Conference Program

Digest

The 13th International Conference on Manipulation, Manufacturing and Measurement on the Nanoscale

IEEE 3M-NANO 2024

Zhongshan, China

29 July - 2 August 2024

Organized by

Zhongshan Institute of Changchun University of Science and Technology, China

International Research Centre for Nano Handling and Manufacturing of China

Changchun University of Science and Technology, China

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Greetings

On behalf of the organizing committee, it is our great pleasure and honor to welcome you in Zhongshan at IEEE 3M-NANO 2024 conference!

3M-NANO is the annual International Conference on Manipulation, Manufacturing and Measurement on the Nanoscale. It will be held on 29 July - 2 August 2024 in Zhongshan, 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 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 2024 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 2024. Last but definitely not least, we thank all the conference participants for their support and contribution. We do hope that IEEE 3M-NANO 2024 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 Zhongshan!

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Conference Information

Venue and Accommodation

Venue

Hilton Zhongshan Downtown is close to corporate and government offices, and adjacent to premium retail and entertainment precinct. It has 3,600m² of flexible meeting and banquet facilities, with 24-hour fitness center, an indoor swimming pool and tennis court.

Hilton Zhongshan Downtown occupies a geographical advantage, standing in the bustling central business district of government agencies and enterprises, directly connected with a variety of well-known fashion shopping brands, catering, entertainment, accommodation, and commercial facilities in one of the new shopping center Lihe Plaza. It takes 60 minutes to Guangzhou, 75 minutes to Macau, and 90 minutes to Hong Kong.

Address: 16 3rd Zhongshan Road, Shiqi District, Zhongshan, Guangdong, China
Tel: +86 760-88888888
E-mail: zhongshandowntown.info@hilton.com

Accommodation

The accommodation of IEEE 3M-NANO 2024 is arranged in the Hilton Zhongshan Downtown.

How to get to Hilton Zhongshan Downtown (IEEE 3M-NANO 2024 Venue)

1. From Hong Kong International Airport (102 km to Hilton Zhongshan Downtown)

Plan A: Public transport: (Skypier Terminal Ferry — Zhonghsan Port — Bus 001): Walk 230m to Skypier Terminal Ferry to take the bus to the Zhonghsan Port, take Bus 001 for 22 stops (direction of Xingzhong Square) to Lihe Plaza, walk 220m get to Hilton Zhongshan Downtown. (About 2 hours and 40 minutes, 500m on foot, 290 yuan)

Plan B: Public transport (A28 — Zhongshan to Hong Kong direct express bus —B10): walk 614m to take A28 for 4 stops (direction of LOHAS Park) to Wong Tai Sin Station, walk 355m to take Zhongshan to Hong Kong direct express bus for 1 stop to Zhongshan Communications Building, walk 246m to take B10 for 3 stops (direction of Expo Center East) to Lihe Plaza. (About 3 hours and 33 minutes, 1.4 km on foot, 80 yuan).

2. From Shenzhen Bao'an International Airport (215.1 km to Hilton Zhongshan Downtown)

Plan A: Shenzhen-Zhongshan Airport Express—K28/K12/K02/K01:

Take Shenzhen-Zhongshan Airport Express Bus (direction of Zhongshan Expo Center) to Zhongshan Expo Center bus station, transfer to K28 (direction of Zhongshan bus terminal station) for 2 stops to Lihe Plaza. (About 2 hours and 27 minutes, 823m on foot, 62 yuan)

Take Shenzhen-Zhongshan Airport Express Bus (direction of Zhongshan Expo Center) to Zhongshan Expo Center, transfer to K12 (direction of Dongfeng People's Hospital) for 3 stops to Lihe Plaza. (About 2 hours and 27 minutes, 823m on foot, 60 yuan)

Take Shenzhen-Zhongshan Airport Express Bus (direction of Zhongshan Expo Center) to Zhongshan Expo Center bus station, transfer to K02 (direction of Di Yin Lake) for 2 stops to Lihe Plaza. (About 2 hours and 26 minutes, 823m on foot, 60 yuan)

Take Shenzhen-Zhongshan Airport Express Bus (direction of Zhongshan Expo Center) to Zhongshan Expo Center bus station, transfer to K01 (direction of Su Bingtian stadium) for 2 stops to Lihe Plaza. (About 2 hours and 26 minutes, 823m on foot, 60 yuan)

Plan B: Shenzhen-Zhongshan Airport Express—003: Take Shenzhen-Zhongshan Airport Express Bus (direction of Zhongshan Expo Center) to Zhongshan Expo Center bus station, transfer to bus 003 (Xiqu No.3 Industrial Zone) for 9 stops to Huabai Market, walk 708m to Lihe Plaza. (About 2 hours and 44 minutes, 1.3km on foot, 62 yuan)

Plan C: Taxi, about 2 hours, 223 yuan.

3. From Zhuhai Jinwan Airport (215.1 km to Hilton Zhongshan Downtown)

Plan A: Public transport: (Airport Bus: Zhongshan Torch Development Zone line — Bus 001/033): Walk 72m to Airport Bus: Zhongshan Torch Development Zone line (direction of Torch Development Zone) to take the bus to Torch Development Zone, walk 166m to take Bus 001/033 for 9 stops (direction of Xingzhong Square) to Lihe Plaza, walk 220m get to Hilton Zhongshan Downtown. (About 2 hours and 43 minutes, 458m on foot, 52 yuan).

Plan B: Taxi: about 1 hour, 150 yuan.

4. From Guangzhou Baiyun International Airport (130 km to Hilton Zhongshan Downtown)

Plan A: Public transport (Guangzhou Airport Express Zhongshan West Line — Bus 050 — Bus K28): walk 282m to take Guangzhou Airport Express Zhongshan West Line for 3 stops (direction of Zhongshan Terminal) to Zhongshan Terminal Station, walk 432m to Cui Jing Community to take Bus 050 for 5 stops to Tian Yue City, take B10 for 6 stops (direction of Expo Center East) to Lihe Plaza. (About 3 hours and 3 minutes, 818m on foot, 84 yuan).

Plan B: Taxi: about 2 hours, 260 yuan.

5. From Zhongshan Station (9 km to Hilton Zhongshan Downtown)

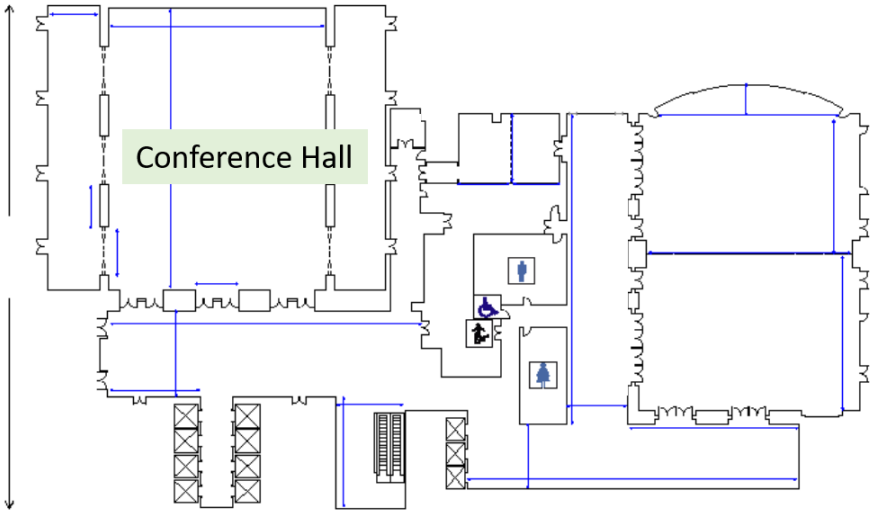
Plan A: Public transport (B19): walk 210m to take B19 for 12 stops (direction of Hospital of Traditional Chinese Medicine of Zhongshan) to Hubai Market, walk 707m to Lihe Plaza. (About 42 minutes, 917m on foot, 2 yuan).

Plan B: Taxi: about 26 minutes, 17 yuan.

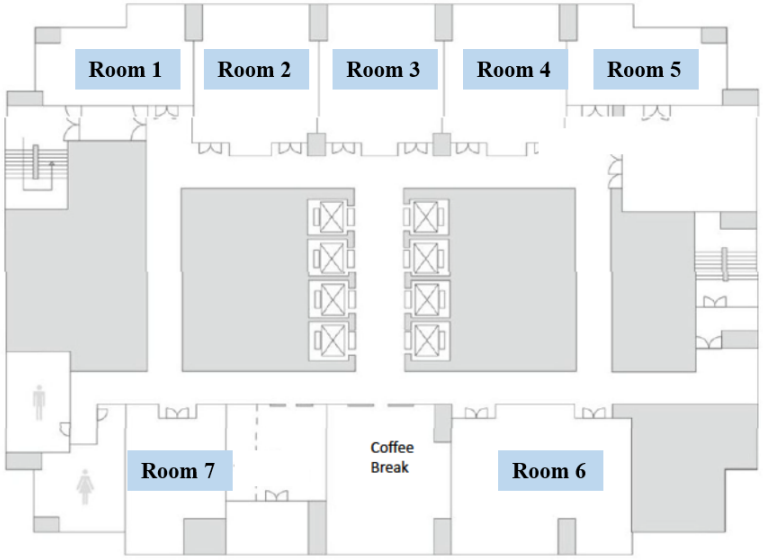
Floor Map of Conference Rooms

Conference registration will be arranged on the following days:

4 F



8 F



4F: Conference Hall

8F: Room 1 - Room 7

29 July, Hilton Zhongshan Downtown Lobby, 1F

30 July - 1 August, Hilton Zhongshan Downtown Lobby Conference Hall, 4F/8F

IEEE 3M-NANO 2024

Program at a Glance

Monday, 29 July, 13:00-18:00 Hilton Zhongshan Downtown, Lobby, 1F	
Registration	
Tuesday, 30 July, 8:00-18:20, Conference Hall, 4F	
08:00—08:20	Opening ceremony
08:20—10:20	Keynote reports (4)
10:20—10:40	Break
10:40—12:40	Keynote reports (4)
12:40—14:00	Lunch
14:00—16:00	Keynote reports (3)
16:00—16:20	Break
16:20—18:20	Keynote reports (3)
18:20—20:00	Welcome banquet
Wednesday, 31 July, 8:00-12:20, Rooms 1-7, 8F	
08:00—10:00	Parallel technical sessions
10:00—10:20	Break
10:20—12:20	Parallel technical sessions
12:20—14:00	Lunch

Wednesday, 31 July, 14:00-18:20, Rooms 1-7, 8F	
14:00—16:00	Parallel technical sessions
16:00—16:20	Break
16:20—18:20	Parallel technical sessions
18:20—20:00	Conference dinner
Thursday, 1 August, 08:00-12:20, Rooms 1-6, 8F	
08:00—10:00	Parallel technical sessions
10:00—10:20	Break
10:20—12:20	Parallel technical sessions
12:20—14:00	Lunch
Thursday, 1 August, 14:00-18:20, Conference Hall, 4F	
14:00—15:00	Editor reports (4)
15:00—16:00	Keynote reports (2)
16:00—16:20	Break
16:20—18:20	Keynote reports (3)
18:20—19:00	Closing Ceremony
19:00—21:00	Farewell banquet
Friday, 2 August	
Social Culture Activities	

Schedule of the Keynote Reports

Tuesday, 30 July, Conference Hall, 4F

Time	Topic	Speaker
Session Chair: Ulrich F. Keyser		
08:20 – 08:50	New Applications of Volume Inscription of Materials with Femtosecond Lasers	Santiago Miguel Olaizola (Spain)
08:50 – 09:20	MEMS Meta-Optics	Karl F. Bohringer (USA)
09:20 – 09:50	Nano Robot Enabled *in Situ* Sensing and Manipulation for Biomedical Applications	Ning Xi (Hong Kong SAR)
09:50 – 10:20	Gels in Biomedicine: Controlling Structure to Improve Performance	Dror Seliktar (Israel)
Session Chair: João Mano		
10:40 – 11:10	Plasma-Based Synthesis of Silver Nanoparticles Embedded in Dielectric Matrices for Control of Charge Injection and Transport Phenomena	Kremena Makasheva (France)
11:10 – 11:40	Exploring Electrohydrodynamics Based Functional Nanofibers as Multi-Dimensional Nano-Biointerfaces	Menglin Chen (Denmark)
11:40 – 12:10	Exploring Ex Vivo Challenges and Applications of Microrobots	Islam Khalil (Netherlands)
12:10 – 12:40	RNA Detection Using Nanopores: From Isoform Analysis to Disease Diagnostics	Ulrich F. Keyser (UK)

Tuesday, 30 July 2024, Conference Hall, 4F

Time	Topic	Speaker
Session Chair: Dror Seliktar		
14:00 – 14:30	Nanomechanical and Microwave Sensors with Single-Particle Resolution for Environmental and Biologic Applications	Selim Hanay (Turkey)
15:00 – 15:30	Interplay of Adhesion and Friction: Foundations and Applications in Nanomanufacturing	Iakov A. Lyashenko (Germany)
15:30 – 16:00	Functional Imagining of Nanodomains in Cardiomyocytes	Julia Gorelik (UK)
Session Chair: Tom Luo		
16:20 – 16:50	Piezoresistive MEMS Devices with Very Large Dynamic Range	Vladimir Stavrov (Bulgaria)
16:50 – 17:20	Finding Bacteria: The Bad, The Good, and The Better	MinJun Kim (USA)
17:50 – 18:20	Monolithic Fabrication and Surface Metalization of Single-Crystal Suspended Sub-Micron Si Nanowires with 3D MEMS Architectures	B. Erdem Alaca (Turkey)

Thursday, 1 August 2024, Conference Hall, 4F

Time	Topic	Speaker
Session Chair: Mingdong Dong		
14:00 – 14:15	Journal Information of RSC Applied Interfaces	Federico Rosei (Italy)
14:15 – 14:30	Journal Information of ACS Applied Materials & Interfaces	Tom Luo (Hong Kong SAR)
14:30 – 14:45	Journal Information of Advanced Engineering Materials & Wiley	Shaoying Cui (China)
14:45 – 15:00	Journal Information of Materials Today Bio	João Mano (Portugal)
15:00 – 15:30	Oxygen Sensing and Transport for Vascular Tissue Engineering	Ronald X. Xu (China)
15:30 – 16:00	Precision Optomechatronic Systems for Large-Area Scanning Probe Lithography and Laser Microprocessing	Zhen Zhang (China)
Session Chair: Julia Gorelik		
16:20 – 16:50	Magnetic Nanoparticles in the Development of Tissue Engineering Constructs Using Bottom-up and Top-down Approaches	João Mano (Portugal)
17:20 – 17:50	Direct Growth of Heterostructure Synthesized by Chemical Vapor Deposition for Highly Efficient Self-Powered Photodetector	Tom Luo (Hong Kong SAR)

17:50 –18:20	Synthesis and Applications of (sometimes exotic) 2D Materials	Federico Rosei (Italy)

Keynote Speakers

(in alphabetical order)

Monolithic Fabrication and Surface Metalization of Single-Crystal Suspended Sub-Micron Si Nanowires with 3D MEMS Architectures

B. Erdem Alaca

Professor
Department of Mechanical Engineering
Associate Vice President for R&I
Koc University
Turkey

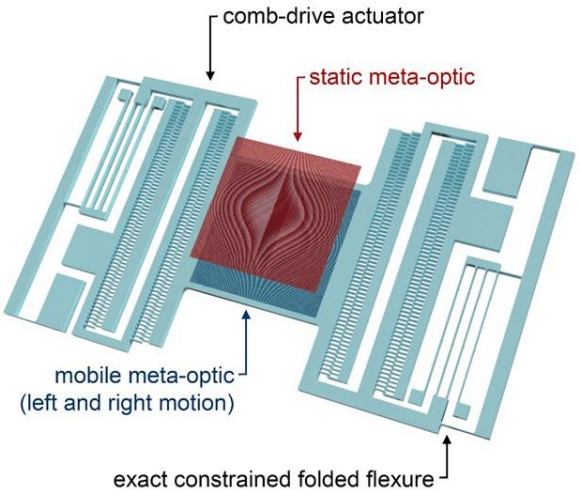
Abstract: Thanks to their superior mechanical, electrical, and optical characteristics, silicon nanowires attract much attention in applications ranging from biochemical sensors and inertial measurement devices to energy storage systems. This study introduces a new method for the scalable production and monolithic integration of sub-micron silicon nanowires with microelectromechanical systems. In-plane (width) and out-of-plane (thickness) critical dimensions of 600 nm and 300 nm, respectively, are demonstrated for sub-micron silicon nanowires with an etch depth of up to 50 μm. Finally, the use of stencil lithography is also demonstrated by selective coating of sub-micron silicon nanowires with a gold layer. Having moderately larger dimensions compared to silicon nanowires, their sub-micron counterparts proved to cut fabrication costs and relieve fabrication-related challenges, as they improve yield and repeatability while they impart added functionality to electromechanical sensors, whose further miniaturization heavily relies on such multiscale processes.

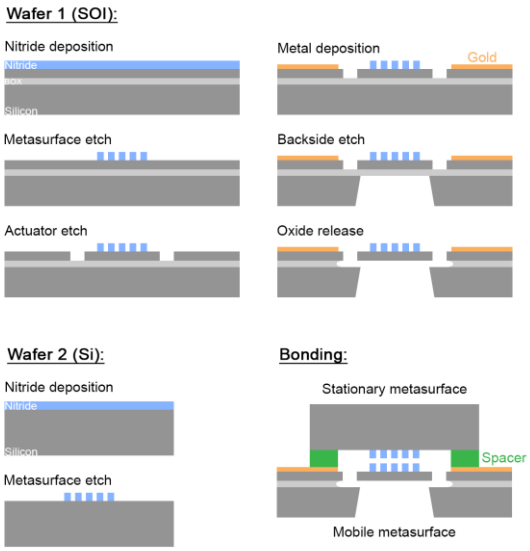
MEMS Meta-Optics

Karl F. Bohringer

Professor
Electrical & Computer Engineering and Bioengineering
Director, Institute for Nano-Engineered Systems (NanoES)
University of Washington
USA

Abstract: Miniature lenses with a tunable focus are essential components for many modern applications involving compact optical systems. While several tunable lenses have been reported with various tuning mechanisms, they often face challenges with respect to power consumption, tuning speed, fabrication cost, or production scalability. In this work, we have adapted the mechanism of an Alvarez lens – a varifocal composite lens in which lateral shifts of two optical elements with cubic phase surfaces give rise to a change in the optical power – to construct a miniature, microelectromechanical system (MEMS)-actuated metasurface Alvarez lens. Implementation based on an electrostatic MEMS generates fast and controllable actuation with low power consumption. The utilization of metasurfaces – ultrathin and subwavelength-patterned diffractive optics – as optical elements greatly reduces the device volume compared to systems using conventional freeform lenses. The entire MEMS Alvarez metalens is fully compatible with modern semiconductor fabrication technologies, granting it the potential to be mass-produced at a low unit cost. We will discuss ongoing work on imaging in the infrared and visible range, with applications ranging from machine vision to endoscopy.





Exploring Electrohydrodynamics Based Functional Nanofibers as Multi-Dimensional Nano-Biointerfaces

Menglin Chen

Professor
Department of Biological and Chemical Engineering
Aarhus University
Denmark

Abstract: The significance of the overall fibrillar and porous nanoscale topography of the extracellular matrix in promoting essential cellular processes has led to consideration of biomaterials with nanofibrous features. Of the many methods for fabricating fibers with micrometer and nanometer diameters, electrohydrodyanmics (EHD) based spinning is simplest, most straightforward and cost-effective. This approach becomes intriguingly powerful when remarkable morphological features were combined with unique chemical, physical, or mechanical functionalisation with ease and control. [1,2]

Alongside the widely studied pathways of biochemical regulation by chemokines, cytokines and growth factors, one often-overlooked but significant influence over the behavior of biological systems is electrical signaling. Voltage gradients among all somatic cells (not just excitable nerve and muscle) control cell behavior, and the ionic coupling of cells into networks via electrochemical synapses allows them to implement tissue-level patterning decisions, which is called developmental bioelectricity. Electrical modulation is therefore a potential target for many new therapies for a range of diseases and biological functions. Our current research focuses on advancing EHD technologies to explore multi-dimensional nano-biointerfaces that synergise the nanostructural induction and the bioelectrical/biochemical signalling to affect cellular behaviours, for biomedical applications in neural and cardiac stimulation and tissue engineering [3-5].

References:

[1] Y Su, Q Li, J Amagat, M Chen, “3D spring-based piezoelectric energy generator”, Nano Energy 2021, 90, 106578

[2] Y Su, T Qiu, W Song, X Han, M Sun, Z Wang, H Xie, M Dong, M Chen, “Melt electrospinning writing of magnetic microrobots” Advanced Science 2021, 8 (3), 2003177

[3] CA Müller, P Li, Y Wang, M Dong, B Tian, M Chen, “Bionic Opto-responsive Fiber for Directing Neurite Growth”, Materials Today Nano, 2023, 100311

[4] J Amagat, Y Su, FH Svejsø, A Le Friec, SM Sønderskov, M Dong, Y Fang, M Chen, “Self-snapping hydrogel-based electroactive microchannels as nerve guidance conduits”, Materials Today Bio 2022 16, 100437

[5] J Amagat, CA Müller, BN Jensen, X Xiong, Y Su, NP Christensen, A Le Friec, M Dong, Y Fang, M Chen, “Injectable 2D flexible hydrogel sheets for optoelectrical/biochemical dual stimulation of neurons”, Biomaterials Advances, 2023, 213284

Functional Imagining of Nanodomains in Cardiomyocytes

Julia Gorelik

Professor
Cellular Biophysics
National Heart and Lung Institute
Imperial College London
UK

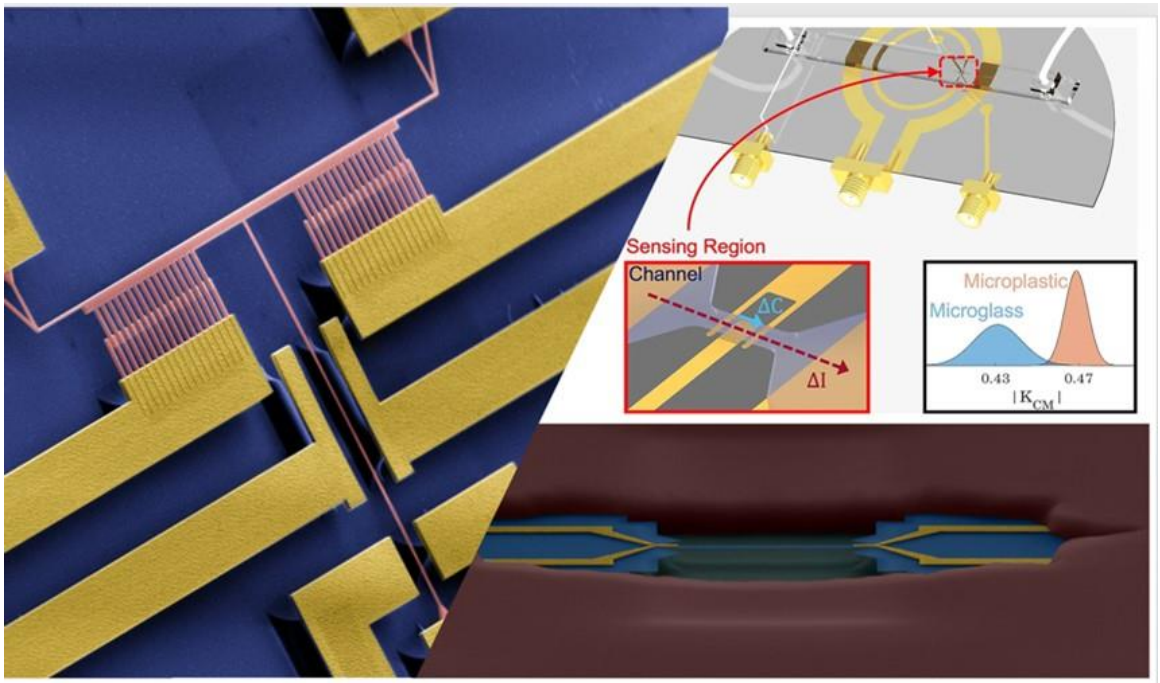
Abstract: This talk will examine new development in cell compartmentation signalling in cardiomyocyte during heart failure. Heart failure (HF) is a major contributor to the cardiovascular disease burden and impacts significantly to global health expenditure. In HF, a progressive loss of a network of deep invaginations, transverse tubules (TT), results in molecular remodelling that includes the alterations in beta adrenergic receptors (βARs), ion channels, in particular L-type calcium channels (LTCCs), Ca2+-handling proteins, and proteins mediating cell-cell coupling. This exaggerates cardiomyocyte Ca2+-handling abnormalities and leads to the development of triggers of arrhythmia (early and delayed after-depolarizations, EADs and DADs). These pathological changes could only be revealed recently thanks to the emerging new nanoscale functional imaging. Scanning ion conductance microscopy (SICM) gives topographical image of cells surface; it can be combined with other techniques to study living myocytes physiology. Scanning nanopipette serves as a precise drug delivery tool, which allows stimulation of nanodomains of signalling. Same nanopipette can be used in a patch-clamp recording of ion currents. Second messengers such as calcium and cAMP can be detected by FRET microscopy in combination with SICM. All the above techniques allowed studying remodelling of the TT and communication between various ion channels and receptors in the nanodomains of signalling. In this talk I will discuss recent findings regarding the loss of nanodomain functional integrity in HF.

Nanomechanical and Microwave Sensors with Single-Particle Resolution for Environmental and Biologic Applications

Selim Hanay

Associate Professor
Mechanical Engineering, and National Nanotechnology Research Center (UNAM)
Bilkent University
Turkey

Abstract: Identification of nanoscale objects in a high throughput manner can help us address critical challenges in environmental and biological fields, such as the quantification of micro/nanoplastic pollution, and screening for viral infection. To attain the necessary throughput and resolution, physical sensors based on resonators constitute an efficient platform. Here we will describe two sensor platforms —nanomechanical and microwave sensors— for detecting micro/nanoparticles, viruses and cells in air and liquid. Nanoelectromechanical systems (NEMS) offer an exquisite sensing platform due to their small sizes. However, these sensors had to be placed in multistage vacuum systems to transport nanoparticles and viruses onto the sensing structure via ion optics. Unfortunately, the use of vacuum systems cancels out all the benefits of NEMS technology being a chip-based, miniature platform. Recently, we have solved this issue by integrating NEMS systems with an on-chip ion lens for the efficient focusing and sensing of nanoparticles under atmospheric conditions. With this advance, bulky vacuum systems are no longer required, and the capture efficiency of the sensor is improved by several orders-of-magnitude. With this approach we obtained the mass distribution of SARS-CoV-2 virus and nanoparticles in the 20-100 nm size range within a short analysis time, operating under ambient conditions [1,2]. For liquid-based applications, we focus on microwave sensors since they can attain high sensitivity in liquid and are not limited by ion shielding effects at physiological ion concentrations, offering a means to probe the internal structure of microparticles. In addition to single-cell sizing experiments, we show dielectric-based material classification at the microparticle level by using polystyrene and soda lime glass particles as model analytes [3]. We will show the extension of capacitive detection for detecting single nanoparticles in liquid where microwave resonators are integrated by nanopore structures [4]. We will conclude by discussing future directions for integrated sensor technologies.



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RNA Detection Using Nanopores: From Isoform Analysis to Disease Diagnostics

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Abstract: Rapid identification of RNA molecules is a major challenge in biotechnology. This is driven by the discovery of RNAs that control cellular function ranging in length from a few to 1000s of nucleotides. Here we design three-dimensional nucleic acid constructs that enable the identification of short and long RNA molecules and nanopore readout.

First, we describe the identification of transcript isoforms at the single-molecule level using solid-state nanopore microscopy. We refold target RNA into RNA identifiers with designed sets of complementary DNA strands. Each reshaped molecule carries a unique sequence of structural (pseudo)colours. The sequence of structural colours of RNA identifiers enables simultaneous identification and relative quantification of multiple RNA targets without prior amplification. RNA IDs discriminate circular and linear transcript isoforms in a one-step, enzyme-free reaction in a complex human transcriptome using single-molecule read-out [1]. We will show recent results on analysing transcription termination [2] and introduce a methodology to count CTG repeats in RNA. In the second part, we use designed DNA identifier that allows the multiplexed identification of short RNA molecules. We demonstrate the power of the approach by identifying common viruses and their variants with a nanopores microscope [3]. Finally we show bacterial disease identification with single-base pair resolution with advanced RNA: DNA nanotechnology and solid-state nanopore sensing [4].

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Exploring Ex Vivo Challenges and Applications of Microrobots

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Abstract: Micro-scale mobile robots offer unparalleled potential to access small spaces in a versatile and noninvasive manner, presenting unique applications in healthcare, microfluidics, and micro-scale factories. Powered and controlled remotely using externally-applied magnetic fields, these robots can navigate in two- and three-dimensional spaces. With their small size and cost-effectiveness for bulk fabrication, the ability for self-propulsion using relatively weak magnetic fields has become a desired capability. In this keynote talk, we will delve into ongoing research addressing three key challenges facing microrobots: dynamic swimming utilizing helical and planar flagellated propulsion, wireless magnetic actuation, and translation into in vivo biomedical applications. We will begin by outlining the distinctive challenges encountered in mobile robotics at the micro-scale, followed by an exploration of the concepts and theory behind these novel locomotion methods. Subsequently, we will present the latest experimental findings regarding helical and flagellated microrobots and their utilization in manipulation and assembly at the micro-scale, including the removal of blood clots in an ex vivo setting. We will conclude with a discussion on future directions in microrobotics research, highlighting the potential for groundbreaking advancements in diverse fields.

