Conference Program

Digest

The 10th International Conference on Manipulation, Manufacturing and Measurement on the Nanoscale

IEEE 3M-NANO 2021

Xi'an, China

2 – 6 August 2021

Organized by:

Xi'an Jiaotong University, China

International Research Centre for Nano Handling and Manufacturing of China

Changchun University of Science and Technology, China

Aarhus University, Denmark

University of Warwick, UK

University of Bedfordshire, UK

Ministry of Education Key Laboratory for Cross-Scale Micro and Nano Manufacturing, China

International Joint Research Center for Nanophotonics and Biophotonics, China

State Key Laboratory of High Power Semiconductor Laser, China

International Society for Nano Manipulation, Manufacturing and Measurement

IEEE Nanotechnology Council

Sponsored by:

IEEE Nanotechnology Council

National Natural Science Foundation of China

Ministry of Science and Technology of the People's Republic of China

Research Executive Agency (REA), European Commission

Jilin Provincial Science & Technology Department

Xi'an Jiaotong University

International Research Centre for Nano Handling and Manufacturing of China

International Society for Nano Manipulation, Manufacturing and Measurement

Changchun University of Science and Technology, China

University of Bedfordshire, UK

University of Warwick, UK

Aarhus University, Denmark

University of Shanghai Cooperation Organization

Ministry of Education of the People's Republic of China

Greetings

On behalf of the organizing committee, it is our great pleasure and honor to welcome you in Xi'an at IEEE 3M-NANO 2021 conference!

3M-NANO is an annual International Conference on Manipulation, Manufacturing and Measurement on the Nanoscale, held for the tenth time in Xi'an. 3M-NANO covers advanced technologies for handling and fabrication on the nanoscale. The ultimate ambition of this conference series is to bridge the gap between nanosciences and engineering sciences, aiming at emerging market and technology opportunities. The advanced technologies for manipulation, manufacturing and measurement on the nanoscale promise novel revolutionary products and methods in numerous areas of application. Scientists working in different research fields are invited to discuss theories, technologies and applications related to manipulation, manufacturing and measurement on the nanoscale. IEEE 3M-NANO 2021 is proud to offer an excellent technical program containing 21 keynote talks on major conference topics delivered by distinguished researchers and around 180 presentations in parallel technical program.

Harald Fuchs
IEEE 3M-NANO 2021
Honorary Chair

Zhuangde Jiang
IEEE 3M-NANO 2021
General Chair

Kyle Jiang
IEEE 3M-NANO 2021
General Chair

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 2021 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 2021. Last but definitely not least, we thank all the conference participants for their support and contribution. We do hope that IEEE 3M-NANO 2021 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 Xi’an!

Table of Content

Greetings

IEEE 3M-NANO 2021 Committees 1

Advisory Committee 1

Organizing Committee 2

Program Committee 3

Conference Information 5

Venue and Accommodation 5

Floor Map of Conference Rooms 7

IEEE 3M-NANO 2021 8

Program at a Glance 8

Schedule of the Keynote Reports 10

Keynote Speakers 13

Technical Program 26

Technical Special Session 01 29

Technical Special Session 01 30

Technical Special Session 01 31

Technical Special Session 01 32

Technical Special Session 02 33

Technical Special Session 02 34

Technical Special Session 03 35

Technical Special Session 03 36

Technical Special Session 04 37

Technical Special Session 04 38

Technical Special Session 04 39

Technical Special Session 05 40

Technical Special Session 05 41

Technical Special Session 07 42

Technical Special Session 07 43

Technical Special Session 07 44

Technical Session 08 ..... **45**
Technical Session 08 ..... **46**
Technical Session 09 ..... **47**
Technical Session 09 ..... **48**
Technical Special Session 10 ..... **49**
Technical Special Session 10 ..... **50**
Technical Session 13 ..... **51**
Technical Session 13 ..... **52**
Technical Special Session 14 ..... **53**
Technical Special Session 14 ..... **54**
Technical Special Session 15 ..... **55**
Technical Special Session 15 ..... **56**
Technical Special Session 16 ..... **57**
Technical Special Session 16 ..... **58**
Technical Special Session 16 ..... **59**
Technical Special Session 17 ..... **60**
Technical Special Session 17 ..... **61**
Technical Special Session 17 ..... **62**
Technical Session 18 ..... **63**
Technical Session 18 ..... **64**
Technical Session 19 ..... **65**
Technical Session 19 ..... **66**
Technical Session 20 ..... **67**
Technical Session 20 ..... **68**
Technical Session 21 ..... **69**
Technical Session 21 ..... **70**
Technical Session 21 ..... **71**
Technical Special Session 22 ..... **72**
Technical Special Session 22 ..... **73**
Technical Special Session 22 ..... **74**
Technical Special Session 23 ..... **75**

Technical Special Session 23 76
Technical Special Session 23 77
Technical Special Session 23 78
Technical Special Session 23 79
Technical Special Session 24 80
Technical Special Session 24 81
Technical Session 25 82
Technical Session 25 83
Technical Session 25 84
Technical Session 26 85
Technical Session 26 86
Technical Session 27 87
Technical Session 27 88
Technical Session 28 89
Technical Session 28 89
Technical Session 28 90
Technical Session 29 91
Technical Session 29 92
Technical Session 30 93
Technical Session 30 94
Technical Session 30 95
Technical Session 31 96
Technical Session 31 97
Technical Special Session 32 98
Technical Special Session 32 99
Technical Special Session 32 100
Technical Special Session 32 101
Junior Researcher Education and Development Forum
Workshop organized by Xueyong Wei: Nanofabrication and Nanomeasurement
General Information 102
Contact Information 105

Index of Authors **106**

MEMO **112**

MEMO **113**

MEMO **114**

IEEE 3M-NANO 2021 Committees

Advisory Committee

Chunli Bai	CAS, CN
Karl Böhringer	University of Washington, US
Peter Bryanston-Cross	University of Warwick, UK
Nicolas Chaillet	FEMTO-ST, FR
Shuo Hung Chang	National Taiwan University, TW
Hyungsuck Cho	KAIST, KR
Harald Fuchs	University of Muenster, DE
Toshio Fukuda	Nagoya University, JP
Shuxiang Guo	Kagawa University, JP
Jianguo Han	NSFC, CN
Huilin Jiang	CUST, CN
Sukhan Lee	Sungkyunkwan University, KR
Tongbao Li	Tongji University, CN
Wen-Jung Li	City University of Hong Kong, HK
Song-Hao Liu	South China Normal University, CN
Bingheng Lu	Xi'an Jiaotong University, CN
Bill Milne	University of Cambridge, UK
Brad Nelson	ETH, CH
Markus Pessa	ORC, FI
Guoquan Shi	CUST, CN
Zhongqun Tian	Xiamen University, CN
Din Ping Tsai	National Taiwan University, TW
Jia-Qi Wang	CIOMP, CAS, CN
Yuelin Wang	SIMIT, CAS, CN
Ning Xi	Michigan State University, US
Dong-Yol Yang	KAIST, KR

Organizing Committee

Honorary Chair

Harald Fuchs	University of Muenster, Germany

Founding Chairs

Huadong Yu	Changchun University of Science and Technology, China
Sergej Fatikow	University of Oldenburg, Germany

General Chairs

Zhuangde Jiang	Xi'an Jiaotong University, China
Kyle Jiang	University of Birmingham, UK

Program Chair

Mingdong Dong	Aarhus University, Denmark

Local Committee Chair

Xueyong Wei	Xi'an Jiaotong University, China

Publication Chairs

Yanling Tian	Tianjin University, China
Zhankun Weng	Changchun University of Science and Technology, China

Conference Secretariat

Wenjun Li	Changchun University of Science and Technology, China
Li Lei	Changchun University of Science and Technology, China
Yingying Song	Changchun University of Science and Technology, China

Web Master

Binbin Cai	Changchun University of Science and Technology, China

Program Committee

Nitin Afzulpurkar (TH)
Gursel Alici (AU)
Wei Tech Ang (SG)
Fumihito Arai (JP)
Karl Böhringer (US)
Aude Bolopion (FR)
Barthelemy Cagneau (FR)
Shoou-Jinn Chang (TW)
Weihai Chen (CN)
Yunfei Chen (CN)
Yu-Bin Chen (TW)
Zhihui Chen (CN)
Po-Wen Chiu (TW)
Gilles Dambrine (FR)
Stefan Dimov (UK)
Ran Ding (CN)
Lixin Dong (US)
Ruxu Du (HK)
Kornel Ehmann (US)
Mady Elbahri (DE)
Chris Ewels (FR)
Vladimir Falko (UK)
Fengzhou Fang (CN)
Antoine Ferreira (FR)
Michaël Gauthier (FR)
L. Jay Guo (US)
Shuxiang Guo (JP)
Sinan Haliyo (FR)
Tawfique Hasan (UK)
Martin Hoffmann (DE)
Zhen Hu (CN)
Han Huang (AU)
Viktor Koledov (RU)
Kostadin Kostadinov (BG)
Wai Chiu King Lai (HK)
Pierre Lambert (BE)
Richard Leach (UK)
Jeong-Soo Lee (KR)
Li Li (CN)
Wen Li (US)
Wen-Jung Li (HK)
Yangmin Li (MO)
Zhongxu Lian (CN)
Liwei Lin (US)
Xianping Liu (UK)
Yan Liu (CN)
Paolo Lugli (DE)
Philippe Lutz (FR)
Bill Milne (UK)
Reza Moheimani (AU)
Michael Molinari (FR)
Lars Montelius (SE)
SangJun Moon (KR)
Rakesh Murthy (US)
Cun-Zheng Ning (US)
Cagdas Onal (US)
Inkyu Park (KR)
Babak Parviz (US)
Changsi Peng (CN)
Xiaogang Peng (CN)
Yves-Alain Peter (CA)
Wilhelm Pfleging (DE)
Valentin Popov (DE)
Manel Puig-Vidal (ES)
Minoru Seki (JP)
Yajing Shen (HK)
Wen-Pin Shih (TW)
Bijan Shirinzadeh (AU)
Albert Sill (DE)
Metin Sitti (US)
Santiago Solares (US)
Young Jae Song (KR)
Zhengxun Song (CN)
Zhao Su (SG)
Daoheng Sun (CN)
Dong Sun (HK)
Chunlei Tan (FI)
Hui Tang (CN)
Ivo Utke (CH)
Deqiang Wang (CN)
Fei Wang (CN)
Huiquan Wang (CN)
Qingkang Wang (CN)
Weidong Wang (CN)
Wenhui Wang (CN)
Martin Wegener (DE)
Dongshan Wei (CN)
Zhipeng Wei (CN)
Zhankun Weng (CN)
Wenming Xi (CN)
Hui Xie (CN)
Hongmei Xu (CN)
Yoko Yamanishi (JP)
Yuen Kuan Yong (AU)
Yong Yue (UK)
Alice Zhang (CN)

Qiang Huang (US)
Wenhao Huang (CN)
Futoshi Iwata (JP)
Baohua Jia (AU)
Yoshiaki Kanamori (JP)
Jayantha Katupitiya (AU)
Tomohiro Kawahara (JP)
Beomjoon Kim (JP)
Lehua Qi (CN)
Linmao Qian (CN)
Long Que (US)
Ivo Rangelow (DE)
Weibin Rong (CN)
Changhai Ru (CN)
Mariaana Savia (FI)
Jin Zhang (CN)
John Zhang (US)
Qing Zhang (SG)
Xianmin Zhang (CN)
Ziang Zhang (CN)
Quan Zhou (FI)
Hanxing Zhu (UK)

Conference Information

Venue and Accommodation

Venue

Xi'an Jianguo Hotel is located outside the East Gate of Xi'an City Wall, adjacent to Xi'an Jiaotong University, Air Force Medical University, Xi'an University of Technology. Changle Park B2 metro station of Metro Line 3 is located just next to the hotel, which makes the hotel convenient to arrive. The hotel is also the starting point and terminal station of the airport shuttle bus No. 4. With many famous high-class restaurants, the hotel can provide a variety of food cuisine. The well-decorated conference hall and meeting rooms in the hotel can meet the needs of any kind of conferences.

Address: No.2 Huzhu Road, Xi’an, Shaanxi 710048, China

Accommodation

The accommodation of IEEE 3M-NANO 2021 is arranged in the Xi'an Jianguo Hotel.

How to get Jianguo Hotel (IEEE 3M-NANO 2021 Venue)

1. From Xi'an International Airport to Jianguo Hotel.

Plan A: From Airport West (T1/T2/T3) metro station (C2 north exit), take Line 14 for 13 stops (direction of Heshao Station) to Shuangzhai Station, then change to Line 3 in the station for 11 stops (direction of Yuhuazhai Station) to Changle Park Station (B2 Southwest Exit, 390 meters walk) to Xi'an Jianguo Hotel.

Plan B: Airport shuttle bus from Xi'an International Airport to Xi'an Jianguo Hotel. Available time: 08:20—20:20, every 40 minutes, RMB 26 each.

Plan C: Taxi (T1/T2/T3 taxi pick-up point, about 50 minutes drive, road tolls need to be paid separately).

