Conference Program

Digest

The 14th International Conference on Manipulation, Manufacturing and Measurement on the Nanoscale

IEEE 3M-NANO 2025

Changchun, China

28 July - 1 August 2025

Organized by

Jilin University, China

International Research Centre for Nano Handling and Manufacturing of China

Changchun University of Science and Technology, China

Changchun University of Technology, China

Jilin University of Chemical Technology, China

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Greetings

On behalf of the organizing committee, it is our great pleasure and honor to welcome you in Changchun at IEEE 3M-NANO 2025 conference!

3M-NANO is the annual International Conference on Manipulation, Manufacturing and Measurement on the Nanoscale. It will be held on 28 July - 1 August 2025 in Changchun, China. The ultimate ambition of this conference series is to bridge the gap between nanosciences and engineering sciences, aiming at technology opportunities and new markets. The advanced technologies for manipulation, manufacturing and measurement at nanoscale promise novel revolutionary products and methods in numerous areas of application. Scientists working in research fields related to 3M-NANO topics are invited to submit papers. All accepted full papers (presented at the conference and following IEEE format) will be submitted in IEEE Xplore database and Ei Compendex. Selected papers will be recommended for publication in the IEEE Trans. on Automation Science & Engineering, Int. J of Nanomanufacturing, IFAC Mechatronics, Int. J of Optomechatronics, J of Micro-Bio Robotics, Journal of Bionic Engineering, Light: Science & Applications, Optics and Precision Engineering, eLight, Light: Advanced Manufacturing and other SCI/EI journals.

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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 2025 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 2025. Last but definitely not least, we thank all the conference participants for their support and contribution. We do hope that IEEE 3M-NANO 2025 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 Changchun!

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Conference Information

Venue and Accommodation

Venue

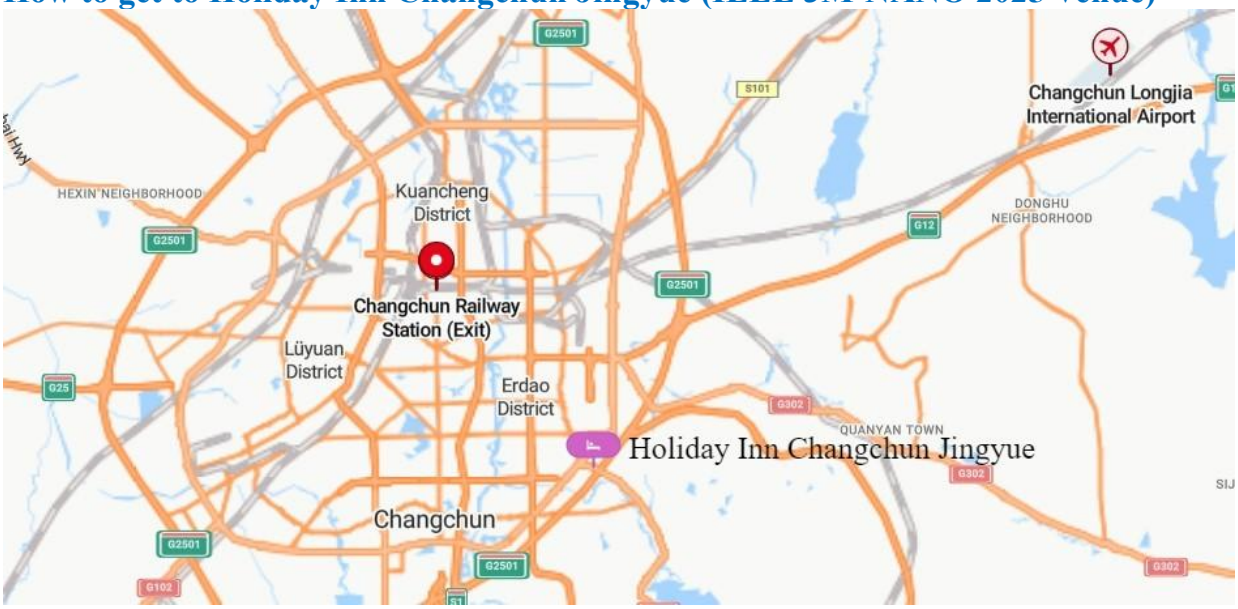
Holiday Inn Changchun Jingyue

Opened in 2021, the Holiday Inn Changchun Jingyue is a great accommodation choice in Changchun. Holiday Inn Changchun Jingyue is 19 km from Changchun South Railway Station and 37 km from Changchun Longjia International Airport. Just a short walk from Jinhejie Metro Station, traveling to most city destinations is a breeze. Keeping busy is easy, with Daishu Jimi Bengchuang Theme Park, Jilin Provincial Museum of Natural History and Taiyangli Square all nearby. After a long day of sightseeing, guests can retire to the comfort of the hotel. This Changchun hotel provides parking on site. According to our guests, this hotel provides a very high level of service.

InterContinental Hotels & Resorts has delighted luxury travelers since 1946, serving as a meeting place for heads of state, a setting for world-changing speeches, and the impetus for some of the most famous love stories of all time. Synonymous with bold exploration, cultural discovery and the worldliness that travel brings, every stay will take the imagination to places that never be expected.

Accommodation

How to get to Holiday Inn Changchun Jingyue (IEEE 3M-NANO 2025 Venue)



From Changchun Longjia International Airport (37 km to Holiday Inn Changchun Jingyue)

Plan A: Public transport (Airport Bus Line 2—Changchun Rail Transit Line 3): take the Bus Line 2 for 1 stop (direction of Weixing Square expressway passenger transport) to Conference & Exhibition Center station, walk 193 m to take Changchun Rail Transit Line 3 for 4 stops (direction of Changchun Movie Wonderland station) to Jinhe Street station, walk 541 m to Holiday Inn Changchun Jingyue. (About 1 hour and 26 minutes, 744 m on foot, 27 yuan)

Plan B: Public transport (Airport Bus Line 3—Bus G102): take the Bus Line 3 for 2 stops (direction of Kaixuan Road passenger station) to Lequn Street station, walk 244 m to take Bus G102 for 13 stops (direction of Tianze road) to Jinping Street station, walk 532 m to Holiday Inn Changchun Jingyue. (About 1 hour and 48 minutes, 1 km on foot, 27 yuan)

Plan C: Taxi: about 35 minutes, about 70 yuan.

From Changchun Railway Station (19 km to Holiday Inn Changchun Jingyue)

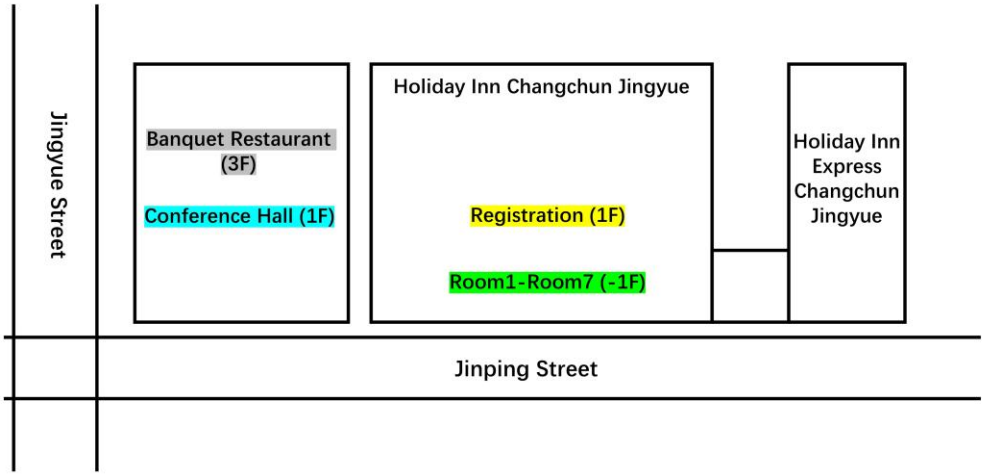
Plan A: Public transport (Changchun Rail Transit Line 1—Changchun Rail Transit Line 3): take Changchun Rail Transit Line 3 for 7 stops (direction of Hongzuizi station) to Weixing Square, transfer to Changchun Rail Transit Line 3 for 9 stops (direction of Changchun Movie Wonderland station) to Jinhe Street station, walk 541 m to Holiday Inn Changchun Jingyue. (About 53 minutes, 807 m on foot, 4 yuan)

Plan B: Taxi: about 30 minutes, about 40 yuan.

Floor Map of Conference Rooms

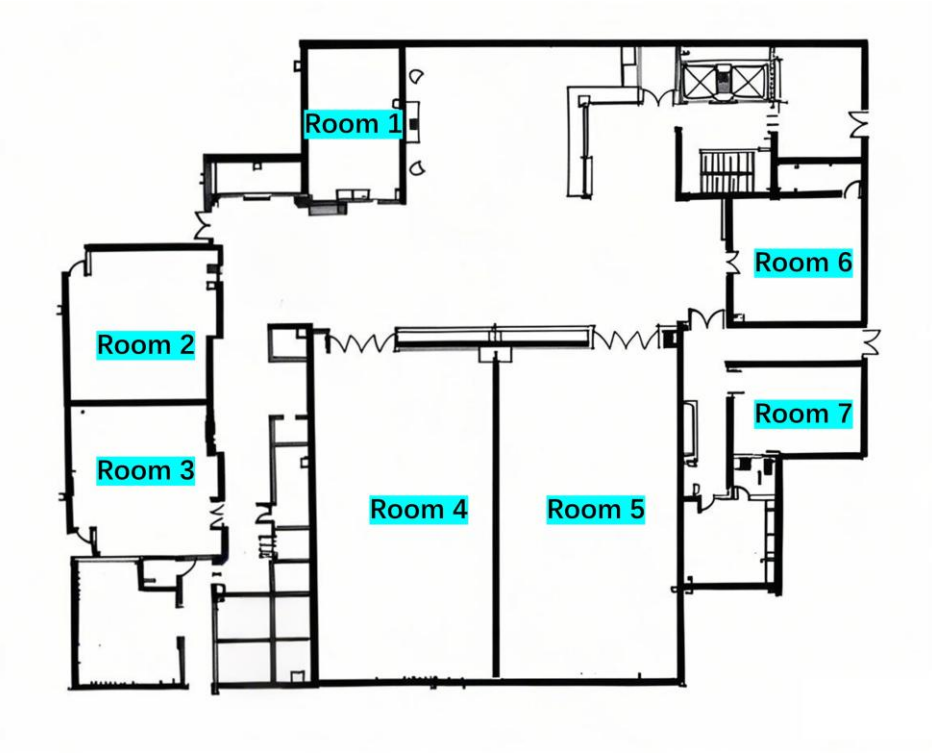
Conference registration will be arranged on the following days:

General View



1F

-1F



1F: Conference Hall
-1F: Room 1 - Room 7

28 July, Holiday Inn Changchun Jingyue Lobby, 1F

29 July - 31 July, Holiday Inn Changchun Jingyue Conference Hall, 1F/-1F

IEEE 3M-NANO 2025
Program at a Glance

Monday, 28 July, 13:00-18:00	
Registration	
Tuesday, 29 July, 8:30-18:50, Conference Hall	
08:30—08:50	Opening Ceremony
08:50—10:50	Keynote Reports (4)
10:50—11:10	Break
11:10—12:40	Keynote Reports (3)
12:40—14:30	Lunch
14:30—16:30	Keynote Reports (4)
16:30—16:50	Break
16:50—18:50	Keynote Reports (4)
18:50—21:00	Welcome Banquet
Wednesday, 30 July, 8:30-18:50, Rooms 1-7	
08:30—10:30	Parallel Technical Sessions
10:30—10:50	Break
10:50—12:50	Parallel Technical Sessions
12:50—14:30	Lunch

14:30—16:30	Parallel Technical Sessions
16:30—16:50	Break
16:50—18:50	Parallel Technical Sessions
18:50—21:00	Conference Dinner
Thursday, 31 July, 08:30-12:50, Rooms 1-6	
08:30—10:30	Parallel Technical Sessions
10:30—10:50	Break
10:50—12:50	Parallel Technical Sessions
12:50—14:30	Lunch
Thursday, 31 July, 14:30-19:30, Conference Hall	
14:30—15:00	Editor Reports (2)
15:00—16:30	Keynote Reports (3)
16:30—16:50	Break
16:50—18:20	Keynote Reports (3)
18:20—19:00	Closing Ceremony
19:00—21:30	Farewell Banquet
Friday, 1 August	
Social Culture Activities	

Schedule of the Keynote Reports

Tuesday, 29 July 2025, Conference Hall, 1F

Time	Topic	Speaker
Session Chair: Ricardo Garcia		
08:50 – 09:20	The Triboelectric Nanogenerator - A Disruptive Energy Technology and Sensing Technology	Zhonglin Wang
09:20 – 09:50	Applications of Discontinuous Metal Thin Films to Electronics Packaging	James Morris
09:50 – 10:20	Nanoplastics and PFAS: Unveiling the Pathway for Contaminant Transport and Toxicity in Aquatic Systems	Istvan Szilagyi
10:20 – 10:50	Force Mediated Reactivity and Emergence in Low Dimensional Molecular Systems	Harald Fuchs
Session Chair: Federico Rosei		
11:10 – 11:40	On-Surface Precise Synthesis of Carbon-Based Functional Molecules and Polymers	Lifeng Chi
11:40 – 12:10	Mechanics of Adhesive Viscoelastic Contacts	Valentin Popov
12:10 – 12:40	Reversible Assembly of Iron Oxide Nanoparticles on Gold Nanorods for Magnetic Alignment and Plasmonic Control	Joseph Tracy
Session Chair: Tomaso Zambelli		
14:30 – 15:00	In-Operando Microscopy and Spectroscopy Measurements on 2D Materials and Devices	Yong P. Chen
15:00 – 15:30	Solid-Water Interfaces at the Molecular Scale	Ricardo Garcia
15:30 – 16:00	Magnetic Miniature Robots for Endoluminal Interventions: From Individual to Microswarms	Li Zhang
16:00 – 16:30	How Can Microfluidic Tools Help during the Self-Assembly and Engineering of Advanced Functional Materials and Crystals	Josep Puigmarti-Luis

Session Chair: Tom Luo		
16:50 – 17:20	FluidFM for Electrochemical Micro Additive Manufacturing of Metals and Polymers	Tomaso Zambelli
17:20 – 17:50	Robotic Endovascular Intervention Utilizing Magnetic Navigation System and Magnetic Microrobot	Gunhee Jang
17:50 – 18:20	SpiCy-MiNT Robotic Technology for Micro and Nano Biomedical Applications	Kostadin Kostadinov
18:20 – 18:50	Expanding the Prospects of Development and Production of Modern Batteries through Laser Technologies	Wilhelm Pfleging

Schedule of the Keynote Reports

Thursday, 31 July 2025, Conference Hall, 1F

Time	Topic	Speaker
Session Chair: Mingdong Dong		
14:30 – 14:45	IOP Publishing NANO and IOP Fellow	Chaoyu Wu
14:45 – 15:00	Light: Science & Applications, eLight, Light: Advanced Manufacturing: Top Tier Journals in Optics	Chenzi Guo
15:00 – 15:30	Materials for the Future	Konstantin Novoselov
15:30 – 16:00	Transforming Antigenic Portable Technologies into Highly Dependable Screening Devices	Luisa Torsi
16:00 – 16:30	pH-Sensitive Clay Nanomaterials for Enhanced Solid Tumor Immunotherapy	Zhiping Xu
Session Chair: Luisa Torsi		
16:50 – 17:20	Distinct Binding Mechanism of SARS-CoV-2 Spike Variants Leads to Enhanced Infectivity and Viral Transmission	Peter Hinterdorfer
17:20 – 17:50	Construction of Functional Artificial Cells	Xiaojun Han
17:50 – 18:20	Magnetic Micro- and Nanorobots for Biomedical Applications	Salvador Pané Vidal

Invited Speakers

(in alphabetical order)

Light: Science & Applications, eLight, Light: Advanced Manufacturing: Top Tier Journals in Optics

Chenzi Guo

Deputy Head of Light Publishing Group

Director of journal eLight

Editor of journal Light: Science & Applications

China

Light Academic Publishing Center:

Light Academic Publishing Center is the technical support department responsible for the planning and publishing of academic journals and monographs of Changchun Institute of Optics, Fine Mechanics and Physics (CIOMP), Chinese Academy of Sciences (CAS). Responsible for the editing, publishing and distribution of light: Science & Applications (light), elight, light: advanced manufacturing (LAM), optical precision engineering, optics of China, Journal of luminescence, liquid crystal and display.

At present, light academic publishing center manages seven kinds of academic journals. They are Light: Science & Applications (Light), Light：Advanced Manufacturing (LAM), eLight, Optics and Precision Engineering (OPE), Chinese Optics (CO), Chinese Journal of Luminescence (CJL), Chinese Journal of Liquid Crystals and Displays (CJLCD).

IOP Publishing NANO and IOP Fellow

Chaoyu Wu
Editorial Development Manager
IOP Publishing
China

IOP Publishing:

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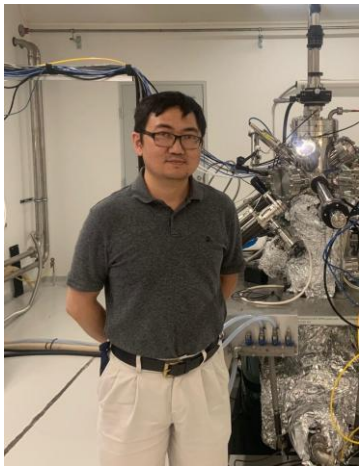
Keynote Speakers

(in alphabetical order)

In-Operando Microscopy and Spectroscopy Measurements on 2D Materials and Devices

Yong P. Chen
Professor
Department of Physics and Astronomy
Aarhus University
Denmark



Abstract: Two-dimensional materials offer unique opportunities to perform multimodal, “in-operand”, (nano) device-compatible measurements combining various surface science/optical microscopies and spectroscopies with electrical transport/gating, to gain a microscopic and deeper understanding of materials properties and device performance. This talk will describe several examples of such measurements in various gated 2D materials (including twisted/stacked heterostructures) ranging from graphene, 2D magnets and semiconductor transition metal dichalcogenides (TMDCs), studied by optical spectroscopy, angle resolved photoemission spectroscopy (ARPES), and scanning probe microscopie (SPM).

On-Surface Precise Synthesis of Carbon-Based Functional Molecules and Polymers

Lifeng Chi

Professor
Academician of the Chinese Academy of Sciences
Foreign Member of Academia Europaea
Institute of Functional Nano & Soft Materials (FUNSOM)
Soochow University
China

Abstract: On-surface Chemistry enables the activation, migration, and coupling of precursor molecules on surfaces to synthesize functional molecules and polymers that are challenging to obtain through traditional methods. Its key advantage lies in the precise structural control of products, achieved through multiple approaches, including precursor design, molecule-substrate/molecule interactions, molecular pre-assembly, and single-molecule manipulation. Representative reported products include structurally tunable graphene nanoribbons, graphdiyne nanowires, polymerized polyenes, molecular quantum materials, and metal-organic hybrids. High-resolution techniques such as scanning tunneling microscopy (STM), bond-resolved atomic force microscopy (br-AFM), scanning tunneling spectroscopy (STS), and single-molecule manipulation allow precise characterization of the surface reactions and fundamental properties of functional carbon-based molecules and polymers. The advancement of on-surface chemistry provides novel strategies for atomic-level precision synthesis and property characterization of molecular materials, opening avenues for designing next-generation functional materials with tailored properties.

Force Mediated Reactivity and Emergence in Low Dimensional Molecular Systems

Harald Fuchs

Professor
Head
Physikalisches Institut and Center for Nanotechnology (CeNTech)
Westfälische Wilhelms-Universität Münster
Germany

Abstract: The development of sophisticated mechanical processing strategies laid the foundation in material sciences and technology to control not only the mechanical but also the electronic and optical properties of materials and devices to a previously unimaginable extent. Common to these strategies is the treatment of systems containing very large numbers of atoms or molecules being exposed to energy applied via extrinsic mechanical forces such as in ball mills. In this conventional mechanochemistry, macroscopic forces are used to modify the atomic or molecular arrangement in materials, and to break up or to form new chemical bonds. However, the local control and direct analysis of the reaction pathways and the energy injection at the individual chemical bond level at pre-defined atomic sites is inaccessible in this way. Here, we will focus on the occurrence of local intrinsic mechanical forces occurring at the atomic level by the interplay of individual molecules with metallic surfaces, and in the absence of any extrinsic forces. We found that this strategy can be used to generate emergent molecular properties as observed in the case of autonomously acting 2D swarm-like metal organic molecular systems acting cooperatively and resulting, for example, in the directed transport of nano-objects over mesoscopic distances.

Solid-Water Interfaces at the Molecular Scale

Ricardo Garcia

Professor
Instituto de Ciencia de Materiales de Madrid (ICMM)
CSIC
Spain

Abstract: This contribution introduces some recent advances of atomic force microscopy to imaging with angstrom-scale resolution the properties of several solid-liquid interfaces with relevance in materials for energy and molecular biology. The presentation is devoted to introduce and illustrate the capabilities of 3D-AFM to image with atomic-scale resolution the interfacial structure of surfaces immersed in aqueous solutions. Atomic-scale images of interfacial water on graphite, 2D materials, self-assembled monolayers and collagen nanoribbons will be presented.

Construction of Functional Artificial Cells

Xiaojun Han

Professor

Head of Chemistry Department

School of Chemistry and Chemical Engineering

Harbin Institute of Technology

China

Abstract: Life begins with cells. Artificial cells are cellular like structures that can mimic some (or all) of cell structures and functions. Building artificial cells from the bottom up helps to reveal the working mechanism of cells and provide a theoretical basis for the origin of life. Targeting the key issues in this field, we carried out following projects in recent years. Par system was reconstituted into GUVs to realize the even plasmids segregation and inheritance mimicry. The mechanism of the influence of osmotic pressure on vesicular deformation was clarified to construct a divisible artificial "eukaryotic cell". Glycolysis metabolic pathway was rebuilt inside an artificial cell for the synthesis of amino acid. We developed a method to construct non spherical organelles to mimic chloroplast grana capable of capturing light energy. The artificial cells capable of carbon fixation and NO production were built. We built spatial coded artificial tissues using magnetic and acoustic fields. These tissues possessed the vasodilation and muscle contraction functions.

Distinct Binding Mechanism of SARS-CoV-2 Spike Variants Leads to Enhanced Infectivity and Viral Transmission

Peter Hinterdorfer

Professor
Institute for Biophysik
Group Leader Atomic Force Microscopy
Johannes Kepler University Linz
Austria

Abstract: Recent waves of COVID-19 correlate with the emergence of the Delta and the Omicron variant. In this study, we combined high-speed atomic force microscopy with single molecule recognition force spectroscopy to investigate, at single molecule resolution, the interaction dynamics of trimeric Spike with its essential entry receptor ACE2. We report that Spike trimer undergoes rapid conformational changes on surfaces, resulting in arc-like movements of the three receptor binding domains (RBDs) that collectively screen a circular range of almost 360° degrees. Acting as a highly dynamic molecular caliper, it thereby forms up to three tight bonds through its RBDs with ACE2 expressed on the cell surface. The Spike of both Delta and Omicron (B.1.1.529) variant enhance and markedly prolong viral attachment to the host cell receptor ACE2, which likely not only increases the rate of viral uptake, but also enhances the resistance of the variants against host-cell detachment by shear forces such as airflow, mucus or blood flow. We uncovered distinct binding mechanisms and strategies employed by circulating SARS-CoV-2 variants to enhance infectivity and viral transmission. The capacity of lectins to block SARS-CoV-2 viral entry holds promise for pan-variant therapeutic interventions. Out of a lectin library, two lectins, Clec4g and CD209c, were identified to strongly bind to the Spike protein of SARS-CoV-2. Multiple bond formations lead to stable complex formation, in which the number of formed bonds enhanced the overall interaction strength and dynamic stability of the lectin/Spike complexes. We also determined the binding capacity of a molecularly engineered lectin cloned from banana, BanLec H84T, which was shown to display broad-spectrum antiviral activity against several RNA viruses. Our studies revealed that H84T-BanLec strongly interacts with the Spike protein of the original viral strain, Wuhan-1 and several variants of concern (Delta, Omicron), which makes it a promising clinical candidate for defeating viral infectivity and transmission.

Robotic Endovascular Intervention Utilizing Magnetic Navigation System and Magnetic Microrobot

Gunhee Jang

Professor
Member of the National Academy of Engineering of Korea
Department of Mechanical Engineering
Hanyang University
Korea

Abstract: Robotic endovascular intervention has been actively studied to replace the incomplete conventional endovascular intervention performed by medical doctors. A robotic intervention system consists of a magnetic navigation system that generates an external magnetic field, a robotic feeding device that inserts surgical devices and performs treatment functions such as suction and drug delivery, and magnetic microrobots that includes magnetic catheter or magnetic guidewire. In this talk, I will introduce a robotically assisted magnetic navigation system and a control method that can improve the magnetic flux density and magnetic field gradient. I will also present a separable and recombinable magnetic robot (SRMR) to deliver and retrieve an untethered magnetic microrobot (UMR) to a target vascular lesion safely and effectively for robotic endovascular intervention. The SRMR functions of steering, separation, movement, tunneling, drug delivery, and recombination will be discussed in a mimetic vascular model with a pseudo blood clot. Finally, I will introduce an in vivo experiment of a mini pig's superficial femoral artery for contrast delivery, separation, movement, and recombination.

SpiCy-MiNT Robotic Technology for Micro and Nano Biomedical Applications

Kostadin Kostadinov

Professor
Institute of Mechanics
Bulgarian Academy of Sciences
Bulgaria

Abstract: The subject of this presentation is the enabling robot technologies for innovative micro &nano biomedical applications. This SpiCy-MiNT technology is combining the self-assembly technology with high performance robotic tools such as precise manipulators with submicron resolution and mechatronic handling or feeding devices, innovative vision to detect either micro objects or the tip of the technological end-effector, force sensing and robot system control.

The SpiCy-MiNT robot technology includes web application for facilitation of the synthesis of closed structures for micro- and nano-applications, utilizing the advantages tense piezo-actuators and closed robot kinematical structures. The robot for desired biomedical technology task requested micro and micro motions is constructing as a combination of a regional and local robot structures. The kinematic schemes for local robot structure utilize either stack piezo actuators or piezo structured ceramics with tense closed kinematic structure. For this purpose it is developed a methodology for synthesis of closed structures for micro- and nano-applications, utilizing the advantages of tense piezo-actuators, structured piezo-ceramics and closed robot kinematics structures. A force sensor for sub μN force range has been developed providing the robot control system with desired resolution feedback which is appropriate for biological micro- and nano technological operations. Appropriate optical system is developed to provide high-resolution imaging of the injection pipette over the working area defined by the cells holder dimensions, i.e. resolution of 4 μm and field of view 1 x 1 mm^2. Demonstrator systems with accent on manipulation and processing of micro objects with dimensions below 1 mm such as biocells, bacteria etc. are chosen to validate the SpiCy -MiNT technology developed. A SpiCy-MiNa robot developed with 7 DoF performs injections of single Xenopus oocyte and hard to transfer cells (HTC) with size of 10-15 microns. Another robot Microna developed for automation of ICSI procedure has been verified and demonstrated that it is realizing automated ICSI procedure for a less than one minute.

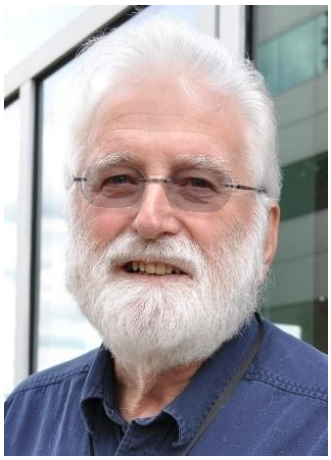
How Can Microfluidic Tools Help during the Self-Assembly and Engineering of Advanced Functional Materials and Crystals

Josep Puigmartí-Luis

Professor
Head of the ChemInFlow group
Department of Physical Chemistry
University of Barcelona
Spain

Abstract: Controlling and understanding the mechanisms that govern crystallization processes is crucial in contemporary materials science, particularly in the field of reticular solids, where significant challenges remain. In this seminar, I will demonstrate how microfluidic synthetic conditions can control the size and shape of various functional porous crystals, such as metal-organic frameworks (MOFs) and covalent-organic frameworks (COFs). Specifically, I will show that microfluidic synthesis can produce the largest MOF single crystals with controlled nonequilibrium shapes reported to date, in contrast to the typical polyhedral microcrystals formed under bulk crystallization conditions. Additionally, I will illustrate how microfluidic technologies can address several challenges in the COF research area. For instance, I will demonstrate that a microfluidic device can enhance the processability of COFs, enabling the creation of macroscopic architectures composed solely of COFs with arbitrary shapes. This is particularly significant given that COFs are typically obtained as powders with limited solubility and no melting point, making conventional processing techniques like solution processing or melt-extrusion inapplicable, which also hinders their use in many potential applications. Moreover, I will also present how our group utilizes microrobotic platforms to apply MOFs and COFs in biotechnology and other advanced fields. These microrobotic systems enable precise 3D manipulation of MOFs and COFs, facilitating innovative applications such as targeted drug delivery, biosensing, and tissue engineering. By integrating microrobotics with our advanced synthesis techniques, we can create highly specialized and functional materials tailored for specific biomedical applications. This approach not only enhances the versatility and functionality of MOFs and COFs but also opens new avenues for their use in cutting-edge biotechnological solutions.

Applications of Discontinuous Metal Thin Films to Electronics Packaging



James Morris

Emeritus Professor
Department of Electrical & Computer Engineering
Portland State University
IEEE Life Fellow
President (2020-2021), IEEE Nanotechnology Council
USA

Abstract: When a metal is deposited on insulating substrate, e.g., Au on glass in vacuo, it initially grows as discrete nanoscale metal islands separated by nm gaps. Such films conduct charge by interisland tunnelling with an electrostatic activation energy. The presentation will briefly cover the widely accepted conduction model and a revised contact injection version which explains most of the former's problems as an introduction. There is a large body of literature on discontinuous metal thin film (DMTF) applications as strain gauges and hydrogen sensors which both have potential applications as reliability sensors in electronics packaging, but the presentation will cover a much wider range of less developed technologies, especially one suggested by a recent analysis of AC data. Early interest in these DMTFs was frustrated by a lack of reproducibility in their fabrication and subsequent drift in properties and the presentation will briefly survey some suggestions to solve both the reproducibility and reliability problems. It will conclude with the description of a fabrication technique which holds the promise of manufacturability and commercial applications.

Materials for the future

Konstantin Novoselov

Nobel Laureate
2010 Nobel Prize in Physics
Academician of Academia Europaea
Director of Institute for Functional Intelligent Materials (I-FIM)
National University of Singapore, Singapore
Langworthy Professor of Physics
The University of Manchester
UK

Abstract: Graphene and 2D materials, despite being relatively fresh materials, have already taken a firm place in research, development and applications. A number of exciting phenomena have been discovered in these crystals and they continue bringing exciting results on a regular basis. However, probably the most important characteristic about 2D materials is that they offer a possibility to form on-demand van der Waals heterostructures, where individual 2D crystals are stacked together, forming a novel, 3D structure, which composition (and thus, their properties) can be controlled with atomic precision. This have opened a new directions of research: materials on demand. The properties of the resulting heterostructure can be designed with very high precision. The space of parameters is so large that the use of machine learning methods becomes essential.

So, what is next for materials science after the dream of "materials on demand" has been realised? One of the dreams are materials which have some characteristics of biological systems: those with self-healing capabilities, with memory functions, those which can evolve differently depending on external conditions. I will be discussing the methodologies to design such artificial living systems and the areas of their applications.

Expanding the Prospects of Development and Production of Modern Batteries through Laser Technologies

Wilhelm Pfleging

Professor
Group Leader-Laser Technology/Lithium-Ion Batteries
Institute for Applied Materials (IAM-AWP)
Karlsruhe Institute of Technology (KIT)
Germany

Abstract: Laser technology is paving the way to modernize and increase the efficiency of battery production processes, preparing them for the next generation of high-performance batteries. Initial concerns about integrating lasers into battery and module manufacturing have dissipated, and already laser-assisted processes have replaced conventional methods, significantly improving production efficiency and quality. For instance, laser welding has become the dominant process in module manufacturing, replacing traditional joining techniques, such as resistance spot welding. A similar transformation is expected for laser cutting, notching and slitting of electrodes. Developed in the last decade, laser cutting is becoming increasingly important for separating electrodes due to its improved cutting-edge quality. Technological advances in high-power fiber lasers, blue diode lasers, and ultrashort pulse lasers open the future prospect of increased laser use in battery manufacturing. While laser cutting and welding replace conventional methods and improve production efficiency without altering battery properties, laser-assisted development of 3D electrodes is being developed to significantly and specifically increase electrochemical performance, opening new perspectives for long lifetime as well as high-power and high-energy battery systems. The 3D battery concept provides access to new electrode designs with optimized diffusion kinetics and wetting behavior and reduced mechanical degradation. Laser printing and ablation complement each other in the development of those 3D electrode architectures. This presentation highlights optimized 3D electrodes that enhance battery lifetime, high-charge capability, energy and power density, and safety by minimizing lithium plating during fast charging.