Finding Bacteria: The Bad, The Good, and The Better

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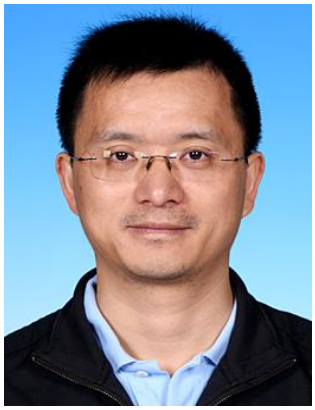
Abstract: There are over 10,000 species of bacteria that have been identified thus far, and it is estimated that there are still millions more yet to be discovered. Of the known species, around 20% are known to be 'bad' for humans; that is, they can be infectious or harmful to the environment. For example, certain spices of Escherichia coli and Salmonella are well known for their ability to infect our digestive system. On the other hand, there are many bacteria that are 'good' for humans. Take, for example, Lactobacillus bacteria which are used to ferment dairy products (e.g., cheese and kimchi), Pseudomonas that are used in bioremediation, and Bifidobacterium that live in our guts and protect against inflammation and infection. Still, while they have been exploited for their beneficial natural functions, better uses for bacteria can be found. One example of finding better uses of bacteria is the use of their organelles, specifically their flagella, for engineering applications. Flagella are helical nanotubes that bacteria rotate in order to move. These naturally occurring nanostructures have many unique properties that can be manipulated for numerous applications. Since the 1960s, it has been known that self-assembly of flagella can be manipulated in vitro, such that flagella can be 'grown' to lengths 10 times their normal length. Utilizing this knowledge, flagella have been used as sensors and actuators for nano/microrobotics. Using flagella as nanotemplates versus fabrication of purely inorganic nanotubes has a number of advantages, including lower cost, faster fabrication times, and greater environmental friendliness. Once fabricated, bacterial flagella by themselves can be used for the propulsion of abiotic swimming micro/nanorobots. Mimicking how real bacteria swim, using a low power rotating magnetic field to rotate flagellated magnetic microparticles, a possible tool for in vivo applications, such as targeted drug delivery and minimally invasive surgery, could be achieved.

Direct Growth of Heterostructure Synthesized by Chemical Vapor Deposition for Highly Efficient Self-Powered Photodetector



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Abstract: The utilization of 2D materials heterostructures, presents unparalleled possibilities for investigating their unique physical properties and serves as a foundation for the development of cutting-edge optoelectronic devices. Chemical vapor deposition (CVD) enables precise control over growth conditions, allowing for the achievement of heterostructures with clean interfaces. Recently, we have investigated various strategies to construct heterostructures with ultraclean interface using a one-pot CVD technique, eliminating the need for transfer steps. Extensive research has been undertaken across various domains to advance our understanding of CVD growth techniques for heterostructures based on transition metal dichalcogenides (TMDs) and their potential applications in photodetectors. Notably, our work demonstrated the fabrication of 1D Te and 2D TMDs van der Waals p-n heterostructures using a single-pot CVD method, showcasing self-driven behavior as a p-n diode with a strong photovoltaic effect. Furthermore, our recent work explores the manipulation of hydrogen purge to precisely control the morphology of MoO_2-$MoSe_2$ heterostructures. By employing interface design in these heterostructures to create a built-in electric field, our study demonstrated self-driven behavior, functioning as a robust photovoltaic p-n diode. The straightforward synthesis approach for achieving high-performance mixed-dimensional p-n junctions hold the potential to pave the way for the development of innovative electronic and optoelectronic devices.

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Interplay of Adhesion and Friction: Foundations and Applications in Nanomanufacturing

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Abstract: Measurements of adhesion forces both on macro and micro scales show that there exist "adhesion hysteresis" which manifests itself in different apparent specific work of adhesion in the phases of approach and detachment. In the present talk, we report both results of numerical simulation of adhesive contacts of rough surfaces using the full three-dimensional Boundary Element Method (BEM) and corresponding experimental results. The difference in apparent adhesion energies appears due to instable jumps of contact area, leading to irreversibility of the processes of both spreading and detaching adhesive contact [1,2]. These instabilities on the nano-scale lead to effective force of friction acting on the boundary of an adhesive contact. Similar effects occur during tangential relative movement of two bodies in adhesive contact. The instabilities lead to appearance of friction force even if both bodies are elastic. The reported results provide new insights into fundamental mechanisms of friction and can serve as designer rules for applications in nanomanufacturing.

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Plasma-Based Synthesis of Silver Nanoparticles Embedded in Dielectric Matrices for Control of Charge Injection and Transport Phenomena

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IEEE Nanotechnology Council
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Abstract: The current tendency in design of compact devices requires integration of different functionalities in the same scheme. A way to respond to this demand is to apply multifunctional components when assembling the device. Typically, these multifunctional components are under the form of piled very thin layers or nanostructures with specific patterns. They offer the possibility for transition from material level of development to system level of applications. For example, to provide a dielectric layer with enlarged and well-controlled electrical properties, one can use metallic nanoparticles dispersed in it.

In this general scheme our scientific approach concerns the multifunctionality of silver nanoparticles (AgNPs) embedded in silica layers to form very thin nanostructures. The attractivity of AgNPs is based on their multifunctional properties, which allows addressing a large variety of applications, as demonstrated by our team. The optical properties of AgNPs were used to elaborate highly-performant plasmonic structures aiming at a study of the conformational changes of proteins adsorbed on solid surfaces. Fine control of the AgNPs biocide properties was proved essential for fabrication of efficient and environmentally-friendly antimicrobial surfaces. The catalytic properties of AgNPs appear extremely helpful to advance our understanding and describe the role of metals in cosmic dust formation.

In particular, this contribution focuses on the electrical charge injection and transport in thin dielectric layers containing AgNPs. The response of these nanostructures under electrical stress was found to be finely controlled via the AgNPs, thus providing solutions to avoid electrostatic issues in MEMS RF switches and HVDC cables. Electron emission from dielectrics under irradiation, which is critical for space applications, also can be controlled by incorporation of AgNPs. Combination of different AgNPs functionalities offers even larger scope when envisaging device assembly and fabrication.

Magnetic Nanoparticles in the Development of Tissue Engineering Constructs Using Bottom-up and Top-down Approaches

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Abstract: Bioinspired engineered microenvironments provide cells with a holistic “instructive niche” that offers the adequate entourage for cellular control both in space and time. In bottom-up tissue engineering approaches small elements can be used as building blocks to be assembled into large constructs to produce macroscopic tissues. We have been proposing different strategies for generating such basic unit elements with well-defined combinations of cells and biomaterials. One possibility is to fabricate cell-rich membranes using magnetic force based tissue engineering. The cells internalised initially magnetic nanoparticles and are forced to accumulate into non-adherent surfaces using external magnetic fields. After maturation, cell constructs can be obtained with different geometries, sizes and stratified heterogeneous organizations. In particular, we developed thin cell micro-stamps that could be assembled into more complex structures. These magnetic cell membranes could be also magnetically stimulated to trigger some biological effects, including stem cell differentiation. We are also developing top-down tissue engineering solutions to produce hybrid scaffolds. Hollow channels in tissue engineering constructs are crucial for mimicking physiological environments and facilitating the rapid delivery of nutrients and oxygen to cells. We develop anzyme-based microparticles incorporating magnetic nanoparticles able to engrave channels by the action of an external magnetic field. This new concept could open new avenues in creating fully controlled channels, in a single, wireless, top-down and biocompatible step, in hydrogels or soft-materials, even with complex tortuosity.

New Applications of Volume Inscription of Materials with Femtosecond Lasers

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Abstract: Laser manufacturing in the (sub)micrometric range is a versatile tool used for different applications. Femtosecond lasers are now being used for different processes such as cutting, welding and surface texturing with high precision and velocity.

One of the unique characteristics of femtosecond laser beams is their capability to be focused inside transparent materials and trigger non-linear effects that produce a localized change on the optical properties of the material. This can be exploited for several applications, among which the most popular one is waveguide inscribing.

In this talk, we will discuss the fundamental aspects of volume inscription that must be taken into account to control the inscribed volume. This includes the optical aberrations and the non-linear effects associated with the high-power pulses in the femtosecond range. Finally we will discuss some applications of the technology such as optical isolation and diffraction gratings.

Synthesis and Applications of (sometimes exotic) 2D Materials

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Abstract: Following the isolation of graphene in 2004, two dimensional materials (2DM) have been widely explored, due to the ease of synthesis coupled with excellent electronic and optoelectronic properties. Still, graphene's zero bandgap and the fixed / large bandgap of inorganic 2DM limit their applicability in various technologies. We describe the synthesis and characterization of organic analogues of graphene, as well as the use of graphene and other 2DM in biomedical, environmental and energy applications.

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Gels in Biomedicine: Controlling Structure to Improve Performance

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Abstract: In the near future, hydrogels are expected to play a much greater role in biomedicine, changing the way we approach issues in stem cell research, cancer biology, drug discovery, tissue engineering and biotechnology. The development of improved methods to synthesize cell-compatible hydrogels to accommodate this trend depends on a thorough understanding of the design possibilities and the limitations. While biological systems provide an exceptional source of design inspiration for creating cell-compatible materials, man-made water-soluble polymers and polymer chemistry have contributed to the establishment of better control over the properties and reliability of the polymeric macromolecules, and subsequently, better control over the properties of the materials they form. Controlling the nano, micro and macro scale architecture of hydrogels has proven particularly effective in regulating cell response at the material-tissue interface. This presentation covers a few of the advanced design principles currently being applied to engineer cell-compatible biomedical hydrogels, with specific focus on how sophisticated new materials systems may lead the way to new discoveries in basic science, clinical medicine and biotechnology.

Piezoresistive MEMS Devices with Very Large Dynamic Range

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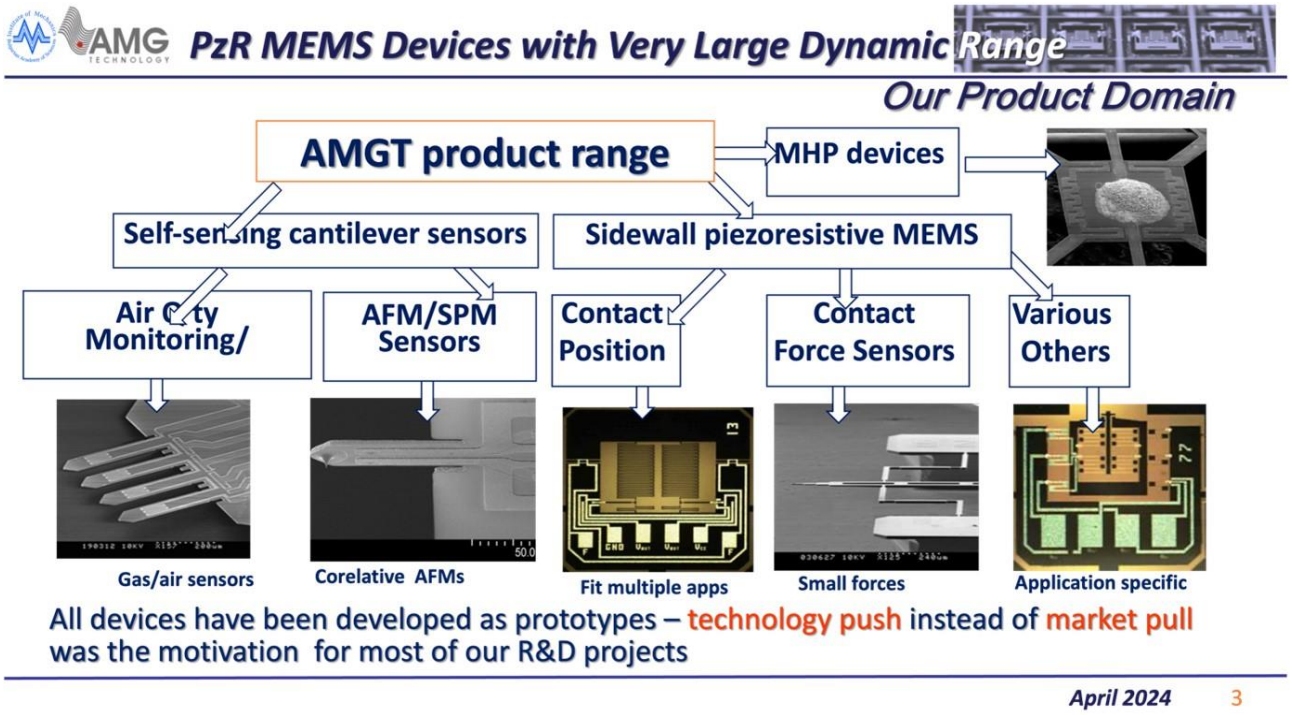
Abstract: Recent advances in development of three groups of MEMS devices comprising flexures with embedded self-sensing elements are briefly summarized. Performance results of are in-house developed devices that are fabricated by two different technologies for integration of planar and sidewall embedded piezoresistors, are presented in this paper.

First group of devices that exploit piezoresistive multi-cantilevers' sensors for air quality monitoring (AQM) are presented. Low selectivity principle of operation is applied in these devices – plurality of electrical signals is simultaneously generated by independent groups of flexures, that are uniformly exposed to a set of stimuli. Flexural elements respond differently due to the specific layout and/or due to a specific functionalization. Thus, having sufficient number of independent signals, exact value of each stimulus can be calculated. To do so, machine learning procedure to be implemented and verified for any specific application. Boosting the sensitivity and reducing the noise level of the sensor signals are challenges of next envisaged R&D projects.

Second group of devices are dedicated to real time detection of specific analytes or objects having mass of about 10fg, that is typical for COVID-19 viruses. To do so, dedicated arrays of piezoresistive cantilevers were designed and a specific detection procedure was developed. Respectively, individual cantilevers in arrays that have controlled differences in resonance frequencies are designed and prototyped. Further, laser ablation method for tuning the resonance frequency of selected flexures was developed and demonstrated. Each array comprises reference and active cantilevers, latest being coated with functionalization layer that provides selective capture of a specific fragment like S-protein or similar. Works on cantilevers' functionalization that can operate in air and/or liquids are currently running with partner organizations.

Third group of very broad range of devices exploit sidewall piezoresistors embedded into in-plane bendable flexures. Multiple displacement sensors, having stroke between 10μm and 2mm have been prototyped and characterized with different techniques. Providing as high as 275mV sensor signal @ 1V power supply, record high dynamic range of >5,000,000e scale intervals was demonstrated, during calibration of such sensors with

Finaly, a success story of exploitation of piezoresistive cantilever and position sensors in an advanced corelative microscope Fusionscope®, is also reported.



Nano Robot Enabled *in Situ* Sensing and Manipulation for Biomedical Applications

Ning Xi

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Abstract: As we enter into the post-genomic era, increasing attention has been focused to characterization of the structure and function of molecules. Understanding the location, structure, and dynamics of these molecules is of fundamental importance to elucidate their function. To gain insights into how these molecules operate, advanced technologies are required for gaining information at the level of cells and molecules. Nano robot technology has been developed to meet such challenges. The unique capability of the nano robot to directly observe and manipulate molecules in their native environments has provided insights into the interaction of proteins that form functionality assemblies. While recognition of individual protein such as specific cell membrane receptor is still a challenge, the technique to use nano robots to recognize and manipulate specific molecules such as antibodies establishes a promising way to identify proteins in a specific manner. This talk will present state-of-the-art techniques enabling in situ sensing and manipulation at cellular and molecular levels using nano robots. Examples of applications such as identification of biomarkers for drug discovery and therapeutic delivery will be discussed.

Oxygen Sensing and Transport for Vascular Tissue Engineering

Ronald X. Xu

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Abstract: Oxygen is a key substance in the metabolic mechanism of organisms and an important material basis for maintaining life activities. Imbalanced oxygen supply and consumption plays a pivot role in many acute and chronic diseases such as stroke, diabetic wounds, and tumors. Maintaining an exquisite balance between Precise detection, accurate delivery and dynamic regulation of oxygen transport remain a major challenge in bioprinting of vascularized large tissues and organs. Over the past few years, we have developed and validated several oximetry techniques and artificial intelligence algorithms for non-invasive assessment of oxygenation and perfusion. We have also developed and tested several micro/nano-encapsulation processes for controlled delivery and stimuli-responsive release of oxygen. We are currently applying these imaging and microfabrication techniques to construct perfusable and regenerative vascular networks in preparation for bioprinting of large tissues and organs.

Precision Optomechatronic Systems for Large-Area Scanning Probe Lithography and Laser Microprocessing

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Abstract: Precision optomechatronic systems play crucial role in various emerging applications such as laser precision manufacturing and scientific instrument. This talk will present our recent work of control of precision optomechatronic systems and its applications in large-area tip-based nanolithography, characterization and laser microprocessing We will show how to design and control precision optomechantornic system to enable large area, high throughput scanning probe lithography and laser microprocessing without stitching.

Editors' Session

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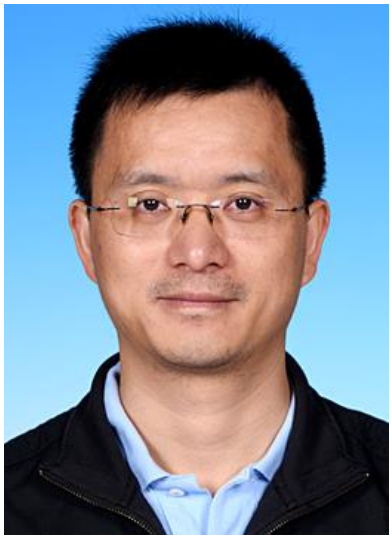
Advanced Science
Advanced Engineering Materials
In-House Editor at Wiley



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Technical Program

(ss: Technical Special Session)

Wednesday, 31 July 8:00-10:00

No.	Room	Session
01	Room 1	Micro/Nano Structural Interface and the Applications (workshop)
02	Room 2	Manufacturing on the Atomic Level Nanoscale (ss)
03	Room 3	Cross-Scale Micro and Nano Manufacturing (workshop)
04	Room 4	Nanoscale Neuromorphic Devices (ss)
05	Room 5	Biological Detection and Medical Imaging (workshop)
06	Room 6	Compliant Micro/Nano System and Precision Equipment Applications (workshop)

Wednesday, 31 July 10:20-12:20

No.	Room	Session
07	Room 1	Micro/Nano Structural Interface and the Applications (workshop)
08	Room 2	Manufacturing on the Atomic Level Nanoscale (ss)
09	Room 3	Cross-Scale Micro and Nano Manufacturing (workshop)
10	Room 4	Nanoscale Neuromorphic Devices (ss)
11	Room 5	Biological Detection and Medical Imaging (workshop)

12	Room 6	Compliant Micro/Nano System and Precision Equipment Applications (workshop)

Wednesday, 31 July, 14:00-16:00

No.	Room	Session
13	Room 1	ENSIGN-BG (ss)
14	Room 2	Manufacturing on the Atomic Level Nanoscale (ss)
15	Room 3	Micro-Nano Additve/Subtractive Manufacturing (ss)
16	Room 4	L4DNANO and LESIA - Joint Research Platforms in Laser Engineering of Surfaces, Interfaces, and Nanomaterials (ss)
17	Room 5	Mechanical Properties and Functions of Graphene Materials (ss)
18	Room 6	Multifunction Nanomaterials for Nanoengineering Processes (ss)
19	Room 7	Ultrafast Nanophotonics/Advanced Lithography (ss)

Wednesday, 31 July, 16:20-18:20

No.	Room	Session
20	Room 1	Nanomanufacturing and Nanoautomation
21	Room 2	Micro-Nano Additve/Subtractive Manufacturing (ss)
22	Room 3	L4DNANO and LESIA - Joint Research Platforms in Laser Engineering of Surfaces, Interfaces, and Nanomaterials (ss)
23	Room 4	Laser-Matter Interactions in Nanophotonics for Optical Metrology Application (ss)
24	Room 5	Nano-Manipulation and Nano-Measurements for Biomedical/Chemical and Chemical (ss)

Thursday, 1 August, 08:00-10:00

No.	Room	Session
25	Room 1	Nanophotonics and Plasmonics (ss)
26	Room 2	Applications of Nanotechnology (ss)
27	Room 3	Nanomaterials and Nanoassembly
28	Room 4	Nanomechanics and Nanomechatronics
29	Room 5	Design, Analysis and Control of Nano-Manipulating Systems (ss)
30	Room 6	Detection of Cell and Cell Antigen (ss)

Thursday, 1 August, 10:20-12:20

No.	Room	Session
31	Room 1	Med-X (workshop)
32	Room 2	Nanomaterials and Nanoassembly
33	Room 3	Nanomechanics and Nanomechatronics
34	Room 4	Nanopositioning and Nanomanipulation
35	Room 5	Preparation of Nanoparticles and Applications

Technical Special Session 01
Micro/Nano Structural Interface and the Applications (workshop)

Room 1

08:00-10:00 Wednesday, 31 July

Chair: Mingdong Dong

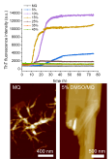
Co-Chair: Lei Liu

01-1 08:00–08:17

Solvent Effect Controls A-Helix PSMα3 Peptide Aggregation and Crystallization

Qian Liu
Department of Biomedicine & iNANO center, Aarhus University, Denmark

- DMSO solvent plays an induction effect on PSMα3 crystallization.
- The formation of PSMα3 crystals adopts layer-by-layer stacking at nanoscale.
- Recrystallization is realized by the addition of DMSO and water alternatively.



Phenol-soluble modulin α3 aggregation and crystallization without and with DMSO, respectively.

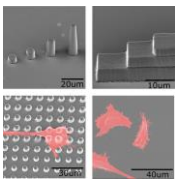
Notes

01-2 08:17–08:34

Maskless Photolithography Fabrication of 3D Microstructures for Improved Cell Interface

Lasse Hyldgaard Klausen[1,*], Mingdong Dong[1]
[1]Interdisciplinary Nanoscience Center (iNANO), Aarhus University, Denmark

- Maskless gray-scale photolithography is used to fabricate concave and convex micropillars at diffraction-limited sizes
- Multi-layer fabrication is used to fabricate complex 3D microstructures compatible with high-resolution optical imaging
- Complex micro-topographies are explored for cell adhesion and alignment



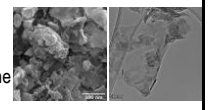
Notes

01-3 08:34–08:51

Light-Driven CO_2 Conversion on a Layered Double Hydroxide Supported by Graphitic Carbon Nitride

Ronghui Lu[1,*], Nina Lock[1,2]
[1]Interdisciplinary Nanoscience Center (iNANO), Aarhus University, Denmark
[2]Department of Biological and Chemical Engineering, Aarhus University, Denmark
*Presenting author, contact: lrh@inano.au.dk

- Facile synthesis of heterostructures composed of layered double hydroxides and carbon nitride, designed as efficient photocatalysts.
- Comprehensive characterizations, including multi-technique analyses, were conducted to elucidate the properties of the synthesized materials.
- Photocatalytic performance was evaluated through CO_2 conversion tests, demonstrating promising results.



SEM and TEM of heterostructure LDH/CN

Notes

Technical Special Session 01
Micro/Nano Structural Interface and the Applications (workshop)
Room 1
08:00-10:00 Wednesday, 31 July
Chair: Mingdong Dong
Co-Chair: Lei Liu

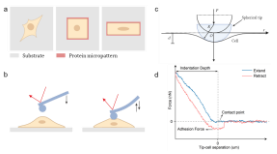
01-4 08:51–09:08

Probing Mechanics of Micropatterned Cells by Atomic Force Microscopy

Xinyue Mi
St. Mark's School, MA, United States

The mechanical impact of extracellular force on cells is assessed with the following techniques:

- Light-induced ECM Micropatterning
- Nanoindentation Measurement using Atomic Force Microscopy
- Comparison of Cell Elasticity and Adhesion Values on Micropatterns with Different Aspect Ratios



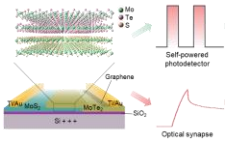
Notes

01-5 09:08–09:25

Gate Voltage Tunable 2D Optoelectronic Devices for Low-Consumption Photodetector and Photonic Synapse

Yi Ouyang[1,2,*], Mingdong Dong[1]
[1]Interdisciplinary Nanoscience Center (iNANO), Aarhus University, Denmark
[2]Department of Biological and Chemical Engineering, Aarhus University, Denmark
*Presenting author, contact: au716078@uni.au.dk

- Simultaneous achievement of photodetector and optical synapse modes on a single device through gate voltage regulation
- The self-powered photodetector mode shows a broadband photodetection and fast photoresponse.
- The optical synapse mode exhibits excellent light signal sensing, memory and high accuracy in image recognition.



Notes

01-6 09:25–09:42

Heterogeneous Photocatalysts for Scalable and Selective Deuteration of *N*-Heteroarenes

Yitao Dai
Suzhou Insititute for Adavnced Research, University of Science and Technology of China, China

- First case of heterogeneous photocatalytic H/D exchange reactions of *N*-heteroarenes
- Single-atom Pd as the active sites for selective deuteration under visible light / inert atmosphere / r.t.
- Kilogram deuterated products and more than 20 various deuterated *N*-heteroarenes can be synthesized

Notes

Technical Special Session 01
Micro/Nano Structural Interface and the Applications (workshop)

Room 1

08:00-10:00 Wednesday, 31 July

Chair: Mingdong Dong

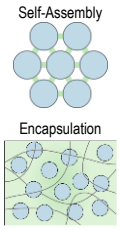
Co-Chair: Lei Liu

01-7 09:42–10:00

Artificial Construction of Multicellular Bacterial Systems

Shuai Hou
School of Materials Science and Engineering, Jiangsu University

- Bacteria are single-cell organisms but often form multicellular systems such as aggregates and biofilms.
- These multicellular systems can be artificially constructed using principles of chemistry and materials science.
- Bacterial assemblies are obtained through bacterial surface modification and subsequent self-assembly. They exhibit typical properties of a multicellular system.
- Artificial biofilms are created by encapsulating bacteria in polyelectrolyte complexes. Applications in recyclable catalysis and probiotic delivery have been demonstrated.



Notes

Technical Special Session 02
Manufacturing on the Atomic Level Nanoscale (ss)

Room 2

08:00-10:00 Wednesday, 31 July

Chair: Lu Cao

Co-Chair: Haochen Sun

02-1 08:00–08:17

Macro-Production of Atomic Level Nanomaterials

Lu Cao
Creatom, Shenzhen, China

- Creatom's Tech: our state-of-the-art cluster ion beam facility produces tons of atomic level nanomaterials every year
- Atomic level nanomaterials: for scientific research, chemical, energy, semiconductor, and biomedical industries
- Elements: >65 elements, compatible with alloys and compounds
- Size Range: Adjustable size range from 1 to 100 nm

Atomic level nanomaterials

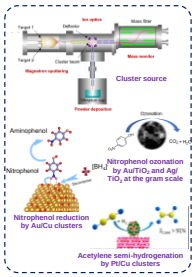
Notes

02-2 08:17–08:34

Physically Deposited Metal Clusters for Heterogeneous Catalysis

Rongsheng Cai
State Key Laboratory of Solid Lubrication, Lanzhou Institute of Chemical Physics, Chinese Academy of Sciences, China

- Depositing preformed clusters onto supports represents a new paradigm for the preparation of heterogeneous catalysts
- Bimetallic clusters with optimized composition were deposited onto catalyst supports for gas/liquid phase model reactions
- The performance of the new nanoalloy materials was validated in gas/liquid phase reactions
- Our studies provide an insight into nanocatalyst design of bimetallic systems at the atomic scale



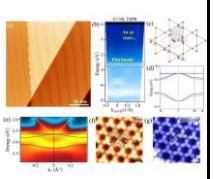
Notes

02-3 08:34–08:51

Growth of Mesoscale Ordered Two-Dimensional Hydrogen-Bond Organic Framework with the Observation of Flat Band

Jianzhi Gao
School of Physics and Information Technology, Shaanxi Normal University, China

- Surface growth of flat band materials with mesoscale, highly ordered THPB HOF on Au(111) substrate
- The observed topological flat bands arise from a electronic breathing-kagome lattice without atomically breathing bonds
- Self-assembly of HOFs provides a viable approach for synthesis of 2D organic topological materials



Notes

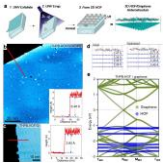
Technical Special Session 02
Manufacturing on the Atomic Level Nanoscale (ss)
Room 2
08:00-10:00 Wednesday, 31 July
Chair: Lu Cao
Co-Chair: Haochen Sun

02-4 08:51–09:08

Synthesis of Large-Scale 2D Organic Framework/Graphene Heterostructure with Observing Dirac and Flat Bands

Xin Zhang
School of Physics and Information Technology,
Shaanxi Normal University, China

- A well-ordered self-assembled hydrogen-bond organic framework of THPB is grown on the HOPG substrate
- A bottom-up procedure to fabricate 2D large-scale floating HOF/graphene heterostructure with clean interface
- Our results demonstrate a approach to fabricate 2D organic-inorganic heterostructure via the self-lifting effect



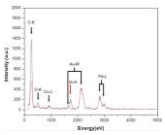
Notes

02-5 09:08–09:25

Hydrocarbon and Silicon Contamination in Electron Microscopes

Dongsheng He
Core Research Facilities, SUSTech, China

- Recent advances in understanding the contamination in charged particle - related instruments
- Method to remove carbon- and silicon- containing contaiminants simultaneously
- Advantages of contaimiantion-free specimen in electron-microscope-based characterization and lithography



EDS spectra for cross-grating specimen before (black) and after (red) contamination removal (Ultramicroscopy, 253, 2023, 113797)

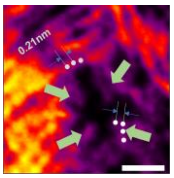
Notes

02-6 09:25–09:42

Atomic Structure of Nanostructured Carbon Film by Aberration Corrected TEM

Nan Jian
Electron Microscope Center, Shenzhen University, China

- Nanostructured carbon film were deposited by electron cyclotron resonance (ECR) sputtering system with low energy electron irradiation
- A combination of aberration corrected TEM techniques including BF-TEM, ADF-STEM and iDPC-STEM was introduced to study the atomic structure of ECR nanostructured carbon film
- New structure of our carbon film, including nanotunnels and triple junctions were found and believed to be the source of its magnetic property



iDPC-STEM image of nanotunnel in the nanostructured carbon film, scale bar is 1nm.

