zhenjiang Terminal (there is no bus direct line for the time being) (about RMB 13, 10-15 minutes to hotel).

4. From “ Zhenjiang South Railway Station (High-speed Railway Station)” to “Crowne Plaza Zhenjiang”.

a. Walk to Zhenjiang South Station, take No. 39 and get off at Zhuang Quan Road Station, transfer to No. 112 and get off at Chunjiang Chao Square Station. Walk 200 meters to Zhenjiang Crown Plaza Hotel (about 1 hour).



Zhenjiang South Railway Station

b. By taxi: about RMB 26 (about 26 minutes).

Floor Maps of Conference Rooms

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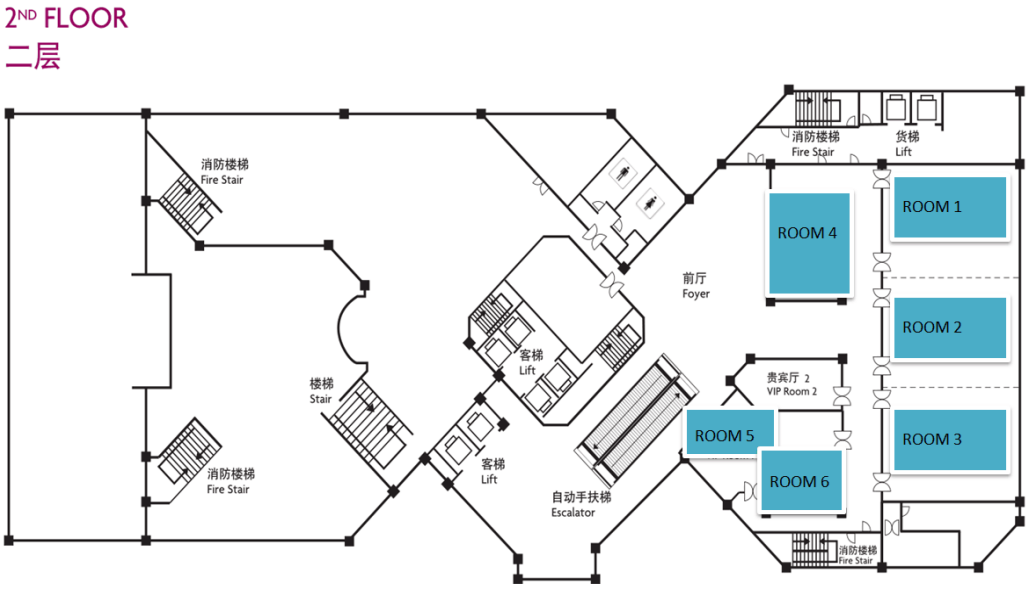

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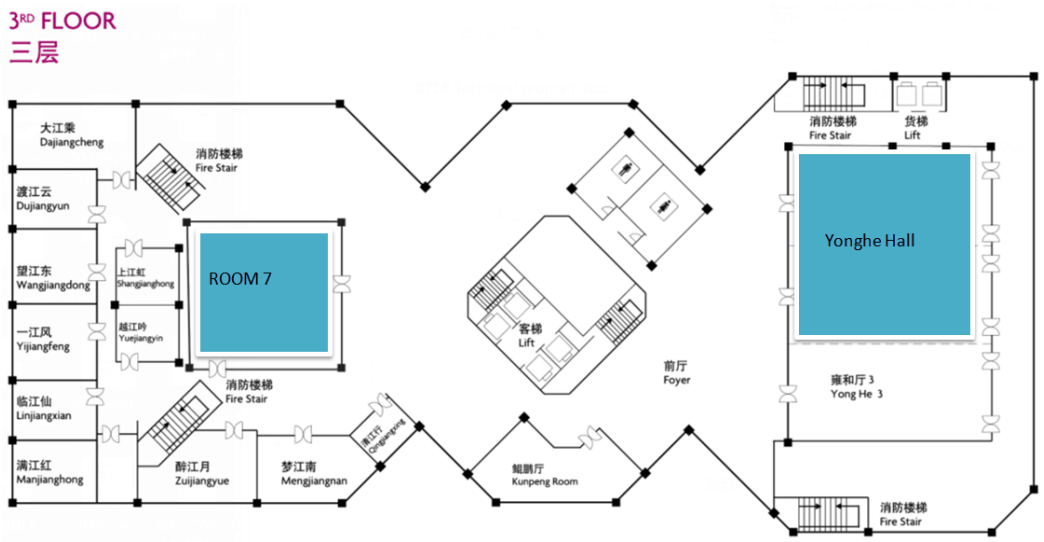

Conference registration will be arranged on the following days:

4 August, 13:00-18:00	**Crowne Plaza Zhenjiang, 1F**
5 - 7 August, 08:00 – 17:00	**Crowne Plaza Zhenjiang, 3F**

IEEE 3M-NANO 2019
Program at a Glance

Sunday, 4 August, 13:00-18:00, Crowne Plaza Zhenjiang, 1F	
Registration	
Monday, 5 August, 8:00-17:10, Yonghe Hall, 3F	
08:00—08:20	Opening ceremony
08:20—10:20	Keynote reports
10:20—10:40	Break
10:40—12:00	Keynote reports
12:00—13:30	Lunch
13:30—15:30	Keynote reports
15:30—15:50	Break
15:50—17:10	Keynote reports
17:10—20:00	Welcome banquet
Tuesday, 6 August, 8:00-10:00, Yonghe Hall, 3F	
08:00—10:00	Keynote reports
10:00—10:20	Break
Tuesday, 6 August, 10:20-12:20, Rooms 1-7, 2-3F	
10:20—12:20	Parallel technical sessions
12:20—13:30	Lunch

Tuesday, 6 August, 13:30-17:50, Rooms 1-7, 2-3F	
13:30—15:30	Parallel technical sessions
15:30—15:50	Break
15:50—17:50	Parallel technical sessions
17:50—20:00	Conference dinner
Wednesday, 7 August, 8:00-12:20, Rooms 1-7, 2-3F	
08:00—10:00	Parallel technical sessions
10:00—10:20	Break
10:20—12:20	Parallel technical sessions
12:20—13:30	Lunch
Wednesday, 7 August, 13:30-18:00, Yonghe Hall, 3F	
13:30—15:30	Keynote reports
15:30—15:50	Break
15:50—17:10	Keynote reports
17:10—18:00	Closing ceremony
18:00—20:00	Farewell banquet
Thursday, 8 August	
Social culture activities	

Schedule of the Keynote Reports

Monday, 5 August 2019, Yonghe Hall, 3F

Time	Topic	Speaker
Session Chair: Mingdong Dong		
08:20 – 09:00	Advanced Functional AIE Dots	Ben Zhong Tang
09:00 – 09:40	DNA-Based Biomaterials and Functional Molecular Networks	Weihong Tan
09:40 – 10:20	From Multifunctional Nanostructures to Nanorobotic Systems	Peer Fischer
Session Chair: Peer Fischer		
10:40 – 11:20	Landscape of TMDs: From Synthesis to Electrochemical Electronics	Zheng Liu
11:20 – 12:00	Nanopatterning by Covalent Grafting of Graphite using Self-Assembled Molecular Networks as Templates	Yoshito Tobe
Session Chair: Gajendra S Shekhawat		
13:30 – 14:10	Surface-mediated Peptide Assembly Structures Studied with STM	Chen Wang
14:10 – 14:50	Plasmonic Nanostructures and Single Electron Devices Based on DNA Constructions	Jussi Toppari
14:50 – 15:30	Graphene Oxide Optoelectronics	Baohua Jia
Session Chair: Jussi Toppari		
15:50 – 16:30	Real-time Nanoscale Visualization of Biological Molecules at Work with High-speed Atomic Force Microscopy	Takayuki Uchihashi
16:30 – 17:10	Micromachined based Chip Scale Thermal Sensor for Hot Spot Mapping in Transition Metal Dichalcogenides	Gajendra S Shekhawat

Tuesday, 6 August 2019, Yonghe Hall, 3F

Time	Topic	Speaker
Session Chair: Lei Liu		
08:00 – 08:40	Gas Adsorption in a Small Pore Hydride: Microscopic and Macroscopic Characterization by in Situ Diffraction	Yaroslav Filinchuk
08:40 – 09:20	Pico-Newton Force Sensing at Liquid-Solid Interfaces: Application to Lubricants	Hiroshi Onishi
09:20 – 10:00	Nanostructured Water-responsive Materials for Evaporation Energy Harvesting	Xi Chen

Wednesday, 7 August 2019, Yonghe Hall, 3F

Time	Topic	Speaker
Session Chair: Cong Liu		
13:30 – 14:10	Planar Magnetic Nanomachines: Role of Symmetry and Controlled Propulsion	Alexander M. Leshansky
14:10 – 14:50	Self-propelled Swimming Nanomachines for Biomedical Applications	Qiang He
14:50 – 15:30	Photochromic Molecules for Photoswitching Units in Molecular Optoelectronics	Kenji Matsuda
Session Chair: Alexander M. Leshansky		
15:50 – 16:30	Structural Investigation of Amyloid Proteins and Its Application in Developing Nanomaterials	Cong Liu
16:30 – 17:10	Nano-molecules: New Building Blocks for Materials Discovery	Zhihong Nie

Keynote Speakers

(in alphabetical order)

Nanostructured Water-responsive Materials for Evaporation Energy Harvesting

Xi Chen

Assistant Professor
CUNY Advanced Science Research Center
Department of Chemical Engineering
The City College of New York
USA
E-mail: xi.chen@asrc.cury.edu

Abstract: Natural evaporation involves water absorbing heat and vaporizing from higher chemical potential to lower chemical potential. While this process could involve a significant amount of energy transfer due to water's large latent heat of vaporization, the energy of natural evaporation remains untapped. Our recent progress in nanostructured water-responsive materials, which swell and shrink in response to changes in relative humidity, has enabled the development of evaporation energy harvesting devices that can directly convert evaporation energy into mechanical energy as well as to electricity. While such energy harvesting technique is still in its early stage, theoretical studies have predicted a great potential of this energy source. Here, motivated by these recent developments, we discuss our current development of water-responsive materials and evaporation harvesting devices, as well as the scientific and technical challenges of improving their overall energy conversion efficiency for practical applications.

Graphene Oxide Optoelectronics

Baohua Jia

Professor
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Engineering and Technology
Swinburne University of Technology
Melbourne, Australia
E-mail: bjia@swin.edu.au

Abstract: Recently, inspired by the extraordinary physical and chemical properties of graphene, great research effort has been devoted to develop functional graphene-enabled devices. However, challenges still exist in developing scalable and low-cost fabrication method. Solution processible graphene oxide provides a viable approach for achieving reasonable quality and large-scale graphene films with minimum fabrication effort through removing the oxygen containing groups in graphene oxide. In this talk I will introduce our recent progress on laser patterned graphene oxide film for highly-integrated optoelectronics devices towards energy, integrated photonic devices, information technology and water desalination applications.

Gas Adsorption in a Small Pore Hydride: Microscopic and Macroscopic Characterization by in Situ Diffraction

Yaroslav Filinchuk

Professor of structural chemistry
Molecules, Solids and Reactivity (MOST)
Institute of Condensed Matter and Nanosciences (IMCN)
Université Catholique de Louvain (UCL)
Belgium
E-mail: Yaroslav.Filinchuk@uclouvain.be

Abstract: We investigated an interaction of porous γ-Mg(BH4)2 [1] with small gas molecules, using neutron powder diffraction to accurately localize the guests at low temperatures and synchrotron X-ray powder diffraction to collect data along the adsorption isobars. The latter allows to study structural changes with pressure and temperature variation, giving insight into guest-host and guest-guest interactions, as well as to extract relevant thermodynamic parameters.

I will discuss the guest-host and guest-guest interactions, size effects, the role of hydridic hydrogen in physisorption, reactivity between the guest and the host. The effect of the probe size on the capacity and location of the guest molecules is remarkable in this small pore system. While typically each pore can be occupied by one of two guests, the amount of hydrogen that can be loaded reaches up to 5 molecules per pore (one pore in two, given the geometrical proximity), yielding the total capacity of 2.33 H2 molecules per Mg atom.

We also report on sub-second diffraction experiments on gas absorption by γ-Mg(BH4)2. We resolve the contributions of two kinetic barriers: most likely, the first is via Kr diffusion along the pore 1-D channels of the crystal structure and the second mechanism is through the interchannel aperture window.

From Multifunctional Nanostructures to Nanorobotic Systems

Peer Fischer

Professor
Max Planck Research Group Leader
Max Planck Institute for Intelligent Systems
University of Stuttgart
Germany
E-mail: fischer@is.mpg.de

Abstract: Manipulation and measurements at the nanoscale in fluids call for multifunctional nanostructures. I describe how one can see specially designed nanoparticles in strongly absorbing whole blood, manipulate them to understand nanorheological fluid properties, and spectroscopically measure their orientation in real time. I describe a general fabrication scheme that can be used to rapidly grow these functional nanostructures, which can be plasmonic, magnetic, and show strong optical activities. Our fabrication technique can be used to tailor the nanostructures' dielectric functions such that record local plasmon resonance (LSPR) sensitivities can be achieved. I will also demonstrate how these chiral nanoantennas can be used as propellers to penetrate real tissues and organs. The nanopropellers are small enough to slip through the macromolecular network of real tissues and are therefore a promising system for targeted delivery.

Self-propelled Swimming Nanomachines for Biomedical Applications

Qiang He

Professor
Micro/Nanotechnology Research Center
Harbin Institute of Technology
China
E-mail: qianghe@hit.edu.cn

Abstract: Current drug nanocarriers have potential to perform targeted drug delivery since they can achieve longer systemic circulation so that more drugs can be deposited at the tumor site through the enhanced permeability and retention (EPR) effect. Although various nanocarriers have been successfully used to deliver drugs, the targeting ratios are still very low since they cannot actively seek the tumor site and also lack a propelling force to penetrate the tumor beyond their normal diffusion limit. Inspired by natural swimmers (e.g. bateria), our group focuses on the design of synthetic swimming nanomachines which have ability of converting chemical energy or various physical stimuli into autonomous motion in fluids. These as-assembled nanomachines are able to be served as both autonomous motor and smart cargo, performing drug loading, targeted transportation and remote controlled release in the vicinity of cells and tissues in an organism. Such swimming nanomachines may provide a new trend in the design of next-generation drug delivery for actively seeking sites of diseases and targeted drug transport.

Planar Magnetic Nanomachines: Role of Symmetry and Controlled Propulsion

Alexander M. Leshansky

Associate Professor
Department of Chemical Engineering
Technion
Israel Institute of Technology
Israel
Email: lisha@technion.ac.il

Abstract: Steering of nano-/microhelices by a rotating magnetic field is considered a promising technique for controlled navigation of tiny objects through viscous fluidic environments. It was recently demonstrated that simple geometrically achiral planar structures can also be steered quite efficiently [1]. Such planar propellers are interesting for practical reasons, as they can be mass-fabricated using standard photolithography techniques.

Following the earlier development of a theory of driven rotation and propulsion of magnetized object of an arbitrary shape in an in-plane rotating magnetic field [2], we propose general symmetry arguments (involving parity and charge conjugation) establishing correspondence between propulsive solutions of simple planar V-shaped structures on orientation of the dipolar magnetic moment [3]. In particular, it can be shown that in-plane magnetization results in propulsion due to a spontaneous symmetry breaking, whereas the rotating motors swim either parallel or anti-parallel to the field rotation axis depending on their initial orientation. Particular off-plane magnetization yields unidirectional propulsion typically associated with chiral structures, such as helices.

Since planar micro/nano-structures are prone to in-plane magnetization and their uniform off-plane magnetization is not an easy task, the interesting question is whether they can be steered in a controllable fashion? Here we demonstrate that actuation by a conically rotating magnetic field (i.e., superposition of an in-plane rotating field and constant field orthogonal to it) can yield efficient unidirectional propulsion of planar and in-plane magnetized structures [4]. In particular, we found that the symmetrical V-shape magnetized along its symmetry axis which exhibits no net propulsion in in-plane rotating field, shows unidirectional in-sync propulsion with a constant (frequency-independent) velocity when actuated by the conical field. When the constant field is imposed in plane of the rotating field, it results in the net propulsion accompanied by the drift orthogonal to the axis of the field rotation. Such setup can potentially be used to achieve spatial control over motion of multiple propellers.

Structural Investigation of Amyloid Proteins and Its Application in Developing Nanomaterials

Cong Liu

Professor
Interdisciplinary Research Center on Biology and Chemistry
Shanghai Institute of Organic Chemistry
Chinese Academy of Sciences
China
E-mail: liulab@sioc.ac.cn

Abstract: Self assembly of amyloid proteins into fibrillar aggregates has been found to be closely associated not only with a dozens of devastating diseases such as Alzheimer's and Parkinson's diseases but are integral to many biological processes including cell surface adhesion and hormone storage. In this talk, I will introduce our work on structural characterization of amyloid proteins by combining a newly developed method Micro-electron diffraction (MicroED) and other biophysical approaches including AFM, X-ray and others. We determined the structure of fibrillation cores from RNA binding protein FUS with ultra-high resolution of 0.73 Å and several other amyloid fibrillar core structures of RNA binding proteins, which provided the mechanism of the reversibility in phase separation of this protein. Furthermore, by utilizing the structural information of different amyloid cores we obtained, we designed a series of amyloid nanosheet architectures for laboratorial retroviral transduction enhancement, elucidating the potential of structure-based design of amyloid nanomaterials with novel architecture and function.

Landscape of TMDs: from Synthesis to Electrochemical Electronics

Zheng Liu

Assistant Professor
Centre for Micro-/Nano-electronics (NOVITAS)
School of Electrical and Electronic Engineering
Nanyang Technological University
Singapore
E-mail: z.liu@ntu.edu.sg

Abstract: Two-dimension (2D) transition-metal dichalcogenides (TMDs) have recently provided a rich source of research opportunity, revealing interesting physical phenomena including quantum-spin Hall effect (QSH), valley polarization, 2D superconductivity, and potential applications for functional devices. Here, we demonstrate that molten salt-assisted chemical vapor deposition can be broadly applied for the synthesis of a wide variety of 2D TMDs [1]. We demonstrate the synthesis of 47 compounds, including 32 binary (Ti-, Zr-, Hf-, V-, Nb-, Ta-, Mo-, W-, Re-, Pt-, Pd- and Fe-based), 13 alloys (including 11 ternary, 1 quaternary and 1 quinary), and 2 heterostructured compounds. We elaborate the general growing mechanism of this method, demonstrating that the salt decreases the melting point of reactants and facilitates the formation of intermediate products.

Based on the 2D materials, we have recnelty revisited the semiconductor-electrolyte interface and unraveled a universal self-gating phenomenon through micro-cell based in-situ electronic/electrochemical measurements [2]. We unveiled a surface conductance mechanism under self-gating that dominates the charge transport in semiconductor electrocatalysts, and demonstrate the strong correlation between them. Then we demonstrate that the type of semiconductor catalysts strongly correlates and their electrocatalysis, i.e., n-type semiconductor catalysts favor cathodic reactions such as hydrogen evolution reaction (HER), p-type ones prefer anodic reactions such as oxygen evolution reaction (OER), and bipolar ones tend to perform both anodic and cathodic reactions. Our study provides a new insight into the electronic origin of semiconductor-electrolyte interface during electrocatalysis, paving the way for designing high-performance semiconductor catalysts.

Photochromic Molecules for Photoswitching Units in Molecular Optoelectronics

Kenji Matsuda

Professor
Department of Synthetic Chemistry and Biological Chemistry
Graduate School of Engineering
Kyoto University
Japan
E-mail: kmatsuda@sbchem.kyoto-u.ac.jp

Abstract: In molecular electronics, photochromic compounds are considered to be promising candidates for photoswitching units. In diarylethenes (DAEs) the connectivity of -system changes significantly by irradiation of light. Based on this idea, the photoswitching of exchange interaction and molecular conductance through DAE molecule has been achieved by our group. Drain-current switching of DAE-channel organic field-effect transistors with light- and electric-field effects will also be presented. With respect to the arrangement of DAE molecules, high sensitive photochemical control of the assembly using high cooperative system at two-dimensional solid/liquid interface will be presented.

Nano-molecules: New Building Blocks for Materials Discovery

Zhihong Nie

Professor
State Key Laboratory of Molecular Engineering of Polymers
Department of Macromolecular Science
Fudan University
China
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Abstract: The past decades have witnessed remarkable success in the synthesis of inorganic nanoparticles with interesting optical, electronic, or magnetic properties. Realizing the enormous potential of nanoparticles in such as energy, biomedical, and optoelectronic fields requires the organization of these particles into larger or hierarchically ordered structures with defined macroscopic properties. Molecules are the most important building blocks of matter. They exhibit astonishing precision in the arrangement of atoms and are capable of assembling into functional structures with high complexity and diverse functions. The ability to organize nanoparticles into molecule equivalents holds great promises to manipulate matter at nanoscale scale and to exploit the emergent properties of nanoparticle ensembles. In this talk, I will present our efforts to the design of “nanoscale molecules” (nano-molecules) via self-assembly and the discovery of new materials from nano-molecules.

Pico-Newton Force Sensing at Liquid-Solid Interfaces: Application to Lubricants

Hiroshi Onishi
Professor
Chemistry Department
Kobe University
Program Officer
Japan Society for the Promotion of Science
Japan
E-mail: oni@kobe-u.ac.jp

Abstract: Frequency-modulation atomic force microscopy (FM-AFM) is a promising tool to observe solid topography and also liquid structure at liquid-solid interfaces. The cantilever with a tip is mechanically oscillated. The shift of the resonance frequency, delta f, represents the force pushing or pulling the tip. Microscopes with a force sensitivity of 10 pN or better in water and organic solvents have been developed and commercialized to date. Using the advanced microscopes, we have examined structured liquids at a number of interfaces including water-CaCO3, SrTiO3, organic monolayers, etc. The observed delta-f distributions are interpreted with water density distribution through Gibbs free energy perturbed by the solid surface. The force sensitivity of 10 pN is the key for probing force on single liquid molecules.

Possible application of delta-f mapping to tribology research will also be mentioned. Most liquid lubricants used in mechanical applications are low-vapor-pressure hydrocarbons modified with a small quantity of polar compounds. The polar modifiers are deposited on the surface of sliding solids, typically steel objects. The deposited layer reduces friction and wear by preventing direct contacts of solids. Controlling the adsorbed layer is the key to improve lubrication at liquid-solid interfaces. The lateral and vertical distribution of the adsorbed layers should be characterized in lubricants. This is not an easy task. FM-AFM provides the local density distribution of lubricants in a spatial resolution of 0.1 nm or better.

Micromachined based Chip Scale Thermal Sensor for Hot Spot Mapping in Transition Metal Dichalcogenides

Gajendra S Shekhawat
Research Professor
Department of Material Science and Engineering
Director, Scanned Probe Imaging and Development Center
Northwestern University
USA

Abstract: The lateral resolution of scanning thermal microscopy (SThM) has hitherto never approached that of mainstream atomic force microscopy, mainly due to poor performance of the thermal sensor. Herein, we will present a nanomechanical system based thermal sensor (thermocouple) that enables high lateral spatial resolution that is often required in nanoscale thermal characterization in wide range of applications. This thermocouple-based probe technology delivers excellent lateral resolution (~ 20 nm), extended high temperature measurements greater than 700°C without cantilever bending, and a very high thermal sensitivity ~(~0.04 °C). The origin of significantly improved figures-of-merit lies in the probe design that consists of a hollow silicon tip integrated with a vertically oriented thermocouple sensor at the apex (low thermal mass) which interacts with the sample through a metallic nanowire (50 nm diameter), thereby achieve high lateral resolution. The efficacy of this approach to SThM is demonstrated by imaging embedded metallic nanostructures in silica core shell, spatially map the temperature rise across various defects and heterogeneities of titanium carbide (Ti3C2Tx - T stands for surface terminations) MXene nanostructures under high electrical bias with sub-50-mK temperature resolution, and to map the spatial distribution of the temperature rise within monolayer transition metal dichalcogenide (TMD) devices upon dissipating a high electrical power through a lateral interface. The results directly demonstrate that lateral heterojunctions between MoS2 sub-50-nm spatial resolutions. The nanoscale pitch and extremely small thermal mass of the probe promise significant improvements over existing methods and wide range of applications including in semiconductor devices, biomedical imaging, and data storage.