Mechanics of Adhesive Viscoelastic Contacts

Valentin Popov

Professor

Director of Institute of Mechanics
Department System Dynamics and Friction Physics
Technical University of Berlin
Germany

Abstract: Adhesion plays a key role in a very wide variety of natural systems and technological applications. First, among them are biology and medicine. Cell adhesion controls growth, differentiation, and proliferation of cells. It plays a vital role in medical technologies ranging from simple plasters to drug delivery systems involving liposomes and other nanoparticle-based carriers. Typically, high adhesion is observed in contacts of easily deformable bodies (soft matter), which in praxis are viscoelastic media. For long time, it was believed that “first-principle” criteria like Griffith’ energetic criterion cannot be applied to viscoelastic contacts due to their dissipative nature. In the present paper, we argue that it might be possible to apply the energy balance principle in a pure and exact way to viscoelastic adhesive contacts too. This new approach sheds a new light to many well-known phenomena in adhesion of viscoelastic bodies which had no clear theoretical explanation so far. The modified energetic approach to adhesion of viscoelastic bodies provides a simple tool for analyzing, designing and controlling adhesion of soft matter.

Nanoplastics and PFAS: Unveiling the Pathway for Contaminant Transport and Toxicity in Aquatic Systems

Istvan Szilagyi

Associate Professor
Department of Physical Chemistry and Materials Science
University of Szeged
Hungary

Abstract: The presence of nano-sized plastic contaminants in aquatic environments has raised significant concerns regarding their interactions with other emerging pollutants. Among these, per- and polyfluoroalkyl substances (PFAS) are of particular interest due to their widespread use, environmental persistence, and potential toxicity. This keynote talk explores recent advances in understanding how nanoplastics act as carriers for PFAS, influencing their transport, adsorption behavior, and biological impacts. Important findings on the role of charge and fluorocarbon chain length in PFAS adsorption onto nanoplastic surfaces will be discussed, highlighting how these interactions modulate PFAS mobility in water. In addition, insights into the colloidal stability of PFAS-nanoplastic complexes will be presented, drawing connections to their cytotoxicity and potential implications for aquatic ecosystems. By integrating findings from multiple studies, this talk will provide a comprehensive perspective on the dual threat posed by nanoplastics and PFAS, emphasizing the urgent need for regulatory strategies and further research into their combined environmental and health risks.

Transforming Antigenic Portable Technologies into Highly Dependable Screening Devices

Luisa Torsi

Professor
University of Bari
Vice-President of the Scientific Committee of the Italian National Research Council
President of the Regional Center on Single-Molecule Digital Assay
Past-President of the European Material Research Society
Italy

Abstract: The emerging field of ionic and electronic devices for biosensing applications, holds promise for advancing the development of innovative diagnostic technologies. The endeavor to screen asymptomatic organisms, encompassing humans, animals, and plants, through the utilization of point-of-care-testing (POCT) technologies boasting high diagnostic accuracy is both visionary and promising. Efficient surveillance necessitates the development of user-friendly, cost-effective, and highly reliable in-vitro diagnostic devices that are ultra-portable and readily deployable as needed. While such devices are not yet commercially available, there are encouraging advancements at readiness-level 5, notably the Clustered-Regularly-Interspaced-Short-Palindromic-Repeats (CRISPR) lateral-flow-strip tests and the Single-Molecule-with-a-large-Transistor (SiMoT) bioelectronic palmar devices.

These technologies embody essential features as stipulated by the World Health Organization for POCT systems, exhibiting a minimal occurrence of false-positive and false-negative errors (<1-5%) and ensuring diagnostic selectivity and sensitivity (> 95 – 99 %). Furthermore, they offer a low limit of detection for various markers. The CRISPR-strip functions as a molecular assay, capable of detecting even a few copies of DNA/RNA markers in blood, while the SiMoT test can identify single oligonucleotides, protein markers, or pathogens in a minute sample of blood, saliva, or olive sap.

SiMoT single-sensor prototype, comprising a palmar electronic-reader and a disposable bioelectronic-cartridge, will reach TRL7 in a couple of years at most through a clinical-trial kicked-off in February 2024 involving 1.500 assays of peripheral-fluids (urine/plasma/serum) from oncological patients. This effort is conducted within the Apulian Regional Innovation-Center for Single-Molecule Digital-Assay (www.singlemolecule.center), chaired by Torsi, at the "Giovanni Paolo II" Scientific Institute for Research, Hospitalization, and Healthcare, the main oncological hospital in Bari.

The SiMoT technological breakthrough hold the potential to enable systematic and dependable surveillance of asymptomatic individuals prior to the aggravation or spread of illnesses, thereby facilitating timely diagnosis and prognosis. This proactive approach could establish a healthcare ecosystem that delivers effective treatments to all living organisms, fostering widespread well-being.

Reversible Assembly of Iron Oxide Nanoparticles on Gold Nanorods for Magnetic Alignment and Plasmonic Control

Joseph Tracy

Professor
Department of Materials Science and Engineering
North Carolina State University
USA

Abstract: Overcoating gold nanorods (GNRs) with plasmonic or magnetic satellite nanoparticles (NPs) can modify the longitudinal and transverse surface plasmon resonances (LSPR and TSPR) through coupling with the satellite NPs. We report use of electrostatic interactions to reversibly assemble different types and amounts of satellite NPs on GNR cores, which allows coupling with and manipulation of the LSPR and TSPR of the GNR core. Cationic Fe_3O_4 NPs and spherical gold NPs (GNPs) functionalized with polyethylenimine (PEI) assemble on the surface of anionic GNRs functionalized with bovine serum albumin (BSA), yielding MagGNRs. The distinct extinction spectra of Fe_3O_4 NPs and GNRs make possible quantification of the loading of satellite NPs from optical extinction spectra. pH is a useful lever for controlling assembly and disassembly processes because the electrostatic properties of PEI- and BSA-functionalized NPs strongly depend on pH. Stable assemblies are obtained at pH between the isoelectric points of BSA (pI ≈5) and PEI (pI ≈11), because the core and satellite NPs have opposite charges within this window. At lower or higher pH, the core and satellite NPs have like charges, which inhibits assembly. Moreover, disassembly is possible by adjusting the pH to values outside of this range.

Magnetic alignment of MagGNRs arising from magnetic dipolar interactions on the anisotropic gold nanorod core is comprehensively characterized, including enhancement (suppression) of the LSPR and suppression (enhancement) of the TSPR for light polarized parallel (orthogonal) to the magnetic field. MagGNRs can also be driven in rotating magnetic fields to rotate at frequencies of at least 17 Hz. For suitably large gold nanorods (148 nm long) and Fe_3O_4 NPs (13.4 nm diameter), significant alignment is possible even in modest (<200 Oe) magnetic fields.

Magnetic Micro- and Nanorobots for Biomedical Applications

Salvador Pané Vidal

Professor
Co-director of the Multi-Scale Robotics Lab
Institute of Robotics and Intelligent Systems (IRIS)
ETH Zürich
Switzerland

Abstract: An emerging family of robotic systems are untethered magnetic micro- and nanorobots, tiny vehicles that can move in their swimming environments by means of magnetic fields. One of the ultimate goals of small-scale robotics is to develop machines that can deliver drugs, or realize other medical missions in confined spaces of the human body. Other applications include water remediation or "on-the-fly" chemistry. The recent rapid developments in small-scale robotics are undeniably related to advances in material science and manufacturing. However, while many applications have been demonstrated, aspects such as complex locomotion, multifunctionality, biocompatibility and biodegradability need to be further investigated for the successful translation of these devices to real applications. To this end, new material-based concepts and novel fabrication schemes are urgently required. In this talk, I will introduce two of our latest developments in small-scale robotics. In the first part, we will show how 3D printed microtemplates can be exploited to produce complex robotic microstructures made of rigid metals, soft polymers and combinations of these. As a result, topologically complex metal-organic structures can be realized with micrometric resolution. The second part of this talk will be focused on multiferroic small-scale robots. These small-scale robots consist of multiferroic magnetoelectric composite materials, which have the ability to generate an electric field under the application of an external magnetic field. Micro and nanorobots capable of wirelessly delivering electric fields can be used for electrostimulation of cells for the central nervous systems applications.

The Triboelectric Nanogenerator - A Disruptive Energy Technology and Sensing Technology

Zhonglin Wang

Professor
Academician of the Chinese Academy of Sciences
Director of Beijing Institute of Nanoenergy and Nanosystems
Chinese Academy of Sciences
China

Abstract: Triboelectric nanogenerator (TENG) was invented by Wang's group in 2012, which is based on the coupling of triboelectrification and electrostatic induction effects for converting mechanical energy into electric power. TENG is playing a vitally important role in the distributed energy and self-powered systems, with applications in internet of things, AL, environmental/infrastructural monitoring, medical science, environmental science, and security. TENG is most effective for utilization of high-entropy energy, which is the random, low-density, low-grade mechanical energy widely-distributed in our living environment and in nature. There are now over 20,000 scientists distributed in 90 countries and regions around the globe who have published papers on TENG. This presentation will first focus on the advances in fundamental science made due to the discovery of TENG both in chemistry and physics. Then we will focus on the technological and industrial impacts that have been made by TENG. We will show how this new invention will benefit to the sustainable development of humankinds.

pH-Sensitive Clay Nanomaterials for Enhanced Solid Tumor Immunotherapy

Zhiping Xu

Professor
Institute of Chemical Biology
Shenzhen Bay Laboratory
China

Abstract: Cancer is one of the most lethal diseases in the world. In recent decades, cancer immunotherapy has led to a revolutionary breakthrough, particular for hematological malignancies, with up to 80% positive responses. However, the immunotherapy including CAR-T therapy is still very limited for solid tumors. The low efficacy is attributed to three barriers for immune cells, i.e. hard infiltration, low recognition of tumor cells and weak killing activity. To overcome these barriers, our research group has developed a neoadjuvant therapy. This therapy focuses on normalizing the aberrant physicochemical properties of tumor microenvironment (TME) using clay nanomaterials so as to enhance the infiltration of immune cells into TME, kill tumor cells, activate the anti-tumor immunity and inhibit tumor growth. Meanwhile, restoring the physicochemical homeostasis in TME helps maintain the functions of exogeneous immune cells for effective tumor killing. Moreover, we have developed a technology to label tumor cells with a specific antigen for T cells to more precisely recognize and kill. This talk will introduce that the persistent neutralization of the excess acidity in TME improved the infiltration of immune cells, enhanced the recognition of tumor cells and inhibited tumor growth, leading to effective solid tumor immunotherapy.

FluidFM for Electrochemical Micro Additive Manufacturing of Metals and Polymers

Tomaso Zambelli

Professor
Laboratory of Biosensors and Bioelectronics (LBB)
Institute for Biomedical Engineering
ETH Zürich
Switzerland

Abstract: FluidFM, a nanoscale dispensing technology combining atomic force microscopy (AFM) with microfluidics, is emerging as a powerful tool for electrochemical micro additive manufacturing (µ-AM). This technique enables precise deposition of materials at the micro- and nanoscale by leveraging electrochemically induced reactions through a microfluidic cantilever.

In electrochemical µ-AM, FluidFM's hollow cantilever, equipped with an electrode, delivers an electrolyte solution to a substrate while applying a voltage to drive localized electrochemical deposition (ECD). This allows for high-resolution patterning of metals, alloys, or conductive polymers with exceptional control over feature size and morphology. The system's force feedback ensures stable tip-substrate distances, minimizing unwanted spreading and improving deposition accuracy.

Key advantages of FluidFM for µ-AM include:

- Sub-micrometer resolution: Enables layer-by-layer fabrication of intricate 3D structures.
- Minimal waste: Electrolyte is dispensed only where needed.
- Multi-material capability: Switching electrolytes allows deposition of different materials in a single process.
- Gentle processing: Non-contact mode reduces mechanical stress on delicate substrates.

Magnetic Miniature Robots for Endoluminal Interventions: From Individual to Microswarms

Li Zhang

Professor

Department of Mechanical and Automation Engineering (MAE)
Professor by Courtesy, Department of Surgery
The Chinese University of Hong Kong (CUHK)
Hong Kong SAR, China

Abstract: Robotics at small scales has attracted considerable research attention both in its fundamental aspects and potential biomedical applications. As the characteristic dimensions of the robots or machines scaling down to the milli-/microscale or even smaller, they are ideally suited to navigating in tiny and tortuous lumens inside the human body which are hard-to-reach by regular medical devices. Although the materials, structural design, and functionalization of micro-/nanorobots have been studied extensively, several key challenges have not yet been adequately investigated for in vivo applications, such as adaptive locomotion in dynamic physiological environments, in vivo localization with clinical imaging modalities, the efficiency of therapeutic intervention, biosafety, and their autonomy for the intervention tasks.

In this talk, I will first present our recent research progress on development of magnetic miniature robots, from individual and modular designs to the microswarms, for rapid endoluminal delivery. Then the key challenges and perspective of using magnetic miniature robots for localized therapy and clinically relevant applications with a focus on endoluminal procedures will be discussed.

Technical Program

(ss: Technical Special Session)

Wednesday, 30 July, 8:30-10:30

No.	Room	Session
01	Room 1	Research on Additive Manufacturing of High-Performance Advanced Materials (ss)
02	Room 2	Med-X (Workshop)
03	Room 4	Sustainable Materials & Materials for Sustainability (Workshop)
04	Room 5	Femtosecond Laser Process of Materials for the Production of High Resolution Surface Textures (ss)
05	Room 6	Nanoscale Neuromorphic Devices (ss)
06	Room 7	Applications of Nanotechnology (ss)

Wednesday, 30 July, 10:50-12:50

No.	Room	Session
07	Room 1	Precision Machining of Difficult-to-Process Materials (ss)
08	Room 2	Med-X (Workshop)
09	Room 4	Sustainable Materials & Materials for Sustainability (Workshop)

10	Room 5	L4DNANO and LESIA - Joint Research Platforms in Laser Engineering of Surfaces, Interfaces and Nanomaterials (ss)
11	Room 6	Nanoscale Neuromorphic Devices (ss)
12	Room 7	Nanoscience for Health I

Wednesday, 30 July, 14:30-16:30

No.	Room	Session
13	Room 1	Bioinspired Materials and Resistant Structural Design (ss)
14	Room 2	Smart 2D Optoelectronics (ss)
15	Room 3	Multifunction Nanomaterials for Nanoengineering Processes (ss)
16	Room 4	Sustainable Materials & Materials for Sustainability (Workshop)
17	Room 5	Micro/Nano Structural Interface and the Applications (Workshop)
18	Room 6	Design, Analysis and Control of Nano-Manipulating Systems (ss)
19	Room 7	Nanoscience for Health II

Wednesday, 30 July, 16:50-18:50

No.	Room	Session
20	Room 1	Nanopositioning and Nanomanipulation
21	Room 2	Nanophotonics and Plasmonics (ss)
22	Room 3	Multifunction Nanomaterials for Nanoengineering Processes (ss)

23	Room 4	Sustainable Materials & Materials for Sustainability (Workshop)
24	Room 5	Micro/Nano Structural Interface and the Applications (Workshop)
25	Room 6	Cross-Scale Macro-Micro-Nano Manufacturing (ss)
26	Room 7	Nanomanufacturing and Nanoautomation

Thursday, 31 July, 08:30-10:30

No.	Room	Session
27	Room 1	Simulation Verification of the Microstructure and Properties of Materials (ss)
28	Room 2	Micro-Nano Actuators and Sensing (ss)
29	Room 3	Nanotech and Environmental Protection
30	Room 4	2D Materials at Nanoscale: From Fundamentals to Applications (ss)
31	Room 5	Energy Harvesting, Detection and System Integration
32	Room 6	Nanofabrication for Emerging Photonics (ss)

Thursday, 31 July, 10:50-12:50

No.	Room	Session
33	Room 1	Integrating Nanoengineering with Advanced Optics (ss)
34	Room 2	International Forum on Frontiers of Multifunctional Nanomaterials (ss)
35	Room 3	Nanomaterials and Applications I

36	Room 4	2D Materials at Nanoscale: From Fundamentals to Applications (ss)
37	Room 5	Nanomaterials and Applications II
38	Room 6	Algorithms and Modeling

Wednesday, 30 July, 8:30 - 12:30

39	Room 3	Junior Researcher Education and Development Forum

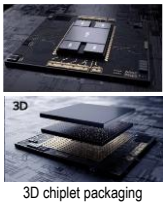
Technical Special Session 01
Research on Additive Manufacturing of High-Performance Advanced Materials (ss)
Room 1
08:30-10:30 Wednesday, 30 July
Chairs: Wenzheng Wu, Yanhong Tian

01-1 08:30–08:54

Micro-Nano Scale Interconnection Technologies in Advanced Electronic Packaging

Yanhong Tian
Harbin Institute of Technology, China

- Micro-nano interconnection is a key process in chip packaging, serving as a bridge from chips to components and systems.
- This report will introduce interconnection technologies in advanced packages including 3D chiplet package, and the life assessment methods of electronic packaging interconnection, including multiple scale modeling and life assessment methods.



3D chiplet packaging

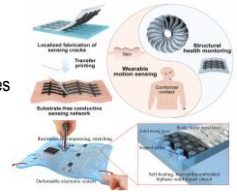
Notes

01-2 08:54–09:18

Localized Fabrication and Self-Healing of Crack Structures for Flexible Electronics

Xiaoliang Chen
State Key Laboratory for Manufacturing Systems Engineering, Xi'an Jiaotong University, China

- Localized fabrication of micro/nano crack structures and tactile sensing.
- In-situ transfer of micro/nano crack structures for conformal strain sensing.
- Self-healing strategies for micro/nano crack and their applications in flexible circuits.



Notes

01-3 09:18–09:42

A Rapid Reliability Assessment Method for Nanometre Resolution Encoder Considering Product Variability

Bowen Li, Chuanhai Chen
Key Laboratory of CNC Equipment Reliability, Ministry of Education Advanced Manufacturing and Intelligent Technology for High-end CNC Equipment, Jilin University, China

- Design and develop grating encoder reliability acceleration experimental equipment.
- The proposed method considers the effects of temperature, humidity, randomness and differences between products.
- Fast and accurate evaluation of reliability based on accelerated degradation modeling is achieved.


Grating encoder reliability accelerated degradation test system

Notes

Technical Special Session 01
Research on Additive Manufacturing of High-Performance Advanced Materials (ss)

Room 1

08:30-10:30 Wednesday, 30 July

Chairs: Wenzheng Wu, Yanhong Tian

01-4 09:42–10:06

Micro/Nano Manufacturing and High-Performance Devices by Electrohydrodynamic Printing

Dazhi Wang
School of Mechanical Engineering, Dalian University of Technology, China

- An innovative approach for micro/nano printing manufacturing based on the electrohydrodynamic coupling of multiple fields was proposed.
- A simulation model for the printing process regulated by electric field-flow field and multi-physics coupling was established.
- A series of processes such as interconnect wire printing and nano-printing were developed, and electrohydrodynamic printing equipment was produced.
- A series of high-performance devices was developed.

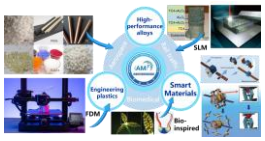
Notes

01-5 10:06–10:30

Additive Manufacturing of Difficult-to-form Advanced Materials

Wenzheng Wu
School of Mechanical and Aerospace Engineering, Jilin University, China

- Additive manufacturing mechanism of difficult-to-form advanced materials.
- Bio-inspired additive manufacturing for aerospace fields.
- Additive manufacturing of high-performance alloys.



Additive manufacturing of advanced materials

Notes

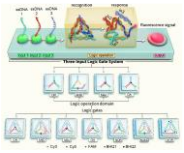
Technical Special Session 02
Med-X (Workshop)
Room 2
08:30-10:30 Wednesday, 30 July
Chairs: Min Wang, Qing Cai

02-1 08:30–08:54

A Functional Programmable DNA Tetrahedra Logic Gate Array for Multiplexed Detection of Cellular Biomarkers and Gene Therapy

Yang Gao
West China School of Stomatology, Sichuan University, China

- The functional DNA tetrahedra logic gate system includes OR, AND, NOR, NAND, XOR, MAJ, and OA gates.
- This system can undergo programmed structural changes in response to eight different input states in cells.
- Multiplexed detection of cellular biomarkers was realized through DNA-based logic operation.
- The siRNA is programmed for release-based gene therapy triggered by target biomarkers.



Functional programmable DNA tetrahedra logic gate

Notes

02-2 08:54–09:18

Volumetric Engineered 3D Drug Reservoir Combats Diabetic Implant Infection

Dize Li, Guangyu Jian, Tao Chen
Stomatological hospital of Chongqing Medical University, Chongqing, China

- Volumetric 3D drug reservoir via dual-dimensional rise engineering.
- The 3D drug reservoir could resist surgical frictional wear.
- Potent bactericidal action based on cuproptosis-like death mechanism.
- Host tissue protection through hunger-triggered mitochondrial integrity maintanence.

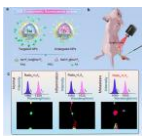
Notes

02-3 09:18–09:42

NIR-II Ratiometric Fluorescence Probes Enable Precise Determination of the Metastatic Status of Sentinel Lymph Nodes

Xin Wang
First Hospital of Jilin University, Jilin University, China

- We report a dual-tracer-based NIR-II ratiometric fluorescence nanoplatform combining targeted and nontargeted moieties.
- They determine the metastatic status of SLNs through the recording of ratio signals.
- Lymphatic function was quick assessed and tumor-infiltrating SLNs were guided to removal.



Ratiometric fluorescence for determination of the metastatic status of SLNs

Notes

Technical Special Session 02
Med-X (Workshop)
Room 2
08:30-10:30 Wednesday, 30 July
Chairs: Min Wang, Qing Cai

02-4 09:42–10:06

Tactile Gripper-On-a-Fiber for Sensitive Perception and Controllable Actuation

Changxu Li
State Key Laboratory of Integrated Optoelectronics, JiLin University, China

- Precision force measurement at the micro-newton scale for cellular biomechanics.
- Precision controllable actuation for micro-scale soft grippers with tunable driving parameters.
- TGoF system achieves synergistic coordination between micro-force sensing and dynamic actuation.

Notes

02-5 10:06–10:30

Covalent Organic Framework-Based Ultrasensitive Bioorthogonal Raman Probes for In Vivo Detection of Bone Crack

Ying Bao
Changchun Institute of Applied Chemistry Chinese Academy of Sciences, China

- We have developed the first covalent organic framework-based bioorthogonal Raman probe (named BDDA COFs).
- BDDA COFs are the most intense alkyne-based Raman probe (up to ~10^5 fold vs Edu) compared to conventional alkyne Raman probes (Figure. 1).
- Polydopamine-coated COFs (BDDA@PDA COFs) were prepared to achieve highly sensitive and specific ex vivo and in vivo bone crack Raman imaging.

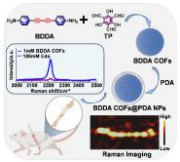


Figure 1.The BDDA@PDA COFs as Raman probes for in vivo imaging

Notes

Technical Special Session 03
Sustainable Materials & Materials for Sustainability (Workshop)

Room 4

08:30-10:30 Wednesday, 30 July

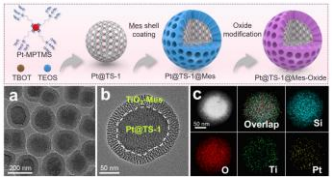
Chair: Federico Rosei

03-1 08:30–08:50

Stabilization Strategies for Noble Metal Nanoparticles in Catalytic Reactions

Guozhu Chen
School of chemistry and chemical engineering, University of Jinan, China

- The oxide and noblemetal (Pt) are functionally separated within a mesopore shell and a microporecore (TS-1zeolite).



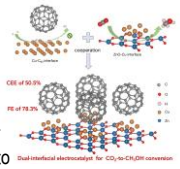
Notes

03-2 08:50–09:10

Design of Electrocatalysts for Energy-Efficient Carbon Dioxide Reduction

Miao Yu
School of Materials and Energy, University of Electronic Science and Technology, China

- Energy consumption is a long-neglected yet critical issue in electrocatalytic CO_2RR.
- The dual interfaces of Cu-C_{60} and ZnO-Cu increase key intermediates and suppress H_2 evolution.
- The system achieves a cathodic energy efficiency of 50.5% and a faradaic efficiency of 78.3% for CH_3OH.
- This work demonstrates an unconventional strategy to improve energy efficiency in electrocatalytic CO_2RR.



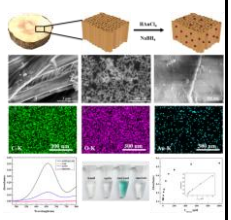
Notes

03-3 09:10–09:30

AuNPs@Wood Nanozyme as Bifunctional Glucose Oxidase-Peroxidase for Cascade Catalysis Reaction

Yuanfu Zhang
College of Chemistry and Chemical Engineering, Liaocheng University, China

- AuNPs@Wood was synthesized by growing AuNPs in situ within the wood's mesoporous structure.
- AuNPs@Wood acts as a bifunctional glucose oxidase-peroxidase for cascade catalysis of glucose degradation.
- Biomimetic cascade catalysis provides a rapid and real-time approach for glucose monitoring.
- This multienzyme has potential applications in biomimetic catalysis, biosensors, bioenergy, and biomedicine.



Notes

Technical Special Session 03
Sustainable Materials & Materials for Sustainability (Workshop)

Room 4

08:30-10:30 Wednesday, 30 July

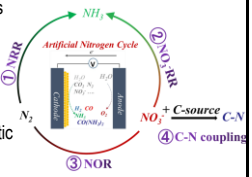
Chair: Federico Rosei

03-4 09:30–09:50

Electrocatalytic Activation of N-containing Molecules and Their Further Applications

Guanzheng Wu, Qing Qin
College of Chemistry and Materials Science, Anhui Normal University, China

- Electrocatalytic N-molecule conversion aligns with green development and national strategies.
- Challenges include high energy barriers and low selectivity in N-electrocatalysis.
- Heteroatom cluster catalysts create synergistic active sites, enhancing activity/selectivity in multi-bond activation systems.
- This work explores green NH_3 synthesis, urea production, and biomass electroreforming.



Schematic diagram of the artificial nitrogen cycle

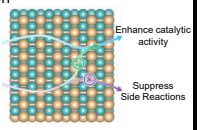
Notes

03-5 09:50–10:10

Intermetallic Compounds for Energy Catalysis

Qipeng Lu
School of Materials Science and Engineering, University of Science and Technology Beijing, Beijing 100083, China

- A series of the synthetic strategies for the preparation of intermetallic compounds are introduced.
- The structure-performance relationship of catalytic materials is comprehensively discussed.
- These synthesized intermetallic compounds exhibit excellent performance towards catalytic reactions in energy conversion.



Intermetallic compounds for energy catalysis

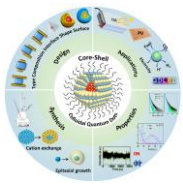
Notes

03-6 10:10–10:30

Colloidal Quantum Dot for Sustainability

Lei Jin
Institute of Nanoscience and Applications,
Southern University of Science and Technology, China

- Emerging design strategies optimize band structure, alignment, and optical properties of QDs.
- Focus on surface engineering and synthesis to improve QD performance in energy devices.
- Future research for optimized QD properties in applications.



Colloidal quantum dot for sustainability: application for PV, LSC, solar-fuel conversion and QLED

Notes

Technical Special Session 04
Femtosecond Laser Process of Materials for the Production of High Resolution Surface Textures (ss)

Room 5

08:30-10:30 Wednesday, 30 July

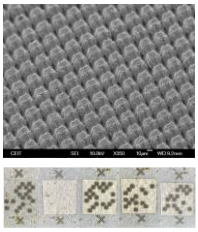
Chairs: Santiago M Olaizola, Wilhelm Pfleging

04-1 08:30–08:54

Fundamentals and Applications of Femtosecond Laser Processing of Materials

Santiago M Olaizola
Ceit-Basque Research and Technology Alliance (BRTA), Spain
University of Navarra, Tecnun, Spain

- Femtosecond laser can produce surface features in materials with submicrometric resolution through 'cold ablation' process.
- The precise control of process parameters can produce different effects as the energy dose is increased: material heating, refractive index change, LIPPS, ablation.
- We will review the fundamentals of each interaction with practical pplications.



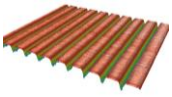
Notes

04-2 08:54–09:18

Direct Laser Writing Process to Generate Bio-Inspired Riblets on Complex 3D Industrial Parts

Mikel Gomez-Aranzadi
Ceit-Basque Research and Technology Alliance (BRTA), Spain
University of Navarra, Tecnun, Spain

- Surface functionalization allows for multiple application, such as drag reduction.
- Bio-based riblets have been demonstrated to reduce the frictional resistance of flat surfaces.
- A new direct laser writing process is presented to replicate riblets in stainless steel substrates.
- A processing time with picosecond regime comparable to femtosecond regime is achieved using burst mode.



100 µm period riblets replicated in stainless steel with the new process

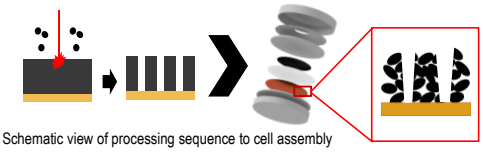
Notes

04-3 09:18–09:42

Impact of the Laser Pulse Length on Ablation of Electrodes for Lithium-Ion Batteries

Yannic Sterzl
Institute for Applied Materials, Karlsruhe Institute of Technology, Germany

- Laser structuring of lithium-iron phosphate cathodes and graphite anodes for high performance lithium-ion batteries.
- Impact of the pulse length in the range of fs to ns on ablation efficiency and structural accuracy.
- Demonstration of process upscaling and electrochemical performance.



Schematic view of processing sequence to cell assembly

Notes

Technical Special Session 04
Femtosecond Laser Process of Materials for the Production of High Resolution Surface Textures (ss)

Room 5

08:30-10:30 Wednesday, 30 July

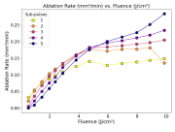
Chairs: Santiago M Olaizola, Wilhelm Pfleging

04-4 09:42–10:06

Controlling Ultrafast Laser Ablation of Stainless Steel via Fluence, Overlap, and Sub-Pulses

Luis Omeñaca
Ceit-Basque Research and Technology Alliance (BRTA), Spain
University of Navarra, Tecnun, Spain

- Two temperature model simulations investigate ultrafast laser interaction, examining the fluence, pulse count and sub-pulses.
- Simulations were validated with static hole ablation experiments, showing strong agreement with experimental data.
- Pool ablation experiments show improved ablation rate guided by simulation insights.



Ablation rate as function of fluence for various sub-pulses

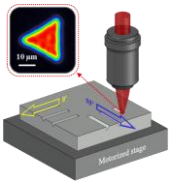
Notes

04-5 10:06–10:30

Ultrafast Laser Microfabrication of Tunable Blazed Gratings Using Triangular Beam Shaping

Jorge Fantova
Ceit-Basque Research and Technology Alliance (BRTA), Spain
University of Navarra, Tecnun, Spain

- Triangular beam shape led to laser engraving of asymmetric channels on stainless steel.
- Wide range of groove geometries were recorded in a single-step process.
- Groove asymmetry ratios up to 5 and blaze angles as low as 12.6° were achieved.
- Manufacturing resolution comparable to commercial blazed gratings and literature reports.



Single-step fabrication of blazed gratings using triangular beams

Notes

Technical Special Session 05
Nanoscale Neuromorphic Devices (ss)

Room 6

08:30-10:30 Wednesday, 30 July

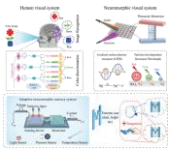
Chairs: Ye Zhou, Suting Han

05-1 08:30–08:50

Emerging Multimode Memristor for Neuromorphic Sensory System

Zhongqiang Wang
Northeast Normal University, China

- Plasmonic optoelectronic memristor enables multifunctionalities integration of image sensing storage and processing.
- Multiwavelength plasmonic optoelectronic memristor achieves high accuracy color image recognition.
- Multimodal neuromorphic perception system implements dynamic sensory adaptation via analog-type complementary memristor.



Neuromorphic visual system and adaptive sensory system

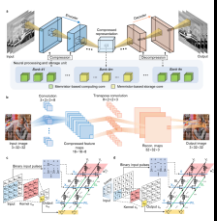
Notes

05-2 08:50–09:10

Memristor-Based Storage System with Convolutional Autoencoder-Based Image Compression Network

Peng Huang
School of Integrated Circuits, Peking University, China

- This work proposes a 4-bit memristor-based storage system integrating a near-storage in-memory computing convolutional autoencoder for images compression and storage.
- The system achieves a peak signal-to-noise ratio exceeding 33 dB on the ImageNet and Kodak24 datasets.
- Benchmark results demonstrate over 20×/5.6× reductions in latency and 180×/91× reductions in energy consumption compared to CPU-/GPU-based systems.



Memristor-based high-density storage system

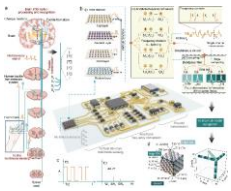
Notes

05-3 09:10–09:30

3D Heterogeneous Sensing System

Lili Wang
Institute of Semiconductors, Chinese Academy of Sciences &
University of Chinese Academy of Sciences

- 3D vertical heterogeneous layout of four sensors.
- Realized the material multi-information detection.
- Single point without spatiotemporal deviation.
- Heterogeneous sensing system have demonstrated an efficiency improvement of approximately 4 times.



Notes

Technical Special Session 05
Nanoscale Neuromorphic Devices (ss)

Room 6

08:30-10:30 Wednesday, 30 July

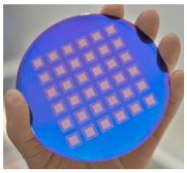
Chairs: Ye Zhou, Suting Han

05-4 09:30–09:50

Carbon-Based Memristor for Memory, Computing, and Neuromorphic Applications

Xiaoning Zhao
State Key Laboratory of Integrated Optoelectronics, Northeast Normal University, China

- Memristor is promising candidate for future memory, computing, and neuromorphic applications.
- Carbon materials are recognized as promising next-generation electronic materials with remarkable electronic, optical and thermal properties.
- Aiming at high performance memory and neuromorphic application, we have developed a series of carbon-based memristors.
- In this presentation, we will systematically introduce these advancements and provide perspectives on their future development.