Notes

Technical Special Session 02
Manufacturing on the Atomic Level Nanoscale (ss)
Room 2
08:00-10:00 Wednesday, 31 July
Chair: Lu Cao
Co-Chair: Haochen Sun

02-7 09:42–10:00

Application of Microscopic Spectroscopy-Optoelectronic Imaging Technology in Characterization of Micro and Nano Devices

Changcheng Ju
CEO , Nanjing Metatest Co., Ltd., China

- Integrate diverse spectral imaging techniques and photoelectronic testing functions with modular design of optical path
- Test the correlation between chemical structure and photocurrent conversion of micro-nano materials
- Achieve high-resolution imaging, so as to obtain more comprehensive and diverse analysis results
- Reserved for extended polarization characteristics, high and low temperature conversion, wavelength conversion, pressure conversion, etc.

迈塔光电 MetaTest

Notes

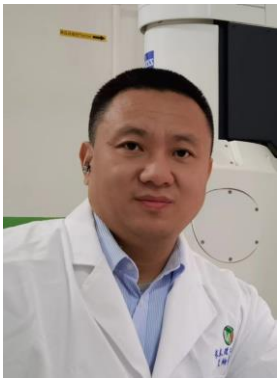
Technical Special Session 03
Cross-Scale Micro and Nano Manufacturing (workshop)

Room 3

08:00-10:00 Wednesday, 31 July

Chair: Jinkai Xu

Co-Chair: Guangjun Chen

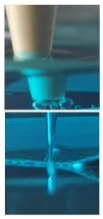


03-1 08:00–08:20

Employing Optimized Anode to Improve Bubble Accumulation in Localized Electrochemical Deposition

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

- Optimization of the anode can significantly improve the effect of bubbles.
- The small bubbles produced at the bottom of the anode escape quickly in the form of bubble flow, and promote the liquid phase mass transfer process.
- An optimized anode is used, which can improve the quality of deposited microstructures and create better surface morphology.



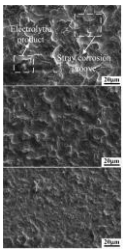
Notes

03-2 08:20–08:40

Surface Integrity Analysis of Electrochemical Machining of TC4 Titanium Alloy and 304 Stainless Steel

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

- The current stabilization time of the two materials decreases with the increase of the processing voltage.
- The dissolution forms of the two materials are different under different processing voltages.
- With the increase of voltage, the surface roughness values of both materials decrease gradually.



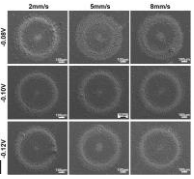
Notes

03-3 08:40–09:00

Experimental Investigation on the Fabrication of Microscale Metal Patterns via Femtosecond Laser-Induced Electrodeposition

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

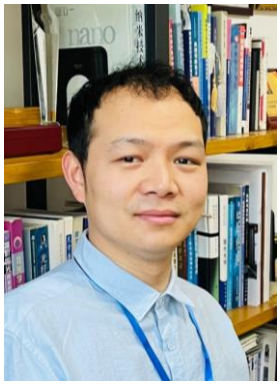
- The optimal selection of liquid layer thickness was investigated in the femtosecond laser-induced electrodeposition process.
- The influence of applied voltage and laser scanning speed on the dimensions of the deposited layer was investigated.
- This provides a reference for the selection of applied voltage and scanning rate in subsequent studies.



SEM images of deposited copper layers using different applied voltages and different laser scanning rate.

Notes

Technical Special Session 03
Cross-Scale Micro and Nano Manufacturing (workshop)
Room 3
08:00-10:00 Wednesday, 31 July
Chair: Jinkai Xu
Co-Chair: Guangjun Chen

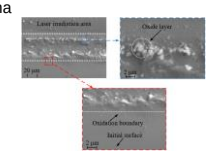


03-4 09:00–09:20

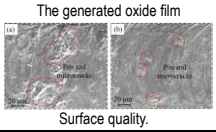
Surface Quality Analysis of Laser-Induced Assisted Grinding of Single-Crystal Silicon

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

- Conducted a laser-induced experiment on single-crystal silicon, resulting in the formation of a more loosely structured oxide film on its surface.
- The comparative experimental results between CG and L-IAG demonstrate that L-IAG can effectively improve the surface machining quality of monocrystalline silicon.



The generated oxide film



Surface quality.

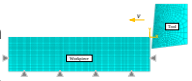
Notes

03-5 09:20–09:40

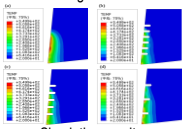
Finite Element Analysis on Cutting AISI 1045 with Micro-Textured Tools Based on ABAQUS

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

- Finite element analysis on cutting AISI 1045 with micro-textured tools
- Micro-textured tools can increase the shear angle，effectively reduce cutting forces and cutting temperatures.
- Among the textured tools with spacing of 80, 100, and 200 μm, the tool with 80 μm spacing demonstrated superior cutting performance



Cutting Models



Simulation results

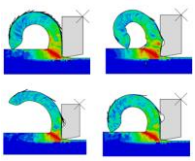
Notes

03-6 09:40–10:00

Simulation Study on Cutting Titanium Alloy with Micro-Textured Tools

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

- The simulation model of orthogonal cutting is established
- The influence of surface micro-texture on cutting performance of cutting tools was investigated
- The cutting force is reduced by 10.4% and the shear angle is increased by 5.39%



Chip morphology

Notes

Technical Special Session 04
Nanoscale Neuromorphic Devices (ss)

Room 4

08:00-10:00 Wednesday, 31 July

Chair: Ye Zhou

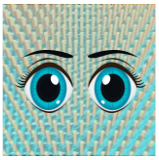
Co-Chairs: Suting Han

04-1 08:00–08:20

Smart Vision with Nanowire Arrays

Leilei Gu
School of Electronic Information and Electrical Engineering,
Shanghai Jiao Tong University, China

- Artificial vision is data redundant, energy and computation power hungry
- Natural eyes, polished and precipitated by time, outperforms artificial visual systems in many aspects
- Learning from nature can be a shortcut to improve our visual sensors
- Combined efforts from interdisciplinary are essential for advanced smart visual systems



Nanowires Arrays can mimic artificial eyes well

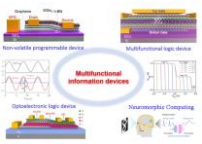
Notes

04-2 08:20–08:40

Multifunctional Devices Based on Ambipolar Two-Dimensional Semiconductors

Dong Li
School of Materials Science and Engineering, Hunan University, Changsha

- Based on ambipolar two-dimensional semiconductor materials, new type field-effect transistors are designed through device structure design
- The coexistence of transistor and memory modes is realized in single device.
- Various applications including reconfigurable transistors, reconfigurable memories, reconfigurable logic circuits, and neuromorphic computing are developed



Multifunctional devices and their applications in electronics and optoelectronics

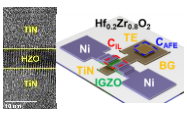
Notes

04-3 08:40–09:00

HfO_2-Based Ferroelectric Material and Devices for Non-Volatile Memory and In-Memory Computing

Xiuyan Li
Department of Nano/Micro Electronics, Shanghai Jiao Tong University, China

- Thermodynamics and kinetics of ferroelectric phase formation in of HfO_2-based material
- Material science for endurance controlling in HfO_2-based ferroelectric material
- Performance engineering of HfO_2-based FeFET
- HfO_2-based ferroelectric memcapacitor and reservoir computing system



HfO_2-based ferroelectric material and devices.

Notes

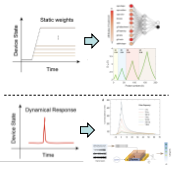
Technical Special Session 04
Nanoscale Neuromorphic Devices (ss)
Room 4
08:00-10:00 Wednesday, 31 July
Chair: Ye Zhou
Co-Chairs: Suting Han

04-4 09:00–09:20

ECRAM for Neuromorphic Computing

Peng Lin
College of Computer Science and Technology,
Zhejiang University, China

- ECRAM is a new member of emerging neuromorphic devices
- The behaviors of ECRAM devices can be modulated between volatile switching and non-volatile switching
- Static ECRAM device with linear and symmetric conductance update can be used for learning tasks
- Dynamical ECRAM devices have shown quantitative responses to spikes at different frequencies, and can be used for classification of sounds



Tuning ECRAM devices for different neuromorphic applications

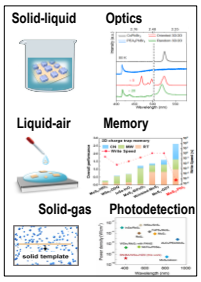
Notes

04-5 09:20–09:40

Two-Dimensional Halide Optoelectronic Materials

Lin Wang
School of Flexible Electronics (Future Technologies)
Nanjing Tech University, China

- Synthesis of 2D ultrathin metal halides through liquid-air, solid-gas, and solid-liquid interfacial growth methods
- Optoelectronics of 2D halide heterostructures with excellent CPL, memory and photo-detectivity properties
- Simple, ultra-rapid and low-temperature fabrication of 2D halide semiconductors
- Devices of 2D halides towards future sensor-memory-computing applications



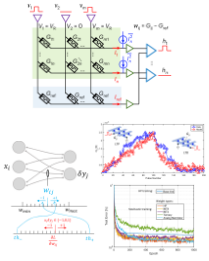
Notes

04-6 09:40–10:00

Learning-in-Memory with Low-Footprint Neuron Circuits and Non-Ideal Artificial Synapses

Wei Wang
Peng Cheng Laboratory, Shenzhen, China

- Need to transfer from compute-in-memory to learning-in-memory for deep neural networks
- In deep belief network, we propose binary stochasticity and gradient accumulations
- We also propose the stochastic binarization of the derivative of activation functions and signed binarization of the backpropagating errors
- Complexities of peripheral/neuronal circuits are greatly reduced and non-idealities of memristive synapses are no longer major issues



Notes

Technical Special Session 05
Biological Detection and Medical Imaging
(workshop)
Room 5
08:00-10:00 Wednesday, 31 July
Chair: Yuanhua Yu
Co-Chair: Yujuan Chen

05-1 08:00–08:12

Real-Time Fluorescent Quantitative PCR for Detection of Peripheral Blood T-Cell Lymphoma

Ren Xu[1],Yibing Jia[2], Xue Sun[2], Hao Zhang[2]*,Yuanhua Yu[2]*
[1]School of Physis, Changchun University of Science and Technology, China
[2]School of Life Science and Technology, Changchun University of Science and Technology, China

- A detection method for RHOA G17V and IDH2 R172 mutations of PTCL cells based on qPCR was established.
- The limit of detection (LOD) was1%.
- The accuracy RSD were less than 2.5%, and the repeatability RSD were less than 2%

qPCR method for detecting the Peripheral Blood T-cell Lymphoma
(Note: Figure 1a is the RHOA mutant and wild type plasmid standard detection graph, Figure 1b is the IDH2 mutant and wild type plasmid standard detection graph)

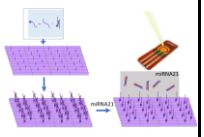
Notes

05-2 08:12–08:24

Study on the Detection of Pancreatic Cancer Tumor Markers Based on Planar DNA Nanostructure Biosensors

Xiuyan Jin
School of Physics, Changchun University of Science and Technology, China

- An electrochemical sensor for the detection of pancreatic cancer Mi-RNA was successfully developed.
- DNA nanostructures improve the sensitivity and addressability of the sensor.
- The linear detection range of 1fM-1uM is realized.
- The sensor shows great potential in the subsequent development of multi-channel sensors.



Design of recognition elements based on DNA nanostructures

Notes

05-3 08:24–08:36

Development of Dual Fluorescence qPCR for the Detection of *Pseudomonas Aeruginosa*

Han Zhang
School of Life Science and Technology
Changchun University of Science and Technology
Changchun, China

- Establish a real-time fluorescence quantitative PCR method for the detection of PA
- DNA sequences of Pseudomonas aeruginosa ETA and OPRL were selected as templates
- pUC57-ETA: Y=-3.297X+44.017(R2=0.999); pUC57-OPRL:Y=-3.476X+45.533(R2=0.999)
- Detection sensitivity up to 10^2copies/mL

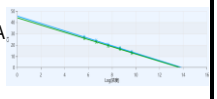


Fig1.Double fluorescence standard curve.

Notes

Technical Special Session 05
Biological Detection and Medical Imaging (workshop)

Room 5

08:00-10:00 Wednesday, 31 July

Chair: Yuanhua Yu

Co-Chair: Yujuan Chen

05-4 08:36–08:48

Development of a Duplex qPCR Assay for the Rapid Detection of Mycobacterium Tuberculosis

Meijiao Li
School of Life Science and Technology,Changchun University of Science and Technology,Changchun,China

- Construction of a duplex qPCR system for the detection of Mycobacterium tuberculosis.
- The target genes used were IS6110 and gyrB.
- The constructed duplex qPCR system for Mycobacterium tuberculosis has good sensitivity, specificity and reproducibility.
- This study is important for the rapid and accurate detection of Mycobacterium tuberculosis.

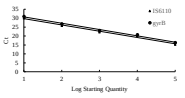


Fig. 1.Duplex qPCR standard curve

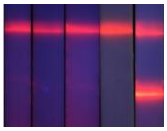
Notes

05-5 08:48–09:00

A Novel Fluorescence Assay for the Rapid Detection of 2019-nCoV

Hongying Wang
School of Life Science and Technology,Changchun University of Science and Technology,Changchun

- Simultaneous detection of N-protein recombinant antigen, Delta inactivated virus solution and Gamma inactivated virus solution
- Higher sensitivity than the traditional colloidal gold immunoside chromatography
- Good stability, reproducibility and specificity
- Provides faster, more sensitive, and more convenient assays



Specificity test

Notes

05-6 09:00–09:12

Microarray Fluorescence Image Processing and Analysis

Chao Niu
School of Life Science and Technology, Changchun University of Science and Technology, China

- The Gaussian filter deals with the noise in the image separately
- Histogram equalization improves image contrast
- The Hough transform's circular detection is precisely positioned and corrected from the graph
- The image is segmented by fuzzy C-means clustering (FCM) method

Notes

Technical Special Session 05
Biological Detection and Medical Imaging (workshop)

Room 5

08:00-10:00 Wednesday, 31 July

Chair: Yuanhua Yu

Co-Chair: Yujuan Chen

05-7 09:12–09:24

Methodological Establishment of ACR Chromatographic Assay in Urine

Jiatong Qin

School of Life Science and Technology, Changchun University of Science and Technology, China

- Urinary ACR is an important indicator of renal function.
- Urine dry chemistry analyzer detects two conventional indicators of microalbumin and creatinine in human urine.
- The optimization of the two conventional indicators can make the test results more accurate.
- Through comparative testing the dry chemical urine analyzer is easy to operate and low cost.

Notes

05-8 09:24–09:36

Study on the Detection Method of Rheumatoid Factor Based on Nano-Microspheres

Yunxuan Guo

School of Life Science and Technology

Changchun University of Science and Technology

Changchun，China

- Establishment of a system designed for the detection of RF by PETIA
- Large- and small-size microspheres were coupled with antigen and mixed separately
- Screening experimental conditions (antigen source, microsphere particle size, microsphere mixing ratio, etc.)
- Linear range at 0-390 mg/L, linear equation y= 0.0017x + 0.0094, R2 = 0.9982 > 0.99

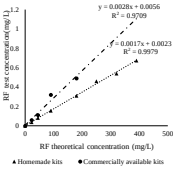


Fig.1.RF Comparison of the linear range of homemade kits and commercially available kits

Notes

05-9 09:36–09:48

Study on the Detection Method of Lipoprotein Phospholipase A2 Based on Nanomicrospheres

Kaili Chen

School of Life Science and Technology, Changchun University of Science and Technology, China

- This study is based on the PETIA principle to detect Lp-PLA2 in serum.
- Determine the optimal reaction conditions for PETIA, including antibody manufacturer, microsphere size and coupling conditions.
- Evaluate the performance of the reagents, including recovery rate, precision, and linear range.
- The optimized detection system can meet the needs of clinical use.

Notes

Technical Special Session 05
Biological Detection and Medical Imaging (workshop)
Room 5
08:00-10:00 Wednesday, 31 July
Chair: Yuanhua Yu
Co-Chair: Yujuan Chen

05-10 09:48–10:00

Research on Glycated Hemoglobin Detection Method Based on Nanotechnology

Ling Liu, Yuanhua Yu, Qingyuan Huang, Ren Xu
School of Life Science and Technology, Changchun University of Science and Technology, China

- This study is based on the principle of latex immunoassay to detect HbA1c in blood cells.
- The optimal reaction conditions, including antibodies, microspheres, and reaction systems, are determined.
- Methodological comparisons are made with HPLC and immunochromatography.
- The performance indicators can meet the needs of clinical use.

Notes

Technical Special Session 06
Compliant Micro/Nano System and Precision Equipment Applications (workshop)

Room 6

08:00-10:00 Wednesday, 31 July

Chair: Hui Tang

Co-Chair: Xin Chen

06-1 08:00–08:20

Optimization Design and Performance Research on Two-Stage Reduction Micro-Drive Mechanism Based on Particle Swarm Algorithm

Manzhi Yang
College of Mechanical Engineering, Xi'an University of Science and Technology, China

- To obtain smaller displacement and higher accuracy, a two-stage reduction micro-drive mechanism is designed .
- Particle-swarm-algorithm is used to optimize the mechanism to obtain the maximum deceleration ratio.
- Finite element analysis were employed to analyze its dynamic and kinematic properties.
- The results demonstrated that it met the design requirements and the achieved reduction-ratio was 24.73:1.
- This paper is significance for the study of precision mechanical motion and micro-drive mechanisms.

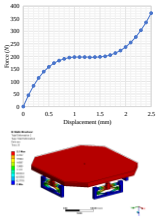
Notes

06-2 08:20–08:40

Design and Analyses of a Heavy-Load and Large-Stroke Micro-Positioning Tip-Tilt Stage with Flexure Levitation

Huaxian Wei*, Zhaoyin Cai, Junqiang Chen, Xinjie Pan, Tinting Liang
Key Laboratory of Intelligent Manufacturing (Shantou University) Ministry of Education, Shantou, China

- A large-stroke, heavy-load tip-tilt stage is designed for microLED laser-based massive transferloads
- Loading capability up to 20 kg and motion range up to millimeter-scale
- A compliant constant-force mechanism is utilized to realize flexure levitation
- Parameter analysis of the compliant constant-force mechanism are carried out



Levitation performances of the compliant tip-tilt stage

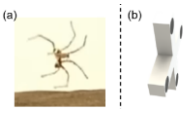
Notes

06-3 08:40–09:00

Design of a Bio-Inspired Magnetic Soft Microrobot for Medical Applications

Ruomeng Xu and Qingsong Xu
Department of Electromechanical Engineering,
Faculty of Science and Technology,
University of Macau, China

- A magnetic soft microrobot is designed, inspired by the golden wheel spider's rolling motion.
- It demonstrates excellent mobility in irregular anatomical cavities with vertical distances up to 8 cm.
- It shows significant potential for targeted drug delivery and precision medicine.



Magnetic soft microrobot inspired by golden wheel spider

Notes

Technical Special Session 06
Compliant Micro/Nano System and Precision Equipment Applications (workshop)

Room 6

08:00-10:00 Wednesday, 31 July

Chair: Hui Tang

Co-Chair: Xin Chen

06-4 09:00–09:20

Design and Optimization of a Sub-Arc-Second Micro-Drive Rotary Mechanism Based on Swarm Optimization

Manzhi Yang
College of Mechanical Engineering, Xi'an University of Science and Technology,

- Aiming at the disadvantages of small movement stroke, low positioning, a micro-drive rotary- mechanism was designed.
- The structure optimization was completed in order to obtain the maximum output angle.
- The related performance of the optimized mechanism was also investigated.
- Compared with pre-optimization, the optimized mechanism has an increase of 57.5%, and the finite element analysis error is 8.27%.
- This study is a reference for the study of ultra-precise positioning.

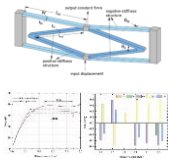
Notes

06-5 09:20–09:40

Optimization Design of a Kind of Compliant Constant Force Mechanism

Shuaishuai Lu, Xiao Zhang, Shulin Wang, et al.
School of Mechanical Engineering，Qilu University of Technology (Shandong Academy of Sciences)
Jinan, China

- This method is based on finite element analysis and multi-objective genetic optimization algorithm.
- The mechanism consists of a V-shaped beam (positive stiffness) and a bistable beam (negative stiffness).
- After determining the initial parameters, the optimization is carried out.
- After optimization, the constant force stroke is increased by 60 %.



Optimization model and optimization content

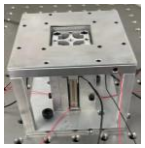
Notes

06-6 09:40–10:00

Design of Fully-Decoupled Piezoelectric 6-DOF Nanopositioning Stage Based on Flexure Hinges

Mingxiang Ling
Robotics and Microsystems Center, Soochow University, China

- A piezoelectric 6-DOF nanopositioner featuring fully-decoupled parallel kinematics with two-axis flexure hinges is proposed.
- Considerably high dynamic response is realized by designing compliant guiding mechanisms.
- The compact dimension of 88 mm × 88 mm × 78 mm can be engineered for high-speed manipulation usages with confined spaces.



The prototype of the 6-DOF nanopositioning stage

Notes

Technical Special Session 07
Micro/Nano Structural Interface and the Applications (workshop)

Room 1

10:20-12:20 Wednesday, 31 July

Chair: Mingdong Dong

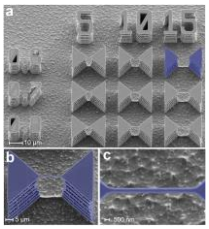
Co-Chair: Lei Liu

07-1 10:20–10:40

Monolithic Fabrication and Surface Metalization of Single-Crystal Suspended Sub-Micron Si Nanowires with 3D MEMS Architectures

B. Ali, M. Bostan Shirin, S. Z. Pakzad, U. Kerimzade, B. E. Alaca
Department of Mechanical Engineering, Koç University, Türkiye

- Top-down fabricated Si nanowires with MEMS
- Etch depths up to 50 µm
- Fabrication compatibility with both Si and Si-on-insulator substrates
- Surface metalization of Si nanowires via stencil lithography for potential biochemical applications



Array of Nanowires with close-up

Notes

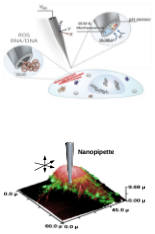
07-2 10:40–11:00

Scanning Ion Conductance Microscope – A New Tool for Single Cell Analysis

Petr Gorelkin
ICAPPIC Limited, London, United Kingdom

The SICM nanopipette is suited for performing nanoscale assays on the cell surface including:

- smart patch-clamp recording,
- intracellular delivery in cytoplasm or nuclear
- nanomechanical mapping,
- electrochemical sensing (ROS, O2, pH ect.),
- biosensing using nanopore translocatin technology.



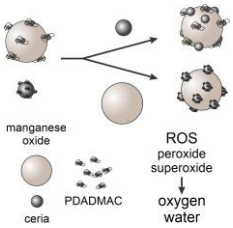
Notes

07-3 11:00–11:20

Design of Nanozyme Architectures to Combat Oxidative Stress

Istvan Szilagyi
MTA-SZTE Momentum Biocolloids Research Group, Department of Physical Chemistry and Materials Science, University of Szeged, Hungary

- Nanozymes are biocatalytic nanomaterials to replace costly and sensitive native enzymes
- Antioxidant ceria, manganese-oxide, Prussian Blue and clay nanozymes were synthesized
- Functional and dispersion stability were improved by surface functionalization and immobilization on plastic beads
- Nanozyme heteroaggregation led to broad-spectrum scavenge of reactive oxygen species



Design of antioxidant nanozyme architectures

Notes

Technical Special Session 07
Micro/Nano Structural Interface and the Applications (workshop)
Room 1
10:20-12:20 Wednesday, 31 July
Chair: Mingdong Dong
Co-Chair: Lei Liu

07-4 11:20–11:40

Cross-Scale Dispersion of Bubbles in the Presence of Electric Field

Wei Zhang
School of Energy and Power Enegineering, Jiangsu University, China
Interdisciplinary Nanoscience Center, Aarhus University, Denmark

- Ionization of gas in ambient liquid sparks a new interfacial phenomenon.
- Rayleigh's prediction failure in the special charged liquid-gas fluid system.
- Plasma bubble morphology can be predicted by a scaling law.
- Polarity effect is crucial for plasma-liquid interface stability.

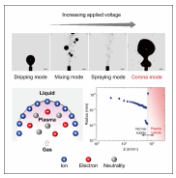


Fig. 1.Bubble dispersion modes under electric field

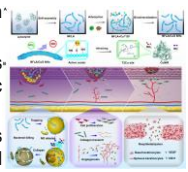
Notes

07-5 11:40–12:00

Amyloid-Like Assembly Confinement Enhancing Enzyme-Mimicking Catalytic Antibacterial Therapy

Yonghai Feng
Institute for Advanced Materials, Jiangsu University, China

- Lysozyme nanofibers induced the ordered growth and distribution of AuCu alloy and CuS nanoparticles.
- The lysozyme nanofibers and nanoparticles nanostructures displayed enhanced biomimetic enzymatic activity and photothermal activity.
- The photothermally enhanced antibacterial catalysis remarkably boosted the bactericidal efficacy and accelerated repair of infected tissues.



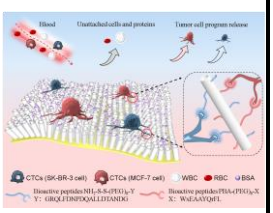
Notes

07-6 12:00–12:20

Smart Biointerface for Tumor Cell Detection and Isolation

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

- Sugar responsive peptide based smart biointerface for CTC isolation
- Pattern dyanmic biointerface and lubricant infused surface for CTC isolation in blood sample
- Peptide based soft film with dynamic biointerface for CTCs sorting in patient's blood samples



Notes

Technical Special Session 08
Manufacturing on the Atomic Level Nanoscale (ss)

Room 2

10:20-12:20 Wednesday, 31 July

Chair: Lu Cao

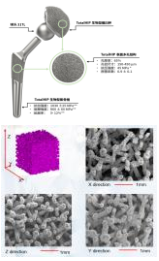
Co-Chair: Haochen Sun

08-1 10:20–10:40

Applications of Metal 3D Printing in Orthopedic Implants

Chenzhou Kong
Suzhou Solo Additive Co., Ltd, China

- Precision Customization: 3D printing creates precise, patient-specific implants for better fit and integration
- Biocompatibility Enhancement: Advanced coatings from 3D printing promote osseointegration for long-term implant success
- Mechanical Reliability: Optimized material properties ensure implants withstand physiological loads effectively
- Regulatory Compliance: Stringent testing for tensile, shear strength ensures safety and efficacy for clinical use



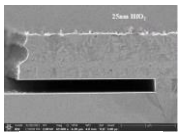
Notes

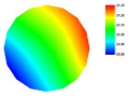
08-2 10:40–11:00

The Advantages and Corresponding Application of Atomic Layer Deposition (ALD) Compared Other Deposition Methods

Song Liu
Atomic Nano-Materials and Equipment Co.,Ltd, China

- The self-limit reaction is a typical feature of ALD, result in several advantages of the deposition method
- The advantages of ALD include high layer uniformity, high layer compactness, and high step coverage, etc
- Each advantage of ALD may be employed in different field, such as IC, Photovoltaic field, Optical field, etc
- The content may tell the researcher and engineer how to employ ALD to solve the current problem when other deposition method can not give a good solution for the current problem





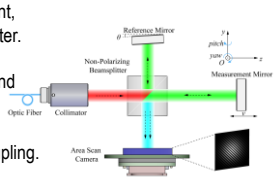
Notes

08-3 11:00–11:20

Three Degree-of-Freedom Optical Probe Based-on Wavefront Homodyne Interferometer

Xionglei Lin, Liang Yu, Pengcheng Hu
Ultra-Precision Optoelectronic Instrument Engineering Center,
Harbin Institute of Technology, China

- Newly developed 3DoF(i.e. displacement, yaw and pitch angles) laser interferometer.
- Single-beam, synchronous, accurate, and fast measurement.
- High-precise interference pattern decoupling.
- Catalyzes ultra-precision equipment development.