DNA-Based Biomaterials and Functional Molecular Networks

Weihong Tan

Distinguished Professor, V. T. and Louise Jackson Professor of Chemistry
University of Florida
USA
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State Key Laboratory of Chemo/Biosensing and Chemometrics
Hunan University, China
Academician, Chinese Academy of Sciences
E-mail: tan@chem.ufl.edu.cn

Abstract: Functional materials are essential for economic growth and human health, and also critical for the continuous innovation in science. Precise synthesis of materials can significantly enrich and/or improve their features, providing a solid scientific foundation and technical support for the development of innovative materials with high-end performance. Because of their distinct properties of programmable design and specific molecular recognition, DNA molecules can serve as one of the ideal building blocks to achieve precise control over materials' structure and function at the molecular level, thus providing infinite possibilities for constructing various functional materials, including biological and clinically useful materials. Meanwhile, multifunctional molecular networks based on DNA can be constructed through the precise synthesis of DNA and the intelligent design of DNA logic circuit. These molecular networks can be potentially used to mimic some basic biological functions. This report will show some examples about using DNA as the best building block for precise fabrication of advanced materials, and our latest research progress in the construction of DNA-based biomaterials and functional molecular networks.

Advanced Functional AIE Dots

Ben Zhong Tang

Stephen K. C. Cheong Professor of Science
Chair Professor of Chemistry
Chair Professor of Chemical and Biological Engineering
Academician, Chinese Academy of Sciences
Fellow, Royal Society of Chemistry
The Hong Kong University of Science and Technology
E-mail: tangbenz@ust.hk

Abstract: Long-term non-invasive cell tracing by fluorescent probes is of great importance to understand genesis, development, invasion and metastasis of cancerous cells. To efficiently trace living cells through a noninvasive and real-time manner, researchers have devoted much effort to develop new fluorescent probes. Traditional π-conjugated fluorophors are prone to aggregate, which often quenches their light emissions and is a common photophysical phenomenon known as aggregation-caused quenching (ACQ). We succeeded in developing a series of efficient organic emitters with aggregation-induced emission (AIE) characteristics by linking propeller-like tetraphenylethene (TPE) unit to traditional dyes through covalent bond. Encapsulation of the AIE luminogens in biocompatible polymer matrix yields optically stable nanodots with uniform size, high brightness and low cytotoxicity. The AIE nanodots carrying specific surface functional groups show high emission efficiency, large absorptivity, excellent biocompatibility and strong photo-bleaching resistance, making them ideal for targeting specific cells and/or tissues, and long-term non-invasive in vitro and in vivo cell tracing. Moreover, different from quantum dot (QD)-based probes, the organic fluorescent nanodots show no blink state and do not contain heavy metal ions that are potentially toxic when used in biological systems. The organic AIE dots outperform their counterparts of commercial inorganic QDs-based cell tracing probes, opening a new avenue in the development of applications, such as organic fluorescent probes for monitoring biological processes.

Nanopatterning by Covalent Grafting of Graphite using Self-Assembled Molecular Networks as Templates

Yoshito Tobe

Professor Emeritus and Guest Professor
The Institute of Scientific and Industrial Research
Osaka University, Japan
Chair Professor
National Chiao Tung University, China
E-mail: tobe@chem.es.osaka-u.ac.jp

Abstract: Since periodically controlled chemical functionalization of carbon materials broadens application potential and supports processing and development, methods that yield nanopatterned functionalization on flat carbon surfaces are critical for modulation of the intrinsic electronic and physical properties of these materials. We reported a new molecular scale lithographic approach which employs lamellar type self-assembled molecular monolayers of n-alkanes as templating masks during electrochemical covalent functionalization of graphite and graphene surfaces. One-dimensional control with a lateral periodicity between 4 and 7 nm was demonstrated utilizing molecular templates of different alkane lengths. The key to the success for this method is a phase separated solution double layer consisting of the masking organic layer underneath an aqueous layer containing electrochemically active diazonium molecules which upon electrochemical reduction generate aryl radicals capable of surface grafting. This protocol was applied to two-dimensional control of grafting by using porous self-assembled molecular networks formed by hexaalkoxy-substituted triangle building blocks as templating masks.

Plasmonic Nanostructures and Single Electron Devices Based on DNA Constructions

Jussi Toppari

Professor
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Nanoscience Center
University of Jyväskylä
Finland
E-mail: j.jussi.toppari@jyu.fi

Abstract: The molecular electronics as well as molecular scale optics (via plasmonics), have long been visualized to pose the next huge leap in technology development. Even not fully realized yet, the promises of these nanotechnologies are certainly getting closer to be fulfilled. The most crucial issues in realization of functional molecular scale electrical devices is to find both molecular conductors as well as suitable building blocks and scaffolds, for nanoscale assembly. For nano-optics the plasmonic nanostructures have shown high potent due to their unique optical properties such as field enhancement and possibilities for subwavelength optics. However, due to limitations of the conventional nanofabrication methods, nanostructures with tunable plasmonic/optical activity in visible range are hard to realize, especially in large amounts. At the moment, DNA has proven to be a very versatile and promising molecule for nanoscale patterning. Quickly developing techniques based on DNA self-assembly provide precise and programmable ways to form electrical molecule scale devices as well as plasmonic nanoscale structures, even in large quantities. Yet, in the respect of the long history and debate on the possibly conductivity of DNA itself, the electrical properties of DNA-based structures are also of a great interest.

We have studied the conductance of several types of individual DNA nanostructures and found that even the electrical conductivity of DNA-helix as such, seems to be too fragile to be directly utilized, the multilayered 3D DNA origami structures may have improved properties. However, more robust realization of DNA-based electrical devices, relies on other components and uses DNA as only a scaffold. Hence, we have utilized DNA nanostructures to assemble a row of gold nanoparticles (AuNP). The whole entity is further trapped between metallic electrodes where AuNPs act as metallic islands to form a single electron transistor (SET). Due to small size of the islands, this SET could work even at room temperature in contrast to the usually needed kryogenic temperatures. For nanoscale optics, we have developed a novel method, which takes advantage of the DNA origami constructions and together with conventional nanofabrication processes enabling fabrication of high quality sub-100-nanometer plasmonic nanostructures with desired shapes. As a demonstration, we have fabricated optical bowtie antennas with a tunable plasmonic resonance in visible range. The method is highly parallel, which enabled us to fabricate also optically chiral surface with high coverage. This ability to fabricate metallic nanoparticles with designed shape in high quantities provides great potential in various applications, especially sensing and metamaterial fabrication.

Real-time Nanoscale Visualization of Biological Molecules at Work with High-speed Atomic Force Microscopy

Takayuki Uchihashi

Professor
Laboratoy of Biomolecular Dynamics and Function
Department of Physics
Nagoya Unversity
Japan
E-mail: uchihast@d.phys.nagoya-u.ac.jp

Abstract: Biological molecules fulfil a wide variety of unique functions. Their functions are essentially elicited from conformational change and/or interactions with other molecules which are often triggered by binding of ligand/substrate and changes in the external environment. Therefore, studying dynamic processes on individual molecules is indispensable to gain mechanistic insight into biological molecules. Nevertheless, a tool with an ability to directly record both conformational changes and dynamic molecular interactions in real time at single-molecule resolution has not been available. Atomic force microscopy (AFM) is a versatile technique to study nanoscale structures of materials under various environments. One of the most coveted new functions of AFM is “fast recording” because it allows the observation of dynamic processes occurring at the nanoscale. The visualization of dynamic processes provides direct and deep insights into the target objects and phenomena under the microscope. This new capability of observation should open a new opportunity to reveal essential mechanisms of working proteins. In this talk, we demonstrate some applications of high-speed AFM to imaging of dynamics of single molecules, living cells and dynamic process at solid/liquid interface.

Surface-mediated Peptide Assembly Structures Studied with STM

Chen Wang

Professor
National Center for Nanoscience and Technology
China
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Abstract: Peptides and proteins are known to form a variety of ordered structures via assembling processes. The molecular insights of the assembly propensities of various peptide-based nanostructures are keen to the pharmaceutical studies and pathological analysis for neurodegenerative disorder processes such as Alzheimer's disease (AD). Documented experimental results have revealed that the capability of peptides to form ordered structures has significant dependence on the sequence and composition of amino acids. An important subject under study is the formation mechanisms of peptide assemblies at the level of individual amino acids. We have endeavored to investigate the assembly propensity of peptides based on the high resolution structural analysis of surface-bound peptide assemblies by using scanning tunneling microscopy (STM). Specifically, the dependence of the peptide assembly structures on sequences will be pursued, including the impact of amino acids on the adsorption stability and assembly propensity. It may be anticipated that these efforts could advance the fundamental mechanism underlying the peptide assembly propensity, as well as provide the potential venues for developing novel diagnosis and therapeutic approaches towards relevant diseases.

Technical Program

(ss: Technical Special Session)

Tuesday, 6 August 10:20-12:20, 2 F

No.	Room	Session
01	Room 1	Micro/nano materials & Structures for Ultrafast Optics and Optical Sensing (ss)
02	Room 2	Nanofabrication and Nanoassembly
03	Room 3	University of Shanghai Cooperation Organization Nanotechnology (ss)
04	Room 4	Nanophotonics and Nanoelectronics
05	Room 5	Nano-Hydrides for Energy Applications (ss)
06	Room 6	Molecular Materials: Catalysis, Sensing and Electronic Applications (ss)

Tuesday, 6 August 13:30-15:30, 2-3 F

No.	Room	Session
07	Room 1	Functional Micromachines and Miniature Devices (ss)
08	Room 2	Surface Science Characterization for Energy, Bio-, and Catalysis Nanomaterials (ss)
09	Room 3	FabSurfWAR (ss)
10	Room 4	Tools and Methods for Nano-assembling (ss)

11	Room 5	2D Materials at Nanoscale: From Fundaments to Applications (ss)
12	Room 6	Micro/nano Structure Measurement and the Application in Bioscience and Environment Science (ss)
13	Room 7	Advanced Technology of Micro-nano Fabrication & Surface Analysis (ss)

Tuesday, 6 August 15:50-17:50, 2-3 F

No.	Room	Session
14	Room 1	Advanced Functional Materials: From Synthesis, Characterization to Actuation (ss)
15	Room 2	Surface Science Characterization for Energy, Bio-, and Catalysis Nanomaterials (ss)
16	Room 3	Design, Analysis and Control of Nano-manipulating Systems (ss)
17	Room 4	Tools and Methods for Nano-assembling (ss)
18	Room 5	2D Materials at nanoscale: From Fundaments to Applications (ss)
19	Room 6	Micro/nano Structure Measurement and the Application in Bioscience and Environment Science (ss)
20	Room 7	Advanced Technology of Micro-nano Fabrication & Surface Analysis (ss)

Wednesday, 7 August 8:00-10:00, 2 F

No.	Room	Session
21	Room 1	Nanomaterial and Nanotechnology for Biological Applications (ss)
22	Room 2	Intelligent Soft Matreial Systems: Nano-Scale Manipulation Enable Novel Applications (ss)
23	Room 3	Nanometrology and Nanocharacterization
24	Room 4	Nanomechanics and Nanomechatronics
25	Room 5	Micro/Nano Robotics for Single Cancer Cells (MNR4SCell) (ss)
26	Room 6	Biological Applications

Wednesday, 7 August 10:20-12:20, 2 F

No.	Room	Session
27	Room 1	Nanomaterial and Nanotechnology for Biological Applications (ss)
28	Room 2	Application of Ferroelectric Nano Materials (ss)
29	Room 3	AFM and Applications
30	Room 4	Nanomechanics and Nanomechatronics
31	Room 5	Nanomaterials and Applications
32	Room 6	Biological Applications

Technical Special Session 01
Micro/nano materials & Structures for Ultrafast Optics and Optical Sensing (ss)

Room 1

10:20-12:20 Tuesday, 6 August

Organizer: Leiran Wang

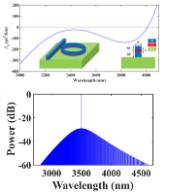
Co-Chair: Qibing Sun

01-1 10:20–10:40

Four wave mixing and its applications in micro-nano structures

Q. B. Sun, L. R. Wang, W. F. Zhang, C. Zeng and G. X. Wang
State Key Laboratory of Transient Optics and Photonics,
Xi'an Institute of Optics and Precision Mechanics of CAS, China

- High efficiency broadband four wave mixing effect in micro-nano structures was demonstrated.
- Time lens and all-optical logic gate via four-wave mixing in the waveguides were investigated.
- Mid-infrared optical frequency comb (OFC) generation via micro-ring resonators was realized.
- These results have potential applications in ultrafast optics, all-optical signal processing, molecular spectroscopy, etc.



$LiNbO_3$ micro-ring resonator and mid-infrared OFC generation

Notes

01-2 10:40–11:00

Application of Nanomaterials in Optical Remote Sensing

Yongxiang Guo, Mengyu Zhang, Yongqiang Li
Beijing Institute of Space Mechanics & Electricity, China

- Nanomaterials can show excellent mechanical, thermal, electrical, optical and other properties
- Due to the excellent optical properties of nanomaterials, being used for eliminating stray light
- Two important international technological breakthroughs
- With the increasing demand for quantification in remote sensing, the applications of nanomaterials are becoming more widespread

Notes

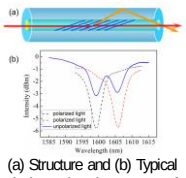
01-3 11: 00–11:20

Gratings with excessively tilted micro structure for passively mode-locked laser

Hushan Wang[1], Yishan Wang[1], Zhijun Yan[1,2], Jiazheng Song[1], Fengyan Zhao[1], Wei Zhang[1], Ting Zhang, and Kaiming Zhou[1,3]

1. State Key Laboratory of Transient Optics and Photonics, Xi'an Institute of Optics and Precision Mechanics of CAS, China
2. The School of Optical and Electronic Information, Huazhong University of Science and Technology, China
3. Institute of Photonic Technologies, Aston University, United Kingdom

- The fabrication of tilted gratings is demonstrated.
- The excessively tilted grating shows special optical properties.
- The application of excessively tilted grating in nanoparticles based saturable absorbers is proposed.
- Such work facilitates passively mode-locked lasers.



(a) Structure and (b) Typical dual-wavelength spectrum of excessively tilted grating

Notes

Technical Special Session 01
Micro/nano materials & Structures for Ultrafast Optics and Optical Sensing (ss)

Room 1

10:20-12:20 Tuesday, 6 August

Organizer: Leiran Wang

Co-Chair: Qibing Sun

01-4 11:20–11:40

Real-time observation of ultrafast pulse formation in nanotube mode-locked fiber laser

Dongdong Han, Zhangqiang Hui, Jiamin Gong, and Feng Zhao
School of Electronic Engineering, Xi'an University of Posts and Telecommunications, China

- Provided a direct insight into the start-up dynamics of stretched-pulse using dispersive Fourier transform technique.
- The physics mechanisms of transient bound states and beating dynamics are discussed.
- Several transient bound states appear in the dynamics, which could be attributed to larger redundant pump power

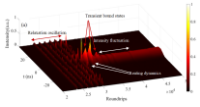


Figure: Real-time observation of the build-up dynamics of the stretched pulse using dispersive Fourier transform technique

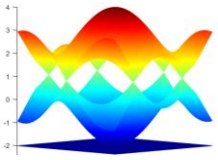
Notes

01-5 11:40–12:00

Flat-band Line states in Photonic Kagome Lattices

Xianglian Liu
Key Laboratory of Advanced Transducers and Intelligent Control System, Ministry of Education, Taiyuan University of Technology , China

- We theoretically investigate the line states that based on flat-band system of kagome lattice.
- Observed the transmission characteristics of line states by adjusting the phase conditions appropriately.
- The "self-healing" properties of linear states under imperfect excitation conditions are discussed.
- Our work provides a new platform for investigating image transmission, photonic topological insulators.



The band structure of Kagome lattice in the first BZ

Notes

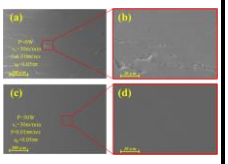
Technical Session 02
Nanofabrication and Nanoassembly
Room 2
10:20-12:20 Tuesday, 6 August
Chair: Zhengxun Song
Co-Chair: Mengnan Liu

02-1 10:20–10:40

The study on surface integrity on laser- assisted turning of SiCp/2024Al

Changtai Zhai
Changchun University of Science and Technology ; China

- The laser-assisted turning is flatter and smoother, and has a lower surface roughness.
- The laser-assisted turning can reduce the roughness of the machined outer surface by 81.73%.
- The laser-assisted turning can significantly inhibit the micro-cracks, pits, bumps and other defects occur.
- The compressive residual stress obtained by laser-assisted turning is large.



SEM images under different processing methods: (a) and (c) are SEM images of different feed rate in the mode of CT and LAT, respectively

Notes

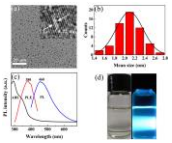
02-2 10:40–11:00

Femtosecond laser-assisted fabrication of fluorescent boron nitride quantum dots

Yanmin Xu, Lihe Yan, Jinhai Si
Key Laboratory for Physical Electronics and Devices of the Ministry of Education and Shaanxi Key Lab of Information Photonic Technique
School of Electronics and Information Engineering,
Xi'an Jiaotong University, Xi'an, China

1. A fast and simple method for the synthesis of high-quality BNQDs based on femtosecond laser ablation was proposed.
2. The BNQDs were well dispersed in solution and showed strong photoluminescence.
3. The photoluminescence of BNQDs was originated from the abundance of surface functional groups.

Contribution: This work provided a fast, low-cost, and simple synthetic strategy for the synthesis of transitional metal dichalcogenides QDs, and other 2D nanomaterials.



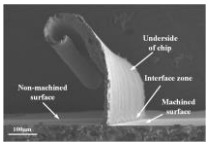
Notes

02-3 11:00–11:20

Study on orthogonal micro-cutting deformation of OFHC

Shuaishuai Yuan
Changchun University of Science and Technology, China

- Fibrosis can be observed by observing the micro-cutting chip root fracture zone at different cutting speeds.
- Irregular slip sheet stack structure formed on the outer surface of the chip.
- The ratio of the minimum cutting thickness to the cutting edge radius of OFHC can be between 5% and 10%.
- The paper study the plastic deformation of OFHC and explore the micro-cutting mechanism.



Micro-morphology of the roots of OFHC chips

Notes

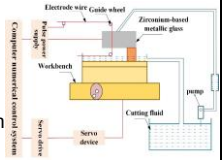
Technical Session 02
Nanofabrication and Nanoassembly
Room 2
10:20-12:20 Tuesday, 6 August
Chair: Zhengxun Song
Co-Chair: Mengnan Liu

02-4 11:20–11:40

Experimental Study on Wire-Electrical Discharge Machining of Zirconium-Based Metallic Glass Based on Orthogonal Test

Qiangqiang Pei
Changchun University of Science and Technology ; China

- The MRR and Ra increase with the increase of peak current and pulse width.
- The MRR and Ra tend to increase first and then decrease with the increase of voltage.
- The influence of processing parameters on surface morphology is significant.
- The optimal combination of material removal rate and roughness is MRR and Ra, respectively.



Schematic Diagram of the WEDM Process of Zirconium-Based Metallic Glass

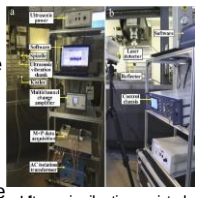
Notes

02-5 11:40–12:00

Experimental Study on Ultrasonic Vibration Assisted Drilling of Ti-6Al-4V at Different Amplitudes

Wei Liang
Ministry of Education Key Laboratory for Cross-Scale Micro and Nano Manufacturing Changchun University of Science and Technology, China

- The cutting force and cutting heat of UAD are significantly lower than CD.
- At the same speed, both the cutting force and the cutting heat decrease with increasing amplitude.
- The influence of the roughness of the two drilling methods on the spindle speed and the feed rate was obtained.
- UAD technology can significantly reduce the hole expansion.



Ultrasonic vibration assisted drilling test setup

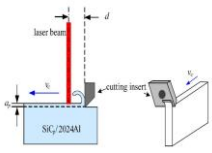
Notes

02-6 12:00–12:20

study on laser-assisted machining of aluminum-based silicon carbide

Zhida Wang
Changchun University of Science and Technology ; China

- Laser-assisted Machining is studied in this paper.
- The surface roughness decreases first and then increases with the increase of cutting speed.
- The surface roughness decreases first and then increases with the increase of cutting depth.
- Laser-assisted cutting can improve the surface roughness and morphology of refractory aluminu matrix composites.
- Laser-assisted cutting can reduce tool wear.



Laser-assisted Machining Process

Notes

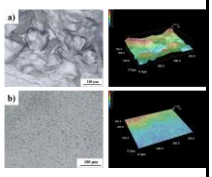
Technical Special Session 03
University of Shanghai Cooperation Organization
Nanotechnology (ss)
Room 3
10:20-12:20 Tuesday, 6 August
Organizer: Zhankun Weng
Co-Chair: Shuye Zhang

03-1 10:20–10:37

3D Printed Magnetic Hydrogels for Biomedical Applications

Shuye Zhang, Peng He*
State Key Laboratory of Advanced Welding and Joining, Harbin Institute of Technology, Harbin, China

- Hydrogel is an excellent polymer material and has widely used in biomedical engineering materials. i.e. drug delivery, tissue engineering.
- As an emerging technology, 3D printing has been able to successfully print polymer materials, and it can graphically fabricate hydrogel.
- We have successfully printed magnetic hydrogels and looked for biological applications.



Printed magnetic hydrogel surface morphology

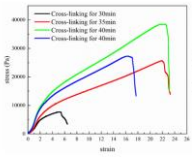
Notes

03-2 10:37–10:54

Enhanced Mechanical and Transparent Properties of Conductive Hydrogels for Stretchable Application

Peng He, Shuye Zhang*
State Key Laboratory of Advanced Welding and Joining, Harbin Institute of Technology, Harbin, China

- Hydrogel has a wide range of applications, and it has broad application prospects in biomedical fields.
- However, most hydrogels have poor tensile properties and are generally brittle.
- In this paper, hydrogels with excellent mechanical properties, conductivity and light transmittance were prepared and their process characteristics were studied.



Elongation rate to 22 times by newly developed hydrogels

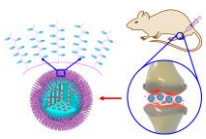
Notes

03-3 10:54–11:11

Lubrication/Drug Delivery Dual-functional Nanospheres for Osteoarthritis Treatment

Hongyu Zhang
State Key Laboratory of Tribology, Tsinghua University, China

- A novel biomimetic nanosphere is developed with enhanced lubrication and drug delivery.
- The nanosphere is biocompatible and can protect chondrocytes from degradation.
- The nanosphere effectively inhibits development of osteoarthritis via *in vivo* study.
- The nanosphere can be a promising strategy to treat osteoarthritis by intra-articular injection.