Memristor array based on amorphous carbon

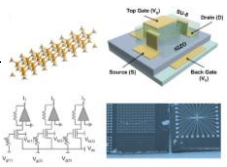
Notes

05-5 09:50–10:10

Multilevel Analog Modulation Based on IGZO Optoelectronic Device Integration

Zhexin Li, Zheng Lou
Institute of Semiconductors, Chinese Academy of Sciences & University of Chinese Academy of Sciences

- 1T1P structure of multilevel analog modulation unit.
- On/Off ratio of dual-gate IGZO transistor is 10^4.
- Specific detectivity of IGZO is 6.12×10^{12} Jones.
- Quinary output under constant optical excitation.



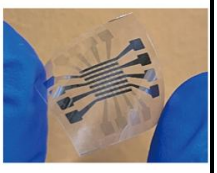
Notes

05-6 10:10–10:30

Functional Memristor

Suting Han
Department of Applied Biology and Chemical Technology, The Hong Kong Polytechnic University, Hong Kong SAR

- Functional memristor can be used in in-sensor computing systems, intelligent robots, mobile medical, etc.
- This talk will introduce our research work in the field of functional memristor.
- We will explore the key influencing factors in the development process of functional memristor.



Notes

Technical Special Session 06
Applications of Nanotechnology (ss)

Room 7

08:30-10:30 Wednesday, 30 July

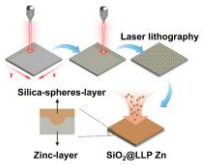
Chairs: Mengnan Liu, Jie Jiao

06-1 08:30–08:50

Laser-Structured Zinc Anode with Silica-Based Interfaces for Robust Zinc-Ion Batteries

Hongyu Wang, Zhen Yang*
School of Mechanical Engineering, Tianjin University, China

- Preparation of hierarchical structure zinc anode by combining laser lithography and protective layer engineering.
- Characterization of surface morphology and chemical composition.
- Assembling button cells to compare anode electrochemical performance.
- A dual-strategy approach was proposed to enhance the stability of zinc anodes.



Schematic diagram of the preparation process of SiO_2@LLP Zn

Notes

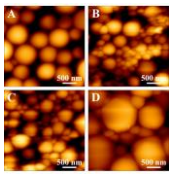
06-2 08:50–09:10

Unraveling Citric Acid-Mediated Self-Assembly Behavior of Zein by Atomic Force Microscopy

Miaomiao Yu[1,2], Vladimir Konstantinov Kotev[3*]

[1]Guangdong University of Technology, Guangzhou, China
[2]International Original Point Intelligent Technology, Foshan, China
[3]Institute of Mechanics at the Bulgarian Academy Sciences, Bulgaria

- Citric acid (0.1% w/v) reduced the density of zein assemblies but enlarged the particle size.
- Citric acid (0.4% and 0.7% w/v) induced zein assemblies exhibited a bimodal size distribution.
- Citric acid (1.0% w/v) drastically reduced the number of zein assemblies and generated exceptionally large structures.



Effects of citric acid on zein molecules

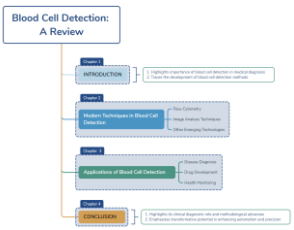
Notes

06-3 09:10–09:30

Blood Cell Detection: A Review

He Wen
International Research Centre for Nano Handling and Manufacturing of China, Changchun University of Science and Technology, China

- Overview of the development of blood cell detection technology.
- Principles, advantages, and disadvantages of blood cell detection techniques: flow cytometry, image analysis, and others.
- Overview of the applications of blood cell detection technology.



Notes

Technical Special Session 06
Applications of Nanotechnology (ss)
Room 7
08:30-10:30 Wednesday, 30 July
Chairs: Mengnan Liu, Jie Jiao

06-4 09:30–09:50

Current in Vitro Food Digestion Systems: Research Status and Strategic Choices

Jie Jiao
Centre for Opto/Bio-Nano Measurement and Manufacturing, Zhongshan Institute of Changchun University of Science and Technology, Changchun University of Science and Technology, China

- Briefly describe the digestive process.
- Transitions and transformations of the in vitro digestive system are reviewed.
- Design and selection strategies for in vitro digestive systems are discussed.
- Provide reference and direction for the development and establishment of digestive tract models.

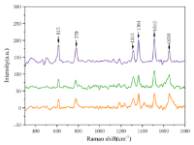
Notes

06-5 09:50–10:10

A Study of Noble Metal Films in Periodic Structures in Relation to Excitation Wavelength for SERS

Xuanyi Dong[1], Mengnan Liu[2*]
[1] International Research Centre for Nano Handling and Manufacturing,China Changchun University of Science and Technology, Changchun, China
[2] Centre for Opto/Bio-Nano Measurement and Manufacturing, Zhongshan, China

- Periodic SERS substrates fabricated via self-assembly and etching.
- R6G detected at 1e-6 M with strong 532/633 nm responses.
- Consistent Raman intensity observed across substrate positions.
- Efficient, reproducible trace detection enabled.



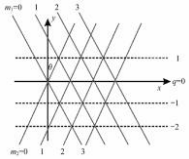
Notes

06-6 10:10–10:30

Ink-Free Moiré Anti-Counterfeiting by DMD Multiple Exposure of Microlens Arrays

Hengxu Zhang, Chong Xing*
Technical Research Support Division, Chanchun China Optical Science and Technology Museum, China

- This study enhances anti-counterfeiting microlens array (MLA) surface precision by DMD-based multiple exposure.
- Surface roughness reduces by 42% compared to thermal reflow.
- Integrated micro-text patterns enable ink-free anti-counterfeiting through Moiré magnification, generating dynamic responses.Experimental verification confirms reliable performance.



Moiré magnification principle

Notes

Technical Special Session 07
Precision Machining of Difficult-to-Process Materials (ss)

Room 1

10:50-12:50 Wednesday, 30 July

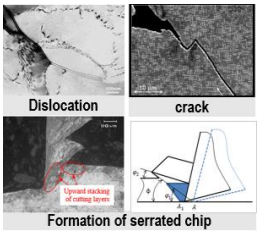
Chairs: Zhaopeng Hao, Mingming Lu

07-1 10:50–11:05

Dynamic Plastic Evolution Mechanism in Cutting Zone of Nickel-Based Superalloy GH4169

Zhaopeng Hao
School of Mechatronic Engineering, ChangChun University of Technology

- Studying the influence of dislocations on work hardening and flow stress.
- Establishing a constitutive model considering the influence of parameters.
- Revealing the mechanism of serrated chip formation from a microscopic perspective.



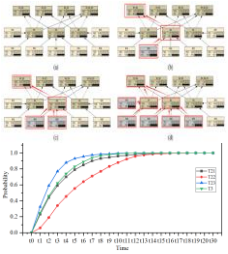
Notes

07-2 11:05–11:20

Fault Analysis and Optimal Design of Stamping Production Line Based on DBN-NK Model

Dongwei Gu
School of Mechatronic Engineering,
Changchun University of technology, China

- Develops a DBN-NK model to quantify dynamic interactions in Human-machine-material-environment (HMME) systems.
- Identifies dominant failure modes and enhances production line reliability through targeted adjustments.
- Flexsim simulations on stamping lines confirm performance gains, with sensitivity analysis guiding practical design adjustments.



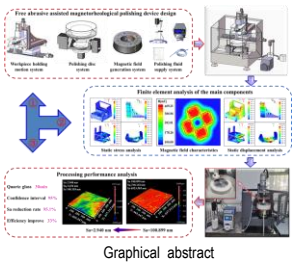
Notes

07-3 11:20–11:35

Research on Magnetorheological Polishing Equipment and Key Technologies

Mingming Lu
School of Mechanical and Electrical Engineering, Changchun University of Technology, Jilin, Changchun, China

- Magnetorheological polishing equipment has been developed.
- A method of free abrasive assisted magnetorheological polishing was proposed.
- Research on key technologies of magnetorheological polishing was carried out.



Graphical abstract

Notes

Technical Special Session 07
Materials and Processes for Advanced Nano-Patterning (ss)

Room 1

10:50-12:50 Wednesday, 30 July

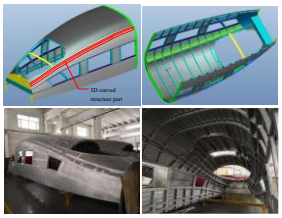
Chairs: Zhaopeng Hao, Mingming Lu

07-4 11:35–11:50

Flexible Precision Forming of High-Performance Lightweight Alloy Body Structural Components

Song Gao
School of Mechatronic Engineering, Changchun University of Technology, China

- Flexible 3D stretch-bending technology and its application.
- Multi-energy field-assisted forming technology and its application.
- Multi-scale simulation technology.
- Characterization of mechanical properties of hard-to-deform materials.



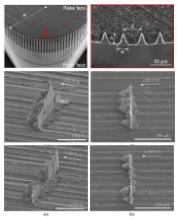
Notes

07-5 11:50–12:05

Large-Area Fabrication of Micro-Grooves on Ferrous Metals by Ultrasonic Vibration-Assisted Turning

Lin Zhang
School of Mechanical and Electrical Engineering, Changchun University of Technology, China

- Propose ultrasonic vibration assisted cutting in micro-grooves on pure iron, verified with finished surfaces and tool wear.
- By using the ultrasonic vibration-assisted cutting, the smooth micro-grooved surface was successfully machined.
- The cutting force acting on tool tip can be largely reduced in ultrasonic vibration-assisted cutting.



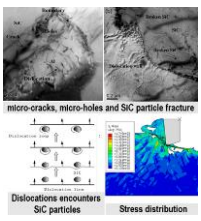
Notes

07-6 12:05–12:20

Cutting Deformation Mechanism of SiCp/Al Composites Based on Strain Gradient Theory

Yihang Fan
School of Mechatronic Engineering, Changchun University of Technology

- A strain-gradient-related constitutive was established based on the JC model and applied to the process.
- Analyzing the strain gradient and size effects on cutting deformation by microplasticity and dislocation theory.
- SiC particles induced high strain gradients, makes the material more prone to localized shear deformation.



Notes

Technical Special Session 07
Precision Machining of Difficult-to-Process Materials (ss)

Room 1

10:50-12:50 Wednesday, 30 July

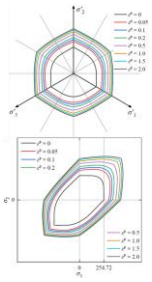
Chairs: Zhaopeng Hao, Mingming Lu

07-7 12:20–12:35

A Shear Deformation Dominated Yield Function Satisfying Physical-Mathematical Consistency

Xiaorui Wang
School of Mechatronic Engineering,
Changchun University of Technology, China

- The new yield function overcomes the traditional limitations between the physical connotation and mathematical modeling.
- A pure shear characteristic stress space based on shear deformation was established.
- Strong physical parameters can accurately describe the complex stress states of materials.
- The subsequent yielding behavior was calibrated to characterize the entire process of material plastic deformation.



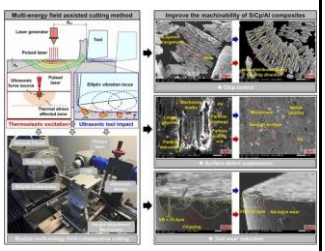
Notes

07-8 12:35–12:50

Cutting Mechanism of SiCp/Al by Pulsed Laser-Ultrasonic Elliptical Vibration Cooperative Cutting

Yongsheng Du
School of Mechanical and Electrical Engineering,
Changchun University of Technology, China

- A multi-energy field-assisted cutting method combining pulsed laser assistance and tool. ultrasonic vibration is proposed.
- Synergistic action can effectively improve material properties and regulate chip formation.
- Multi-energy field assistance can further reduce tool wear.



Graphical abstract

Notes

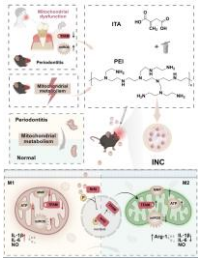
Technical Special Session 08
Med-X (Workshop)
Room 2
10:50-12:50 Wednesday, 30 July
Chairs: Min Wang, Qing Cai

08-1 10:50–11:14

Itaconate-Based Nano Cocktail for Enhanced Periodontitis Therapy by Reprogramming Mitochondrial Metabolism

Qing Cai
School and Hospital of Stomatology, Jilin University, China

- Mitochondrial associated metabolism is downregulated in gingiva of periodontitis.
- INC, formulation redesigning of itaconate, demonstrating its great potential to treat various inflammatory diseases.
- INC activates Nrf2/TFAM to protect mitochondrial metabolism.
- Developing nanomedicine targeting mitochondrial metabolism for treating periodontitis.



Notes

08-2 11:14–11:38

An Evolutionary Computation Approach for Multi-Objective Optimization in Unmanned Aerial Vehicle Networks

Tingting Zheng
College of Computer Science and Technology,
Changchun University of Science and Technology, China.

- Collaborative beamforming (CB) allows multiple UAVs forming a virtual element antenna array and transmitting data collaboratively.
- The goal is to improve CB transmission performance considering the energy cost for UAV deployment.
- We formulate a multi-objective optimization problem and propose an enhanced multi-objective evolutionary computation approach.
- Simulation results demonstrate the effectiveness of the approach for UAV-assisted communication networks.

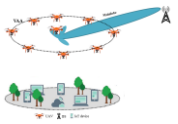


Illustration of the network scenario

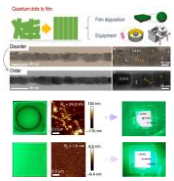
Notes

08-3 11:38–12:02

Emitter Structure Design of Quantum Dot LEDs

Xiaoyu Zhang
School of Materials Science and Engineering, Jilin University, China

- LED electroluminescence external quantum efficiency is determined by the emitter emission quantum yield.
- Emitter layers assembled in order have much better carrier mobility than layers assembled in disorder.
- Large-area, uniform, bright emitting layers can be generated with optimal interface interactions.
- Emitter structure design can improve both device performance and stability.



Emitter structure determines the performance of quantum dot light-emitting diodes

Notes

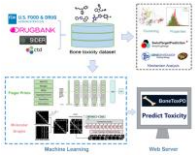
Technical Special Session 08
Med-X (Workshop)
Room 2
10:50-12:50 Wednesday, 30 July
Chairs: Min Wang, Qing Cai

08-4 12:02–12:26

Unveiling Drug-Induced Osteotoxicity: A Machine Learning Approach and Webserver

Yi He
Life Science College, Jilin University, China

- Identified key osteotoxicity-related genes (IL6, TNF, ESR1, MAPK3) and analyzed their mechanisms.
- Developed AI models (transformer, GNN, KPGT) with up to 0.89 AUC for osteotoxicity prediction.
- Launched Bonetox, the first online platform to assess drug-induced bone toxicity and improve drug safety.



Workflow of BoneToxPD

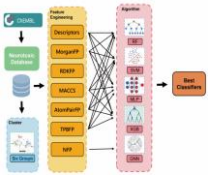
Notes

08-5 12:26–12:50

Research on Neurotoxicity Prediction Based on the Combination of Molecular Fingerprints and Machine Learning

Min Wang
International Research Center for Nano Handling and Manufacturing
Changchun University of Science and Technology, China

- Advantages of the MorganFP-SVM model in neurotoxicity prediction establish it as an essential tool.
- It provides higher predictive accuracy , demonstrates strong stability and reliability across multiple evaluation metrics.
- It offers a promising method for neurotoxicity risk assessment in drug development and environmental pollutants.



GNN: Graph neural network; MLP: multi-layer perceptron; RF: random forest; XGB: extreme gradient boosting

Notes

Technical Special Session 09
Sustainable Materials & Materials for Sustainability (Workshop)

Room 4

10:50-12:50 Wednesday, 30 July

Chair: Federico Rosei

09-1 10:50–11:10

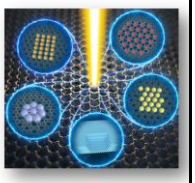
Toward Precision Manufacturing with Electron Microscopes

Mark H. Rümmeli

Electron Beam Emergent Additive Manufacturing (EBEAM) Centre, CNT, CEET, Technical University Ostrava, Czech Republic

SIEMIS, CoE, College of Energy, Soochow University, China

- Atom-by-atom control.
- In situ synthesis and real-time characterization.
- Tailored nanomaterials.
- Electron beam-driven nanomanufacturing.
- This work pioneers the use of electron microscopes as tools for material synthesis at the atomic level.
- By harnessing the precision of TEM, it enables direct, real-time fabrication and control of nanostructures, marking a transformative step in nanomanufacturing.



Notes

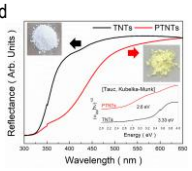
09-2 11:10–11:30

Titanate-Based Nanomaterials with Environmental Function

Tohru Sekino

SANKEN, The University of Osaka, Japan

- Multifunctional titania/titanate nanotubes (TNTs) could be synthesized using facile solution chemical route.
- Chemical modification by peroxo groups realized visible light responsivity with small bandgap around 2.6 eV.
- Visible light photocatalytic activity of TNT was mainly due to formation of superoxide anion radical.
- Co-doping of metal cations accelerates TNTs' photocatalytic activity of decomposing organic molecules and hydrogen generation.



UV-vis reflectance spectra of TNT and peroxo-modified TNT (PTNT) and their optical bandgap energy

Notes

09-3 11:30–11:50

In-Situ Scanning Tunneling Microscopy Investigation of Molecular Electrocatalytic Reactions

Dong Wang

Institute of Chemistry, CAS, Beijing China

- Electrochemical scanning tunneling microscopy to study the interfacial electrochemical reactions by molecular catalysts at molecular level.
- The time evolution of molecular adsorption, in situ conversion and desorption on metalloporphyrins and metallophthalocyanines during ORR and CO2RR is resolved.

Notes

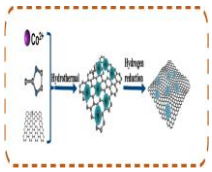
Technical Special Session 09
Sustainable Materials & Materials for Sustainability (Workshop)
Room 4
10:50-12:50 Wednesday, 30 July
Chair: Federico Rosei

09-4 11:50–12:10

Energy Storage Materials and Database

Lixian Sun, Fen Xu
Guangxi Key Laboratory of Information Materials; School of Materials Sicnce and Engineering, Guilin University of Electronics, China

- Hydrogen storage materials such as MgH2, alanatea and MOFs were studied.
- Hydrogen sensors based on novel nano -composites were investigated.
- Organic phase change materials with high performance were explored.
- Database for hydrogen storage materials was constructed by machine learning.



Flowchart for the preparation of 3D-Co/rGO catalyst

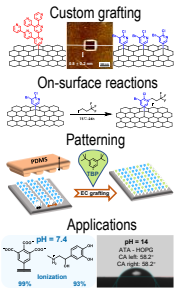
Notes

09-5 12:10–12:30

Custom Functionalization of Carbon-Based Surfaces and Interfaces

Oleksandr Ivasenko
FUNSOM, Soochow University, China

- Custom Grafting: explored the controlled ultrathin (<1 nm) direct covalent grafting of heterocycles.
- On-surface Reactions: studied the reactivity of grafts to fine-tune surface functional groups.
- Patterning: developed inexpensive, versatile and convenient micropatterning of C-C grafted adlayers.
- Applications: showcased design and testing of model biosensor interface.



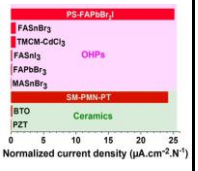
Notes

09-6 12:30–12:50

High-Performance Piezoelectric Nanogenerators

Dayan Ban
Department of Electrical and Computer Engineering,
University of Waterloo, Canada

- Organic-inorganic hybrid perovskites (OIHP) were developed for high-performance piezoelectric nanogenerators (PENGs).
- The device performance of PENGs were optimized through unique compositional engineering and novel molecular design strategies.
- The strategies include halogen atom regulation, halogen-bond bridging, quasi-spherical cation and Jahn-Teller distortion, and nanoparticle surface functionalization.
- Record-breaking device performance was demonstrated.



One order of magnitude higher than other organometal halide perovskite (OHP) and better than inorganic piezoelectric materials

Notes

Technical Special Session 10
L4DNANO and LESIA - Joint Research Platforms in Laser Engineering of Surfaces, Interfaces and Nanomaterials (ss)

Room 5

10:50-12:50 Wednesday, 30 July

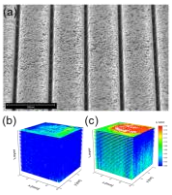
Chairs: Wilhelm Pfleging, Santiago M Olaizola

10-1 10:50–11:08

Laser Technologies for Battery Manufacturing- Latest Approaches and Trends

Wilhelm Pfleging
Institute for Applied Materials, Karlsruhe Institute of Technology, Germany

- Development of novel electrode and material concepts for high-performance batteries.
- Improvement of battery lifetime, fast charging capability, and battery safety demonstrated.
- Increased ablation efficiency through appropriate selection of material and laser parameters.
- Rapid laser plasma spectroscopy successfully evaluated as a new (inline) analytical tool for 3D electrode mapping.



Structured electrode (a) and Li distribution in structured (b) and unstructured (c) anodes

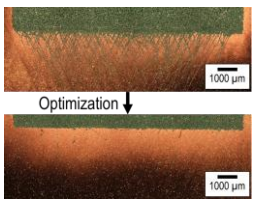
Notes

10-2 11:08–11:25

Optimized Printing Quality of Battery Electrode Materials by Laser-Induced Forward Transfer

Ulrich Rist
Institute for Applied Materials, Karlsruhe Institute of Technology, Germany

- Laser-induced forward transfer (LIFT) is used for rapid prototyping of battery electrode architectures.
- Nanometer and micrometer scaled materials are used for printing process.
- Defect density and structure quality of printings were significantly enhanced by optimized parameters.



Edge quality improvement of printed electrodes

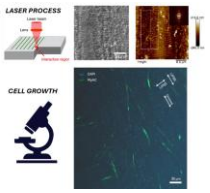
Notes

10-3 11:25–11:42

Femtosecond Laser Processing of Surfaces for Health-Related Applications

Gemma G. Mandayo
Laser Process Manufacturing Group, Ceit, San Sebastian, Spain

- Surface patterning has shown its potencial to influence cell-material interaction in different applications.
- Femtosecond laser is a highly versatile tool to get micro and nanostructures or even hierarchical structures, that can be transferred to several substrates.
- This research examines the impact of laser-induced periodic surface structures (LIPSS) with different orientations on cellular behavior, focusing on their influence on fibroblasts and myotubes.



SEM and AFM images of surface with LIPSS. Nuclei and myoblasts on substrate with LIPSS

Notes

Technical Special Session 10
L4DNANO and LESIA - Joint Research Platforms in Laser Engineering of Surfaces, Interfaces and Nanomaterials (ss)

Room 5

10:50-12:50 Wednesday, 30 July

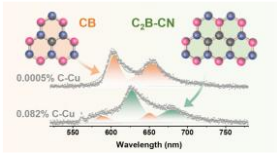
Chairs: Wilhelm Pfleging, Santiago M Olaizola

10-4 11:42–11:59

Structured-Defect Engineering of Hexagonal Boron Nitride for Identified Visible Single Photon Emitters

Tsz Wing Tang, Zhengtang Luo*
Department of Chemical and Biological Engineering, The Hong Kong University of Science and Technology, Hong Kong

- Tailoring carbon defect structures for precise SPE engineering.
- Modifying carbon diffusion in molten Cu during CVD achieves defect structure modification.
- Employing density functional theory to analyze alterations in band structure and electronic transitions.



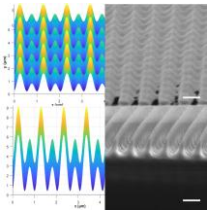
Notes

10-5 11:59–12:16

3+1 Beam Laser Interference Lithography for Preparing 3D Nanostructures

Xiaokun Liang[1,2], Litong Dong[1,2*]
[1] International Research Centre for Nano Handling and Manufacturing,China Changchun University of Science and Technology, Changchun, China
[2] Centre for Opto/Bio-Nano Measurement and Manufacturing, Zhongshan, China

- The 3+1 beams interference mechanism is analyzed.
- The regularity of high aspect ratio pattern formed by the 3+1 Beam interference field regulated by the incident angle is studied.
- The 3+1 Beams laser interference lithography system is established for preparing 3D nanostructures.



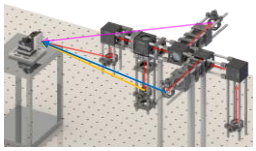
Notes

10-6 12:16–12:33

Design Method of Laser Interference System for Manufacturing Inverse Opal Structures

Jianhua Dai, Fujun Wang
Key Laboratory of Mechanism Theory and Equipment Design of Ministry of Education, Tianjin University, Tianjin, China

- This paper proposes a design method for a laser interference system for manufacturing inverse opal structures.
- The adjustment range of beam parameters was determined on the basis of laser interference simulation.
- The physical model design of the optical path system was completed.



Laser interference system for manufacturing inverse opal structures

Notes

Technical Special Session 10
L4DNANO and LESIA - Joint Research Platforms in Laser Engineering of Surfaces, Interfaces and Nanomaterials (ss)

Room 5

10:50-12:50 Wednesday, 30 July

Chairs: Wilhelm Pfleging, Santiago M Olaizola

10-7 12:33–12:50

High-Precision, Large-Range Flexure-Based Micropositioning Stages: From Design to Experimental Validation

Ashenafi Kassa
Robotics and Mechatronics Research Laboratory (RMRL), Monash University, Australia

- Mechanical design of high-dexterity parallel, serial, and hybrid flexure-guided positioning stages.
- Kinematics, kinetostatics, and dynamical modeling of compliant mechanisms.
- Material selection and fabrication methods.
- Advanced control system design with integrated actuation and sensing: challenges and future directions.

$xy\theta$ planar parallel micropositioning stage

Notes

Technical Special Session 11
Nanoscale Neuromorphic Devices (ss)

Room 6

10:50-12:50 Wednesday, 30 July

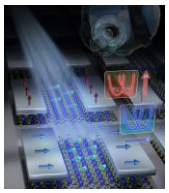
Chairs: Ye Zhou, Suting Han

11-1 10:50–11:10

Reconfigurable 2D Magneto-Optoelectronic Devices for in-Sensor Vision Systems

Yuyan Wang
BNRIST, School of Integrated Circuits, Tsinghua University, China

- The magnetic and photoelectronic properties are tightly connected at room temperature in all-2D devices including photodetectors and MTJs.
- Based on the magneto-band structure effect and spin filtering effect, the photoresponse can be non-volatilely defined by the magnetization.
- A new promising dimension is introduced to obtain reconfigurable optoelectronic devices for the construction of in-sensor vision systems.



Room-temperature magneto-photoresponse in all-2d optoelectronic devices for in-sensor vision systems

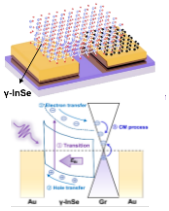
Notes

11-2 11:10–11:30

Photodetection and Visual Biomimetic Devices Based on Low Dimensional InSe

Weizhen Liu
School of Physics, Northeast Normal University, China

- A two-terminal photodetector featuring a unilateral Schottky junction based on 2D γ-InSe is constructed.
- The photodetector demonstrates good UV responsivity benefiting from strong built-in electric field and carrier multiplication effect.
- The device can also operate in self-powered mode and exhibit good human-eye-like adaptation behaviors.



UV detector based on γ-InSe and its working principle

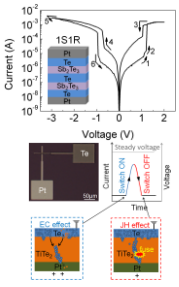
Notes

11-3 11:30–11:50

A New Opportunity for the Emerging Tellurium Semiconductor: Making Neuromorphic Devices

Huanglong Li
Department of precision instrument, Tsinghua university, China

- Background: memristive synapses and neurons are building block devices for neuromorphic computers.
- Problems: current-volatility dilemma & hardware overhead-biophysical realism dilemma.
- Te: electrochemically active, low-melting temperature, low-thermal conductivity.
- Te synapatic devices: nonvolatile under low currents for artificial synapses, volatile under high currents for selectors.
- Te neuronal devices: LIF and oscillation in a single device without any auxiliary circuit.



Notes

Technical Special Session 11
Nanoscale Neuromorphic Devices (ss)

Room 6

10:50-12:50 Wednesday, 30 July

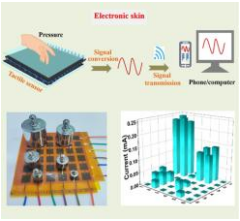
Chairs: Ye Zhou, Suting Han

11-4 11:50–12:10

Skin-Inspired Highly Sensitive Tactile Sensors with Ultrahigh Resolution Over a Broad Sensing Range

Qijun Sun
School of Physics and Optoelectronic Engineering, Guangdong University of Technology, China

- Flexible tactile sensor with high sensitivity and resolution over a wide detection range.
- A fast response speed of 18 ms and ultrahigh resolution of 100 Pa over 100 kPa.
- A universal route by employing the multilayered composite films for tactile sensors.



Notes

11-5 12:10–12:30

Copper-Iodide-Based Artificial Synaptic Device for Brain Computer Interface

Hongyuan Liang, Xiaoguang Liang
Department of Physics, Guanxi Normal University, China

- Copper-iodide-based artificial synaptic device exhibits good resistive switching properties.
- The neuroelectronic synaptic device shows a potential in brain–computer interface (BCI).
- The modulated neuromorphic stimuli match well with the signals extracted from the electroencephalogram.
- This work suggests a possible strategy to counteract brain aging and neurological disorders.

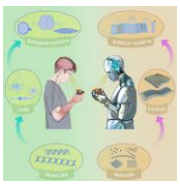
Notes

11-6 12:30–12:50

Neuromorphic Tactile Sensing Device

Ye Zhou
Institute for Advanced Study, Shenzhen University, China

- Tactile sensing systems can be used in human-computer interaction systems, intelligent robots, mobile medical, etc.
- This talk will introduce our research work in the field of neuromorphic tactile sensing.
- We will explore the key influencing factors in the development process of tactile sensing devices.



Notes

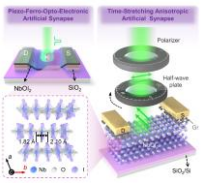
Technical Session 12
Nanoscience for Health I
Room 7
10:50-12:50 Wednesday, 30 July
Chairs: Ying Wang, Xiaolin Jiang

12-1 10:50–11:04

In-Plane Anisotropic Piezo-Ferro-Opto-Electronic 2D $NbOI_2$ for Multi-Functional Artificial Synapse

Decai Ouyang, Yuan Li*, Tianyou Zhai*
School of Materials Science and Engineering,
Huazhong University of Science and Technology, China

- Piezo-/ferro-electronics and optoelectronics in 2D $NbOI_2$, boosting multifunctional artificial synapse design.
- Time-stretching anisotropic artificial synapse: synaptic behavior governed by in-plane polarity and multiple optical transition.
- Piezo-ferro-optoelectronic artificial synapse: synaptic behavior governed by strain-modulated optoelectronic relaxation dynamics.



Multi-functional synapse design based on 2D $NbOI_2$

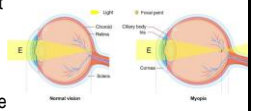
Notes

12-2 11:04–11:18

Research Progress on Myopia Control Based on Eyeball Wall Tissue

Siqi Li, Weijun Chen*, Zuobin Wang*
International Research Centre for Nano Handling and Manufacturing of China,
Changchun University of Science and Technology, China

- The changes in the eyeball wall tissue during the occurrence of myopia were summarized.
- This review summarizes the research progress on myopia control targeting different ocular wall tissues in recent years.
- Myopia has become a global public health issue, with its incidence rate continuously rising. The purpose of this review is to provide theoretical support for new treatment strategies and drug development, and to facilitate research innovation in related fields.



The manifestation of myopia

Notes

12-3 11:18–11:32

Evolution and Future Directions of Cosmetic Efficacy Evaluation Technologies

Hangze Song, Zuobin Wang*
International Research Centre for Nano Handling and Manufacturing of China,
Changchun University of Science and Technology, Changchun, China

- A systematic overview of the evolution of cosmetic efficacy testing technologies: from traditional methods to cutting-edge innovations.
- A systematic tripartite comparative analysis of conventional, contemporary mainstream, and cutting-edge cosmetic efficacy testing methodologies.
- Future perspectives on disruptive technologies in cosmetic efficacy assessment: microfluidic organ-on-a-chip systems, multi-omics biomarker profiling, nanosensor-based detection, and ai-driven predictive analytics.

Bioprinting fabricating 3D reconstructed skin

Notes

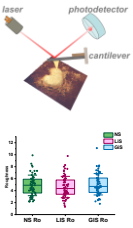
Technical Session 12
Nanoscience for Health I
Room 7
10:50-12:50 Wednesday, 30 July
Chairs: Ying Wang, Xiaolin Jiang

12-4 11:32–11:45

Structural Changes in Immune Cells Following Sepsis and IRF5 Knockdown: An Atomic Force Microscopy Study

Viktoria Sergunova, Vladimir Inozemtsev, Maxim Dokukin
Federal Research and Clinical Center of Intensive Care Medicine and Rehabilitology, V.A. Negovsky Research Institute of General Reanimatology
Moscow, Russia

- The morphological and mechanical changes in neutrophils were found to be associated with infectious and septic complications.
- IRF5 knockout by siRNA induced complex changes including modulation of M1/M2 marker expression, alteration of mitochondrial content, and modification of cell properties such as stiffness and surface roughness.
- Potential biophysical markers related to inflammatory conditions and macrophage polarization were suggested.