Structure of 3DoF optical probe

Notes

Technical Special Session 08
Manufacturing on the Atomic Level Nanoscale (ss)

Room 2

10:20-12:20 Wednesday, 31 July

Chair: Lu Cao

Co-Chair: Haochen Sun

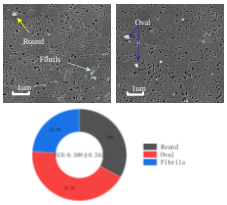
08-4 11:20–11:40

Micro and Nano-Scale Wear Debris Analysis from Artificial Joint Prosthesis

Hua Xin

Mechanical, Shaanxi university of science and technology, China

- Wear particles generated from joint prosthesis are in sub-micro to nano scale
- Particle morphology classification and size distribution are the main context for bio-tribology study
- Insights from wear debris analysis normally corelate to the wear mechanism and tissue response



Wear particle morphology

Notes

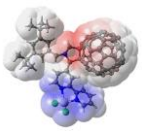
08-5 11:40–12:00

Electron Beam and EUV Patterning with Fullerene-Based Resists

Dongxu Yang

Institute of Optics & Electronics, Chinese Academy of Sciences, China

- Multiple exposure mechanism of fullerene and its derivatives was reviewed
- Fullerene derivatives showed remarkable potential in high-resolution EBL and EUV patterning
- The flexibility in side-chain engineering of fullerene derivatives enables development of novel functional resist materials



Notes

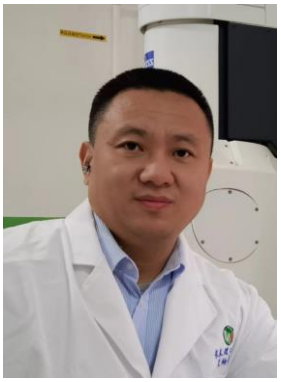
Technical Special Session 09
Cross-Scale Micro and Nano Manufacturingn (workshop)

Room 3

10:20-12:20 Wednesday, 31 July

Chair: Jinkai Xu

Co-Chair: Guangjun Chen



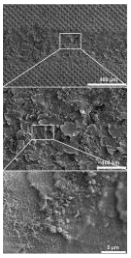
09-1 10:20–10:40

Research on AZ91D Magnesium Alloy Self-Healing Coating

Yuxi Zhao

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

- Self-healing coating was prepared on AZ91D magnesium alloy surface
- Compared with the substrate, the surface corrosion current density of LTS-$Mg(OH)_2$ is reduced by one order of magnitude
- During the corrosion process, it is assumed that the newly formed material in the scratched area is magnesium and manganese bilayer hydroxide



Notes

09-2 10:40–11:00

High-Quality and Efficiency Machining of Micro-EDM

Xiaodong Zhang

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

- Designing L27(3^5) orthogonal experiments to explore the interaction of parameters on microgroove machining in micro-EDM
- Using grey relational analysis (GRA) method, less machining time , low axial and radical electrode were obtained
- The machining time, axial and radical electrode wear were respectively reduced by 13.89%, 3.31%, and 10.80%

Microgroove morphology

Electrode after machining

Machined with optimized parameters

Notes

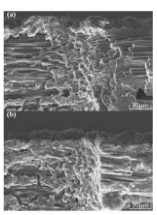
09-3 11:00–11:20

Effect of Ultrasonic Vibration on Micro-EDM of C/SiC

Yongcheng Gao

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

- Microfabricated EDM of C/SiC composites after introduction of ultrasonic vibration is fully feasible
- Mechanism of microfine EDM of C/SiC based on ultrasonic vibration
- Ultrasonic vibration amplitude of 5um optimizes the surface morphology and increases the material removal rate by almost half.



Comparison of morphology before and after applying ultrasonic vibration

Notes

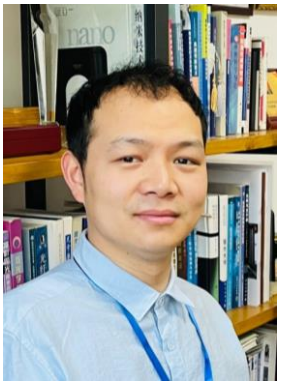
Technical Special Session 09
Cross-Scale Micro and Nano Manufacturingn (workshop)

Room 3

10:20-12:20 Wednesday, 31 July

Chair: Jinkai Xu

Co-Chair: Guangjun Chen

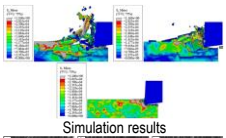


09-4 11:20–11:40

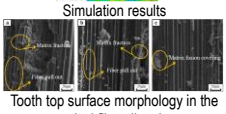
Thread Features Surface Morphology of C/SiC Composites by Laser-Ultrasonic Hybrid Machining

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

- The results of CM, LAM, and L-UHM simulations when cutting in the parallel and vertical direction of fibers. The results show that the bending deformation of the fiber is reduced and the brittle fracture is eliminated.
- In L-UHM experiment, the matrix breakage was significantly reduced which highlights improved structural integrity. Additionally, the matrix fusion covering was observed on the fiber surface.



Simulation results



Tooth top surface morphology in the vertical fiber direction

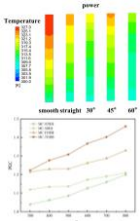
Notes

09-5 11:40–12:00

Heat Transfer Enhancement in Microchannel Heat Sink with Rectangular Diagonal Ribs

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

- A new microchannel heat sink with oblique rectangular ribs.
- The microchannels with inclined rectangular ribs at an angle of 60° have the optimal comprehensive performance in all cases, with a comprehensive performance factor of 1.33 at Re=800.



Simulation results

Notes

09-6 12:00–12:20

Research on Image Sharpness Evaluation in Microstructure Processing

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

- The proposed function improves sensitivity and steepness.
- The curve of the function carries a better performance.
- This evaluation function expresses a strong anti-noise ability.

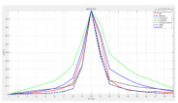


Fig 1 Line chart results

Function	Left Steepness	Right Steepness	Sensitivity
Brenner	112.6523	121.4327	65.10653
Tenengrad	50.22435	46.66598	43.1076
Laplacian	------	--------	3.485655
Energy Gradient	38.88256	41.76803	22.32675
SMD	427.5939	417.7949	203.9979
EAV	10.92615	10.4904	10.05465

Fig 2 Data results

Notes

Technical Special Session 10
Nanoscale Neuromorphic Devices (ss)
Room 4
10:20-12:20 Wednesday, 31 July
Chair: Ye Zhou
Co-Chair: Suting Han

10-1 10:20–10:40

Organic Artificial Synapses and Neurons Based on Spike-Induced Ions Migration

Qi Wang, Yanfei Zhao, Zhichao Xie
School of Materials and Energy, Lanzhou University, China

- The organic technology roadmap for the challenges of neuromorphic computing
- The device structure and molecular design schemes for neuromorphic devices
- The n-type organic synaptic devices and artificial neurons for ANN / SNN

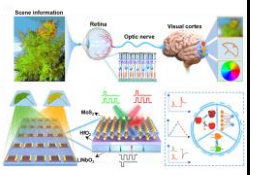
Notes

10-2 10:40–11:00

Reconfigurable Bionic Vision Within 2D Ferroelectric Optoelectronic Transistor

Xianfu Wang
State Key Laboratory of Electronic Thin Film and Integrated Devices, UESTC, China

- Reconfigurable sensing-memory-processing and logical integration in a novel $LiNbO_3$-based optoelectronic transistor
- Operation under CMOS-compatible voltage (~ 1.5 V)
- This work provides opportunities for the complex bionic vision and large-scale integration compatible with silicon-based processes



Reconfigurable all-in-one 2D transistor for bionic vison system

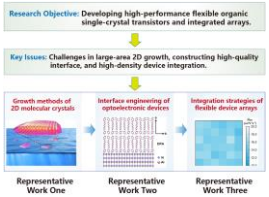
Notes

10-3 11:00–11:20

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

Technical Special Session 10
Nanoscale Neuromorphic Devices (ss)

Room 4

10:20-12:20 Wednesday, 31 July

Chair: Ye Zhou

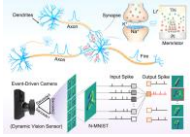
Co-Chair: Suting Han

10-4 11:20–11:40

Research on the Computing-in-Memory Integrated Memristors and Security Application

Cong Ye
Key Laboratory of Intelligent Sensing System and Security, Ministry of Education, School of Microelectronics, Hubei University, Wuhan , China

- A leaky integrate-and-fire neuron is built with Li_xAlO_y memristor array for achieving efficient SNNs
- Reconfigurable Ag/HfO_2/NiO/Pt memristors for renewable homogeneous neuromorphic system
- Decimal operation are explored on the basis of 2D $CdPS_3$ flexible memristor arrays
- Encryption and decryption of 512 × 512 pixel images using the PUF characteristics of WTiO memristor



Schematic diagram of the biological synapse and Neurons and and three-layer SNN

Notes

10-5 11:40–12:00

Intelligent Neuromorphic Vision Device and System

Feichi Zhou
School of Microelectronics, Southern University of Science and Technology, China

- The number of nodes in the sensory network is rapidly growing, forcing frequent data exchange in sensory and computing units.
- This presentation will present the recent progress in emerging neuromorphic vision devices for versatile image processing.
- Hardware implementation of a neuromorphic vision system based on ORRAM will be introduced.

Notes

10-6 12:00–12:20

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 tactile sensing
- We will explore the key influencing factors in the development process of tactile sensing devices

Notes

Technical Special Session 11
Biological Detection and Medical Imaging (workshop)

Room 5

10:20-12:20 Wednesday, 31 July

Chair: Yuanhua Yu

Co-Chair: Yujuan Chen

11-1 10:20–10:31

Establishment and Optimization of Quantum Dot Detection Method for Allergen-Specific IgE Antibodies

Jie Yu
School of Life Science and Technology, Changchun University of Science and Technology, China

- Establish a detection method for allergen-specific IgE antibodies
- Optimal conjugation parameters: 120nm quantum dots, 10μL NHS, 5μL EDC
- Labeling parameters: 0.02M MES buffer, pH 6.0, 10μg labeling protein, 25μL quantum dot microspheres
- High consistency in clinical validation
- Compared to traditional instrument-based detection methods, more convenient, less costly, faster, and more portable

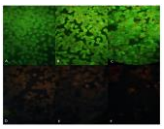
Notes

11-2 10:31–10:42

Screening and Application of HEp-2 cell Culture Medium Without Ingredients of Animal Origin

Jinglin Yang,Yuanhua Yu*,Anqi Sheng
School of Life Science and Technology,Changchun University of Science and Technology,Changchun

- Cultivating Hep-2 cells in serum-free medium
- Compared with the control group containing serum, there was no difference in cell proliferation time
- Cells cultured in serum-free medium can be successfully subjected to indirect immunofluorescence assays



Indirect immunofluorescence experiment

Notes

11-3 10:42–10:53

Mechanical Structure Design of Microdrop Digital PCR Chip Reader

Heting Wu
School of Life Science and Technology, Changchun University of Science and Technology, China

- Chip positioning structure provide an original method for the design of PCR chip reader
- Excitation light source structure with adjustable injection Angle provide an original design method
- Provides a reliable theoretical basis for the mechanical structure design about Digital PCR Chip Reader

Microdrop Digital PCR Chip Reader

Notes

Technical Special Session 11
Biological Detection and Medical Imaging (workshop)

Room 5

10:20-12:20 Wednesday, 31 July

Chair: Yuanhua Yu

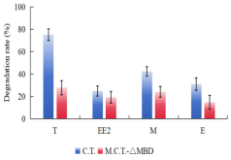
Co-Chair: Yujuan Chen

11-4 10:53–11:04

Characterization of a Meso-Butanediol Dehydrogenase in Comamonas Testosteroni ATCC11996

Xiangyu Shi, Hao Zhang*, Yuanhua Yu*, Sichen Zhang
School of Life Science and Technology
Changchun University of Science and Technology
Changchun, China

- Analysis of transcriptome results and multiple sequence alignment of MBD.
- To investigate the impact of MBD on steroid hormone metabolism in *Comamonas testosteroni* ATCC11996.
- The regulatory effects of different regulators of testosterone induced MBD expression was investigated.



Histogram of steroids degradation rate by HPLC

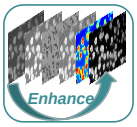
Notes

11-5 11:04–11:15

An Algorithm for Enhancing Contour Features of Tissue Cell Images Based on Fluorescence in Situ Hybridization

Dianxin Song
School of Life Science and Technology, Changchun University of Science and Technology, China

- Computer technology is widely used in medical image processing
- An image contour enhancement method combining image illumination and an improved local binary pattern (LBP) is proposed
- Experiments have verified the effectiveness of this method in image enhancement
- provides a method for enhancing the processing of fluorescence in situ hybridization tissue images



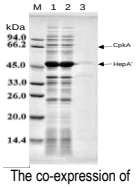
Notes

11-6 11:15–11:26

Enhancement of Cytoplasmic Solubility of Heparinase I from Flavobacterium Heparinum in Escherichia Coli by Adding a Polycationic Peptide Tag and Co-Expression with CpkA

Chuanrui Xu
School of Life Science and Technology, Changchun University of Science and Technology, China

- Recombinant HepA is difficult to express as its soluble form in Escherichia coli.
- HepA was fused with anchor tag (GGRRGR) at its N-terminus.
- The modified HepA was then expressed alongside pACYCDuet-1-CpkA.
- The amount of soluble HepA' increased to 95% of the total soluble fraction of E. coli lysate.



The co-expression of HepA' with CpkA

Notes

Technical Special Session 11
Biological Detection and Medical Imaging (workshop)

Room 5

10:20-12:20 Wednesday, 31 July

Chair: Yuanhua Yu

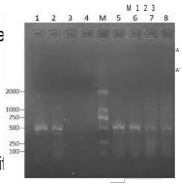
Co-Chair: Yujuan Chen

11-7 11:26–11:37

Expression and Characterisation of Pyrophosphatase TK1700 from Thermus Thermophilus Archaea

Shengxu Ji
School of Life Science and Technology, Changchun University of Science and Technology, China

- TK1700 was cloned on pET-28a and expressed in the Escherichia coli .
- TK1700 showed the highest catalytic activity at 50 ℃-60 ℃.
- TK1700 optimal pH range was 7-9.
- TK1700 was added to thermal cycle PCR could amplif more products.



Notes

11-8 11:37–11:48

Evaluation of the Analytical Properties of Anti-Cyclic Citrulline Peptide Antibody Reagents

Qingyuan Huang
School of Life Science and Technology,
Changchun University of Science and Technology, China

- This study is based on the principle of nanoparticle immunoturbidimetry.
- Optimization of anti-cyclic citrulline peptide antibody detection system.
- The precision, linear interval and accuracy of the optimized reagent were evaluated.
- After optimization, the optimal detection system can meet the needs of clinical use.

Notes

11-9 11:48–11:59

Performance Validation Study of Allergen-Specific IgE Quantum Dot Test Kits

Yu Song
School of Life Science and Technology, Changchun University of Science and Technology, China

- The coefficient of variation (CV%) for precision testing ranged from 7.72% to 12.39%
- The recovery rates for accuracy testing were all between 85% and 115%
- The proportion of LoB validation samples with values less than or equal to 0.1 IU/mL was 100%
- The proportion of LoD validation samples with values greater than or equal to 0.2 IU/mL was 100%
- The proportion of LoQ validation samples with a bias TE ≤ 15% was 100%

Notes

Technical Special Session 11
Biological Detection and Medical Imaging (workshop)

Room 5

10:20-12:20 Wednesday, 31 July

Chair: Yuanhua Yu

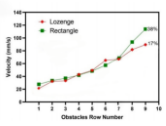
Co-Chair: Yujuan Chen

11-10 11:59–12:10

Design and Study of Microfluidic Chip for Isolation of Circulating Tumor Cells

Jiale Jin
School of Life Science and Technology
Changchun University of Science and Technology, China

- Early detection of tumor metastasis
- Design of microfluidic chips
- The effects of diamond shaped and rectangular microcolumns on flow velocity and pressure in CTC cells
- Using an example tracking module to simulate cells being captured by the chip, calculate the number of particles at the exit and entrance to simulate the chip capture rate
- Selecting diamond shaped microcolumns as obstacles in the chip separation area



•Fig1.The fluid velocity magnitude through the rows of the Chip, measured between the micropillar

Notes

11-11 12:10–12:20

Study on Tradition Chinese Medicine Anti-$A\beta_{25-35}$-Induced Damage in SH-SY5Y Cells by AFM

Yujuan Chen
School of Life Science and Technology,
Changchun University of Science and Technology, China

- SH-SY5Y cells were used to study the effect of anti-AD in vitro.
- AFM was used to establish the evaluation method.
- Several Tradition Chinese Medicine were screened.
- An active compound was obtained.

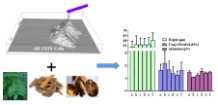


Fig.1 Detect the effect of TCM extract on SH-SY5Y cells by AFM

Notes

Technical Special Session 12
Compliant Micro/Nano System and Precision Equipment Applications (workshop)

Room 6

10:20-12:20 Wednesday, 31 July

Chair: Hui Tang

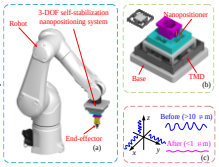
Co-Chair: Xin Chen

12-1 10:20–10:40

Design and Assessment of 3-DOF Nano-Gimbal for Spatial Manipulation

Chengsi Huang
Electromechanical engineering, Guangdong University of Technology, China

- A 3-DOF nano-gimbal is proposed for precision enhancement of spatial manipulation and measurement;
- The parameterization and optimization of passive TMD and ATMD for suppressing MDOF vibrations are presented;
- The effectiveness and difference of the system are validated via a set of FEA and numerical simulations.



The designed 3-DOF nano-gimbal

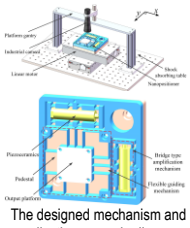
Notes

12-2 10:40–11:00

Design and Optimization of a New Compact and Totally Decoupled Nanopositioning Stage

Wei Wu
Electromechanical engineering, Guangdong University of Technology, China

- Applied to the precision alignment of MicroLED mass transfer defect repair;
- Asymmetric L-beam guide design is adopted, and the coupling rate is less than 0.3%;
- After MOGA optimization, the mechanism stroke is greater than 278μm, which is improved by 20%.



The designed mechanism and application scenario diagram

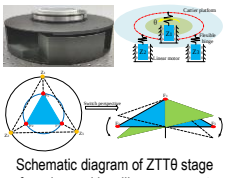
Notes

12-3 11:00–11:20

Visual Focusing and Levelling Towards Optical Inspection of Mini/MicroLED Panels

Xiaoxian Ou
Electromechanical engineering, Guangdong University of Technology, China

- Applied to the visual focusing and leveling process of panel optical inspection;
- New image focus evaluation method (F-GFD) is presented, the axial resolution better than 1.25 μm axial ;
- After optimization and experiments, F-GFD combined with ZTTθ stage can complete focusing and leveling process .



Schematic diagram of ZTTθ stage focusing and levelling movement

Notes

Technical Special Session 12
Compliant Micro/Nano System and Precision Equipment Applications (workshop)

Room 6

10:20-12:20 Wednesday, 31 July

Chair: Hui Tang

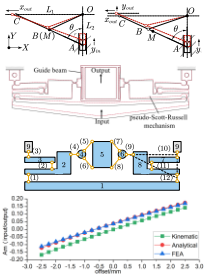
Co-Chair: Xin Chen

12-4 11:20–11:40

A Pseudo-Scott-Russell Mechanism and Its Applications to the Displacement Reducer

Chen Qian, Silu Chen, Liming Yuan, Chi Zhang, Guilin Yang
Ningbo Institute of Materials Technology & Engineering, CAS, China

- Analyze the parasitic displacement of Pseudo-Scott-Russell mechanism (PSRM) caused by pivot position deviation
- Propose a compliant displacement reducer using the parasitic displacement of PSRM, which can achieve infinite reduction ratio
- Develop the kinematic model and the static model, demonstrating consistency with FEA simulation results.



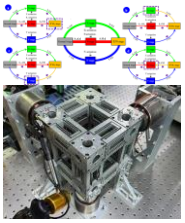
Notes

12-5 11: 40–12:00

Constraint-Flow Based Synthesis of Compliant Parallel Mechanisms

Haiyang Li
School of Mechanical Engineering, Dalian University of Technology, China

- A constraint flow concept is introduced for the synthesis of compliant parallel mechanisms.
- The mathematical expressions of the constraint flow concept is presented.
- Case studies are presented to demonstrate the effectiveness of the proposed synthesis method.
- Examples of applications utilizing the proposed compliant parallel mechanisms are showcased.



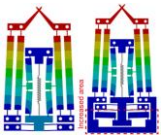
Notes

12-6 12:00–12:20

Design of a New Compliant Piezoelectric Microgripper With Parasitic Motion Self-Compensation

Zehao Wu, Zekui Lyu, Zeyi Wu, Lap Mou Tam, and Qingsong Xu
Dept. of Electromechanical Engineering, University of Macau, Macau, China
Zhuhai-UM Science and Technology Research Institute, Zhuhai, China

- A novel compliant piezoelectric-driven symmetrical microgripper with parasitic motion self-compensation is designed.
- Analytical modeling is carried out to investigate the working mode of the microgripper.
- Simulation and comparison studies are carried out to demonstrate the effectiveness of the microgripper.



Notes

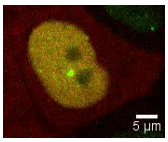
Technical Special Session 13
ENSIGN-BG (ss)
Room 1
14:00-16:00 Wednesday, 31 July
Chair: Kostadin Kostadinov
Co-Chair: Irina Georgieva

13-1 14:00–14:20

Dynamics of Micro-Irradiation Induced DNA Repair Foci at the Sites of DNA Lesions

Stoyno Stoynov
Institute of Molecular Biology, Bulgaria

- Introduction of complex DNA damages via UV micro-irradiation, in vivo
- The kinetics of 70 proteins at complex DNA damage sites were measured and modeled
- Quantification of the alterations in PARP1 dynamics and activity elicited by seven PARP inhibitors
- The extent of PARP1 chromatin retention relates to PARP inhibitors cytotoxicity



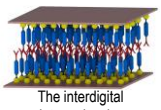
Notes

13-2 14:20–14:40

Phospholipid Bilayer Nanostructures Functionalized by Amide SWCNTs

Ognyan Ivanov, Minko Petrov, Haritun Naradikian, Yordan Marinov, Boyko Katranchev, Petar Todorov, Kostadin Kostadinov and Tihomir Tiankov
Bulgarian Academy of Sciences, Bulgaria

- Growth of bilayer phospholipid structure on a solid surface
- Bionanocomposites by phospholipid and functionalized nanotubes
- Modeling of the thermal and structural features of the bionanocomposites



The interdigital intramolecular interactions in the bilayer

Producing of bionanocomposites able to imitate the cell biomembrane functions.

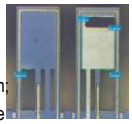
Notes

13-3 14:40–15:00

Resonance Frequency Tuning of Piezoresistive Cantilever Arrays

Mariya Villani et al
[1)] CLSENES-BAS, Bulgaria, [2)]AMG Technology Ltd, Bulgaria

- FEA computer program Mecway™ used for simulation of resonance frequency shifts in "large" cantilevers arrays;
- Coarse & fine tuning of cantilevers' resonance frequencies were achieved with FemtoLAB laser micromachining system;
- Coarse tuning of resonance frequency in the 5-7kHz range achieved by laser ablation of a patterned flexure;
- Laser micromachining fit the required tuning of cantilever arrays for detection of pathogens and biomarkers.



Notes

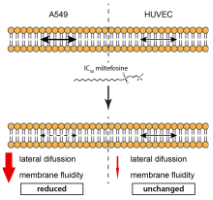
Technical Special Session 13
ENSIGN-BG (ss)
Room 1
14:00-16:00 Wednesday, 31 July
Chair: Kostadin Kostadinov
Co-Chair: Irina Georgieva

13-4 15:00–15:20

Structural Changes in Membrane Dynamics Under the Action of Antitumor Lipids

Irina Georgieva
Transmembrane signaling laboratory, Institute of Biophysics and Biomedical Engineering, Bulgaria

- Miltefosine, an alkylphosphocholine, interacts with cell membranes;
- increases cholesterol levels;
- reduces membrane fluidity in A549 cells
- Miltefosine alters the biophysical properties of lipid membranes specifically in cancer cells



Notes

13-5 15:20–15:40

Optical Metasurfaces for GHz Communications: Prospects and Prototype Validation

Ivan Christov Buchvarov
Faculty/School of Physics, Sofia University, "St. Kl. Ohridski"
Bulgaria

- Demonstration free space modulation of light using optical dichroic metasurface
- Utrafast –GHz amplitude modulation optical metasurface
- Giant modulation depth
- TA-spectroscopy for nanostructure characterization
- A new technology allows the study of ultrafast and long-living quantum states simultaneously

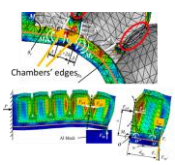
Notes

13-6 15:40–16:00

Modeling of PneuNets as Prismatic Pressure Vessels Interacting via Membrane Contact Forces

Svetoslav Nikolov[a], Zhu Liu[b], Fujun Wang[b], Kostadin Kostadinov[a]
[a] Institute of mechanics, Bulgarian Academy of Sciences, Bulgaria
[b] School of Mechanical Engineering, Tianjin University, China

- The dominant contribution to the free-end bending angle comes from bottom layer bending via pressure-induced intra-chamber edge bending moments.
- The tip force generated by PneuNets is evaluated from equilibrium of moments applied only to the PneuNets' tip chamber.
- The membrane contact force acting on the tip chamber is found both analytically & with FEA.
- Edge bending moments are found using prismatic pressure vessels analogy, and a new analytical model for hyperelsatic membranes in contact is developed.



Top: Inner edges where bending moments act
Bottom right: Fictitious cut for tip force evaluation

Notes

Technical Special Session 14
Manufacturing on the Atomic Level Nanoscale (ss)

Room 2

14:00-16:00 Wednesday, 31 July

Chair: Lu Cao

Co-Chair: Haochen Sun

14-1 14:00–14:20

Electron-Beam Powder-Bed 3D Printed Metallic Implants

Tao Sun
Guangzhou Sailong Additive Manufacturing Co., Ltd, China

- Additive Manufacturing (AM), also known as 3D printing, offers a promising method to make the complex and customized orthopedic implants. In this article, the technology of Electron-Beam Powder-Bed 3D Printing (EBM), EBM 3D printed Ti-alloy implants, EBM 3D printed Ta implants and the corresponding applications are presented.

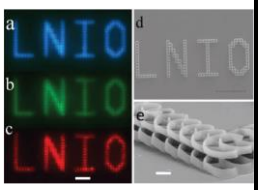
Notes

14-2 14:20–14:40

Functional Photopolymer Materials for High-Resolution 3D Lithography and Nano-Optics

Ying Peng
Creatom, China

- 3D nanostructures containing QDs with feature sizes down to 80 nm were achieved
- The influence on the resolution of the as-prepared structures was investigated
- Show potential in the integration of single nano-emitters with precise positioning in nanophotonic devices



Photoluminescence images of QDs-containing 3D microstructures

Notes

14-3 14:40–15:00

Compact Desktop CMM with Interferometric Position Feedback

Gabor Molnar[1], Christian Werner[1], Liang Yu[2]
[1]MPro GmbH, Germany, [2]Harbin Institute of Technology, China

- Positioning system with integrated interferometric encoder using the modified Homodyn-Twyman-Green interferometer concept
- The scanning range of the prototype is approximately 25 mm with a resolution in the sub-nanometer range
- Novel discrete Fourier transform signal processing approach based on a high-speed CMOS sensor

Desktop CMM prototype

Notes

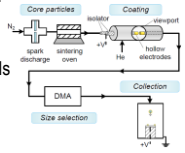
Technical Special Session 14
Manufacturing on the Atomic Level Nanoscale (ss)
Room 2
14:00-16:00 Wednesday, 31 July
Chair: Lu Cao
Co-Chair: Haochen Sun

14-4 15:00–15:20

Spark Ablation Aerosol Technology as a Function Platform for Nano Manufacturing

Simeng Zhuang
Phenom Scientific &VSParticle, China

- Spark ablation technology is a plasma method which can synthesis different 0-20 nm particle materials in ordinary pressure
- Spark ablation can produce many new nano materials
- Spark ablation device help build new nano structure with the combination of different platform
- Spark ablation applications for electronic catalysis and MEMS



Spark ablation platform

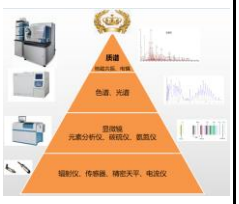
Notes

14-5 15:20–15:40

Innovation and Development of Domestic Mass Spectrometry

Wei Gao
Guangzhou Ji Nan University, China

- Mass spectrometer is the most advanced scientific instrument, widely used in national strategy, industrial support and so on
- Domestic market demand is strong, import growth is obvious, compound growth rate of more than 20% , the scale of 12 billion
- In 2023, there are more than 100 mass spectrometer manufacturers in China, and some products have been replaced by domestic ones



Notes

Technical Special Session 15
Micro-Nano Additve/Subtractive Manufacturing (ss)

Room 3

14:00-16:00 Wednesday, 31 July

Chair: Zhankun Weng

Co-Chair: Fen Qiao

15-1 14:00–14:20

Microstructures and Properties of LMD AMed Ti/AlCoCrFeNi High Entropy Alloys

Kai Wang
School of Mechatronic Engineering and Automation, Foshan University, China

- The present study utilized the laser cladding technique to fabricate a series of Ti/Alx(CoCrFeNi) high-entropy alloys and systematically investigated the influence of Ti and Al content on the alloy's microstructure, phase composition, mechanical properties, and electrochemical performance.
- This study provides a strong theoretical and experimental foundation for the design of high-performance CoCrFeNi-based high-entropy alloys.
- Key words: Laser melting deposition; HEAs; CoCrFeNiTi; Microstructure; Property

Notes

15-2 14:20–14:40

Fundamental Researches on Additive and Laser Manufacturing for Batteries and Energy Storage

Wei Yuan, Xiaoqing Zhang
School of Mechanical & Automotive Engineering, South China University of Technology, China

- Additive and laser manufacturing processes can be effectively used to construct batteries and energy storage devices;
- Creating functional structures, surfaces, and interfaces in the batteries and super-capacitors helps improve their performances;
- High-performance manufacturing makes it possible to breakthrough the limitation of material properties for the next-generation energy storage.