Design and application of dual-functional nanospheres

Notes

Technical Special Session 03
University of Shanghai Cooperation Organization
Nanotechnology (ss)
Room 3
10:20-12:20 Tuesday, 6 August
Organizer: Zhankun Weng
Co-Chair: Shuye Zhang

03-4 11:11–11:28

Nanomechanical and angle-dependence optical properties in beetle Popillia indgigonacea Motsch (Coleoptera)

Wei Wu[1], Chao Liu[1], Jin Tong[1], Jiyu Sun[1]
[1] Key Laboratory of Bionic Engineering (Ministry of Education, China), Jilin University
Corresponding author: sjy@jlu.edu.cn

- The nanomechanical properties of E_r and H for epidermis layer and stratum basale of elytra are higher than that for interior part.
- The distribution of nanomechanical properties for LD is better to bear compression, but worse to endure tensile force.
- The interior parts of whole elytra perform to be lightweight and engage in high strength.

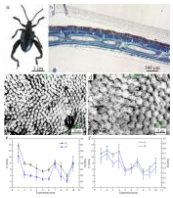


Figure S. *Lichtenstein*, microstructures and nanomechanical properties of its elytra

Notes

03-5 11:28–11:45

Imaging Analysis of Micro-milling Tool in the Process of Tool Setting Based on Digital Holography

Yaya Cheng
Changchun University of Science and Technology, China

- The method of tool setting based on digital holography is presented in this paper.
- Optimal reconstruction distance is obtained by using wavelet transform function and piecewise progressive search algorithm.
- Holographic reconstructed image and image taken by super-depth microscopic have an error of 6.4 mm.
- Holographic imaging is feasible in the field of tool setting of micro-milling tool.

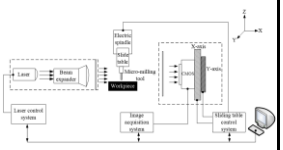


Fig.1 Schematic diagram of tool setting device based on digital in-line holography

Notes

03-6 11:45–12:02

Effect of Gas Block on Removed Irregular Pore Layer for Porous InP by Chemical Etching

ZhanKun Weng, Chunmei Li, Mingxue Dong, Miaomiao Yu, and Zuobin Wang
International Research Centre for Nano Handling and Manufacturing of China, Changchun University of Science and Technology, Changchun 130022, China,
email: wengzk@cust.edu.cn

- A chemical method was presented to remove the IPL based on the effect of the gas block.
- The complete porous structures were observed afte the IPL removed in the mixed solution with the gas filling in the pores.
- Finally, the effect of the gas block in the pores was also discussed in this work.

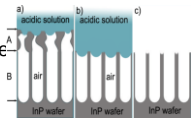


Figure.1 The model I of the IPL removed in the acidic solution with filled the air in the pores

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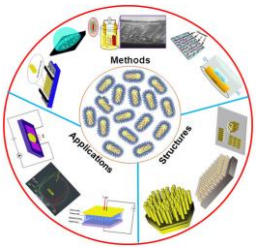
03-7 12:02–12:20

Controllable Self-Assembly of Colloidal Nanocrystals

Fen Qiao
Department of New Energy, Jiangsu University, China

Abstract: Combining with the thermal properties of organic ligands on the surface of NRs and thermal annealing technology, NRs may align into either parallel arrays or vertical ones depending on the concentration of NRs.The melted Cd-phosphonate complex surrounding NRs during thermal annealing process serves as a media for NRs to self-assemble into an ordered structure.



Notes

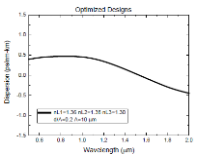
Technical Session 04
Nanophotonics and Nanoelectronics
Room 4
10:20-12:20 Tuesday, 6 August
Chair: Lijun Xu
Co-Chair: Meng Xu

04-1 10:20–10:40

Novel Flattened Near-zero Dispersion photonic crystal fibers with selectively material-filled structure

Lijun Xu*1,a ,Fangzhou Zhao1,b, Xianfeng Gao2,c, Pengbo Zhang1,d, Wenzhi Chen1,e
Changchun University of Science and Technology
Changchun, Jilin, 130022,China

- Dispersion properties of photonic crystal fiber of liquid-filling the cladding holes have been investigated.
- The nearly zero flattened dispersion PCF was designed.
- Photonic crystal fiber with near zero flattened dispersion properties is significant to the optical fiber communication.



Changchun University of Science and Technology

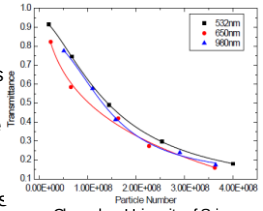
Notes

04-2 10:40–11:00

Study on the Influence of Copper Powder Smoke on Laser Transmission Characteristics

Lijun Xu*1,a , Hao Wang 1,b, Ming Liu1,c, Jinping Lv 1,d, Fangzhou Zhao 1,e, Jingru Duan1,f
Changchun University of Science and Technology
Changchun, Jilin, 130022,Chnia

- The extinction, absorption and scattering coefficient of a single copper particle was simulated by Mie-plot
- Lasers have a trend of decrease with the increase of the particles number concentration.
- The multi-scattering occurs in the process of laser transmission is the main reasons.



Changchun University of Science and Technology

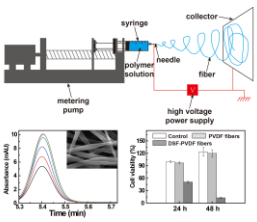
Notes

04-3 11:00–11:20

A disulfiram-loaded fibers scaffold fabricated via electrospinning method

Chenchen Xie
CNM, Changchun University of Science and Technology, China

- Disulfiram was successfully incorporated into the electrospun fibers.
- Diverse methods were proposed to estimate the anti-cancer effect of disulfiram-loaded scaffold.
- Disulfiram-loaded scaffold hold great potential as a scaffold for inhibiting the regional recurrence of cancer.



Notes

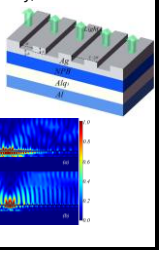
Technical Session 04
Nanophotonics and Nanoelectronics
Room 4
10:20-12:20 Tuesday, 6 August
Chair: Lijun Xu
Co-Chair: Meng Xu

04-4 11:20–11:40

The enhanced light extraction Top-emitting Organic Light-emitting Diode based on metallic grating anode

Dun Qiao, Kang Li, Nigel Copner
Faculty of Computing, Engineering and Science, University of Southwales, UK
Yongkang Gong
School of Physics and Astronomy, Cardiff University, UK

- A structural model of top-emitting Organic light emitting diode with Ag grating anode is proposed.
- Finite element simulations shows the recovery of waveguide mode and surface plasmon mode.
- Simulated emission spectra indicates the enhancement due to metallic grating anode.



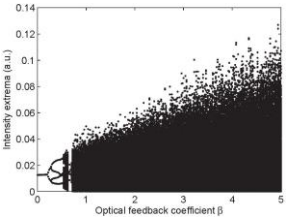
Notes

04-5 11:40–12:00

Bifurcation Analysis of Quantum-Dot Spin-VCSELs Subject to Optical Feedback

Lili Li, Yiyuan Xie, Bocheng Liu, Junxiong Chai
The School of Electronic and Information Engineering, Southwest University, Chongqing, China

- Bifurcation analysis of QD spin-polarized VCSELs subject to optical feedback is demonstrated.
- The modified spin-flip equations are studied for numerical simulation.
- The different nonlinear states found in the bifurcation diagram are observed in detail.



Bifurcation diagram with optical feedback coefficient β as the control parameter calculated for P = 0.9, η = 1.6.

Notes

Technical Special Session 05
Nano-Hydrides for Energy Applications (ss)

Room 5

10:20-12:20 Tuesday, 6 August

Organizer: Hai-Wen Li

Co-Organizer: Yongtao Li

05-1 10:20–10:35

Nanoengineering Promoted Hydrogen Storage and Battery Performances of Solid-State Hydrides

Hai-Wen Li
Platform of Inter/Transdisciplinary Energy Research, Kyushu University, Japan

- Solid-state hydrides have high potentiality for multiple energy applications such as hydrogen storage, rechargeable battery, superconductor, and so on.
- Hydrogenation of as-purchased MgB_2 powder does not occur even in 40 MPa H_2, while can be improved significantly by nanostructure to form $Mg(BH_4)_2$.
- We will discuss the relationship between the size distribution of Ni nanoclusters on the surface of $LaNi_5$-based alloys and the nickel-metal hydride batteries.

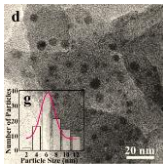
Notes

05-2 10:35–10:50

Nanostructured Metal Borohydrides for Energy Storage

Yongtao Li
School of Mater. Sci. & Eng., Anhui University of Technology, China

- The MBH_4 nanocrystals were successfully synthesized by mechanically driven anion metathesis.
- Monodispersed $NaBH_4$ nanodots were uniformly anchored onto freshly-exfoliated graphitic nanosheets by mechanical-force driven self-printing process.
- The Bi-NSs anode with compatible borohydride solid electrolyte shows expected high capacity and long-lived performance.
- I contributed to proposing the concept, designing all experiments and writing the paper.



$NaBH_4$ nanodots with particle size of about 6 nm

Notes

05-3 10:50–11:05

Novel catalysts for CO_2 hydrogenation to methanol and thermal storage functional catalysts

Kongzhai Li
Faculty of Metallurgy and Energy Engineering, Kunming University of Science and Technology, Kunming, China

- A novel three-dimensional ordered macroporous (3DOM) Cu-ZnO-ZrO_2 catalysts for CO2 hydrogenation to methanol will be presented.
- The synergy among the different components in controlling the catalytic performance will be discussed.
- The role of ZnO-ZrO_2 interaction in determining the catalytic activity is highlighted.
- A thermal storage functional catalyst via a core–shell strategy is prepared

Notes

Technical Special Session 05
Nano-Hydrides for Energy Applications (ss)

Room 5

10:20-12:20 Tuesday, 6 August

Organizer: Hai-Wen Li

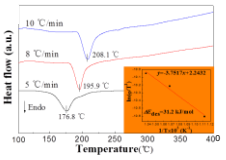
Co-Organizer: Yongtao Li

05-4 11:05–11:20

Magnesium-based Nano-hydrides for Hydrogen Storage

Yunfeng Zhu
College of Materials Science and Engineering, Nanjing Tech University, China

- Highly active Mg-based nano-hydrides were prepared by HCS+MM and HCVD.
- The homogeneously distributed catalyst with refined particle size leads to superior hydrogen storage kinetics of MgH_2.
- Mg_2NiH_4 nanoparticles (NPs) were in situ microencapsulated on the surface of graphene sheets (GS).
- Superior hydrogen desorption kinetics with Ea of 31.2 kJ/mol of Mg_2NiH_4/GS was achieved.



DSC profiles and Kissinger's plot for hydrogen desorption of Mg_2NiH_4/GS at different heating rates.

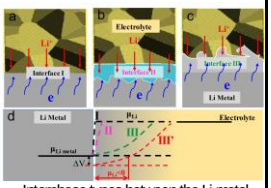
Notes

05-5 11:20–11:35

Fluorinated solid electrolyte interphase enables highly reversible solid-state Li metal

Xiulin Fan,[1] Xiao Ji,[2] Fudong Han,[2] Jie Yue,[2] Chunsheng Wang[2]
[1]School of Materials Science and Engineering, Zhejiang University, Hangzhou 310027, PR China;
[2]Department of Chemical and Biomolecular Engineering, University of Maryland, College Park, MD 20740, USA.

- A nano-LiF-rich solid-electrolyte-interphase (SEI) between SSEs and the Li metal was in situ formed.
- The LiF-rich SEI successfully suppresses the penetration of Li dendrite into SSEs
- Low electronic conductivity and intrinsically electrochemical stability of LiF block side reactions between SSEs and Li
- The LiF-rich SEI enhances the critical current density to a record-high value of >2 mA cm^{-2}.



Interphase types between the Li metal and the solid state electrolytes

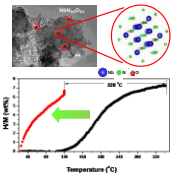
Notes

05-6 11:35–11:50

High catalytic activity of N-containing Nb-based oxides for hydrogen storage in MgH_2

Yongfeng Liu, Xin Zhang, Ke Wang, Mingxia Gao, Hongge Pan
School of Materials Science and Engineering, Zhejiang University, China

- A N-containing Nb_2O_5 with superior catalytic activity is successfully prepared.
- The N-Nb_2O_5-containing MgH_2 starts releasing H_2 from 170 °C, and the dehydrogenated sample absorbs rapidly 6.2 wt% H_2 at 70 °C and 50 atm.
- The in-situ formed $NbN_{0.9}O_{0.1}$ plays the critical catalyst role.
- The presence of N facilitates a much higher catalytic activity of Nb.



TEM image of N-Nb_2O_5-containing MgH_2 and hydrogenation curves with temperature

Notes

Technical Special Session 05
Nano-Hydrides for Energy Applications (ss)

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Organizer: Hai-Wen Li

Co-Organizer: Yongtao Li

05-7 11:50–12:05

Gas adsorption in a small pore hydride: microscopic and macroscopic characterization by *in situ* diffraction

Yaroslav Filinchuk, Iurii Dovgaliuk, Xiao Li, Dmitry Chernyshov
IMCN, Université catholique de Louvain, Belgium
SNBL, European Synchrotron Radiation Facility, France

- We investigated gas adsorption by porous γ-$Mg(BH_4)_2$ using diffraction along the adsorption isobars.
- I will discuss the guest-host and guest-guest interactions, size effects, the role of hydridic hydrogen in physisorption, reactivity between the guest and the host.
- We also report on sub-second diffraction experiments on gas absorption by γ-$Mg(BH_4)_2$.

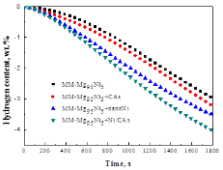
Notes

05-8 12:05–12:20

Hydrogen Storage Properties of Mg-Ni/Carbon Aerogels Nano-composites

Rui Shi
College of Materials Science and Engineering, Nanjing Tech University, China

- Nano Ni confined in carbon aerogels (Ni/CAs) was successfully synthesized by liquid reduction.
- Nano Ni and CAs showed synergistic catalysis on hydrogen absorption/desorption of $Mg_{95}Ni_5$.
- The dehydrogenation activation energy of $Mg_{95}Ni_5$ decreased about 45 kJ/mol after doping with 5 wt.% Ni/CAs catalyst.



Dehydriding curves of the nano-composites measured at 250 ºC

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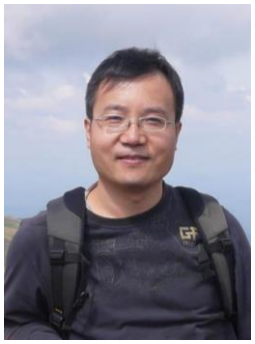
Technical Special Session 06
Molecular Materials: Catalysis, Sensing and Electronic Applications (ss)

Room 6

10:20-12:20 Tuesday, 6 August

Organizer: Shengbin Lei

Co-Organizer: Min Li

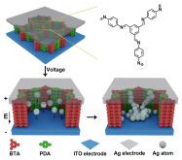


06-1 10:20–10:35

Robust Non-volatile Resistive Memory Device Based on Freestanding Imine Polymer Film

Jie Liu#, Fangxu Yang#, Shengbin Lei*, Wenping Hu*
Tianjin Key Laboratory of Molecular Optoelectronic Science, Department of Chemistry, Tianjin University, Tianjin, 300072 , P. R. China.

- A wafer-scale ultrathin two-dimensional imine polymer (2DP) film with controllable thickness was synthesized at the air-water interface. The synthesized freestanding 2DP films is ideally tailored for non-volatile memristors based on conductive filament mechanism. The devices exhibit excellent switching performance with high reliability and reproducibility, and the ON/OFF ratios are in the range of 10^2 to 10^5 depending on the thickness of the film.



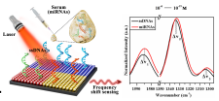
Notes

06-2 10:35–10:50

SERS Frequency-Shift Sensing Method: A Way of Detecting Event from Biomolecules to Ions

Min Li
Institute of High Enerage Physics, Chinese Academy of Sciences, China

- A normal mode vibrational frequency of a Raman reporter is shifted upon analyte binding.
- It requires measurement of a shift in an intense signal rather than resolving a peak above noise.
- It retains the excellent multiplexing capability of SERS, with identifying their spectral fingerprint in a single read-out.



Multiplex frequency-shift sensing assay of biomolecules

Notes

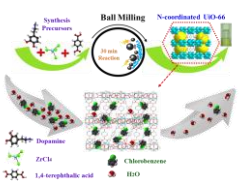
06-3 10:50–11:05

Chemical Process Intensification for VOCs adsorption and catalytic degradation

Zhenxia Zhao

School of Chemistry and Chemical Engineering, Guangxi University, China

- Alkaline-N modification can adjust hardness of metal cluster, resulting in a reduce of adsorption to H_2O.
- N-/Zn dopant reduce band gap of MIL-125, and enhanced photo-catalysis activity for CH_3CHO degradation.
- Selective adsorption and degradation mechanisms for VOCs were systematically investigated



N-modified UiO-66 exhibited high adsorption capacity and selectivity for Cl-VOCs under humidity

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Technical Special Session 06
Molecular Materials: Catalysis, Sensing and Electronic Applications (ss)

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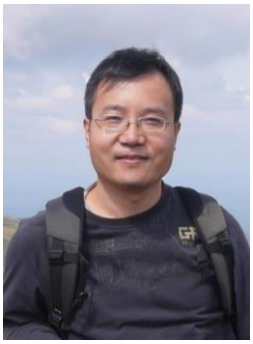
Co-Organizer: Min Li



06-4 11:05–11:20

Molecular Materials and Skin-like Sensors

Zhongwu Wang, Liqiang Li
Tianjin Key Laboratory of Molecular Optoelectronic Sciences, Department of Chemistry, Institute of Molecular Aggregation Science, Tianjin University, Tianjin 300072, China

- Skin-like sensors are fabricated with molecular materials (organic semiconductor, conductive polymer, and nanocarbons).
- High-performance pressure sensor based on semiconductor/conductor interface piezoresistive effect and
- Strain sensor based on membrane-shell structure
- Novel airflow sensor based on tunable interlayer distance between graphene oxide sheet.

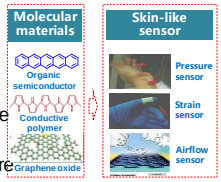


Figure 1 Molecular materials and skin-like sensors

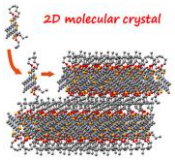
Notes

06-5 11:20–11:35

2D Molecular Crystals: Molecular Design, Controlled Assembly and Optoelectronic Applications

Rongjin Li
Department of Chemistry, Tianjin University, China

- A "phase separation" molecular design towards large-area 2D molecular crystals is proposed
- Layer-defined self-assembly of organic semiconductors on Liquid surface
- Optoelectronic properties of the molecularly thin molecular crystals
- Heterojunctions based on 2D molecular crystals



On liquid surface assembly of 2D molecular crystals

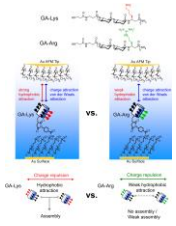
Notes

06-6 11:35–11:50

Cationic Side Chain Identity Directs Hydrophobically-Driven Self-Assembly of β-Amino Acid Oligomers

Chenxuan Wang
Department of Biophysics and Structural Biology, Chinese Academy of Medical Sciences and Peking Union Medical College, Beijing 100005, China

- Hydrophobic interactions are influenced by local chemical and physical contexts.
- Single molecule force measurements with globally amphiphilic β-peptides revealed the effects of cations on hydrophobic interactions.
- Cationic side chain identity was found to direct hydrophobically-driven β-peptide association in bulk solution.



Experimental systems used to investigate the effects of cationic groups on assembly of β-peptides

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Technical Special Session 06
Molecular Materials: Catalysis, Sensing and Electronic Applications (ss)

Room 6

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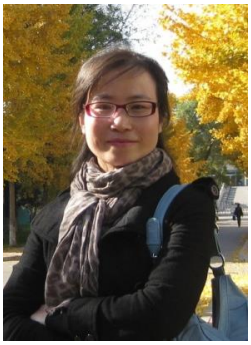
Organizer: Shengbin Lei

Co-Organizer: Min Li



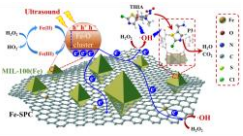
06-7 10:50–12:05

Highly Advanced Degradation of Neonicotinoids by Synergistic Chemisorption-Catalysis Strategy Using MOFs Composite

Zhongxing Zhao

School of Chemistry and Chemical Engineering, Guangxi University, China

- A nano-spongy carbon was grafted into MOF though Fe-bridging strategy to enhance charge separation/transfer of MOF.
- Synergistic mechanism of chemisorption and Fenton-like catalysis was crucial for THIA complete mineralization.
- Electrostatic potential energy and geometry optimization revealed that one degradation-resistant intermediate exhibited obvious structural.



Proposed reaction mechanism for ultrasonic-assisted degradation of THIA over MIL(Fe)/Fe-SPC

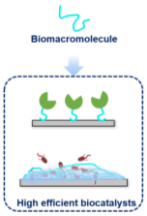
Notes

06-8 12:05–12:20

Manipulate the interface interaction for construction of highly efficient biocatalytic system

Yibing Wang, Hao Dong, Chao Chen, Xiaoxing Chen, Ping Wang
School of Biotechnology, East China University of Science and Technology, China

- •Orientated assembly of carbonic anhydrase (CA) on SWNT by affinity binding peptide.
- •Flexible immobilization of enzymes on polydopamine nanomaterial produced high activity and stability.
- •Biocompatible polymers build microenvironment that favors enzyme catalysis.
- •Extracellular polymeric matrix of biofilm as natural material for keeping biocatalysts activity.



Interfacial manipulation of biocatalytic systems by adhesion molecules

Notes

Technical Special Session 07
Functional Micromachines and Miniature Devices (ss)

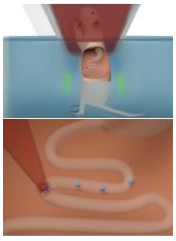
Room 1
13:30-15:30 Tuesday, 6 August
Organizer: Li Zhang
Co-Chair: Zhiguang Wu

07-1 13:30–13:50

Targeted retention in intestine from active motion of the microrobot capsules

Zhiguang Wu
Lab for Microsystems and Microstructure Manufacturing
Harbin Institute of Technology Harbin, China
zhiguangwu@hit.edu.cn

- Tremendous progress of synthetic nano/micromotors has been made for potential biomedical applications.
- Existing nano/micromotor platforms are inefficient in deep tissue imaging and motion control *in vivo*.
- An imaging- guided ingestible microrobotic system enables deep tissue navigation *in vivo* with enhanced targeted retention.
- The integration of the newly developed microrobotic system and PACT enables precise imaging and control of the micromotors *in vivo* and promises practical biomedical applications.



Notes

07-2 13: 50–14:10

Bioinspired Intelligent Soft Actuators

Xuemin Du
Shenzhen Institutes of Advanced Technology (SIAT),
Chinese Academy of Sciences (CAS), Shenzhen, PR China

- Bioinspired actuators based on stimuli-responsive polymers.
- Inside-out 3D reversible Ca^{2+}/Na^{+} ion-triggered actuation.
- Intelligent soft actuators can interact with the changing environment.
- Near-infrared light-driven controllable motions of gold-hollow-microcone array.
- Programmed actuations for biomedical applications.