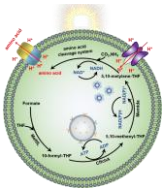
Notes

12-5 11:45–11:58

Artificial Photosynthetic Cells

Chao Gao, Yujie Xiong*
School of Chemistry and Materials Science, University of Science and Technology of China, China

- We made contributions to producing complex products from small molecules.
- Artificial photosynthetic cells are invented by assembling artificial materials, edited enzymes, membranes and transport proteins.
- The artificial photosynthetic cells can be programmed for highly selective production of various complex products.
- The energy conversion efficiency outperforms natural photosynthesis by over three-fold.



Artificial photosynthetic cells

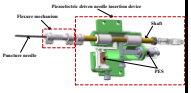
Notes

12-6 11:58–12:11

Development and Validation of an MRI-Compatible Brain Puncture Lateral Force Sensor Based on FBG

Hui Li
School of Mechatronic Engineering, State Key Laboratory of Robotics and System, Harbin Institute of Technology, China

- MRI-compatible actuator designed for image-safe neurosurgical use.
- FBG-integrated flexure enables real-time lateral force sensing.
- Sensor module is embedded in piezo-driven puncture actuator.
- This work presents a compact, MRI-safe actuation-sensing module that enables precise force-controlled puncture in neurosurgical operations.



Integrated structure of brain puncture driving device and force sensing flexible device

Notes

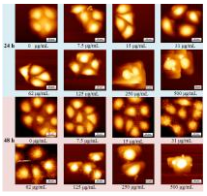
Technical Session 12
Nanoscience for Health I
Room 7
10:50-12:50 Wednesday, 30 July
Chairs: Ying Wang, Xiaolin Jiang

12-7 12:11–12:24

The Study of the Inhibitory Effect of Schisandra Chinensis Extracts on the SMMC 7721 Cells by AFM

Ying Wang
International Research Centre for Nano Handling and Manufacturing of China, Changchun University of Science and Technology, China

- Schisandra chinensis induces SMMC 7721 cell apoptosis.
- Using atomic force microscopy to assess the effects of schisandra chinensis on 7721 cells: cell adhesion force, Young's modulus, and morphological features.
- This methodology provided evidence to support the use of schisamndra chinensis for clinical applications.



AFM images of SMMC 7721 cells treated with the different concentrations of schisandra chinensis extracts for 24 and 48 h

Notes

12-8 12:24–12:37 (Poster)

Influence of Multi-Enzyme Reaction Systems On PCR Reactions

Zhiru Liu
Changchun University of Science and Technolog, China

- Recombine the expression of DNA polymerase and construct a PCR system.
- Study on the stability of PCR reaction storage and the repair ability of damage.
- The chaperonins CpkA and CpkB can extend the stable period of KOD DNA polymerase.
- The repair rates of CpkA and CpkB for inactivated polymerases were 57.5% and 35.8%, respectively.

Notes

12-9 12:37–12:50 (Poster)

Effect of Helicase on PCR Reactions

Deyu Tong
Changchun University of Science and Technolog, China

- The isothermal amplification reaction system constructed by helicase TK0178 can specifically amplify DNA templates with high GC content.
- The addition of TK0718 helicase successfully reduced the non-specific amplification of the PCR reaction.
- It provides an experimental basis for the construction of a PCR multi-enzyme reaction system with high activity, high specificity and high stability.

Notes

Technical Special Session 13
Bioinspired Materials and Resistant Structural Design (ss)

Room 1

14:30-16:30 Wednesday, 30 July

Chairs: Jiyu Sun, Wei Wu and Yueming Wang

13-1 14:30–14:54

Addressing the Pollination Crisis: The Current Situation and Prospects of Ground Pollination Technologies

Wantong Zhang
College of Biological and Agricultural Engineering, Jilin University, China

- The pollination crisis is threatening food security.
- Artificial pollination techniques are an effective way to alleviate the pollination crisis.
- Ground-based pollination machinery has greatly enhanced pollination efficiency.
- Pollination robots are the future direction of development.

The development of artificial pollination

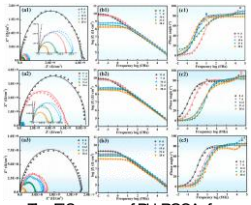
Notes

13-2 14:54–15:18

Study on High-Temperature Resistant and Anti-Corrosive Coatings of PU-RGOA$_x$

Yuping Liu
Key Laboratory of Bionic Engineering, Jilin University Changchun, China

- The reduced graphene oxide aerogel material was successfully prepared.
- The high-temperature resistant and anti-corrosion PU-RGOAx coating was developed.
- The corrosion resistance rate of PU-RGOA2 increased by 83.87% compared with the PU.
- PU-RGOA2 can withstand high-temperature cycles of 200℃ for more than 15 times.



The EIS curves of PU-RGOA$_x$ for different immersion days

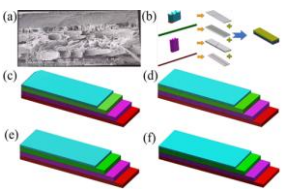
Notes

13-3 15:18–15:42

Mechanical Performance of Arranged Multilayer Inspired by Sagra Femorata Purpurea Lichtenstein Beetle Elytra

Wei Wu
University of Shanghai for Science & Technology, China

- Based on the microstructures of Sagra femorata purpurea Lichtenstein elytra, bionic models were constructed.
- Four bionic models were created with interlayer angles of 90°, 60°, and 0°.
- The 60° arrangement demonstrates superior mechanical performance.
- These findings clarify how fiber orientation affects mechanical properties of microstructure, offering insights into the design for high-strength multilayered structures.



(a) Cross-sectional strucutres of the elytra; (b) Bionic model and its assembly procedure; (c) M1; (d) M2; (e) M3; (f) M4

Notes

Technical Special Session 13
Bioinspired Materials and Resistant Structural Design (ss)

Room 1

14:30-16:30 Wednesday, 30 July

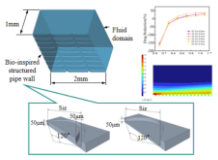
Chairs: Jiyu Sun, Wei Wu and Yueming Wang

13-4 15:42–16:06

Simulation Study on the Erosion-Resistant Structure of the Epidermis of Flounder

Jiajun Fan
School of Engineering, Huzhou University, China

- Bioinspired grooves reduce erosion due to via viscous sublayer.
- Optimal 0.2 mm interlaced 3D grooves achieve 18.8% drag reduction.
- High impact angles (60°) negate erosion resistance, increasing wear.
- Erosion factors significance: angle > size > flow direction > arrangement > dimension.



The anti-erosion surface constructed based on the epidermis of flounder

Notes

13-5 16:06–16:30

Structural Design and Numerical Simulation Analysis of Spraying System for High-Frame Plant Protection Machine

Wantong Zhang, Jiyu Sun *
Key Laboratory of Bionic Engineering (Ministry of Education, China), Jilin University, Changchun, China

- The problem of corn diseases and insect pests seriously endangers food security.
- The optimal spraying parameters are an operating height of 0.75 m, a spraying pressure of 0.3MPa, and a moving speed of 6 km · h^{-1}.
- The precision, unmanned operation, and sustainability of plant protection machinery are the future development directions.

High-frame plant protection machine spraying system

Notes

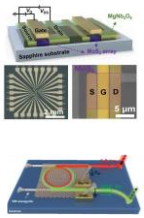
Technical Special Session 14
Smart 2D Optoelectronics (ss)
Room 2
14:30-16:30 Wednesday, 30 July
Chairs: Jiewei Chen, Tianyue Wang

14-1 14:30–14:50

Low-Dimensional VdW Semiconductors and Device Integration

Jingkai Qin
School of Integrated Circuits,
Harbin Institute of Technology (Shenzhen), China

- FET based on 1D Te-BNNT nanowire shows high current capacity (~1.5 × 10^8 A cm^{-2}) with tunable transport behavior.
- 2D transistors based on ultra-thin $MgNb_2O_6$ gate dielectrics demonstrate excellent comprehensive device performance (hysteresis, on/off ratio, subthreshold swing and high temperature reliability).
- 2D SnP_2Se_6 combined with 1D SiN waveguide can be used for monolithic on-chip electronic-photonic integration.



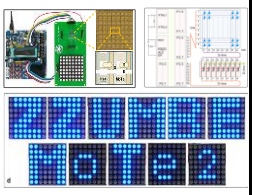
Notes

14-2 14:50–15:10

Two-Dimensional Transition Metal Dichalcogenides and Advanced Optoelectronic Devices

Longhui Zeng
School of Physics, Zhengzhou University, China

- The wafer-scale synthesis of high-quality 2D TMDs materials was successfully using vapor phase deposition.
- We successfully achieved room-temperature infrared photodetection based on different operating mechanisms.
- The high detection performance of heterojunction devices has enabled novel wide-ranging optoelectronic applications.



System-level 2D switch circuits in an InGaN-based blue LED display system

Notes

14-3 15:10–15:30

Thermal Probe Technology for Nanoelectronics in Neuromorphic Computing

Xiaorui Zheng
School of Engineering, Westlake University, China

- Thermal probe technology for nanofabrication, characterization and manipulation.
- Exploring interactions between thermal probe and novel nanomaterials.
- Addressing challenges in nanoelectronic devices.
- Unlocking new opportunities in neuromorphic computing.

Schematic summary

Notes

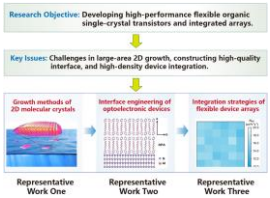
Technical Special Session 14
Smart 2D Optoelectronics (ss)
Room 2
14:30-16:30 Wednesday, 30 July
Chairs: Jiewei Chen, Tianyue Wang

14-4 15:30–15:50

Low-Dimensional Organic Semiconductor Crystal Materials and Devices for Flexible Electronics

Fangxu Yang
Key Laboratory of Organic Integrated Circuits, Ministry of Education
Department of Chemistry, School of Science, Tianjin University, China.

- A variety of large-area, few-layer 2D molecular crystals were grown using a liquid substrate strategy.
- Manipulation of charge transport and exciton physics was achieved by constructing single-crystal interfaces.
- Highly uniform and highly integrated flexible electronic device arrays were prepared using a bottom-up self-assembly strategy.



Main academic achievements

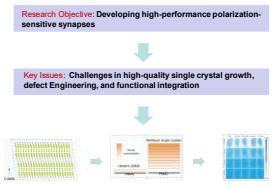
Notes

14-5 15:50–16:10

Organic Single-Crystal-Based Polarized Neuromorphic Transistor

Yu Zhang
Department of Materials Science and Technology Research, Ji Hua Laboratory, China

- Large-area, few-layer 2D organic single crystals were grown using a liquid substrate strategy.
- High-performance polarization-sensitive synapses based on high-quality 2D organic single crystals.
- Robust chiroptical data encoding for secure visual transmission processes.



Main academic achievements

Notes

14-6 16:10–16:30

Two-Dimensional Neuroelectronic Materials for Brain-Inspired Perception and Computation

Yuan Li
Materials Science and Engineering, Huazhong University of Science and Technology, China

- Design of 2D materials for memristors and optoelectronic synapses.
- Wafer-scale growth of vdW heterostructures with high uniformity.
- In-memory computing for visual attention and neuromorphic perception.
- Scalable integration for intelligent terminal-oriented neuromorphic systems.

Notes

Technical Special Session 15
Multifunction Nanomaterials for Nanoengineering Processes (ss)

Room 3

14:30-16:30 Wednesday, 30 July

Chairs: Svetlana von Gratowski, Victor Koledov

15-1 14:30–14:54

Laser Interference Lithography Treatment of the Surfaces for Enhanced Heat Transfer in Magnetic Cooling

Victor Kolesov
Kotel'nikov institute of Radioengineering and Electronics of RAS, Russia

- The paper considers a mechanical thermal switch for magnetic cooling with laser interference lithography (LIL) modified contact surfaces.
- The thermal contact resistance of the contact pairs with LIL-modified surfaces was measured and the time of thermal equilibrium onset was obtained.
- A comparison of the obtained results with literature data is given.
- The work was supported by RSF grant No 25-19-20141, https://rscf.ru/project/25-19-20141/.

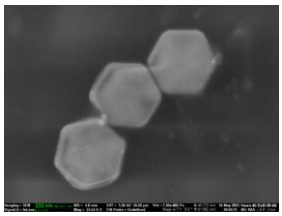
Notes

15-2 14:54–15:18

Study the Method of Creation Nanolasers Arrays from Upconversion Fluoride Nanocrystals β-NaYF4/Yb+3/Er+3

Svetlana von Gratowski
Kotel'nikov IRE RAS, Moscow, Russia

- The paper reports on the synthesis fluoride nanocrystals β-NaYF4/Yb+3/Er+3 with up conversion of IR radiation to visible range.
- The possibilities are discussed of creating nanolaser arrays by self-assembly and nanomanipulation methods.
- The work was supported by state task of kotelnikov IRE RAS.



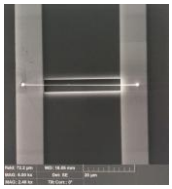
Notes

15-3 15:18–15:42

Resonator Based on a Single ZnO Nanorod

Vladimir G. Krishtop
Institute of Microelectronics Technology and High Purity Materials of Russian Academy of Sciences, Russia

- Technology for manufacturing microresonators based on 1D nanostructures.
- Process for forming ZnO nanorod arrays.
- Technique for manipulating individual nanorods.
- Method for fabricating acoustic microresonators on single ZnO nanorod.
- Prototype of resonator based on single nanorod.
- The developed resonators are intended for high-frequency filters, sensors, and microelectromechanical systems (MEMS).



Microresonator based on single ZnO nanorod

Notes

Technical Special Session 15
Multifunction Nanomaterials for Nanoengineering Processes (ss)

Room 3

14:30-16:30 Wednesday, 30 July

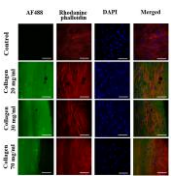
Chairs: Svetlana von Gratowski, Victor Koledov

15-4 15:42–16:06

Nanostructuring of Type I Collagen for Cell Cultivation

Yuliya Nashchekina
Center of Cell Technologies, Institute of Cytology Russian Academy of Sciences
Nanoheterostructures dpt., Ioffe Institute, Russia

- This paper presents the results of the nanostructuring of type I collagen under the influence of mechanical forces using the 3D printing method.
- During the printing process, native collagen fibrils are formed.
- The directional orientation of the fibrils was only observed in the scaffold obtained from their solution with a collagen concentration of 70 mg/ml.
- During cultivation, cells are aligned along the oriented collagen fibrils obtained from collagen solutions of 20, 30, and 70 mg/ml.



Morphology of cells on collagen films after 24 hours of cultivation

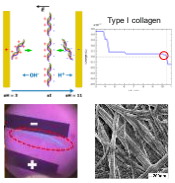
Notes

15-5 16:06–16:30

Isoelectric Focusing of Type I Collagen for Creating an Artificial Cornea

Alekxey Nashchekin
Nanoheterostructures dpt., Ioffe Institute, Russia

- The paper presents the results of determining the isofocusing point of collagen molecules in an external electric field.
- The position of the isofocusing point for type I collagen is pH=10.5 and is confirmed by molecular charge modeling and polarization microscopy.
- The process of drift of collagen molecules in an electric field was visualized by bonding the fluorescent label FITC 488.
- A model of collagen molecules movement in an external field has been constructed, taking into account also the rotation of molecules.



Model, calculation, experiment and structure of collagen

Notes

Technical Special Session 16
Sustainable Materials & Materials for Sustainability (Workshop)

Room 4

14:30-16:30 Wednesday, 30 July

Chair: Federico Rosei

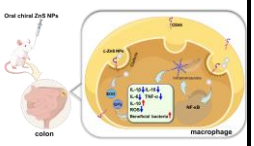
16-1 14:30–14:50

Chiral Nanoparticles for Remodeling Intestinal Homeostasis

Chuanlai Xu

International Joint Research Laboratory for Biointerface and Biodetection, School of Food Science and Technology, Jiangnan University, China

- Chiral zinc sulfide nanoparticles was pareaded which could remodel the gut microbiota by orally administered.
- It was found chiral zinc sulfide significantly scavenged ROS in macrophages, which resulted in the inhibition of NF-κB and NLRP3 signaling pathways.
- Chiral zinc sulfide nanoparticles exhibited excellent treatment and prophylactic effects on IBD mouse model.



The therapeutic and preventive effects of chiral ZnS NPs in mice with inflammatory bowel disease

Notes

16-2 14:50–15:10

Crafting Realistic Lung Phantoms via Hierarchical Engineering

Fulvio Ratto

"Nello Carrara" Inst. Applied Physics, National Research Council, Italy

- Lung phantoms for multimodal methods represent a strategic goal and a challenging issue.
- We have developed a hierarchical approach yielding PDMS gas-porous sponges (ECM analog) with hydrogel inclusions (cell analog).
- This platform is suitable for hosting various contrast agents for ionizing and non-ionizing radiation, while also showing relevant dynamic behavior.
- Challenges include casting this material into anatomical molds and improving its shelf life.

Notes

16-3 15:10–15:30

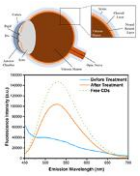
Transport of Carbon Quantum Dots Across Bovine Blood Retina Barrier

Jisu Song[a], Howyn Tang[a], Chao Lu[b], Jin Zhang[a,b*]

[a] School of Biomedical Engineering, University of Western Ontario, Canada N6A 5B9

[b] Department of Chemical and Biochemical Engineering, University of Western Ontario, Canada N6A 5B9

- Carbon quantum dots (CQDs) used for theranostic system for eye diseases.
- No fluorescence emission from the neural retinal layer of the bovine blood retina barrier (BRB).
- After treatment with CQDs, the emission peak at 530 nm observed in bovine BRB.



Notes

Technical Special Session 16
Sustainable Materials & Materials for Sustainability (Workshop)

Room 4

14:30-16:30 Wednesday, 30 July

Chair: Federico Rosei

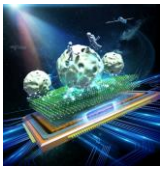
16-4 15:30–15:50

Hybrid Heterojunction with Interface Engineering towards High-Sensitivity Photodetectors

Kaixi Shi

Nanophotonics and Biophotonics Key Laboratory of Jilin Province, Changchun University of Science and Technology, China

- No.vel 2D/0D heterojunctions enable high responsivity photodetectors by coupling charge and energy transfer mechanisms.
- "Physical adsorption" and "ALD sequence control" methods enable strongly-coupled interfaces with efficient carrier separation.
- Engineered plasmonic heterojunction interfaces enable photodetectors with high responsivity and ultrafast speed.



Schematic of the 2D/0D heterojunction photodetector

Notes

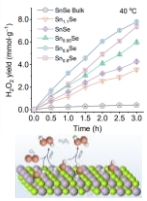
16-5 15:50–16:10

Thermocatalytic H_2O_2 Production from Water and Oxygen at Ambient Conditions

Shun Li

School of Chemistry and Chemical Engineering, Jiangsu University, China

- SnSe nanosheets with Sn vacancies can directly catalyze H_2O_2 production from H_2O and O_2 under ambient conditions (~2.6 mmol·g^{-1}·h^{-1} at 40 ℃).
- No need of additional energy inputs (e.g., light, electricity), cocatalyst, or sacrificial reagents.
- Propose a new thermocatalytic effect arises from a dynamic process involving Sn vacancy defect-induced sequential adsorption/dissociation of H_2O molecules.



H_2O_2 production at ambient conditions over $Sn_{1-x}Se$

Notes

16-6 16:10–16:30

Manganese Doped Quantum Dots

Hui Zhang

School of Advanced Materials and Nanotechnology, Xidian University, China

- Photoluminescence mechanism and temperature response of manganese-doped PbS quantum dots were investigated
- Optoelectronic properties of Mn doped wide-bandgap (Mn:ZnSe/ZnS) quantum dots were investigated
- Interpreting the discrepancy of photophysical mechanism of manganese doping in narrow/wide bandgap quantum dots

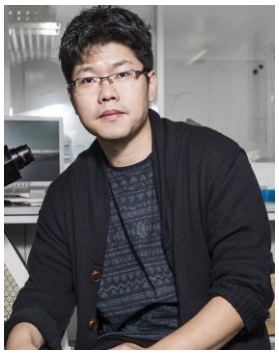
Notes

Technical Special Session 17
Micro/Nano Structural Interface and the Applications (Workshop)

Room 5

14:30-16:30 Wednesday, 30 July

Chairs: Mingdong Dong, Lei Liu

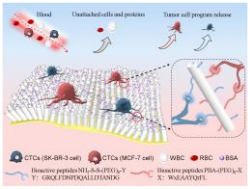


17-1 14:30–14:40

Smart Biointerface for Biomedical Applications

Lei Liu
Institute for Advanced Materials, Jiangsu University, Zhenjiang, China

- Sugar responsive peptide based smart biointerface for CTC isolation.
- Peptide based soft film with dynamic biointerface for CTCs sorting in patient's blood samples.
- Peptide based nano biointerface applied in modulating the fate of cell.



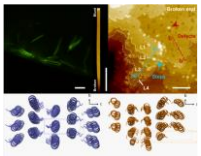
Notes

17-2 14:40–14:51

Mechanobiological Responses on Curvature-Engineered ECM Micropatterns

Yin Wang
Tianjin Institute of Industrial Biotechnology, Chinese Academy of Sciences, China

- The introduction of DMSO induces PSMα3 from amyloid-like fibril into crystal.
- The broken end shows that the crystal possesses layer-by-layer structure with oligomer on edge and in-plane defects.
- Due to DMSO, the α-helix structure has a conformation change, leading to spatial rearrangement of monomer to generate a phase change for crystallization.



DMSO-induced PSMα3 amyloid-like crystal (fluorescent image, layer-by-layer crystal structure, and spatial rearrangement of monomer)

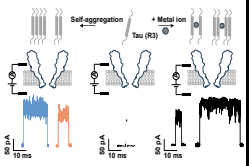
Notes

17-3 14:51–15:02

Nanopore Measurement on Metals Induced Tau Protein Aggregation at Nanoscale

Liang Wang
Chongqing Institute of Green and Intelligent Technology, Chinese Academy of Sciences, China

- Real-time measurement of monomers and different aggregates of Tau protein.
- Label-free measurement of nine essential-metal or heavy-metal ions on induced Tau protein aggregation.
- Novel method potential for investigating Tau pathology driven by metal imbalance and exploring biomarkers detection.



Notes

Technical Special Session 17
Micro/Nano Structural Interface and the Applications (Workshop)

Room 5

14:30-16:30 Wednesday, 30 July

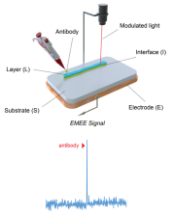
Chairs: Mingdong Dong, Lei Liu

17-4 15:02–15:13

Experimental Control of a Reaction Occurring during the Interaction between Chicken Anemia Virus (CAV) and Its Corresponding Antibodies using Electromagnetic Echo Effect

Ognyan Ivanov
Institute of Solid State Physics, Bulgarian Academy of Sciences, Bulgaria

- Demonstrating a novel approach for rapid viral detection.
- A new type of biosensor that offers rapid and precise diagnostics.
- The proposed technique can be used for reliable control of viral and bacterial outbreaks.



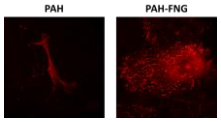
Notes

17-5 15:13–15:24

ECM-Mimicking PEM Films as a Valuable Tool for Enhanced Endothelial Cell Adhesion

Marina Ivanova, Rumiana Tzoneva
Institute of Biophysics and Biomedical Engineering, Bulgarian Academy of Sciences, Sofia, Bulgaria

- FNG-coated PEMs demonstrate enhanced cell viability.
- FNG-coated PEMs show improved cell spreading and attachment.
- PAH-FNG induces the strongest focal adhesions.
- The least hydrophilic and positively charged PAH- ended PEM, which adsorbs the highest amount of FNG by an effective exposure of its D-domains, enhances HUVEC viability, and improves cell spreading and adhesion.



Focal adhesion sites of HUVECs adhered to PEMs

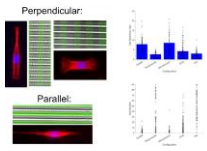
Notes

17-6 15:24–15:35

Photolithographic Micropatterning for Simultaneous Physical and Chemical Cues

Lasse Hyldgaard Klausen*, Mingdong Dong
Interdisciplinary Nanoscience Center (iNANO), Aarhus University, Denmark

- Maskless photolithography used to fabricate topographically defined cell substrates and extracellular matrix protein patterns.
- True independent patterning of both physical and chemical cues.
- Proof-of-concept reveals cell alignment by combined physical and chemical cues.



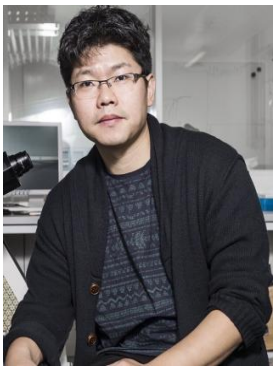
Notes

Technical Special Session 17
Micro/Nano Structural Interface and the Applications (Workshop)

Room 5

14:30-16:30 Wednesday, 30 July

Chairs: Mingdong Dong, Lei Liu

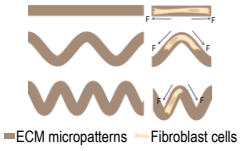


17-7 15:35–15:46

Mechanobiological Responses on Curvature-Engineered ECM Micropatterns

Shuhe Zhang, Yuge Zhang, Lasse Hyldgaard Klausen
Interdisciplinary Nanoscience Center (iNANO)
Aarhus University, Denmark

- Cell migration and directional polarity along ECM micropatterns.
- Curvature sensing and mechanotransduction through cytoskeletal tension and focal adhesion modulation.
- Stress-induced cell mobility and stiffening
- Provide the possible application on muscle cell repair and rehabilitation.



ECM micropatterns in different curvatures and shaped cells

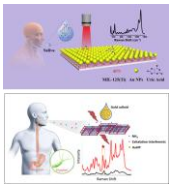
Notes

17-8 15:46–15:57

SERS-Active MOF/COF Sensors for Sensitive Detection of Biomarkers

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

- The application of MOF/COF as SERS-active platforms in VOCs detection is still less explored.
- MIL125(Ti) was firstly demonstrated to serve as a cutting-edge raman-based biosensor platform for the noninvasive evaluation of uric acid (UA) levels in saliva.
- 2D porphyrin-based MOF was used for diagnosis of helicobacter pylori infection through the specific detection of ammonia in human exhalation.



SERS-active MOF/COF platform

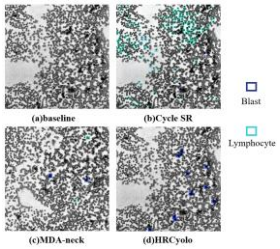
Notes

17-9 15:57–16:08

HRCyolo: High-Resolution Cell Detection via Super-Resolution and Attention Mechanisms

Du Zhang, Yanling Tian*
School of Engineering, University of Warwick, Coventry, UK

- Integrated super-resolution to enhance small, blurry image details.
- Proposed and cycle SR for efficient ROI-guided image enhancement.
- Developed MDA-neck with attention method for better tiny object feature extraction.
- Combined yolo and super-resolution method to achieved significant accuracy boost in tiny cell detection.



Inference detection results using different methods

Notes

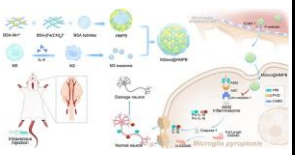
Technical Special Session 17
Micro/Nano Structural Interface and the Applications (Workshop)
Room 5
14:30-16:30 Wednesday, 30 July
Chairs: Mingdong Dong, Lei Liu

17-10 16:08–16:19

Biomimetic Mineralization Inhibitor for Vascular Dementia Therapy

Rongrong Wu
Shanghai Sixth People's Hospital Affiliated to Shanghai Jiao Tong University School of Medicine, China

- Developing an intrinsic bioactive nanodrug targeting the AIM2 inflammasome.
- Further validation of the involvement of the AIM2 inflammasome in disease progression and offers a precise therapeutic strategy.
- Potential scalability to other complex inflammatory disorders.



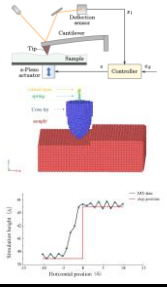
Notes

17-11 16:19–16:30

Research on Contact AFM Surface Topography Measurement Based on Molecular Dynamics Simulation

Xinhao Tian
School of Mechanical Engineering, Tianjin University, China

- A MD model for AFM is established based on the point mass mode.
- The relationship between the force between the tip and the sample is obtained through simulation.
- The measurement process of the sample in contact mode is simulated using MD.
- Explored the influence of scanning speed, direction, and needle tip shapes on measurement results.



Notes

Technical Special Session 18
Design, Analysis and Control of Nano-Manipulating Systems (ss)

Room 6

14:30-16:30 Wednesday, 30 July

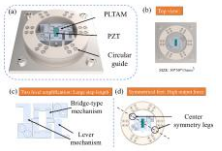
Chairs: Zhen Zhang, Peng Yan

18-1 14:30–14:45

High-Performance Piezoelectric Stick-Slip Rotary Actuator Based on a Parallel Lever Two-Level Amplification Mechanism

Yang Chen, Ziran Wang, Peng Yan*
School of Mechanical Engineering, Shandong University, China

- The actuator uses the PLTAM mechanism to increase displacement, producing a larger step length.
- The two driving legs of the PLTAM improve output force.
- The symmetric arrangement of the driving legs ensures stable and reliable rotational motion.



Structure of an inchworm mechanical structure of the actuator

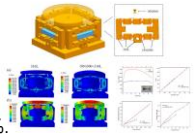
Notes

18-2 14:45–15:00

Effect of Local Additive Manufacturing of Heterogeneous Alloys on the Performance of Flexible Tip Stage

Xin Hou, Peng Yan*
Key Laboratory of High-Efficiency and Clean Mechanical Manufacture Ministry of Education
School of Mechanical Engineering Shandong University, Jinan, China

- This article combines additive manufacturing, heterogeneous alloys, and flexible mechanisms.
- The yield stress and tensile limit of the flexible deflection table are significantly improved after replacing heterogeneous alloys.
- After replacing the heterogeneous alloy, the output displacement of the swing table increased by 32.6%.
- After replacing the heterogeneous alloy, the deflection angle of the deflection table increased by 101%.



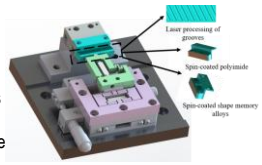
Notes

18-3 15:00–15:15

Design, Analysis, and Experimental Validation of Surface-Modified Inchworm-Based Piezoelectric Actuators

Yunkai Liu
School of Mechanical Engineering, Shandong University, China

- Flexible contact surface modification significantly improves looper actuator performance.
- Laser processing of surfaces increases speeds by 78% to 17821 μm/s.
- Polyimide and shape memory alloy surfaces increase speeds by 21% and 57% respectively, surface modification to increase loading capacity to 240 grams.
- This paper can be used to enhance the output performance of the inchworm actuator through surface modification techniques.



Structure of an inchworm actuator with different flexible contact surfaces

Notes

Technical Special Session 18
Design, Analysis and Control of Nano-Manipulating Systems (ss)

Room 6

14:30-16:30 Wednesday, 30 July

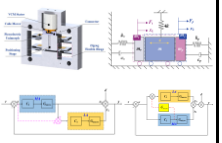
Chairs: Zhen Zhang, Peng Yan

18-4 15:15–15:30

Dynamic Modeling and Sensitivity-Decoupling Control of a Macro-Micro Positioning Stage

Beibei Hou, Pengbo Liu*
School of Mechanical Engineering, Qilu University of Technology (Shandong Academy of Sciences), Jinan, China

- A VCM-PZT driven compliant positioning stage is designed for millimeter stroke and nano precision.
- The electromechanical coupling dynamic model is established to demonstrate the dual actuating performance.
- The sensitivity decoupling based control method is developed for the dual-driven stage, such that excellent control peroformance is achieved.



The dynamic modeling and sensitivity decoupling control method of the macro-micro composite system

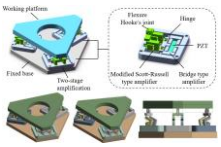
Notes

18-5 15:30–15:45

Design and Analysis of a Spatial 3-DOF Compliant Micro-Motion Platform

Runqing Wang, Pengbo Liu*
School of Mechanical Engineering, Qilu University of Technology (Shandong Academy of Sciences), Jinan, China

- A parallel Z-tip-tilt motion stage is developed, which is actuated by three two-stage compliant amplification mechanism.
- The in-plane output displacements of PZTs are tranferred into the out-of-plane motion via the bridge-type and scott–russell based two-stage amplification mechanism.
- Theoretical modeling and finite element simulations verify the mechanical perofrmance.



Platform structure and motion characteristics

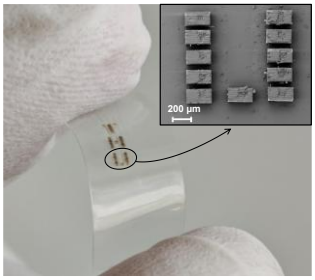
Notes

18-6 15:45–16:00

AOD-Assisted Maskless Laser-Induced Micro-Components Transfer

Kuai Yang, Zhen Zhang*
Department of Mechanical Engineering, Tsinghua University, China

- Programmable micro-LED transfer onto flexible substrates.
- High-efficiency transfer strategy with pre-etching and laser ablation.
- AOD use enabling multi-fold improvement in transfer throughput.