3D printing for various applications in Li-ion batteries

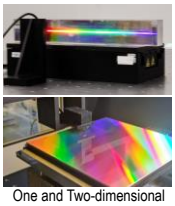
Notes

15-3 14:40–15:00

Research on Precision Grating Displacement Measurement Technology

Wenhao Li
Changchun Institute of Optics, Fine Mechanics and Physics, Chinese Academy of Sciences, China.

- Propose a bidirectional Doppler measurement technique, a four-fold subdivision can be achieved with one time diffraction.
- Propose a cone diffraction measurement technique, The problem of phase error induced by aliasing of inverse and diffracted optical signals is solved.
- a one-dimensional grating displacement sensor with a range of 350mm are developed.
- two-dimensional grating displacement sensor with a range of 200mm×200mm are developed.



One and Two-dimensional grating displacement sensor

Notes

Technical Special Session 15
Micro-Nano Additve/Subtractive Manufacturing (ss)

Room 3

14:00-16:00 Wednesday, 31 July

Chair: Zhankun Weng

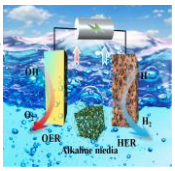
Co-Chair: Fen Qiao

15-4 15:00–15:20

Design of Nanocatalysts and Their Application in Electrocatalytic Hydrogen Evolution

Qiao Fen
Department of Energy Storage Science and Engineering, Jiangsu University, China

- Co-Ni_3S_2/NF villi structure provides abundant active sites, which is conducive to the diffusion of electrolyte ions.
- Further sulfidation treatment makes the Co-Ni_3S_2/NF sample show better intrinsic activity.
- Gibbs free energy of Co-Ni_3S_2 is close to 0 eV, which is more conducive to H* desorption.



Nanostructures for HER applicaiton

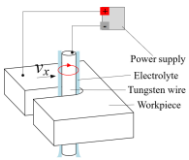
Notes

15-5 15:20–15:40

Experimental Investigation of the Elliptic Vibration Shape and Frequency on the Electrochemical Micromachining

Zhemin Shen
College of Aeronautical Engineering, Civil Aviation University of China, China

- A novel elliptical vibration assisted wire electrochemical micromachining (WEMM) method.
- The elliptical vibration-assisted WEMM method is able to improve the cutting quality.
- It obtained smaller width and RMSE compared to no vibration and one-dimensional vibration.
- Introducing a novel wire electrochemical micromachining method, and the impact of parameters on the machining quality is explored.



The experimental schematic diagram of the machining process

Notes

Technical Special Session 16
L4DNANO and LESIA - Joint Research Platforms in Laser Engineering of Surfaces, Interfaces, and Nanomaterials (ss)

Room 4

14:00-16:00 Wednesday, 31 July

Chair: Wilhelm Pfleging

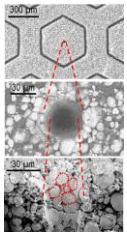
Co-Chair: Santiago Miguel Olaizola

16-1 14:00–14:20

Laser Engineering of Surfaces, Interfaces, and Nanomaterials for Lithium-Ion Batteries

W. Pfleging, Y. Sterzl, U. Rist, C. Reinhold, N. Straßburger, A. Meyer, P. Zhu
Institute for Applied Materials, Karlsruhe Institute of Technology, Germany

- A wide variety of laser processes are increasingly being used in battery manufacturing
- 3D battery concept realized by structuring and printing of micro- and nanomaterials
- Successful implementation of upscaling concepts for ultrafast laser structuring of electrode materials
- Improving electrochemical performance in terms of high-power operation, fast charging, and battery life
- Introduction of new material and electrode design concepts for next generation batteries



Ultrafast laser structured thick-film cathode

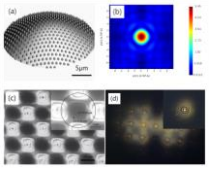
Notes

16-2 14:20–14:40

Biomimetic Moth-Eye Structures Prepared by Coplanar Three-Beam LIL in Flexible Material

Xiangyu Li[1st,2nd], Litong Dong[1st,2nd], Mengnan Liu[1st,2nd], Dayou Li[3rd], Zuobin Wang [1st,2nd,3rd]
[1st]JR3CN&CNM, CUST, China; [2nd]ZSCUST, China;
[3rd]IRAC & JR3CN, University of Bedfordshire, UK

- Simulation of biomimetic moth-eye structures with double-period.
- Design a coplanar three-beam laser interference lithograph for fabricating double-period structures.
- Preparing biomimetic moth-eye structures in PDMS.
- Studying diffraction properties of biomimetic moth-eye structures.



(a-b) Schematic diagram of the double-period structure and the simulation result;
(c) Morphology of the biomimetic moth-eye structure;
(d) Diffraction ring array of the biomimetic moth-eye structure.

Notes

16-3 14:40–15:00

Bioinspired Surfaces for Directional Liquid Transport: Design and Manufacturing

Chuanchuan Guo
International Research Centre for Nano Handing and Manufacturing of China, Changchun University of Science and Technology, China

- Classical directional transport mechanisms, including wettability gradient and Laplace pressure difference, are introduced.
- Recent advances in design and manufacturing, from single to multiple biomimetic surfaces, are reviewed.
- Some challenges faced in the current development of bioinspired surfaces are summarized.

Notes

Technical Special Session 16
L4DNANO and LESIA - Joint Research Platforms in Laser Engineering of Surfaces, Interfaces, and Nanomaterials (ss)

Room 4

14:00-16:00 Wednesday, 31 July

Chair: Wilhelm Pfleging

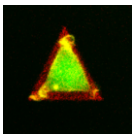
Co-Chair: Santiago Miguel Olaizola

16-4 15:00–15:20

Protein Micropatterning for Cell Mechanobiology

Yuge Zhang
Interdisciplinary Nanoscience Center, Aarhus University, Denmark

- Utilizing PRIMO photopatterning module to create protein micropatterns
- Modulating cellular adhesion and morphology
- Investigating cell behaviors under various micropatterned mechanical environments
- Observing changes in cell mechanics and migration dynamics with different protein patterns



Single cell on protein micropattern

Notes

16-5 15:20–15:40

Addressing Mechanical and Electrochemical Aging of Cylindrical LFP Battery Cells by Laser Structuring of Electrodes

Yannic Sterzl, Wilhelm Pfleging
IAM-AWP, Karlsruhe Institute of Technology, Germany

- Implementation of lithium iron phosphate (LFP) 3D electrodes in cylindrical batteries
- Identification of an optimized process window for ultrafast laser structuring of LFP electrodes
- No coating defects after winding of 3D structured electrodes at small inner core radii of cylindrical cells
- Improved rate capability for batteries with structured electrodes compared to those with unstructured electrodes

Schematic illustration of unstructured and structured electrodes after winding at small radii

Notes

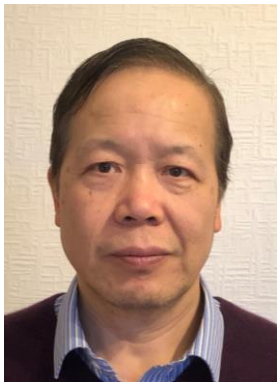
Technical Special Session 17
Mechanical Properties and Functions of Graphene Materials (ss)

Room 5

14:00-16:00 Wednesday, 31 July

Chair: Hanxing Zhu

Co-Chair: Qing Peng



17-1 14:00–14:20

Mechanics Model of Graphene Platelet Films

H. Zhu, P. Qi and X. Chen

School of Engineering, Cardiff University, Cardiff CF24 3AA, UK

- Multilayer periodic random Voronoi model
- Finite element simulation
- Five independent elastic constants
- Effects of different parameters on the elastic properties

Notes

17-2 14:20–14:40

Conformation-Induced Stiffening Effect of Crosslinked Polymer Thin Films

Zhengyang Zhang

University of Michigan–Shanghai Jiao Tong University Joint Institute, Shanghai Jiao Tong University, China

- Conformational origin and principles of the mechanical behavior change of crosslinked polymers is reported
- A theory for guiding the fabrication of high stiffness polymeric thin films is proposed
- Decoupled the thickness and the elastic property of the crosslinked polymer films
- Fabricated PDMS films with two-order-of-magnitude difference in stiffness but with similar thicknesses

Notes

17-3 14:40–15:00

Anisotropic and Temperature-Dependent Mechanical Properties of TPDH-Graphene

Qing Peng

State Key Laboratory of Nonlinear Mechanics, Institute of Mechanics, Chinese Academy of Sciences, China

Guangdong Aerospace Research Academy, China

- TPDH-graphene is a new two-dimensional carbon material whose structure contains four-, five-, six- and ten-membered rings and has significant anisotropy.
- The special structure gives it excellent mechanical properties, which are promising for applications in nano-electronics. We use classical molecular dynamics methods to conduct a comprehensive test of its mechanical properties, exploring the influence of factors such as tensile direction and temperature, and also explore the effect of the addition circular defects on its mechanical properties.
- Our results show that TPDH-graphene exhibits significant anisotropy in the x and y directions, and its tensile strength decreases with increasing temperature. It has a certain tensile toughness along the armchair direction compared to the zigzag direction.
- Keywords: TPDH-graphene; MD; Mechanical property; Defects

Notes

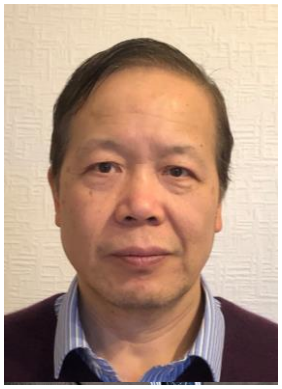
Technical Special Session 17
Mechanical Properties and Functions of Graphene Materials (ss)

Room 5

14:00-16:00 Wednesday, 31 July

Chair: Hanxing Zhu

Co-Chair: Qing Peng



17-4 15:00–15:20

Effect of Temperature, Vacancy, and Microcracks on Mechanical Properties of 8-16-4 Graphyne

Qing peng
School of Science, Harbin Institute of Technology, China
State Key Laboratory of Nonlinear Mechanics, Institute of Mechanics, Chinese Academy of Sciences, China
Guangdong Aerospace Research Academy, China

- The 8-16-4 graphyne, a recently identified two-dimensional carbon allotrope, exhibits distinctive mechanical and electrical properties, making it a candidate material for flexible electronic applications.
- This study endeavors to enhance our comprehension of the mechanical properties of 8-16-4 graphyne. The mechanical properties of 8-16-4 graphyne were evaluated through molecular dynamics simulations, examining the impact of temperature, and the coupled interactions between temperature, vacancy defects, and microcracks. The findings reveal that 8-16-4 graphyne undergoes fracture via the cleavage of ethylene bonds at a critical strain value of approximately 0.29.
- Temperature, vacancy concentration, and the presence of microcracks markedly affect the mechanical properties of 8-16-4 graphyne. In contrast to other carbon allotropes, 8-16-4 graphyne exhibits a diminished sensitivity to vacancy defects in its mechanical performance. However, carbon vacancies at particular sites are more prone to initiating cracks. Furthermore, pre-existing microcracks within the material can potentially alter the fracture mode.
- Keywords: 8-16-4 graphyne; mechanical properties; molecular dynamics;

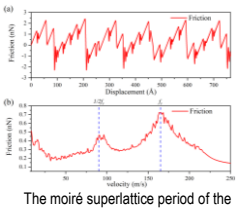
Notes

17-5 15:20–15:40

Friction Behavior of Graphite/h-BN Heterostructures

Yujia Zhou, Tianyi Zhang, Yunfei Chen*
School of Mechanical Engineering, Southeast University, China

- MD simulation and PF model confirms the friction behavior is affected by the heterostructure superlattices
- It is found that the period of the moiré pattern affects the stick-slip period
- The relative motion between tip and substrate leads to the peaks in average friction force.
- The formation of heterostructures can effectively reduce friction



The moiré superlattice period of the heterostructure has great influence on the instantaneous friction force and the average friction force.

Notes

Technical Special Session 18
Multifunction Nanomaterials for Nanoengineering Processes (ss)

Room 6

14:00-16:00 Wednesday, 31 July

Chair: Svetlana von Gratowski

Co-Chair: Victor Koledov

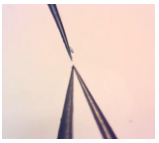
18-1 14:00–14:20

Creation of Nano Welding Technology for 3-Dimensional Mechanical Bottom Up Nano Assembling

Svetlana von Gratowski, Victor Koledov, Alexey Prokunin, Anastasia Vaulinskaja

Kotel'nikov Institute of Radioengineering and Electronics Russian Academy of Sciences, Moscow, Russia

- The nano-welding e.d. reliable mechanical and electrical connection between micro-objects is of special importance in developing the technology of 3-D mechanical bottom up nano-assembly
- The creation has been demonstrated of a strong mechanical and electrical connection between two tungsten micro-needles by initiating plasma discharge between them and the third tungstant microneedle in air
- The work was supported by RSF grant No 22-1900783.



Three micro-needles for nano-welding

Notes

18-2 14:20–14:40

Thermal Switch for Magnetic Refrigeration with LIL-Fabricated Surface

V.Koledov[2], K. Kolesov[2], A. Mahirov[2], V.Shavrov[2] , Z.Song[1]

[1]Chanchun University of Science and Technology, China

[2]Laboratory of magnetic phenomena in microelectronics, Kotelnikov IRE RAS, Russia

- The problem of heat manipulation and switching in vacuum is recognized for many years.
- The contact surfaces in many works was treated in a special way in order to get high thermal contact conductance (TCC) in vacuum
- The paper discusses mechanical thermal switches for magnetic cooling technology where for the first time the periodic nanostructure was fabricated by laser interference lithography (LIL) to improve TCC

The work was supported by RSF grant No 20-19-00745

Notes

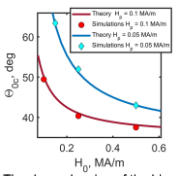
18-3 14:40–15:00

Nonisochronicity of Ferromagnetic Thin Films with Perpendicular Magnetic Anisotropy Subjected to Bias Magnetic Field

Artem Matveev

Kotel'nikov Institute of Radioengineering and Electronics, Russian Academy of Sciences, Russia

- We obtain expression for the nonisochronicity coefficient of ferromagnetic thin film with perpendicular anisotropy
- We show that it is possible to control nonisochronicity using an bias magnetic field
- Nonisochronous adjustment is most effective in films with large perpendicular anisotropy
- The theoretical results are verified by micromagnetic simulations



The dependencies of the bias magnetic field angle Θ_{0c} at which the nonisochronity is zero on the magnitude of this field H_0

Notes

Technical Special Session 18
Multifunction Nanomaterials for Nanoengineering Processes (ss)

Room 6

14:00-16:00 Wednesday, 31 July

Chair: Svetlana von Gratowski

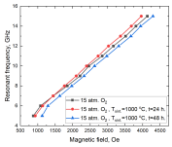
Co-Chair: Victor Koledov

18-4 15:00–15:20

FMR Spectra of $NiFe_2O_4$ Magnetic Semiconductors

David Gabrielyan
Kotel'nikov Institute of Radioengineering and Electronics, Russian Academy of Sciences, Russia

- Single crystals of $NiFe_2O_4$ were grown for the first time by the method of zone melting.
- With increasing firing time in an oxygen atmosphere, the lattice parameter decreases (XRD data).
- On FMR spectra, the optimal synthesis mode is achieved by annealing for 24 hours (minimizing the applied constant field).



Dependence of the resonant frequency on the magnetic field in $NiFe_2O_4$ single crystals at different annealing times

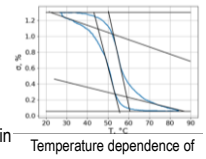
Notes

18-5 15:20–15:40

Functional Properties of Cold-Rolled Rapidly Quenched Ribbons of Shape Memory TiNiCu Alloy

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

- Rapidly quenched TiNiCu alloy ribbons are a precursor for creating nanotweezers
- Cold rolling of the $Ti_{50}Ni_{25}Cu_{25}$ alloy ribbons in the initial amorphous state was used to reduce their thickness from 30 to 20 μm.
- Rolling result in narrowing of hysteresis and decreasing the value of the shape memory effect in isothermally crystallized ribbons
- There is significant reduction in surface roughness and improvement in the thickness uniformity of the rolled ribbons



Temperature dependence of the shape change of the rolled ribbon (20 μm) under a constant load of 100 MPa

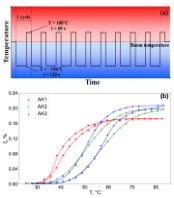
Notes

18-6 15:40–16:00

Effect of Rejuvenation on Properties of Amorphous-Crystalline TiNiCu Alloy Ribbons

Alexander Shelyakov, David Khachatryan, Nikolay Sitnikov, Kirill Borodako
National Research Nuclear University MEPhI , Moscow, Russia

- Layered amorphous-crystalline TiNiCu alloy ribbons with two-way shape memory effect (TWSME) in bending were produced by melt spinning technique
- The ribbons are used to create microtweezers for grasping and manipulating micro- and nanoobjects
- The ribbons were subjected to a rejuvenation procedure using cryogenic thermal cycling
- Rejuvenation leads to noticeable increasing of the value of the TWSME and to a significant narrowing of its temperature hysteresis which can improve the functional properties of microtweezers



Schematic of the rejuvenation procedure (a) and temperature dependence of the TWSME (b)

Notes

Technical Special Session 19
Ultrafast Nanophotonics/Advanced Lithography (ss)

Room 7

14:00-16:00 Wednesday, 31 July

Chair: Jingquan Lin

Co-Chair: Feng Lin

19-1 14:00–14:15

Properties and Optical Applications of EPs in Non-Hermitian Metasurfaces

Xiangrong Wu and Feng Lin
State Key Lab for Mesoscopic Physics, School of Physics, Peking University, Beijing 100871, China

- Metasurfaces can be regarded as non-Hermitian systems,which exist exceptional points (EPs) in parameter spaces.
- Encircling the EPs, a full 2π phase accumulation is topolo-gically protected.
- Phase-only holography was realized in our designed meta-surface with the assistant of EP phases.

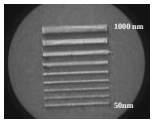
Notes

19-2 14:15–14:30

Imaging EUV Lithography Mask Phase Defect with PEEM at the Illuminating Wavelength of 13.5nm

Bochao Li, Zhenlong Zhao, Jiawei Li, Xiaowei Song and Jingquan Lin
School of Physics, Changchun University of Science and Technology, China

- The work of inspecting EUV mask blank defects by use of photoemission electron microscopy (PEEM) is proposed
- The programmed phase defect and random defect are investigated and the results show that the EUV-PEEM can image both types of defects
- By varying the inspection wavelength of the EUV-PEEM, we achieved the results of distinguish a phase defect from amplitude defect



PEEM image of linear phase defect

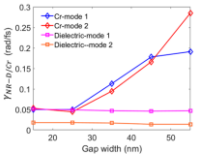
Notes

19-3 14:30–14:45

Inhibiting Interfacial Damping of Adhesive Layers Based on SP Coupling

Lun Wang, Boyu Ji, Xiaowei Song, Jingquan Lin
School of Physics, Changchun University of Science and Technology, China

- The interfacial damping induced by metal adhesive layers is inhibited by more than 80%
- This inhibition is achieved via the coupling of the plasmon modes
- This inhibition is attributed to the stronger energy confinement of the plasmon coupling



The gap size dependence of the non-radiative damping rate of the gold nanorod dimers

Notes

Technical Special Session 19
Ultrafast Nanophotonics/Advanced Lithography (ss)

Room 7

14:00-16:00 Wednesday, 31 July

Chair: Jingquan Lin

Co-Chair: Feng Lin

19-4 14:45–15:00

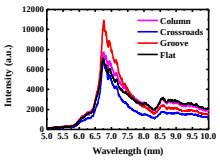
Laser-Produced Plasma Source Based on Micro-Structured Gd Target for EUV Lithography

Yibin Zhang[1], Qijin Zhang[1], Weihao Yin[1], Yinping Dou[1,2], Zhuo Xie[1], Xiaowei Song[1,2], Xun Gao[1,2], Jingquan Lin[1,2]

[1] School of Physics, Changchun University of Science and Technology, China

[2] Zhongshan Institute of Changchun University of Science and Technology, China

- The spectral widths from the micro-structured target are approximately two-thirds of the flat target case ;
- The EUV intensity enhancement ratio is 1.48;
- The groove position of the structured target significantly confines the plasma expansion.



The EUV spectra for the flat target, groove, crossroads, and column positions of the structured target, respectively.

Notes

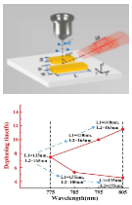
19-5 15:00–15:15

Flexible Manipulation of Plasmon Dephasing Time Based on Fano Asymmetric Dimer

Yang Xu, Jingquan Lin*

School of Physics, Changchun University of Science and Technology, China

- Fano resonance dark mode greatly prolongs the dephasing time
- As the resonance wavelength shifts to certain direction, dephasing time can have different variation trends
- Dephasing time increases with the decrease of the gap size in the nanorod dimer



Structure diagram and dephasing time variation

Notes

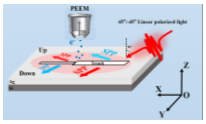
19-6 15:15–16:30

Characterization of a Four-Channel Surface Plasmon Polaritons Emitter Using Photoemission Electron Microscopy

Zhenlong Zhao, Boyu Ji, Xiaowei Song, Jingquan Lin

School of Physics, Changchun University of Science and Technology, China

- 1.A four-channel surface plasmon polaritons (SPPs) emitter is proposed;
- The physical mechanism behind the combined groove structures as a four-channel SPPs emitter was thoroughly analyzed;
- A near-field imaging method of photoemission electron microscopy, with the advantage of fast, non-invasive, and temporally resolved accessibility, is utilized in this work.



Experimental setup of the four-channel SPPs emitter based on the combined groove structure.

Notes

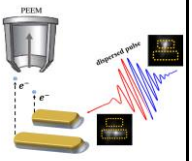
Technical Special Session 19
Ultrafast Nanophotonics/Advanced Lithography (ss)
Room 7
14:00-16:00 Wednesday, 31 July
Chair: Jingquan Lin
Co-Chair: Feng Lin

19-7 15:30–15:45

Spatiotemporal Manipulation of the Hybridized Plasmonic Field

Hanbing Song, Peng Lang
School of physics, Changchun university of science and technology, China

- Hybridization plasmonic mode in Au nanorod dimer;
- All optical control of localized electric field within fs-nm spatiotemporal scale;
- Flexible manipulation of the hybridization plasmonic mode with dispersed femtosecond laser;
- Transformation time interval as low as 15 fs.



Coherent control of plasmonic field from Au dimer

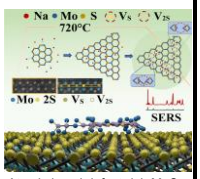
Notes

19-8 15:45–16:00

Mechanism and Performance Regulation of MoS_2-Based SERS Substrates

Yingjiao Zhai
School of Physics, Changchun University of Science and Technology, Changchun

- Investigation on SERS performance of MoS_2 semiconductor substrates
- Regulating SERS performance of MoS_2 substrates by compositing with metals based on electromagnetic enhancement mechanism.
- Improving SERS performance of MoS_2 by activating inert basal plane based on chemical enhancement mechanism.
- Providing new research ideas and potential development directions for semiconductor SERS technology.



Atomic basal defect-rich MoS_2 SERS substrates

Notes

Technical Session 20
Nanomanufacturing and Nanoautomation

Room 1

16:20-18:20 Wednesday, 31 July

Chair: B. Erdem Alaca

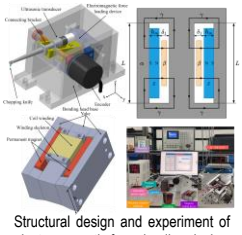
Co-Chair: Rui Wang

20-1 16:20–16:40

Design of Electromagnetic Force Loading Device for Ultrasonic Transducer

Tong Liu, Hongjie Zhang, Yangchun Cai
School of Mechanical Engineering, Tiangong University
Tianjin, China

- A workload simulation device is designed based on the equivalent magnetic circuit method and FEA
- Completed the design and optimization of magnetic circuit structural parameters and produced a device prototype
- Tests show that the force-to-flow ratio of the simulated loading device can reach 12.39N/A



Structural design and experiment of electromagnetic force loading device

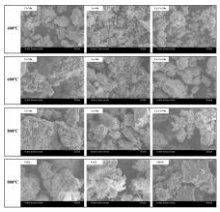
Notes

20-2 16:40–17:00

Study on the Preparation and the Degradation of Congo Red Dye Performance of La, Ce-Mn Composite Oxides

Wenjing Lu
School of Engineering, Huzhou University, P.R. China

- Synthesized LaCe-Mn oxides for effective Congo red dye degradation
- Achieved over 99% degradation efficiency using Ce-Mn and La+Ce-Mn oxides
- Identified electron holes and radicals as key active species
- Characterized materials using XRD, UV-Vis, and FT-IR spectroscopy56



The SEM plot of the compound oxide

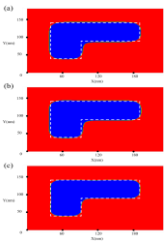
Notes

20-3 17:00–17:20

Three-Dimensional Proximity Effect Correction in Electron beam Lithography

Yuteng Zhang, Zhuming Liu
School of Electronics and Information Engineering, Wuyi University, China

- A novel 'A+V' type three-dimensional proximity effect correction method based on dose correction is proposed
- A simulation investigation combining the three-dimensional energy deposition model with the development process are undertaken
- The 'A+V' type dose correction method provides a effective approach for proximity effects correction



Bottom X-Y cross-section of the L-shaped pattern with. (a) uncorrected; (b) 2D correction; (c) 3D correction.

Notes

Technical Session 20
Nanomanufacturing and Nanoautomation

Room 1

16:20-18:20 Wednesday, 31 July

Chair: B. Erdem Alaca

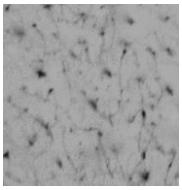
Co-Chair: Rui Wang

20-4 17:20–17:40

Fabrication of Polymer Composite Enhanced with CNTs-Aggregated Fiber via an Electric-Field-Assisted Method

Haoyu Luo, Hua Hong
School of Electronic Science and Engineering, Southeast University, China
SEU-FEI Nano-Pico Center, Southeast University, China

- Scalable CNTs-fiber Composite: A method for preparing CNTs-fiber-enhanced composites using electric-field-assisted alignment.
- Improved Mechanical & Electrical Properties: 57.2% higher flexibility with minimal elastic modulus reduction compared to pure polymer.
- Variable Frequency Control: Utilizes different frequencies for precise CNT alignment, enhancing composite quality.
- Versatile & Cost-effective: Suitable for large-scale manufacturing and various polymer applications.