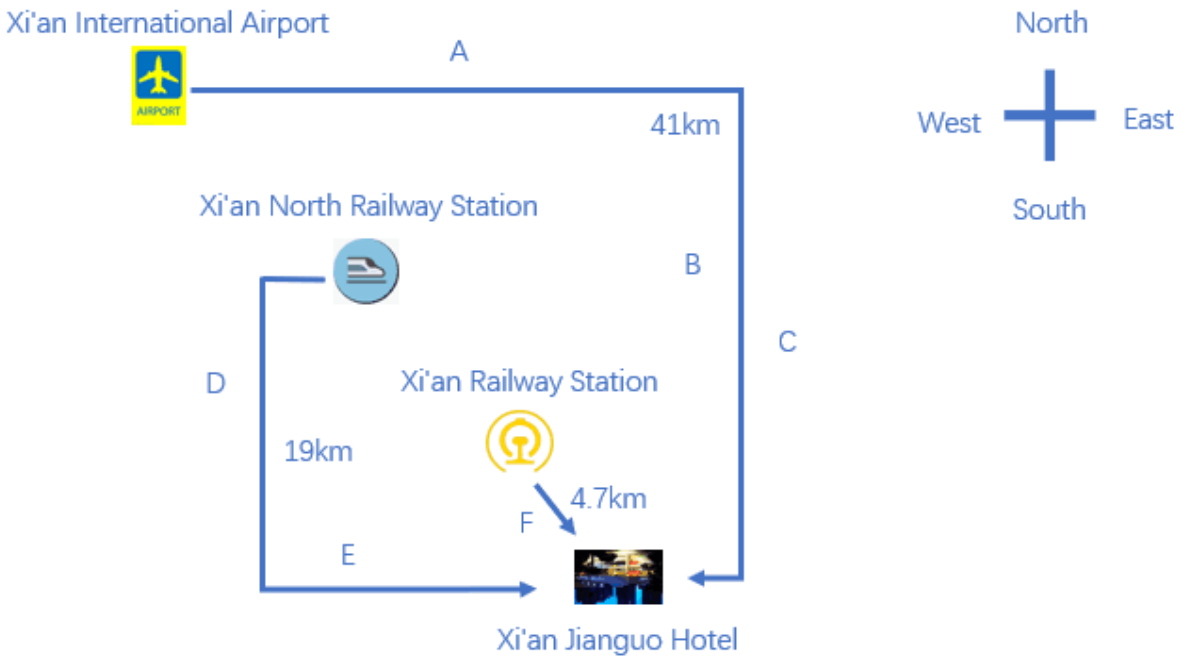
2. From Xi'an North Railway Station to Jianguo Hotel.

Plan D: From Xi'an North Railway Station (B Southwest exit) take Line 14 for 5 stops (direction of Heshao Station) to Shuangzhai Station, then change to Line 3 in the station for 11 stops (direction of Yuhuazhai Station) to Changle Park Station (B2 Southwest Exit, 390 meters walk) to Xi'an Jianguo Hotel.

Plan E: Taxi (Zone L, Floor B2, South Underground Parking Lot of Xi'an North Railway Station, about 35 minutes drive).

3. From Xi'an Railway Station to Jianguo Hotel.

Plan F: Taxi (from the taxi pick-up point at north exit on B2 floor in Xi'an Railway Station, about 25 minutes drive).



Floor Map of Conference Rooms

Conference registration will be arranged on the following days:

2 August 13:00-18:00 Jianguo Hotel Lobby, 1F

3-5 August 8:00-18:20 Jianguo Hotel Conference Center, 1F

IEEE 3M-NANO 2021
Program at a Glance

Monday, 2 August, 13:00-18:00 **Jianguo Hotel, 1 F**	
Registration	
Tuesday, 3 August, 8:00-12:10, Changle Hall, 1F	
08:00—08:20	Opening ceremony
08:20—10:20	Keynote reports (4)
10:20—10:40	Break
10:40—12:10	Keynote reports (3)
12:10—14:00	Lunch
Tuesday, 3 August, 14:00-18:20, Rooms 1-6, -1F-2F	
14:00—16:00	Parallel technical sessions
16:00—16:20	Break
16:20—18:20	Parallel technical sessions
18:20—20:00	Welcome banquet
Wednesday, 4 August, 8:00-12:20, Rooms 1-6, -1F-2F	
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, 4 August, 14:00-18:20, Changle Hall, 1F	
14:00—16:00	Keynote reports (4)
16:00—16:20	Break
16:20—18:20	Keynote reports (4)
18:20—20:00	Conference dinner
Thursday, 5 August, 08:00-12:20, Rooms 1-6, -1F-2F	
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, 5 August, 14:00-18:30, Changle Hall, 1F	
14:00—16:00	Keynote reports (4)
16:00—16:20	Break
16:20—17:20	Keynote reports (2)
17:20—18:30	Closing ceremony
18:30—20:00	Farewell banquet
Friday, 6 August	
Social culture activities	

Schedule of the Keynote Reports

Tuesday, 3 August, Changle Hall, 1F

Time	Topic	Speaker
Session Chair: Xueyong Wei		
08:20 – 08:50	**Femtosecond Laser Bionic Fabrication**	Feng Chen Xi'an (China)
08:50 – 09:20 (2 Aug: 20:50-21:20)	**Multifunctional Materials for Emerging Technologies**	Federico Rosei Quebec (Canada)
09:20 – 09:50 (3 Aug: 10:20-10:50)	**Micro Robotics Advances Bio Sciences**	Tatsuo Arai Tokyo (Japan)
09:50 – 10:20 (2 Aug: 21:50-22:20)	**Microsystems for Manipulating and Characterizing Cells and Tissues**	Yu Sun Toronto (Canada)
Session Chair: Yanling Tian		
10:40 – 11:10	**Microrobotic Manipulation for Cell Therapy**	Dong Sun Hong Kong (China)
11:10 – 11:40 (2 Aug: 20:10-20:40)	**Microrobots Go in-vivo: From Test-tubes to Live Animals**	Joseph Wang San Diego (USA)
11:40 – 12:10	**Bio-inspired Magnetic Microrobots: From Individual to Swarm**	Li Zhang Hong Kong (China)

Wednesday, 4 August, Changle Hall, 1F

Time	Topic	Speaker
Session Chair: Kun Qian		
14:00 – 14:30 (4 Aug: 9:00-9:30)	**Manipulation and Assembly of Particles Using Acoustic Field Gradient and Electromagnetic Needle**	Quan Zhou Helsinki (Finland)
14:30 –15:00 (4 Aug: 8:30-9:30)	**From Chemical Bonds to Molecular Assemblers**	Harald Fuchs Muster (Germany)
15:00 – 15:30 (4 Aug: 9:00-9:30)	**Micro- and Nanorobots in the Body: Monitoring and Safety Challenges**	Veronica Iacovacci Pisa (Italy)
15:30 – 16:00 (4 Aug: 9:30-10:00)	**Ultrasound-controlled Swarmbots in Physiological Flows**	Daniel Ahmed Zurich (Switzerland)
Session Chair: Feng Chen		
16:20 – 16:50	**Optical MEMS-based Spectrally Adaptive Remote Sensing**	Mariusz Martyniuk Perth (Australia)
16:50 – 17:20	**Laser Precision Engineering: from Micro-scale to Nano-scale**	Minghui Hong Singapore
17:20 – 17:50 (4 Aug: 10:20-10:50)	**Microrobotic Systems for Swarm Delivery of the Therapeutics Agents**	Ali K. Hoshiar Essex (UK)
17:50 – 18:20 (4 Aug: 10:50-11:20)	**Machining with the Tip of an AFM Probe: Research Efforts Towards an Alternative Nano-manufacturing Process**	Emmanuel Brousseau Cardiff (UK)

Thursday, 5 August, Changle Hall, 1F

Time	Topic	Speaker
Session Chair: Zenghui Wang		
14:00 – 14:30	**Metamaterials Baked on Broken Symmetries**	Andrea Alù
14:30 –15:00 (5 Aug: 08:30-09:00)	**Nanocomposites to Enhance Sensitivity, Specificity and Multiplexing Capability of Biosensors**	Yi Sun Copenhagen (Denmark)
15:00 – 15:30 (5 Aug: 9:00-9:30)	**Nanoelectrochemistry: Unravelling Nanoparticle (re-)activity by Single Nanoparticle Electrochemistry**	Kristina Tschulik Bochum (Germany)
15:30 – 16:00 (5 Aug: 13:00-13:30)	**Multifunctional Helical Nanobots: Roles of Material and Geometry**	Ambarish Ghosh Bangalore (India)
Session Chair: Lei Liu		
16:20 – 16:50 (5 Aug: 10:20-10:50)	**Tip- and Laser- based Nanofabrication in Extended Areas with Sub-nanometre Precision**	Eberhard Manske Ilmenau (Germany)
16:50 – 17:20 (5 Aug: 10:50-11:20)	**How to Engineer Biofriendly Nanobots and Bring them from in Vitro to in Vivo**	Samuel Sánchez Ordóñez Catalonia (Spain)

Keynote Speakers

(in alphabetical order)

Ultrasound-Controlled Swarmbots in Physiological Flows

Daniel Ahmed

Associate Professor

Acoustics Robotics Systems Lab
Institute of Robotics and Intelligent Systems
Department of Mechanical and Process Engineering
ETH Zürich, Switzerland
E-mail: dahmed@ethz.ch

Abstract: Precise, accurate, and controlled motion of microrobots can create new opportunities in targeted and precise delivery of drugs or genes, transducing forces on specific cells or tissues, performing biopsies, and use in non-invasive surgery. However, the application of micro/nanorobots in medicine is fundamentally limited, especially in the vasculature where they need to be manipulated within an imposed blood flow. Typically, tiny agents follow the bloodstream of the vasculature with little to no control in the circulatory system. The ability to propel against the flow or undergo upstream motility would help micro/nanoparticles navigate to a specific site, which could lead to a paradigm shift in targeted drug delivery in medicine. In this talk, I will present swarm-based microrobots in a combination of acoustic and magnetic fields and then purely in ultrasound that shows upstream and cross-stream motion under physiological relevant flows.

Metamaterials Baked on Broken Symmetries

Andrea Alù

Director, Photonics Initiative
Einstein Professor of Physics
Professor of Electrical Engineering
Advanced Science Research Center
The City College of New York, USA

E-mail：aalu@gc.cuny.edu

Abstract: In this talk, I discuss our recent research activity in electromagnetics, nano-optics, acoustics and mechanics, showing how suitably engineered materials at the nanoscale forming metamaterials open exciting venues to realize new phenomena and devices for light, radio-waves and sound. I discuss venues to induce emerging phenomena stemming from broken geometrical symmetries, to largely break Lorentz reciprocity and realize isolation without the need of magnetic bias based on broken time-reversal symmetry induced by mechanical motion, spatio-temporal modulation and/or nonlinearities. I also discuss how broken symmetries in space and space-time can open the opportunity to induce topological order in metamaterials. Another class of interesting metamaterials based on broken symmetries are parity-time symmetric metamaterials, which are asymmetric in space, but symmetric upon parity and time inversion. In the talk, I will also discuss the impact of these concepts from basic science to practical technology, from classical waves to quantum phenomena.

Micro Robotics Advances Bio Sciences

Tatsuo Arai

Professor

Beijing Advanced Innovation Center for Intelligent Robots and Systems
Beijing Institute of Technology, China

Visiting Professor of Global Alliance Laboratory

University of Electro-Communication, Japan

Abstract: We have been working on micro robotics including dexterous high-speed micromanipulation, micro assembly, cell characterization, and 3D cellular system construction. The basic idea is to devise and to utilize dexterous two finger micro hands, and to achieve total micromanipulation system with high-speed vision and interfaces for bio applications. Our system is multi-scalable and can manipulate micro object with the size ranging from one to hundreds micron meters seamlessly. Our constant system improvements and refinements have achieved wide range of workspace with real time 3D information, simple finger setting-up procedure, fine force sensing capability as well as automated calibration, automated picking-and-placing, etc. Based on these activities and our collaboration experiences with biologists and medical doctors we carried out 5-year national project on “Bio Assembler” in 2011-2016, whose target is a challenge of constructing artificial 3D cellular system in vitro. The major topics are high-speed cell characterization & sorting, 3D cellular system construction, and cell functionalization analysis. Now we are looking at more advanced researches and developments in new bio application fields, such as causality of various stresses in differentiation, proliferation, generation, development, and disease. The mechano biology is one of the examples of such activities and currently so active in biology and medical, however, we are looking for more than that, not just limited to the mechanical matter. We will try to collect as many precise physiological data as possible corresponding to various multi-modal stresses and to clarify novel biological findings by applying the system science principles.

Machining with the Tip of an AFM Probe: Research Efforts towards An Alternative Nano-manufacturing Process

Emmanuel Brousseau

Assistant Professor
High Value Manufacturing Research Group
Department of Mechanical Engineering
School of Engineering
Cardiff University, United Kingdom
E-mail: brousseaue@cardiff.ac.uk

Abstract: The controlled nano-scale removal of material from the surface of a workpiece conducted with the tip of an Atomic Force Microscope (AFM) probe is a technique which has gained increased attention in the past decade within the micro- and nano-manufacturing research community. The attractive characteristics of this process are that it is relatively simple to implement and it is low-cost compared with vacuum-based lithography techniques for micro- and nano-fabrication. This presentation will provide an overview of a number of research investigations conducted at Cardiff University (UK) in the field of AFM probe-based machining in the past 10 years. The reported work will include a range of experimental and theoretical studies and will also cover recent results from a specific application of the process in the field of nano-magnetism.