Notes

Technical Special Session 18
Design, Analysis and Control of Nano-Manipulating Systems (ss)

Room 6

14:30-16:30 Wednesday, 30 July

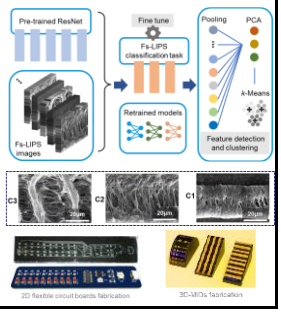
Chairs: Zhen Zhang, Peng Yan

18-7 16:00–16:15

Machine Learning Based Optimization of Femtosecond Laser-Induced Porous Structures

Yu Liu, Jun Ren
School of Mechanical Engineering, Jiangnan University, China

- Femtosecond laser-induced porous structures (fs-LIPS) process is developed.
- A deep learning (DL)-based evaluation method is considered for accurately evaluating the quality of the porous structures.
- The different ML architectures (ResNet18, ResNet50, and ResNet101) are evaluated.
- The decision boundary between laser processing parameters and fs-LIPS types is established using the random forest (RF) algorithm.
- The resulting decision tree provides instructive parameters for the laser processing of various fs-LIPS types.



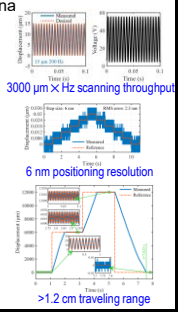
Notes

18-8 16:15–16:30

High-Throughput Scanning with Stick-Slip Piezoelectric Actuators

Xiangyuan Wang, Limin Zhu
State Key Laboratory of Mechanical System and Vibration,
Shanghai Jiao Tong University, China

- We demonstrate that not only the high-velocity stepping, but also the high-throughput scanning can be achieved by a typical stick-slip piezoelectric actuator.
- By combining the stepping and scanning characteristics, a high performance was achieved from the nano to the macro scale.
- The scanning throughput was optimized by exploring the actuator's scannable trajectory set.
- Optimal smooth trajectories was designed for further improving the throughput of uniform-velocity scanning.



Notes

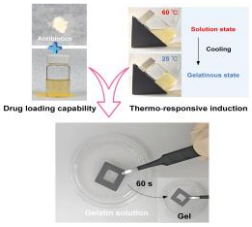
Technical Session 19
Nanoscience for Health II
Room 7
14:30-16:30 Wednesday, 30 July
Chairs: Guangming Xiong, Hao Zhang

19-1 14:30–14:45

Bubble Blowing Inspired Ultrathin Hydrogel Films with Drug-Loading Capability

Minghao Li, Faze Chen*
School of Mechanical Engineering, Tianjin University, China

- An ultrathin hydrogel film (just 5 μm thick) was fabricated using a closed mold.
- The film's thickness increases radially from the center toward its edges.
- Large-area hydrogel membranes can be produced by stitching together multiple templates.
- The hydrogel film is capable of drug loading and undergoes complete degradation.



Notes

19-2 14:45–15:00

Detection Method of Antibody Colloidal Gold Based on CHO Recombinant Antigen CTN-1 Virus Vaccine

Dingyao Liu[1], Hao Zhang[1]*, Xingfu Feng[1]*
[1]Changchun University of Science and Technology, China
[2]Changchun Zhuoyi Biotech Co., China

- Objective:This study aims to establish a method for detecting IgG colloidal gold in human rabies virus antibody.
- Method: The detection principle adopts indirect method. Prepare colloidal gold solution using trisodium citrate reduction method, label mouse anti human IgG and chicken IgY antibodies with colloidal gold, and coat CHO recombinant CTN antigen and sheep anti chicken IgY on the T (detection line) and C (quality control line) of the test strip, respectively. Evaluate the performance of the test strip using human rabies virus antibody positive serum.
- Conclusion:This study is based on the detection method of CHO recombinant CTN antigen colloidal gold antibody, which has good sensitivity and accuracy, and provides an important basis for further optimization of the methodology system and the development of test strip products.

Notes

19-3 15:00–15:15

High-Precision Incremental PID Temperature Control Module for Enzyme-Linked Immunosorbent Assay

Yinghui Li, Xin Zhang
School of Computer Science and Technology, Changchun University of Science and Technology, China

- A low-cost module solves poor ELISA temperature control.
- Hardware uses an STM32, dual heaters, and PT1000 sensors.
- Software employs an incremental PID algorithm with an anti-windup function.
- It achieves ±0.2℃ stability and uniformity, enhancing experimental reproducibility.

Notes

Technical Session 19
Nanoscience for Health II
Room 7
14:30-16:30 Wednesday, 30 July
Chairs: Guangming Xiong, Hao Zhang

19-4 15:15–15:30

Optically Induced Dielectrophoresis for Bactericidal Non-Destructive Testing Agent Developmen

Chenxi Zhao
International Research Centre for Nano Handling and Manufacturing of China, Changchun University of Science and Technology, China

- An optically controlled dielectrophoretic force field was applied to manipulate *Saccharomyces cerevisiae* and *Escherichia coli*.
- ODEP enabled directional microbial manipulation, verified with *E. coli*.
- ODEP non-destructively examined isopropyl alcohol's bactericidal effect on *E. coli*, verified by AFM.

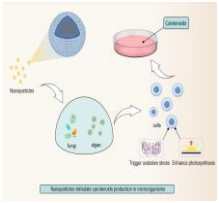
Notes

19-5 15:30–15:45

Nanoparticles: Innovative Tools to Enhance Carotenoid Production in Microorganisms

Jiahua Lin
Guangdong Provincial Key Laboratory of Natural Drugs Research and Development, Guangdong Medical University, Dongguan 523808, China

- This review provides the first summary of nanoparticle-mediated regulation of carotenoid biosynthesis in microorganisms.
- Mechanisms involve modulation of redox homeostasis and photosynthetic efficiency to enhance nanoparticle-induced carotenoid production.
- It proposes nanotechnology–synthetic biology integration to boost pigment yield and enable smart fermentation.



Nanoparticles stimulate carotenoids production in microorganisms

Notes

19-6 15:45–16:00 (Poster)

Research on the Combination of Isothermal Amplification and Immunochromatography Detection Method of New Coronavirus Nucleic Acid

Tengfei Liu
Changchun University of Science and Technolog, China

- Isothermal amplification of recombinant enzymes polymerase (RPA) and fluorescence immunochromatography.
- Established RPA and immunochromatographic detection method system and optimized it.
- The detection sensitivity is three times higher than that of colloidal gold.
- Detection limit as low as 25 pg/mL and time reduced to 40 minutes.

Notes

Technical Session 19
Nanoscience for Health II
Room 7
14:30-16:30 Wednesday, 30 July
Chairs: Guangming Xiong, Hao Zhang

19-7 16:00–16:15 (Poster)

Establishment and Application of an Immunochromatographic Method for the Detection of dust Mite Allergen-Specific IgE Antibodies

Yueqi Jia
Changchun University of Science and Technolog, China

- A quantitative detection method for dust mite allergen sIgE using quantum dot immunoassay was established and optimised, with a linear range of 0.0975 IU/mL and a detection limit of 0.0903 IU/mL.

Notes

19-8 16:15–16:30 (Poster)

Study and Application of Colloidal Gold Detection Reagent for New Crown Virus (2019-nCoV) Antigen Self-Test

Xiaolu Liu
Changchun University of Science and Technolog, China

- Double antibody sandwich assay based on SARS-CoV-2 antigen, N1a and N1 antibodies.
- The limit of detection is 5 pg/mL and the interpretation time is less than 30 minutes.
- The accuracy is the same as that of fluorescence quantitative PCR, and it can be detected anywhere without instruments and professional operation.

Notes

Technical Session 20
Nanopositioning and Nanomanipulation

Room 1

16:50-18:50 Wednesday, 30 July

Chairs: Anna Emakova, Yujuan Chen

20-1 16:50–17:00

Size-Based Sorting Yeast Cells via Optically Induced Dielectrophoretic Virtual Channels

Yongqi Hu

International Research Centre for Nano Handling and Manufacturing of China , Changchun University of Science and Technology, Changchun

- Design and construction of an optically Induced dielectrophoretic (ODEP) virtual channels system.
- Manipulation and size-based sorting of yeast cells via the ODEP virtual channels system.
- The cell sorting effect was the best when the applied signal frequency and voltage were 3 kHz and 3 V.
- The study confirmed the high sensitivity and reliability of ODEP virtual channels technology in eukaryotic microorganism sorting.

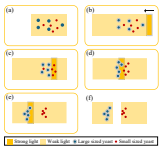


Illustration of the yeast cell separation process in the ODEP microfluidic system

Notes

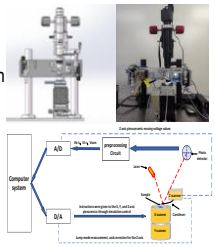
20-2 17:00–17:11

Design of Atomic Force Microscope System Based on Z-Axis Separated Force Measurement

Haiyue Yu, Zuobin Wang*

International Research Centre for Nano Handling and Manufacturing of China, Changchun University of Science and Technology, China

- Beam deflection routes that are more suitable for force measurements.
- Jump mode measures single-molecule interaction forces.
- The new probe holder facilitates probe access.
- The dissociation constant was calculated by design.



Notes

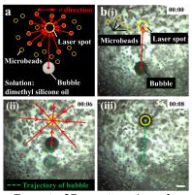
20-3 17:11–17:22

Attraction Control of Optothermal Bubble Microrobots in Dimethyl Silicone Oil

Yuting Zhou

Shenyang Institute of Automation, Chinese Academy of Sciences, China

- Bubble microrobots are generated at the chip-liquid interface via the optothermal effect.
- The discovery of dimethyl silicone oil as a medium enables remote 2D manipulation of microbubbles.
- Remote control is achieved through the bubble's inherent phototaxis, thermotaxis, and thermocapillary (marangoni) microflow attraction.
- Provides novel control methods for bubble microrobots, enhancing their utility in microscale environments.



Remote 2D re-attraction of a bubble microrobot by the laser

Notes

Technical Session 20
Nanopositioning and Nanomanipulation

Room 1

16:50-18:50 Wednesday, 30 July

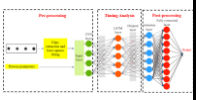
Chairs: Anna Emakova, Yujuan Chen

20-4 17:22–17:33

Intelligent Micro-Dispensing Method of High-Viscosity Adhesive

Yuchen Kong
School of Mechanical Engineering, Dalian University of Technology, China

- An LSTM-based time series prediction method for HVA dot size was proposed.
- The enhanced YOLO algorithm with attention mechanism is built-up to accurately obtain the dispensing position.
- A ResNet50-based quality assessment model detects HVA dot dispensing-process anomalies.



Architecture of the prediction model of dot size for HVA dispensing

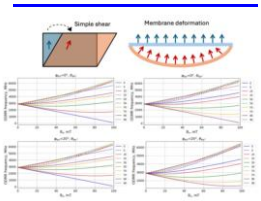
Notes

20-5 17:33–17:44

Nanodiamonds as Sensors for Nanoscale Motion

Leander Deleux, Anna Ermakova
UHasselt, BIRA-IASB, Belgium

- The nitrogen-vacancy center in (nano)diamond is sensitive to the 3D magnetic field.
- Changes in spatial position and orientation influence the positions of the ODMR lines.
- It can be used to detect deformations of soft matter with high resolution.



centers corresponding to various spatial orientations represent tilt motion

Notes

20-6 17:44–17:55

Review on the Research of Nanorobots:Driving Mechanisms, Biomedical Applications, Challenges

Xu Chen, Xiaolin Jia
School of Foreign Languages, Jilin Institute of Chemical Technology, China

- Reviews innovations in chemical, external field, and biohybrid nanorobot driving mechanisms.
- Explores nanorobot efficacy in targeted therapy and precise diagnosis applications.
- Proposes multimodal driving fusion to address biocompatibility and motion control challenges.

Notes

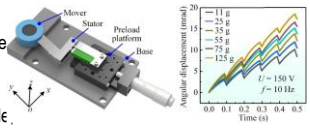
Technical Session 20
Nanopositioning and Nanomanipulation
Room 1
16:50-18:50 Wednesday, 30 July
Chairs: Anna Emakova, Yujuan Chen

20-7 17:55–18:06

Influence of the Mover Mass on Stepping Characteristics of Stick-Slip Piezoelectric Actuators

Zhaochen Ding, Huadong Yu*
School of Mechanical and Aerospace Engineering, Jilin University, Changchun, China.

- Increasing the mover mass reduces the backward displacement and enhances the motion linearity.
- Higher driving frequencies improve actuator performance, particularly when paired with heavier movers.
- A low voltage (60 V) enables stable, energy-efficient operation with high linearity.



Notes

20-8 18:06–18:17

Force Self-Sensing in a Four-Degree-of-Freedom Microclamp

Yu Wang, Yuguo Cui*
Mechanical Engineering & Mechanics Ningbo University Ningbo, China

- The proposed piezoelectric micro-clamp achieves four degrees of freedom in motion.
- A current integration-based sensing-enabled method is proposed to measure the grasping force of the microclamp.
- Experimental results demonstrate that the microclamp effectively achieves four degrees of freedom.

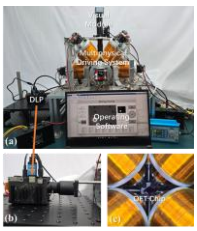
Notes

20-9 18:17–18:28

Design of Microrobot Driving System Based on Magneto Optical Cooperation

Zhejian Feng, Ming Du
School of Mechatronical Engineering, Beijing Institute of Technology, China

- Customized, precise control of microrobots.
- Cooperation between multiphysical fields.
- Organic combination of electromagnet and photoelectric tweezers.



Notes

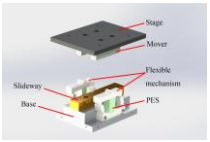
Technical Session 20
Nanopositioning and Nanomanipulation
Room 1
16:50-18:50 Wednesday, 30 July
Chairs: Anna Emakova, Yujuan Chen

20-10 18:28–18:39 (Poster)

A Small Size Walking Type Piezoelectric Actuator with Flexible Mechanism Vertical Installation

Jingwen Gao
Jilin University, China

- Flexible mechanism: a compliant mechanism for precision motion.
- Dual-foot alternating drive: two contact feet operate sequentially for motion generation.
- Normal force: perpendicular contact force critical for friction-based actuation.



3D model of piezoelectric actuator

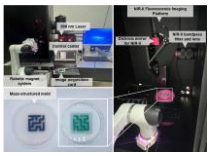
Notes

20-11 18:39–18:50 (Poster)

Autonomous Navigation of Magnetic Nanorobot Swarm via NIR-II Imaging

Qi Ding, Lin Lin, Xiaohui Yan*
School of Public Health
Xiamen University, Xiamen, China

- Real-time swarm tracking with NIR-II visual feedback.
- U-Net and YOLOv5 ensure accurate visual perception.
- BFS algorithm plans optimal swarm paths.
- Sub-millimeter tracking achieved in complex environments.



Schematic diagram of the integrated platform

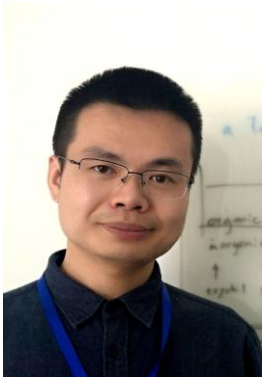
Notes

Technical Special Session 21
Nanophotonics and Plasmonics (ss)

Room 2

16:50-18:50 Wednesday, 30 July

Chairs: Lei Shao, Xiaolu Zhuo

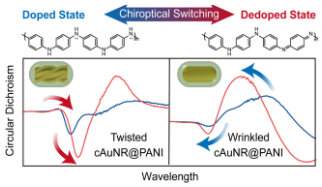


21-1 16:50–17:10

Morphology-Dependent Chiroptical Switching in Intrinsically Chiral Gold Nanorods Encapsulated with Polyaniline

Xiaolu Zhuo
The Chinese University of Hong Kong, Shenzhen, China

- Synthesis of twisted and wrinkled chiral gold nanorods (cAuNRs).
- Encapsulation of polyaniline (PANI) leading to opposite chiroptical switching behaviors.
- Impact of near-infrared absorption of PANI on the circular dichroism spectra.



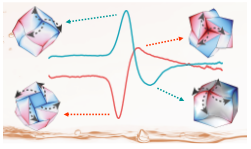
Notes

21-2 17:10–17:30

Bichiral Plasmonic Nanoparticles with Geometry-Dependent Circular Dichroism

Qingfeng Zhang
College of Chemistry and Molecular Sciences, Wuhan University, China

- Bichiral plasmonic nanoparticles exhibited intriguing geometry-dependent circular dichroism reversal.
- Multiple chiral centers on one particle are further demonstrated in nanoparticles with different chiral geometry.
- Applications of chiral nanoparticles in photonics, sensing, and catalysis are also shown.



Bichiral Au nanoparticles with geometry-dependent plasmonic circular dichroism reversal

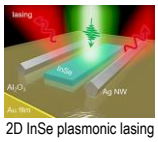
Notes

21-3 17:30–17:50

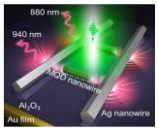
Room-Temperature Low-Threshold Plasmonic Nanolasers Enabled by Metallic F-P Cavity

Fajun Xiao
School of Physical Science and Technology, Northwestern Polytechnical University, China

- A low-loss metallic F-P cavity is proposed.
- The first room-temperature plasmonic laser based on 2D material is realized by the enhancement of feedback (reduced cavity loss) and plasmon-exciton energy transfer (increased gain) in the F-P cavity.
- Single-mode multi-wavelength lasing is realized in the F-P cavity by tuning the cavity length to form wedge shape to spatially match the emission wavelengths of the gain nanowires.



2D InSe plasmonic lasing



Multi-wavelength plasmonic lasing

Notes

Technical Special Session 21
Nanophotonics and Plasmonics (ss)

Room 2

16:50-18:50 Wednesday, 30 July

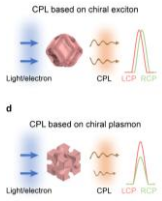
Chairs: Lei Shao, Xiaolu Zhuo

21-4 17:50–18:10

Circularly Polarized OLEDs from Chiral Plasmonic Nanoparticle-Molecule Hybrids

Lei Shao
School of Electronics and Information Technology, Sun Yat-sen University, China

- Chiral plasmonic NPs serve as the chiral scaffold and chiral optical nanoantenna to modulate the circularly polarized absorption and emission of the supramolecular chromophores.
- We constructed various CP-OLEDs with the emission dominated by chiral excitons or chiral plasmons, with the EQE reaching 2.5% and g_{EL} reaching 0.31.



Circularly polarized photo-and electro-luminescence from chiral plasmonic nanoparticle-molecule hybrids

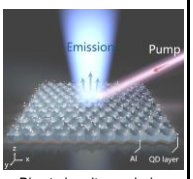
Notes

21-5 18:10–18:30

Exciton Emission Enhanced by Symmetry Breaking in Topological Cavities

Yurui Fang
School of Physics, Dalian University of Technology, China

- We realize a σ_h-breaking plasmonic honeycomb cavity supporting quasi-BIC modes with Q-factors over 10^6.
- Coupling PQDs to the cavity leads to 32× emission enhancement and directional blue emission with 12.6° beam divergence.
- The structure suppresses Ohmic loss and shortens emitter lifetime, boosting brightness and beam quality.
- Topological band inversion and Zak phase confirm the existence of topological nontrivial modes.



Directed exciton emission enhanced by symmetry breaking in topological light fields

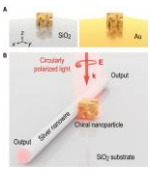
Notes

21-6 18:30–18:50

Substrate-Modulated Chiroptical Responses and Routing of Surface Plasmon Polaritons

Yilin Chen[1,2], Xiaolu Zhuo[1], Jianfang Wang[2]
[1]School of Science and Engineering, The Chinese University of Hong Kong, Shenzhen, China
[2]Department of Physics, The Chinese University of Hong Kong, Shatin, Hong Kong SAR, China

- Investigated the inversion of chiroptical responses of chiral gold nanoparticles.
- Measured scattering dissymmetry factors using single-particle differential dark-field scattering.
- Routing of surface plasmon polaritons in a silver nanowire with an attached chiral nanoparticle.
- Analyzed the chirality-induced propagation behaviors in the chiral nanowaveguides.



(A) Schematics of chiral nanoparticles on silica and gold substrates
(B) A chiral nanowaveguide excited by circularly polarized light

Notes

Technical Special Session 22
Multifunction Nanomaterials for Nanoengineering Processes (ss)

Room 3

16:50-18:50 Wednesday, 30 July

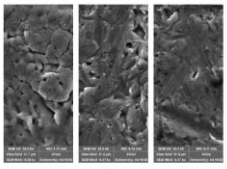
Chairs: Victor Koledov, Svetlana von Gratowski

22-1 16:50–17:14

The Development of Laser Processing Technology for Medical Titanium Alloy Implants

Gosteva E. Alexander
Peoples' Friendship University of Russia, Russia

- The work conducted has demonstrated the feasibility of using laser ablation to modify the morphology of titanium alloy VT1.0 on the micron scale, thereby opening up new avenues for future research.
- Maximum surface roughness (Ra) was observed when the laser power was 15 watts and the pulse duration was 20 nanoseconds, which corresponds to published data for implanting samples into class I bone, which is considered high quality.



a b c

15 (a), 10 (b), 5 watts (c)

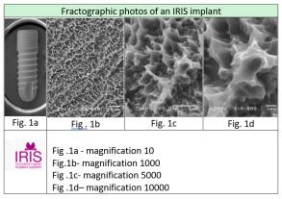
Notes

22-2 17:14–17:38

Research of Dental Implant Surfaces, Represented in Russia

Gosteva E. Aleksandrovna
Peoples' Friendship University of Russia, Russia

- Qualitative aspects influencing the process of osseointegration include: the condition of the sample surface, the allocation and density of micropores, their height, the presence of unetched areas, as well as inclusions of impurities.
- The article is devoted to studying microstructural surfaces of different implant systems that are officially represented on the russian dental market nowadays.



Notes

22-3 17:38–18:02

Novel Technique for Detecting Localization of Acid and Base Lewis and Bronsted Surface Sites Based on Atomic Force Microscopy

Julia Spivak
Department of Micro and Nanoelectronics, ETU "LETI", Russia

- A novel AFM technique for determining the localization of different surface sites is proposed.
- It permits to distinguish the localization of acidic and basic Lewis and Brønsted sites.
- Technique enables establish the relationship between the surface sites and the nanofeatures of morphology.
- An example of technique application is given on porous silicon with a known sites composition.

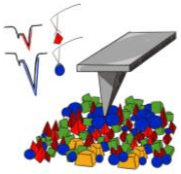


Illustration of the idea for determining the local distribution of adsorption sites on the surface of nanomaterials using the AFM method

Notes

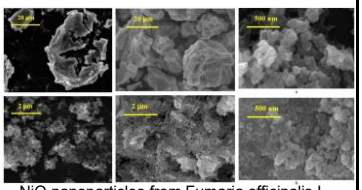
Technical Special Session 22
Multifunction Nanomaterials for Nanoengineering Processes (ss)
Room 3
16:50-18:50 Wednesday, 30 July
Chairs: Victor Koledov, Svetlana von Gratowski

22-4 18:02–18:26

Influence of Technological Conditions on the Parameters of Porous Nickel Oxide Nanoparticles

Kamilya Khalugarova
Micro and nanoelectronics ETU "LETI" Saint Petersburg, Russia

- Achieves high SSA (130 m^2/g) for NiO nanoparticles.
- Compares two plant extracts' effects on NiO.
- Analyzes extractant types' influence on NiO.
- Provides optimized green synthesis conditions.



NiO nanoparticles from Fumaria officinalis L. NiO nanoparticles from Origanum vulgare L. NiO nanoparticles from Fumaria officinalis L. with isopropyl (a) and ethyl (b) alcohol extractants.

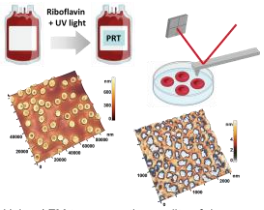
Notes

22-5 18:26–18:50

Assessing the Effects of Donor Red Blood Cell Processing Methods Using AFM

Ekaterina Sherstyukova[1], Alexander Kostin[2], Viktoria Sergunova[1]
[1]Federal Research and Clinical Center of Intensive Care Medicine and Rehabilitology, Russia
[2]Sklifosovsky Research Institute for Emergency Medicine, Russia

- AFM analysis used to assess blood units processed with riboflavin + UVB pathogen reduction (PRT).
- RBC morphology, cytoskeletal structure, and elasticity remained stable during storage.
- Technology is safe for emergency transfusions in massive blood loss.



Using AFM to assess the quality of donor red blood cells

Notes

Technical Special Session 23
Sustainable Materials & Materials for Sustainability (Workshop)

Room 4

16:50-18:30 Wednesday, 30 July

Chair: Federico Rosei

23-1 16:50–17:10

Building-Facades in Carbon-Neutrality-Era Arts of Color-Field in Photovoltaics

Leo Lau, Zhiqiang Han, Po Wan Shum
College of Chemistry & Chem. Engin., Linyi University, China

- In the era of carbon neutrality, all buildings should comply with the "standard" of zero carbon emission.
- Only building-integrated photovoltaics (BIPV) can make buildings E-plus and zero carbon emission.
- BIPV must be colorful as urbans all painted with monochromic greyish-black PVs are dreadfully dull.
- S&T innovations enable zero-carbon urban-designs with the arts of color-field: colors with no photoabsorption, thus no PV loss.

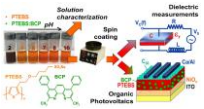
Notes

23-2 17:10–17:30

Green and Biodegradable Organic Solar Cells

Giovanni Fanchini
Physics & Astronomy and Chemistry, Western University, Canada

- We present the solution processing of green organic photovoltaics (OPV) from earth-abundant elements and not requiring toxic solvents.
- We review a host of water-soluble polymers for OPV including poly[2(3thienyl) ethoxy-4-butylsulfonates (PTEBS) and the required device architectures.
- The photo-physics of PTEBS is discussed in light of their excitonic & dielectric properties.
- Our paper reports the highest OPV photo-conversion efficiencies obtained so far from any water-soluble polymers, except for poly-thiophene particles previously processed in nonpolar solvents.



Green OPV fabrication

Notes

23-3 17:30–17:50

Heterogeneous Photocatalysis for Synthetic Chemistry

Ren Su
Dept. Energy, Soochow University, China

- Understanding photocatalyzed reactions by surface science and in-situ spectroscopy.
- Precise design of heterogeneous photocatalyst materials.
- Precise synthesis of value-added chemicals by heterogeneous photocatalysts.
- Design of modular tubular systems for large scale applications.

Precise photosynthesis using designed flow systems and photocatalyst

Notes

Technical Special Session 23
Sustainable Materials & Materials for Sustainability (Workshop)

Room 4

16:50-18:30 Wednesday, 30 July

Chair: Federico Rosei

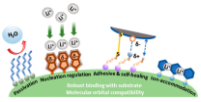
23-4 17:50–18:10

Molecular Self-Assembly for Energy-Dense Li Metal Batteries

Yanbin Shen

Suzhou Institute of Nano-Tech and Nano-Bionics (SINANO), CAS, China

- Molecular self-assembly is useful for regulating electrode surface chemistrty of Li metal batteries.
- Here, heteroatomic conjugated molecules are self-assembled on a Cu foil to induce a surface dipole.
- Surface dipole increase the adsorption force of inner Helmholtz plane to anions, resulting in anion derived SEI.
- The uniform and robust anion-derived SEIs are onducive to uniform Li-deposited morphology, leading to a high Li plating/stripping coulombic efficiency.



Self-assembled molecular layers for batteries

Notes

23-5 18:10–18:30

Direct Cathode Regeneration Technology for Sustainable Spent Lithium-Ion Battery Recycling

Tingzhou Yang

State Key Laboratory of Catalysis, Dalian Institute of Chemical Physics, Chinese Academy of Sciences, China

- Sustainable cathode material regeneration technology.
- Highly efficient green extraction technology.
- Regeneration into next generation cathode materials for lithium/sodium battery.
- Life cycle analysis.
- Techno-economic analysis.

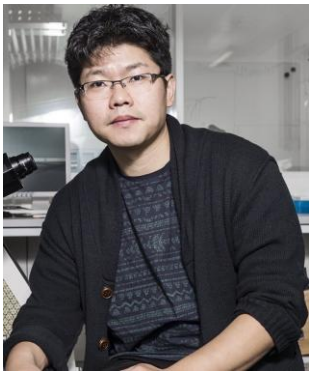
Notes

Technical Special Session 24
Micro/Nano Structural Interface and the Applications（Workshop）

Room 5

16:50-18:50 Wednesday, 30 July

Chairs: Mingdong Dong, Lei Liu

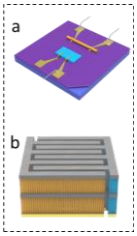


24-1 16:50–17:14

Micro-Nano Electrochemical Energy Storage Materials and Devices

Xiaocong Tian
School of Materials Science and Technology, Wuhan University of Technology, China

- With the rapid development of portable electronics and wearables, micro-nano electrochemical energy storage devices (EESDs) have received extensive attention.
- Micro-nano engineering has brought broad prospects and new opportunities to EESDs. Recently, novel micro-nano battery/capacitor materials/devices and integrated energy systems have been reported with excellent electrochemical properties via a universal manufacturing.
- The integrated energy devices were explored towards novel application areas, and the intrinsic energy storage mechanism was studied.



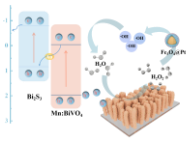
Notes

24-2 17:14–17:38

Nanozymes Induced Z-Scheme Heterostructure PEC Signal Amplification

Faying Li
School of Chemistry and Pharmaceutical Engineering, Shandong First Medical University, China

- Z-scheme heterostructure was employed to facilitate the photoinduced charge separation process.
- Catalytic decomposition of the hole-derived H_2O_2 by nanozymes for signal amplification.
- The charge transfer pathway is adjusted by modulating the positions of Au NPs.



Mechanism of the proposed PEC sensing platform.

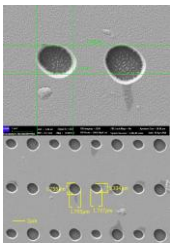
Notes

24-3 17:38–18:02

Angle-Insensitive Dual Bound States in Continuum on Germanium Metasurface

Yiqing Liu, Zhengji Xu*
School of Microelectronics Science and Technology,
Sun Yat-sen University, China

- Two distinct BIC modes were identified, excited by orthogonal polarization directions, each with unique field patterns.
- Strong angular robustness:(1) BIC modes remain decoupled from external fields across varying incident angles; (2) Q-BIC resonance peak remain unchanged across varying incident angles.
- Promising platform for next-generation multifunctional planar optical devices, including sensing, nonlinear optics, and light–matter interaction.



Notes

Technical Special Session 24
Micro/Nano Structural Interface and the Applications（Workshop）
Room 5
16:50-18:50 Wednesday, 30 July
Chairs: Mingdong Dong, Lei Liu

24-4 18:02–18:26

Interface Engineering of Low-Dimensional Materials and Their High-Performance Sensor Applications

Shipu Xu
School of Microelectronics Science and Technology, Sun Yat-sen University
Zhuhai 519082, P. R. China

- The cutting-edge research about semiconductor-type gas sensors focuses on enhancing sensing sensitivity and specificity.
- This investigation miniaturizes the sensing site to achieve detection towards ultra-trace gases.
- To enhance specificity, the Schottky-junction-based sensing is proposed to correlate molecule-polarity and device-transport properties.

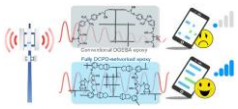
Notes

24-5 18:26–18:50

Advanced Thermosets for 5G-Telecommunications

Jianming Zhang
School of chemistry and chemical engineering, Jiangsu University, China

- We designed a low-cost fully dicyclopentadiene (DCPD)-networked epoxy electronic material.
- The cured DCPD-based resin demonstrates excellent thermal properties (Tg > 250 ℃).
- The resin features low dissipation factors (0.0065@10 GHz), indicating its potential as a promising high-performance electronic material.



Notes

Technical Special Session 25
Cross-Scale Macro-Micro-Nano Manufacturing (ss)

Room 6

16:50-18:50 Wednesday, 30 July

Chairs: Shiwei Zhang, Zhongxu Lian

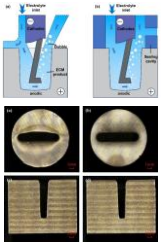
25-1 16:50–17:05

Improvement of Deep and Narrow Groove Profiles for Electrochemical Machining Based on Electrolyte jet Constraints

Jinpeng Zhao

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

- We analyze the influence of the free jet on the contour morphology at different machining depths.
- Through the hermetic field to constrain the electrolyte jet at the outlet to achieve the improvement of the contour morphology on the surface of deep and narrow groove.
- The flow paths of the electrolyte under the free jet and jet restraining are analyzed by gas-liquid two-phase flow simulation.



Notes

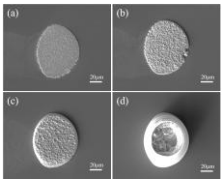
25-2 17:05–17:20

Meniscus-Confined Electrodeposition of Noncircular Structures: Control of Deposition Morphology by Liquid Surface Confinement

Ningqian Tang

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

- Precise regulation of the end face morphology of shaped glass microtubes has been realized.
- Glass microtubes with non-circular cross-section characteristics were successfully prepared.
- The contours of the deposited structures match the geometry of the glass micropipette end faces.



SEM image of non-circular deposition structure

Notes

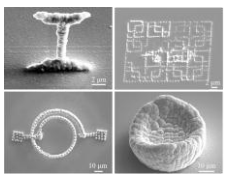
25-3 17:20–17:35

Design and Manufacturing of Complex Pure Copper Microstructures by Localized Electrodeposition

Zhengyi Yang

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

- Using the comsol multiphysics field simulation software to analyze the micro-area deposition process.
- Analyze the distribution patterns of the pressure, flow rate and metal ion concentration in the micro-area electrolyte.
- By using slicing software and matlab, it was converted into a (.csv) file and the microstructure was prepared.