DEP-aligned 0.1mg/ml C-PUA (fiber-line structures)

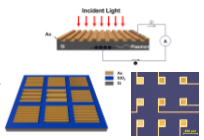
Notes

20-5 17:40–18:00

Silicon Based Integrated Plasmonic Schottky Spectral-Polarization Detector Array

Minghao Ma
ZJU-UIUC Institute, International Campus Zhejiang University, China

- Multiple plasmonic Schottky detectors on a single chip enables spectral and linear polarization detection.
- Demonstrate fine spectral and linear polarization responses in the wavelength range of 500-900nm.
- High compatibility with CMOS processes.
- Potential applications such as material analysis, scatter imaging, and medical diagnostics



Plasmonic Schottky spectral-polarization detector array

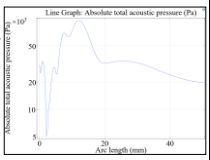
Notes

20-6 18:00–18:20

Optimization Design of Megasonic Cleaning Trans-Ducers Based on Sound Field Simulation by Comsol

Xiangyu Zhu, Yanxing Liu, Zecheng Yao, Haodong Li, Zhili Long
School of Mechanical Engineering, Dongguan University of Technology, China
School of Mechanical and Electrical Engineering, Harbin Institute of Technology, China

- Semiconductor is developing rapidly, and chip manufacturing and cleaning are indispensable
- Megasonic cleaning can remove particles smaller than 0.2μm, with minimal damage to the chip
- The influence of different matching layers on sound field distribution is studied by using COMSOL
- Quartz as a matching layer for megaacoustic transducers can reduce energy loss during transmission



Notes

Technical Special Session 21
Micro-Nano Additve/Subtractive Manufacturing (ss)

Room 2

16:20-18:20 Wednesday, 31 July

Chair: Zhankun Weng

Co-Chair: Fen Qiao

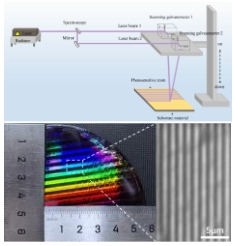
21-1 16:20–16:40

Scanning Laser Interference Method and System

Xiaoqun Liu

CountryMicro and Nano Scale Additive/Subtractive Manufacturing Laboratory, The School of Mechatronic Engineering and Automation, Foshan University, Foshan

- Faced with the urgent need to solve the technical challenges of large area, high efficiency, and low cost in laser micro-nano manufacturing, this paper proposed a new approach combining scanning galvanometers with laser interference, constructed a scanning laser interference micro-nano structures preparation system, developed the system's host computer.
- micro-nano structures, laser interference, system, scanning galvanometers



Notes

21-2 16:40–17:00

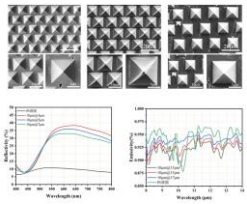
Preparation and Optical Performance of Polyimide Thin Films with Micro Prism

Junting Hu

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

Changchun, China

- The micro prism structure is complete, evenly distributed, with smooth sidewalls and sharp vertices
- The PI micro prism film has a higher reflectivity in the visible light band
- The PI micro prism film has a higher emissivity in the infrared band
- The PI micro prism thin film has excellent radiation cooling performance



Structural characterization and optical performance analysis

Notes

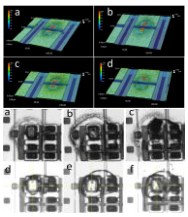
21-3 17:00–17:20

Research on Laser Repair Technology for Micro-LED Display Chips

Jiheng Wang

College of Electromechanical Engineering, Changchun University of Science and Technology University, China

- In-situ removal and replacement repair of defective Micro-LED chips
- Optimization of process parameters achieved rapid and precise removal and high-quality leveling of solder pad surfaces
- Achieving high-quality re-bonding and high-brightness light emission.
- providing important guidance for the rapid repair of defective chips in the large-scale production of medium and large Micro-LED displays



Notes

Technical Special Session 21
Micro-Nano Additve/Subtractive Manufacturing (ss)

Room 2

16:20-18:20 Wednesday, 31 July

Chair: Zhankun Weng

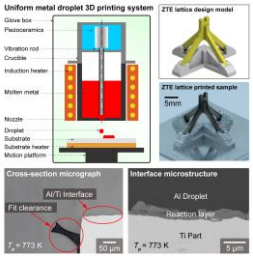
Co-Chair: Fen Qiao

21-4 17:20–17:40

A Novel Method for Additive Manufacturing Zero Thermal Expansion Lattice Structures Based on Uniform Metal Droplet 3D Printing

Lewen Yang
School of Mechanical Engineering, Northwestern Polytechnical University,China

- A novel method for additive manufacturing of ZTE lattice structures was proposed
- ZTE lattice units were printed in different preheating temperatures
- Increasing the preheating temperature can effectively eliminate internal defects
- The intermetallic compound layer between Al and Ti is 1-3 μm thickness



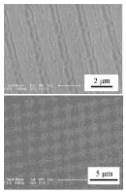
Notes

21-5 17:40–18:00

Fundamental Nanostructures Obtained by Hydrogel Photoresist in Laser Processing

Wei Wu, Dongfang Tu, Haoxuan Li, et al
School of Mechanical Engineering, University of Shanghai for Science & Technology, Shanghai

- The desired grating structures on the photolithography pattern is achieved.
- The exposure dose and time were investigated to form unbroken and uniform grating structures with laser power of 500 mW and 5 s exposure.
- The HEMA-co-MMA hydrogel in secondary nanosecond laser processing shows its ability to fabricate complex two-dimensional structures.



Nanostructures obtained by hydrogel photoresist

Notes

Technical Special Session 22
L4DNANO and LESIA-Joint Research Platforms in Laser Engineering of Surfaces, Interfaces, and Nanomaterials (ss)

Room 3

16:20-18:20 Wednesday, 31 July

Chair: Wilhelm Pfleging

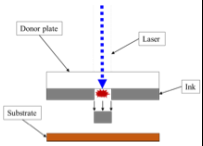
Co-Chair: Santiago Miguel Olaizola

22-1 16:20–16:40

LIFT–Current Approaches and Perspectives for 4D Printing of Batteries

Ulrich Rist
IAM-AWP, Karlsruhe Institute of Technology, Germany

- Laser-induced forward transfer (LIFT) can print liquids, suspensions, solids and small dies
- LIFT as a versatile tool for rapid prototyping of electrode architectures
- Printing of large-scale electrodes for assembling in pouch-cell design
- Printed batteries show a good cyclability



Schematic illustration of the LIFT process.

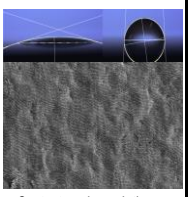
Notes

22-2 16:40–17:00

Dynamic Wetting Behavior of Femtosecond Laser-Textured Chromium Surfaces

Diego Gallego
Laser Precise Manufacturing dept., Ceit, Spain

- Investigation on temporal evolution wettability on nanostructured chromium surfaces.
- Influence of Laser processing conditions on surface roughness and oxidation.
- Impact of CO_2 stream and inert atmosphere on Surface roughness and oxidation.
- Environmental contaminants effect on contact angle



Contact angle evolution on LIPSS patterned surface

Notes

22-3 17:00–17:20

Design and Experiments of a Non-Resonant Hollow Vibration Generator

Xiaolu Zhao[1], Fujun Wang*[1], Jianhua Dai[1], Beichao Shi[1], Cunman Liang[1], Yanling Tian[2]
1 School of Mechanical Engineering, Tianjin University, China
2 School of Engineering, University of Warwick, U.K.

- The design and characteristic analysis of a non-resonant hollow vibration generator is proposed.
- Finite element analysis is conducted to characterize its static and dynamic performance.
- The prototype has been fabricated and the natural frequency is 6.37 kHz.
- The vibration amplitude and frequency are proved to be independently tunable.

Notes

Technical Special Session 22
L4DNANO and LESIA-Joint Research Platforms in Laser Engineering of Surfaces, Interfaces, and Nanomaterials (ss)

Room 4

16:20-18:20 Wednesday, 31 July

Chair: Wilhelm Pfleging

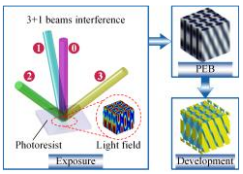
Co-Chair: Santiago Miguel Olaizola

22-4 17:20–17:40

Simulation Study on Laser Interference Lithography of Inverse Opal Structures

Jianhua Dai[1], Fujun Wang*[1], Yanling Tian[2]
1. Key Laboratory of Mechanism Theory and Equipment Design of Ministry of Education, Tianjin University, Tianjin, 300072, China
2. School of Engineering University of Warwick, Coventry CV4 7AL, UK

- This paper proposes a method for manufacturing inverse opal structures based on laser interference lithography.
- A light field simulation model of 3+1 beams laser interference lithography has been established.
- The modulation effects of multi-beam parameters on the pattern and scale of the light field are simulated.



Fabrication process of inverse opal structures by laser interference lithography

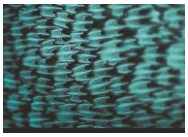
Notes

22-5 17:40–18:00

Optimization of Shark Groove Drag Reduction Based on CFD and Genetic Algorith

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

- A new method is proposed to predict drag reduction performance of shark scales with different shapes.
- The geometric structure change of shark scales and drag reduction simulation are automatically integrated.
- It provides a new research idea for the optimal design of drag reduction of shark scales.



Notes

Technical Special Session 23
Laser-Matter Interactions in Nanophotonics for Opical Metrology Application (ss)

Room 4

16:20-18:20 Wednesday, 31 July

Chair: Kang Li

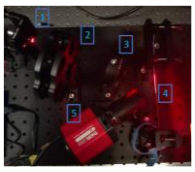
Co-Chair: Adam Jones

23-1 16:20–16:40

Non-Destructive Surface Roughness Analysis for Polymer-Based Products: Integrating Laser Speckle Contrast and Stylus Profilometry

Adam Jones, Kang Li
Faculty of Computing, Engineering and Science
University of South Wales, United Kingdom

- Novel approach for measuring nano-micro scale surface roughness for polymer-based applications
- Utilises laser speckle photometry principles
- Offers non-contact and non-destructive in-process measurement
- Addresses current challenges of surface roughness assessment in polymer manufacturing, impacting product quality and performance



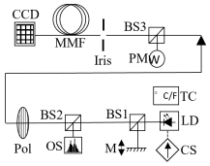
Notes

23-2 16:40–17:00

Experimental Study of External Cavity Laser Diode Under Cavity Length, Optical Feedback, Spectral Linewidth, and Speckle

Christopher Evered
Faculty of Computing, Engineering and Science, University of South Wales, CF37 1DL, UK

- Differing degrees of feedback-induced speckle reduction
- Laser linewidth broadening can be achieved by varying the ECL
- Laser speckle contrast (LSC) of a visible LD under external optical feedback (EOF)
- No discernible correlation between these parameters.



Experimental setup for measuring the LSC

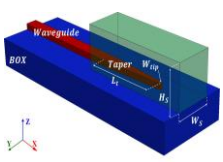
Notes

23-3 17:00–17:20

Dual Frequency Swept Interferometer Based on the Nano SOI Waveguide

Sivagunalan Sivanathan
Faculty of Computing, Engineering and Science, University of South Wales, CF37 1DL, UK

- A symmetrical dual-sweep source for the Frequency Scanning Interferometry (FSI)
- Four Wave Mixing (FWM) in Silicon on Insulator (SOI) nano waveguides
- Tunable laser for FSI with Tuning rate – 2000nm/s
- Dual Wavelength Band – 1530nm to 1545nm, and 1547nm to1560nm



SOI waveguide with taper coupler

Notes

Technical Special Session 23
Laser-Matter Interactions in Nanophotonics for Opical Metrology Application (ss)

Room 4

16:20-18:20 Wednesday, 31 July

Chair: Kang Li

Co-Chair: Adam Jones

23-4 17:20–17:40

Fabrication of Glass Micro/Nano Array Mirrors via Continuous Laser Direct Irradiation Assisted by Microperforated Masking

Lianshuang Ning

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

- Rapid laser fabrication of Micro/Nano array mirrors
- A new technique of continuous laser scanning mask is used to manufacture array lenses
- Fluid simulation method for laser processing of glass array convex lens
- Parameter control technology of laser manufacturing array mirrors

Notes

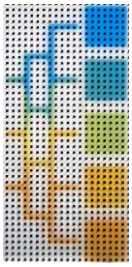
23-5 17:40–18:00

Active-Matrix Digital Microfluidics Enabled Virtual Channels

Maolin Zhang[1,2], Hanbin Ma[1,2]*

1. School of Biomedical Engineering (Suzhou), University of Science and Technology of China, China
2. Suzhou Institute of Biomedical Engineering and Technology, Chinese Academy of Sciences, China

- Field programmable virtual microfluidics channels on large-area active-matrix electrowetting-on-dielectric digital microfluidics platform
- Analyzes pressure tolerance in virtual channels of digital microfluidic systems
- Explores flow characteristics including velocity and impact of geometry in virtual channels
- Demonstrates custom concentration generation and precise fluid manipulation for lab-on-chip applications using virtual channels



Notes

Technical Special Session 24
Nano-Manipulation and Nano-Measurements for Biomedical/Chemical and Chemical (ss)

Room 5

16:20-18:20 Wednesday, 31 July

Chair: Victor Koledov

Co-Chair: Svetlana von Gratowski

24-1 16:20–16:40

Ni-Mn-In-V Heusler Alloy New Functional Material for Micro-Bio-Nanomanipulation

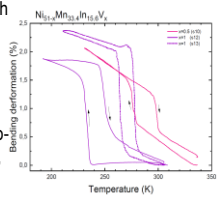
S.Taskaev[1], V.Koledov[2], Kuznetsov[2], A. Mashirov[2], A.Nesolenov[2], V.Kalashnikov[2], V.Shavrov[2] , E.Morozov[2], I.Musabirov[3]

[1]Chelyabonsk State University, Chelyabinsk, Russia

[2]Kotelnikov IRE of RAS, Moscow Russia

[3]Institute for Metals Superplasticity Problems of RAS Ufa, Russia

- The new smart materials from family of NiMnInV magnetic shape memory alloys demonstrate high sensitivity to external magnetic field.
- This opens a way to design of magnetic-field-controlled micro-mechanical tools for 3D nano manipulation at constant temperature.
- Numerus unresolved task in the field of bio-nano-manipulation can be resolved using these tools, operating under moderate magnetic fields.



The work was supported by state task No FFWZ-2024-007 .

Notes

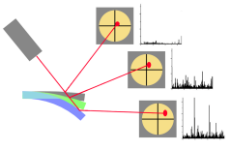
24-2 16:40–17:00

Bacterial Nanomotion: Detection with Atomic Force Microscopy

Svetlana Pleskova, Nikolay Bezrukov, Sergey Bobyk, Olga Grubova

Research Laboratory of Scanning Probe Microscopy, Lobachevsky State University of Nizhny Novgorod, Russian Federation

- In addition to usual movements (by flagella), bacteria also have a special type of movement – nanomotion
- Nanomotion can be detected with high sensitive methods only, like atomic force microscopy
- The amplitude and frequency of nanomotion can be used for detection of bacterial antibiotic resistance and species of microorganism



Detection of bacterial nanomotion by atomic force microscopy

Notes

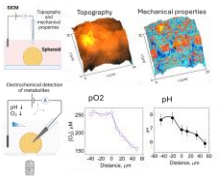
24-3 17:00–17: 20

Smart Nanopipette Technology for Studying 2d and 3d Cancer Model

Erofeev A.S.

National University of Science and Technology “MISIS”, Russia

- Nanopipettes, enable manipulation and measurement at the nanoscale, essential for nanotechnology, single-cell biology, and electrochemistry
- First-time use of SICM to map the topography and Young’s Modulus of cell and spheroids surfaces
- First-time electrochemical profiling of oxygen and pH values inside spheroids using nanoelectrodes



Smart nanopipette-based technologies for studying spheroids

Notes

Technical Special Session 24
Nano-Manipulation and Nano-Measurements for Biomedical/Chemical and Chemical (ss)

Room 5

16:20-18:20 Wednesday, 31 July

Chair: Victor Koledov

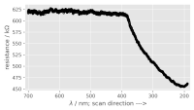
Co-Chair: Svetlana von Gratowski

24-4 17:20–17:40

Study of the Functional Properties of Single Nanowires of ZnO for Photonic and Biochemical Nanosensors

Maria Evstafieva
Institute of Microelectronics Technology RAS, Russia

- 3D manipulation technology was used to fabricate UV sensors from single ZnO nanowires.
- The spectral dependence has been studied to investigate the effect of radiation of different wavelengths on the sensing properties of the structure on a single ZnO nanowire.
- The conductivity of the structure is only affected by UV radiation in all ranges, with the maximum effect of C-band radiation.



Spectral sensitivity of a single ZnO nanowire

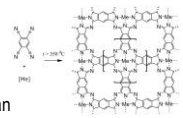
Notes

24-5 17:40–18:00

Liquid-Phase vs CVD Routes to 2D Polymeric Phthalocyanines

Tatiana Rudneva[a], Eleonora Shtykova[b], Nicolai Ovanesyan[c], Liubov Dadinova[b], Eugene Yakimov[a], Lev Buravov[c], Maxim Knyazev[a], Anna Lizunova[d],Vitaly Korepanov[a],
[a]IMT RAS, Chernogolovka, Russia
[b]NRC "Kurchatov Institute" RAS, Moscow, Russia
[c]FRC PCP MC RAS, Chernogolovka, Russia
[d]MIPT(National Research University), Dolgoprudny, Russia

- Several samples of FePPc have been synthesized in liquid paraffine using carbonyl iron, ferrocene and ferric chloride as the metal source;
- IR and Raman spectra showed a good degree of polymerization of the product;
- The polymer has a semiconducting character with an
- activation energy of ~ 0.25-0.28 eV



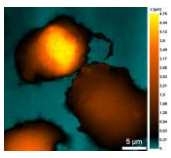
Notes

24-6 18:00–18:20

Chemoattractant-Dependent Neutrophil Migration

Nikolay Bezrukov, Sergey Bobyk, Eseniya Otstavnova, Ekaterina Gorshkova, Svetlana Pleskova
Research laboratory of scanning probe microscopy, Lobachevsky State University of Nizhny Novgorod, Russian Federation

- LTB4, LXA4 and TNFα affect neutrophil migration, adhesion and aggregation in living *in vitro* model
- Endothelial cell monolayer surface is required to provide better neutrophil migration
- The direction of migration correlates with chosen chemoattractant



Neutrophils contact during migration imagedby SICM

Notes

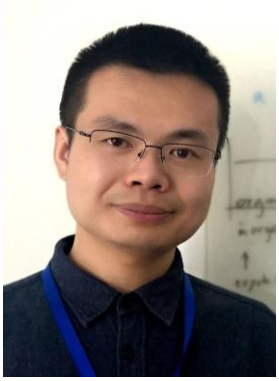
Technical Special Session 25
Nanophotonics and Plasmonics (ss)

Room 1

8:00-10:00 Thursday, 1 August

Chair: Lei Shao

Co-Chair: Xiaolu Zhuo

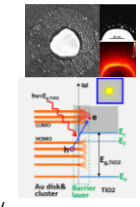


25-1 08:00–08:17

Hot Electrons in Clusters

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

- Au clusters / TiO2 have hybrid levels
- Holt electrons can be excited directly in the hybrid levels
- Hot electrons from plasmonic disks can dope the cluster
- Plasmonic disks can enhance the absorption of the clusters.
- Provide an approach for the harvesting of solar energy with antenna–sensitizer complexes



Enhanced hot electrons emission by Au antenna–sensitizer complexes

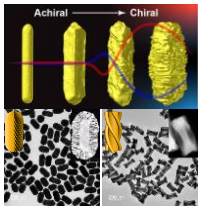
Notes

25-2 08:17–08:34

Intrinsically Chiral Gold Nanorods: Optical Activity, Structural Stability, and Chiroptical Switching

Xiaolu Zhuo
School of Science and Engineering,
The Chinese University of Hong Kong, China

- Synthesis of chiral Au nanorods and the underlying growth mechanisms
- Localized surface plasmon resonances of chiral plasmonic nanorods:
  (i) Abnormally high absorption-to-scattering ratio
  (ii) High-ordered modes
- Structural and optical stability: Two approaches
- Demonstration of chiroptical switching



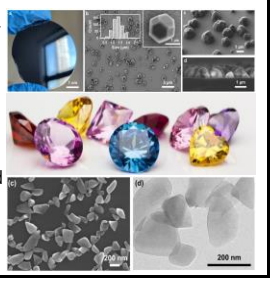
Notes

25-3 08:34–08:51

Breaking the Boundaries of Diamond: From Jewelry to Nanophotonics and Beyond

Zhiqin Chu
Department of Electrical and Electronic Engineering
School of Biomedical Sciences, The University of Hong Kong

- Large bandgap (~5.5 eV) and high carrier mobility for efficient electronic transport
- High breakdown strength, thermal conductivity (~2100 W/mK), and optical transparency for robust and versatile applications
- Stable properties, no photobleaching, and quantum behavior at room temperature for reliable and innovative technologies



Notes

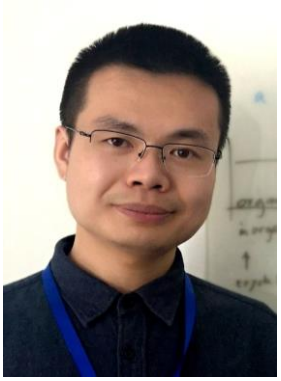
Technical Special Session 25
Nanophotonics and Plasmonics (ss)

Room 1

8:00-10:00 Thursday, 1 August

Chair: Lei Shao

Co-Chair: Xiaolu Zhuo

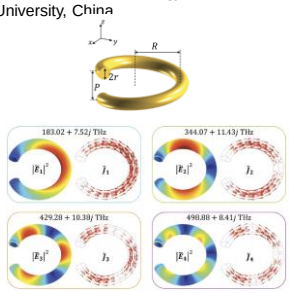


25-4 08:51–09:08

Modal Analysis of Non-Hermitian Plasmonic Nanostructures

Zhaolong Cao
School of Electronics and Information Technology,
Sun Yat-Sen University, China

- Modal analysis of plasmonic particles to understand the interplay between geometrical chirality, far-field chirality, and near-field chirality
- Using rigorous quasinormal mode theory
- A nanohelix metasurface is proposed to maximize the CD signal



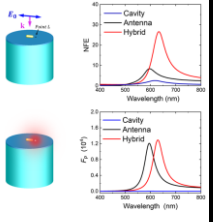
Notes

25-5 09:08–09:25

Relations between Near-Field Enhancements and Purcell Factors in Nanophotonic Resonators

Zhongjian Yang
School of Physics, Central South University, China

- The divergence between near-field enhancements (NFE) and Purcell factors (FP) is pronounced in plasmonic-dielectric hybrid systems
- The peak FP can be predicted by using the NFE and extinction cross section responses
- NFE is closely associated with the multiplicative effects of the NFEs provided by the antenna and dielectric cavity
- The FP is determined by the sum of the FPs provided by the antenna and dielectric cavity



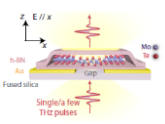
Notes

25-6 09:25–09:42

Tuning Optoelectronic Properties of Molybdenum Ditelluride via Lattice Structure Manipulation

Yaqing Bie
School of Electronics and Information Technology,
Sun Yat-sen University, China

- Triggering the transition of monolayer $MoTe_2$ from the 2H to the 1T' phase using terahertz pulses
- Identifying the Moiré Raman modes in $MoTe_2$ homobilayers via low-frequency Raman spectroscopy
- Tuning exciton emission in $MoTe_2$ homobilayers via twist angles control ranging from 0° to 60°
- Charged exciton emission in twisted bilayer $MoTe_2$



Polymorphic transition in $MoTe_2$ induced by high field THz pulses

Notes

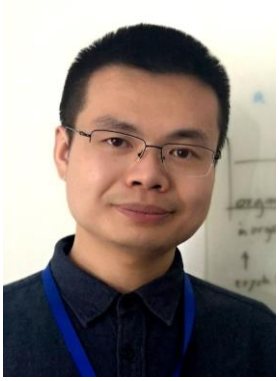
Technical Special Session 25
Nanophotonics and Plasmonics (ss)

Room 1

8:00-10:00 Thursday, 1 August

Chair: Lei Shao

Co-Chair: Xiaolu Zhuo

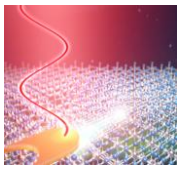


25-7 09:42–10:00

Nanophotonics in Low-Symmetry Van Der Waals Crystals

Zebo Zheng
School of Electronics and Information Technology,
Sun Yat-sen University, China

- Reporting the anisotropic phonon polaritons in van der Waals alpha-MoO_3 crystal
- Demonstrating the Manipulation of mid-infrared and THz electromagnetic field with alpha-MoO_3 and its nanostructures
- Reviewing other polaritonic phenomena in various low-symmetry van der Waals crystals



Notes

Technical Special Session 26
Applications of Nanotechnology (ss)

Room 2

8:00-10:00 Thursday, 1 August

Chair: Mengnan Liu

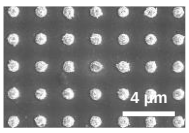
Co-Chair: Jing Hu

26-1 08:00–08:17

Research on the Controllable Growth of Gold Nanopillars by Nanohole Templates on Gold-Plated Substrates

Xiaomin Wu
Collage of Medical Informatics, Chongqing Medical University, China

- A novel method for preparing mushroom-shaped gold nanopillars was proposed
- By immersing the nanohole template on gold-plated substrate in reaction solution, the nanostructures were obtained
- The mechanism of this phenomenon was analyzed from the perspective of heterogeneous nucleation sites



SEM image of the mushroom-shape gold nanostructures

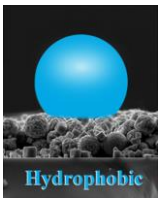
Notes

26-2 08:17–08:34

Fabrication of Hydrophobic Copper Surface Using Nanosecond Laser Interference Patterning

Miaomiao Yu*, Zhankun Weng, Jing Hu, Shenzhi Wang, Junting Hu, Tong Liu
Guangdong University of Technology
Guangzhou 510000, China

- 3D porous Cu surface was fabricated by nanosecond laser interference patterning.
- The existence of dimples and voids renders the 3D porous Cu surface hydrophobic.
- Hydrophobic surface consists of Cu nanorods and nanocubes which are crossed on nanoflower ridges.



Schematic diagram of microstructure hydrophobic preparation by laser interferometry

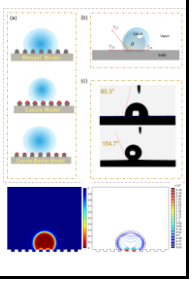
Notes

26-3 08:34–09:51

Insights into Droplet Impact Dynamics on Microstructured Surfaces

L Weng, H Zhang, C Yang*, M Wang, Z Yang, N Ni*, Z Lu, Z Zhao
Key Laboratory of Mechanism Theory and Equipment Design of Ministry of Education, Tianjin University, China

- The interaction between droplets and microstructure was simulated using phase field model
- The superhydrophobic Inconel 718 alloy surface with microgrid structure was successfully prepared
- The numerical simulation uncovered variations in droplet velocity and pressure upon impact
- The research enhances understanding of droplet behavior on microstructured surfaces and guides the design and optimization of superwetting surfaces, showing great significance for practical applications.



Notes

Technical Special Session 26
Applications of Nanotechnology (ss)

Room 2

8:00-10:00 Thursday, 1 August

Chair: Mengnan Liu

Co-Chair: Jing Hu

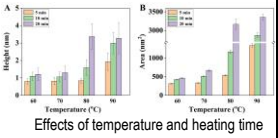
26-4 08:51–09:08

Thermal Denaturation of IgE Molecules Visualized by Atomic Force Microscopy

Jing Hu[1,2,3], Mingyan Gao[2,3], Litong Dong[2,3], Mengnan Liu[2,3], Zuobin Wang[2,3,4*]

[1]School of Materials Science and Engineering, Changchun University of Science and Technology, China
[2]Centre for Opto/Bio-Nano Measurement and Manufacturing, Zhongshan Institute of Changchun University of Science and Technology, China
[3]International Research Centre for Nano Handling and Manufacturing of China, Changchun University of Science and Technology, Changchun 130022, China
[4]JR3CN & IRAC, University of Bedfordshire, Luton LU1 3JU, UK

- The thermal denaturation of IgE was monitored by AFM
- High temperatures and heating cause IgE aggregate into flower-like structures.
- Height and area of IgE aggregates are proportional to temperature and heating



Effects of temperature and heating time on IgE height (A) and area (B).

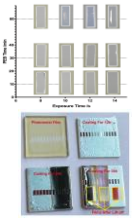
Notes

26-5 09:08–09:25

An Extra-Thick Photoresist Processing Method for Extreme Heating Conditions

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

- This work proposed a suitable extra-thick photoresist processing method by optimized coating and exposure parameters;
- The optimized results allow an extra-thick photoresist to be adapted to 150 ℃'s heating for 36 h;
- This work expand the range of patterned mask options for e-beam evaporation;
- This work helps to simplify the fabrication process of multifunctional devices.



The effect of exposure time and PEB time and films coated in 150 ℃ for 36 h

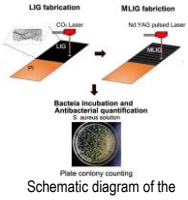
Notes

26-6 09:25–09:42

Micro-Nano Structured Laser-Induced Graphene Antibacterial Surfaces Fabricated by Two-Step Laser Marking

Lu Wang[1], Xiaochi Chen[1], Cuihua Hu[1], Yujuan Chen[1], Yuqing Chang[1] and Zhongliang Qiao[2]
1. JR3CN&CNM, CUST, China
2. School of Physics and Electronic Engineering, HAINNU, China

- In this paper, a method for preparing micro-nano structured laser-induced graphene (MLIG) antimicrobial surfaces was proposed by two-step laser ablation of polyimide (PI) films.
- The fabricated micro-patterned laser induced graphene(LIG) has high surface purity, stable surface properties, large porosity and superhydrophobicity.
- The antibacterial ability of LIG and MLIG against Staphylococcus aureus was measured by plate counting method.



Schematic diagram of the fabrication process of LIG and MLIG by two-step laser marking

Notes

Technical Special Session 26
Applications of Nanotechnology (ss)

Room 2

8:00-10:00 Thursday, 1 August

Chair: Mengnan Liu

Co-Chair: Jing Hu

26-7 09:42–10:00

Laser-Induced Ultra-Thick Cathode for Superior-Performance Lithium Metal Batteries

Ziyang Chen
School of Mechanical Engineering, Tianjin University
Tianjin, China

- This article uses femtosecond laser to process lithium iron phosphate cathode.
- The chemical reaction rate and ion transfer rate have increased.
- Laser structure improves the performance of lithium metal batteries.
- Laser processing of thick electrodes is a feasible way to achieve the practicality of high-energy batteries.