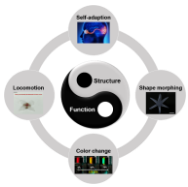


Figure 1. Bioinspired intelligent soft actuators.

Notes

07-3 14:10–14:30

Medical Micro-Nano Robots: From A Concept to Real-World Applications

Xiaohui Yan
CMITM, Xiamen University, P. R. China

- Stating critical challenges for the development and clinical translation of medical micro-nano robots.
- Providing several promising strategies to resolve all these challenges.
- Demonstrating our experimental results on the *in vivo* developments and pre-clinical trials
- Highlighting our further works to accomplish practical applications of medical micro-nano robots.

Multifunctional biohybrid micro-nano robots are optional for the clinical translation

Notes

Technical Special Session 07

Functional Micromachines and Miniature Devices (ss)

Room 1

13:30-15:30 Tuesday, 6 August

Organizer: Li Zhang

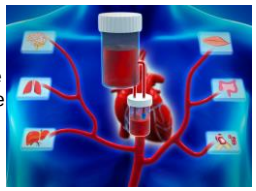
Co-Chair: Zhiguang Wu

07-4 14:30–14:50

A Hydrostatic Pressure-driven Passive Micropump Enhanced with Siphon-based Autofill Function

Xiaolin Wang
Department of Micro/Nano Electronics, Shanghai Jiao Tong University, China

- Simple system setup without peripheral equipment makes it suitable for resource-limited settings
- Siphon-based autofill function enables the long-term perfusion with constant flow rate
- Flow rate can be simply and accurately adjusted
- Multiplexed flow conditions are allowed through this platform with high controllability and flexibility



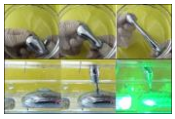
Notes

07-5 14:50–15:10

Functional liquid metals actuation for future soft robotics

Liang Hu
Beijing Advanced Innovation Center for Biomedical Engineering, Beihang University, China

- We develop several strategies for liquid metal actuation.
- Various transformation and locomotion were achieved to
- 3D stretch of liquid metals in large scales were achieved to make an intelligent electrical connection.



3D stretch of liquid metals

Notes

Technical Special Session 08
Surface Science Characterization for Energy, Bio-, and Catalysis Nanomaterials (ss)

Room 2

13:30-15:30 Tuesday, 6 August

Organizer: Mingdong Dong

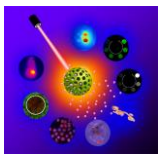
Co-Organizers: Lei Liu, Ren Su

08-1 13:30–13:50

Bismuth-Based Photothermal Nanoagents for Multimodal Imaging and Thermo-Chemotherapy

Miao Yu
Harbin Institute of Technology, China

- Stimuli-responsive theranostics is of great importance for precise cancer diagnosis and treatment.
- Bi-based nanomaterial are developed as antitumor agents for multimodal imaging and chemo-photothermal combination therapy.
- The nanoagents afforded high-contrast CT/MRI/PA imaging and high antitumor efficacy.
- This work highlights the great potentials of Bi-based nanoagents as a versatile theranostics in clinic.



Notes

08-2 13:50–14:10

Sino-Danish Workshop

Peptide based nanomaterial, characterization and application

Lei Liu
liul@ujs.edu.cn
Institute for Advanced Materials, Jiangsu University, Zhenjiang, 212013, China.

- High resolution structural imaging for amyloid peptide self assembly and modulation
- Peptide-organic co-assembly inhibiting amyloid aggregation and the cytotoxicity
- Bio-interface constructed by specific peptide assembly realize the specific cell behavior modulation and the selective cell isolation

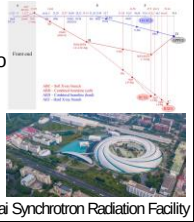
Notes

08-3 14:10–14:30

Energy Material beamline in SSRF and its application in nano-characterization

Fei Song
Shanghai Synchrotron Radiation Facility (SSRF), Zhangjiang Laboratory, Chinese Academy of Sciences, Shanghai, 201024, China

- Synchrotron-based spectroscopy and microscopy has gradually become a powerful tool in characterizing structures at nanoscale.
- Energy materials beamline (E-line) is equipped with XES, RIXS, NAP-XPS, NAP-STM, in-situ TEM and so on.
- Focus on-surface reactions, surface catalysis, electrochemistry in battery, surface corrosion at nanoscale with insight from physical and electronic structures.



E-line and Shanghai Synchrotron Radiation Facility

Notes

Technical Special Session 08
Surface Science Characterization for Energy, Bio-, and Catalysis Nanomaterials (ss)

Room 2

13:30-15:30 Tuesday, 6 August

Organizer: Mingdong Dong

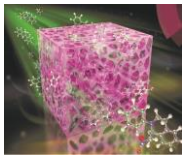
Co-Organizers: Lei Liu, Ren Su

08-4 14:30–14:50

Visible light photocatalysis on surface via immobilized organic photocatalyst

Yuxing Huang
School of Material Science and Engineering, Nanchang University, China

- Sponge visible light photocatalyst was prepared by anchoring organic photocatalyst on the chemical inert surface of PDMS material
- A sustainable visible light photocatalyst was made by modification of the cotton fiber surface
- A novel organic–inorganic composite photocatalyst was prepared through self-assembly and can catalyze various organic transformations in water



Organic Sponge Photocatalyst

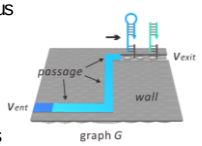
Notes

08-5 14:50–14:10

Tailoring DNA self-assembly for regulating functional interactions

Huajie Liu
School of Chemical Science and Engineering, Tongji University, China

- Tailoring DNA self-assembly in nanoscale enables us regulating functional interactions:
- Programming DNA origami patterning with non-canonical DNA-based metallization
- Quantizing single-molecule surface-enhanced Raman scattering with DNA origami metamolecules
- Solving mazes with single-molecule DNA navigators



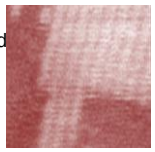
Notes

08-6 14:10–15:30

Self-Assembled Nanostructures and Their Biomedical Applications

Qiang Li
School of Chemistry and Chemical Engineering , Shandong University, China

- Identification of a novel parallel β-strand conformation within molecular monolayer of amyloid peptide
- Modulating amyloid peptide assembly by graphene oxide
- HIV Tat protein and amyloid-β peptide form multifibrillar structures that cause neurotoxicity



AFM high-resolution image of amyloid molecular monolayer

Notes

Technical Special Session 09
FabSurfWAR (ss)

Room 3

13:30-15:30 Tuesday, 6 August

Organizer: Zhankun Weng

Co-Organizer: Xianping Liu

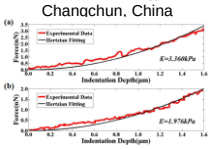
09-1 13:30–13:50

Morphological and mechanical properties characterization for healthy and cancerous cells by home-made atomic force acoustic microscopy （AFAM）

Jiajing Zhu, Yanling Tian, Xianping Liu
School of Engineering
University of Warwick
Coventry,UK

Liguo Tian, Zuobin Wang
Changchun University of Science and Technology
Changchun, China

- The morphology of HL-7702 cells and SMMC-7721 cells were characterized by optical microscope, SEM and AFAM respectively.
- The Hertz model was applied to fit the force–depth curves from the AFAM nano-indentation experimental results.
- Our research provides a valuable technique to discriminate the healthy and cancerous cells by using the AFAM.



Force-Depth curves during loading part and the best fitting curves by using Hertz model for (a) HL-7702 cells with the force of 1.5 nN and (b) SMMC-7721 cells with the force of 2.0 nN.

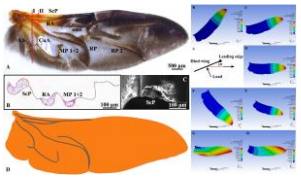
Notes

09-2 13:50–14:10

Analysis of the effect of the attack angles on the deformations of the hind wing

Zelai Song, Fadong Li, Wei Wu, Jin Tong, Jiyu Sun
Key Laboratory of Bionic Engineering (Ministry of Education, China), Jilin University, P.R. China

- The structure morphologies of hind wing and cross sections of hind.
- Design the three-dimensional (3-D) model of hind wing.
- Static analysis of the right hind wings of *Harmonia axyridis*.



The light microscopy imaging technique of hind wing and cross-sections of hind wing.
Static analysis of the right hind wings of Harmonia axyridis.

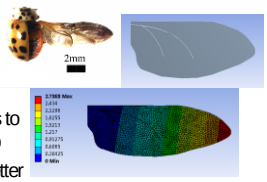
Notes

09-3 14:10–14:30

Effect of wing shape on flight performance

Jiyu Sun, Fadong Li, Zelai Song, Na Li, Zhijun Zhang*
Key Laboratory of Bionic Engineering (Ministry of Education, China), Jilin University
Changchun, P.R. China

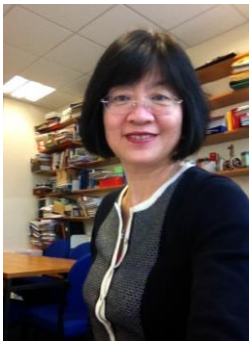
- Three different beetles were selected to create three different winged
- Pressure simulation of three different models, comparing the results
- Perform aerodynamic simulation analysis to obtain a velocity and pressure cloud map
- Compare the results obtained to get a better model



A beetle prototype, modeling and pressure simulation results map selected in this paper

Notes

Technical Special Session 09
FabSurfWAR (ss)
Room 3
13:30-15:30 Tuesday, 6 August
Organizer: Zhankun Weng
Co-Organizer: Xianping Liu

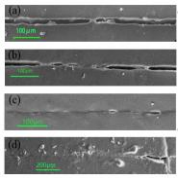


09-4 14:30–14:50

TO@CA Nanocapsule anti-corrision coating: self-healing and mechanical properties

Jiyu Sun, Na Li1, Yueming Wang1, Limei Tian1
1 Key Laboratory of Bionic Engineering (Ministry of Education, China), Jilin University
Corresponding author: lmtian@jlu.edu.cn

- The synthesis of TO@CA nanocapsule .
- The preparation of self-healing silicone rubber coating.
- Viewing of the dispersibility of nanocapsules in coating.
- Discussion of self-healing and mechanical properties of the coating.



The self-heling result of silicone rubber coating.

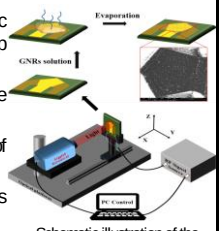
Notes

09-5 14:50–15:10

High Sensitivity Near-infrared Sensors based on Gold Nanorods Modified Aluminum Nitride Resonator

Quanquan Guo, Shan He, Chang Liu, Wei Pang, Yanyan Wang*
State Key Laboratory of Precision Measuring Technology & Instruments, Tianjin University, China

- Uncooled Near-infrared sensor based on acoustic wave resonator with AlN layer grown on top electrode.
- AlN film enhanced infrared light absorption in the sensing area of the resonator.
- Modifying the surface of AlN with a layer of evenly distributed gold naorods.
- The sensitivity of gold nanorod modified sensors to NIR is 13 times stronger than reference.



Schematic illustration of the setup and GNRs self-assembly on the sensor surface

Notes

Technical Special Session 10
Tools and Methods for Nano-assembling (ss)

Room 4

13:30-15:30 Tuesday, 6 August

Organizer: Artemy Irzhak

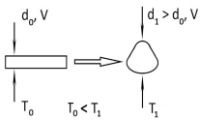
Co-Chair: Victor Koledov

10-1 13:30–13:50

Melting of In nano particles for nanoassembling

Artemy Irzhak
Lab of X-ray optics, IMT RAS, Russia
Victor Koledov,
Kotelnikov IRE RAS, Moscow, Russia
Tatiana Zhuravleva
Department of materials science of semiconductors and dielectrics National University of Science and Technology Moscow, Russia

- Partial melting of indium particles at t ~ 55 °C was demonstrated, which is at least 100 degrees less than melting temperature of indium of bulk In sample, equal to 156.6 °C
- The potential possibility of using submicron metal particles as solder is shown



The principle of "nanosolder " on the basis of 1D nanoparticle

Notes

10-2 13:50–14:10

Shapiro steps in NbS3-II at the temperatures of the charge-density wave transition

S.A. Nikonov, S.G. Zybtsev, V.Ya. Pokrovskii, V.V. Pavlovskiy
Kotel'nikov Institute of Radioenginering and Electronics of Russian Academy of Sciences, Russia

- The extremely high coherence of the room-temperature CDW allows its synchronization under RF electric field up to T_{P1}=365 K, the temperature of the CDW transition, and even above it.
- The higher is the RF frequency, the higher is the utmost temperature of Shapiro steps observation.
- We obtained a universal *T* independent current-frequency calibration in the range 250-365 K.
- The result present the NbS_3 whiskers as high-temperature nano-sized RF detectors.

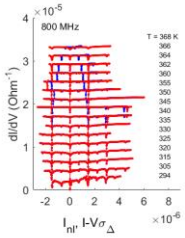


Fig.1. The dI/dV vs. non-linear current (b) and excess current (r)

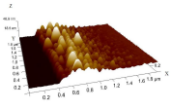
Notes

10-3 14:10–14:30

Electric current driven formation of micro-and nano-sized beads in thin Cr films

Victor Koledov, Svetlana von Gratowski
Kotelnikov IRE RAS, Moscow, Russia
Praveen Kumar
Indian Institute of Science (IISc) Bangalore, India

- Application of electric potential on Cr sputtered thin films results in melting of the material below the cathode and flow of the molten material away from the cathode in radially symmetric fashion.
- A ring with a chain of nanometer-sized beads forms at the flow front of the ring.
- Raman spectroscopy shows that in the vicinity of the periphery of the melted circles beads of oxide phase Cr2O5 is present.



AFM scan of the region of one of the craters after formation of beads.

Notes

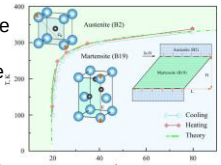
Technical Special Session 10
Tools and Methods for Nano-assembling (ss)
Room 4
13:30-15:30 Tuesday, 6 August
Organizer: Artemy Irzhak
Co-Chair: Victor Koledov

10-4 14:30–14:50

On the fundamental limits of the size of the shape memory nanoactuators posed by martensitic transition in Ti_2NiCu shape memory alloy on nano-scale

Peter Lega, Ilya Nedospasov, Victor Koledov, Andrey Orlov
Kotelnikov IRE RAS, Moscow, Russia
Natalia Tabachkova, NUST MISiS, Moscow, Russia
Artemij Irzhak, IMT RAS, Cernogolovka, Russia

- Crystal structures in the local areas of the wedge shaped plates of the Ti2NiCu alloy in the thickness range of 10-100 nm investigatedin the temperature range of 100-400K
- Fundamental limitations derived from the theoretical and experimental considerations confirm in principal submicron overall size of the robotic systems based on martensitic transition and shape memory effect



Dependence of the martensitic transformation temperature on the plate thickness

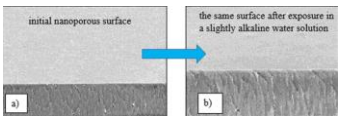
Notes

10-5 14:50–15:10

Structures based on porous silicon and graphene

Ekaterina Gosteva
Department of materials science of semiconductors and dielectrics National University of Science and Technology Moscow, Russia

- The article discusses the features of the morphology of deep porous silicon layers with variable pore structure, as well as the features of the formation of graphene layers on the inner surface of the pores.
- The results of the influence of graphene on the characteristics of composite layers are presented.



Notes

Technical Special Session 11
2D Materials at nanoscale: From Fundaments to Applications (ss)

Room 5

13:30-15:30 Tuesday, 6 August

Organizer: Zegao Wang

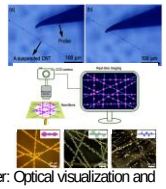
Co-Organizer: He Tian

11-1 13:30–13:50

Optical visualization, manipulation and measurement of nanomaterials

Rufan Zhang
Department of Chemical Engineering, Tsinghua University, China

- In this talk, I will present the optical visualization, controlled manipulation and feasible measurement of nanomaterials. One example is the optical visualization and manipulation of individual carbon nanotubes. Another example is the in situ observation of the nanoscale capture and evolution of aerosols on nanofibers.



Upper: Optical visualization and manipulation of individual carbon nanotubes. Lower: In situ observation of the nanoscale capture of aerosols on nanofibers

References:
1. ***Nature Communications*, 4**: 1727, 2013.
2. ***Nanoscale*, 5**, 6584-6588, 2013.
3. ***Nature Nanotechnology*,** 8, 912-916, 2013.
4. ***Nature Nanotechnology***, 13, 589-595, 2018.
5. ***Nano Letters***, 18, 1130–1138, 2018.

Notes

11-2 13:50–14:10

Novel Perovskite-Based Devices

Fan Wu, He Tian*
Institute of microelectronics, Tsinghua University, China

- Three kinds of perovskite-based devices have been developed
- The position-dependent photodetector can realize millimeter long range detection
- The phototransistor shows the 600 A/W photoresponsivity with 75 days stability
- The perovskite-Si junction shows 520 ns record high-speed photodetection

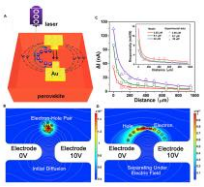


Figure 1: Device structure, results and simulations of the position-dependent perovskite photodetector

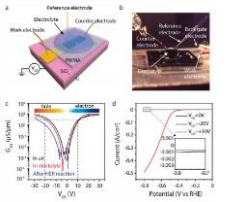
Notes

11-3 14:10–14:30

Interfacial catalysis on ambipolar WSe_2

Zegao Wang, Mingdong Dong
College of Materials Science and Engineering, Sichuan University, China

- Electric field tuned electrochemical microcell was fabricated.
- Ambipolar WSe_2 was employed as electrocatalyst.
- The results show that WSe_2 with electron as the dominant carrier exhibits much higher activity than that of WSe_2 with hole as the dominant carrier.



Catalytic activity of ambipolar WSe_2 based electrochemical microcell

- DFT calculations demonstrate that the energy barrier can down to 0.11 eV (similar with Pt) from 1.68 eV by injecting pristine WSe_2 with electron concentration of $0.3\times10^{14}cm^{-2}$

Notes

Technical Special Session 11
2D Materials at nanoscale: From Fundaments to Applications (ss)

Room 5

13:30-15:30 Tuesday, 6 August

Organizer: Zegao Wang

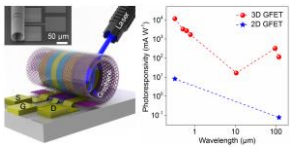
Co-Organizer: He Tian

11-4 14:30–14:50

Three-Dimensional Graphene Field-Effect Transistors as High-Performance Photodetectors

Tao Deng
School of EIE, Beijing Jiaotong University, China

- Three-dimensional (3D) graphene field effect transistors (GFETs) with tubular architectures were fabricated.
- The operation spectral range of the 3D GFET photodetectors is from ultraviolet to terahertz.
- The photoresponsivity of the photodetectors is over 1 A W^{-1} at 325 nm and 0.232 A W^{-1} at 3.11 THz.
- The response time of the 3D GFET photodetectors is about 265 ns.



3D GFET and its photoelectric properties

Notes

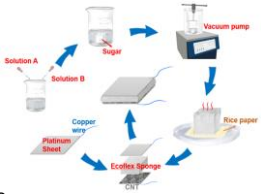
11-5 14:50–15:10

Highly compressible flexible supercapacitor

Tianyi Fan, Chaolun Wang, Yuhan Pan, Hongyu Ren and Xing Wu*

Shanghai Key Laboratory of Multidimensional Information Processing, Department of Electronic Engineering, East China Normal University, China.

- MWNTs as the electrode material on platinum sheets while Ecoflex sponge as the flexible separator.
- Compressibility up to 90%
- Rebound immediately under cycling test for thousands of times.
- excellent potential in the exploration of the human arthrosis health care.



Preparation processes of the highly compressible flexible super capacitor

Notes

11-6 15:10–15:30

Base-free aerobic oxidation of hydroxyl fatty acid with Pd@Ni/Al layer double hydrotalcite

Rongrong Dai [1], Zheng Guo [1,*], Bekir Engin Eser [1]

[1] Department of Engineering, Aarhus University, 8000 Aarhus, Denmark

Flower-like hierarchical Pd-LDH catalysts were prepared for oxidation of hydroxyl fatty acid.

The layered double hydroxide supported nanopalladium catalyst using the basic support instead of neutral support indeed exhibits catalytic activity when absence of base in the oxidative reaction.

The heterogeneous can quantitatively recovered from the reaction by a simple centrifugation and reused for a number of cycles with acceptable activity loss compare to first run of oxidative reaction.

TEM images of the fresh and used catalyst show that the nanostructured palladium supported on LDH will aggregates a little after reaction, while XPS data identify the Pd species on the surface of catalysts.

Notes

Technical Special Session 12
Micro/nano Structure Measurement and the Application in Bioscience and Environment Science (ss)

Room 6

13:30-15:30 Tuesday, 6 August

Organizer: Li Guan

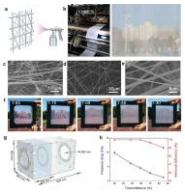
Co-Organizer: Gaofeng Deng

12-1 13:30–13:50

IEEE 3M-NANO 2019
The pyro- and piezo effects and it's industrial application in air filtration

Li Guan
Department of Chemistry, Renmin University of China, China

- 3D nanofibers could be fabricated using press spraying;
- Charges could be quickly regenerated by subtle temperature variation or slight vibration;
- High filtration efficiency and low resistance;
- Washable and reusable: fabricated fibers could be refreshed and easily dried.
- Industrial production is feasible and the application in anti-haze window screen is possible.



Notes

12-2 13: 50–14:10

Interpretation of the Development of Chinese Fresh Air Purification Industry

Gaofeng Deng
China Academy of Building Research, China Air Purification Industry Alliance

- Status of Fresh Air Purification Industry Development
- Progress in Standards and Specifications
- Solving Existing Problems
- The contribution: this paper analyses the problems existing in the technical level, regulatory system and criteria specifications of fresh air purification industry in China, and puts forward suggestions for improvement.