The SEM image of I-beam, hollow bowl, ring, and dot matrix structure

Notes

Technical Special Session 25
Cross-Scale Macro-Micro-Nano Manufacturing (ss)

Room 6

16:50-18:50 Wednesday, 30 July

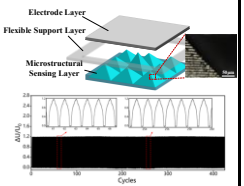
Chairs: Shiwei Zhang, Zhongxu Lian

25-4 17:35–17:50

Experimental Study of Flexible Sensors Based on Multi-Level Microstructure

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

- Finer stepped microstructures within the hierarchical architecture.
- PDMS demolding from 3D printed molds.
- Sensitivity 0.0741 kPa^{-1} in the low-pressure range, R^2=0.98 in the high-pressure range, with high stability and fast response.



Sensor structure and partial results

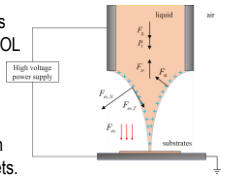
Notes

25-5 17:50–18:05

Simulation and Experimental Study of Electrodynamic Fluid Inkjet Printing

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

- Numerical simulation of different parameters by means of the simulation software COMSOL multiphysics.
- Exceeding the critical voltage can easily trigger multiple jets or unstable jets.
- Laws of influence of different parameters on the formation and stability of jets and droplets.



Schematic diagram of force analysis

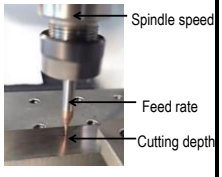
Notes

25-6 18:05–18:20

Study on the Influence of Machining Parameters on Tool Life During the Machining Process of Micro Milling Cutters

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

- Periodic experiments of micro milling under different parameters.
- Moderate spindle speed, low feed rate and cutting depth are ideal for micro-milling.
- In the whole life cycle of the tool, the wear of the tool is divided into three phenomenally different stages.



Notes

Technical Special Session 25
Cross-Scale Macro-Micro-Nano Manufacturing (ss)

Room 6

16:50-18:50 Wednesday, 30 July

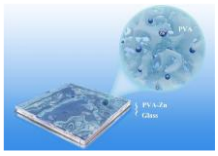
Chairs: Shiwei Zhang, Zhongxu Lian

25-7 18:20–18:35

Preparation of Moisture-Absorbing Coatings and Research on Their Anti-Fog Performance

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

- A new type of nano-moisture-absorbing and anti-fog coating has been developed.
- Study the relationship among the rotational speed, thickness and anti-fog performance of the coating.
- We built a real-time anti-fog performance test platform.



Moisture-absorbing layer mechanism diagram

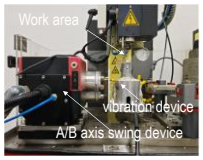
Notes

25-8 18:35–18:50

Research on Controllable Forming Technology of Curved Channel in Ultrasonic Assisted Flexible Electrode Discharge Machining

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

- We investigate the effects of ultrasonic vibration on the discharge gap, and the electrode–workpiece dynamic coupling.
- The optimal vibration amplitude was determined based on the empirical gap estimation for discharge.
- The influence of different currents on the surface quality of the material was explored.



Notes

Technical Session 26
Nanomanufacturing and Nanoautomation

Room 7

16:50-18:50 Wednesday, 30 July

Chairs: Ruizhou Wang, Tuoyu Ju

26-1 16:50–17:05

Research on Masking and Etching of GaAs Vertical Cavity Surface Emitting Lasers

Lilai Zhang
State Key Laboratory of High Power Semconductor Laser of Changchun University of Science and Techonlogy, Changchun, China
Institute of Advanced Data Transmission Systems, ITMO University, Kronverksky pr. 47A, Saint-Petersburg, Russian

- Photoresist/SiO_2 mask influence to GaAs etching.
- ICP/Wet etching research.
- Etching rate-temprture depence research.
- Deep etching for GaAs.

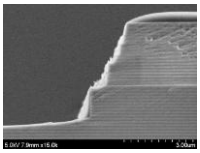


Figure SEM image of GaAs deep etching

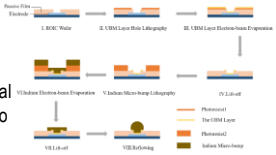
Notes

26-2 17:05–17:20

Enhancing 3D Integration Connectivity of a APD Detector Module through Optimized Indium Micro-Bumps Reflow Process

Yuexu Zhu
Southwest Institute of Technical Physics, Chengdu, China

- An indium micro-bump reflow process involves a constant temperature of 195℃ for 5 min and three times of filling with formic acid through multiple iterations of process experiments.
- The process has achieved ideal ellipsoidal indium micro-bumps with a height of up to 14.8 μm after reflow.
- The flip-chip technology based on the reflow process has enabled the APD detector module to achieve an ideal connectivity rate of 98.3%.



The schematic of the indium micro-bumps' fabrication process

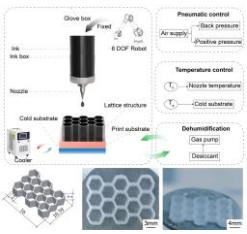
Notes

26-3 17:20–17:35

Droplet-Based Freeze Printing for Frost-Minimized Fabrication of 3D Structures

Yue Xiao
School of Mechanical Engineering, Northwestern Polytechnical University, Xi'an, China

- Novel freeze-printing apparatus employs cutting-edge humidity management to drastically reduce frost formation.
- Maintains ultra-low 7.2% RH for optimal freeze printing.
- Establishes a quantitatively derived parameter framework to optimize the freeze-printing process.
- Facilitates the creation of intricate, high-fidelity ice structures.



Notes

Technical Session 26
Nanomanufacturing and Nanoautomation

Room 7

16:50-18:50 Wednesday, 30 July

Chairs: Ruizhou Wang, Tuoyu Ju

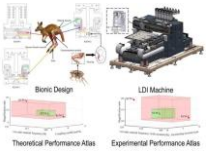
26-4 17:35–17:50

Design and Performance Atlas Analysis of Kangaroo-Inspired Compliant Mechanisms for Flying Photography Inside the LDI Machine

Ruizhou Wang

State Key Laboratory of Precision Electronic Manufacturing Technology and Equipment, Guangdong University of Technology, China

- Kangaroo-inspired mechanisms (KCMs) were designed to develop a compact flying photography inside the LDI machine.
- Theoretical models were developed for complex bionic compliant configurations.
- By analyzing the performance atlases, the optimal design approach of the mechanism was selected.
- Three KCMs were designed to meet the flying-photography requirements of the LDI machine. Theoretical and experimental performance atlases were constructed for analysis and optimal design.



Notes

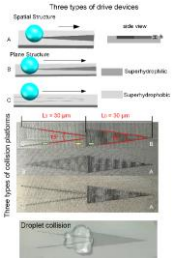
26-5 17:50–18:05

Self-Driven Collision Droplet Collisions on Micro/Nano Structured Surfaces with Patterned Wettability

Zhirui Liu, Faze Chen*

School of Mechanical Engineering, Tianjin University, China

- Three wedge-shaped structures were prepared on the composite wettable surface.
- Three wedge-shaped structures will drive the droplets to move spontaneously.
- The three drive structures are combined in pairs to form three collision platforms.
- After being released, the droplets collide and fuse on the collision platform.



Notes

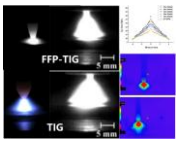
26-6 18:05–18:20 (Poster)

Effect of High-Frequency Pulse Current Parameters on FFP-TIG Arc Behavior

Jiyu Tian

School of Mechanical and Electrical Engineering, Changchun University of Technology, Changchun

- The arc behavior of FFP-TIG has advantages in terms of contraction, pressure, and energy density.
- With an increase of current amplitude, the arc diameter and arc area are reduced.
- With an increase of current amplitude, the arc center pressure is increased.
- With an increase of current amplitude, the arc energy divergence and arc temperature are reduced.



Arc shape, arc pressure and energy density

Notes

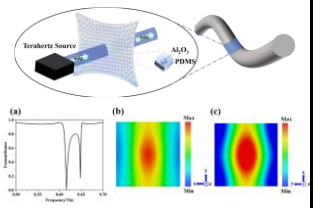
Technical Session 26
Nanomanufacturing and Nanoautomation
Room 7
16:50-18:50 Wednesday, 30 July
Chairs: Ruizhou Wang, Tuoyu Ju

26-7 18:20–18:35 (Poster)

Terahertz Flexible Metasurface Arrays for Dual-Channel Transmission

Junyi Li, Jiewei CHEN
School of Optoelectronic Science and Engineering, South China Normal University, Guangzhou, China

- Easy-to-fabricate terahertz metasurface for dual-channel control.
- Enables independent tuning of electric (ED) and magnetic (MD) dipole resonance peaks via period (Px/Py) changes.
- Novel platform for developing terahertz modulators, strain sensors, and wearable devices.



Flexible metasurface for dual-channel sensing

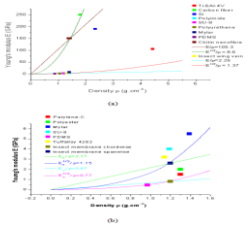
Notes

26-8 18:35–18:50 (Poster)

Material Choice for Artificial Insect Wing Design by Mimicking Natural Insect Wings

Xiaoqing Bao
Nanzhi Institute of Advanced Optoelectronic Integration Technology, JITRI, Nanjing, China

- Material compositions and properties of natural insect wings were reviewed.
- We outlined material choice criteria to mimic natural insect wings, potentially facilitating the bionic design.
- SU-8 and PDMS were proposed as good material for artificial wing veins and membranes, respectively.



Material property charts showing different material candidates for (a) wing vein and (b) wing membrane

Notes

Technical Special Session 27
Simulation Verification of the Microstructure and Properties of Materials (ss)

Room 1

08:30-10:30 Thursday, 31 July

Chairs: Huan Wang, Bowei Wang

27-1 08:30–08:50

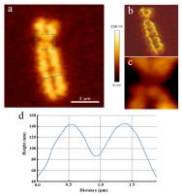
Analysis of the Effects of Colchicine, KCl and Glacial Acetic Acid on Chromosome Microstructure by AFM

Bowei Wang[1], Junxi Wang[1, 2,*]

[1]School of Electrical Engineering and Computer, Jilin Jianzhu University, China

[2]Key Laboratory of Architectural Cold Climate Energy Management, Ministry of Education, Jilin Jianzhu University, China

- The chromosome structure plays a decisive role in the transmission and expression of biological genetic information.
- The chromosome length was moderate when colchicine was treated for 1-1.5 h, which meets the needs of structural analysis.
- After 30 min of KCl treatment, the chromosomes in the cells were more dispersed.
- When the content of glacial acetic acid in the stationary solution is 35%, the obtained chromosome image is not disturbed by pollutants.



The AFM height image of a single chromosome and its corresponding profile curve

Notes

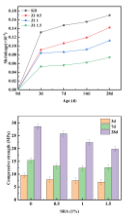
27-2 08:50–09:10

Synthesis of Shrinkage-Reducing Agents and Their Effects on the Performance of Cementitious Materials

WeiCheng Liu, Huang Wang

Key Laboratory for Comprehensive Energy Saving of Cold Regions Architecture of Ministry of Education, Department of Materials Science，Jilin Jianzhu University, China

- With increasing SRA dosage, the contact angle of the solution decreased, indicating a corresponding reduction in liquid surface tension.
- The incorporation of SRA had a negative impact on the mechanical strength of cementitious materials. When 1.0% of SRA-1% was added, the compressive strength decreased by 5.7%, 7.9%, and 9.1% at 3, 7, and 28 days, respectively, compared to the control group. This trend is consistent with the typical influence of SRAs on the mechanical performance of cement-based systems.
- Conversely, the addition of SRA significantly mitigated the drying shrinkage of cementitious materials. At the same 1.0% dosage of SRA-1%, the drying shrinkage values were reduced by 38.9%, 37.6%, and 39.2% at 3, 7, and 28 days, respectively, relative to the control.



Notes

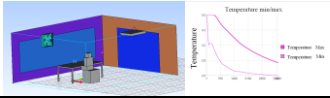
27-3 09:10–09:30

Simulation Analysis of Thermal Environment in learning Areas Based on The Climate of Cold Regions

Xubo Xiao, Yaodan Chi

School of Electrical and Computer Engineering, Jilin Jianzhu University, China

- Focusing on the climate of cold regions, this study utilized Cradle CFD software to model a human-fan system and analyze the distribution of the local thermal environment in a learning space.
- The results indicate that the local airflow field generated by the desktop fan in the learning area was highly non-uniform, significantly altering the thermal distribution characteristics of the learning microenvironment.
- This study revealed the interaction mechanism between micro-environmental thermal distribution and the overall environment, thereby providing a scientific basis for the precise thermal comfort design of learning environments.



Notes

Technical Special Session 27
Simulation Verification of the Microstructure and Properties of Materials (ss)

Room 1

08:30-10:30 Thursday, 31 July

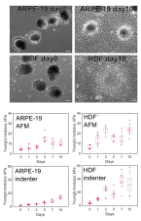
Chairs: Huan Wang, Bowei Wang

27-4 09:30–09:50

Nanomechanical Properties of Epithelial and Mesenchymal Cell Spheroids Assessed by AFM During Spreading

Yuri Efremov
Institute for regenerative medicine, Sechenov University, Russia

- AFM-based viscoelastic mapping was employed to analyze dynamic changes in the cell spheroids.
- An increase in cell stiffness over time was observed in epithelial and mesenchymal spheroids.
- The results were validated using complementary micro-scale indentation measurements.
- The observed stiffening may be attributed to a time-dependent increase in surface tension.



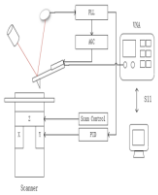
Notes

27-5 09:50–10:10

AFM-Based Scanning Microwave Microscopy and Applications

Rongqiang Wei
International Research Centre for Nano Handling and Manufacturing of China, Changchun University of Science and Technology, China

- The theoretical basis of AFM-based scanning microwave microscopy.
- Instrumentation of AFM-based Scanning Microwave Microscopy.
- Applications of AFM-based Scanning Microwave Microscopy



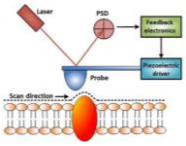
Notes

27-6 10:10–10:30

Atomic Force Microscopy in Cellular Biomechanics: A Review

Xiaolin Jiang[1,2], Anna Orlova[*2], and Zuobin Wang[*1]
[1] International Research Centre for Nano Handling and Manufacturing of China, Changchun University of Science and Technology, China
[2] International Research and Education Centre for Physics of Nanostructures, ITMO University, Russia.

- The Young's moduli and adhesion forces of cells are reviewed to clarify the interaction between tip and cells.
- The limitations of AFM in the mechanical measurements are discussed.
- Research on cellular biomechanics has critical implications for the prevention and treatment of malignant diseases.



Schematic diagrams of principles of AFM

Notes

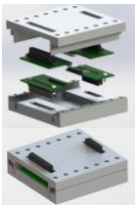
Technical Special Session 28
Micro-Nano Actuators and Sensing (ss)
Room 2
08:30-10:30 Thursday, 31 July
Chairs: Hailong Tian, Lin Zhang

28-1 08:30–08:54

Design Concept and Exploration of Modular Piezoelectric Positioning

Hailong Tian
Department Name, Jilin University, China

- Proposed a new concept of modular piezoelectric actuators.
- Various modules such as series stick-slip type, direct type, and inchworm type are combined to achieve flexible control of driving performance.
- Single degree of freedom series module control strategy.



Modular piezoelectric actuator

Notes

28-2 08:54–09:18

Theory and Application of Piezoelectric/Dielectric Asymmetric Drive-Control Method

Jianping Li
College of Engineering, Zhejiang Normal University, China

- Piezoelectric/dielectric asymmetric drive-control method has been proposed and applied for cancer biophysical property measurment.
- Different influence factors has been investigated for the piezoelectric/dielectric asymmetric actuators and measurments.
- Experimental results have been carried to confirm the feasibility of cancer biophysical property measurement.

Cancer biophysical property measurment

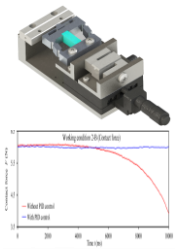
Notes

28-3 09:18–09:42

The Effect of Closed-Loop Control of Contact Force on the Performance of PZT Actuators

Lin Zhang, Hailong Tian
School of Mechanical and Electrical Engineering,
Changchun University of Technology, China

- Realize real-time measurement of contact force.
- By applying compensation waveforms to the piezoelectric stack to regulate the contact force.
- Contact force closed-loop control method-solving the changes in driving performance caused by factors such as wear on the guide surface.
- Displacement-contact force closed-loop control method-solving the problem of drive performance changes caused by horizontal load variations.



Notes

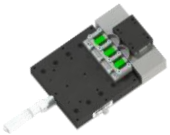
Technical Special Session 28
Micro-Nano Actuators and Sensing (ss)
Room 2
08:30-10:30 Thursday, 31 July
Chairs: Hailong Tian, Lin Zhang

28-4 09:42–10:06

A High-Speed Continuous Biomimetic Inchworm Piezoelectric Actuator Inspired by Snail Locomotion

Shijun Ji
School of Mechanical and Aerospace Engineering, JiLin University, China

- Mimics snail-like wave motion for continuous.
- No backstep, stable motion under load.
- Forward/backward speeds reached 5.74 mm/s and 5.687 mm/s.
- Resolutions are 172 nm and 224 nm in forward/backward directions.



Schematic diagram of a snail-type actuator

Notes

28-5 10:06–10:30

Self-Powered Smart Tool Holder with Multi-Modal Sensing and Fault Early Warning

Jianhai Zhang
School of Mechanical and Aerospace Engineering, Jilin University, China

- PN-TES integrates TENG and nonlinear cantilever for vibration sensing.
- Collision-induced stiffness modulation enhances dynamic response sensitivity.
- Enables real-time monitoring of machining status in CNC systems.
- Supports tool wear detection via triboelectric signal analysis.

PN-TES in CNC machine tool cutting monitoring

Notes

Technical Session 29
Nanotech and Environmental Protection

Room 3

08:30-10:30 Thursday, 31 July

Chairs: Josep Puigmartí-Luis, Yi Zeng

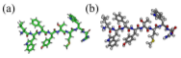
29-1 08:30–08:45

Study on the Effect of Different Surface Defects of Single-Crystal Al on the Adsorption Behavior of AMPs Molecule in a Vacuum Environment

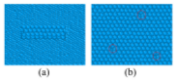
Changji Mu

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

- The AMPs was considered to be applicable as coatings for marine machinery to provide antifouling and antimicrobial effects.
- The adsorption mechanism of AMPs molecule was analyzed by MD at the atomic scale under vacuum conditions.
- The 15×30×15 Å^3 pit surface defect was found to exhibit superior adsorption performance and stability.
- The 0.5% vacancy surface defect was also observed to demonstrate good adsorption performance and stablity.



Molecular diagrams of AMPs.(a) by pymol (b) by materials studio



Surface morphology image of single-crystal Al substrate.(a) pit surface defect (b) vacancy surface defect

Notes

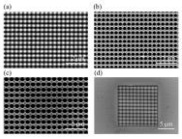
29-2 08:45–09:00

Study on Trace Detection of Nanopore Arrays as SERS Substrates Based on FIB Method

Jian Qiao

School of Mechanical and Electrical Engineering, Changchun University of Science and Technology, China

- An optimization method for high-sensitivity surface-enhanced raman scattering (SERS) substrates based on focused ion beam (FIB) fabrication technology.
- The three-dimensional modulation mechanism of depth gradient on electromagnetic field distribution was revealed through COMSOL Multiphysics simulation.
- A multiscale correlation analysis framework linking “processing parameters nanostructure-optical performance” was pioneered.



SEM images of circular hole array structures with different dwell times

Notes

29-3 09:00–09:15

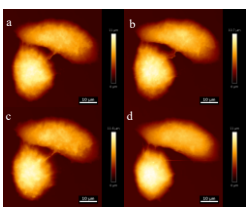
Analysis of the Longitudinal Mechanical Response and Morphological Evolution of Cells Based on the Multi-Scale Coupling of Finite Element and Atomic Force Microscopy

Yi Zeng[a], Zuobin Wang*[b]

[a]Changchun Technical University of Aautomobile, Changchun, China

[b] Changchun University of Science and Technology, Changchun, China

- Unveiling the essence of cellular mechanical responses lies in the dynamic energy dissipation mechanism.
- Finite element simulation has proved that the reason for the non-linear stress attenuation is cooperative dissipation.
- Established the "load-stress-morphology" mapping model.



The variation in the application of force led to differences in the clarity of the image

Notes

Technical Session 29
Nanotech and Environmental Protection

Room 3

08:30-10:30 Thursday, 31 July

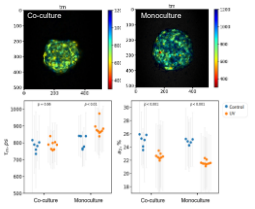
Chairs: Josep Puigmartí-Luis, Yi Zeng

29-4 09:15–09:30

FLIM-Based Metabolic Profiling of Cell Organoids for Bioink Quality Control

Daria Kuznetsova
Institute for Regenerative Medicine
I.M. Sechenov First Moscow State Medical University
Moscow, Russia

- Organoids derived from gingival cells and co-cultures with dental pulp cells exhibited distinct metabolic profiles.
- UV exposure increases NADH lifetime (τ_m) in monocultures but not co-cultures, while co-cultures show greater sensitivity to temperature shifts.
- FLIM is a reliable, label-free method for evaluating organoid functionality before bioprinting.



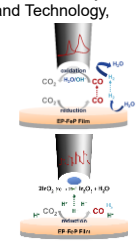
Notes

29-5 09:30–09:45

Probing the CO Distribution and Interfacial pH of CO_2 Reduction through Multimode Scanning Electrochemical Microscopy

Jiayang Lin[1], Lianhuan Han[2*], Dongping Zhan[1]
[1]College of Chemistry and Chemical Engineering, Xiamen University, China
[2]Pen-Tung Sah Institute of Micro-Nano Science and Technology, Xiamen University, China

- Facile synthesis of metal porphyrin thin film via electropolymerization, designed as efficient CO_2RR catalysts.
- Multimode SECM was employed to elucidate the correlation between CO distribution and interfacial pH.
- Maximum CO selectivity occurs before the onset of water reduction, attributable to significant CO_2 depletion via buffering reaction and chemical reaction.



Multimode Scanning Electrochemical Microscopy

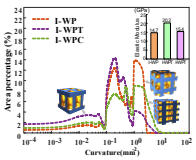
Notes

29-6 09:45–10:00 (Poster)

Simulation Study on the Influence of Surface Curvature on the Mechanical Properties of Triply Periodic Minimal Surface (TPMS) Scaffolds

Zhitong Li
School of Mechatronics Engineering, Harbin Institute of Technology, China

- Unit type and porosity are important in determining the surface curvature distribution of TPMS lattices.
- Effect of surface curvature on mechanical properties is second only to that of cell type.
- High porosity can lead to curvature dispersion and easily cause stress concentration.



The effect of surface curvature on mechanical properties of TPMS structures

Notes

Technical Session 29
Nanotech and Environmental Protection

Room 3

08:30-10:30 Thursday, 31 July

Chairs: Josep Puigmartí-Luis, Yi Zeng

29-7 10:00–10:15 (Poster)

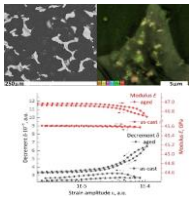
Effect of Heat Treatment on Microstructure and Microplasticity of Mg Alloys Containing LPSO

Dmitrii Kalganov

Lab. Diffr. Methods Investig. Real Cryst.-Struct., Ioffe Institute, Russia

ADTS Institute, ITMO University, Russia

- An alloy with a nominal composition of Mg-2.6Y-1Zn-0.5Gd-0.2Zr-0.1Yb was investigated.
- The content of long-period stacking ordered (LPSO) structure was about 15% vol.
- The internal friction (IF) and elasticity (E) had three stages with boundaries $T_1 \approx 150^{\circ}C$ and $T_2 \approx 300^{\circ}C$.
- The influence of aging (at 200ºC for 100h) on internal friction, elasticity and stress-time curve was established.



Electron microscopy images of the aged sample (top), IF and E on strain dependence in as-cast and aged samples (bottom)

Notes

29-8 10:15–10:30 (Poster)

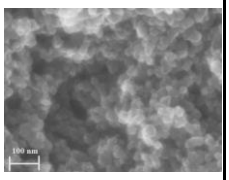
Codoped Titanium Dioxide for Water Treatment

Natalia V. Chirkunova[1], Maksim V. Dorogov[2]

[1]Institute of Advanced Technologies, Togliatti State University, Russia

[2]Institute of Advanced Data Transfer Systems, ITMO University, Russia

- A method for mechanical doping of titanium dioxide, easily scalable to industrially applicable production volumes of photocatalysts, is presented.
- Doping titanium dioxide with Sn and S at a concentration of 5 at.% reduces the band gap of titanium dioxide by 0.3 eV (to 2.9 eV).
- Doped TiO_2 (5 at.% Sn) shows high photocatalytic activity under visible light, the value of the effective reaction rate constant for the decomposition of methylene blue in water is 0.025 min^{-1}.



SEM photo of titanium dioxide doped with Sn and S (5 at.%)

Notes

Technical Special Session 30
2D Materials at Nanoscale: From Fundamentals to Applications (ss)

Room 4

8:30-10:30 Thursday, 31 July

Chairs: Zegao Wang, He Tian

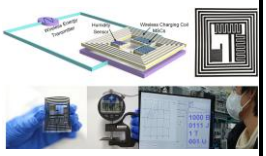
30-1 08:30–08:42

A Seamlessly Integrated Device Towards Wireless Energy Storage and Humidity Sensing

Qing You, Chang Gao, Tao Deng

School of Electronic and Information Engineering, Beijing Jiaotong University, China

- A wireless energy storage and humidity sensing integrated device (WES-HSID) with flexible appearance was proposed.
- The WES-HSID utilized all-in-one material and structure strategy to reduce energy loss.
- The WES-HSID was integrated in a human-machine interaction system for respiration monitoring and language expression.



The component, appearance and application of the WES-HSID

Notes

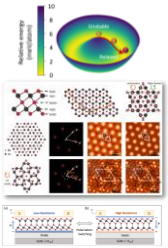
30-2 08:42–08:54

New Structural Pictures in 2D Ferroelectric Memory Material In_2Se_3

Yuting Huang, Nianke Chen, Minyu Ma, Xianbin Li*

State Key Laboratory of Integrated Optoelectronics, College of Electronic Science and Engineering, Jilin University, Changchun 130012, China

- In_2Se_3 has a robust ferroelectricity even in the thinnest limit, showing a promising potential for high-density data storage applications. Here, we introduce three structure related new pictures in monolayer In_2Se_3.
- A mexican-hat potential energy surface is discovered in β-In_2Se_3 and the corresponding entropy barrier of Se atoms limits its fast phase transition.
- Complicated CDW structures are found in β-In_2Se_3.
- A polarization-defect coupling field-effect-transistor model is proposed in α-In_2Se_3 for storage application.



Notes

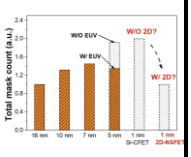
30-3 08:54–09:06

A Process Scheme of Equivalized 1 nm Technology Node Based on 2D Materials

Yang Shen

School of Communication & Electronic Engineering, East China Normal University, China

- Fabricating MoS_2 nanosheet field-effect transistors (NSFETs) for parameter calibration.
- Building a multiscale framework, including DFT calculation, device and circuit simulation.
- Validating the feasibility of equivalized 1 nm node with scaled 2D-NSFETs and providing a 2D technology solution for 1 nm node.
- The horizontally miniaturized 2D-NSFET achieves a frequency increase of 28% at a fixed power consumption.



Evolvement of total mask number

Notes

Technical Special Session 30
2D Materials at Nanoscale: From Fundamentals to Applications (ss)

Room 4

8:30-10:30 Thursday, 31 July

Chairs: Zegao Wang, He Tian

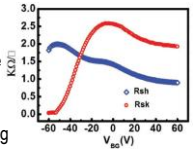
30-4 09:06–09:18

How to Distinguish the Electrical Property of 2D Material Under Metal Contact and Channel

Songgang Peng

Institute of Microelectronics, Chinese Academy of Sciences, China

- We proposed a method to distinguish the electrical property of 2D material under metal contact and channel.
- Taking into account the different potential distributions in the channel and contact regions, the potential distribution at the metal/two-dimensional material contact interface was reconstructed.
- By introducing a backward contact resistance testing method, the material surface resistance (R_{SH}) in the channel region and the material surface resistance (R_{SK}) in the contact region of two-dimensional material devices can be extracted separately.



Distinguish the electrical property of 2D materials under metal contact and in channel

Notes

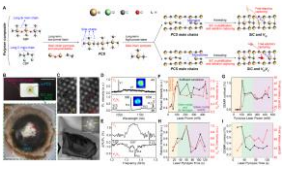
30-5 09:18–09:30

Laser Writing of Spin Defects in Polymers

Hao Guo, Yue Qin

State key Laboratory of Extreme Environment Optoelectronic Dynamic Testing Technology and Instrument, North University of China, China

- An in-situ laser-induced fabrication strategy of spin defects from polymers was proposed.
- Silicon carbide spin defects were fabricated in microfluidic devices, cardiac patches, and medicine bottles.
- Spin defects in polymer-based products can be applies to in-situ sensing and anti-counterfeiting.



Spin structures in polymers

Notes

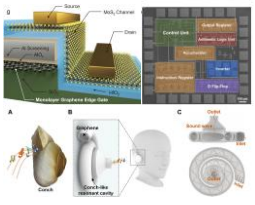
30-6 09:30–09:42

Novel 2D Materials-Based Transistors, Memory and Sensors

He Tian

School of Integrated Circuits & Beijing National Research Center for Information Science and Technology(BNRist), Tsinghua University, China

- Scaling down the transistor gate length and channel length to 0.34 nm and 8 nm, respectively.
- 1-bit CPU based on 2D materials.
- Graphene earphone with conch-like cavity.
- These results indicated that 2D materials-based transistors, memory and sensors can be integrated together to build a more powerful system.



Notes

Technical Special Session 30
2D Materials at Nanoscale: From Fundamentals to Applications (ss)

Room 4

8:30-10:30 Thursday, 31 July

Chairs: Zegao Wang, He Tian

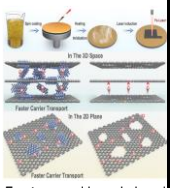
30-7 09:42–09:54

How to Achieve High Conductivity and High Patterning Precision in Laser-Induced Graphene

Rui You

Laboratory of the Intelligent Microsystem, Beijing Information Science and Technology University, China

- We proposed a method for preparing composite graphene based on femtosecond laser-induced doping of precursors. By leveraging the high precision and low thermal impact advantages of femtosecond laser processing, combined with pre-doping film preparation methods using metal ions and MXene, the approach achieves both high conductivity and high-precision patterning in femtosecond laser-induced graphene-based materials. This method provides fundamental support for the application of two-dimensional graphene-based materials in electronic circuits, sensing, and electromagnetic property modulation.



Femtosecond laser-induced composite graphene to improve conductivity

Notes

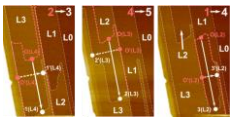
30-8 09:54–10:06

Reversible Amyloid Crystallization

Mingdong Dong

Interdisciplinary Nanoscience Center, Aarhus University, Denmark

- Amyloid crystals are thermodynamically stable form by the self-assembly process.
- How environmental factors affect the dynamics of amyloid crystallization and disassembly.
- Reversible self-assembly of amyloids provides fundamental biomaterials.



Notes

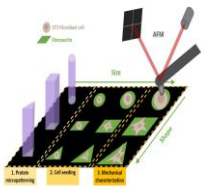
30-9 10:06–10:18

Shaping Cell Mechanical Properties through Protein Micropatterning at a Single-Cell Level

Mi Li, Mingdong Dong, Judith Zubia-Aranburu

Interdisciplinary Nanoscience Center (iNANO), Aarhus University, Aarhus C DK-8000, Denmark

- Fibronectin micropatterns with varying shape and size printed via PRIMO maskless photopatterning.
- Attachment and adaption of single fibroblast cells onto the micropatterns.
- Systematic quantification of the mechanical features of the fibroblasts through atomic force microscopy.



Notes

Technical Special Session 30
2D Materials at Nanoscale: From Fundamentals to Applications (ss)

Room 4

8:30-10:30 Thursday, 31 July

Chairs: Zegao Wang, He Tian

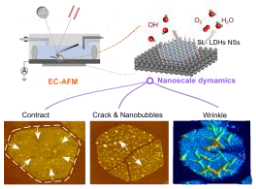
30-10 10:18–10:30

In Situ Tracking of Water Oxidation Generated Nanoscale Dynamics in Layered Double Hydroxides Nanosheets

Yuqing Wang

State Key Laboratory of Chem/Bio-Sensing and Chemometrics, College of Chemistry and Chemical Engineering, Hunan University, China

- Visualizing live changes of SL-NiCo LDHs morphology during operation.
- Phase transition to the active phase induces lattice expansion, generating in-plane strain.
- Intrinsic defects cause nanosheet cracking under OER.
- Interactions between stacked nanosheets introduce biaxial strain, which relaxes out-of-plane via buckling and wrinkle delamination.