Notes

Technical Session 27
Nanomaterials and Nanoassembly

Room 3

8:00-10:00 Thursday, 1 August

Chair: Istvan Szilagyi

Co-Chair: Liguo Tian

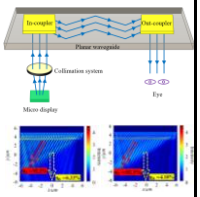
27-1 08:00–08:15

Polarization Surface Relief Gratings Coupled with Diffractive Waveguide for Near-Eye

Hu Chi

School of Opto-electronic Engineering, Xi'an Technological University, China

- A polarization surface relief grating (PSRG) coupling device is proposed.
- The diffraction efficiency for TE and TM modes exceeds 92%
- PSRG is insensitive to working conditions and manufacturing errors
- This is significant for the field-of-view (FOV) extension and full-colour display of holographic waveguide display systems.



Near-eye display systems and PSRG models

Notes

27-2 08:15–08:30

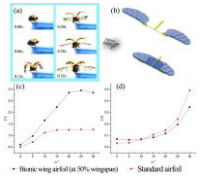
Design of Bionic Deployable Wing Based on the Hindwing of Asian Ladybird

Junyi Shi[1], Haozhe Feng[1], Tianyu Shen[2], Liuyi Shi[1], Ruixiang Han[1], Feng Jiang[1], Fengwei Zhang[1],Chao Liu[2, *]

[1] School of Future Science and Engineering, Soochow University, China

[2] School of Mechanical and Electric Engineering, Soochow University, China

- The folding/unfolding of Asian ladybird during flight was captured by High-speed camera
- Learn from the Asian ladybird hindwings, A deployable wing was designed
- The folding mechanism of bionic deployable wing operates ideally
- The lift-to-drag ratio of bionic deployable wing translates to a 40.11% enhancement relative to the standard airfoil



(a) Unfold process of the ladybird's hindwings; (b) A deployable wing model; Curves of lift coefficient (c) and drag coefficient (d) of airfoils

Notes

27-3 08:30–08:45

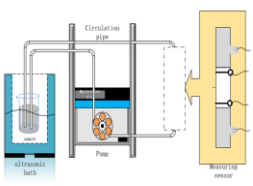
Measurement of Particle Size Distribution in Nano Colloidal Dispersions Using EIS

Fei Cao

School of Chemical and Process Engineering

University of Leeds, United Kingdom

- To measure relative changes in the PSD of colloidal dispersions using EIS.
- Use of pump circulation system with four-electrode sensor for EIS measurements.
- Impedance measurement results across various frequencies are correlative with the results of PSD.



Notes

Technical Session 27
Nanomaterials and Nanoassembly
Room 3
8:00-10:00 Thursday, 1 August
Chair: Istvan Szilagyi
Co-Chair: Liguo Tian

27-4 08:45–09:00

Thickness-Dependent Ferroelectric and Piezoelectric Characterization of $Hf_xZr_{1-x}O$ Nanofilms and Properties Analysis Using FEM

Haoqi Lyu
Aerospace Information Research Institute, CAS, Beijing, China

- Analyzed thickness-dependent ferroelectric and piezoelectric properties of HZO films (5-30 nm)
- Constructed FEM model of HZO thin films for P-E loops and piezoelectric butterfly tests.
- Identified increased polarization asymmetry and piezoelectric coefficient (12.83 pm/V).
- Predicted HZO films' performance under thickness and stress conditions to help optimize various nanodevice design.

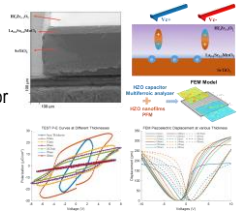


Fig. Thickness Dependence of Piezoelectricity and Ferroelectricity in HZO Films

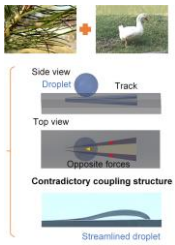
Notes

27-5 09:00–09:15

Bioinspired Reverse Coupling Architecture for Streamlined Droplet Creation

Ziyue Gao
School of Mechanical Engineering, Tianjin University, China

- Synergistically mimicked the asymmetrical structures of pine needles and duck bills
- A novel drive platform for streamlined droplet formation was designed by coupling the two structures inversely
- Streamlined droplet bionic transport platform provides a new idea for condensation heat transfer, drug delivery, microfluidics, etc



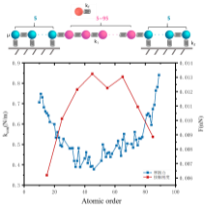
Notes

27-6 09:15–09:30

Friction Characterization of Suspended Two-Dimensional Materials

Tianyi Zhang, Yujia Zhou, Yunfei Chen*
School of Mechanical Engineering, Southeast University, China

- A one-dimensional atomic chain with dual end constraints: MD simulations for studying frictional properties and stiffness
- A methodology for examining contact stiffness in the instantaneous friction curve using MD simulations
- AFM experiments to investigate the frictional properties of suspended two-dimensional (2D) materials at various levels of contact stiffness



Notes

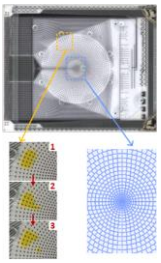
Technical Session 27
Nanomaterials and Nanoassembly
Room 3
8:00-10:00 Thursday, 1 August
Chair: Istvan Szilagyi
Co-Chair: Liguo Tian

27-7 09:30–19:45

Active-Matrix Digital Microfluidics in Polar Coordinate

Bingbing Zhang,[1] Hanbin Ma*[2] and Jinhua Li*[1]
[1]School of Physics, Changchun University of Science and Technology, China
[2]Suzhou Institute of Biomedical Engineering and Technology, Chinese Academy of Sciences, China

- Our work designed a DMF chip with polar arrayed EWOD electrodes driven by TFTs
- It contains 33 different pixel widths from 39.2 um to 405 um
- The device can generate droplets with gradual changeable volumes from 0.03 nL to 3.29 nL
- This work shows the great application potential of lab-on-a-chip systems for chemical and biological analysis



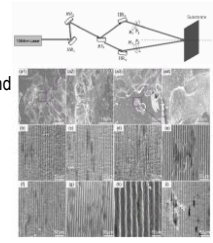
Notes

27-8 09:45–10:00

Fabrication of Micro-Nano Grooved Structures with Biocompatibility by Laser Interference Lithography

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

- The bulge and groove structures are investigated regarding the surface morphology, surface roughness and wettability.
- Cells were analyzed for proliferation, adhesion and diffusion in different structures at 24,48, and 72h.
- All laser-treated samples had significant positive effects on cell proliferation.
- The best value-added rate was shown when the ratio of groove to bulge width was 8:2.



Notes

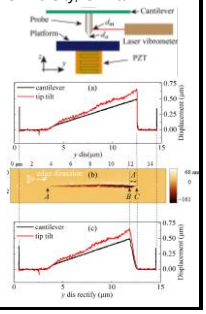
Technical Session 28
Nanomechanics and Nanomechatronics
Room 4
8:00-10:00 Thursday, 1 August
Chair: Wei Zhang
Co-Chair: Chuanchuan Guo

28-1 08:00–08:17

Investigation of Lateral Force in Tip-Based Nanofabrication

Weijie Wang
School of Mechanical Engineering, Tianjin University, China

- Tip tilt of different scratching directions is measured and rectified in Tip-based Nano Fabrication.
- Scratching length is rectified based on the tip tilt
- A simplified model of lateral force is established
- Friction coefficient is estimated based on the lateral force model



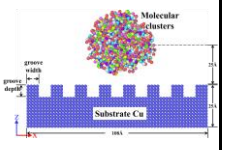
Notes

28-2 08:17–08:34

Study on the Adsorption Mechanism of 2,4-D Molecules on the Surface of Cu

Xinyu Wang
Changchun University of Science and Technology, P. R. China

- The adsorption mechanism of 2,4-D molecules on Cu substrate surfaces was investigated by molecular dynamics (MD) simulations.
- The analysis was conducted on the distribution of surface 2,4-D molecules.
- The variation in both the width and depth of the rectangular grooves on the Cu substrate impacts adsorption of 2,4-D molecules.
- The 2,4-D molecules are distributed on the surface of the substrate in a layered structure.



2, 4-D adsorption mechanism

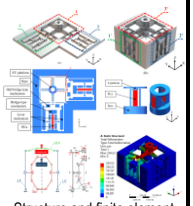
Notes

28-3 08:34–08:51

A Space-Type 4-DOF Precision Operation Stage with a Large Stroke Three Stage Motion Amplification Mechanism

Yajie Dang, Hongjie Zhang, Chuanming Jia
School of Mechanical Engineering, Tiangong University, China

- We presented a novel three stage MAM is proposed to realize a large workspace
- Inspired by the deployable structure, the three stage MAM is folded to realize a compact structure.
- The motion amplification ratios can reach 25.4 in the X- and Y- axis
- The precision operation stage provides greater operational flexibility for the operating tool



Structure and finite element analysis of the operation stage

Notes

Technical Session 28
Nanomechanics and Nanomechatronics
Room 4
8:00-10:00 Thursday, 1 August
Chair: Wei Zhang
Co-Chair: Chuanchuan Guo

28-4 08:51–09:08

Study on Cavitation Behavior of Fan Impeller Under Different Working Conditions

Chenjie Lu
School of Engineering, Huzhou University, P.R. China

- Cavitation behavior in fan impellers is investigated using Fluent simulation
- Effects of rotational speed and fluid inlet flow rate on cavitation are analyzed
- Higher cavitation risks in cryogenic fluids due to low pressure vaporization are highlighted

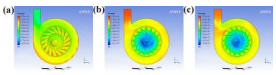


Fig. Simulation Analysis of Three Fluids: (a) Air, (b) Cryogenic Liquid Nitrogen, and (c) Cryogenic Liquid Oxygen

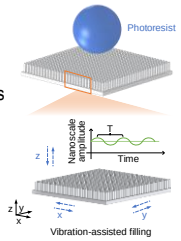
Notes

28-5 09:08–09:25

Numerical Simulation of Vibration-Enhanced Liquid Precursor Filling in Porous Nanostructures

Minghao Li
School of Mechanical Engineering, Tianjin University, China

- A proposed strategy to enhance liquid precursor filling in porous nanostructures using three-dimensional vibration
- Numerical simulation of the filling effect of vibrations of different frequencies and amplitudes without introducing a complex energy field
- The proposed method holds promise for enhancing the filling rates of high viscosity solutions and reducing filling defects in porous nanostructures



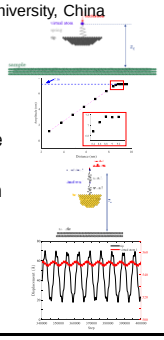
Notes

28-6 09:25–09:42

A Preliminary Investigation of the Dynamic Response of Amplitude Modulation AFM Based on MD Simulation

Guangwei Zhu
School of Mechanical Engineering, Tianjin University, China

- A MD model of amplitude modulation AFM is established based on point-mass model.
- The amplitude and phase shift of tip-sample distance are gained by simulation.
- A MD model of bimodal AFM is established based on double spring double oscillator model.
- Two modes of amplitude can be observed during the bimodal AFM simulation.



Notes

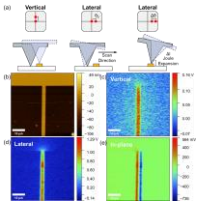
Technical Session 28
Nanomechanics and Nanomechatronics
Room 4
8:00-10:00 Thursday, 1 August
Chair: Wei Zhang
Co-Chair: Chuanchuan Guo

28-7 09:42–10:00

Scanning Joule Expansion Microscopy Based on Lateral Deflection for Improved Nanoscale Thermal Imaging

Qihai Jiang
ZJU-UIUC Institute International Campus, Zhejiang University, China

- Pioneering utilize lateral deflection signals to demodulate thermal expansion on sample surfaces
- Provide an adjustable sensitivity by changing the contact (frictional) force
- The detection limit of this mode is improved by more than an order of magnitude
- Mixed trace and retrace scanning signals to distinguish in-plane and out-of-plane expansions of DUT



(a)Lateral deflection-based SJEM principle (b)Topography of DUT (c) Vertical deflection-based SJEM (d) Lateral deflection-based SJEM (e) In-plane expansion of SJEM

Notes

Technical Special Session 29
Design, Analysis and Control of Nano-Manipulating Systems (ss)

Room 5

8:00-10:00 Thursday, 1 August

Chair: Zhen Zhang

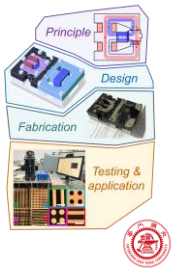
Co-Chair: Peng Yan

29-1 08:00–08:17

Normal Stressed Electromagnetic Actuated Compliant Nanopositioners

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

- Recent advances in NSEA compliant nanopositioners are reviewed
- The principle, advantages, applications, and challenges of NSEA compliant nanopositioners are discussed
- The authors' developments, including NSEA stiffness-tunable nanopositioner and serial-kinematic NSEA nanopositioner for AFM, are introduced.
- Prospects for future NSEA and nanopositioning technology are provided



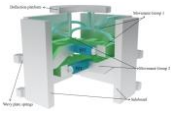
Notes

29-2 08:17–08:34

Design and Analysis of a Monolithic Tilt/Tip Platform Based on Anti-Symmetric Flexible Structure

Jianyang Zhang , Jian Yang , Ziran Wang , Peng Yan
School of Mechaical Engineering, Shandong University, China

- The PZT-driven tilt/tip platform is compact and space-efficient.
- By controlling the input voltage signal, a two-degree-of-freedom bias pendulum motion can be realized.
- This design is capable of high-precision deflection with a linear increase in force and displacement.
- Contribution: A biaxial tilt stage driven by two PZTs is developed using additive manufacturing techniques to enhance the spatial compactness of the overall structure, thereby achieving high precision deflection down to nanoscale



Structural design of tilt stage and motion schematic diagram

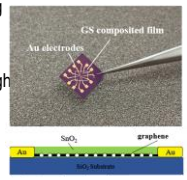
Notes

29-3 08:34–08:51

A Fast-Response and Sensitive Gas Sensor Based on Graphene-Tin Dioxide Film for Ammonia Detection at Ambient Temperature

Chen Wang, Feng Xu, Ziran Wang, Peng Yan
School of Mechaical Engineering, Shandong University, China

- Graphene-SnO2 (G-S) composited film as a sensing material, enabling sensitive detection of NH3 at ambient temperature.
- G-S gas sensor demonstrates fast-response and high stability , and enhanced sensitivity with lower detection limits.
- G-S gas sensor maintains detection limit down to 5 ppm NH3 at 25 °C, resolution down to 2.6 Ω/ppm
- Contribution: the G-S gas sensor offers a potential prospect for widespread NH3 monitoring under standard environment conditions in daily applications.



Graphene-SnO_2 gas sensor structure and characterization

Notes

Technical Special Session 29
Design, Analysis and Control of Nano-Manipulating Systems (ss)

Room 5

8:00-10:00 Thursday, 1 August

Chair: Zhen Zhang

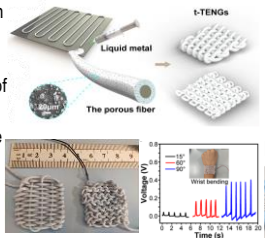
Co-Chair: Peng Yan

29-4 08:51–09:08

Direct Writing of Porous Elastomeric Fiber for Engineering Meso/Micro TENG

Yu Liu, Xinghao Zhang
School of Mechanical Engineering, Jiangnan University, China

- Simultaneous evaporation and foaming methodology proposed for the fabrication of porous elastomeric
- The above methodology is integrated with direct ink writing for the production of elastomeric fiber
- Fiber surface micro/nano porosity can be regulated through the formulation of material ratios
- Woven structure design developed for high electrical performance



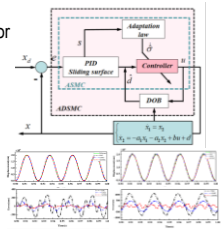
Notes

29-5 09:08–09:25

Disturbance Observer Based Adaptive Sliding Mode Control for Fast Tool Servo System

Yajie Jing, Xiaochen Hu, Qingkuo Feng, Pengbo Liu*, Shuaishuai Lu, Zhiming Zhang
School of Mechanical Engineering Qilu University of Technology
Shandong Institute of Mechanical Design and Research
School of Mechanical and Electrical Engineering Jining University
Jinan, China

- The adaptive sliding mode control is proposed for the tracking control of FTS considering system uncertainties.
- An exponentially convergent disturbance observer is developed on top of the ASMC structure to further improve the anti-disturbance performance.
- Experiments on the FTS prototype demonstrate good tracking performance and robustness, as well as anti-disturbance capability.



The DOB-based adaptive sliding mode control structure

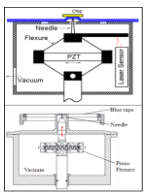
Notes

29-6 09:25–19:42

Positive Motion Control of a Piezo-Driven Flexure Micro-Positioning Stage for Chip Peeling

Huaxian Wei
State Key Laboratory of Precision Electronic Manufacturing Technology and Equipment & Shantou University, Guangzhou, China

- The process of ejecting and peeling the chip from the blue tape can easily lead to chip damage
- It is of great importance to realize positively synchronous control of motion and force exerted on the chip during the ejection process
- This paper developed a piezo-driven flexure micro-positioning stage for chip ejection which can realize positively synchronous control of motion and force



The piezo-driven flexure ejection system

Notes

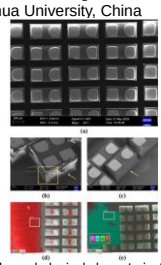
Technical Special Session 29
Design, Analysis and Control of Nano-Manipulating Systems (ss)
Room 5
8:00-10:00 Thursday, 1 August
Chair: Zhen Zhang
Co-Chair: Peng Yan

29-7 09:42–10:00

Bonding Process for Micro-LEDs on Polyimide Sacrificial Layer Supporting Laser-Induced Mass Transfer

Zhenghua Ma, Yuxuan Cao and Zhen Zhang*
Department of Mechanical Engineering, Tsinghua University, China

- A novel coating-bonding-baking method is proposed using a PI sacrificial layer for laser mass transfer of Micro-LEDs;
- The efficiency of the bonding process is quantitatively assessed by defining bonding success ratio and embedding depth ratio;
- Reactive Ion Etching removed the excess PI sacrificial layer surrounding the Micro-LEDs and the residues on the sidewalls.



SEM morphological characterization and EDS results.

Notes

Technical Special Session 30
Detection of Cell and Cell Antigen (ss)

Room 6

8:00-10:00 Thursday, 1 August

Chair: Hao Zhang

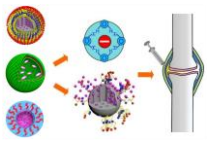
Co-Chair: Kaige Qu

30-1 08:00–08:15

Development of Lubricating Nanoparticles for the Treatment of Early Osteoarthritis

Hongyu Zhang
Department of Mechanical Engineering, Tsinghua University, China

- Biomimetic nanoparticles are developed with enhanced lubrication and drug delivery properties.
- The nanoparticles are biocompatible and can protect chondrocytes from degradation.
- The nanoparticles effectively inhibit progression of osteoarthritis via an *in vivo* study.
- The nanoparticles can be a promising strategy to treat early osteoarthritis by intra-articular injection.



Design and application of dual-functional nanoparticles

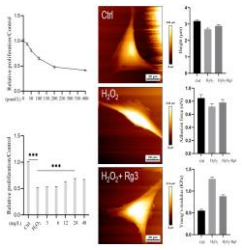
Notes

30-2 08:15–08:30

Study on the Mechanical Properties of Ginsenoside Rg3 in Protecting Cardiomyocytes from Oxidative Damage

Shuwei Wang
Affiliated Hospital of Jilin Medical University, China

- H_2O_2 inhibited the activity of neonatal cardiomyocytes
- Prior administration of Ginsenoside Rg3 enhances the reduction in cardiomyocyte viability caused by H_2O_2.
- Rg3 protects cardiomyocytes and has a key correlation with cell mechanical properties



Notes

30-3 08:30–08:45

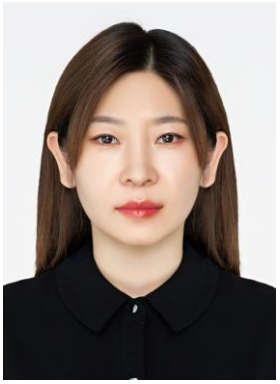
Rapid Detection of Four Foodborne Pathogens Based on Terahertz Time Domain Spectroscopy

Wenzhi Bian
School of Life Science and Technology, Changchun University of Science and Technology, China

- The accuracy of clustering software analysis results is 100 %, which shows that the method has good stability and specificity. The detection limit of Cronobacter sakazakii is 1%.
- Successfully established the method of terahertz time-domain spectroscopy detection for foodborne pathogenic bacteria. This method is rapid, stable and sensitive, and has a broad application prospect.

Notes

Technical Special Session 30
Detection of Cell and Cell Antigen (ss)
Room 6
8:00-10:00 Thursday, 1 August
Chair: Hao Zhang
Co-Chair: Kaige Qu



30-4 08:45–09:00

The Role of Exercise Intervention on Insulin Resistance

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

- Insulin resistance (IR) refers to the decrease of insulin sensitivity and the insensitivity of the body to insulin.
- Exercise is a non-drug intervention to prevent and treat IR.
- In this article, the pathogenesis of insulin resistance are reviewed.
- The mechanism of intervention of exercise on insulin resistance is combed.

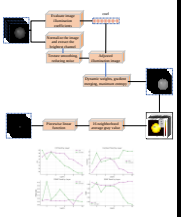
Notes

30-5 09:00–09:15

Fluorescence Feature Image: Fluorescence Enhancement Method Based on Illumination Adaptation

Lemin Shi
School of Computer Science and Technology,
Changchun University of Science and Technology, Changchun, China

- A dynamic lighting adaptation method is proposed
- Locate high-intensity signal areas via heatmaps
- Improve image details using piecewise linear strategies
- Using Cycle-GAN network for fluorescence feature compensation
- This paper proposes a fluorescence image enhancement method based on dynamic illumination, heat map positioning, piecewise linearity and Cycle-GAN to improve fluorescence feature recognition accuracy and image quality



Algorithm flowchart

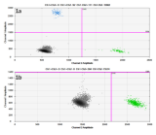
Notes

30-6 09:15–09:30

Establishment of a Detection Methodology for CAR-T Cell Vector Copy Number Using Droplet Digital PCR

Xiao Xiao[1], Le Gao[2], Yuanhua Yu[2], Xinyu[2] Chen[1]
[1]School of Physis, Changchun University of Science and Technology, China
[2]School of Life Science and Technology, Changchun University of Science and Technology, China

- A detection method for the copy number of CAR-T cell vectors based on ddPCR was established.
- The limit of detection (LOD) was 0.05%.
- The CV values for both high and low precision standard samples are less than 5%.



ddPCR method for detecting the copy number of CAR-T cell vectors (Note: Figure 1a is the positive sample detection graph, Figure 1b is the negative sample detection graph)

Notes

Technical Special Session 30
Detection of Cell and Cell Antigen (ss)

Room 6

8:00-10:00 Thursday, 1 August

Chair: Hao Zhang

Co-Chair: Kaige Qu

30-7 09:30–09:45

Stability Study of Leukocyte Differentiation Antigen CD34 (Flow Cytometry-PE) Detection Kit

Han Liu

School of Life Science and Technology, Changchun University of Science and Technology[1] Changchun Institute of Biological Products Co.,Ltd.,[2] China

- Evaluate appearance, accuracy, precision, and conduct staining stability experiments
- The kits remained stable when stored at 4℃ for 24 months and transported at 4℃ for 7 days
- The kits remained stable when opened for 18 months and incubated at 37℃ in the dark for 4 weeks
- Samples could be stored at 4℃ in the dark for 48 hours before staining and 24 hours after staining

Notes

30-8 09:45–10:00

Performance Verification for Leukocyte Differentiation Antigen CD34 Assay Kit by Flow Cytometry

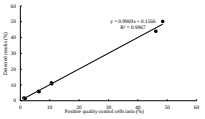
Anqi Sheng

School of Life Science and Technology

Changchun University of Science and Technology

Changchun, China

- CD34 PE assay kit was used to perform performance verification with linear range, precision, accuracy and specificity.
- CD34 assay kit was linear in the percentage of positive cells and positive cell concentration in the range of 30-3×10^3 count/μL positive cells.
- The CD34 assay kit has a correlation and high consistency with commercial kit (BD).
- Hemolysis and high-fat samples have no significant effect on CD34 Assay Kit.



Correlation analysis of CD34 assay kit with commercial reagent

Notes

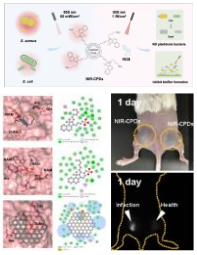
Technical Special Session 31
Med-X (workshop)
Room 1
10:20-12:20 Thursday, 1 August
Chair: Qing Cai
Co-Chair: Min Wang

31-1 10:20–10:35

The NIR-CPDs for NIR-II Bioimaging and Therapy of Bacterial Infection

Qing Cai
School and Hospital of Stomatology, Jilin University, P. R. China

- The core-shell structure of the NIR-CPDs facilitates an increase in fluorescence brightness and photostability
- The NIR-CPDs exhibit selective bacterial-targeting properties
- The NIR-CPDs exhibit potent photodynamic effects that target and damage bacterial membranes
- Not only precise imaging capabilities but also significant therapeutic efficacy demonstrated in wound healing



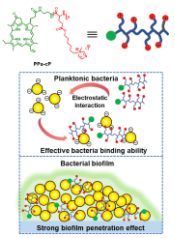
Notes

31-2 10:35–10:50

Photosensitizer-Polypeptides Conjugate with Synergistic Antibacterial Efficacy

Pengqi Wan, Chunsheng Xiao*
Changchun Institute of Applied Chemistry, Chinese Academy of Sciences, China

- Continuous bacterial resistance has emerged as one of the most serious threats to human health.
- A series of photosensitizer-polypeptides conjugate (PPa-cP) were readily synthesized.
- The cationic PPa-cP showed effective antibacterial activity against bacterial under light irradiation.
- PPa-cP could significantly eradicate S. aureus biofilm due to its potent penetration ability into S. aureus biofilms.
- The PPa-cP provides a new approach for the treatment of bacteria and bacterial biofilm infections.



Notes

31-3 10:50–11:05

Femtosecond Laser “Dual 3D” Fabrication of Smart Micro/Nanoactuators

JiaYi Wan
State Key Laboratory of Integrated Optoelectronics, Jilin University, China

- Femtosecond laser direct writing processing true three-dimensional, high-precision, programmable intelligent micro-nano robots
- Bio-inspired miniature tunable imaging system based on smart protein for artificial compound eyes
- Flexible integration of microactuators with devices or appliances enables the development of complex sensing and actuation systems.

Notes

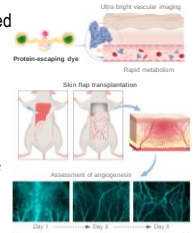
Technical Special Session 31
Med-X (workshop)
Room 1
10:20-12:20 Thursday, 1 August
Chair: Qing Cai
Co-Chair: Min Wang

31-4 11:05–11:20

NIR-II Protein-Escaping Dyes Enable Long-Term Prognosis Evaluation of Flap Transplantation

Yijing Du
College of Chemistry, Jilin University, China

- Highly bright protein-escaping NIR-II dyes possessed fast excretion and excellent imaging contrast
- Continuous monitoring of vascular reconstruction and tissue necrosis in flap transplantation
- Protein-escaping strategy for various cyanine dyes for two-color imaging
- Long-term intraoperative blood supply monitoring of flaps



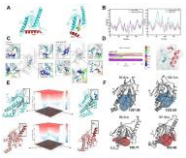
Notes

31-5 11:20–11:35

Molecular Dynamics Simulati onto Study the Mode of Action of Alzheimer's Disease-Associated Proteins with Ligands

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

- The mutated residues may affect the interaction between mutant Mint2 and APP
- APP has a better afnity for binding to mutant Mint2 than to WT Mint2
- The mutant Mint2's active pocket shrinks, which is advantageous for APP binding
- Molecular dynamics simulations were used to reveal the effect of Mint2 mutation



Illustrations of the mode of action of Alzheimer's disease-associated proteins with ligands

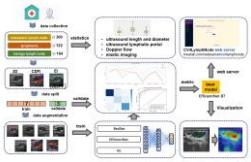
Notes

31-6 11:35–11:50

Application of Deep Learning Based on Convolutional Neural Network Model in Multimodal Ultrasound Diagnosis of Unexplained Cervical Lymph Node Enlargement

Shanshan Jiang
Harbin Medical University, China

- CDFI,2D and EI lymph node images were collected from 586 patients from three hospitals
- Retrospectively analyzed multimodal ultrasound findings and clinical characteristics of cervical lymph node enlargement
- Using multiple CNNs for diagnosis classification, the accuracy rate reached 88%
- Built CV4LymphNode webserver and can predict online (hwwlab.com/webserver/cv4lymphnode)



Workflow of the study

Notes

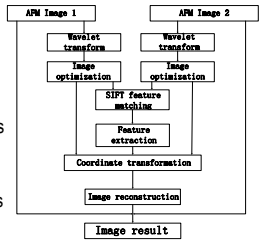
Technical Special Session 31
Med-X (workshop)
Room 1
10:20-12:20 Thursday, 1 August
Chair: Qing Cai
Co-Chair: Min Wang

31-7 11:50–12:05

Research of AFM Image Matching Based on Wavelet Transform SIFT Algorithm

Liguo Tian
International Research Centre for Nano Handing and Manufacturing of China , Changchun University of Science and Technology, Changchun

- This study was developing a SIFT algorithm based on the optimization of wavelet transform.
- To enhance the detection accuracy and dynamically expressed features in images acquired through AFM.
- Our method is simple, has good reliability, enhances imaging efficiency, and expands the detection range.