Femtosecond Laser Bionic Fabrication

Feng Chen

Professor, Director

Ultrafast Photonic Laboratory (UPL)
Director of Shaanxi Key Laboratory of
Photonics Technology for Information (PTI)

Xi'an Jiaotong University
Xi'an, China
E-mail：chenfeng@mail.xjtu.edu.cn

Abstract: Biological micro/nano-structures all comprise the goals for the next-generation smart artificial materials and devices. This presentation summarizes the recent progress in the development of bioinspired smart structures via femtosecond laser micro/nanofabrication, with a focus on controllable, biomimetic, and switchable wetting surfaces, as well as their applications in biology, micro-optics, and industry, all of which demonstrate the ability of laser microfabrication in producing various multiscale structures and its adaptation in a great variety of materials. The current challenges and future research prospects of this rapidly developing field are also being discussed.

From Chemical Bonds to Molecular Assemblers

Harald Fuchs

Professor

Head

Physikalisches Institut and Center for Nanotechnology (CeNTech)

Westfälische Wilhelms-Universität Münster

Germany

E-mail：fuchsh@uni-muenster.de

Abstract: Surfaces and interfaces represent low-dimensional spatial confinements opening unique pathways towards on-surface chemical reaction schemes with regio-selective and kinetic control that is not available in conventional liquid- or gas-phase chemistry. In addition, surfaces may be catalytically active, and by surface reconstruction or faceting the spatial confinement may display one- or zero-dimensional character. Beyond pure mechanical support, surfaces may also promote ordering by self-assembly of educts and products and may stabilize them by molecule-substrate interactions. We have studied numerous novel chemical surface reaction types including metal-organic compounds, precursors for generating graphdiynes, and peroxides, otherwise unstable in liquid or gas phases [1]. By using on-surface chemistry techniques intermediate states can be analyzed with high resolution techniques such as low-temperature STM and AFM under ultrahigh vacuum condition. This approach also opens the pathway for controlled orthogonal reactions. Beyond all that, we found a fascinating new and powerful potential of on-surface chemistry which allows to set up a new strategy for the generation of intelligent functional systems. In this context, we recently introduced a molecular swarm like system performing a coordinated surface restructuring. It is based on N-heterocyclic carbenes (NHC) binding to a single noble metal atom such as of an Au(111) surface after vacuum deposition. Depending on the type of N-ligands, NHCs are able to pull a single atom out of the surface after forming a covalent bond and then travel in the so-called ‘ballbot’- motion type across the surface, eventually forming densely packed islands [2]. The ballbots form spontaneously on the surface. We discovered that on an Au(1x2) reconstructed surface ballbot-NHcs are able to autonomously re-organize that surface atom by atom in a well-controlled and ‘swarm-like’ manor [3]. No external supporting measures are required such as lithography or STM and AFM probes. Rather, the cooperative restructuring occurs in a special zipper-mode by the molecular machines which are re-arranging Au atoms with atomic precision and in a massive parallel scheme. As a result, the Au(1x2) surface is transferred at room temperature into an Au(1x3) -‘Added Row (AR)’ structure. It is known that the Au(1x3)-AR surface displays a higher chemical reactivity than the native Au(1x2) structure and does not spontaneously transform back to the (1x2) reconstruction as does the conventional Au(1x3) reconstruction occurring at temperatures around 800 K on a clean Au (111) surface. This observation opens the door for the generation of ‘programmed’ and autonomously acting molecular species possibly allowing to optimize surfaces in a cooperative way, for example, for catalysis applications.

Multifunctional Helical Nanobots: Roles of Material and Geometry

Ambarish Ghosh
Associate Professor
Center for Nano Science and Engineering
Indian Institute of Science
Bangalore
India
E-mail：ambarish@iisc.ac.in

Abstract: Helical nanobots driven by magnetic fields can provide mechanical information about their local surrounding with sub-micron spatial resolution, probe complex, heterogenous biological environments, such as the intracellular environment, as well as the extracellular matrix; and provide a rich and powerful platform towards futuristic drug delivery. The same system can be used for sub-micron colloidal cargo manipulation in microfluidic devices and on-chip assembly applications. Their fabrication is based on shadow evaporation allowing a wafer scale route towards integration of many different functionalities in a single nanostructure. Crucially, their properties and functionalities can be tuned with great control using intelligent design of material and geometry, and I will present few examples of the same.

Laser Precision Engineering: from Micro-Scale to Nano-Scale

Minghui Hong
Professor
Fellow of Optical Society of America
Department of Electrical and Computer Engineering
National University of Singapore
Singapore
E-mail：elehmh@nus.edu.sg

Abstract: Laser precision engineering in ambient air has unique advantages as a non-contact and high-speed process. It is a key advanced manufacturing approach for high quality micro/nano-structures' fabrication. In the past decades, we have witnessed its extensive applications in research laboratories and production lines. Combined with some advanced processing tools, such as AFM and NSOM, laser precision engineering's resolution can be pushed down to 10 ~ 25 nm, much smaller than Optical Diffraction Limit, which provides an excellent opportunity for the nano-manufacturing. In this talk, the physics behind laser-matter interactions will be reviewed. How to achieve small heat affected zone (HAZ) is one critical challenge for high quality laser precision engineering to push its resolution from micro-scale to nano-scale. The next critical challenge is how to ensure high enough nano-fabrication speed to meet industrial needs. Since one beam laser processing at high resolution could not achieve such mission, parallel laser beam processing is developed to cater for both high resolution and high speed at the same time. Another challenge is how to carry out the laser nano-structuring in far field as the near field processing requires the tiny optics working very close to sample surfaces, which makes the laser nanofabrication in near field be only suitable for very limited super-smooth surface samples. Our recent research shows that hybrid pulsed laser processing in far field and in ambient air is a novel method to make ~15 nm features directly on Si surfaces. With better understanding of the complicated physics behind this unique experimental result, as well as further fine tuning of our experimental setup and laser processing parameters, it is highly possible to bring our laser precision engineering resolution down to ~10 nm.

Microrobotic Systems for Swarm Delivery of the Therapeutics Agents

Ali K. Hoshiar

Assistant professor

School of Computer Science and Electronic Engineering (CSEE)

University of Essex

UK

E-mail：a.kafashhoshiar@essex.ac.uk

Abstract: The rapid advancement in microrobotic systems in recent years for the medical applications, as well as human scale microrobotics systems, and advancements in the medical monitoring systems (magnetic particle imaging (MPI), fast MRI, and X-ray) lead to the precise control of microswarms in therapeutic delivery applications. However, predicting the nonlinear complex behaviour of the microswarms in the magnetic field remained as an open challenge. In this talk I will present the recent monitoring schemes (e. g. MPI), the practical actuation schemes, and most recent predictive models for microswarm control.

Micro- and Nanorobots in the Body: Monitoring and Safety Challenges

Veronica Iacovacci

Marie Curie Fellow

The BioRobotics Institute

Scuola Superiore Sant'Anna, Pisa

Italy

E-mail：veronica.iacovacci@santannapisa.it

Abstract: Medical micro- and nanorobots have been demonstrated for a variety of non-invasive biomedical applications, such as tissue engineering, drug delivery, and assisted fertilization, among others. However, most of these demonstrations have been carried out in in vitro settings and under optical microscopy, being significantly different from the clinical practice. Furthermore, the predominant use of magnetic micro and nanostructures might pose force scaling, safety and biodistribution challenges. In this framework, despite astonishing advancements in the fabrication, powering, and control of tiny motile devices, many challenges still prevent micro- and nanorobots route to the clinic.In this talk, some of these challenges will be analyzed, with a particular focus on how tracking tiny machines in real tissues and how retrieving them upon task execution.

Tip- and Laser- Based Nanofabrication in Extended Areas with Sub-Nanometre Precision

Eberhard Manske

Professor

Institute of Process Measurement and Sensor Technology

Faculty of Mechanical Engineering

Ilmenau University of Technology

Germany

E-mail：Eberhard.Manske@tu-ilmenau.de

Abstract: For several years, new tip-based or laser-based patterning techniques have been attracting increasing attention as alternative lithography approaches. Most tip-based techniques are based on the use of commercial or modified atomic force microscopes (AFM) and have so far only been demonstrated at the micrometer scale. Direct laser writing is mostly based on galvanoscanners or (similar to the AFM methods) on piezo drives. The biggest disadvantage in all cases, however, is the insufficient measurement and positioning technology.

At the TU Ilmenau, nanopositioning and nanometrology machines based on advanced laser interferometers have been successfully developed over many years, which are able to overcome this deficit. Consequently, this technique is therefore applied to processes of tip- and laser-based manufacturing. This will enable measurement and patterning at the atomic level on both flat and non-flat surfaces (e.g. precision optical surfaces).

The laser interferometer-based high-precision machines now have resolution up to 5 picometers and sub-nanometer reproducibility in measurement ranges up to 200 mm x 200 mm. They can be used with AFM heads for both lithography purposes and high-resolution measurement of fabricated structures. In addition, direct laser writing was demonstrated with both single-photon processes (at 405 nm) and two-photon processes based on femtosecond lasers. New effects for laser-based writing below the Rayleigh resolution limit were found and used.

UV nanoimprint lithography on flat as well as on curved surfaces was demonstrated as another technology. For direct laser writing on curved surfaces, a metrologically traceable 5-axis machine concept was developed and experimentally tested. Combining advanced nanofabrication technologies with ultra-precise nanopositioning and nanometrology, a unique symbiosis is created for alternative cross-scale lithography approaches.

Optical MEMS-Based Spectrally Adaptive Remote Sensing

Mariusz Martyniuk

Associate Professor
SMIEEE Principal Research Fellow
School of Engineering,
University of Western
Australia
E-mail：mariusz.martyniuk@uwa.edu.au

Abstract: The anticipated feature of future generation remote infrared (IR) sensing and imaging technologies includes adding so-called multi-colour capabilities, which allow real-time spectral information to be gathered from multiple wavelength bands. The resulting multi/hyper-spectral imaging capability significantly improves target recognition and is applicable to numerous remote sensing spectroscopy/imaging applications. In order to provide a reduced size, weight and power (SWaP) solution, this talk presents a micro-electromechanical systems (MEMS) based electrically tuneable adaptive filter technology that has been developed for the technologically important short-wave IR (SWIR, 1.4-2.5 μm), mid-wave IR (MWIR, 3-5 μm), and long-wave IR (LWIR, 8-12 μm) wavelength regions, as well as the emerging THz band (~1 THz or ~300 μm) of the electromagnetic spectrum.

How to Engineer Biofriendly Nanobots and Bring Them from in Vitro to in Vivo

Samuel Sánchez Ordóñez

Group Leader
Institute for Bioengineering of Catalonia
Barcelona Institute for Science and Technology
Catalan Institute for Research and Advanced Studies, Barcelona
Spain
E-mail：ssanchez@ibecbarcelona.eu

Abstract: One of the dreams in nanotechnology is to engineer small vehicles and machines which can eventually be applied in vivo for medical purposes. In order to reach that fascinating goal, there are several challenges to be addressed. First, researchers need to incorporate efficient but also bio-friendly propulsion mechanisms into the nanobots. Our strategy comprises the use of bio-catalysts such enzymes for converting biologically available fuels into a propulsive force. The combination of biological components and artificial ones emerges into what we call hybrid nanobots.

In my talk, I will present how we bioengineer hybrid nanobots combining the best from the two worlds: biology (enzymes) and (nano)technology (nano- micro-particles) providing swimming capabilities, biocompatibility, imaging, multifunctionality and actuation. I will present some of the proof-of-concept applications of biocompatible nanobots such as the efficient transport of drugs into cancer cells (1) and 3D spheroids (2), sensing capabilities (3) and the use of molecular imaging techniques (PET-CT) for the tracking and localization of swarms of nanobots both in vitro and in vivo in confined spaces like mice bladder (4).

Multifunctional Materials for Emerging Technologies

Federico Rosei

Fellow of the Royal Society of Canada

Centre for Energy, Materials and Telecommunications

Institut National de la Recherche Scientifique

Varennes (QC), Canada

E-mail: rosei@emt.inrs.ca.ca

Abstract: This presentation focuses on structure property/relationships in advanced materials, emphasizing multifunctional systems that exhibit multiple functionalities. Such systems are then used as building blocks for the fabrication of various emerging technologies. In particular, nanostructured materials synthesized via the bottom–up approach present an opportunity for future generation low cost manufacturing of devices. We focus in particular on recent developments in solar technologies that aim to address the energy challenge, including third generation photovoltaics, solar hydrogen production, luminescent solar concentrators and other optoelectronic devices.