Notes

Technical Session 31
Energy Harvesting, Detection and System Integration

Room 5

08:30-10:30 Thursday, 31 July

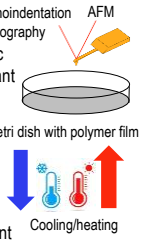
Chairs: Valentin Popov, Zhengxun Song

31-1 08:30–08:45

Surface Behaviour of Thermoresponsive Substrates for Cell Sheets Technology

Anastasia Frolova
Institute for Regenerative Medicine, Sechenov University, Russia

- Smart thermoresponsive polymers have great potential for biomedical applications, particularly for cell sheet technologies.
- Poly-N-isopropylacrylamide is the most important synthetic thermoresponsive polymer due to its physiologically relevant transition temperature.
- Atomic force microscopy allows to monitor the phase behaviour of thermoresponsive substrates without destroying.
- Each copolymer based on PNIPAM have especially with their own phase behaviour.
- These findings useful for understanding the cell detachment and attachment processes in cell sheets technology.



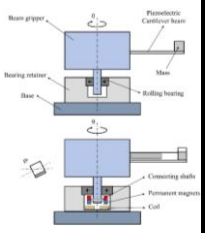
Notes

31-2 08:45–09:00

Design and Performance Study of a Direction-Adaptive Piezoelectric Energy Harvester

Yixin Cui , Xu Yang*
School of Mechanical and Aerospace Engineering ,Jilin University, China

- A harvester achieving energy harvesting from arbitrary 3D excitation directions is proposed.
- The key performance parameters affecting energy harvesting efficiency are analyzed.
- An electromagnetic harvesting unit is integrated to maximize energy output.
- The hybrid harvester effectively enhances output voltage by 35.4%.



Schematic diagram of the direction-adaptive energy harvester

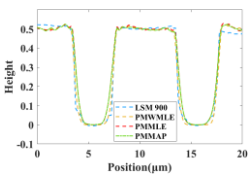
Notes

31-3 09:00–09:15

Precise Differential Confocal Measurement of Microstructure Surface Profile with Edge Effect Suppression

Shengze Huang, Yuguo Cui
Ningbo Key Laboratory of Micro-nano Motion and Intelligent Control, Ningbo University, China

- The experimental system is based on the differential confocal system.
- A weight matrix contributes to a smaller edge overshoot.
- Constraint penalty function based on the Geman-McClure model achieves the suppression of the edge effect.
- The simulation and experimental results verify the validity of the method proposed in this paper.



Experimental results of the edge effect suppression

Notes

Technical Session 31
Energy Harvesting, Detection and System Integration

Room 5

8:30-10:30 Thursday, 31 July

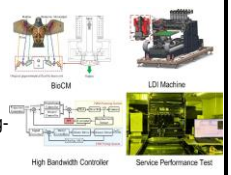
Chairs: Valentin Popov, Zhengxun Song

31-4 09:15–09:30

High-NF Design and High-Bandwidth Control of a Flying-Focus Bionic Compliant Mechanism

Long Yang, Ruizhou Wang*
State Key Laboratory of Precision Electronic Manufacturing Technology and Equipment, Guangdong University of Technology, China

- Optimal design of a high-NF (natural frequency) BioCM (bionic compliant mechanism).
- Design of a high-bandwidth controller for the high-NF BioCM.
- Performance of the BioCM and controller was demonstrated within the LDI (laser direct imaging) machine.
- A high-NF novel BioCM was designed for flying-focus systems. The BioCM was optimized to obtain a high NF. A high-bandwidth controller was proposed. The performance of the BioCM and controller was verified during the flying-focus shooting inside the LDI machine.



Notes

31-5 09:30–09:45

Development of an On-Chip Pyrosequencing System Based on Digital Microfluidics

Huiting Hu, Siyi Hu*, Jinhua Li*
College of Physics, Changchun University of Science and Technology, China
CAS Key Laboratory of Bio-Medical Diagnostics, Suzhou Institute of Biomedical Engineering and Technology Chinese Academy of Sciences, China

- Integrate the optical detection device into the active-matrix digital microfluidic chip.
- Automatic programmed delivery of reagents and signal detection.
- Accurate sequence reading, stable system operation.
- SNP typing of the CYP2C19 gene, which is important for individualized drug therapy.

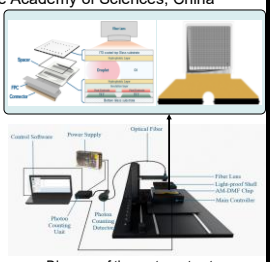


Diagram of the system structure

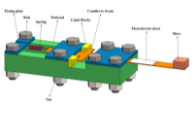
Notes

31-6 09:45–10:00

Simulation Study on the Performance of Frequency Self-Adjusting Piezoelectric Vibration Energy Harvester

Weian Wang, Xu Yang*
School of Mechanical and Aerospace Engineering, Jilin University, China

- Proposes a self-adjusting resonant piezoelectric vibration harvester.
- Elastic elements release axial constraints to adapt t stochastic vibrations.
- 33.3% broader bandwidth and 20.61% higher voltage vs. fixed-frequency devices.
- MATLAB-based dynamic model validates stiffness-performance relationship.



Schematic diagram of a frequency self-adjusting energy harvester

Notes

Technical Session 31
Energy Harvesting, Detection and System Integration

Room 5

8:30-10:30 Thursday, 31 July

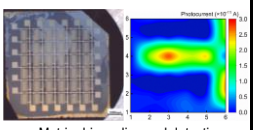
Chairs: Valentin Popov, Zhengxun Song

31-7 10:00–10:15 (Poster)

Diamond-Based Matrix-Driven Solar-Blind UV Imaging Detector

Mengting Qiu
Optical System Technology Research and Development Department, Southwest Institute of Technical Physics, China

- A new circuit arrangement of diamond detection imaging array was constructed.
- The feasibility of the fabrication process of the structure is verified.
- It effectively solves the problem of many lead ends in the diamond static-drive pixel array.
- It is beneficial to maximize the photosensitive surface in a limited diamond plane.



Matrix-driven diamond detection arrays and imaging effects at 210 nm UV

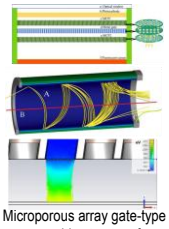
Notes

31-8 10:15–10:30 (Poster)

Optimization and Performance Analysis of Complex Detection Systems Based on Microporous Array Gate-Type Waveguide Structures

He Wang
College of Traffic Information, Jilin Communications Polytechnic, China

- Optimizes composite photonic-electronic detector using microhole-array grid waveguide structure.
- Establishes theoretical model for beam modulation and optical signal transmission analysis.
- Simulates electric field effects on electron control, coupling efficiency, and transient dynamics.
- Demonstrates sub-microsecond response and strong compatibility with semiconductor fabrication methods.



Microporous array gate-type waveguide structure for complex detection

Notes

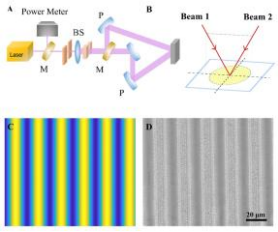
Technical Special Session 32
Nanofabrication for Emerging Photonics **(ss)**
Room 6
08:30-10:30 Thursday, 31 July
Chairs: Sadaf Saeed, Kinza Arshad

32-1 08:30–08:54

Fabrication of Hybrid Si Microwires-Holes Arrays for Emerging Applications

Sadaf Saeed
College of Physics and Optoelectronic Engineering, Shenzhen University, Shenzhen, China

- Development of Si micropatterns for emerging applications.
- Optimization of two beam -LIL for high-resolution micro structuring.
- The fabricated Si micropatterns are integrated into SERS-based detection platforms, enabling advancements in applications such as chemical sensing, environmental monitoring, and biomedical diagnostics.



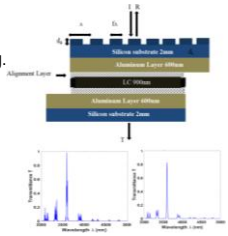
Notes

32-2 08:54–09:18

Nanoscale Fabrication and Optimization of Liquid Crystal-Enhanced Resonant Waveguide Gratings for Tunable Mid-IR Filtering

Kinza Arshad
Key Laboratory of Optoelectronic Devices and Systems of Ministry of Education of Guangdong Province, College of Physics and Optoelectronic Engineering, Shenzhen University, China

- Designed subwavelength resonant structures integrated with LCs for tunable Mid-IR filtering.
- FDTD simulations optimized grating period, depth, and fill factor for sharp resonance.
- Voltage-tunable TE and TM modes achieved through LC-driven wavelength shift.
- Simulated structures exhibit efficient light–matter interaction and tunability for sensing use.



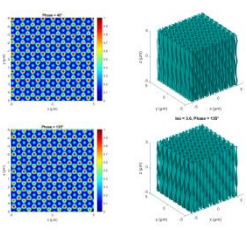
Notes

32-3 09:18–09:42

Tailoring 2D and 3D Interference Structures via Multi-Parameter Control in a 3+1 Beam Laser Interference System

Amir Hamza
International Research Centre for Nano Handling and Manufacturing of China
Changchun University of Science and Technology
Changchun, China

- Multi-parameter modulation (phase, intensity, and beam geometry) in a 3+1 beam laser interference system enables precise control of 2D and 3D nanostructure patterning, allowing for the creation of complex, application-specific interference structures.



Notes

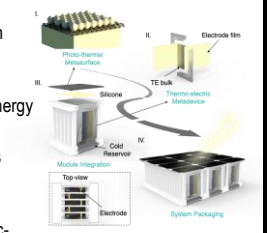
Technical Special Session 32
Nanofabrication for Emerging Photonics **(ss)**
Room 6
08:30-10:30 Thursday, 31 July
Chairs: Sadaf Saeed, Kinza Arshad

32-4 09:42–10:06

Boosting Solar Photonic-Thermal-Electrical System via Photon and Heat Management

Zifu Xu*, Wei Li*
State Key Laboratory of Applied Optics, CIOMP CAS, China

- Establishing an energy model of the multi-module system and environment based on photon and heat management.
- Developing a selective photo-thermal metasurface for boosting net solar-heat energy accumulation of the system.
- A transverse thermoelectric co-transport is proposed to enhance the thermoelectric conversion performance of the system.
- Developing and deploying a solar photonic-thermal-electrical system for outdoor harvesting by synergizing multiple-field coupling effect.



Development of the solar photonic-thermal-electrical system with photon and heat management

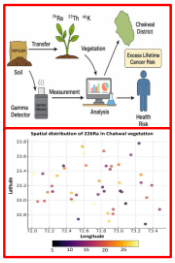
Notes

32-5 10:06–10:30

Nanoscale Detection and Assessment of Radiological Hazards in Vegetation samples for Environmental Protection

Fozia Aslam
Laboratory of Optoelectronic Devices and Svstems of Ministry of Education of Guangdong Province, College of Physics and Optoelectronic Engineering, Shenzhen University, China

- Integrating nanotechnoogy with environmental protection strategies to mitigate potential risk.
- Uilization of nanobased sensors and analytical techniques the techniques provides detailed insight into concentration levels and their corelations across different sites.
- This research contributes to development of more effective suustainable and targeted approaches for managing radiological hazards in eco systems.



Notes

Technical Special Session 33
Integrating Nanoengineering with Advanced Optics (ss)

Room 1

10:50-12:50 Thursday, 31 July

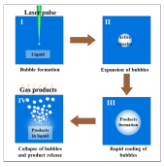
Chairs: Bo Yan, Bo Guo

33-1 10:50–11:14

Laser Bubbling in Liquid for the Production of Clean Energy and High-Value Chemicals

Bo Yan
School of Advanced Energy, Sun Yat-sen University, China

- Laser-induced micro-nano bubbles with extreme thermodynamic microenvironments.
- Extremely high peak temperatures and rapid heating and cooling rates.
- This microscopic environment is used for the preparation of clean energy and high-value chemicals.



Laser bubbling in liquid for the preparation of clean energy and high-value chemicals

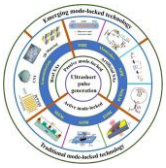
Notes

33-2 11:14–11:38

Advances in Nonlinear Optical Applications of 2D Materials

Bo Guo
Key Laboratory of In-fiber Integrated Optics of Ministry of Education of China, Harbin Engineering University, China

- The status of mid-IR ultrafast fiber lasers based on 2D material passive mode-locking is emphatically discussed.
- Novel advances on mode-locking and gain fibers of mid-IR ultrafast fiber lasers are explored.
- Current and prospective applications of such laser systems are also introduced in detail.



Advances in nonlinear optical applications of 2D materials

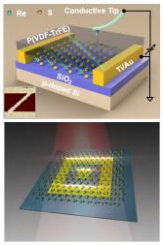
Notes

33-3 11:38–12:02

Tunable Nanoelecronics and Nonlinear Optics in 2D Material/Ferroelectric Heterostructures

Dawei Li
School of Optoelectronic Engineering and Instrumentation Science, Dalian University of Tehchnology, China

- We probe the anisotropic transport properties of 2D 1T'-ReS_2 via ferroelectric field effect combined with ferroelectric domain patterning.
- We achieve ferroelectric polymer P(VDF-TrFE) thin films composed of closed-packed crystalline nanowires via interface-epitaxy with 1T'-ReS_2.
- We report the modulation of the magnitude and polarization of the SHG nonlinear light in monolayer MoS_2/Pb(Zr,Ti)O_3 heterostructures via ferroelectric domain patterning.



Notes

Technical Special Session 33
Integrating Nanoengineering with Advanced Optics (ss)

Room 1

10:50-12:50 Thursday, 31 July

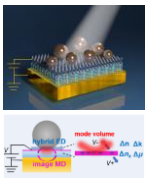
Chairs: Bo Yan, Bo Guo

33-4 12:02–12:26

Dielectric Composite Nanostructures for Electrically Tunable Light-Matter Interactions

Xinyue Liu
Institute of Nanophotonics, Jinan University, China

- Mie-based nanogap platforms are demonstrated to electrically optimize the mie-exciton fano coupling.
- The image magnetic mode can realize effective spatial and spectral overlapping with exciton.
- The narrowband electrical tuning of scattering intensity provides a candidate to load optical information dynamically.
- It is a powerful strategy for constructing electrically tunable nanopixels in active optical devices.



Electrically-enabled Mie-exciton hetero-gap platform

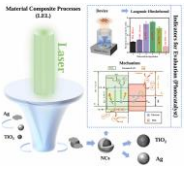
Notes

33-5 12:26–12:50

Developing a Hybrid Photocatalyst Nanocrystals by Selective Laser Embedding in Liquid

Juntao Tan
Sun Yat-sen University, China

- Constructing a hybrid nanostructure with synergetic effect is a crucial approach.
- How to insert the spherical noble metal components into semiconductors with neatness, facility, and efficiency are full of technical challenges.
- We propose an in-depth understanding of the nanocrystal structural mechanism design by laser-induced manufacturing and offers a reference for the performance optimization of photocatalysts.



Developing a hybrid photocatalyst nanocrystals by selective laser embedding in liquid

Notes

Technical Special Session 34
International Forum on Frontiers of Multifunctional Nanomaterials (ss)

Room 2

10:50-12:50 Thursday, 31 July

Chairs: Dazhi Sun, Hongyu Yang

34-1 10:50–11:14

Extraction Optimization and Antioxidant Activity in Ganoderma Lucidum Sprouts

Haoyu Qi
School of Chemistry and Pharmaceutical Engineering, Jilin Institute of Chemical Technology, China

- MAE maximizes polysaccharides (0.77%) and proteins (4.93%) via microwave disruption; UAE leads triterpenoid yield (10.82%) with cavitation.
- MAE extracts show strongest antioxidant activity (ABTS IC50: 1.13 mg/mL), surpassing HRE's thermal degradation.
- Tailored protocols recommended: MAE for antioxidants, UAE for triterpenoids; HRE underperforms industrially.

Notes

34-2 11:14–11:38

Optimization of Water Extraction Process and Antioxidant Activity of Polysaccharides from Dictamnus dasycarpus Turcz

Meiyue Cui, Xing Jin
School of Chemistry and Pharmaceutical Engineering, Jilin Institute of Chemical Technology, China

- Optimize the water extraction process of dictamnus dasycarpus turcz(DDT) and evaluate its antioxidant activity.
- After optimized water extraction, the polysaccharide yield of DDT is high (44.74 ± 1.3%).
- DDT extraction solutions shows good ABTS radical scavenging activity (ABTS IC_{50}: 4.72 mg/mL).
- DDT extraction solutions shows good DPPH radical scavenging activity (DPPH IC_{50}: 7.56 mg/mL).
- This study lays groundwork for DDT's mechanism exploration and skincare product development.

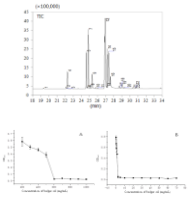
Notes

34-3 11:38–12:02

Composition Analysis and Antibacterial and Antioxidant Activities Evaluation of Rearing Meles Meles Oil in Changbai Mountain Area

Yao Dong, Hao Cui
College of Biology & Food Engineering, Jilin Institute of Chemical Technology, China

- GC-MS identified 14 fatty acids in badger oil, mostly unsaturated.
- Main components include oleic, linoleic, and palmitic acids.
- Badger oil showed broad-spectrum antibacterial activity against six microbes and antioxidant activity.
- Badger oil has potential applications in the fields of food and pharmacy.



Notes

Technical Special Session 34
International Forum on Frontiers of Multifunctional Nanomaterials (ss)

Room 2

10:50-12:50 Thursday, 31 July

Chairs: Dazhi Sun, Hongyu Yang

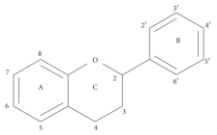
34-4 12:02–12:26

Optimisation of the Extraction Process and Analysis of the Activity of Flavonoids from Leymus Chinensis

Ying Liu, Hao Cui

School of Chemistry and Pharmaceutical Engineering Jilin Institute of Chemical Technology Jilin, China

- Finding the best conditions for getting Leymus chinensis flavonoid compounds out of it.
- The antimicrobial and antioxidant activity of petroleum ether-extracted flavonoids is significant.
- The strong reducing ability of crude flavonoid compounds has been experimentally confirmed.
- This study provides a foundation for future research on Leymus chinensis.



Flavonoid structure

Notes

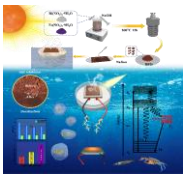
34-5 12:26–12:50 (Poster)

Creation and Performance of a Novel Photothermal and Photovoltaic Dual-Functional Bismuth Ferrite Solar-Driven Interface Water Evaporator

Tinghui Wu

College of Materials Science and Engineering, Jilin Institute of Chemical Technology, China

- Achieved a 1.54 $kg \cdot m^{-2} \cdot h^{-1}$ evaporation rate in 3.5 wt% NaCl brine.
- Produced freshwater meeting WHO drinking standards.
- Achieved synergistic photothermal-photovoltaic integration, enhancing overall energy utilization.
- Excellent photothermal photoelectric conversion capability for efficient seawater desalination.



Synthesis method, excellent performance and multi-functional application diagram of BFO 2D water evaporato

Notes

Technical Session 35
Nanomaterials and Applications I

Room 3

10:50-12:50 Thursday, 31 July

Chairs: Svetlana Morozkina, Hao Wu

35-1 10:50–11:10

The Electrospinning of Resveratrol Encapsulated into the Matrix Based on Hyaluronic Acid

Hao Wu
International Research Centre for Nano Handling and Manufacturing of China, Changchun University of Science and Technology, China
Institute of Advanced Data Transmission Systems, ITMO University, Russian

- Fabricated resveratrol-loaded HA nanofibers via electrospinning.
- Used water/DMSO solvent system, ensured biocompatibility.
- Investigated process under different voltages (22–30 kV).
- Showed potential for wound healing and drug delivery.

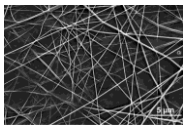


Figure SEM image of resveratrol -loaded hyaluronic acid fibers electrospun at 28 kV under magnification of 16,000×

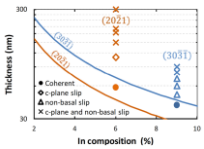
Notes

35-2 11:10–11:30

Mechanical Stresses and Dislocations in Semiconductor Nano-Heterostructures

Alexey E. Romanov
Institute of Advanced Data Transfer Systems, ITMO University, Russia

- Due to the difference in the lattice parameters of the semiconductor materials that make up nano-heterostructures (NHSs), mechanical stresses in such objects are inherent.
- Relaxation of stresses leads to formation of various defects, e.g. dislocations, in NHSs.
- Both stresses and dislocations influence physical and mechanical properties of NHSs.
- Critical conditions for the defect formation in semiconductor NHSs are established.



The state of relaxation in semipolar $In_xGa_{1-x}N$ / GaN nano-heterostructures

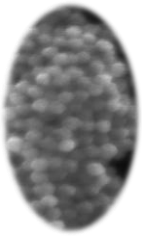
Notes

35-3 11:30–11:50

Near-Infrared Photodynamic Therapy with 100 nm $Cu_{2-x}Se$ Nanoparticles

Baichuan Wang, Yujuan Chen*
International Research Centre for Nano Handling and Manufacturing of China, Changchun University of Science and Technology, Changchun 130022, China

- One-step direct synthesis prepare copper-deficient copper(I) selenide.
- The material exhibits excellent near-infrared region II photothermal properties, laying a solid foundation for subsequent drug delivery therapy.



Notes

Technical Session 35
Nanomaterials and Applications I

Room 3

10:50-12:50 Thursday, 31 July

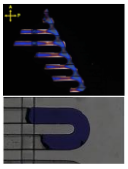
Chairs: Svetlana Morozkina, Hao Wu

35-4 11:50–12:10

How Can Microfluidic Tools Help During the Self-Assembly and Engineering of Advanced Functional Materials and Crystals

Josep Puigmartí-Luis
Department of Physical Chemistry, Barcelona University, Spain

- Controlling and understanding the mechanisms that govern crystallization is crucial in contemporary materials science.
- Microfluidic synthesis can produce the largest MOF single crystals with controlled nonequilibrium shapes.
- Microrobotic systems enable precise 3D manipulation of MOFs and COFs facilitating innovative applications.



MOF single crystals with nonequilibrium shapes

Notes

35-5 12:10–12:30

Nanomaterials for Tympanic Membrane Reparation – from Fundamental Research to Clinical Application

Svetlana N. Morozkina, Petr P. Snetkov
Institute of Advanced Data Transfer Systems, ITMO University, Saint-Petersburg, Russia

- Nanomaterials based on natural polymers represent promising materials for tympanic membrane (TM) reparation.
- Chitosan, collagen, hyaluronic acid demonstrate the best TM reparation properties.
- 3D printing and nanofibrous materials have great advantages over traditional materials.
- Clinical trials revealed that the introduction of various growth factors into biosafe polymer matrix enhance TM healing.

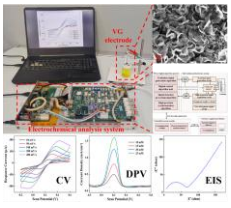
Notes

35-6 12:30–12:50

A High-Precision Electrochemical Analysis System Based on Vertical Graphene

Siyu Liu
School of Electronics and Information Technology, Sun Yat-sen University, China

- Utilize vertical graphene as an electrode in electrochemical experiments.
- Independently design a fast, high-precision electrochemical analysis system.
- Compare with platinum and glass carbon materials in electrochemical tests.
- Verify the usability of the system, including its high electrical conductivity and sensitivity.



Schematic diagram of the system

Notes

Technical Special Session 36
2D Materials at Nanoscale: From Fundamentals to Applications (ss)

Room 4

10:50-12:50 Thursday, 31 July

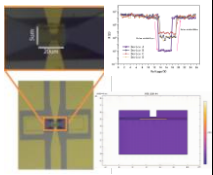
Chairs: Zegao Wang, He Tian

36-1 10:50–11:05

High-Performance PCMs RF Switches

Libin Gao
School of Integrated Circuit Science and Engineering, University of Electronic Science and Technology of China, China

- A new type of high-performance RF switch based on phase change materials achieves excellent performance (PCMs switch).
- PCMs switch does not require continuous power supply to maintain its state, thus achieving ultra-low power consumption.
- PCMs switch developed by our research team has a loss of <0.75 dB, isolation of >18 dB @67 GHz, return loss of <18 dB, and power capacity of up to 40 dBm.



PCMs switches with their thermal field simulation and switch process

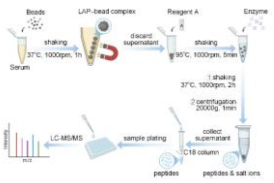
Notes

36-2 11:05–11:20

Functionalized Nanomagnetic Beads Enable Analysis of Low-Abundance Proteins

Mingyi Wei[1], Bingrun Tong[1], Xiaoqing Wang, Xiaohui Liu, Shunxiang Li*, Kun Qian*
School of Biomedical Engineering, Shanghai Jiao Tong University, China

- Magnetic nanobeads rapidly enrich and enzymatically hydrolyze low-abundance proteins.
- This application can be well used with chromatography-mass spectrometry systems.
- Data-independent acquisition and quality control ensure test reproducibility.
- The research provides a platform for proteomics and disease biomarker discovery.



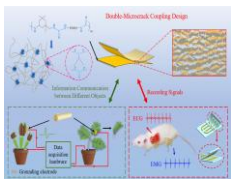
Notes

36-3 11:20–11:35

Interface Bonding Strategy for Soft Bioelectrodes

Dianpeng Qi
School of Chemistry and Chemical Engineering, Harbin Institute of Technology, China

- Dual microcracks coupling strategy was proposed to enhance the stretchability and stability of bioelectrode.
- Soft bioelectrode with high tissue adhesion was produced.
- MRI compatible all carbon-based stretchable electrode was created.



Interface bonding strategy enables dual microcracks coupling for stretchable bioelectrodes

Notes

Technical Special Session 36
2D Materials at Nanoscale: From Fundamentals to Applications (ss)

Room 4

10:50-12:50 Thursday, 31 July

Chairs: Zegao Wang, He Tian

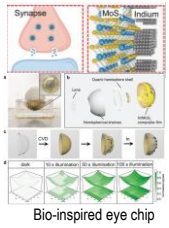
36-4 11:35–11:50

Bio-Inspired Devices Based on 2D Materials

Pingan Hu, Huiwen Ren, Hongying Yang

Harbin Institute of Technology, China

- Flexible functional structural materials and devices hold significant application potential in fields such as artificial intelligence and smart healthcare.
- Design and fabrication of functional sensitive structures with a large linear response range for highly sensitive e-skin devices integrating proximity sensing and force/tactile perception functions.
- Bioinspired visual devices based on two-dimensional (2D) semiconductors demonstrate ultra-low power consumption and excellent capabilities in perception, memory, and imaging, mimicking human-eye functions.



Bio-inspired eye chip

Notes

36-5 11:50–12:05

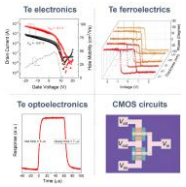
Exploring Tellurium Semiconductors for Electronics, Optoelectronics, and Ferroelectrics

You Meng[1*], Johnny C. Ho[2*]

[1]College of Semiconductors, Hunan University, China

[2]Materials Science and Engineering, City University of Hong Kong, HKSAR

- Developing multiscale vdWs epitaxial growth to deposit Te nanomesh on arbitrary surfaces at 100 ℃.
- Exploring photothermoelectric coupling of Te for developing IR in-sensor convolutional networks.
- Using flexoelectric manipulation strategy to enhance ferroelectric polarization of self-strained Te.
- Optimizing BEOL compatibility of Te alloying films for achieving low-power CMOS circuits.



The advancements in Te semiconductors and utilizations

Notes

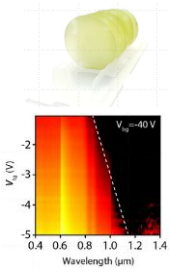
36-6 12:05–12:20

The Growth of 2D Semiconductor and its Sensor Application

Zegao Wang

College of Materials Science and Engineering, Sichuan University, China

- By optimizing the CVD-setup, the wafer-scale growth of MoS_2, WSe_2 wafers are realized.
- The effects of electric field, atomic doping have been carried out to promote its application in sensing.
- The photodetection with high-performance in light intensity, polarization and wavelength is exhibited.
- By tuning the electronic structure, the 2D materials shows high response in gas sensing, and potential application in fringe identify application.



Notes

Technical Special Session 36
2D Materials at Nanoscale: From Fundamentals to Applications (ss)

Room 4

10:50-12:50 Thursday, 31 July

Chairs: Zegao Wang, He Tian

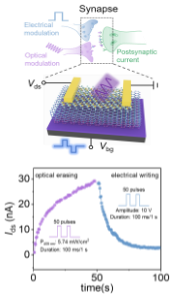
36-7 12:20–12:35

2D-Material-Based Memristors for Opto-Electronic Neuromorphic Computing

Feng Xiong

College of Advanced Interdisciplinary Studies, National University of Defense Technology, China

- Optoelectronic performance of diverse 2D memristors were investigated to explore their applications for neuromorphic computing.
- The mechanisms of memristive effects were revealed in Ag/SiO_2/graphene and LDH-based memristors.
- TaS_2 Mott memristors with fast thermal modulation speeds (~μs) were built.
- MoS_2/BN/graphene heterostructures exhibiting negative and positive photoconductivity were fabricated to construct optoelectronic hybrid neural networks.



Notes

36-8 12:35–12:50

ZnO Nanoflowers for Enhanced Detection of Small Metabolites by Laser Desorption/Ionization Mass Spectrometry

Wenjing Zhang, Yuning Wang*, Kun Qian*

College of Chemistry and Chemical Engineering, IMU, China

- The study developed ZnO nanoflowers for enhanced metabolite detection in LDI-MS advancing clinical diagnostics.
- ZnO nanoflowers were prepared by simple room-temperature method.
- Three-dimensional flower-like ZnO NFs offer high surface area for analyte adsorption, excellent photoelectric performance.

Notes

Technical Session 37
Nanomaterials and Applications II

Room 5

10:50-12:50 Thursday, 31 July

Chairs: Kostadin Kostadinov, Yaroslav Beltukov

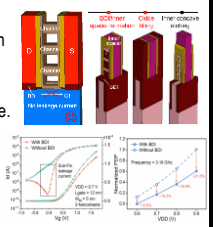
37-1 10:50–11:05

Source/Drain BDI in Si Nanosheet GAAFETs: A Simplified Scheme for Performance Improvement

Hengbin Ding

School of Integrated Circuits and Beijing National Research Center for Information Science and Technology (BNRist), Tsinghua University, China

- A simplified GAAFET scheme with bottom dielectric isolation (BDI) structure, compatible with main process flow.
- Device-level benefit: suppressing sub-fin effects, reducing leakage and optimizing gate capacitance.
- The scheme improves the switching performance and noise immunity for inverter.
- Circuit-level benefit: improving power-delay product by 15.2% at 0.7 V V_{DD} at the 3 nm node.



Notes

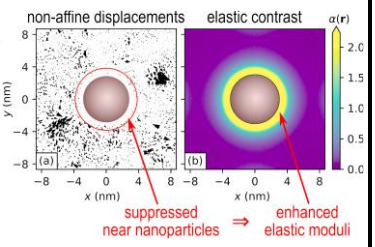
37-2 11:05–11:20

Disorder-Induced Elastic Moduli of Nanocomposites

Yaroslav Beltukov

Ioffe Institute, St. Petersburg, Russia

- Amorphous systems have irregular non-affine atomic displacements under homogeneous stress.
- Non-affine displacements are suppressed near rigid nanoinclusions.
- It leads to the strong increase in the elastic moduli in the interfacial region.



Notes

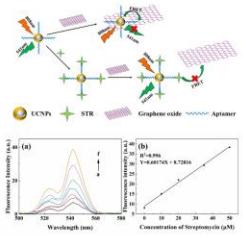
37-3 11:20–11:35

A Turn-On Aptasensor for the Detection of Streptomycin Using 808 nm-Excited Upconversion Nanoparticles

Yuegang Peng, Jingwen Mo*

School of Mechanical Engineering, Southeast University, P.R. China

- An aptamer-functionalized upconversion fluorescence sensor for specific detection of streptomycin was developed.
- The "turn-on" sensing strategy improves the sensing selectivity.
- The sensor has a detection range of 1-50 μM and a low detection limit of 1.28 μM.
- The sensor was sensitive and successfully applied to detect streptomycin in food samples.



Notes

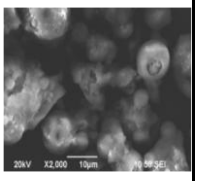
Technical Session 37
Nanomaterials and Applications II
Room 5
10:50-12:50 Thursday, 31 July
Chairs: Kostadin Kostadinov, Yaroslav Beltukov

37-4 11:35–11:50

Preparation of Mg Salt-Modified Fly Ash and Its Adsorption Performance on Congo Red Dye

Dong Xue, Yuanfeng Hui*
College of Resources and Environment Engineering, Jilin Institute of Chemical Technology, China

- Develops a novel resource utilization pathway for fly ash industrial waste recycling.
- Innovates magnesium salt modification to enhance adsorption performance for efficient congo red removal.
- Establishes green sustainable treatment technology aligning with environmental governance trends.
- Proposes a low-cost modification strategy combining Mg salts with fly ash for practical application.



SEM of Mg-MFA microbeauty powers dye adsorption

Notes

37-5 11:50–12:05

Research on the Current Situation, Challenges and Countermeasures of the Nanomaterials Industry Development

Xiaolin Jia
School of Foreign Languages, Jilin Institute of Chemical Technology, China

- Global nanomaterials market expanding in 2025 with china as a major player.
- Industry faces high costs, technical bottlenecks, and environmental challenges from non-biodegradable materials.
- Innovation trends focus on developing sustainable nanomaterials and integrating with emerging technologies.