Notes

12-3 14:10–14:30

Construct Three-Dimensional Heterostructure Based on the {001} facet-Exposed TiO2 Nanosheets for Enhanced Photoelectric and Photocatalytic Performance

Bo Liu Shandong University of Technology, China

- The two-dimensional (2D) TiO2 nanosheets with dominant high-energy {001} facets ({001} TiO2 NSs) have attracted much attention since they not only provide more active sites for PEC reaction than those with dominant general {101} and {010} facets but also possess a "surface heterojunction" between {001} and {101} facets to promote the internal carriers transport. Nevertheless, the wide band gap (Eg > 3.0 eV) and the relatively high recombination rate of photogenerated carriers still limit their PEC performance.
- In our works, {001} TiO2 NSs were used as synthetic template, followed by composite Fe2O3 nanorods (NRs) or ZnO NRs, CdS quantum dots to construct a hierarchical structure by simple hydrothermal, chemical water bath deposition and SILAR the like.
- The results indicated that all composite materials can obtain better PEC performance owing to their larger surface area and the establishment of a beneficial heterojunction structure. In addition, the growth and enhanced PEC performance mechanism also have been discussed. Interestingly, both Fe2O3 NRs and ZnO NRs preferentially grown on the {101} facets of TiO2 NSs, which can effectively shorten the electron conduction path-ways and achieve larger charge transfer force due to the lower band edge position of {101} facets than that of {001} facets

Notes

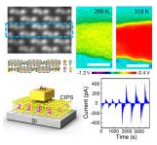
Technical Special Session 12
Micro/nano Structure Measurement and the Application in Bioscience and Environment Science (ss)
Room 6
13:30-15:30 Tuesday, 6 August
Organizer: Li Guan
Co-Organizer: Gaofeng Deng

12-4 14:30–14:50

Applications of functional pyroelectric and ferroelectric nanomaterials

Lin Niu
MSE, Nanyang Technological University, Singapore

- Controlled Growth and Reliable Thickness-dependent Properties of Organic-inorganic Perovskite Platelet Crystal
- Synthesis and Room-temperature Pyroelectricity of CuInP2S6 Ultrathin Flakes
- Environmental protection nano-polymer materials for air filtration



Notes

Technical Special Session 13
Advanced Technology of Micro-nano Fabrication & Surface Analysis (ss)

Room 7

13:30-15:30 Tuesday, 6 August

Organizer: Gajendra S Shekhawat

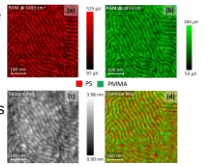
Co-Organizer: Xijun Li

13-1 13:00–13:50

Nanoscale Hyperspectral Mapping of Nanomaterials by Photo-induced Force Microscopy

Ji ming[1], Sung Park[2]
[1]Shanghai NTI Co., Ltd., China
[2]Molecular Vista, Inc., USA
Email: jiming@shnti.com

- A new technique of AFM with Vis ~ IR based on PiFM will be introduced.
- PiFM can chemically map and identify organic and inorganic materials via localized Vis ~ IR spectrum.
- PiFM is also very useful for many semiconductor applications such as strain mapping, contaminants inspection.
- PiFM provides for < 10 nm spatial resolution with excellent surface sensitivity such as monolayer.
- PiFM can work with other optical and spectral technique such as confocal and super-resolution microscopy, Raman and PL Spectroscopy.



PiFM images at 1493 cm-1 for PS molecules (a) and at 1733 cm-1 for PMMA molecules (b); topography (c); and PiFM images combined to yield a chemical map) of PS-b-PMMA block copolymer with block width of 11 nm (d). The combined image clearly shows the lamellar structure with each chemical block clearly delineated.

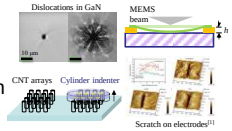
Notes

13-2 13:50–14:10

Applications of Nanoindentation/Scratch Testing

Kebei Chen
Platform for Characterization &Test, Suzhou Institute of Nano-Tech and Nano-Bonics, CAS, China

- Nanoindentation applys stress to produce defects in GaN and controls dislocation generation-slip process.
- The height h between beam and substrate can be calculated from load-displacement curve.
- Adhesion force of carbon nanotube arrays is obtained using a reverse loading program.
- Higher friction coeffcient of the electrode obtained by scratching indicates the stronger binding force.



Different parameters of various materials can be obtained by applying the corresponding functions.

Reference: [1] Guo S, et al. ADV ENERGY MATER, 2018, 8(24): 1800434.

Notes

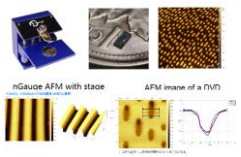
13-3 14:10–14:30

nGauge the world's smallest, simplest and most affordable atomic force microscope (AFM)

Zoe Lv（ICSPI）

The nGauge was developed over nearly 10 years of research and development at the University of Waterloo with funding from DARPA. All of the essential components of a conventional AFM have been replaced with a single-chip micro-electro-mechanical systems (MEMS)-based device.

- **Surface roughness**
- **Topography (surface profile)**
- **Thickness**
- **Morphology**
- **Particle counting**
- **Grain size**



Applications of AFM in research & development and quality control in academia and industry

Notes

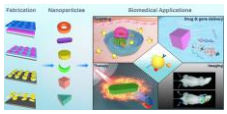
Technical Special Session 13
Advanced Technology of Micro-nano Fabrication & Surface Analysis (ss)
Room 7
13:30-15:30 Tuesday, 6 August
Organizer: Gajendra S Shekhawat
Co-Organizer: Xijun Li

13-4 14:30–14:50

Nanoimprint Lithography and Applications

Haixiong Ge
Department of Materials Science and Engineering, College of Engineering and Applied Sciences, Nanjing University, China

- Introduction of nanoimprint lithography.
- The key elements of nanoimprint: imprint machine, mold, resist and process.
- Development and bottleneck of nanoimprint lithography.
- Applications of nanoimprint lithography: some examples of application or potential application in electronics , photonics, and bio-medicine.



Fabrication of shape-controlled, monodisperse nanoparticles for biomedical applications by nanoimprint lithography.

Reference: [1] Fu X, et al. Advanced Drug Delivery Reviews, 2018,133: 169.

Notes

Technical Special Session 14
Advanced Functional Materials: From Synthesis, Characterization to Actuation (ss)

Room 1

15:50-17:50 Tuesday, 6 August

Organizer: Li Zhang

Co-Chair: Bin Dong

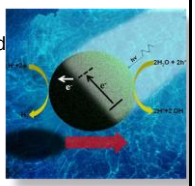
14-1 15:50–16:10

Light responsive smart polymer based micromotor

Bin Dong

Department Name, University Name, Country

- Light driven smart polymer based micromotor
- Unprecedented motion behaviors which are regulated by light
- Versatile functionalities enabled by the stimuli-responsiveness of the smart polymer
- Attractive candidate for diverse applications in the practical field



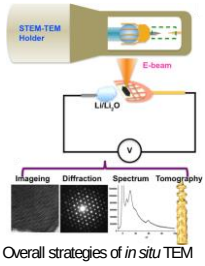
Notes

14-2 16:10–16:30

The importance of in situ TEM for understanding the fundamental science of energy storage

Qianqian Li
Materials Genome Institute, Shanghai University, P.R. China

- In-situ TEM is one indispensable tool for materials characterization in dynamic reaction process.
- Many gaps exist in understanding the processes relating operation, performance limitations, and failure of electrodes.
- Fundamental study will enable, the discovery of significant advances relevant to energy storage technologies.



Overall strategies of *in situ* TEM and Nanobattery setup

Notes

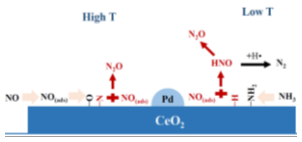
14-3 16:30–16:50

Reaction between NO and NH_3 over Pd/CeO_2

Hangsheng Yang, Liping Sheng, Zhaoxia Ma, and Yong Wang

School of Materials Science and Engineering, Zhejiang University, PR China

- In the absence of O_2, the dissociation of HON is the route for N_2O formation below 250ºC, the reaction between NO and surface N is the route for N_2O formation above 250ºC. A nearly 100% NO conversion and 100% N_2 selectivity could be achieved under optimal conditions.
- O_2 suppresses the NO reduction, and also induces N_2O formation.
- SO_2 suppresses the N_2O formation in the presence of O_2.



Notes

Technical Special Session 14
Advanced Functional Materials: From Synthesis, Characterization to Actuation (ss)

Room 1

15:50-17:50 Tuesday, 6 August

Organizer: Li Zhang

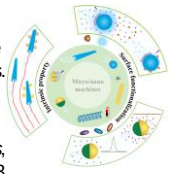
Co-Chair: Bin Dong

14-4 16:50–17:10

Recent development of magnetic microrobots for biomedical applications

Li Zhang
Department of Mechanical and Automation Engineering, The Chinese University of Hong Kong, Shatin NT, Hong Kong SAR, China

- Micro-/nanomachines have attracted tremendous attentions because of the introduction of controllable locomotion and the integration of multi-functionalities.
- In this talk, I will summarize the recent advances of magnetic microrobots for biomedical applications.
- Some recent key publications: (1) *Science Advances*, Vol. 5, no. 1, eaau9650, 2019. (2) *ACS Nano*, Vol. 13, 5999-6007, 2019. (3) *Nature Communications*, Vol. 9, 3260, 2018. (4-5) *Advanced Functional Materials*, Vol. 28, 1806340 & 1705802, 2018. (6) *Science Robotics*, Vol. 2, eaaq1155, 2017. (7) *Adv. Mater. Technol.* Vol. 4, 1800636, 2019.



Group website

Notes

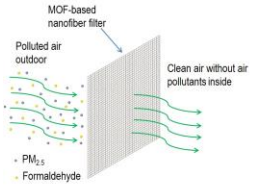
14-5 17:10–17:30

MOF-based Nanofiber Filters as Highly Promising Candidates for Air Pollution Control

Ye BIAN, Chun CHEN, Li ZHANG
Department of Mechanical and Automation Engineering, The Chinese University of Hong Kong, China

Bullet points:

- MOF-based nanofiber filters;
- High filtration efficiency;
- $PM_{2.5}$ and formaldehyde;
- Indoor air quality improvement.



The MOF-based nanofiber composite filter showed high filtration efficiency for $PM_{2.5}$ and formaldehyde

Notes

Technical Special Session 15
Surface Science Characterization for Energy, Bio-, and Catalysis Nanomaterials (ss)

Room2

15:50-17:50 Tuesday, 6 August

Organizer: Mingdong Dong

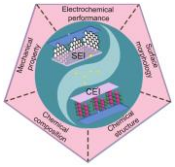
Co-Organizers: Lei Liu, Ren Su

15-1 15:50–16:10

Advanced Characterization of Solid Electrolyte Interphase in Lithium-ion Batteries

Yanbin Shen
i-lab, SINANO, CAS, China

- Characterization and understanding of solid electrolyte interphase (SEI) in lithium ion batteries
- In-situ probing of SEI
- Atomic level picture of SEI
- Design robust SEI for stable lithium ion batteries



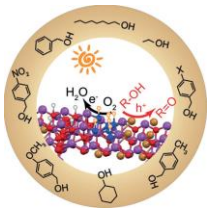
Notes

15-2 16:10–16:30

Photocatalytic Organic Synthesis: From Fundamental to Applications

Ren Su
College of Energy, Soochow University, China

- Selective and efficient photocatalytic synthesis of value-added chemicals
- Atomic level picture of reactions
- In-situ probing of reaction mechanisms
- Design and synthesis advanced photocatalyst for scale-up



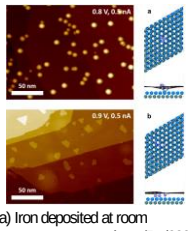
Notes

15-3 16:30–16:50

Intercalation Mechanisms of Fe Atoms underneath A Graphene Monolayer on Ru(0001)

Peng Zhao, Xin Yu
SynCat@Beijing, SynguelsChina. China

- The intercalation process is thermodynamically favored with certain energy barriers
- The intercalation process is easier when defect size is larger
- The larger Fe cluster size results in the intercalation more thermodynamically favored
- The strong interaction between Fe and Ru is the driven force of intercalation.



(a) Iron deposited at room temperature on graphene/Ru(0001); (b) After annengling (a) at 700 K.

Notes

Technical Special Session 15
Surface Science Characterization for Energy, Bio-, and Catalysis Nanomaterials (ss)

Room2

15:50-17:50 Tuesday, 6 August

Organizer: Mingdong Dong

Co-Organizers: Lei Liu, Ren Su

15-4 16:50–17:10

Atomic Design of Model Catalysts with Oxide-Film Template

Xiong Zhou
Synfuels China Technology Co., Ltd., China

- We developed a new methodology to control the morphology of metal in the atomic scale by using oxide film as a template.
- Such a new methodology has been successfully applied to prepare Au single atoms (Fig. 1a), Pt single atoms and clusters and large-lattice Ni films (Fig. 1c) on the CuO monolayer film grown on Cu(110).

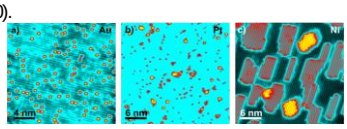


Figure 1. (a) Au single atoms, (b) Pt single atoms and clusters and (c) large-lattice Ni films.

Notes

15-5 17:10–17:30

Selective on-surface covalent coupling based on non-covalent metal-organic coordination

Ziliang Shi
Center for Soft Condensed Matter Physics & Interdisciplinary Research, School of Physical Science and Technology，Soochow University, No. 1 Shizi Street, Suzhou 215006, China

- Selective on-surface C-C coupling based on Fe-terpyridine coordination
- Selectivity/recognition of on-surface covalent reaction via a control of C-Br activation
- Rational design of on-surface synthesis combining hierarchical growth and template effect.

The selective on-surface covalent coupling achieves a porous N-doped carbon nanoribbon structure.

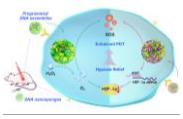
Notes

15-6 17:30–17:50

Designer DNA Nanosponges for Enhanced Photodynamic Therapy

Xiaoqing Liu
College of Chemistry and Molecular Sciences, Wuhan University, China

- Programming DNA nanoassembly for enhanced photodynamic therapy *via* modulation of tumor microenvironment
- Versatile nanostructures to load and delivery photosensitizer effectively, target tumor precisely, and overcome hypoxia remarkably
- Robust *in vitro* and *in vivo* anti-cancer efficacy with excellent biosafety



Notes

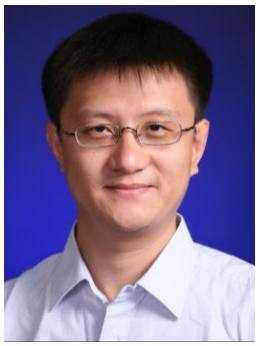
Technical Special Session 16
Design, Analysis and Control of Nano-manipulating Systems (ss)

Room 3

15:50-17:50 Tuesday, 6 August

Organizer: Zhen Zhang

Co-Organizer: Peng Yan

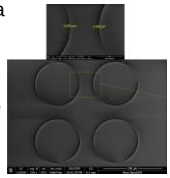


16-1 15:50–16:10

A robust tracking of a compliant nanomanipulator-based micro stereo lithography system

Yue Cao, Zhen Zhang*
Department of Mechanical Engineering, Tsinghua University, China

- A robust control strategy is proposed to support a compliant nanomanipulator-based micro stereo lithography system
- RBF neural network and repetitive control are integrated to deal with nonlinearity and to reduce tracking errors
- Fabrication results demonstrate the developed MSL system is capable of fabricating a sample with a line width of 2.5μm



The SEM image of the MSL fabrication result

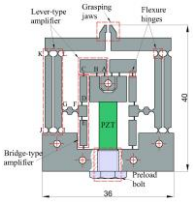
Notes

16-2 16:10–16:30

Design and analysis of a compliant micro-gripper with LBL type displacement amplifier

Jiawei Qian and Peng Yan
School of Mechanical Engineering, Shandong University, China

- A compliant piezo-driven micro-gripper with large tip displacement supporting micro scale manipulations is presented.
- An integrated lever-bridge-lever (LBL) type amplification mechanism is proposed, which incorporates the merits of lever-type and bridge-type mechanism.
- An analytical model is established to predict the output displacement based on elastic beam theory.



A compliant micro-gripper with LBL type amplifier

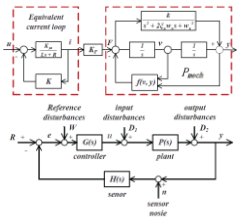
Notes

16-3 16:30–16:50

Fractional-order robust controller for high precision galvanometer scanner

Zongyang Yue and Peng Yan
School of Mechanical Engineering, Shandong University, China

- A novel fractional-order controller design method for galvanometer scanner system is presented.
- The dynamical model of the galvanometer scanner system is analyzed.
- The proposed fractional order controller simultaneously considers the specifications in both frequency domain and time domain.



The fractional-order controller for galvanometer scanner system

Notes

Technical Special Session 16
Design, Analysis and Control of Nano-manipulating Systems (ss)

Room 3

15:50-17:50 Tuesday, 6 August

Organizer: Zhen Zhang

Co-Organizer: Peng Yan

16-4 16:50–17:10

Design and Modeling of a Novel Wheel-Type Piezoelectric Nanopositioning Motor with Centimeter-scale Stroke

Dingtao Yu
Electromechanical Engineering, Guangdong University of technology, China

- Design a wheeled structure to make intermittent displacements continuous.
- No limit to the stroke of the output theoretically.
- A new solution for generating parasitic displacements using asymmetric hinges.

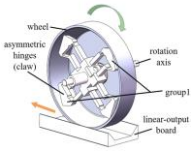


Figure. the wheel-type motor

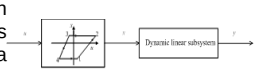
Notes

16-5 17:10–17:30

A Nonsmooth Predictive Control for Hammerstein Systems with Backlash

Qingmei Cao Ruili Dong Yonghong Tan
Institute of Robotics and Automation, Nankai University
College of Information Science and Technology, Donghua University
College of Inf., Mech. and Electrical Engineering Shanghai NormalUniversity

- A nonsmooth predictive control approach for Hammerstein systems with backlash is proposed in this paper. In this approach, a Clark subgradient is applied in this paper. Then, a nonsmooth predictive control strategy based on nonsmooth optimization technique is proposed. Afterwards, simulation results are presented.



The structure of Hammerstein systems with backlash

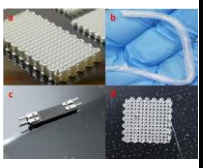
Notes

16-6 17:30–17:50

Rapid Prototyping of Soft Miniature Sensors by Hybrid Modes with Direct Ink Writing

Yu Liu, Qiang Zhang, Jiawen Xu, etc.
School of Mechanical Engineering, Jiangnan University, China

- Automated high-precision direct ink writing machine with integrated hybrid functions for deposition of materials and shapes by customization
- Process design and manufacturing art selectivity to deal with different performance materials
- Tuning of different processes in fit with tooling determination during 3D printing
- Device design and new development in engineering sectors.



Printed functional samples: a. ceramics; b. tubular channel; c. graphene / PDMS temperature sensor; d. epoxy network.

Notes

Technical Special Session 17
Tools and Methods for Nano-assembling (ss)

Room 4

15:50-17:50 Tuesday, 6 August

Organizer: Artemy Irzhak

Co-Chair: Victor Koledov

17-1 15:50–16:10

Study of the sticking effects during mechanical nano-manipulation using shape memory nanotools

Svetlana von Gratowski, Adrey Orlov, Peter Lega, Victor Koledov, Alexey Frolov, Kotelnikov IRE RAS, Moscow, Russia
Artemy Irzhak, IMT RAS, Chernogolovka, Russia
Nithya G, Praveen Kumar, Veda Sandeep Nagaraja, Nitte Meenakshi Institute of Technology Centre for Nanomaterials and MEMS, Bangalore, India
Zhengxun Song, Zuobin Wang, Li Li, International Research Centre for Nano Handling & Manufacturing of China Changchun, China

- Main fundamental problems in mechanical nano-manipulation is that connected with large influence of sticking force between nanogripper and object under nanomanipulation
- Sticking forces between CNTs and Ti_2NiCu nanotweezers are studied experimentally
- Theoretical estimation of the nature of those forces are discussed

Notes

17-2 16:10–16:30

Surface nanostructuring of dental prosthesis based on titanium

Vitaly Starkov, Ekaterina Gosteva
Russian Academy of Sciences Institute of Microelectronics Technology and High Purity Materials Chernogolovka, Russia

- The paper considers the possibility of using different methods of nanostructuring the surface of prostheses based on titanium and its alloys.
- The possibility of changing the surface roughness characteristics in a wide range of values, as well as changes in the morphology and chemical composition of the prosthesis surface from nanoporous structures to TiO2 nanotubes is shown.

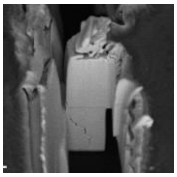
Notes

17-3 16:30–16:50

House of Cards: Nuances of Fabricating Stable Stacked Junction Structures in Layered Crystals

Aleksei Frolov
Kotelnikov Institute of Radioengineering and Electronics of RAS, Russia

- The problem of the stability of the stacked junction structures (mesas) in layered materials is discussed
- There are two main factors that lead to rupture of stacked junction - residual deformations and thermal expansion
- We have developed several techniques that allow to obtain resistant to temperature changes mesa-junction structures in layered crystals
- A brief summary of these techniques is presented



SEM Image of TbTe3 stacked junction cracked after thermal cycling

Notes

Technical Special Session 17
Tools and Methods for Nano-assembling (ss)

Room 4

15:50-17:50 Tuesday, 6 August

Organizer: Artemy Irzhak

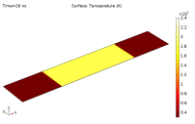
Co-Chair: Victor Koledov

17-4 16:50–17:10

Simulation of local laser annealing of amorphous TiNiCu alloy to create nanostructured functional material

Kirill Borodako, Victor Koledov
Kotelnikov IRE RAS, Moscow, Russia
Alexander Shelyakov
National Research Nuclear University MEPhI , Moscow, Russia

- An amorphous ribbons of $Ti_{50}Ni_{25}Cu_{25}$ alloy with shape memory effect were produced by melt spinning technique
- The amorphous ribbons were thinned by electrochemical polishing to a thickness of 5 μm
- The opportunity to create a layered nanocrystalline-amorphous layered composite was simulated via Comsol Multiphysics
- The composite is necessary to manufacture nanotweezers



Typical 3D image of temperature distribution at sample (20 ns, 10^{10} W/m^2)

Notes

Technical Special Session 18

2D Materials at nanoscale: From Fundaments to Applications (ss)

Room 5

15:50-17:50 Tuesday, 6 August

Organizer: Zegao Wang

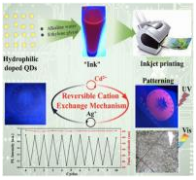
Co-Organizer: He Tian

18-1 15:50–16:10

Semiconductor Nanocrystal Engineering by Applying Ligand & Solvent-Coordinated Cation Exchange and Inkjet-printed Patterns for Anticounterfeiting

Meng Xu
School of Materials Science & Engineering, Beijing Institute of Technology, China

- Including the composition and crystallinity, novel nanocrystal engineering has been achieved by coordinated cation exchange kinetics.
- Enabled by such, high-quality p-type Ag doped cubic phase ZnS and CdS QDs were synthesized successfully.
- Novel strategy based on reversible cation exchange enabled Ag doped CdS QDs was provided a higher security for anticounterfeiting.



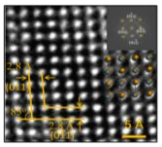
Notes

18-2 16:10–16:30

Wafer-size 2D SnSe Thin film by Sputtering for High Performance Photodetector

Yunjie Liu and Lanzhong Hao
College of Materials Science and Technology, China University Petroleum (East China), China

- Wafer-size SnSe thin film with a perfect crystal structure was realized by a sputtering method.
- SnSe photodetectors showed an ultrahigh responsivity value due to photogating effect.
- SnSe/Si vdWs heterostructure exhibited excellent photosensing performance with high detectivity and fast response speed.
- Optical SnSe/Si position sensitive device showed an extremely high sensitivity under low laser powers.



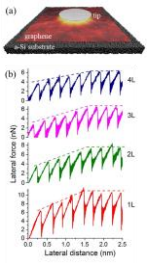
Notes

18-3 16:30–16:50

Nanoscale friction on graphene

Suzhi Li
State Key Laboratory for Mechanical Behavior of Materials, Xi'an Jiaotong University, China

Earlier work has shown that the frictional behavior of graphene exhibits traits unlike those of conventional bulk materials. Atomistic simulations reveal that the evolution of static friction of graphene is strongly related to the re-adjustment of its configurations as a direct consequence of its greater flexibility. The current findings also suggest a means of controlling friction of two-dimensional materials via strain engineering.