Microrobotic Manipulation for Cell Therapy

Dong Sun

Professor

Fellow of Canadian Academy of Engineering

Department of Biomedical Engineering

Director of Centre for Robotics and Automation

City University of Hong Kong

China

E-mail：bmehead@cityu.edu.hk

Abstract: The application of robot technology to achieve early diagnosis and treatment of diseases at the cellular level represents a new frontier in the development of contemporary medical robots. Microrobotic manipulation for cell therapy is an entirely new emerging theme that is enabled with specially designed automated micromanipulation tools to perform medical diagnosis and treatment on single cells at large scale. This talk will introduce our development of combining robotics technologies with micro-manipulation tools including optical tweezers, microneedles and electromagnetic devices, to accomplish various cell manipulation tasks. With this emerging technology, various cell surgical operations can be achieved, which include the use of magnetic microrobots to deliver cells in vivo. These inventions will permit many new unforeseen clinical applications previously thought impossible, and profoundly affect therapeutic treatment in precision medicine.

Nanocomposites to Enhance Sensitivity, Specificity and Multiplexing Capability of Biosensors

Yi Sun

Associate Professor

Department of Healthcare Technology

Technical University of Denmark

Denmark

E-mail：suyi@dtu.dk

Abstract: Nanomaterials is a rapidly evolving field, and new materials with unique magnetic, electrical, and optical properties are constantly emerging. Combination of different nanomaterials into nanocomposites allows a number of functions to be incorporated in a single platform. In recent years, a variety of novel nanocomposites are coupled with biosensors to improve their performance by making the biosensors more sensitive, selective and multiplexed. In this talk, I will present our recent work in nanomaterial-based biosensors for detection of antibiotics and pathogens in food and clinical samples.

Microsystems for Manipulating and Characterizing Cells and Tissues

Yu Sun

Professor

Lifetime Fellow, Canadian Academy of Engineering (CAE)

Department of Mechanical and Industrial Engineering

University of Toronto

Canada

E-mail：sun@mie.utoronto.ca

Abstract: The capability of manipulating micro and nanometer-sized objects, such as cells and nanomaterials opens new frontiers in robotic surgery, disease diagnostics, industrial applications and enables new discoveries in many disciplines such as biology, medicine, and materials science. The field of micro-nanorobotics involves the design and construction of robotic agents that are micro-nanometer sized and robotic manipulation of objects with dimensions in the micrometer and nanometer ranges. The past two decades has witnessed spurred development of micro-nanorobotic systems and technologies with common hallmarks of precision instrumentation, sensing, actuation, and control. This talk will begin with a brief review of the evolution of the robotic micromanipulation field, followed by an overview of challenges, opportunities, and recent advances made in this field. Examples of robotic cell manipulation systems for clinical surgery and drug screen will be given, and sub-micrometer position control and sub-nanoNewton force control for realizing 3D intracellular and intra-tissue manipulation and measurement will be introduced.

Nanoelectrochemistry: Unravelling Nanoparticle (re-)activity by Single Nanoparticle Electrochemistry

Kristina Tschulik

Professor
Chair of Analytical Chemistry II
Electrochemistry and Nanoscale Materials
Ruhr-University Bochum
Germany
E-mail：nanoec@rub.de

Abstract: Nanomaterials have been in the focus of major research interest for more than two decades. The great potential of electrochemistry to characterize these particles in terms of both, their physical properties and chemical reactivity, however, has hardly been explored. The ease of sample preparation, the comparably high speed and low cost of nano-electrochemistry, make it a useful complement or even alternative to the established nanoparticle characterization methods, like SEM or TEM. The number of particles that can conveniently be analysed, ranges from individual ones to ensembles comprising myriads of nanoparticles, depending on the techniques use. In this talk, several examples will be presented.

A convenient method for nanoparticle sizing in their native environment is via transformative nano-impact analysis. This methodology uses the Brownian motion-based sporadic impact of dispersed nanoparticles at a potentiostated electrode to electrochemically convert one particle at a time. The charge transferred during this conversion can, for instance, be used to size the particle or to determine its composition. Measuring the electrocatalytic activity – likely the most frequently used electrochemical nano-ensemble studies – may also be realized at the single particle level. This is presented for the oxygen evolution reaction (OER) at mixed transition metal oxide nanoparticles at extremely high current density and turn-over-frequencies orders of magnitude higher than achieved in conventional studies.

Last but not least, individual particle reactivity studies at surface-immobilized particle ensembles will be introduced. This will be shown for Ag and Au nanoparticles by dark-field microscopy coupled to hyperspectral imaging in different liquid surroundings.

Microrobots Go in-vivo: From Test-tubes to Live Animals

Joseph Wang

Distinguished Professor

SAIC Endowed Chair

Department of Nanoengineering

University California San Diego (UCSD)

USA

E-mail：josephwang@eng.ucsd.edu

Abstract: Nanoscale robots that can effectively convert diverse energy sources into movement and forces represent a rapidly emerging and fascinating robotic research area. Such nanoscale robots offer impressive capabilities, including greatly enhanced power and cargo-towing forces, multi-functionality, easy surface functionalization, and versatility. The new capabilities of modern nanorobots indicate immense potential for a variety of biomedical applications, and should have major impact on disease diagnosis, treatment, and prevention . Recent in vivo applications using different types of biocompatible and biodegradable microrobots will be illustrated, including enhanced drug delivery towards enhanced treatment of stomach bacterial infection, active vaccine delivery, autonomous gastric fluid neutralization, the ability to selectively localize at desirable segments of the GI tract, or efficient intracellular delivery of functional proteins and nucleic acids.

Manipulation and Assembly of Particles using Acoustic Field Gradient and Electromagnetic Needle

Quan Zhou

Professor

Department of Electrical Engineering and Automation

Aalto University

Finland

E-mail：quan.zhou@aalto.fi

Abstract: Robotic instruments are miniature robots and mechatronic systems that can manipulate small objects and precisely interact with different surfaces. In this talk, I will discuss our recent work in robotic instruments for manipulation and assembly of particles using two techniques: acoustic manipulation devices that can automatically manipulate/assembly/shaping a large amount of particles on a surface using the field gradient generated by a single acoustic transducer, both in ambient air and submerged; and robotic electromagnetic needles that can precisely extract and independently manipulate/assemble magnetic microparticles in the presence of neighboring magnetic particles by contact or contactless. Additionally, I will discuss electromagnetic needle induced active magnetic fluid manipulator that can manipulate particles on the air-liquid interfaces.

Bio-inspired Magnetic Microrobots: From Individual to Swarm

Li Zhang

Professor

Department of Mechanical and Automation Engineering

Chow Yuk Ho Technology Centre for Innovative Medicine

CUHK T Stone Robotics Institute

The Chinese University of Hong Kong (CUHK)

China

E-mail：lizhang@mae.cuhk.edu.hk

Abstract: People have envisioned tiny machines and robots that can explore the human body, find and treat diseases since Richard Feynman's famous speech, "There's plenty of room at the bottom," in which the idea of a "swallowable surgeon" was proposed in the 1950s. Even though we are at a state of infancy to achieve this vision, recent intense progress on nanotechnology, MEMS/NEMS technology and micro-/nanorobotics has accelerated the pace toward the goal. A number of research efforts have been recently published regarding the development of tiny swimming machines/robots from the basic principles and fabrication methods to practical applications.

Technical Program

(ss: Technical Special Session)

Tuesday, 3 August 14:00-16:00

No.	Room	Session
01	Room 1	2D Materials at Nanoscale: from Fundamentals to Applications (ss)
02	Room 2	Functional Faterials for Nanophotonics (ss)
03	Room 3	Nanobiophotonics (ss)
04	Room 4	Two-Dimensional Materials and Devices I and II (ss)
05	Room 5	University of Shanghai Cooperation Organization Nanotechnology (ss)
06	Room 6	Junior Researcher Education and Development Forum (ss)

Tuesday, 3 August 16:20-18:20

No.	Room	Session
07	Room 1	2D Materials at Nanoscale: from Fundamentals to Applications (ss)
08	Room 2	Nanofluidics
09	Room 3	AFM-Based Nanohandling
10	Room 4	Two-Dimensional Materials and Devices I and II (ss)
11	Room 5	University of Shanghai Cooperation Organization Nanotechnology (ss)
12	Room 6	Junior Researcher Education and Development Forum (ss)

Wednesday, 4 August 08:00-10:00

No.	Room	Session
13	Room 1	Nanomanipulation and Nanorobotics
14	Room 2	Micro/Nano Mechanics and in Situ Characterization Techniques (ss)
15	Room 3	Ultrafast optical technology and application (ss)
16	Room 4	Design, Analysis and Control of Nano-manipulating Systems (ss)
17	Room 5	Biomedical Sensors & Measurement for Micro/Nano Technology (ss)

Wednesday, 4 August 10:20-12:20

No.	Room	Session
18	Room 1	AFM Applications
19	Room 2	Nanofabrication Processes and Systems I
20	Room 3	Micro- and Nano-Structures and Characterization
21	Room 4	Nanomechanics and Nanomechatronics
22	Room 5	Nanoheterojunctions and Nanosensors (ss)

Thursday, 5 August 8:00-10:00

No.	Room	Session
23	Room 1	Nanomaterials and Nanostructures for Plasmonic Effects and Applications (ss)
24	Room 2	Light Field Manipulation and Measurement in Ultrafast optics (ss)
25	Room 3	Nanomaterials and Applications I
26	Room 4	Biological Applications I
27	Room 5	MEMS

Thursday, 5 August 10:20-12:20

No.	Room	Session
28	Room 1	Nanofabrication Applications
29	Room 2	Nanofabrication Processes and Systems II
30	Room 3	Nanomaterials and Applications II
31	Room 4	Biological Applications II
32	Room 5	Functional Nanomaterials for Microelectronics and Biotechnology (ss)

Technical Special Session 01
2D Materials at Nanoscale: from Fundamentals to Applications (ss)

Room 1

14:00–16:00 Tuesday, 3 August

Organizer: Zegao Wang

Co-Organizer: He Tian

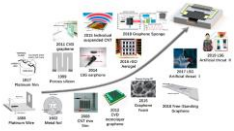
01-1 14:00–14:12

Graphene Artificial Throat

He Tian

School of Integrated Circuits, Tsinghua University, Beijing 100084, China

- Sound has been emitted from graphene.
- Graphene artificial throat has been made with laser-scribing technology.
- Different tone can be detected with high accuracy.



The development of graphene artificial throat

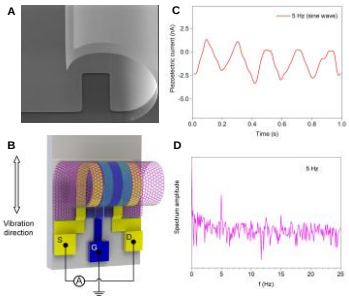
Notes

01-2 14:12–14:24

A self-powered vibration sensing element based on three-dimensional graphene field effect transistor

Shasha Li, Yuning Li, Jingye Sun, Fang Su, Weijie Yin, Mingqiang Zhu, and Tao Deng*

School of Electronic and Information Engineering, Beijing Jiaotong University, Beijing 100044, China.



- A 3D non-closed tubular structure is adopted to develop the piezoelectricity in graphene by the induced strain.
- The peak-to-peak amplitude current up to 4.2 nA is achieved, which can be further enhanced (~10.8 nA) by increasing the source-drain bias voltage (≤ 6 mV).
- Piezoelectric coefficient up to ~14.8 nC/N.
- Paves new way to develop the 2D piezoelectric effect of graphene.

Notes

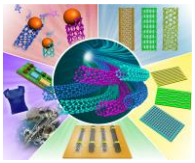
01-3 14:24–14:36

Synthesis and Application of Ultralong Carbon Nanotubes

Rufan Zhang*

Department of Chemical Engineering, Tsinghua University, Beijing 100084, China

- Half-meter long carbon nanotubes were synthesized.
- These ultralong CNTs exhibit excellent properties.
- Ultrasensitive flow sensors were fabricated using these ultralong CNTs.



Structures, synthesis and applications of ultralong CNTs.

Notes

Technical Special Session 01
2D Materials at Nanoscale: from Fundamentals to Applications (ss)

Room 1

14:00-16:00 Tuesday, 3 August

Organizer: Zegao Wang

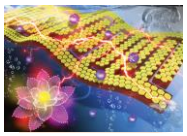
Co-Organizer: He Tian

01-4 14:36–14:48

Flexible Solid-State Supercapacitors Based on Metallic 2D Materials

Xing Wu
School of Communication and Electronic Engineering,
East China Normal University, China

- Metallic VSe_2 nanosheets prepared by CVD are used as the binding free electrode material.
- The VSe_2 based flexible supercapacitor presents high mechanical stability and high energy density.
- The synergistic effect of the VSe_2/CNT composite electrode could further improve the electrical cycling performance.
- Our works promote the application of metallic 2D materials in flexible energy storage devices for wearable equipment.



Notes

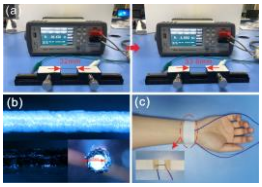
01-5 14:48–15:00

Highly Sensitive Resistance-type Flexible Pressure Sensor for Cuffless Blood-Pressure Monitoring by using Neural Network Techniques

Qian Zhang , Ping Liu *, Caixia Liu, Ying Huang

School of Microelectronics, Hefei University of Technology, Hefei 230009, P.R. China

1. The sensor with crack structure exhibits a high GF (~ 1582.7).
2. The correlation coefficients of systolic blood pressure, diastolic blood pressure and mean blood pressure were 0.950, 0.875 and 0.947, respectively, which could meet the A-level standards of BHS and AAMI.