AFM image matching flowchart

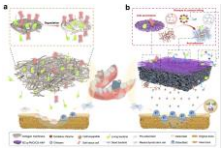
Notes

31-8 12:05–12:20

All-in-One Guided Bone Regeneration Membrane Based on Spatiotemporally Hierarchical Structure

Shulu Luo, Yan Li*
Hospital of Stomatology, Guanghua School of Stomatology, Sun Yat-sen University, China

- Spatiotemporally hierarchical bilayer membrane owns dense nanonetwork facing gingiva and loose micro-network facing alveolar bone
- The dense layer maintains regeneration space, blocks fibroblasts, and prevents bacterial invasion with multiple mechanisms
- The loose layer seals bone defects and enables ingrowths of osteogenesis-associated cells, creating favorable osteogenic microenvironments
- The all-in-one membrane enables full protection and osteogenic promotion, a promising material for guided bone regeneration



Schematic illustration of structures and protective behaviors in commercial collagen membrane and all-in-one membrane

Notes

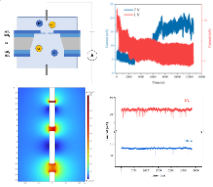
Technical Session 32
Nanomaterials and Nanoassembly
Room 2
10:20-12:20 Thursday, 1 August
Chair: Istvan Szilagyi
Co-Chair: Fan Yang

32-1 10:20–10:35

Controlling the Solid-State Nanopore Size Using Electric Fields

Shulei Liu
School of Mechanical Engineering, Southeast University, China

- Propose a simple method for controlling the pore size of solid-state nanopores
- Judge pore size changes by observing the current feedback
- Analyze the relationship between the electric field across the nanopore and the pore size.
- Verify the detection capabilities of nanopores with different pore sizes for different biomolecules



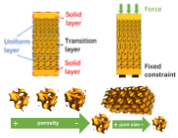
Notes

32-2 10:35–10:50

Effect of Functional Grading on The Performance of Triply Periodic Minimal Surface Scaffolds

Pan Wang
School of Mechanical Engineering, Southeast University, China

- The strength problem of transition layer in gradient scaffolds is investigated by finite element simulation.
- The strength of the porosity gradient scaffold depends on the region with the highest porosity.
- Stress concentration exists in the transition layer of pore size gradient scaffolds.
- The research of gradient scaffolds can provide reference for the design of related structures.



Structure and simulation model of gradient scaffold

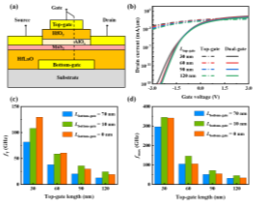
Notes

32-3 10: 50–11:05

Enhanced Electrical Performance of Short-Channel MoS_2 Transistors through Dual-Gate Structures

Junzhou Chen, Qingguo Gao*, Lu Cheng, Zijian Huang, Shuting Wei, Xinjian Pan, Ping Liu
University of Electronic Science and Technology of China Zhongshan Institute
gqgemw@163.com

- Established and calibrated a bilayer MoS_2 transistor model in Sentaurus.
- Dual-gate MoS_2 transistors improve DC performance under short-channel conditions.
- Both dual-gate and top-gate achieve f_T and f_{max} over 100 GHz for sub-50 nm gates.



The dual-gate structure improves the DC performance, and achieving f_T and f_{max} over 100 GHz

Notes

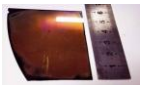
Technical Session 32
Nanomaterials and Nanoassembly
Room 3
10:20-12:20 Thursday, 1 August
Chair: Istvan Szilagyi
Co-Chair: Fan Yang

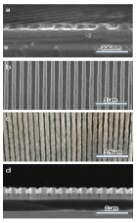
32-4 11:05–11:20

Periodic Silicon Metasurfaces for High Ferformance Structural Color

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

- A new method for making large-area medium structural color.
- Finding the brightest structural color parameters by FDTD simulation.
- Using PhableR-100C exposure system to process a 2 inch sample.


actual picture


SEM pictures of preparation process

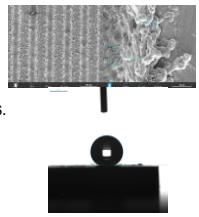
Notes

32-5 11:20–11:35

Preparation of Patterned Microstructures with Superhydrophobicity on Stainless Steel

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

- Fabrication of super-hydrophobic patterned microstructures on stainless steel surface by laser direct writing.
- The morphology and size of microstructure are controlled by changing laser processing parameters.
- Using fluorosilane to reduce the surface energy of treated samples
- The best surface contact angle is 168.1°, which is super-hydrophobic surface



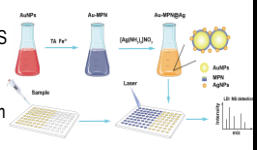
Notes

32-6 11:35–11:50

Au-MPN@Ag Nanocomposite-Assisted Mass Spectrometry for Metabolite Detection

Qi Sang, Yanyan Li, Wanshan Liu, Yuning Wang*, Kun Qian*
State Key Labtoratory of Systems Medicine for cancer, School of biomedical Engineering, Institute of Medical Robotics and Shanghai Academy of Experiment Medicine , Shanghai Jiao Tong University, China

- We synthesized a novel noble metal based nanocomposite Au-MPN@Ag
- Au-MPN@Ag nanocomposite based LDI-MS platform achieved direct detection of metabolites in biofluids
- Our work provided a new advanced platform for metabolic analysis towards in vitro diagnostics



Notes

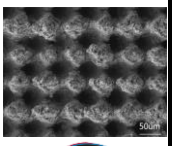
Technical Session 32
Nanomaterials and Nanoassembly
Room 2
10:20-12:20 Thursday, 1 August
Chair: Istvan Szilagyi
Co-Chair: Fan Yang

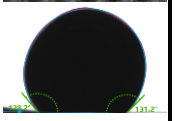
32-7 11:50–12:05

Study on the Wettability of Liquid Metal to Microstructures Fabricated by Laser Direct Writing

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

- The microstructures with different topography and sizes on copper sheets were fabricated by laser direct writing and the microstructures were replication on polydimethylsiloxane by template method to study the wettability of liquid metal.
- The processing parameters of laser power, scanning speed, and spacing were considered to controll the topography and sizes of grid microstructures which had effect on hydrophobicity of liquid metals.
- The square grid microstructures with priod of 50um and feature size of 100nm were obtained and the contact angle of liquid metal was 130° .





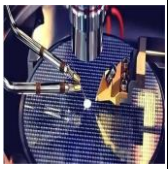
Notes

32-8 12:05–12:20

PGC-Arctan Demodulation Method Based on Improved IKEF

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

- Propose a compensation scheme for demodulation acc uracy of the PGC-arctan algorithm.
- The algorithm uses the L-M method to adjust the predic ted covariance matrix to ensure global convergence.
- Establish a Kalman filter state-space obser- vation mo del composed of PGC orthogonal component para meters.
- Perform optimal estimation and correction of the amplit ude and bias of the PGC demodulation orthogonal com ponents.



Precision chip manufacturing process

Notes

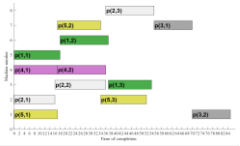
Technical Session 33
Nanomechanics and Nanomechatronics
Room 3
10:20-12:20 Thursday, 1 August
Chair: Wei Zhang
Co-Chair: Chuanchuan Guo

33-1 10:20–10:37

Multi-Objective Flexible Job-Shop Scheduling Problem with Improved NSGA2 Algorithm

Hongyi Xu
School of Engineering, Hu Zhou University, China

- Parameter adaptive strategy was proposed to realize adaptability of individual crossover and mutation probability.
- BAS was used to carry out a second search avoid falling into local optimal.
- A population initialization method was designed based on three optimization objectives.



Gantt chart of product production task scheduling

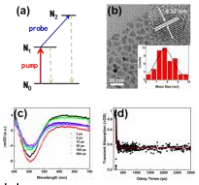
Notes

33-2 10:37–10:54

Ultrafast Carrier Dynamics in InP/ZnS Core-Shell Quantum Dots

Yanmin Xu
School of Communication and Information Engineering,
Xi'an University of Science and Technology, China

- The ultrafast carrier dynamics in the InP/ZnS core/shell quantum dots is investigated.
- Femtosecond time-resolved transient absorption technique is used.
- Carrier relaxation consists of hole states trapping, defect states capture and carrier radiative recombination processes.
- This work offers a useful reference for design the high efficiency photoelectric devices.



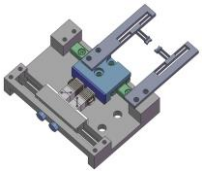
Notes

33-3 10:54–11:11

Design of a Stick-Slip Actuated Microgripper with a Large Motion Stroke

Beichao Shi, Zhichen Huo, Fujun Wang*, Yanling Tian, Cunman Liang, Xiubing Jing
Key Laboratory of Mechanism Theory and Equipment Design of Ministry of Education, Tianjin University, Tianjin, 300072, China
2.School of Engineering University of Warwick, Coventry CV4 7AL, UK

- A stick-slip actuated microgripper with millimeter scale operation stroke is proposed.
- A T-shaped compliant mechanism composed of four leaf-type compliant hinges is developed.
- The actuating principle of the longitudinal-shear PZT actuator and the microgripper is illustrated.
- It can be seen that the maximum deformation of the weak stiffness object is 9.39 μm.



The structure diagram of the stick-slip actuated microgripper

Notes

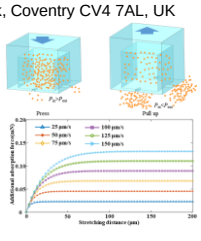
Technical Session 33
Nanomechanics and Nanomechatronics
Room 3
10:20-12:20 Thursday, 1 August
Chair: Wei Zhang
Co-Chair: Chuanchuan Guo

33-4 11:11–11:28

Adhesion Force Modeling of Octopus-Like Stamp for Micro Transfer Printing

Cunman Liang[1*], Fujun Wang[1], Pan Li[2], Beichao Shi[1], Yanling Tian[3], Dawei Zhang[1]
1. Key Laboratory of Mechanism Theory and Equipment Design of Ministry of Education, Tianjin University, China
2. College of Mechanical Engineering, Tianjin University of Science and Technology, China
3. School of Engineering, University of Warwick, Coventry CV4 7AL, UK

- A novel octopus-like stamp is designed, which consists of micro chamber and micro channel
- The additional adhesion force model of the stamp is established, according to the Navier-Stokes equation and the first law of thermodynamics;
- The effects of stretching distance and velocity on the additional adhesion force of the stamp are investigated.



Notes

33-5 11:28–11:45

Research on Low-Loss Flow Detection Method Based on Pressure Feedback

Bo Liu[1] , Zhian Zhang[2] , Dong Li[2],
1. Jilin Zhongke Instrument Technology Co., Ltd., Changchun, China
2. Suzhou Institute of Biomedical Engineering and Technology, Chinese Academy of Sciences, SuZhou, China

- The experimental platform consists of a 488 nm laser, a liquid path system, and a scattered light collection device
- By identifying the dramatic pressure fluctuations caused by the air cushion, we accurately located the time when the sample reached the detection area
- The sample loss can be controlled within 5 μl, with a 5 to 50 μl/min injection flow rate, and a 10 to 50 μl sample volume

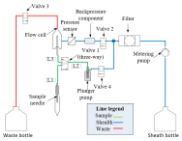


Fig. 1. Schematic diagram of fluidic circuit

Notes

33-6 11:45–12:02

Fractional Order PID Control of Micro Nano Positioning Platform

Lina Hao, Liu Meng, Huiming Qi, Zhang Ying*
Department of Mechanical Engineering Automation
Northeastern University, China

- A fuzzy fractional-order PID controller to compensate for the hysteresis behavior of piezoelectric ceramics
- Integrating fuzzy theory and designning membership functions and fuzzy rules to mitigate the hysteresis effects
- The effectiveness of the controller has been verified through experiments

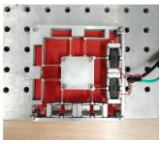


Figure Physical image of micro nano positioning platform

Notes

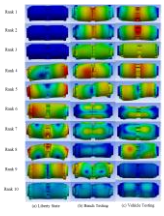
Technical Session 33
Nanomechanics and Nanomechatronics
Room 3
10:20-12:20 Thursday, 1 August
Chair: Wei Zhang
Co-Chair: Chuanchuan Guo

33-7 12:02–12:20

Model Analysis of the Gear Box of the Electromechanical Transmission

Jiajing Zhu, Hui Sheng, Daqian Pang, Shenlong Li, Zhenglong Yang, Zhanchun Sun
Science and Technology on Vehicle Transmission Laboratory, China North Vehicle Research Institute, Beijing
Yanling Tian
School of Engineering, University of Warwick, Coventry
Zuobin Wang
International Research Centre for Nano Handling and Manufacturing of China, Changchun Universityh of Science and Technology,Changchun

- The first 10 modes of gear box of Electromechanical Transmission System under three constraints are calculated and the results are analyzed.
- It can be observed that the modal variation trend of the gear box in the free state is quite different from that under the fixed constraints of the bench testing and the vehicle testing
- The modal variation trend of the gear box is similar under the fixed constraints of the bench testing and the vehicle testing.
- Therefore, it is essential to pay more attention the vibration condition of this point in the subsequent optimization design process, so as to avoid the system working in the resonance interval effectively.



Three dimensional diagram of 10 modal formations of the gear box under three constraints

Notes

Technical Session 34
Nanopositioning and Nanomanipulation

Room 4

10:20-12:20 Thursday, 1 August

Chair: Menglin Chen

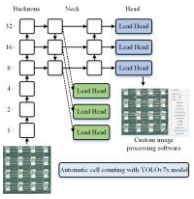
Co-Chair: Xiaomin Wu

34-1 10:20–10:37

Automatic Cell Counting with YOLOv7x for Digital Microfluidic Applications

Zhiqiang Jia
College of Mechanical and Electrical Engineering, Changchun University of Science and Technology, China

- An annotated dataset for the AM-DMF biochip
- An AI-enabled automatic cell counting method to overcome the limitations of manual cell counting
- A custom image processing software, leveraging the graphical user interface application framework QT
- The mAP_{50} value on the test dataset is 95.3%



Automatic cell counting with YOLOv7x model for active-matrix digital microfluidic applications

Notes

34-2 10:37–10:54

Development of an Electronic Target-Type Optical Performance Calibration Device for Medical Rigid Endoscopes

Lin Liu
Key Laboratory of Jilin Province Measurement and Testing Instruments and Technology, Jilin Institude of Metrology , China

- This article uses an electronic target display screen as the target generator
- The high integration of the device makes it easy to carry to the site
- The device has implemented software automatic recognition and processing

Medical endoscope optical performance testing device

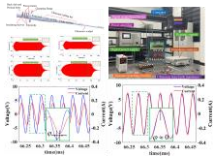
Notes

34-3 10:54–11:11

Study of a Dynamic Impedance Matching Method for Ultrasonic Bone Knife Transducer

Junqiang Wu, Hongjie Zhang ,Yangchun Cai
School of Mechanical Engineering, Tiangong University, China

- We designed a closed-loop control system for dynamic impedance matching of ultrasonic bone knife transducer
- Dynamic impedance calculation model was developed
- The electrical characteristic parameters are obtained and the calculation of the matching inductance value is realized
- The steady state output amplitude of the current is significantly improved



Structure and exciting trials of the proposed transducer

Notes

Technical Session 34
Nanopositioning and Nanomanipulation

Room 4

10:20-12:20 Thursday, 1 August

Chair: Menglin Chen

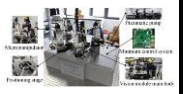
Co-Chair: Xiaomin Wu

34-4 11:11–11:28

Development of a Micromanipulator Robot Based on Four Micropipettes for Multicellular Operation

Fangxin Chen
Xlab, Jihua Laboratory, China

- Developed a micromanipulator robot with four micropipettes
- Design a movement method for micropipettes based on vision and coordinate mapping
- Proposed an operation strategy for the multicellular manipulation with dual visual field
- This paper presents a micromanipulator robot system for automatic multicellular operation



Micromanipulator robot system

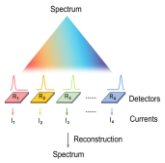
Notes

34-5 11:28–11:45

A Convolution Neural Network Based Algorithm for More Accurate Spectrum Reconstruction of Miniaturized Spectrometers

Jiayi Ye
ZJU-UIUC Institute, Zhejiang University, China

- Proposed a neural network-based reconstruction algorithm for miniaturized spectrometers addressing insufficient device responsivities.
- Incorporate a matrix similarity computation method, superseding the conventional approach of resolving underdetermined equation sets.
- Exhibiting unique advantages in both image quality and parameters comparing to other algorithms.



The workflow of miniaturized spectrometer

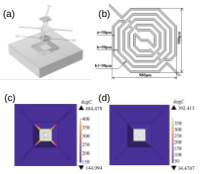
Notes

34-6 11:45–12:02

Structural Design and Optimization of MEMS Gas Sensor Microhotplate

Deyuan Meng
School of Mechano-Electronic Engineering,
Xidian University, China

- The MEMS gas sensor microhotplate designed in this paper proposes novel shapes of electrode.
- After optimization, the temperature gradient of the microhotplate is reduced from 15.6% to 6.6%.
- The standard deviation of the temperature in the effective working area is 0.465 ℃.
- Only 9.14 mW is needed to reach 390℃.



(a)suspended-film structure, (b)The heating electrode shape, Surface temperature distribution of the gas sensor: (c)before optimization, (d)after optimization.

Notes

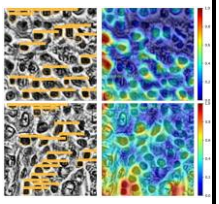
Technical Session 34
Nanopositioning and Nanomanipulation
Room 4
10:20-12:20 Thursday, 1 August
Chair: Menglin Chen
Co-Chair: Xiaomin Wu

34-7 12:02–12:20

LCI-YOLOv8: A Lightweight Model Based on Modified YOLOv8 for Cells

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

- Partial Convolution and dilation wise residual to YOLOv8 for lightweight improvements
- Sliding Local Attention into YOLOv8, balancing precision with model complexity
- Migrated and Validated model on DR-Narin cell dataset
- Addressed lightweight and small object detection issues in cell image detection



Notes

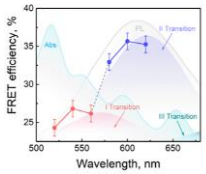
Technical Session 35
Preparation of Nanoparticles and Applications
Room 5
10:20-12:20 Thursday, 1 August
Chair: Alexey E. Romanov
Co-Chair: Jin Yan

35-1 10:20–10:37

Luminescent Quantum Nanocrystals: Opportunities and Limitations in Life Science Applications

Anna Orlova
PhysNano Department, ITMO University, Russia

- Quantum Dots have been combined with photosensitizers for ROSenhancement by FRET and ET



T. O. Oskolkova et al. ChemNanoMat 2024, 10, e202300469.

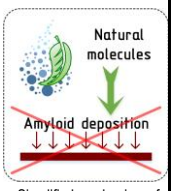
Notes

35-2 10:37–10:54

Molecular Mechanisms of Amyloid Blockage Under Natural Compounds and Its Nanoformulations

Svetlana N. Morozkina
Institute of Advanced Data Transfer Systems, ITMO University, Russia

- At least 40% of drugs introduced into the clinical practice are represented by natural compouds.
- Natural compounds possess a wide range of biological activity with minimum side-effects.
- The understanding of natural products mechanisms of action on amyloid blockage is the way for rational drug discovery to the treatment of social diseases such as cardiac amyloidosis, Alzheimer, Parkinson diseases over the World.
- Drug delivery system of tafamidis and diflunisal based on biosafe and biodegradable hyaluronic acid has been developed.



Simplified mechanism of amyloid blockage

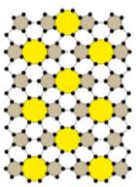
Notes

35-3 10:54–11:11

Disclinations in Nanoobjects and Graphene

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

- Disclinations are defects of rotational type in solids with specific elastic fields and energies
- Disclination properties become the controlling factors when considering various phenomena in solids
- Disclinations are responsible for stability of pentagonal rods and icosahedral micro- and nanoparticles
- Disclinations are the only natural defects in graphene and pseudo-graphenes that form defective 4-, 5-, 7-, and 8-member carbon rings



An example of pseudo-graphene 5-8-5 A

Notes

Technical Session 35
Preparation of Nanoparticles and Applications

Room 5

10:20-12:20 Thursday, 1 August

Chair: Alexey E. Romanov

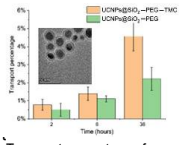
Co-Chair: Jin Yan

35-4 11:11–11:28

Advanced Upconversion Nanoparticles for Enhanced Endothelial Barrier Transport

Chao Lu, Jin Zhang*
Department of Chemical and Biochemical Engineering, University of Western Ontario, Canada

- Core-shell upconversion nanoparticles (UCNPs@SiO2) were successfully produced.
- The surface of the core-shell UCNPs was modified with a cationic polymer.
- An in vitro endothelial barrier was developed.
- Suitable surface modification enhances the transport of UCNPs across the endothelial barrier



Transport percentage of core-shell with the surface modification across the Endothelial barrier in 36 hours

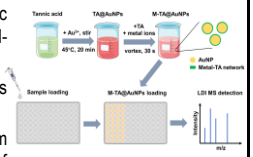
Notes

35-5 11:28–11:45

Metal Ion-Tannic Acid Network-Coated Gold Nanoparticles for Metabolite Analysis by Laser Desorption/Ionization Mass Spectrometry

Tong Hu, Dingyitai Liang, Chunmeng Ding, Ziyue Zhang, Yuning Wang*, Kun Qian*
State Key Laboratory of Systems Medicine for Cancer, Shanghai Jiao Tong University, China

- We successfully synthesized metal ion-tannic acid network-coated gold nanoparticles (M-TA@AuNPs)
- M-TA@AuNPs were used as novel matrices in LDI MS for detection of small motabolites
- The M-TA@AuNPs-based LDI MS platform was successfully used in the analysis of complex biofluids



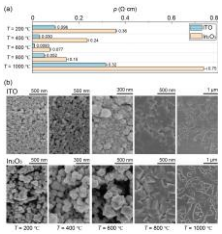
Notes

35-6 11:45–12:02

Effect of Laser Sintering Parameters on Semiconductor Nanoparticle Coarsening

Xiangyu Chen, Jianqin Zhu, Zhi Tao, Lu Qiu*
School of Energy and Power Engineering, Beihang University, China

- Temperature rise of semiconductor nanoparticle (NPs) sintering was investigated by different laser parameters
- Temperature-dependent absorbance of semiconductor NPs is critical in temperature rise of laser sintering
- Significant differences in electrical properties and microscopic morphology between different sintered and molten semiconductor materials



Electrical properties and microscopic morphology of laser sintered ITO and In_2O_3 NPs

Notes

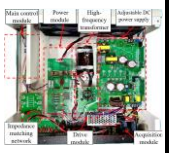
Technical Session 35
Preparation of Nanoparticles and Applications
Room 5
10:20-12:20 Thursday, 1 August
Chair: Alexey E. Romanov
Co-Chair: Jin Yan

35-7 12:02–12:20

Megasonic Power Supply Design for Precision Cleaning of Nanoimprint Stencils

Zecheng Yao, Yanxing Liu, Xiangyu Zhu,
Liangxuan Yang, Zhili Long
School of Mechanical Engineering, Dongguan University of Technology
School of Mechanical and Electrical Engineering, Harbin Institute of Technology

- The cleanliness of the nanoimprint stencils affects the quality of the lithography process, and it is essential to clean it precisely
- Megasonic cleaning can remove particles smaller than 0.2μm, with minimal damage to the nanoimprint stencils
- For ultra-high operating frequency, a new power conversion and control scheme, a high-frequency transformer and an impedance matching network are designed
- The megasonic power supply can continuously and stably output 400W and 1-3MHz electrical signals



Notes

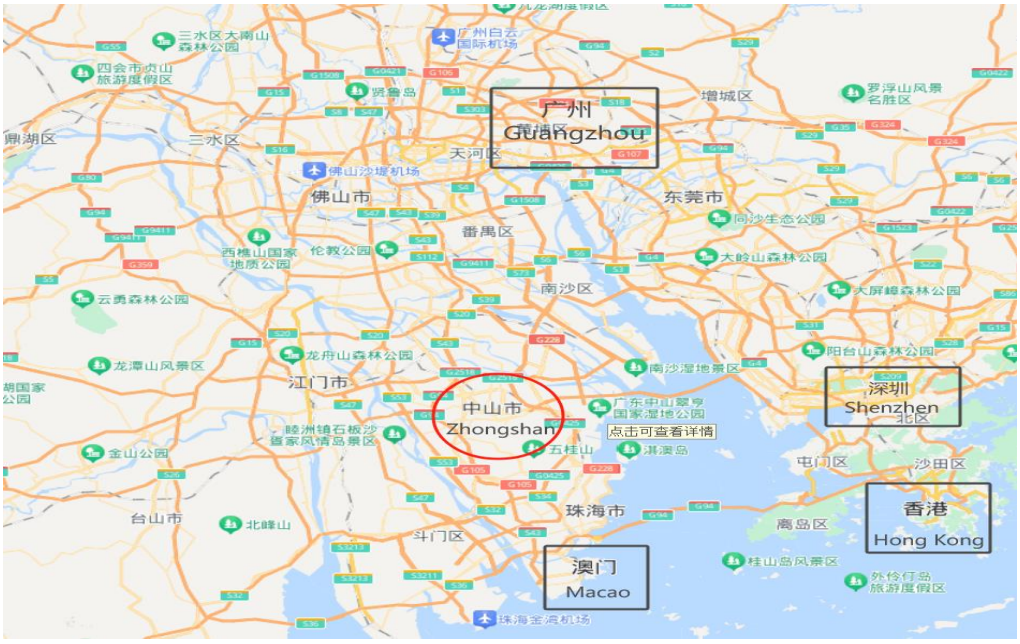
General Information

Overall

Zhongshan City, formerly known as Xiangshan, is located in Guangdong Province, and it is a national historical and cultural city. The Xiangshan culture, originated in Zhongshan, is an important source of modern Chinese culture. It enjoys the reputation as the hometown of Cantonese opera. Zhongshan is also the hometown of Dr. Sun Yat-sen, is a national AAAAA level tourist attraction in Zhongshan City. In addition, Zhongshan is one of the birthplaces of Canton cuisine. Its food is famous throughout the country and the world [1].

Prime location

Zhongshan is situated in the Pearl River Delta Region of Guangdong Province, and it is geographically connected with Guangzhou on the north [2]. Situated in the south of China, Zhongshan is the geometric center of the Guangdong-Hong Kong-Macao Greater Bay Area, with five international airports in Zhuhai, Shenzhen, Guangzhou, Hong Kong and Macao, as well as four deep-water ports, namely, Nansha Port, Yantian Port, Shekou Port and Gaolan Port, within a radius of 90 km [1].



Specialty

Zhongshan is one of the birthplaces of Canton cuisine. Its food is famous throughout the country and the world. "Eating in Zhongshan" is the consensus of compatriots, as well as overseas compatriots [1].


Shixia Longan


Maoshengwei Banana


March Red Litchi


Shenwan Pineapple


Huangpu Cured Meat


Shiqi Squab


Zongzi in Bamboo Shoots


Giant Freshwater Prawn


Zhongshan Crisped Grass Carp

Tourist

The Museum of Dr. Sun Yat-sen

Tourism Area of Sun Yat-sen Hometown is a national AAAAA level tourist attraction in Zhongshan City, Guangdong Province [1]. The 140-thousand-square-meter museum is a national protection unit of cultural relics [4]. According to the functions, the museum has three approved organization names - "Museum of Dr. Sun Yat-sen", "Zhongshan Folklore Museum" and "Zhongshan Institute for Sun Yat-sen Studies" [3].

References:

[1] http://www.zs.gov.cn/ywb/aboutzhongshan/

[2] http://www.zs.gov.cn/ywb

[3] https://sunyat-sen.org/portal/list/index.html?id=225

[4]http://www.zs.gov.cn/ywb/aboutzhongshan/touristroutes/content/post_1637051.html

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Changchun University of Science and Technology

7089 Weixing Road, Chaoyang District, Changchun, China, 130022

Conference Venue

All sessions will be held at Hilton Zhongshan Downtown

Address: 16 3rd Zhongshan Road, Shiqi District, Zhongshan, Guangdong, China

Electricity

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

Dialing Codes

China International Country Code: +86

Zhongshan’s Local Area Code: 760

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MEMO

MEMO

MEMO