Notes

Technical Special Session 18

2D Materials at nanoscale: From Fundaments to Applications (ss)

Room 5

15:50-17:50 Tuesday, 6 August

Organizer: Zegao Wang

Co-Organizer: He Tian

18-4 16:50–17:10

Ultra-flexible, Freestanding, Micro-healing Transparent Electrodes for Wearable Sensors

Yuting Wang
Department of Engineering and Interdisciplinary Nanoscience Center, Aarhus University, DK-8000 Aarhus C, Denmark

- 1. Water vapor was used to transfer energy and heal microfiber-based electrodes.
- 2. The designed electrode shows great transparency and low resistance.
- 3. The damaged aligned fibers could be healed in seconds through steam treatment.
- 4. The healing process could be contributed to the combination of van der Waals force and capillary force.

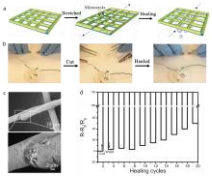


Figure 1. Schematic diagram of self-healing process. From left to right is the original, after damaged, and after healing state of this network.

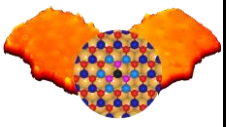
Notes

18-5 17:10–17:30

2D Cobalt Iron Oxides on Au(111): Atomic-scale Quantification of Catalytic Promotion Effects

Zhaozong Sun[a], Zegao Wang[a], Jakob Fester[a], Jonathan Rodríguez-Fernández[a], Mingdong Dong[a], Jeppe V. Lauritsen[a]
[a] Interdisciplinary Nanoscience Center (iNANO), Aarhus University, Denmark

- A range of catalytically active Fe-doped CoO nanoislands with a well-defined Fe content on Au(111) substrate are synthesized.
- We investigate the link between Fe content and the resulting atomic structure, the hydroxylation behavior and the electrochemical performance.
- The reactivity correlates well with an optimum reactivity for low concentration of Fe
- The positioning, as well as the aggregation may be possible ways to engineer the catalytic promotion effects



Left: metal mode, right: O mode STM images and center: ball model showing Fe-doped CoO on a Au(111) substrate. Color code: red: O, dark blue: Co, black: Fe, light blue: modified Co, purple: modified O and yellow: Au.

Notes

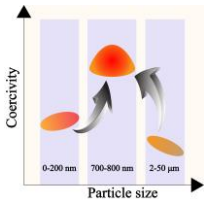
18-6 17:30–17:50

Controlling of particle size to maximize the coercivity of $SmCo_5$ hard magnet

Hao Tang, Mohammad Aref Hasen Mamakhel, and Mogens Christensen

Department of Chemistry and iNANO, Aarhus University, Aarhus C, Denmark

- $SmCo_5$ particles with average particle size (APS) ranging from 188 to 810 nm was synthesized successfully.
- The particle size and the purity of $SmCo_5$ can be tuned by the morphology and composition of precursor.
- A maximum coercivity of 2642 kA m^{-1} (33.2 kOe) was achieved for $SmCo_5$ with an APS of 805 nm.



schematic presentation of single domain theory

Notes

Technical Special Session 19
Micro/nano Structure Measurement and the Application in Bioscience and Environment Science (ss)

Room 6

15:50-17:50 Tuesday, 6 August

Organizer: Li Guan

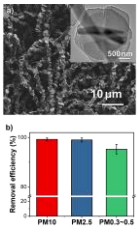
Co-Organizer: Gaofeng Deng

19-1 15:50–16:10

PAN@LDH Composite Membrane: an Efficient adsorbent for Particulate Matter Capture

Yao Cheng, Wei Chen* and Yu-Fei Song*
State Key Laboratory of Chemical Resource Engineering, Beijing University of Chemical Technology, China

- Electrospinning and *in-situ* growth process were taken to prepare PAN@LDH composite membranes.
- Mortise and tenon structure formed between LDH plates and PAN fibers.
- PAN@60%LDH showed highly efficient removal performance to PM with different sizes in short time.
- PAN@LDH can be a competitive material for further application in environmental purification.



(a) SEM and TEM images of PAN@60%LDH; (b) the removal efficiency of PM with different sizes.

Notes

19-2 16:10–16:30

Research and Application of the Anti-haze Screen

Yingxia Yang
China Academy of Buiding Research, China

- How to prevent haze of the anti-haze screen?
- The main performance of the anti-haze screen.
- Light transmission of the anti-haze screen and its test method.
- $PM_{2.5}$ filtration efficiency of the anti-haze screen and its test method.

Notes

19-3 16:30–16:50

Standards for air purifiers

Fang Liu
China Academy of Building Research, Beijing, China

- **Background**
- **Current air purifier standards (China and ISO)**
- **Air purifier classification**
- **Detecting Method and detecting parameter**
- **GBT34012-2017 and GBT 18801-2015**

Notes

Technical Special Session 19
Micro/nano Structure Measurement and the Application in Bioscience and Environment Science (ss)

Room 6

15:50-17:50 Tuesday, 6 August

Organizer: Li Guan

Co-Organizer: Gaofeng Deng

19-4 16:50–17:10

The New International Standard ISO16890 -Energy Saving Solution of HVAC System

Kelly Zhu
R&D Dept., Air Filter Div, MayAir China

- About MayAir
- Development of standard of Air Filter
- Introduction of ISO16890
- Energy Saving Solution – The compact type of ISO16890 air filter in VAV system, Mechfil
- Energy Saving Solution – The high efficiency and low resistance type of air filter in multistage filtration system, NanoGuard

Notes

Technical Special Session 20
Advanced Technology of Micro-nano Fabrication & Surface Analysis (ss)

Room 7

15:50-17:50 Tuesday, 6 August

Organizer: Gajendra S Shekhawat

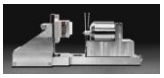
Co-Organizer: Xijun Li

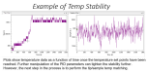
20-1 15:50–16:10

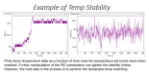
High temperature /In-Situ Nanomechanics Testing System

Dr. Cunyi Xie

- Nano Indenter family In-Suit
- Application examples of Nano Indenter at ambient
- **In-situ platforms including NanoFlip and InSEM HT**
- SEM Integration of in-situ products







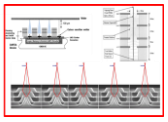
Notes

20-2 16:10–16:30

Multiple Electron Beam Lithography Future Player of MiniFab

Xijun Li
Zhejiang Key Laboratory of 3D Micro/Nano Fabrication and Characterization, Westlake University, China
Westlake Center for Micro/Nano Fabrication, Westlake University, China

- New demands of SemiFab in the post microelectronics era
- Nanolithography: the challenge for the new SemiFab
- Multiply electron beam lithography, the promising choice of future nanolithography
- Multiple electron beam lithography system and its challenges



Schematics of a multiple e-beam column

This presentation establishes a new conception of future fab flexible for micro/nano integrated system in the post microelectronics era and analyzes the challenges of its core patterning tool, multiple electron beam lithography.

Notes

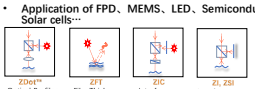
20-3 16:30–15:50

Application of Multi-mode Optical Profiler in Micro-nano characterization

XXXX（KLA Corporation）

Mutli-mode Optical Profiler

- R&D，Production，Automated
- Sub-nm,nm,>10nm in Z resolution
- Defect inspection and review
- Step height、3D morphology、Bow、Stress…
- Application of FPD、MEMS、LED、Semiconductor、Solar cells…



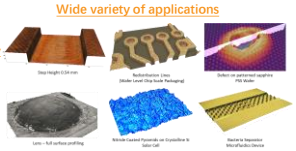
Measurements Enabled by Multi-Mode Technology

- Transparent and multi-layered surfaces
- Low reflectivity and low contrast
- High roughness
- Large height variations
- High aspect ratio trenches
- Mixed material surfaces
- Step heights in the presence of thin films

Advantages

- Versatile – capable for multiple measurements
- Application specific software and algorithms
- Insensitive to vibration and sample tilt
- High light throughput design
- Easy to use – users up and running quickly

Wide variety of applications



Notes

Technical Special Session 21
Nanomaterial and Nanotechnology for Biological Applications (ss)

Room 1

8:00-10:00 Wednesday, 7 August

Organizer: Qiang Li

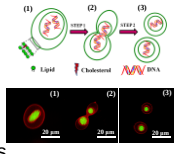
Co-Organizer: Zaixing Jiang

21-1 8:00–8:20

Phospholipid Self-Assembly Based Artificial cells

Xiaojun Han
School of Chemistry & Chemical Engineering, Harbin Institute of Technology, Harbin, Heilongjiang, 150001, China
Email: hanxiaojun@hit.edu.cn

- Artificial cells can be used to study cell structure and function.
- A fissionable vesicle in vesicle structure was used to mimick eukaryote cell.
- The grana-like cisternae stacks were assembled to mimick grana functions.
- Artificial endoplasmic reticulums with helical structures were fabricated with charged lipid membranes.



Division of eukaryote like artificial cell

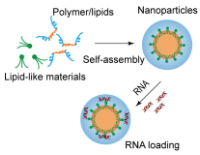
Notes

21-2 8:20–8:40

Development of Nanoparticulate Systems for Gene Therapy and Precise Medicine

Chuanxu Yang
School of Chemistry and Chemical Engineering, Shandong University, China

- A library of lipid-like materials were synthesized for generating of a serial of nanoparticles;
- Optimization and in vitro screening identified highly potent nanoparticle for delivery RNA therapeutics, including siRNA, mRNA and CRISPR-Cas9;
- Knockdown of inflammatory cytokines TNF-α or interleukin-1β in arthritic mice as a potential gene therapy for arthritis treatment.



Notes

21-3 8:40–9:00

Biomimetic Design of Dynamic Biomaterial Interfaces

Guoqing Pan
panguoqing@ujs.edu.cn
Institute for Advanced Materials Jiangsu University, China

- Dynamic biomaterial interface is a new concept of biomaterials for mimicking the dynamic nature of extracellular matrix
- Reversible chemical interactions can be used as the dynamic driving forces for the fabrication of smart biointerfaces
- We have developed several novel dynamic biointerfaces through reversible covalent bonds, coordinative interactions, and the molecular affinity of imprinted synthetic receptors

Dynamic biomaterial interfaces based on reversible chemical interactions

Notes

Technical Special Session 21
Nanomaterial and Nanotechnology for Biological Applications (ss)

Room 1

8:00-10:00 Wednesday, 7 August

Organizer: Qiang Li

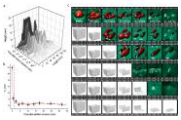
Co-Organizer: Zaixing Jiang

21-4 9:00–9:20

Dynamic Behavior of Biological Samples Observed by High Speed Atomic Force Microscope

Zaixing Jiang
Department of Polymer Science and Technology, School of Chemical Engineering and Technology, Harbin Institute of Technology, People's Republic of China

- Under atomic force microscopy, we investigatived real-time imaging of 3D DNA origami and in vitro anatomy of cable bacterial cells.
- Our results indicate that the digestion process is a combination of rapid collapse and slow degradation phases. Damage to box origami occurs mainly in the collapse phase.
- The structural stability of 3D DNA box origami should be improved, especially in the collapse phase, before these structures are used in clinical applications.
- Observations on the in vitro anatomy of cable bacterial cells indicates that the strings serve an important function in maintaining integrity of individual cable bacteria cells as a united filament.
- We propose a model for the division and growth of the cable bacteria, which illustrate the possible structural requirements for the formation of centimeter-length filaments in the recently discovered cable bacteria.



Degradation kinetics of 3D DNA box origami in serum

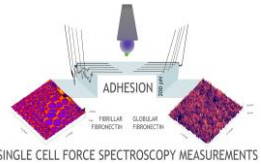
Notes

21-5 9:20–9:40

Protein structure-function pairing reveals a molecular trick for bacterial colonization

Hüsnü Aslan
iNANO Centre, Aarhus University, Denmark

- In this study, we show that the same protein, fibronectin, when in its natural globular form gets completely ignored by *Staphylococcus epidermidis*, however, in its surface-bound fibrillated form promotes bacterial attachment. To be more specific, *Staphylococcus epidermidis'* receptor known as Embp, interacts differently with fibronectin based on its 3D conformation. Our results indicate that it is not only the type of protein but also the protein's conformation directly influences the bacterial attachment thus colonization.



Notes

Technical Special Session 22

Intelligent Soft Matreial Systems: Nano-Scale Manipulation Enable Novel Applications (ss)

Room 2

8:00-10:00 Wednesday, 7 August

Organizer: Xiaoshi Qian

Co-Chair: Rujun Ma

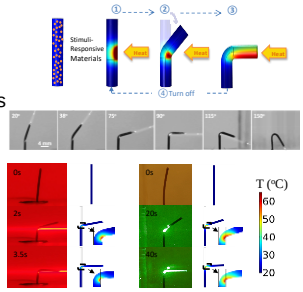
22-1 8:00–8:20

Self-Adaptive Nanocomposite for Artificial Intelligent Material System with Decision Making Capabilities

Xiaoshi Qian
School of Mechanical Engineering, Shanghai Jiang Tong University, China

Bio-inspired Artificial Tropistic Materials

1. Bio-inspired spontaneous locomotion with self-awareness
2. Tightly self-regulated material system enabling the artificial phototropism
3. Benefits in fields of energy harvesting
4. Demonstration in practical applications.



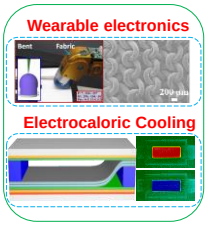
Notes

22-2 8:20–8:40

Applications of Wearable Electronics and highly Efficient Electrocaloric Cooling based on Functional Polymers

Rujun Ma
School of Materials Science and Engineering, Nankai University, China

- Ag NPs constructed effective electrical networks between the microscale Ag flakes
- The fibers with extraordinarily high conductivity, stretchability, and mechanical strength may be useful for wearable electronics applications.
- A cooling device with a high intrinsic thermodynamic efficiency using a flexible electrocaloric polymer film and an electrostatic actuation mechanism.
- New cooling device opened a path to using the technology for a variety of practical applications



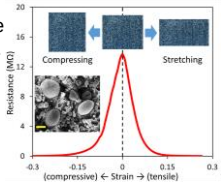
Notes

22-3 8:40–9:00

Defying conventions with liquid metal embedded magnetorheological elastomers (LMMRE)

Shiyang Tang
School of MMMB, University of Wollongong, Australia

- The LMMRE exhibits a positive piezoconductive effect, whose resistivity drops as it is elongated.
- The LMMRE exhibits a high piezoconductive coefficient of 7.88×10^{7}.
- The LMMRE is magnetic field responsive that can significantly reduce its resistivity within magnetic field.
- These unique properties lead to an unprecedented mechano-electro-Joule heating effect of the LMMRE.



Resistivity of the LMMRE upon the application of mechanical loadings, the inset shows the SEM image of the LMMRE (scale bar is 10 μm)

Notes

Technical Special Session 22

Intelligent Soft Matreial Systems: Nano-Scale Manipulation Enable Novel Applications (ss)

Room 2

8:00-10:00 Wednesday, 7 August

Organizer: Xiaoshi Qian

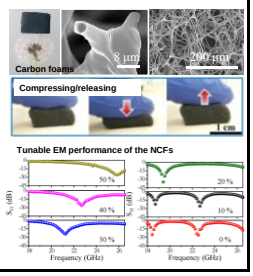
Co-Chair: Rujun Ma

22-4 9:00–9:20

High-elastic Carbon Foam for Dynamically Tunable GHz Electromagnetic Absorption

Jian Zhang
Institute of Advanced Magnetic Materials, Hangzhou Dianzi University, China

- We demonstrate ultralight and high-elastic nitrogenous carbon foams (NCFs) with hollow framework.
- The elastic NCFs results in an excellent electromagnetic (EM) absorption performance.
- By compressing/releasing the NCFs, the electromagnetic absorption can be arbitrarily tuned.
- Our work provides a strategy for the design of "dynamic" EM functional materials.



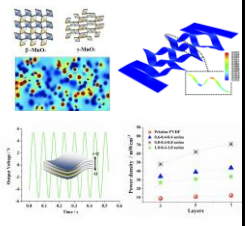
Notes

22-5 9:20–9:40

The fabrication and design of flexible PVDF based nanocomposites for nanogenerators application

Lu Yang[1,2], Qiuying Zhao[2], Jinhao Qiu[2]
1. Department of Mechanics and Materials, Hohai University, China
2. State Key Laboratory of Mechanics and Control of Mechanical Structures, Nanjing University of Aeronautics and Astronautics, China

- A nonequilibrium manufacturing approach involving electrospining, hot pressing and rolling was developed.
- Tuning the output performance through topological-structure and composition modulations of PVDF.
- Kirigami technique with linear cut patterns was developed to design stretchable nanogenerators



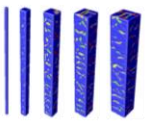
Notes

22-6 9:40–10:00

Phase-field model of electrocaloric and pyroelectric effects

Houbing Huang
Advanced Research Institute of Multidisciplinary Science
Beijing Institute of Technology, Beijing, China

- Ferroelectric materials show strong coupling of polaziation and temperature.
- The ferroelectric nanowires have larger polarization, entropy and temperature changes based on the free-standing mechanical boundary conditions.
- The present study contributes to the understanding of size effects of electrocaloric effects and the design of pyroelectric materials.



Polarization distribution at different size of ferroelectric nanowire

Notes

Technical Session 23

Nanometrology and Nanocharacterization

Room 3

8:00-10:00 Wednesday, 7 August

Chair: Chenxuan Wang

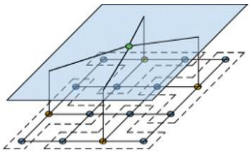
Co-Chair: Wenjun Li

23-1 8:00–8:20

A novel architecture with low laser power based on Optical Networks-on-Chip

Ye Su, Yiyuan Xie, Lixia Fu, Junxiong Chai
The School of Electronic and Information Engineering, Southwest University, Chongqing, China

- A novel double-layer structure combining inter-cluster communication and non-cluster communication is proposed.
- Using OPNET simulation software, the network performance of this structure is analyzed.
- The minimum laser output power are studied for numerical simulation.



Low laser output power consumption double-layer structure called VCmesh based on optical networks-on-chip

Notes

23-2 8:20–8:40

Application Research of Dynamic Programming Optimal Algorithm in locomotive wheelset Detection System

Lei Huang
Key Laboratory of Jilin Province Measurement and Testing Instruments and Technology, JILIN INSTITUTE OF METROLOGY, China

- Large-span two-dimensional linkage measurement in size measurement of locomotive wheelset;
- A displacement compensation optimal compensation algorithm for dynamic programming;
- The system uses a specially designed high-precision, high-stability marble structure;
- The X-axis positioning accuracy achieve to 7.9μm, the Z-axis positioning accuracy achieve to 6.6μm(3 meter range);
- The X-axis horizontal straightness achieve to 4.5μm6.6μm(3 meter range);

Large-span two-dimensional linkage XZ axis measurement system

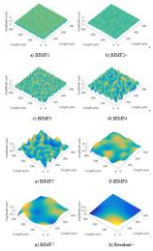
Notes

23-3 8:40–9:00

Characterization of 3D Surface Roughness in Micro-Milling

Wenqin Li
Ministry of Education Key Laboratory for Cross-Scale Micro and Nano Manufacturing, Changchun University of Science and Technology, China

- Micro-milling surfaces with different morphologies can be constructed by non-Gaussian rough surfaces.
- Mirror method can suppress boundary effect.
- Roughness surface and reference plane can be separated by BEMD.
- Three-dimensional roughness evaluation systemcan be used to characterize different micro-milling surfaces.



Time domain diagrams of BIMFs and residual decomposed by BEMD algorithm

Notes

Technical Session 23

Nanometrology and Nanocharacterization

Room 3

8:00-10:00 Wednesday, 7 August

Chair: Chenxuan Wang

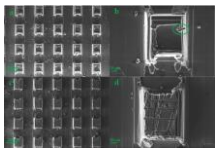
Co-Chair: Wenjun Li

23-4 9:00–9:20

The Effect of Micro-column Structure on Surface Wettability of Aluminum

Pu Cui
Changchun University of Science and Technology; China

- Construction of micro-column structure on the surface of aluminum alloy via milling.
- Remove the burr from the surface of the square by grinding.
- Compare the change of contact angle of aluminum alloy surface before and after milling and grinding
- Analyze of the effect of single-scale square column on the wettability of aluminum alloy surface



Micro-column structure on the surface of aluminum alloy

Notes

23-5 9:20–9:40

Imaging quality assessment of different AFM working modes on living cancer cells

Guoliang Wang, Baishun Sun, Xiaomin Wu, Wenxiao Zhang, Yinming Qu, and Zuobin Wang
CNM, Changchun University of Science and Technology, China

Abstract —Since the invention of atomic force microscope (AFM) in 1986, its capabilities in biophysical research, such as living cell imaging, molecule imaging and recognition and drug treatment analysis, have been deeply investigated. Various types of working modes of atomic force microscopy have been used for the imaging and analysis of living cells. The physical properties of living cells can be directly illustrated by its good resolution images. In this paper, the applications of three AFM working modes including contact, tapping and quantitative imaging (QI) modes for the investigation of living cancer cells (A549) are presented. Meanwhile, the quality of images of the cells obtained by different working modes is compared through the image quality assessment (IQA) methods.

Notes

23-6 9:40–10:00

Study on Anti-reflection Performance of Titanium Alloy Based on Times Change of Nanosecond Laser Processing

Jiaru Li, Jinkai Xu, Zhongxu Lian and Huadong Yu*
Ministry of Education Key Laboratory for Cross-Scale Micro and Nano Manufacturing
Changchun University of Science and Technology Changchun 130022, China

- Method suitable for large-scale processing
- Simple processing method, low cost and strong practicability
- Can significantly improve the anti-reflection function of titanium alloy

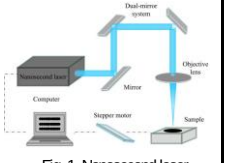


Fig. 1. Nanosecond laser micromachining experimental setup

Notes

Technical Session 23

Nanometrology and Nanocharacterization

Room 3

8:00-10:00 Wednesday, 7 August

Chair: Chenxuan Wang

Co-Chair: Wenjun Li

23-7 Poster

Research of Intelligent Test Platform for Displacement Sensor

Dong LI

SUZHOU INSTITUTE OF BIOMEDICAL ENGINEERING AND TECHNOLOGY

CHINESE ACADEMY OF SCIENCE, SuZhou JiangSu PROVINCE, China

- Intelligent acquisition platform of linear displacement sensor is an instrument that has standard interface;
- The platform utilizes the virtual instrument technology;
- Intelligent acquisition platform is a part of displacement measuring system, but it is also a part of displacement sensor calibration system;
- The uncertainty component of platform is 0.033%, the uncertainty is less than 1/3 of secondary instrument.

Intelligent Test Platform for Displacement Sensor

Notes

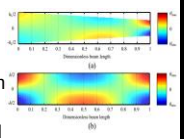
Technical Session 24
Nanomechanics and Nanomechatronics
Room 4
8:00-10:00 Wednesday, 7 August
Chair: Hongyu Zhang
Co-Chair: Chunxiang Pan

24-1 8:00–8:20

Study on Thermoelastic Damping in Micro/nano-Beam Resonators with Linearly Varying Thickness

Pu Li & Hongyue Zhou
School of Mechanical Engineering, Southeast University, China

- Thermoelastic damping (TED) is confirmed as a momentous energy dissipation mechanism in vacuum-operated resonators.
- The TED model for linearly tapered micro/nano-beam resonators is proposed basing on the Zener's theory.
- TED in tapered micro/nano-beams depends on modal parameters including the vibration frequency and the modal shape function.
- TED is significantly affected by boundary conditions and geometrical parameters.