The characterization of materials and sensors

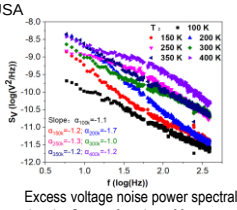
Notes

01-6 15:00–15:12

Low-Frequency 1/*f* Noise in a Graphene/Silicon X-ray Detector

Ningqin Deng, Pan Wang, Enxia Zhang, Bin Guo, Dehong Li, Boxuan Ma, Daniel M. Fleetwood, He Tian, Jian Zhang
National Institute of Metrology (NIM), Beijing, China
Institute of Microelectronics, Tsinghua University, Beijing, China
Department of Electrical Engineering and Computer Science, Vanderbilt University, USA

- Fabricated graphene-based X-ray detector
- Characterization and performance of the X-ray detector
- Measured the low-frequency noise of the X-ray detector
- Analyzed the cause of low-frequency noise



Excess voltage noise power spectral density S_V as a function of frequency at different temperatures from 100 K to 400 K

Notes

Technical Special Session 01
2D Materials at Nanoscale: from Fundamentals to Applications (ss)

Room 1

14:00-16:00 Tuesday, 3 August

Organizer: Zegao Wang

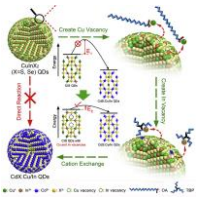
Co-Organizer: He Tian

01-7 15:12–15:24

Defect Engineering Induced Semiconductor QDs Synthesis Novel Method and Photoelectric Property

Meng Xu
School of Materials, Beijing Institute of Technology, China

- An effective surface-vacancy-engineering-initialized strategy to realize energy-unfavored semiconductor QDs synthesis reactions, un-precedentedly.
- Thiol- and solvent-coordinated cation exchange reaction kinetics have been applied to engineer the composition and crystallinity of novel QDs.
- Dopant diffusion equilibrium overcoming impurities loss of doped qds for multimode anti-counterfeiting and encryption.



Unique method in QDs via defect engineering overcoming chemical kinetic energy barriers.

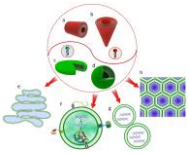
Notes

01-8 15:24–15:36

Phospholipid Self-Assemblies Based Artificial cells

Xiaojun Han
School of Chemistry & Chemical Engineering, Harbin Institute of Technology, China

- Artificial cells, as simplified cell models, can be used to study their structure and function.
- The grana-like cisternae stacks were assembled to mimick grana functions.
- Artificial eukaryotic cells were obtained with division functions.
- Spatially coded prototissue architectures arrays were obtained using magnetic manipulation.
- The other recent progresses on lipid based artificial cells will also be presented.



Schematic of phospholipid assemblies

Notes

01-9 15:36–15:48

Peptide Based Nanomaterial From Characterization to Tumor Detection and Isolation

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

- High resolution structural imaging for amyloid peptide self assembly and modulation
- Bio-interface constructed by specific peptide assembly and disassembly
- Tumor cell detection and isolation

Notes

Technical Special Session 01
2D Materials at Nanoscale: from Fundamentals to Applications (ss)

Room 1

14:00-16:00 Tuesday, 3 August

Organizer: Zegao Wang

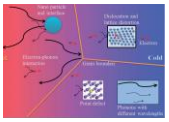
Co-Organizer: He Tian

01-10 15:48–16:00-

Synergistically Enhanced Thermoelectric Performance Enabled by Interface Engineering

Lei Yang
School of Materials Science and Engineering, Sichuan University, China

- Interface engineering are enabled by combining surface modification of powders and SPS process.
- Modified interfaces provide stronger phonon scattering to reduce the lattice thermal conductivity.
- Rationally designed interfaces can decouple the phonon and carrier scattering, leading to synergistically enhanced thermoelectric performance.



Schematic of interface engineering in thermoelectric materials

Notes

Technical Special Session 02
Functional Materials for Nanophotonics (ss)

Room 2

14:00-16:00 Tuesday, 3 August

Organizer: Zhipeng Wei

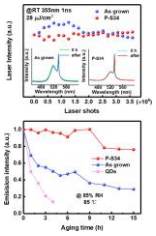
Co-Organizer: Rui Chen

02-1 14:00–14:24

Abnormal Negative Thermal Quenching & Stability Improvement of Perovskites

Rui Chen
Department of Electrical and Electronic Engineering, Southern University of Science and Technology, China

- The abnormal fluorescent thermal quenching phenomenon of all-inorganic perovskite nanomaterials has been investigated.
- Perovskite core-shell structure was proposed for improved stability and high optical gain.
- Various surface modification technique have been used and stable emission has been realized, which enables high optical gain for ultra-sensitive sensing based on random lasers.



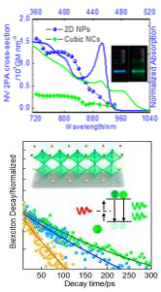
Notes

02-2 14:24–15:48

Nonlinear Optical Properties of Metal Halides

Tingchao He
College of Physics and Optoelectronic Engineering, Shenzhen University, Shenzhen 518060, P. R. China

- The modulation of nonlinear optical properties in all-inorganic perovskite nanocrystals will be discussed.
- The applications in amplified stimulated emission and photodetector based on multiphoton absorption have been investigated.
- Second harmonic generation has been observed in chiral 2D hybrid copper halides.



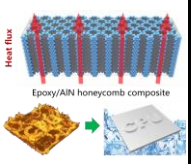
Notes

02-3 15:48–15:12

Fabrication of AlN honeycomb reinforcements for enhanced thermal conductivity of epoxy composites

Zhongqi Shi, Zhilei Wei
State Key Laboratory for Mechanical Behavior of Materials
Xi'an Jiaotong University, China

- Anisotropic epoxy (EP)/aluminum nitride honeycomb (AlN-H) composites were fabricated by freeze-casting and EP infiltration.
- Vertically aligned and interconnected AlN-H networks significantly enhanced thermal conductivity of the composites.
- Microstructure and thermal properties of the composites can be controlled by adjusting the solid loading.
- The EP/AlN-H composites exhibited excellent heat dissipation performance.



Graphical abstract

Notes

Technical Special Session 02
Functional Materials for Nanophotonics (ss)
Room 2
14:00-16:00 Tuesday, 3 August
Organizer: Zhipeng Wei
Co-Organizer: Rui Chen

02-4 15:12–15:36

Cavity ring-down spectroscopy in trace-gas detection

Jin Yu
Aerospace Information Research Institute, Chinese Academy of Sciences, People's Republic of China

Cavity Ring-Down Spectroscopy (CRDS) represents a cavity enhanced spectroscopic absorption technique developed from high-finesse passive resonators and sees its wide utilization in analytical chemistry, atmospheric environment monitoring, and medical detection research, etc. In this presentation, our effort and recent progresses are introduced concerning the study in CRDS and the development of in-situ deep-sea water-soluble methane monitoring and vehicle-mounted natural gas leakage detection devices.

Notes

02-5 15:36–16:00

Lead Halide Perovskite Microwires for High Performance Optoelectronic Devices

Shuang-Peng WANG
IAPME, University of Macau, Macao SAR, China

- Freestanding Single-crystal Lead Halide Perovskite Microwires Synthesized with a Predefined Lattice Framework
- Ultra-Long Microwires with Remarkable Photo and Thermal Stability
- Single Microwire-Based Photodetectors for Micro-Object Detection & Visible Light Communication
- Demonstrate FP Lasing in Submillimeter-Scale Long Perovskite Microwires

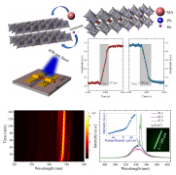


Photo Detectors and Lasing in Freestanding Lead Halide Perovskite Microwires

Notes

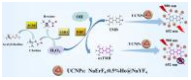
Technical Special Session 03
Nanobiophotonics (ss)
Room 3
14:00-16:00 Tuesday, 3 August
Organizer: Jinhua Li
Co-Chair: Xiaomin Liu

03-1 14:00–14:24

Near-infrared light Triggered Fluormetric Biosensor for Detection of Acetylcholinesterase Activity

Xu Zhao, Ling Zhang, Xu Yan, Xiaomin Liu* and Geyu Lua*
College of Electronic Science and Engineering, Jilin University, Changchun 130012, People's Republic of China

- A $NaErF_4$:0.5%Ho@$NaYF_4$ fluorescent probe with monochromic red upconversion emission under multi-band excitation in the NIR region.
- Ho^{3+} ions, as the transient energy trapping centers into the $NaErF_4$ core, confining the excitation energy and minimizing the energy loss
- The biosensor exhibits the detection limit of AChE as low as 0.0019 mU mL^{-1}



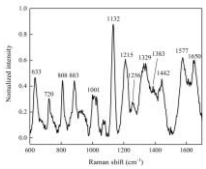
Notes

03-2 14:24–14:48

SERS Research on Joint Synovial Fluid

Jianhua Yin
Department of Biomedical Enginieering, Nanjing University of Aeronautics and Astronautics, China

- SERS is used to detect Raman spectra of joint synovial fluid (SF) at different osteoarthritis (OA) stages for research on OA and its diagnosis.
- SF Raman spectra are easily detected by SERS enhancement, rather than in normal condition.
- Protein content changes in OA SF, the structure and abundance of proteins at advanced OA stage remarkably differ from the healthy.
- SERS has potential to find OA biomarkers in SF, and to be an effective tool in clinical OA diagnosis.



SERS spectra of synovial fluid excited by 785 nm laser

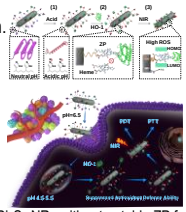
Notes

03-3 14:48–15:12

Electronic Band Structure Regulated Biomedical Applications of Nanomaterials

Haiyuan Zhang
Changchun Institute of Applied Chemistry, Chinese Academy of Sciences

- Nanomaterials with unique intrinsic properties can significantly contribute to their biomedical application.
- Photothermal and photodynamic properties of nanomaterials can be used for deep tumor therapy.
- Regulation of electronic band structure of nanomaterials will effectively enhance these functions.
- Precise construction of nanomaterials is a feasible approach to regulate their electronic band structure.



Bi_2S_3 NRs with retractable ZP for improved phototherapeutic effect.

Notes

Technical Special Session 03
Nanobiophotonics (ss)
Room 3
14:00-16:00 Tuesday, 3 August
Organizer: Jinhua Li
Co-Chair: Xiaomin Liu

03-4 15:12–15:36

Notes

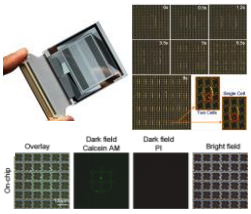
2102571

03-5 15:36–16:00

The Single Cell Manipulation Platform Based on the Digital Microfluidics for the Bioimaging System

Siyi Hu[1], Jingmin Ye[2], Subao Shi[2], Hanbin Ma[1*]
[1]CAS Key Laboratory of Bio-medical Diagnostics, Suzhou Institute of Biomedical Engineering and Technology, CAS, Suzhou, P.R. China
[2]Guangdong ACXEL Micro & Nano Tech Co., Ltd, China

- High throughput automated single cell generation, sorting, and manipulation platform.
- Digital microfluidic (DMF) system based on Electrowetting-on-dielectric (EWOD) principle.
- DMF system has a high degree of integration and can be integrated with commercial microscopic imaging system and temperature control model.



ACXEL

Notes

Technical Special Session 04
Two-Dimensional Materials and Devices I and II (ss)
Room 4
14:00-16:00 Tuesday, 3 August
Organizer: Yang Chai
Chair: Wenzhong Bao
Co-Chair: Qingliang Feng

04-1 14:00–14:17

Notes

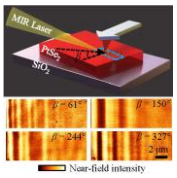
2102401

04-2 14:17–14:34

Mid-Infrared Nanoimaging of Platinum-Dichalcogenides

Shu Ping Lau
Department of Applied Physics, The Hong Kong Polytechnic University, Hong Kong SAR, China

- The MIR surface plasmons in the $PtTe_2$ were investigated by near-field nanoimaging.
- The annihilation of plasmonic modes in the ultrathin $PtTe_2$ was observed and analyzed.
- Sample-edge-orientation dependent nanoimaging together with spectroscopic nanoimaging characterization of the $PtSe_2$ were studied.
- $PtSe_2$ optically acts as a dielectric material with a high refractive index of ~5 and a low extinction coefficient in the MIR region.