Notes

37-6 12:05–12:20

Modulatory Effects of Ginkgo Biloba Extract on Glucose-Damaged Mesangial Cells: AFM-LSM-FC Study

Peishuang Sun, Zhengxun Song*
International Research Centre for Nano Handing and Manufacturing of China, Changchun University of Science and Technology, China

- Using AFM-LSM-FC combined technology, the nanoscale changes of HBZY-1 were measured on a multi-dimensional scale.
- Repair effect of Ginkgo biloba extract on HBZY-1 in glucose environment.
- The functions of HBZY-1GJIC in different states were measured.

Notes

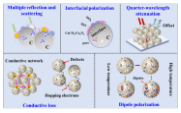
Technical Session 37
Nanomaterials and Applications II
Room 5
10:50-12:50 Thursday, 31 July
Chairs: Kostadin Kostadinov, Yaroslav Beltukov

37-7 12:20–12:35 (Poster)

Nano-Ash Hybrid Recycled Carbon Black: A Strong, Wideband Electromagnetic Wave Absorbent

Qirui Sun, Liqun Zhang
College of Materials Science and Engineering, Beijing University of Chemical Technology, China.

- Extracting ash hybridized recycled carbon black from waste tires for microwave absorbing materials.
- The EAB of the sample treated at 800 °C reaches 4.14 GHz at a thickness of 1.5 mm.
- Synergistic enhancement of microwave absorption by multi-interface polarization and defect dipole polarization.
- Providing a new direction for the high-value utilization of waste tires.



Schematic of the EWA mechanisms of RCB treated at low and high temperatures

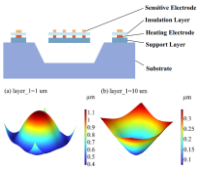
Notes

37-8 12:35–12:50 (Poster)

Analysis of the Effect Geometric Parameters of MEMS Micro-Hot Plate on Device Performance

Baoqing Han, Benben Wang,*
School of Mechano-Electronic Engineering, Xidian University, China

- The MEMS micro-hot plate designed in this work adopts a suspended film structure.
- A novel design for heating and sensing electrode shapes has been proposed.
- The multi-physics field coupling simulation analysis method was adopted.
- The effects of geometric parameters on the microhotplate's temperature, stress, and power consumption were studied.



Schematic structure of the suspended film micro-hot plate and some simulation results

Notes

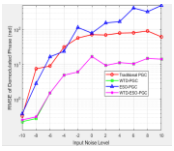
Technical Session 38
Algorithms and Modeling
Room 6
10:50-12:50 Thursday, 31 July
Chairs: Hanxing Zhu, Santiago M Olaizola

38-1 10:50–11:00

Research on the Performance of PGC Phase Demodulation Algorithm Based on WTD-ESO

Jiaqi Xi
International Research Centre for Nano Handling and Manufacturing of China, Changchun University of Science and Technology, china

- A hybrid PGC demodulation algorithm combining wavelet threshold denoising and extended state observer.
- Real-time estimation and compensation of harmonic distortion and residual noise are carried out.
- Reduce the root mean square error of demodulation and suppress noise and high-order harmonics.
- Accurately restore the phase signal and improve the stability of phase demodulation.



Demodulation performance comparison and noise level

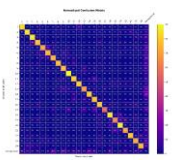
Notes

38-2 11:00–11:10

Light-Weighting Chromosome Instance Segmentation Method Based on Mask R-CNN

Wentao Yu
International Reseach Centre for Nano Handing and Manufacturing of China
Ministy of Education Key Laboratomy for Cross-Scale Micro and Nano Manufacturing, Changchun University of Science and Technology, China

- Develops lightweight models: SCmask R-CNN and SCCascade mask R-CNN variants.
- Reduces computational cost: significantly lowers parameters and FLOPs (e.g., 14.9% params, 9.4% FLOPs).
- Maintains competitive accuracy: achieves efficient segmentation with minimal performance drop.
- These computational efficiency improvements significantly reduce hardware dependencies and enable practical deployment in resource-constrained laboratory environments.



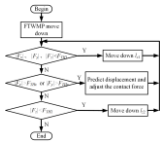
Notes

38-3 11:10–11:20

A Contact Force Control Method for Weak Stiffness Micro Parts Based on Optimized BP Neural Network

Beichao Shi[1], Fujun Wang*[1], Zhichen Huo[2], Yanling Tian[3], Hongqiang Lu[2], Cunman Liang[1]
1. Key Laboratory of Mechanism Theory and Equipment Design of Ministry of Education, Tianjin University, Tianjin, 300072, China
2. Xi'an Institute of Applied Optics, Xi'an 710065, China
3. School of Engineering University of Warwick, Coventry CV4 7AL, UK

- The contact force is introduced to guide the insertion process to avoid damaging micro parts.
- An efficient contact force control method based on back-propagation neural network is proposed.
- An intelligent insertion control strategy based on the established mapping relationship is designed.



The insertion process based on optimized BP neural network

Notes

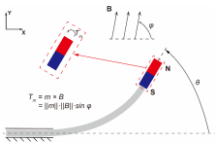
Technical Session 38
Algorithms and Modeling
Room 6
10:50-12:50 Thursday, 31 July
Chairs: Hanxing Zhu, Santiago M Olaizola

38-4 11:20–11:30

Modeling and Motion Control of Magnetic Continuum Robots

Huanyu Zhou
Shenyang Institute of Automation, Chinese Academy of Sciences, China

- Developed a magnetic torque–curvature model for soft continuum robots.
- Achieved precise deflection control via 8-coil field superposition.
- Enabled smooth navigation through complex obstacle courses.
- Demonstrated potential for targeted delivery in minimally invasive microrobotic interventions.



Schematic of magnetic bending mechanism in the continuum robot

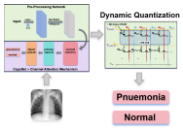
Notes

38-5 11:30–11:40

Quantization Strategies for an Attention CapsNet Pneumonia Recognition Algorithm Based on Pd/HfO2/Ag RRAM

Guoxiang Xu, Feichi Zhou*
School of Microelectronics, SUSTech, China

- Introduced a lightweight attention-enhanced capsule network for pneumonia recognition.
- Optimized weight quantization strategies for attention-enhanced capsule network implemented with Pd/HfO_2/Ag RRAMs are proposed.
- 3-bit dynamic quantized model achieved comparable performance than full-precision model.
- Hardware simulations showed robustness: <6% accuracy drop with RRAM variations.



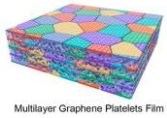
Notes

38-6 11:40–11:50

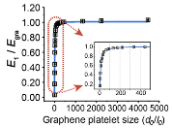
Modelling the Mechanical Properties of Multilayer Graphene Platelet Films

Hanxing Zhu, Penghao Qi, Xindong Chen
School of Engineering, Cardiff University, Cardiff CF24 3AA, UK

- Multilayer periodic random geometric model.
- Finite element simulations.
- Effects of different geometric parameters on the elastic properties.
- Dominant deformation mechanisms.
- Broad range of applications.



Multilayer Graphene Platelets Film



Notes

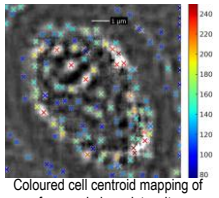
Technical Session 38
Algorithms and Modeling
Room 6
10:50-12:50 Thursday, 31 July
Chairs: Hanxing Zhu, Santiago M Olaizola

38-7 11:50–12:00

Label-Free Digital Holographic Phase Imaging of Live Human Cheek Cell Nuclei

Peter Bryanston-Cross
School of Engineering University of Warwick, UK United Kingdom
Nano Metrology Changchun University, China

- Digital holographic phase images using a NA 0.6 microscope at 470nm revealing subnuclear cell motion.
- The phase images have a ~150 nm lateral ~200 nm axial resolution.
- The images show ~6° rotation of peripheral nuclear features in ~1 min.



Coloured cell centroid mapping of focussed phase intensity

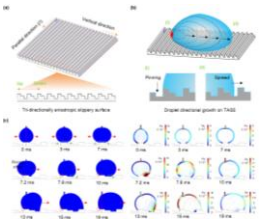
Notes

38-8 12:00–12:10

Simulation of Directional Droplet Spreading on Tri-Directionally Anisotropic Slippery Surface

Meng Wang, Faze Chen*
School of Mechanical Engineering, Tianjin University, China

- The mechanism underlying directional droplet growth is revealed.
- Structural asymmetry promotes early contact and spreading toward the lower step.
- Persistent internal pressure gradient reinforces unidirectional motion.
- These insights would provide a mechanistic foundation for the design of anisotropic surfaces.


Droplet directional growth process

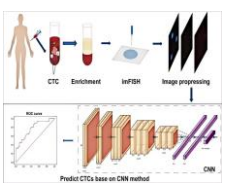
Notes

38-9 12:10–12:20 (Poster)

Recent Advances in Microfluidic Detection of Circulating Tumor Cells Based on Deep Learning

Yizeng Liu[1], Siqi Liu[1], Can Cheng[1,2*]
[1]Department of Biomedical Engineering, Guangdong Medical University Dongguan, China
[2]Bay Lab for Artificial Intelligence and Cardio-cerebrovascular Engineering, Guangdong Medical University Dongguan, China

- Deep learning enhances microfluidic chip performance for efficient circulating tumor cell (CTC) sorting.
- Integration of deep learning with spectroscopic technologies improves CTC detection sensitivity.
- Deep transfer learning facilitates technological advances in CTC lesion tracing.
- It proposes establishing cancer-specific CTC databases to guide microfluidics-deep learning integration.



Notes

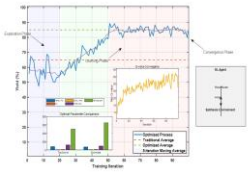
Technical Session 38
Algorithms and Modeling
Room 6
10:50-12:50 Thursday, 31 July
Chairs: Hanxing Zhu, Santiago M Olaizola

38-10 12:20–12:30 (Poster)

Intelligent Optimization of Nanomaterial Synthesis Process by Integrating Multimodal Data and Large Language Models

Shihui Zhu
Jilin Institute of Chemistry and Technology

- Utilizing multimodal AI models for nanomaterials R&D optimization.
- Enhanced structure prediction accuracy with CNN/GNN integration.
- Improved synthesis yield through reinforcement learning approaches.
- Constructed knowledge graph reveals new insights in nanotech.



Reinforcement learning optimizes the synthesis process of nanomaterials

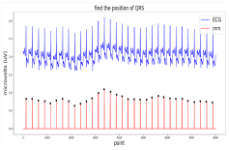
Notes

38-11 12:30–12:40 (Poster)

The Application of Morphology and Moving Window Algorithm in R-wave Detection

Xiran Zhang, Guozhong Xu*
School of Life Science and Technology,
Changchun University of Science and Technology, China.

- New Algorithm: combines morphology and moving window for QRS/R-wave detection.
- Method: simplifies morphology, uses moving window filtering and thresholds.
- Advantages: low O(n) complexity; corrects baseline drift and noise concurrently.
- Performance: 99.68% R-wave accuracy verified on MIT-BIH database.



The result of combined morphology and moving window processing

Notes

38-12 12:40–12:50 (Poster)

Construction and Application Validation of an ELISA Detection System for Rabies Virus CTN-1 Vaccine Titer

[1]Dingyao Liu, [1]Hao Zhang*, [2]Xingfu Feng*
[1]Changchun University of Science and Technology, China
[2]Changchun Zhuoyi Biotech Co., Ltd, China

- Establish an ELISA method for determining the potency of rabies virus CTN-1 strain vaccine.
- Determine the detection system of ELISA, including the concentration of coated antibodies and enzyme-linked antibodies.
- Evaluate the performance of the reagents and compare them with commercially available reagents to detect vaccine samples.
- The potency results of self-prepared reagents are better than those of commercially available reagents, with good specificity.

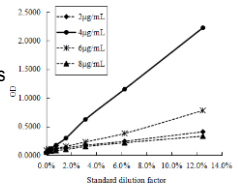


Figure 1 Screening results of antibody concentration in the package

Notes

Special Session: Junior Researcher Education and Development Forum

Established in 2019 through a partnership between IEEE 3M-NANO International Conference and iBowu-JSA, Junior Researcher Education and Development Forum organizes a special session in the Conference. The forum aims to popularize nanotechnology and interdisciplinary research among young students. The forum provides a platform for academically outstanding teenagers to demonstrate their participation in scientific research and to broaden their horizons by awakening scientific aspirations.

The forum features presentations on original scientific research works conducted by teenagers who are actively involved in the intersection of physics, chemistry, molecular biology, bioinformatics, and nanotechnology. Additionally, the forum serves as a platform for the young talents to engage with and learn from the globally renowned scientists.

About iBowu-JSA

The Juvenile Science Academy (JSA) is the first scientific research academy for young students in China, operated solely by the civil forces. JSA was founded by iBowu, a China-based platform for youth scientific activities and academic research projects. JSA is aimed at providing Chinese young talents with high-quality scientific practice opportunities.

JSA received scientific support and capital investment from BGI and the Good Future Education Industry Fund. With a strong scientific and capital background, JSA has assembled a cohort of top scientists working in a variety of multidisciplinary research fronts around the world, including China, the United States, Denmark, Norway, Singapore, Australia, among others. With the help of the scientists, we compiled joint laboratory resources from dozens of universities and research institutions in several countries for our future scientists.

JSA provides students with state-of-the-art STEM research programs and elite training programs. We are committed to fostering a scientific mindset among Chinese youth, nurturing future scientific talents for China and for the global scientific and technological community.

Dr. Enshi Xu

iBOWU-JSA

Forum Chair

Ph. D. 2016 in Computational Nanomaterials and Physics at Penn State University

Executive Member of the iBowu-JSA Academic Committee; mentored students to publish on SCI journals and win ISEF and iGEM awards

Pengjun Guo

The Experimental High School Attached to Beijing Normal University

Stable Co(III), Ni(III) Hexahydrazide Clathrochelate Complexes Formed by Air Oxidation in Water

In this work, we synthesized two hexahydrazide clathrochelate complexes [CoC12H12O6N12]3−(1) and [NiC12H12O6N12]3−(2) through air oxidation and hydrogen peroxide in water. The compounds were characterized by single-crystal XRD, FT-IR, ESI-HRMS, TGA, electrochemical analysis (CV), XRD, and superconducting quantum interference device magnetometry (SQUID), along with DFT calculations involving geometry optimization, vibrational analysis, single-point energy calculation, and wave function analysis. Mass spectroscopy and single-crystal XRD results indicate that complex-1 and complex-2 are mononuclear clathrochelate anions with nickel and cobalt centers, respectively.The metal atom is coordinated by six deprotonated nitrogen atoms, exhibiting a structure similar to previously reported analogs. The magnetic properties of complex-1 and complex-2 revealed $3d^7$ and $3d^6$ electronic configurations, respectively, which correspond to the +3 oxidation state of Co and Ni in the clathrochelates. Complex-1 is stable in both alkaline and neutral aqueous solutions, whereas complex-2 is stable only in neutral aqueous solutions. Notably, as a nickel(III) complex, complex-2 not only remains stable in water but can also be formed through oxidation. This is the first reported chemical species exhibiting such unique properties, thereby expanding the chemistry of high-oxidation-state nickel, which provides a foundation for investigating the potential catalytic capabilities of complex-1 and complex-2.

Bomin Wei

University of California, Los Angeles

ProteinDINO: Self-Supervised Finetuning Protein Encoder Using a DINO Trick

Introduced by OpenCLIP, transformer based encoding has been a common approach to process high-level abstract information by building feature alignment with text embeddings. Similar approach can be applied on encoding protein sequences for better understanding protein internal structure information. The common challenge in both image and RNA encoding is the lack of high-quality labeled data alongside the abundance of unlabeled data. Recent advances in computer vision have introduced effective self-supervised learning methods which leverage large unlabeled datasets to train the encoder to understand the internal structural information by "reading enough". Among these, the DINO model has demonstrated remarkable performance in visual feature extraction, significantly enhancing visual representation learning in Vision Language Models (VLMs). In this project, we introduce ProteinDINO, a protein encoder that leverages the DINO self-supervised learning framework to fine-tune a CLIP-based pretrained protein encoder. Specifically, we fine-tune the base protein encoder by distilling a contrastive learning loss between two non-mutated variants of an unlabeled protein. Ideally, the model should be capable of identifying both the structural similarities and differences between diverse protein sequences. We apply our approach to the Meta ESM2-650M protein encoder and evaluate it on the TAPE RemoteHomology classification task. ProteinDINO achieves a 5% accuracy increase on the test split, corresponding to a ~25% relative improvement in the encoder's general representation performance.

Gloria Huang

Shanghai Starriver Bilingual School

Mechanistic Study of Astragalin's Effects on NAFLD through ER Stress and Hepatocyte-Macrophage Crosstalk

This study investigates the therapeutic potential of astragalin in non-alcoholic fatty liver disease (NAFLD) by targeting ER stress and hepatocyte-macrophage crosstalk. With the global prevalence of NAFLD rising and effective treatments lacking, its pathogenesis involves lipid toxicity-induced ER stress (GRP78/UPR pathway) and chronic inflammation. We hypothesize that astragalin, a natural compound with anti-inflammatory and antioxidant properties, may attenuate NAFL-to-NASH progression by suppressing ER stress and macrophage-driven inflammatory feedback. Using a hepatocyte-macrophage co-culture model, combined with Western blotting and confocal microscopy, we will analyze astragalin's effects on ER stress markers (e.g., PERK, IRE1α), pro-inflammatory cytokines (TNF-α, IL-1β), and lipid metabolism. The anticipated results may validate astragalin as a candidate for early NAFLD intervention and elucidate its mechanistic targets.

Leo Liu

International School of Beijing

Navigating through the Chemical Space: Deep Learning for Generative Drug Discovery

Traditional drug discovery processes often take decades and billions of dollars. Recent advancements in AI have prompted researchers to new avenues offered by computer-aided drug design. However, many earlier algorithms lacked a guided way of exploring the chemical space due to its discrete nature, making new discoveries computationally infeasible. Deep learning has allowed researchers to represent the chemical space continuously, giving the models the ability to conduct guided exploration of the chemical space using gradient based methods. Recent advancements in deep learning models like transformers, variational autoencoders (VAEs), and generative adversarial networks (GANs), are allowing researchers to efficiently explore the chemical space and identify lead compounds at a higher hit rate while reducing computational cost. This presentation will critically examine the strength and weakness of each approach while proposing novel methods of improving the generative process.

Max Shuhe Zhang

Beanstalk International Bilingual School

Mechanobiological Responses on Curvature-Engineered ECM Micropatterns

This study investigates the mechanisms of cell migration and directional polarity guided by extracellular matrix (ECM) micropatterns, with a focus on curvature sensing, mechanotransduction, and stress-induced cellular responses. We explore how cytoskeletal tension and focal adhesion dynamics regulate cell behavior in response to geometric cues, particularly examining stress-induced cell mobility and stiffening as adaptive mechanisms. By integrating microfabrication, live-cell imaging, and biophysical assays, we aim to elucidate how ECM topology influences migratory precision and polarity establishment. Furthermore, this research highlights potential applications in muscle cell repair and rehabilitation, where engineered microenvironments could enhance regenerative therapies by optimizing mechanical cues for directed cell migration and tissue regeneration.

Mi Li

Schule Marienau

Shaping Cell Mechanical Properties through Protein Micropatterning at a Single-Cell Level

This study investigates fibroblast mechanobiology through engineered fibronectin micropatterns fabricated via PRIMO-based maskless photopatterning, enabling precise control over extracellular matrix (ECM) geometry. Single fibroblasts were seeded on these patterns to analyze their morphological adaptation and mechanical responses. Using atomic force microscopy (AFM), we systematically quantified cellular mechanical properties in response to micropattern-driven spatial constraints. The integrated approach—combining protein micropatterning, live-cell imaging, and nanomechanical profiling—reveals how ECM topology dictates fibroblast mechanotransduction, with implications for designing biomimetic scaffolds in tissue engineering.

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Delivery of siRNA with Lipid Nanoparticle for Cancer Treatment

Cancer is one of the deadliest diseases worldwide, but due to the lack of specificity of chemotherapy, radiotherapy, and surgery for tumor cells, they often come with serious side effects. Nucleic acid therapy can selectively modify gene expression in tumor cells, presenting an exciting new approach to cancer treatment and a potentially promising alternative to several common tumor treatment strategies currently available. In this study, we utilized lipid nanoparticle (LNP) as siRNA delivery carrier and investigated the results of suppressing cell proliferation of siRNA targeting ribonucleotide reductase subunit M2 (siRRM2).

Development of "FeliSilence": A Synbio-Based Feline Feed Additive Targeting Fel d 1 Silencing via RNAi

This project aims to address feline allergies at the molecular level by developing "FeliSilence," a synthetic biology-based feed additive for cats. The core strategy employs RNA interference (RNAi) technology to specifically suppress the expression of Fel d 1, the major allergen produced in feline salivary glands. The workflow encompasses: (1) bioinformatic design of siRNA sequences; (2) large-scale siRNA production via in vitro transcription; (3) construction and optimization of a lipid nanoparticle (LNP) delivery system; and (4) functional validation in a feline renal epithelial cell line (CRFK). Furthermore, a GFP reporter system was engineered to enable high-throughput screening of siRNA activity.

Gloria Huang

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Jenny Dong

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Shell Li

Peddie School

Jingxi Zhang

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General Information

Overall

Changchun is the capital city of Jilin Province and one of the 15 sub-provincial cities assigned by the State Council. The total area covers 24,744 square kilometers with a metropolitan area of 20,571 square kilometers which includes 7 administrative districts, three cities, and one town. [1]

Changchun has become a multi-functional and modern city with numerous reputations such as “The Automotive Capital”, “The Hollywood of China”, “The City of Organic Food”, “The City of Forests”, “The City of Science and Education”, and “The City of Sculptures”. Changchun has won countless awards such as the “2011 Top Ten Low Carbon City”, the “2012 National Cultural City Award”. It is also the first to receive the “National Innovative City” award and voted the “City with Most Happiness” and “City Provides Happiness for its Citizens” by the national media and press. [2]

As a beautiful city, Changchun has a pleasant climate and distinct scenery in each of the four seasons. Owning the largest artificial forest of Asia, the city, 41.5 percent of whose urban area is covered by green, is awarded as the “National Model of Green City”, “Environment Friendly City”, and “National Clean City”. [3]

Vivacious Spring City

The “Integration of the cities of Changchun and Jilin” provided opportunities for the urban structure and the industry distribution of Changchun, and created a solid foundation for better and faster development of the

backbone industries and the economy. Scientific development planning, solid development foundation, and the advanced distribution helped Changchun became one of the innovative cities that is capable of development. In 2012, Changchun was among the first group of cities to receive the “National Innovative City” awarded by the State Council. The rank of innovation capability of Changchun city has been rising since 2018. [4]

1 The Famous Automotive Capital

1.1 The First Automobile Works of China (FAW)

The FAW Group is a historic milestone in the history of development of China's automotive industry as its pioneer and leader. Over the years, the FAW has been emphasizing on the development of the auto part industry in expansion, industrialization, and collection under the enterprise development guidelines of the “Independent Innovation; Open Cooperation”. The FAW had completed the transformation from a single product factory to a global enterprise with a multi-brand, multi-series, and multi-dimension product lines that ranges from small, mid-sized and heavy trucks to passenger cars, mini-sized vans, buses, and military vehicles as well as the leading automotive enterprise with a diverse capital structure that operates in both international and domestic markets. [5]

1.2 Changchun Railway Vehicles Co., Ltd. (CRV)

Changchun Railway Vehicles Co., Ltd. is the cradle of China Metro Transit and EMU. The former Changchun Passenger Car Factory, founded in 1954, is one of the key construction projects of the First Five-Year Plan.

The CRV produces 180-200 EMUs, 4,000 urban rail vehicles and 600 ordinary railway buses every year. The products have been exported to more than 20 countries and regions The total number of export vehicles has exceeded 9,000, and the contract value has exceeded 12 billion US dollars. CRH5 200 km/h AC emu is the pioneer of the sixth large-scale speed-up of Chinese Railway in 2007. It is the first class high-speed EMU in the world. [6]

2 Photoelectric Industry

Changchun is the cradle of China’s photoelectric technology. In 1951, the famous scholar, Wang Daheng came to Changchun to establish the Changchun

Optical Precision Machinery and Physics Research Institute of the Chinese Academy of Science, and engaged in basic, applied, engineering and high-tech industrialization research work. Led by fellow researchers, Wang Daheng and Xu Xurong together with a group of scientists have made over 1,700 achievements in scientific research, developed over ten "First in China" technological advancements including China's first ruby laser and the first large-scaled theodolite, trained more than 2,200 talents, and contributed to the national science and technology development, economic development, and national defense development. The institute is known as the "the Cradle of China's Optics" and has created the foundation for the formation and development of Changchun's photoelectric industry. [7]

Relying on its solid foundation, strong innovative ability, and a complete R&D team, Changchun is emphasizing on the development of the photoelectric industry. So far, Changchun has completed projects such as "The Changchun Photoelectric Industry Base of the National Torch Project", "The Software Industry Base of the National Torch Project", "The National High-Tech Export Base", and the "Chinese Overseas Student Entrepreneurship Base". As the officially certified "National Photoelectric Industry Base", Changchun is moving forward to a market-oriented and demand-oriented photoelectric R&D base.

3 The City of Academic Culture

Changchun has long enjoyed its fame of the "City of Science, Education, and Culture". With a great number of universities, scientific and cultural institutions, and cultural activities, Changchun becomes one of the knowledge-intensive cities of China. The city is praised as "Boston in the East" with its nation- and world-renowned universities, such as Jilin University, Northeast Normal University, and Aviation University of the Air Force of the Chinese People's Liberation Army; 107 private scientific and technological research institutions, and 98 state-owned scientific research institutions; 19 national key open laboratories for scientific research; 31 academicians from the Chinese Academy of Sciences and the Chinese Academy of Engineering; and over 339 thousand professionals of different fields. [5]

4 Changchun Film Studio (CFS)

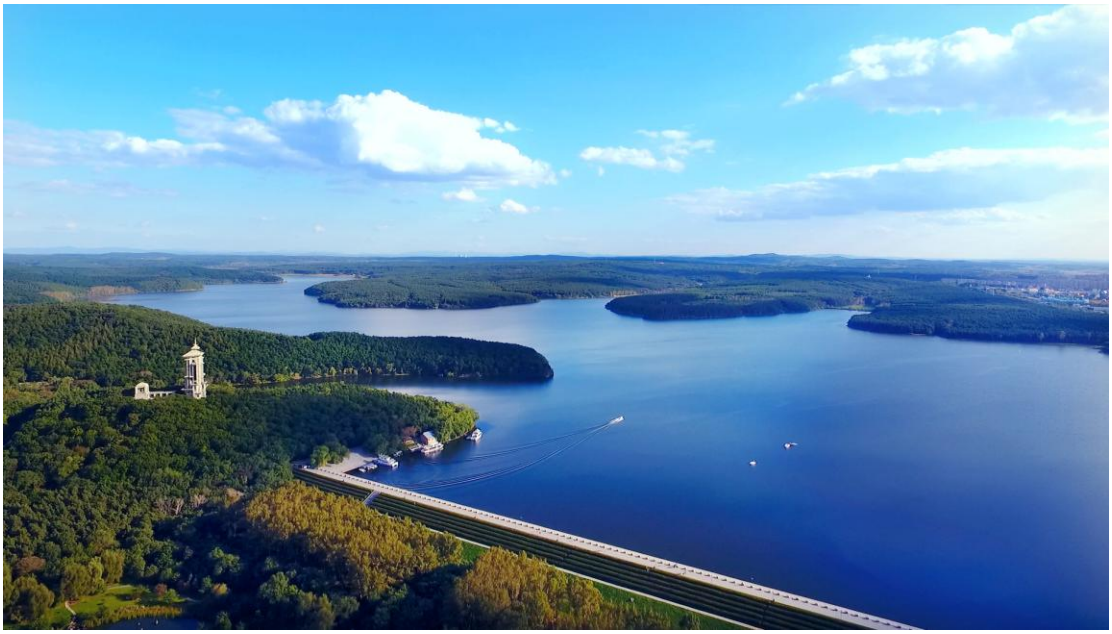
As the film cradle of the PRC, the Changchun Film Studio (CFS), in its history of over 60 years, has produced over 1000 films and translated over 1000 overseas films. Under its influence, Changchun has won its reputation as City of Film, held 12 national film festivals since 1992, established Changying Century City --- the first worldclass film theme park of China, transformed the former site of the CFS, attracted millions of tourists with its film industry, and earned the honour and realized the dream of its film culture. [5]

A City for Livability and Quality of Life

The Province of Jilin is the “Ecological Model Province”. Changchun, as the capital of Jilin takes the leadership role in the ecological development of the province. A temperate, semi-humid continental monsoon climate makes Changchun a beautiful scroll of sceneries that draw the eyes of millions. The locals are kindhearted and easy to get along with. Numerous stories of “positive energy” are evident. A genuine daily life with an optimistic attitude towards any eventualities can also be found in the city.

1 Urban Forests and Natural Sceneries

Changchun, also better known as the “National Garden City”, “National Model of Green City”, and “A City of Forests”, uses the color green in its name card to make the visualization of a perfect ecological environment that only exists in people’s imaginations. Everyone has the luxury of forests, gardens, and parks around where they live. This is not a mirage but something real that can be touched, giving anyone a feeling of an out-of-this-world dreamland. The beautiful natural sceneries have raised the environmental awareness of the citizens. Currently, Changchun is the holder of numerous awards such as the “The Model of Chinese Living Environment”, “The National Garden City”, the “The Model City of Environmental Protection”, and the “National Clean City”. [8]



2 The Mingling of Ice and Snow and the Crossing of Spring and Autumn

Changchun City is situated at the heart of Songliao Plains in northeast China, and it's counties and districts located at 124'18" - 127'02" east longitude, 43'05" - 45'15" north latitude. At the end of April, Changchun comes to a season of bird singing, green grass growing, and the fragrance of different flowers. In summer time when the people in the south try to survive the heat, Changchun comes to the best time of the year with the color of fresh green and the flowers allowing the city to become passionate. The annual Summer Relaxation Festival attracts visitors to get away from the hot summer. [8]

The winter in Changchun is just cold enough to have powdery snow and just long enough to let people enjoy miles of icy and snowy sceneries. It also lets people enjoy the winter activities such as skiing, snow ball fighting, or just chilling outdoors. These have become the signature for the winter tourism. So far, Changchun has held 26 successful China Changchun Ice and Snow Tourism Festivals. Changchun has become a part of the Vasaloppet International Skiing series by hosting the Jingyuetan Vasaloppet International Cross-Country Skiing, a global event that attracts more and more visitors and athletes from around the world. The Vasalopet International Ski Festival has been held on the second Saturday of March every year at Jingyuetan Park in Changchun since 2003. After the success of holding the “9th National Winter Games” in 1999, “the 6th Asian Winter Games” in 2007, Changchun has held

“the 12th National Winter Games” in 2012. It has demonstrated its organizing ability and versatility to host large, multi-competition sporting events. [9]

3 Delicious Cuisines and Joyful Life

For those who come to Changchun, it is a must to try the local cuisines. Eating in Changchun is just as wonderful as anywhere else in China.

3.1 Jilin Cuisine

When referring to northeastern Chinese cuisines, it often comes to the Manchu Han Imperial Feast, but Jilin Cuisine has been one of the important northeastern cuisines in recent years. It was developed by hotels and restaurants in the province, featured with ingredients from local meats and vegetables. Today, the Jilin cuisine consists of 3,150 different items, 91 famous banquets, 183 famous dishes, and 67 small delicacies. Together, they have formed new sets of menu with national, folk, imperial, and mountain-side dishes. Renowned traditional dishes such sauerkraut, stir-fried pork with sour cabbage, and thin starch noodles and other delicious new cuisines are not only loved by the locals but also enjoyed by guests from home and abroad.

3.2 Korean Cuisine

Korean Cuisine is also known as South Korean Food or South Korean Cooking. Most of the Korean Chinese population lives in the three northeastern provinces, especially in the Yanbian Prefecture of Jilin Province. As one of the economic and cultural centers of the Northeast Asian region, many Koreans work and live in Changchun, the Korean restaurants can be found virtually everywhere in the city.

A City of Happiness

The city of Changchun presented an overall goal of developing “A City of Happiness” during the 12th Party’s Congress. A City of Happiness shall be a city where every individual has a place to live, where everybody is satisfied with their careers and has a happy and joyful family, and most of all, where it shall be a city filled with harmony. With the foundation of a strong economy and the support of a stable society, A City of Happiness builds on the ecological environment and the harmonious atmosphere; Cultural-wise, it has its distinction; spiritual-wise, it looks to the idea of openness and advancement.

The local residents are the decision-makers for the city where they will have to create a better future for themselves and enjoy the process while doing it.

A Beautiful Changchun

Changchun has blue waters and skies, green trees and mountains; residents can feel the joy of society's blend of nature everywhere. Changchun is well-known as “A Forest City” in China with the largest artificial forest in Asia, the Jingyuetan Forest Park. The Changchun Northlake Wetland National Park is the largest urban ecological wetland park in Northeast China. As the oxygen bar and the lung of the city, it provides the city with clean air, and gives a refreshed feeling to the citizens. [10]

The citizens of Changchun are living right in this ecological place called home. They are spending time in the four seasons with distinct characteristics. They are enjoying the gifts of nature, and experiencing the self-created happiness in daily life. Nature is eternal and creation will never stop. On Changchun’s 20,571 square kilometers of black soil, its 8.5 million citizens will continue to create more happiness for the realization of a City of Happiness.

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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.

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