Imaginary part of temperature contour in dimensionless scale clamped-clamped microbeam

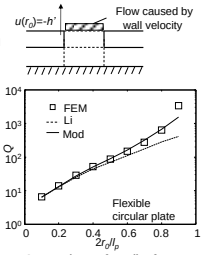
Notes

24-2 8:20–8:40

Analytical model of squeeze-film damping for perforated circular plate

Pu Li , Cunhao Lu
School of Mechanical Engineering, Southeast University, China

- Considering the hole wall velocity, the perforation term has been modified.
- Using the modified perforation term, the modified squeeze-film damping model has been proposed.
- For fully clamped circular plate, the modified model is more accurate than the previous model.
- This work may helps the design of MEMS devices



Comparison of quality factor

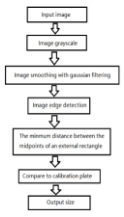
Notes

24-3 8:40–9:00

A novel characteristic information extraction method based on machine vision

Yadong Wei, Han Chen, et al.
School of Electrical Engineering and Intelligentization, Dongguan University of Technology, Dongguan

- In this paper, a fast, high-precision, multi-target image processing method based on machine vision is proposed.
- For the image including more complexed structures, it can also be accurately detected.
- The algorithm is transferable and extensible, and can be applied in wider image processing fields.



Flow chart of the image measurement.

Notes

Technical Session 24
Nanomechanics and Nanomechatronics

Room 4

8:00-10:00 Wednesday, 7 August

Chair: Hongyu Zhang

Co-Chair: Chunxiang Pan

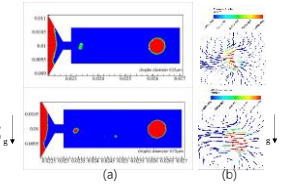
24-4 9:00–9:20

Simulation of aluminum droplet formation process based on the uniform droplet ejection technique in microgravity

Lei Zhao, Jun Luo, Jieguang Huang, Hongcheng Lian, Hao Yi, lehua Qi *
School of Mechanical Engineering, Northwestern Polytechnical University, China

Bullet points:

- A transverse ejection numerical simulation model was developed ;
- Based on the VOF two-phase flow method, the model was solved in normal and microgravity conditions;
- The ejection using small diameter nozzle could ignore the effect of gravity .



(a) Droplet flight distance is 3.2mm;
(b) Inner flow of droplets was affected by gravity.

Contribution: lay a foundation for microgravity similar simulation on the ground and detailed methods described in the manuscript.

Notes

24-5 9:20–9:40

Bionic Model Reliable Reconstruction of Dragonfly Wing Based on Reverse Engineering Technology

Chunxiang Pan
Mechanical Department of fundamental institute,
Air Force Aviation University, Changchun,China

- In this paper, the three-dimensional geometric reconstruction model of dragonfly's membrane fin is constructed based on Imageware software.
- The biological data of dragonfly's membrane fin sample is scanned by three-dimensional laser scanner, and the obtained point group data is input into reverse engineering software Imageware. The ideal three-dimensional reconstruction geometric model is obtained by simplifying and denoising the point group data, which provides a basis for reverse reconstruction of biofilm fin.

Figure Structural model of dragonfly's front and rear wings

Notes

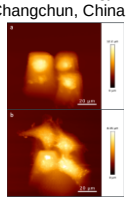
24-6 9:40–10:00

Liposome Induced mechanical properties changes in cell membrane

Zhefei Zhang, Mingdong Dong
Interdisciplinary Nanoscience Center (iNANO)
Aarhus University
Aarhus, Denmark

Fan Yang, Zuobin Wang
Changchun University of Science and Technology
Changchun, China

- The morphological information of HEK293T cells treated with or without liposome were characterized by optical microscope and AFM.
- Physical changes of living cells caused by liposome were revealed from the perspective of Young's Modulus of cell membrane.
- Our research presents some important information for evaluating cytotoxicity of transfection reagents for gene therapy.



AFM morphology image of HEK293T cells without or with liposome treatment.

Notes

Technical Special Session 25
Micro/Nano Robotics for Single Cancer Cells (MNR4SCell) (ss)

Room 5

8:00-10:00 Wednesday, 7 August

Organizer: Yanling Tian

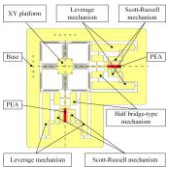
Co-Organizer: Fujun Wang

25-1 8:00–8:17

A Novel XY Nano Positioning Stage with a Three Stage Motion Amplification Mechanism

Yanling Tian
Key Laboratory of Mechanism Theory and Equipment Design of Ministry of Education, Tianjin University, Tianjin 300072, China

- The design, modeling, and simulation of a novel flexure-based XY nano positioning stage driven by piezoelectric actuators is presented.
- A new kind of three stage motion amplification mechanism is proposed to achieve a large workspace and a compact structure.
- The maximum displacements in x- and y-axes can reach 126.54 μm and 126.92 μm, respectively.



3D model of proposed XY nano positioning stage

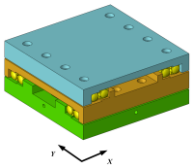
Notes

25-2 8:17–8:34

Design and Modeling of a Decoupled 2-DOF Stick-slip Positioning Stage

Yanling Tian, Zhichen Huo, Fujun Wang*, Beichao Shi, Dawei Zhang
School of Mechanical Engineering, Tianjin University Tianjin, China

- A 2-DOF stick-slip positioning stage with hybrid decoupling strategy.
- Finite element analysis (FEA) is carried out to explore the characteristics of driving unit.
- Dynamic analysis is conducted to investigate the motion characteristic of positioning stage, and the maximum step displacement is simulated as 8.1 μm.



Schematic of the stick-slip positioning stage

Notes

25-3 8:34–8:51

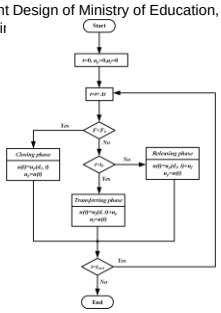
Smooth Position/Force Switching Control of a Piezoelectric Actuated Microgripper for Micro Manipulation

Fujun Wang, Beichao Shi, Zhichen Huo, Yanling Tian, Xingyu Zhao, Dawei Zhang
Key Laboratory of Mechanism Theory and Equipment Design of Ministry of Education, Tianjin University, Chi

•This paper presents a position/force switching control of a piezoelectrically actuated microgripper for micro manipulation.

•The jaw's output displacement and the grasping force are regulated by PI controller. The stable and smooth switching between two consecutive phases is achieved by adding the final voltage value in previous phase to that of next phase.

•The left jaw can grasp the copper wire with a velocity of 100 μm/s, and the steady state error of grasping force is ±1 mN. The experiment results confirm that the microgripper can achieve high speed and high precision manipulation under the action of the switching controller.



The flow chart of the position/force switching control.

Notes

Technical Special Session 25
Micro/Nano Robotics for Single Cancer Cells (MNR4SCell) (ss)

Room 5

8:00-10:00 Wednesday, 7 August

Organizer: Yanling Tian

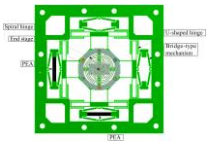
Co-Organizer: Fujun Wang

25-4 8:51–9:08

Design, modeling, analysis and testing of a novel piezo-actuated XYZ compliant mechanism for large workspace nano-positioning

Mingxuan Yang
School of Mechnical Engineering, Tianjin University, China

- A novel piezo-actuated 3-DOF XYZ compliant mechanism for nanopositioning.
- Three directional bridge-type mechanisms, mirror symmetric configuration and spiral hinge guarantee large working range.
- FEA shows the working range of 83.7μm* 83.7μm* 50.4μm can be realized.



3D model of proposed XYZ compliant mechanism

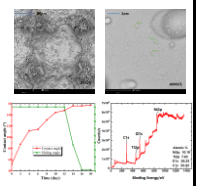
Notes

25-5 9:08–9:25

Modification of wettability property of NITI alloy by laser texturing and carbon ion implantation

Dawei Zhang, Meng Wang, Yuechao Zhao, Chengjuan Yang*, Zhen Yang
School of Mechanical Engineering, Tianjin University Tianjin, China

- Surface wettability and topography of nitinol alloy samples were modified by means of nanosecond laser treatment and the following carbon ion implantation process.
- Carbon ion implantation can change the nano scale structure and it strenghenes the hydrophobic ability
- The revolution of contact angle in the air was expedited when laser ablated surface was treated with carbon ion implantation.



Notes

25-6 9:25–9:42

Direct Inverse Hysteresis Compensation of PEA Using Recursive Least Squares Method

Heng Duan, Rurui Jia , Yanding Qin*
College of Artificial Intelligence, Nankai University, China

- Adaptive hysteresis compensation based on recursive least squares and direct inverse modeling is proposed.
- Tracking of continuous and discontinuous trajectories is effective .
- The proposed method has excellent tracking performance across a wide frequency range.

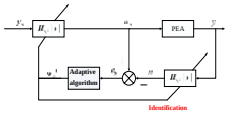


Fig 1. Adaptive algorithm based hysteresis compensation.

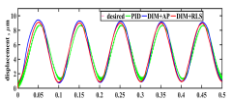


Fig 2. Tracking performance of three different controllers for a 10 Hz sinusoidal trajectory

Notes

Technical Special Session 25
Micro/Nano Robotics for Single Cancer Cells (MNR4SCell) (ss)

Room 5

8:00-10:00 Wednesday, 7 August

Organizer: Yanling Tian

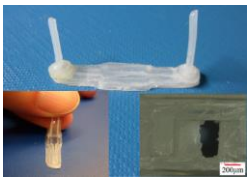
Co-Chair: Fujun Wang

25-7 9:42–10:00

Ultrasonic molding of polymer micro devices

Liangyu Cui[1], Houjun Qi[1], YanlingTian[2], Dawei Zhang[2]
[1]School of mechanical engineering, Tianjin University of Technology and Education, China
[2]School of mechanical engineering, Tianjin University, China

- Ultrasonic molding is a fast and low cost fabrication process for polymer devices
- For some polymer devices, ultrasonic molding can replace micro injection molding
- Micro fluidic chips can be fast and low cost fabricated
- The height of the devices normally less then 5cm



Polymer microfluidic chip assembled with ultrasonically molded parts

Notes

Technical Session 26
Biological Applications

Room 6

8:00-10:00 Wednesday, 7 August

Chair: Liang Yuan

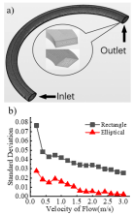
Co-Chair: Yonghai Feng

26-1 8:00–8:20

Effects of microchannel cross-section shape on particle focusing

Dexian Ma, Yin Zhang, Yunfei Chen*
Jiangsu Key Laboratory for Design and Fabrication of Micro-Nano Biomedical Instruments, School of Mechanical Engineering
Southeast University, Nanjing, 211189, P. R. China
yunfeichen@seu.edu.cn

- Microchannels with elliptical cross sections allow the Dean vortex to develop sufficiently
- Increasing the flow rate enhances the focus of the particles
- Dean drag force and aspect ratio determine the position where the particle is focused
- The paper found that elliptical cross section microchannel with aspect ratio of 2 has the best particle focusing effect.



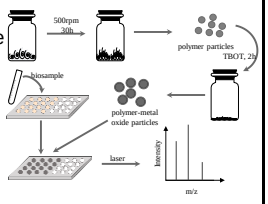
Notes

26-2 8:20–8:40

Polymer-metal oxide Nanoparticles for Small Metabolite Detection

Zhehui Gong
School of Biomedical Engineering, Shanghai Jiao Tong University, China

- Sensitive and high throughput small metabolite detection in human biofluid are important in disease diagnosis. We designed a novel polymer-metal oxide nanoparticles for MALDI MS detection of small metabolites. These nanoparticles could detect small molecules in 1.0 microliter biofluid and are situable for different biosamples.



Schematic diagram of polymer-metal oxide particle synthesis and its application in MALDI MS.

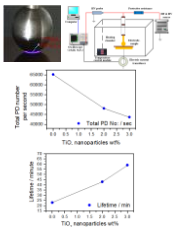
Notes

26-3 8:40–9:00

FTIR analysis of partial discharge-initiated polyimide nanocomposites degradation and insulation durability under high frequency ac voltage stress

Muhammad Asif
School of Electrical and Electronic Engineering, North China Electric Power University, China

- Contribution of inorganic TiO2 nanoparticles in reduction of partial discharge activity and insulation durability has been intensively investigated considering PD characteristic parameters, PRPD and bonding structure analysis via FTIR spectroscopy.
- Space charges suppression has been demonstrated via phase resolved partial discharge (PRPD) patterns focusing rabbit ear like cluster formation.
- Nanoparticles in PI matrix improve the resistance to PD and lifetime due to formation of abundant amount of hydrogen bonds at nanocomposite interface.



PD activity, aging test platform, PD number/sec and lifespan

Notes

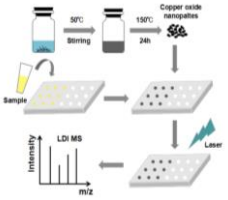
Technical Session 26
Biological Applications
Room 6
8:00-10:00 Wednesday, 7 August
Chair: Liang Yuan
Co-Chair: Yonghai Feng

26-4 9:00–9:20

Plate-like metal oxide nanostructure for detection of small metabolites by mass spectrometry

Shenlan Wu
School of Biomedical Engineering, Shanghai Jiao Tong University, China

- Fast and sensitive detection of small metabolites in LDI MS can be a useful tool for clinical diagnose. Here we reported novel metal oxide nanoplates as a solid matrix for detection of small metabolites. The matrix was applied for the analysis of amino acids and complex biosamples by LDI MS.



Schematic illustrations of metal oxide nanoplates synthesis and the application in LDI MS.

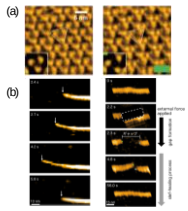
Notes

26-5 9:20–9:40

High-Speed Atomic Force Microscopy for Visualization of Dynamic Processes in Biological and Artificial Supramolecules

Takayuki Uchihashi
Department of Physics, Nagoya University, Japan,
ExCELLS, Japan

- A frame rate speed of AFM has now reached to more than 10 fps.
- The high-speed imaging enables us to directly observe various dynamic events on biological and artificial supramolecules in liquid.
- As examples by HS-AFM , self-assembly and conformational dynamics of membrane proteins and supramolecular nanofiber are demonstrated.



HS-AFM images of (a) bacteriorhodopsin and porphyrin nanofiber.

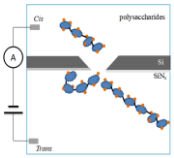
Notes

26-6 9:40–10:00

Single-molecular Detection of Polysaccharides with Chemically-Modified Nanopores

Yao Cai
College of Instrumentation & Electrical Engineering, Jilin University, China

- Use solid-state nanopores (SSN) on the detection of polysaccharides.
- Suggesting that polysaccharides have different perforation behaviors in chemically-modified nanopores compared with bare ones.
- Study the different perforation behaviors of long chain polysaccharides and short chain polysaccharides.
- Study the different perforation behaviors of polysaccharides under different bias voltages.



Schematic representation of nanopore detection of polysaccharides. This can be used to analysis the characterization of materials across the nanopores.

Notes

Technical Special Session 27
Nanomaterial and Nanotechnology for Biological Applications (ss)

Room 1

10:20-12:20 Wednesday, 7 August

Organizer: Qiang Li

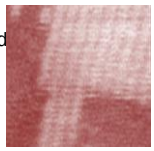
Co-Organizer: Zaixing Jiang

27-1 10:20–10:40

Self-Assembled Nanostructures and Their Biomedical Applications

Qiang Li
School of Chemistry and Chemical Engineering , Shandong University, China

- Identification of a novel parallel β-strand conformation within molecular monolayer of amyloid peptide
- Modulating amyloid peptide assembly by graphene oxide
- HIV Tat protein and amyloid-β peptide form multifibrillar structures that cause neurotoxicity



AFM high-resolution image of amyloid molecular monolayer

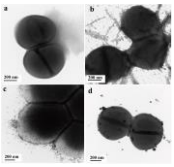
Notes

27-2 10:40–11:00

Amyloid Peptide Assembly Confined Au Nanofibers for Antibacterial Photothermal Lysis

Yonghai Feng
Institute for Advanced Materials, Jiangsu University, China

- Gold based photothermal nanoagents face the challenge of difficultly being eliminated from human body due to their large size (> 50 nm).
- Amyloid peptide assembly confined Au nanofibers with primary Au nanoparticles (< 5 nm) are synthesized as an alternative photothermal agent, which will be easily eliminated by human body due to the small size of less than 5 nm.
- Strong interaction between the nanofiber and the bacteria facilitates the enhanced local photothermal bactericidal efficiency.



TEM of MRSA (a), MRSA with Au@peptide nanofiber (b), Au@peptide conjugate, and pristine Au particles (d).

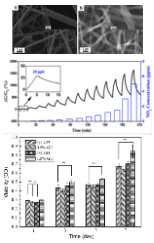
Notes

27-3 11:00–11:20

Polymer-based Scaffold for Sensing and Biomedical Application

Dan Xia
School of Materials Science and Technology, Hebei University of Technology, Tianjin, China

- The 1D AgNPs, 2D polymer fibers and AQRGO sheets are integrated into a 3D sensing scaffold for high-performance NO_2 sensing.
- The obtained highly flexible and stretchable network-M/P mat exhibited a superior comprehensive sensing performance.
- The porous nHAC/PLGA/GO composite scaffolds significantly promotes cell adhesion and proliferation of MC3T3-E1.



Notes

Technical Special Session 27
Nanomaterial and Nanotechnology for Biological Applications (ss)

Room 1

10:20-12:20 Wednesday, 7 August

Organizer: Qiang Li

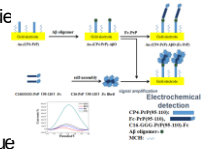
Co-Organizer: Zaixing Jiang

27-4 11:20–11:40

Electrochemical detection of amyloid-β oligomer with the signal amplification based on peptide assembly

Yujin Huang, Liang Yuan, Lei Liu*
Institute for Advanced Materials, Jiangsu University, People's Republic of China

- Soluble Aβ oligomers are the most neurotoxic specie and become reliable biomarker in Alzheimer's disease.
- The peptide we designed has high affinity for Aβ oligomer and can self-assemble into nanofibrils.
- The peptide displays a signal amplification effect due to its self-assembly.



Schematic illustration of the strategy for AβO detection.

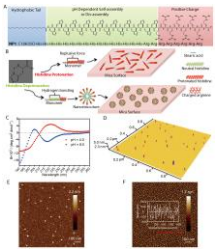
Notes

27-5 11:40–12:00

Histidine-Rich Cell-Penetrating Peptide for Cancer Drug Delivery and Its Uptake Mechanism

Lei Zhang
College of Biotechnology, Jiangsu University of Science and Technology, China
Department of Chemical Engineering, University of Waterloo, Canada

- A drug delivery system based on a systematically designed histidine-rich lipidated peptide
- Behaviors of peptide: a pH-responsive self-assembly and –disassembly
- Positively charged arginine amino acids facilitate peptide-drug direct translocation the negatively charged plasma membrane
- First author and co-corresponding author with Dr. Pingkai Ouyang (NJTech) and Dr. Pu Chen (UW)



Notes

Technical Special Session 28
Application of Ferroelectric Nano Materials (ss)

Room 2

10:20-12:20 Wednesday, 7 August

Organizer: Xiangzhong Chen

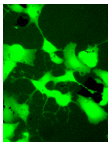
Co-Chair: Yaojin Wang

28-1 10:20–10:37

Integration of ferroelectric materials in microdevices for biomedical application

Xiangzhong Chen, Bradley J. Nelson, Salvador Pané
Multi-Scale Robotics Lab (MSRL), Institute of Robotics and Intelligent System
Swiss Federal Institute of Technology (ETH) Zurich, Switzerland

- Microrobots are emerging candidates for targeted therapeutic interventions.
- The implementation of piezoelectric building blocks can help develop highly-integrated small-scale machines.
- These magnetoelectric micro devices can wirelessly generate electric output.
- These micro devices find applications in biomedical field such as cell stimulation and drug delivery.



Neuron-like cells differentiated by electrostimulation

Notes

28-2 10:37–10:54

Piezo-catalysis for Nondestructive Tooth Whitening

Yaojin Wang
School of Materials Science and Engineering, Nanjing University of Science and Technology, Nanjing 210094, Jiangsu, China

- We report a nondestructive, harmless and convenient strategy based on piezo-catalysis effect.
- The teeth with vinegar stain can be notably whiten by the poled $BaTiO_3$ turbid liquid after vibration for 3 hours.
- Rhodamin B can be degraded using poled $BaTiO_3$ piezo-catalyst with a degradation rate constant of k=0.488 h^{-1}.
- The $BaTiO_3$-based piezo-catalysis tooth whitening exhibits less damage to both enamel and biological cells.

Figure 1. Piezo-catalysis effect and its working principle for tooth whitening

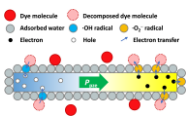
Notes

28-3 10:54–11:11

Piezocatalytic Effect of Perovskite-type Ferroelectric Nanomaterials

Ni Qin
School of Materials Science and Engineering, Sun Yat-sen University, China

- Perovskite-type ferroelectric nanomaterials was explored with respect to piezocatalytic effect.
- Influence of chemical composition and morphological features on piezocatalytic performance was focused.
- Piezo-response of nanocrystals to ultrasonification was simulated by FEM.
- This paper give further insight into the mechanism of piezocatalysis.



Schematics of the piezocatalytic mechanism

Notes

Technical Special Session 28
Application of Ferroelectric Nano Materials (ss)

Room 2

10:20-12:20 Wednesday, 7 August

Organizer: Xiangzhong Chen

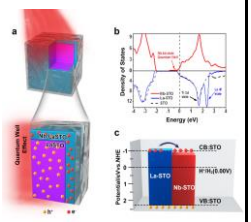
Co-Chair: Yaojin Wang

28-4 11:11–11:28

core-shell quantum well strcture for high performance photocatalysts

Feng Dang
Key Laboratory for Liquid-Solid Structural Evolution and Processing of Materials (Ministry of Education), Shandong University, China

- Nanoscale quantum well core-shell structure was successfully fabricated on the $SrTiO_3$ nanoparticle due to surface doping of Nb for the first time.
- The high photocatalytic efficiency is attributed to the unique nanoscale quantum well structure and graphene acted as charge acceptor. QW-$SrTiO_3$/GR hybrid also exhibits excellent stability and recyclability in the H_2 production process.



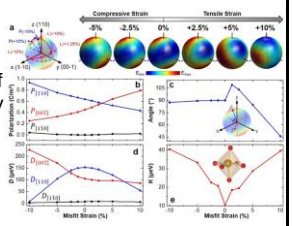
Notes

28-5 11:28–11:45

Domain Engineering and Magnetism in Multiferroic $BiFeO_3$ Thin Films----Redux

Zuhuang Chen
School of Materials Science and Engineering, Harbin Institute of Technology, Shenzhen, China

- Control Domain Variants by Oxygen Octahedral Rotation Coupling
- Deterministic control of all three types of stripe domains by engineering boundary conditions
- Unveil the origin of strain evolution of magnetic order in $BiFeO_3$ films



Notes

28-6 11:45–12:02

Methodology and Annealing Effect of Aerosol Deposited Hygroscopic Electroceramic for Humidity Sensor Applications

Cong Wang
Department of Microwave Engineering, Harbin Institute of Technology, China

- $BaTiO_3$-based sensing film is prepared through aerosol deposition method;
- Sensing film is annealed at 200 and 400 ºC to increase sensitivity of humidity sensor;
- Humidity sensing is analyzed through capacitance, open-area-ratio, and electric field distribution of capacitive devices;
- All capacitive devices are prepared via integrated passive device technology.