Schematic diagram of near-field imaging on a $PtSe_2$ sample

Notes

04-3 14:34–14:51

Notes

2102411

Technical Special Session 04
Two-Dimensional Materials and Devices I and II (ss)
Room 4
14:00-16:00 Tuesday, 3 August
Organizer: Yang Chai
Chair: Wenzhong Bao
Co-Chair: Qingliang Feng

04-4 14:51–15:08

Notes

2102421

04-5 15:08–15:25

Notes

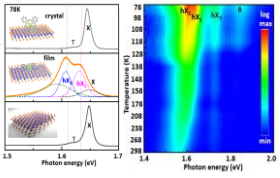
2102431

04-6 15:25–15:42

Controlled Exciton Behavior in van der Waals Heterostructures

Xiaoxian Zhang
Key Laboratory of Luminescence and Optical Information, Ministry of Education, Institute of Optoelectronic Technology, Beijing Jiaotong University, Beijing 100044

1. Molecular orientated exciton behavior were observed in CuPc /1L-$MoSe_2$ heterostructure.
2. Ultrafast hot electron transfer was detected in this vdws system with strong interfacial coupling.
3. Robust interlayer exciton was observed in WS_2/$MoSe_2$ heterostructure by high pressure.



Molecular orientation dependent hybrid exciton

Notes

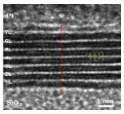
Technical Special Session 04
Two-Dimensional Materials and Devices I and II (ss)
Room 4
14:00-16:00 Tuesday, 3 August
Organizer: Yang Chai
Chair: Wenzhong Bao
Co-Chair: Qingliang Feng

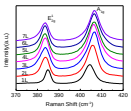
04-7 15:42–15:59

Stacking multiple MoS_2 monolayers for electronic and optoelectronic devices

Wenzhong Bao
Shool of Microelectronics, Fudan University, China

- Wafer-scale CVD grown MoS_2 monolayer are transferred to form randomly stacked 2L- to 7L-MoS_2 films
- Raman and TEM characterization to reveal the interlayer coupling property.
- Back and top gated transistors are fabricated and measured
- Demonstration of vertically stacked logic devices





Notes

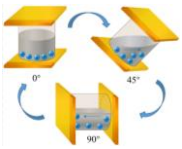
Technical Special Session 05
University of Shanghai Cooperation Organization
Nanotechnology (ss)
Room 5
14:00-16:00 Tuesday, 3 August
Organizer: Zhankun Weng
Co-Chair: Peng He

05-1 14:00–14:20

Fabrication of Solid-liquid Dual-phase TENG Based on PCL

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

- A reliable solid-liquid dual-phase TENG driven by elbow motion was designed and prepared.
- The output performance of TENG greatly increases by using PCL network microstructure.
- The output voltage of PI-GaIn alloy-based TENG reaches 223V and peak current reaches 17.8.μA.
- PI-GaIn alloy -based TENG can provides a stable power supply for LED bulbs.



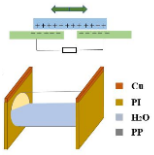
Notes

05-2 14:20–14:40

Effects of Two Methods on the Output Performance of Solid-liquid Dual-phase TENG

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

- Proton irradiation can indeed increase the electrical properties of solid-liquid dual-phase TENG.
- PCL has a lower effect on the output performance of TENG compared with PI.
- The MXenes materials we use cannot effectively improve the effect of charge transmission



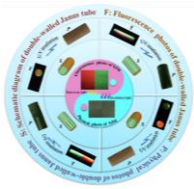
Notes

05-3 14:40–15:00

Design, Electrospinning Construction and Performances of Nanomaterials with Luminescent-conductive-magnetic Multifunction

Xiangting Dong*, Yinghe Wang, Liu Yang, Haina Qi,
Yunrui Xie, Qianli Ma, Wensheng Yu, Hong Shao
Changchun University of Science and Technology, China

- Five kinds of peculiar one-dimensional nanostructures are designed and constructed via electrospinning.
- Anisotropic conductive film is devised and manufactured using the one-dimensional nanostructure as building unit.
- Switch-typed anisotropic conductive film is firstly proposed and constructed by electrospinning.
- Novel 3D Janus tube is easily obtained via rolling the 2D anisotropic conductive film.



Notes

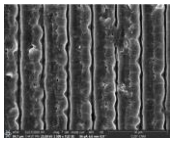
Technical Special Session 05
University of Shanghai Cooperation Organization
Nanotechnology (ss)
Room 5
14:00-16:00 Tuesday, 3 August
Organizer: Zhankun Weng
Co-Chair: Peng He

05-4 15:00–15:20

Surface modification of medical implanted titanium alloy by laser interference

Siyuan Cao, Wenjun Li, Wenyu Zhu, Zhankun Weng, Zuobin Wang
CNM, Changchun University of Science and Technology, China

- Both antibacterial and friction reducing titanium alloy surface structure was prepared by laser interference.
- Silver was used as an antibacterial agent on the surface and it played a lubricating role in friction.
- The groove structure reduced friction by reducing the contact area.
- The friction coefficient could be reduced by up to 60% and the antibacterial rate reached 99%.



SEM image of structure

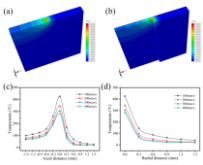
Notes

05-5 15:20–15:40

Numerical simulation of temperature field in C/SiC laser-assisted machining

Changtai Zhai, Jinkai Xu*, Guibin Sun, Beibei Zhao
Ministry of Education Key Laboratory for Cross-Scale Micro and Nano Manufacturing, Changchun University of Science and Technology, China

- The laser absorption rate of C/SiC in laser-assisted machining is 0.84
- The main and secondary order that affect the cutting temperature is P>V>L>D>ap
- The empirical formula of temperature is obtained by using multiple linear regression
- Laser power is a key parameter affecting temperature



Surface and internal temperature distribution of C/SiC composites under laser dynamic heating

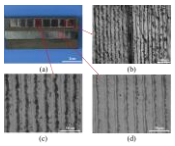
Notes

05-6 15:40–16:00

A laser scanner-stage synchronization system supporting large area precision polishing

Mengjia Cui, Zhen Zhang
Department of Mechanical Engineering, Tsinghua University, China

- A synchronized scanner-stage approach is developed and successfully implemented for a large area laser precision polishing with the self-developed open architecture system.
- The stitching errors can be avoided thanks to continuous motion during laser polishing.
- In comparison with the existing step-scan method, the processing efficiency of the proposed method is improved by 38.22% and the surface quality of the laser-polished area is significantly enhanced.



Large-area laser polishing with synchronized motion compared with step-scan method

Notes

Technical Special Session 07
2D Materials at Nanoscale: from Fundamentals to Applications (ss)

Room 1

16:20–18:20 Tuesday, 3 August

Organizer: Zegao Wang

Co-Organizer: He Tian

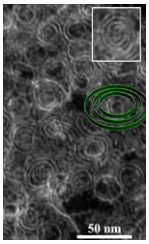
07-1 16:20–16:33

IEEE 3M-NANO 2021

Atomic-level Molybdenum Oxide Nanostructure for Light-responsive Properties

Yong Yang
State Key Laboratory of Solidification Processing, Center of Advanced Lubrication and Seal Materials, Northwestern Polytechnical University, Xi'an, Shaanxi 710072, P. R. China

Size effect is the key issue in nanoscience. At the sub-nanometer scale, ultrathin nanostructures will affect the assembly characteristics and electronic structure, and the latter can also affect the properties of materials in turn. In this presention, we will present the synthesis of atomic-level molybdenum oxide nanostructure as well as their light–matter interactions. These atomic-level nanorings displayed strong photo-absorption in both the visible and infrared-light ranges and acted as a photothermal agent. The light shape memory response, self-healing and reshaping performance will be discussed.



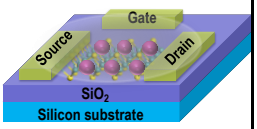
Notes

07-2 16:33–16:46

Vertical Transistor for Neuromorphic Nociceptor

Jie Jiang
Hunan Key Laboratory of Super Microstructure and Ultrafast Process, School of Physics and Electronics, Central South University, China

- An ion-coupling gate-tunable vertical 0D/2D hybrid-dimensional van der Waals heterojunction is demonstrated.
- Efficiency-adjustable photoelectronic Pavlovian conditioning and photoelectronic hybrid neuronal coding behaviors are successfully implemented.
- Visual adaptation function based on an environment-adjustable threshold is also demonstrated.



Notes

07-3 16:46–16 :59

Probing and Manipulating Photogenerated Carriers in 2D Van der Waals heterostructures

Xiao Wang
School of Physics and Electronics, Hunan University, China

- Realization of Controlled Vapor Growth of 2D Vertical Heterostructures with Tunable Band Alignments and Interfacial Charge Transfer Behaviors
- Room temperature near unity spin polarization in 2D Van der Waals heterostructures
- Picosecond ultrafast photocurrent response in 2D Van der Waals heterostructures

Notes

Technical Special Session 07
2D Materials at Nanoscale: from Fundamentals to Applications (ss)

Room 1

16:20–18:20 Tuesday, 3 August

Organizer: Zegao Wang

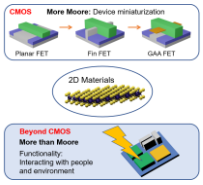
Co- Organizer: He Tian

07-4 16:59–17:12

High-Performance Logic and Functional Devices for the Post-Moore Era

Yuda Zhao
School of Micro-Nano Electronics, Zhejiang University, China

- Graphene as Cu interconnect barrier for blocking fast-diffusing Cu species
- Extraordinarily strong interlayer interaction in 2D Group-10 transition metal dichalcogenides
- The layer-dependent semiconductor-to-semimetal transition and high room-temperature mobility of $PtSe_2$ field-effect transistor
- Responsive 2D (opto)electronic devices to realize functional devices including optical memory, light-switchable p-n diode, and electrochemically switchable transistor.



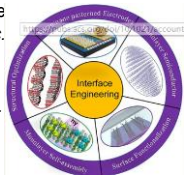
Notes

07-5 17:12–17:25

Interface Engineering for Effective Charge Transport in Organic Field-Effect Transistors

Deyang Ji
Institute of Molecular Aggregation Science, Tianjin University, China

- Synergistic induction effect of nanostructures and strong polarity in dielectric/ semiconductor interface for effective charge transport (*J. Am. Chem. Soc.* **2017,** *139*, 2734−2740)
- Optimizing the chemical structures of co-polymer dielectric for efficient charge transport (*Nat. Commun.* **2018**, *9*, 2339)
- Surface self-assembled monolayers assisting small molecular films with "band-like" transport (*Nat. Commun.* **2019**, *10*, 12)



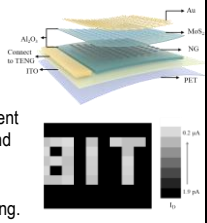
Notes

07-6 17:25–17:38

Mechanoplastic Tribotronic Nonvolatile Optoelectronic Memory Based on 2D Materials

Jing Zhao
School of Mechatronical Engineering, Beijing Institute of Technology, China

- A novel MoS_2 nonvolatile memory combined with nanographene as floating gate realize multilevel storage state triggered by both mechanical and optical stimulation without applying extra gate voltages. The device demonstrates excellent characteristics with high programming/erasing current ratio >10^7, performance stability over 200 cycles and retention time excess 10^5 s. In addition, the stable flexibility enables integrated devices feasibility for wearable memories in image capturing and recording.



Notes

Technical Special Session 07
2D Materials at Nanoscale: from Fundamentals to Applications (ss)

Room 1

16:20–18:20 Tuesday, 3 August

Organizer: Zegao Wang

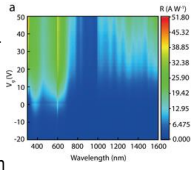
Co-Organizer: He Tian

07-7 17:38–17:51

Manipulate the Light-Matter Interaction of 2D Materials for High Performance Photodetection

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

- Large-scale of 2D semiconductor has been growth and investigated.
- The electrical property has been studied showing p-type semiconducting.
- The build-in electric filed of heterojunction has been stuided.
- The tunable photodetection including its photoresponse, detection and rise/fall time has been discussed.
- The photorespone can be extended from visible to near infrared.



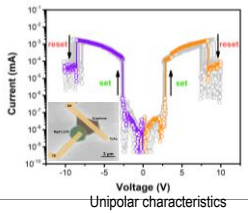
Notes

07-8 17:51–18:04

Layered Double Hydroxides Based Memrsitor

Xuya Xiong
iNANO, Aarhus University, Denmark

- Mg Al LDH/graphene memristor
- uniploar resistive switching behavior with ON/OFF ratio up to 10^6
- conductive mechanism is dominated by space-charge-limited current (SCLC) model
- in-situ characterization of mechanism by C-AFM



Unipolar characteristics

Notes

07-9 18:04–18:17

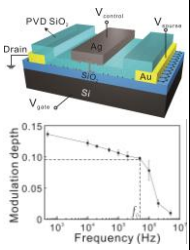
Resistive Switching Effect in Low Dimensional Electronics

Feng Xiong
College of Advanced Interdisciplinary Studies, National University of Defense Technology, China
Interdisciplinary Nanoscience Center (iNANO), Aarhus University, Denmark

Resistive switching (RS), a nonlinear electric property shown by some materials (or configuration), has the potential application in on-chip electronics. Here we systematically investigated RS effect in both Ag/SiO_2/graphene and 1T-TaS_2 to explore their applications in modern electronics.

•Graphene local sensor was used to investigate RS effect in Ag/SiO_2 structure.

•A thermal gate transistor has been invented based on RS effect in TaS_2.



Notes

Technical Session 08
Nanofluidics

Room 2

16:20–18:20 Tuesday, 3 August

Chair: Hongyang Yu

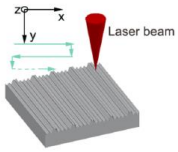
Co-Chair: Yujie Zhou

08-1 16:20–16:44

Transmission of Microfluid in Open Groove

JinLong Xu
Mechanical and electrical engineering,
Changchun University of Science and Technology, China

- Laser processing grooves for microfluid .
- Influence of non-parallel grooves on fluid flow compared with parallel .
- Influence of the shape parameters of rectangular grooves on the fluid flow velocity.
- This work promoted the basic research of microfluidics .
- This work has a certain guiding significance for the development of microfluidics.



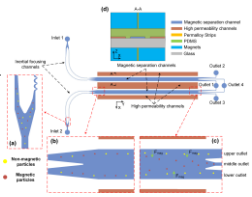
Notes

08-2 16:44–17:08

A magnetic field enhanced microfluidic device for precise particle separation

Yujie Zhou
School of Mechanical Engineering , Southeast University , China

- A magnetic field enhanced microfluidic device was fabricated based on MEMS technology for precise particle separation.
- The use of high permeability channels intensifies the magnetic field.
- A recovery ratio as high as 92.2% for particles separation was achieved.



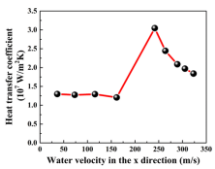
Notes

08-3 17:08–17:32

IEEE 3M-NANO 2021
The effect of flow velocity on the convection in nanochannel

Hongyang Yu, Yi Tao, Yu Zhao, and Jingjie Sha
Mechanical Engineering, Southeast University, China

- We investigate the effect of flow velocity on the convection in nanochannel
- The heat transfer coefficient does not increase with the increase of flow velocity monotonously
- There is an optimal convective heat transfer velocity.
- The fluid at optimal velocity can achieve the maximum heat transfer efficiency



Notes

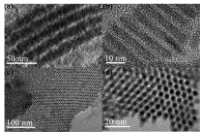
Technical Session 08
Nanofluidics
Room 2
16:20–18:20 Tuesday, 3 August
Chair: Hongyang Yu
Co-Chair: Yujie Zhou

08-4 17:32–17:56

Polarization optical properties of oriented nanorods film prepared by self-assembly technology

Ziheng Wang, Xueying Chu*, Jinhua Li*, Mingze Xu, Fangjun Jin, Yingjiao Zhai
Nanophotonics and Biophotonics Key Laboratory of Jilin Province, Changchun University of Science and Technology, Changchun 130022, China

- Ordered CdSe@CdS nanorods anisotropic film was fabricated by a simple and low cost self-assembly technology.
- The photoluminescence intensity of the CdSe@CdS nanorods film periodically varied with the polarization angle.
- The polarization ratio of the photoluminescence is 0.16 ± 0.02, which indicates the film can be used in ultraviolet polarization detection.



Morphology of self-assembled films

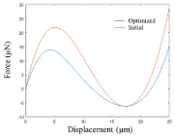
Notes

08-5 17:56–18:20

Optimization of the bistable mechanism properties based on radial basis function agent model

Min Liu, Weidong Wang, Zimin Huo, Siyan Dong, Yingmin Zhu and Haiyan Zhang
School of Mechano-Electronic Engineering Xidian University, Xi'an, China

- An optimization method for analyzing the mechanical characteristics of a bistable structure used in inertial switch was studied.
- A robust optimization based on radial basis function agent model was developed.
- The maximum force used to toggle the bistable beam is reduced from 21.81 μN to 13.81 μN and the contact force band at 95% confidence is narrowed from ±1.68 μN to ±0.82 μN.



Comparison of the force and displacement relationships between initial beam structure and optimized structure

Notes

Technical Session 09
AFM-Based Nanohandling

Room 3

16:20–18:20 Tuesday, 3 August

Chair: Liang Cao

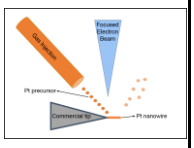
Co-Chair: Cunhua Liu

09-1 16:20–16:40

Direct Modification of Conductive AFM Probes by Focused Electron Beam Induced Deposition

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

- FEBID modified conductive AFM probes are presented.
- The modified probes exhibit superior spatial resolution and high stability during AFM scans.
- The direct FEBID modification can be used to restore damaged probes.



Schematic diagram of FEBID modified CAFM tip

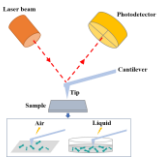
Notes

09-2 16:40–17:00

Analysis of the Mechanical Properties of Chromosomes in Air and Liquid by AFM

Bowei Wang
CNM, Changchun University of Science and Technology, China

- The morphologies of chromosome prepared by different methods were monitored by atomic force microscopy (AFM).
- The mechanical properties of chromosomes in air and liquid were investigated quantitatively through AFM-based force spectroscopy.
- The chromosome characterization under the liquid phase was more meaningful to reveal the physiological characteristics of chromosomes.



Schematic diagram of chromosome detection by AFM.

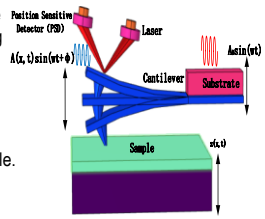
Notes

09-3 17:00–17:20

Tapping atomic force Microscopy imaging at phase resonance

Baishun Sun
CNM, Changchun university of science and technolgy, China

- The driving probe at the phase resonance peak was selected to improve the imaging quality of TM-AFM phase image, which is defined as PR-AFM.
- PR-AFM can provide the structure information of the subsurface of the sample.
- PR-AFM can be applied for better characterization of micro and nano materials.



Schematic image of TM-AFM working principle

Notes

Technical Session 09
AFM-Based Nanohandling

Room 3

16:20–18:20 Tuesday, 3 August

Chair: Liang Cao

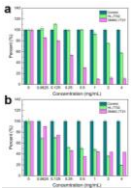
Co-Chair: Cunhua Liu

09-4 17:20–17:40

Effect of Astragalus Polysaccharides on Cancer Cells Studied by AFM

Zhengcheng Lu
JR3CN & IRAC, University of Bedfordshire, UK

- The effects of Astragalus Polysaccharides on cancer cells and healthy cells were studied by AFM.
- The concentration of Astragalus Polysaccharide solution and co-incubation time both affected hepatocytes and hepatoma cells.
- This work provides a new way for the development of new drugs.



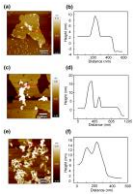
Notes

09-5 17:40–18:00

The Effect of Electricity on the Interaction between Aβ and Lipid Bilayer by AFM

Yixuan Pan
School of Mechanical Engineering , Southeast University , China

- Supported lipid bilayers with different proportions of negative charges were used .
- The interaction between Aβ (25-35) and lipid bilayer was studied to determine the influence .
- AFM was used to observe the binding of Aβ (25-35) to lipid bilayer.
- It was found that Aβ (25-35) deposited more on the negatively charged lipid bilayers.



AFM topography images of POPE/POPS lipid bilayers after the action of Aβ (25-35)

Notes

09-6 18:00–18:20

A Novel Disturbance Observer Based Sliding Mode Combined Repetitive Learning Control Strategy for Large Range Nanopositioning System

Cunhuan Liu, Yongchun Fang, Ningning Qi
College of Artificial Intelligence, Nankai University, China

- In this paper, a novel feedback control strategy for large range nanopositioning system is proposed;
- The control strategy combines disturbance observer based sliding mode control with repetitive learning control;
- The stability of close loop system is proved via Lyapunov method;
- Simulations and experiments are conducted to validate the effectiveness of proposed strategy.

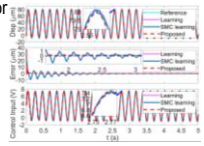


Figure: Comparison experimental results of tracking sinusoid signals with 30 rad/s

Notes

Technical Special Session 10
Two-Dimensional Materials and Devices I and II (ss)

Room 4

16:20–18:20 Tuesday, 3 August

Organizer: Yang Chai

Chair: Wenzhong Bao

Co-Chair: Qingliang Feng

10-1 16:20–16:40

Two-dimensional van der Waals Heterostructure Transistor for electronics and optoelectronics

Zheng Zhang
University of Science and Technology Beijing, China

- Two-dimensional (2D) transition metal dichalcogenides (TMDCs) are considered as potential candidates for next-generation channel materials.
- Van der Waals Heterostructures provide a promising platform to construct the high performance transistor with dangling bond free interface.
- With precise interface engineering via Defect, Strain, and Contact, the performances can reach the requirements of the applications.

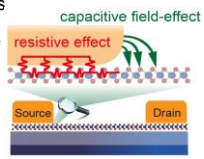
Notes

10-2 16:40–17:00

Electrical insight into metal-2D material contact

Yao Guo, Yang Chai, Qing Chen
School of Physics, Beijing Institute of Technology, China

- A method to investigate the resistance and current flow distribution at electrical contact to 2D materials
- First experimental demonstration of the destructive metal deposition.
- Electrical contact contributes not only a resistive effect (known as contact resistance),but also a capacitive field-effect that give rise to abnormal current saturation.



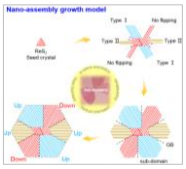
Notes

10-3 17:00–17:20

Two-dimensional Re-based TMDs: Controlled Synthesis and Photoelectric Properties

Hua Xu
School of Materials Science and Engineering,
Shaanxi Normal University, China

- Energy band engineering and electrical modulation of Re-based 2D TMDs (ReS_2 and $ReSe_2$).
- Revealing the unusual "nano-assembly growth model" of Re-based 2D TMDs.
- Realizing the intrinsic anisotropic growth of ReS_2 on Au(101) toward large-scale single crystal fabrication.
- Polarization-dependent photodetectors of Re-based 2D TMDs.



Nano-assembly growth model of Re-based 2D TMDs

Notes

Technical Special Session 10
Two-Dimensional Materials and Devices I and II (ss)

Room 4

16:20–18:20 Tuesday, 3 August

Organizer: Yang Chai

Chair: Wenzhong Bao

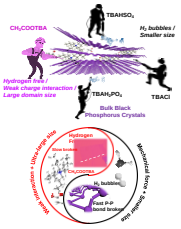
Co-Chair: Qingliang Feng

10-4 17:20–17:40

Electrochemical Delamination of Ultra-large Few-layer Black Phosphorus

Ning Wang, Qingliang Feng*
School of Chemistry and Chemical Engineering,
Northwestern Polytechnical University, China

- The largest domain size of few layer black phosphorus flakes up to 119 μm is reported.
- A electrochemical intercalation method of the weak charge interaction with a hydrogen-free process is developed.
- This method could be easily used to large-scale production of high-quality FL-BP flakes in factory.



Electrochemical Delamination Process

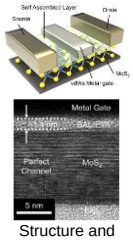
Notes

10-5 17:40–18:00

Van Der Waals Metal Gate to 2D Semiconductors for Sub-1 V Operation and Near Ideal Sub-Threshold Slope

Jingli Wang
Frontier Institute of Chip and System, Fudan University, China

- vdWs transfer method help to reduce damage in metal gate fabrication process and persist perfect interface
- vdWs gap and self-assembled layer help to reduce the metal induced gap states
- Metal gate allows for self aligned doping to reduce contact resistance



Structure and Cross-section TEM

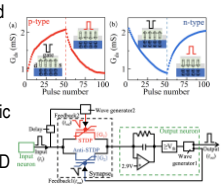
Notes

10-6 18:00–18:20

2D Materials for Neuromorphic Computing

Qi Chen, Yangyang Chen, Yue Zhou, Yuhui He*
Department of Microelectronics, Huazhong University of Science & Technology, China heyuhui@hust.edu.cn

- As synapses: methods to obtain ***nonvolatile*** and ***analog*** conductance tuning
- Graphene/h-BN transistor: shift of Dirac point by gate voltage sweeping and potential as synapse
- Complementary synapses: Graphene/ferroelectric transistor with potentiative & depressive tuning
- Reinforcement learning & supervised learning: 2D transistor-based complementary synapses to implement R-STDP



2D bipolar materials based Complementary synapses and neural network application

Notes

Technical Session 13
Nanomanipulation and Nanorobotics

Room 1

8:00–10:00 Wednesday, 4 August

Chair: Tiantian Xu

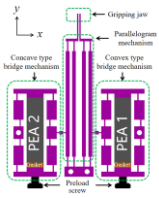
Co-Chair: Bo Chang

13-1 8:00–8:20

Design and Analysis of a New Compliant Microgripper with Two Working Modes

Zekui Lyu and Qingsong Xu
Faculty of Science and Technology, University of Macau, China

- This paper presents a new flexible gripper based on dual piezoelectric actuators.
- It is characterized by two working modes: normally open and normally closed.
- The design, modeling, optimization, and simulation of the gripper have been completed and displayed.
- The gripping stroke of the clamp reaches 800 μm with high adaptability.



Schematic of the proposed compliant microgripper.