AD method-based electroceramic and its application in humidity sensor

Notes

Technical Special Session 28
Application of Ferroelectric Nano Materials (ss)

Room 2

10:20-12:20 Wednesday, 7 August

Organizer: Xiangzhong Chen

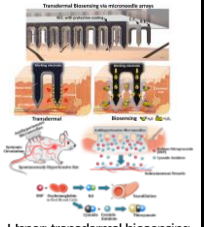
Co-Chair: Yaojin Wang

28-7 12:02–12:20

Application of Microneedles Patches in Transdermal Biosensing and Hypertension Treatments

Fanmao Liu
The First Affiliated Hospital, Sun Yat-sen University, Guangzhou, China

- Microneedle (MN) technique demonstrates versatile potentials in medical applications.
- Nanostructure integrated MNs sensor achieved real-time in vivo monitoring of subcutaneous reactive oxygen species (ROS).
- Antihypertensive MNs treatment provides an efficient, side-effects controllable and self-administrable therapy for hypertensive emergency.



Upper: transdermal biosensing of ROS via MNs sensor.
Lower: MNs patches for treating hypertensive emergencies

Notes

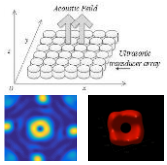
Technical Session 29
AFM and Applications
Room 3
10:20-12:20 Wednesday, 7 August
Chair: Zhili Long
Co-Chair: Yinan Wu

29-1 10:20–10:40

Simulation Model of Ultrasonic Array Acoustic Field for Particle Manipulation

Zhaotian Jiang, Zhili Long, Yuyang Yuan, Yan Jin
Department of Mechatronics, Harbin Institute of Technology(Shenzhen), China

- The mathematical model of acoustic manipulation is established based on ultrasonic phased array.
- The genetic algorithm (GA) is introduced into the phase optimization to get the optimal solution with high efficiency.
- The results show that the mathematical acoustic manipulation model is accurate and the genetic algorithm is efficient in the optimization of ultrasonic phased array.



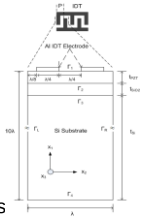
Notes

29-2 10:40–11:00

PZT based Multilayer Surface Acoustic Wave Device for High Frequency Applications

Muhammad Zubair Aslam[1], Varun Jeoti[1], Saravanan Karuppanan[2] and Ami Chand[3]
[1]Department of Electrical and Electronics Engineering, [2]Department of Mechanical Engineering, Universiti Teknologi PETRONAS, Malaysia. [3]Applied nanostructures, Inc., 415, USA

- There is need of high frequency and highly sensitive SAW devices with high electromechanical coupling coefficient
- The PZT/SiO_2/Si multilayer structure is proposed and the propagation of the Rayleigh and Sezawa surface acoustic wave mode are studied very first time
- The Sezawa wave mode has been established as more efficient surface acoustic wave mode in PZT/SiO_2/Si structure
- This mode can be utilized for high frequency future devices with edge of very high coupling coefficient



Geometry of PZT/SiO_2/Si structure

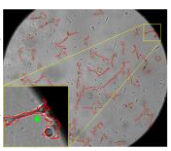
Notes

29-3 11:00–11:20

Design of Vision Assistant System for an Atomic Force Microscopy Based on Object Detection

Yifei Ren, Zhi Fan, Yinan Wu, Cunhuan Liu and Chao Wang
Institute of Robotics and Automatic Information System, Nankai University, China

- This paper designs a vision assistant system for an atomic force microscopy based on object detection
- An object distribution uniformity evaluation function is proposed to evaluate the uniformity of object distribution.
- A differential image binarization (DIB) method is proposed to detect the objects accurately



Detection Result of DIB Algorithm

Notes

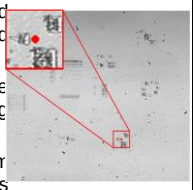
Technical Session 29
AFM and Applications
Room 3
10:20-12:20 Wednesday, 7 August
Chair: Zhili Long
Co-Chair: Yinan Wu

29-4 11:20–11:40

Geometrical Patterns Based Cross-scale Image Registration for AFM and Optical Microscopy

Ziqi Hu, Zhi Fan, Cunhuan Liu, Yinan Wu and Chao Wang
Institute of Robotics and Automatic Information System, Nankai University, Tianjin, China

- This paper proposes a geometrical patterns based cross-scale template matching algorithm for AFM and optical microscopy.
- A designed assessment function is applied to the whole image to calculate each point's matching possibility.
- Experiments show that the proposed algorithm provides an effective way for cross-scale images registration.



Matching Result of Triangle-shaped Pattern

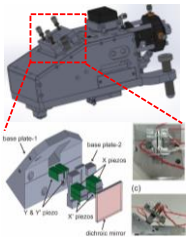
Notes

29-5 11:40–12:00

Development of wide-area tip-scanning high-speed atomic force microscopy

Hiroki Watanabe
IMS, ExCELLS, National Institutes of Natural Sciences, Japan

- A tip-scanning type high-speed AFM, which is combined with optical microscopy, has recently been developed.
- This system enables simultaneous imaging of high-speed AFM and optical microscopy, but scanning area of this combined system has been limited at few μm^2.
- To magnify the scanning range, we improved a design of a mirror unit which is the important part for cantilever tracking.
- The new designed mirror unit could track at the range of ~ 50 μm × 30 μm



Schematic image of tip-scanning HS-AFM (upper) and a mirror unit (bottom)

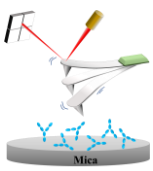
Notes

29-6 12:00–12:20

Direct imaging of IgE onto mica by tapping-mode atomic force microscopy

Jing Hu, Ying Wang, Mingyan Gao, Yujuan Chen, Zuobin Wang
International Research Centre for Nano Handling and Manufacturing of China, Changchun University of Science and Technology, China

The effect of protein concentration and adsorption time on IgE morphology of mica surface was investigated by atomic force microscopy (AFM). In addition, the height and average roughness of IgE were also obtained. The changes of IgE molecule morphology, height and average roughness indicated that the interaction of protein-surface and protein-protein is varying with the protein concentration and adsorption time.



Schematic diagram for imaging IgE by atomic force microscopy

Notes

Technical Session 30
Nanomechanics and Nanomechatronics
Room 4
10:20-12:20 Wednesday, 7 August
Chair: Hongyu Zhang
Co-Chair: Huaxian Wei

30-1 10:20–10:40

Research on friction properties of titanium alloy surface microstructure substrate titanium dioxide films

Ying Zhang
Ministry of Education Key Laboratory for Cross-Scale Micro and Nano Manufacturing, Changchun University of Science and Technology, China

1.Titanium alloy groove surface coated with films has the lowest coefficient of friction.

2.Titanium alloy groove surface coated with films has produces the shallowest scratch depth .

3. Titanium alloy groove surface coated with films has produces the least wear.

4.Titanium alloy groove surface coated with films is very slightly different from groove surface.

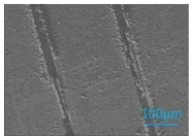


Fig.1. The pattern of wear scars on the surface of the grooved titanium alloy coated with TiO_2 films.

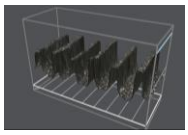
Notes

30-2 10:40–11:00

Condensation properties of grooved composite microstructured aluminum alloy surface

Meng Zhang
College of Mechanical and Electrical Engineering, Changchun University of Science and Technology, China

- Preparation of superhydrophobic aluminum alloy surface by using WEDM
- The condensation properties of the three surfaces were observed and it was found that the coagulation properties and wettability of the aluminum alloy surface were related.
- The superhydrophobic surface was found to have a large Laplacian pressure, which increased the anti-condensation effect of the surface.



Three-dimensional diagram of grooved composite microstructure

Notes

30-3 11:00–11:20

Construction of T-shaped microstructure on aluminum alloy surface

Wen Cheng
Changchun University of Science and Technology ; China

- Construction of a T-shaped trench and square pillar microstructure on the surface of aluminum alloy via EDM
- The processed surface exhibits both hydrophobic and high viscosity properties
- The processed surface also exhibits good chemical stability
- Provide basic research on the wetting mechanism of T-shaped microstructures

Water droplets on the surface of an aluminum alloy with a T-shaped microstructure

Notes

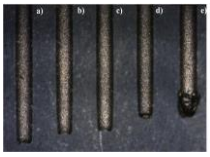
Technical Session 30
Nanomechanics and Nanomechatronics
Room 4
10:20-12:20 Wednesday, 7 August
Chair: Hongyu Zhang
Co-Chair: Huaxian Wei

30-4 11:20–11:40

Research on Processing Technology of MEDM for SiCp/Al Micro-hole

Guangxu Cui
Changchun University of Science and Technology, China

- the Processing Technology of MEDM for SiCp/Al is studied.
- the peak current and pulse width have a gentle effect on the micro-hole processing speed.
- the peak current and pulse width have a greater influence on the electrode loss and the linear influence trend is more obvious.
- the lower pulse frequency causes a peak like bulge at the bottom of the micro-holes
- Promote the popularization and application of micro-hole structures on SiCp / Al



Cross sectional view of micro-holes at different peak currents

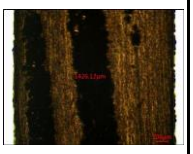
Notes

30-5 11:40–12:00

Study of effective hinge thickness of additive-manufactured flexure mechanisms

Huaxian Wei
Department of Mechatronic Engineering, Shantou University, China

- The reasons of variation of thickness correction factors between designs are clarified.
- Ten flexure samples were designed, additive-manufactured, measured and tested in detail.
- The deviation of hinge thickness is caused by an external layer formed by the melt particles.
- The effective hinge thickness of SLM flexure part is described better by a stable thickness deviation.



Pictures of the flexure hinges under microscope

Notes

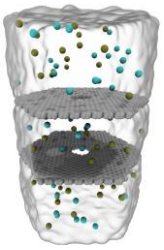
Technical Session 31
Nanomaterials and Applications
Room 5
10:20-12:20 Wednesday, 7 August
Chair: Guimiao Lin
Co-Chair: Zhengxun Song

31-1 10:20–10:40

A Double Nanopore System for Seawater Desalination

Chang Chen, Wei Si, Yu Qiao, Jingjie Sha*, Yunfei Chen
School of Mechanical Engineering and Jiangsu Key Laboratory for Design and Manufacture of Micro-Nano Biomedical Instruments
Southeast University, Nanjing, 211189, P. R. China

- Novel way for nanopore desalination
- A double nanopore system can successfully remove K^+ and Cl^- ions from the water in the area separated by the two membranes under the electric field
- Electrification of the upper and lower nanopores can significantly improve desalination efficiency
- The results are of great significance to the design of new nanopore desalination device



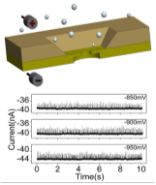
Notes

31-2 10:40–11:00

Size Characterization of Single Nanoparticles using Solid-state Nanopores

Qianyi Sun, Wei Si, Jingjie Sha*, Yunfei Chen
School of Mechanical Engineering and Jiangsu Key Laboratory for Design and Manufacture of Micro-Nano Biomedical Instruments,
Southeast University, P. R. China

- The current blockades are attributed to the translocations of the silver nanoparticles across the nanopore.
- For the same samples, the amplitude and the duration are related to the voltage.
- The amplitude increases when the size of samples enlarges under the same voltage.
- The work indicates nanopore is a high-throughput method for characterizing the size of nanoparticles.



Schematic diagram of nanopore system and the ionic current trace of translocations.

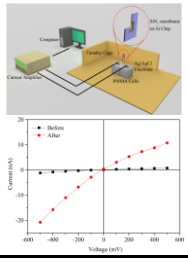
Notes

31-3 11:00–11:20

Fabrication of Nanopores using Controlled Dielectric Breakdown

Zhicheng Zhang, Qianyi Sun, Fangzhou Fu, Jingjie Sha*, Yunfei Chen
School of Mechanical Engineering and Jiangsu Key Laboratory for Design and Manufacture of Micro Nano Biomedical Instruments,
Southeast University, P. R. China

- Small-scale nanopores were fabricated on SiNx membranes by controlled dielectric breakdown successfully.
- Two different voltage types were used to fabricate nanopores: pulse voltage and constant voltage.
- The formation and the diameters of nanopores can be estimated from the current-voltage curves.
- It is an easier method to fabricate nanopores with a diameter about 2 nm.



Notes

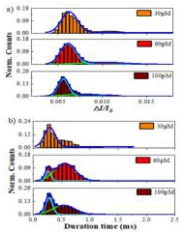
Technical Session 31
Nanomaterials and Applications
Room 5
10:20-12:20 Wednesday, 7 August
Chair: Guimiao Lin
Co-Chair: Zhengxun Song

31-4 11:20–11:40

Molecule concentration dependence of DNA translocation configuration through solid-state nanopores

Jiabin Zhao, Yin Zhang, Jingjie Sha*
Jiangsu Key Laboratory for Design and Fabrication of Micro-Nano Biomedical Instruments, School of Mechanical Engineering
Southeast University, Nanjing, 211189, P. R. China

- Co-translocation of DNA molecules is prone to occur at a high DNA concentration
- Decreasing bias voltage eliminates the phenomenon of co-translocation
- Capture region of solid-state nanopores reduces along with the nanopore size conspicuously
- The paper found that high DNA concentration and large pore size both cause DNA molecules to be captured simultaneously by the nanopore.



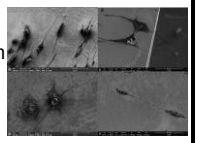
Notes

31-5 11:40–12:00

Growth of Nerve Cells Induced by Diverse Nanopillar Arrays

Mengnan Liu, Litong Dong, Xueying Yang, Xuan Guo, Xuan Wang, Chenchen Xie, Zhengxun Song, and *Zuobin Wang
International Research Center for Nano Handling and Manufacturing of china, Changchun University of Science and Technology, China

- Laser interference lithography is used to prepare nanopillar arrays with same and different size gaps in two directions
- Nerve cells have growth selectivity for the size of the gaps on different directions.
- Studying how anisotropic structure induce neuronal synapses is beneficial to the regenerative medicine



Growth of human neuroblastoma SH-SY5Y cells by nanopillar arrays with different size gaps

Notes

31-6 12:00–12:20

Are Engineered Nanoparticles Safe?-Toxicity Studies on Quantum dots

Guimiao Lin
Department of Physiology, Shenzhen University, China

In vitro cell model, QDs enter cells, cause cell dysfunction. In *vivo* animal model, QDs accumulated in the major organs, causing disorders in the immune and reproductive systems. Our research provides direct evidence of the bio-safety of QDs, but also a feasible method for evaluating nanoparticle toxicity.

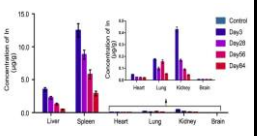


Figure1:In vivo biodistribution of In from QDs in major organs after injection.

Notes

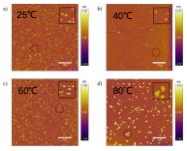
Technical Session 32
Biological Applications
Room 6
10:20-12:20 Wednesday, 7 August
Chair: Kostadin Kostadinov
Co-Chair: Chenchen Xie

32-1 10:20–10:40

AFM Study of Temperature and pH Effects on BSA Structure and Adhesion

Mengyi Hao, Yulin Ji, Yujuan Wang*, Yunfei Chen
School of Mechanical Engineering and Jiangsu Key Laboratory for Design and Manufacture of Micro- Nano Biomedical Instruments
Southeast University, P. R. China

- Temperature and pH are revealed to be effective techniques in transforming the structure of protein.
- The adhesion between BSA and silicon tips decreased when the temperature increased.
- Under strong acidic or alkaline conditions, the protein adhesion is reduced.
- It is important to explore the influence of environment on biological materials structure and properties.



AFM images of BSA at different heating temperatures.

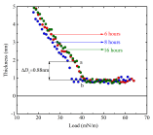
Notes

32-2 10:40–11:00

Adsorption of the Nafion Polymers on Mica Substrate in Water

Xuanxuan Zhang, Yajing Kan
School of Mechanical Engineering and Jiangsu Key Laboratory for Design and Manufacture of Micro- Nano Biomedical Instruments, Southeast University, Nanjing,China

- The adsorption of the Nafion on mica was characterized by the SFA technique
- The repulsive force at all distances between Nafion and mica surface
- Water molecules were extrude from the Nafion film under high load
- It is important to explore the structure of Nafion ultra-thin film at the interface



The thickness of Nafion film in water

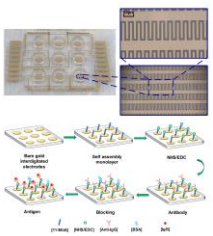
Notes

32-3 11:00–11:20

Electrochemical impedance immunosensor with micro scale interdigitated Au electrodes

Kai Jin[1,2], Siyi Hu[2], Zhe Liu, Chenxuan Hu[2], Wei Hou, Linrun Feng, Jinhua Li[1]*, Hanbin Ma[2]*
1.School of Science, Changchun University of Science and Technology, Changchun, P.R.China
2.CAS Key Laboratory of Bio-Medical Diagnostics, Suzhou Institute of Biomedical Engineering and Technology, Chinese Academy of Sciences, Suzhou, P.R.China

- A 3×3 micro scale interdigitated Au electrodes array was designed and fabricated.
- Verification and biofunctionalization of the interdigitated Au electrodes.
- Impedance testing of different concentrations of IgG on interdigitated electrodes.
- In this work, the detection limit of this immunosensor as low as 0.1 ng/ml.



Notes

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32-4 11:20–11:40

The hydrogen sensors based on the dandelion-like nanostructured TiO_2

Cheng Zhang
School of Mechanical Engineering, Xi'an Jiaotong University, China

- TiO_2 nanomaterials were prepared by hydrothermal method, and doped with Ag.
- TiO_2 nanomaterials were 3D dandelion-like structure.
- Gas sensors based on Ag-doped TiO_2 had a good response for H_2.
- Doping Ag nano structure formed TiO_2—Ag schottky contact.

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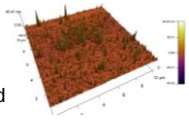
Notes

32-5 11:40–12:00

Formation of Nanosized Needles Structure in a Ultra-Thin Organic Film for Biosensor Applications

George Ivanov, Kostadin Kostadinov*, Zhengxun Song**
Nano Lab, University of Architecture, Civil Engineering and Geodesy, Bulgaria
**Mechatronics Dept., Institute of Mechanics, Bulgarian Academy of Sciences*
***Int. Research Centre for Nano Handling & Manufacturing, CUST, China*

- Water quality monitoring and cancer research applications require well-developed active layer for high sensitivity interaction with analyte.
- We propose ultra-thin organic films prepared by the LB method from a fluorescently labelled phospholipid
- From layers with thickness of 3 nm, suggesting fast reaction times, protrude stable over time around 10 nm high spikes with diameters from 50 to 300 nm.
- The well-developed 3D structure obtained is foreseen for biosensor applications with enhanced sensitivity.



AFM picture of a Langmuir-Blodgett (LB) monolayer from a fluorescently labelled phospholipid.

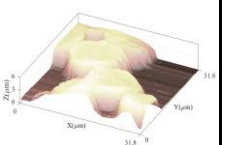
Notes

32-6 12:00–12:20

Characterizing the Disruption of HEK-293 Cell Membrane in AFM-based Indentation using Energy Limiter Method

Tianyao Shen
Department of Mechanical and Aerospace Engineering, Monash University, Australia

- Simulating the stress-deformation relationship in the deformed cell membrane using energy limiter method
- Identifying the disruption of the cell membrane based on the sudden force reduction
- Characterizing the energy limit of HEK-293 cell membrane in AFM-based indentation basing on experimental results



HEK-293 cells scanned by FlexAFM system.

Notes

Special Session: Junior Researcher Education And Development Forum

This forum is to popularize the advanced Nanotechnology and Interdisciplinary among young people, to enhance outstanding scientific teenagers' interest in learning and applying of the technology, therefore they are able to broaden horizons and establish scientific ideals. This forum will feature presentations from scientific teenagers who are actively involved in training in nanoscience and nanotechnology. Furthermore, the forum also helps to provide the platform for the young talents to meet the world leading scientists to present their ideas with their preliminary finding.

Presentations will be focused in the following area:

- Graphene Nanomaterials
- DNA nanotechnology
- e-beam lithography
- Molecular Biology Application & IGEM Introduction

Chairman:

Xu Ping
Virginia Wang
Dr.Aslan Husnu

Organizer:

BGI Juveniles Science Academy iBowu

Bomin Wei
Princeton International School of Math and Science

Zhu He
Dulwich College Beijing

Pekka Li
Beijing Keystone Academy

Steven Chen
Tilton School

Liangxi Chen
Fay School

Li Jiayi
Harrow Beijing

Ian Liu
The Stony Brook School

Chenhao Zhang
Beijing World Youth Academy

Tianjie Xu
Beijing Chaoyang Normal Affiliated Primary Schooi

Ziyu Liu
Harrow Beijing

Zixuan Fu
Beijing World Youth Academy

Daniel Shi
Shanghai Soong Ching Ling school

Yingxin Liu
Beijing World Youth Academy

Alice Wang
Suzhou Industrial Park Xinghai Experimental School

Pengjun Guo
RDFZ Chaoyang Branch School

Zian Liu
Harrow Beijing

Xian Cao
Beijing World Youth Academy

Karen Feng
Dalian American International School

Ziao Ji
KNOX Grammar School

Maria Meng
Beijing World Youth Academy

General Information

Zhenjiang, a pretty city

Zhenjiang has been called an “Urban Forest” since ancient times. There are 235 hills and 63 rivers in the city. 68.8% of the surface water meets high quality standards (Level III), and in the city proper, 42.3% of the land is under forest coverage. Zhenjiang is a national pioneering and demonstration city for ecological civilization, national low carbon pilot city and the only city in Jiangsu Province to conduct reforms for ecological development.

Climate

With a recorded history of over 3000 years, Zhenjiang is the cradle of the Wu Culture in ancient China. The city is home to many famous folktales and stories, such as Romance at Ganlu Temple, and Madam White Snake Flooding Jinshan Temple. China’s earliest existing anthologies of poetry and literature Wen Xuan, the first systematic work of literary criticism The Literary Mind and the Carving of Dragons, and many other literary masterpieces were written in Zhenjiang. The city is home to 6 higher education institutions and over 20 technical and vocational schools, with over 100,000 students enrolled. In the ranking of Innovation City in China, Zhenjiang ranks the nineteenth.

Architecture

Zhenjiang is situated between Shanghai Economic Circle and Nanjing Metropolitan Circle. There are five railway lines and five highways traversing the city. It takes one hour from Zhenjiang to Shanghai and four hours to Beijing by train. Zhenjiang has the longest deepwater shoreline along the Yangtze River in the Province, and the throughput of Zhenjiang Port is 150 million tons..

Culture

It’s among the province’s top 5 cities in terms of major per capita economic indexes. All the three county-level cities are Top 100 Counties in China. High-end equipment manufacturing and new materials are two industries with output value exceeding 100 billion Yuan individually. Zhenjiang has one national economic and technological development zone, one national-level hi-tech industrial development zone, one national-level comprehensive bonded zone, six provincial-level economic development zones, and eighty industrial parks.

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Changchun University of Science and Technology

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Conference Venue

All sessions will be held at The Crowne Plaza Zhenjiang

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Electricity

The electric current used in China is 220V 50Hz. The hotels can provide 220V power outlets. Please note that plug adapters may be necessary.

Dialing Codes

China International Country Code: +86

Zhenjiang’s Local Area Code: 0511

Index of Authors

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