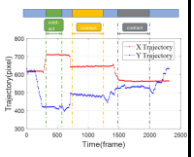
Notes

13-2 8:20–8:40

Division of CNT Placement Meta-task for Micro-Nano Robotic Manipulator

Chirui Han
School of Mechanical and Electric Engineering, Soochow University China

- Determine the process of placing CNT onto the gap on the surface of the nanodevice using SmarAct and PicMotor in SEM.
- Obtain the trajectory of AFM cantilever in SEM by means of image processing.
- The meta-task partitioning criterion for micron-nanometer manipulations was established and successfully applied to the placement of CNTs.



Some of the meta-tasks delineated

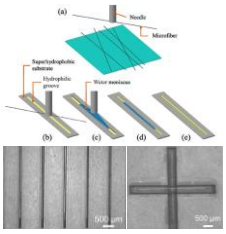
Notes

13-3 8:40–9:00

Capillary Micromanipulation of Microfibers

Bo Chang[1], Binkai Wang[1], Jialong Jin[1], Quan Zhou[2]
[1]College of Mechanical and Electrical Engineering, Shaanxi University of Science and Technology, China, [2]School of Electrical Engineering , Aalto University, Finland

- A capillary method is proposed for manipulation of microfibers.
- Microfibers can be picked up and released to the target using super hydrophilic – super hydrophobic grooved structures.
- Microfibers can align and distribute evenly on grooved structures.
- The proposed method has great potential for constructing complex microstructures out of microfibers.



Capillary micromanipulation of microfibers

Notes

Technical Session 13
Nanomanipulation and Nanorobotics

Room 1

8:00–10:00 Wednesday, 4 August

Chair: Tiantian Xu

Co-Chair: Bo Chang

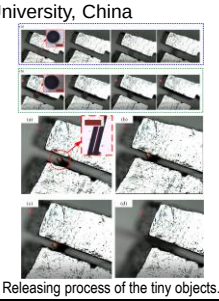
13-4 9:00–9:20

A Shear Force Assisted Tiny Object Releasing Method of a 2-DOF Microgripper

Fujun Wang, Beichao Shi, Zhichen Huo, Xiaolu Zhao, Yanling Tian, Xingyu Zhao, Dawei Zhang

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

- A novel shear force assisted releasing method is proposed in this paper
- This paper establishes the theoretical analysis model of the release process of cylindrical and spherical .
- Experimental tests are carried out to evaluate the performance of the shear force assisted releasing method.



Releasing process of the tiny objects.

Notes

13-5 9:20–9:40

Transporting and Rotating of Microstructures Actuated by Algal Microrobots

Shuangxi Xie[1,*] and Niandong Jiao[2,*]

[1] School of Electrical and Mechanical Engineering, Pingdingshan University, Pingdingshan, China

[2] State Key Laboratory of Robotics, Shenyang Institute of Automation, Chinese Academy of Sciences, Shenyang, China

*Corresponding-author: shuangxi881228@126.com; ndjiao@sia.cn

- Algal cells were controlled to follow arbitrarily set trajectories.
- Controlled assembly of algal robots and objects and using algal robots to perform tasks were realized.
- Robotized algal cells were expected to function in microassembly and microcargo traverse.

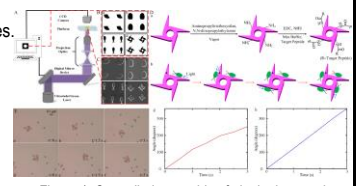


Figure 1. Controlled assembly of algal robots and micro-objects, and rotating of microstructures actuated by algal microrobots.

Notes

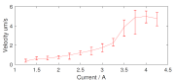
13-6 9:40–10:00

Motion Characteristics and Control of Magnetic Microbeads by Magnetic Gradient Fields

Zhengyu Lai[1], Tiantian Xu*[1], Chengyang Huang[1], Zhiming Hao[1], Shanxiu Zhang[1], Xinyu Wu[1], Li Zhang[2]

1. Shenzhen Institute of Advanced Technology, Chinese Academy of Sciences
2. The Chinese University of Hong Kong, Hong Kong, China

- A two-dimensional magnetic coils system consisting of 4 copper coils and ferromagnetic cores, capable of generating gradient magnetic field.
- A microbead which is superpara-magnetic polymer beads can be controlled by gradient magnetic field.
- The velocity of microbeads is proportional to the strength of magnetic field which can be adjusted by current.
- The trajectory control experiment shows good maneuverability of microbeads.



Notes

Technical Special Session 14
Micro/nano Mechanics and in Situ Characterization Techniques (ss)

Room 2

08:00–10:00 Wednesday, 4 August

Organizer: Weidong Wang

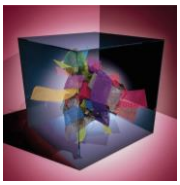
Co-Chair: Wenjie Xia

14-1 8 :00–8:20

Multiscale Modeling of Structure and Mechanics of Nanostructured 2D Materials

Wenjie Xia
Dept. of Civil, Construction and Environmental Engineering
North Dakota State University, USA

- Multiscale modeling framework for sheet-like 2D materials
- Mechanical behaviors of multilayer sheet assemblies
- Complex structure and dynamics of crumpled nanosheet
- Glassy behaviors of foam-like graphene assemblies



Glassy behaviors of graphene assemblies

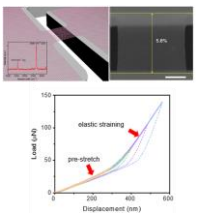
Notes

14-2 8:20–8:40

***in situ* Nanomechanics of 2D Materials**

Yang LU
Mechanical Engineering, City University of Hong Kong, Hong Kong SAR, China

- Development of nanomechanics platform for 2D materials
- First direct tensile tests of freestanding monolayer 2D materials (**graphene** & **h-BN**)
- "Realistic" engineering strength obtained
- Sample-wide large uniform elastic strain achieved
- Great potential for deep elastic strain engineering of 2D materials for electronics and optoelectronics applications



Elastic straining of monolayer graphene (***Nat. Commun.*** 11: 284, 2020)

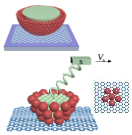
Notes

14-3 8:40–9:00

IEEE 3M-NANO 2021
Fabrication of superlubric interface across nano- and micro-scales

Yitian Peng
College of mechanical Engineering, Donghua University, China

- A novel method to fabricate superlubric interfaces across nano- and micro-scales is developed.
- The robust superlubric interface across 20 nm and 10 μm between highly hydrophobic FDTS SAMs and atomically thin graphene was achieved
- The superlubric mechanisms at the interface of FDTS/graphene across nano to micro scale was proposed.



The superlubric Interface of FDTS/Graphene

Notes

Technical Special Session 14
Micro/nano Mechanics and in Situ Characterization Techniques (ss)

Room 2

08:00–10:00 Wednesday, 4 August

Organizer: Weidong Wang

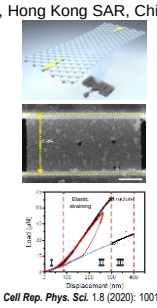
Co-Chair: Wenjie Xia

14-4 9:00–9:20

Large deformation and defect tolerance of h-BN monolayers

Ying HAN
Mechanical Engineering, City University of Hong Kong, Hong Kong SAR, China

- First direct tensile tests of freestanding monolayer h-BN
- Sample-wide large uniform elastic strain achieved in h-BN
- Large **defects tolerance** of h-BN (GB, edge defects, submicrometer voids, clamping ends)
- Great potential of h-BN in piezoelectrical and elastic strain engineering applications



Cell Rep. Phys. Sci. 1.8 (2020): 100172

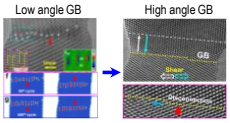
Notes

14-5 9:20–9:40

Atomistic dynamics of interface-dominated deformation

Jiangwei Wang
School of Materials Science and Engineering, Zhejiang University, China

- Interfaces are crucial for metallic materials, but its atomistic deformation mechanism remain largely lacking.
- Grain boundaries (GBs) can migrate by either GB dislocations and disconnections, depending on GB structures.
- Twin boundaries and phase boundaries show a strong-orientation dependent deformation, inducing the boundary cracking.
- Our studies provide new insights into the theory of interface plasticity.



Transition of atomistic GB dynamics

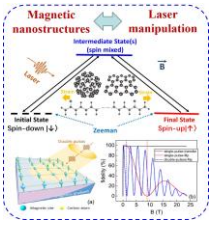
Notes

14-6 9:40–10:00

Strain-manipulated magneto-optical dynamics in low-dimensional nanostructures

C. Li*，Y.M. Zhang，J. Liu，S. Xu
School of Mechanics, Civil Engineering and Architecture, Northwestern Polytechnical University, China

- The reversible spin-transfer processes can only be obtained in the strained GNFs.
- The applied strain can effectively modulate the spin-dynamics properties in endohedral metallofullerenes.
- The optically induced subpicosecond spin-transfer scenario over 4.428 nm (CMOS scale) in zigzag carbon chains.
- Strain modulation of the spin-dynamics behavior provides new ideas in designing future spin-logic devices.



Notes

Technical Special Session 15
Ultrafast Optical Technology and Application (ss)

Room 3

08:00–10:00 Wednesday, 4 August

Organizer: Bo Guo

Co-Chair: Lu Li

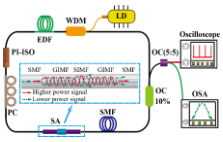
15-1 8:00–8:24

Ultrafast Soliton Fiber Laser and its Control based on Multimode Fiber

Qianchao Wu, Yong Yao

School of Electronic and Information Engineering, Harbin Institute of Technology, Shenzhen 518055, China

- Various optical nonlinear effects in graded-index multimode fiber and its applications.
- The all-fiber saturable absorber (SA) can be obtained by designing different multimode fiber structure.
- Based on multimode fiber structure SA, the versatile ultrafast soliton fiber lasers and its control are demonstrated and achieved.



Soliton fiber laser: design and control of ultrafast soliton fiber laser, fabrication and mechanism of multimode fiber structure SA.

Notes

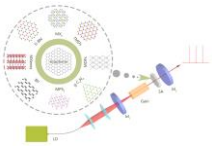
15-2 8:24–8:48

Advances in multi-wavelength ultrafast photonics

Bo Guo

Key Lab of In-Fiber Integrated Optics, Ministry Education of China, Harbin Engineering University, China

- Novel nonlinear optical devices for multi-wavelength ultrafast photonics are prepared.
- By introducing them into the fiber laser, the versatile multi-wavelength ultrafast lasers and phenomenon are demonstrated.
- 2D material can be as an excellent nonlinear materials with rich physical connotation and application prospect.



2D Layered Materials: Synthesis, Nonlinear Optical Properties, and Device Applications

Notes

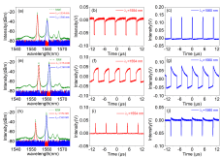
15-3 8:48–9:12

Switching and Evolution of Vector Pulses in Ultrafast Fiber Laser

Qianchao Wu, Yong Yao

School of Electronic and Information Engineering, Harbin Institute of Technology, Shenzhen 518055, China

- Various vector pulses and their characteristics are introduced.
- The switching and evolution of dark and bright pulse in a vector dark-bright pair are studied through a ultrafast fiber laser.
- Based on MoS_2 saturable absorber, a three-component bright-dark-bright vector pulse fiber laser was found and investigated.



Switching and evolution of dark and bright pulse in a vector dark-bright pair

Notes

Technical Special Session 15
Ultrafast Optical Technology and Application (ss)

Room 3

08:00–10:00 Wednesday, 4 August

Organizer: Bo Guo

Co-Chair: Lu Li

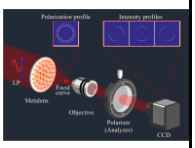
15-4 9:12–9:36

Metalens for Generating Multiple Customized Vectorial Foci

Ruoxing Wang, Li Li

Key Laboratory of In-Fiber Integrated Optics of Ministry of Education, Harbin Engineering University, China

- Present situation and progress of metalenses
- Metalens with four vectorial foci for incident polarization detection
- Metalens for generating a customized vectorial focal curve
- Prospect for a metalens that produces a vector holographic image
- L. L. supervised the project, R. W. mainly completed this project



Schematic of the metalens with customized vectorial focal curve

Notes

15-5 9:36–10:00

Nonlinear optical properties of 2D materials and the application in ultrafast lasers

Lu Li

School of Science, Xi'an University of Posts and Telecommunications, China

- The optical characteristics of group VB TMDCs and ultrafast laser application are studied.
- Ternary TMDCs for Q-switched or mode-locked fiber lasers are studied.
- Ternary TMDCs for high power vector dissipative soliton ultrafast fiber laser are studied.
- Some developmental challenges, potential prospects, and future research directions are summarized

Notes

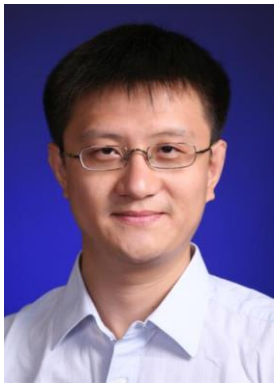
Technical Special Session 16
Design, Analysis and Control of Nano-Manipulating Systems (ss)

Room 4

08:00–10:00 Wednesday, 4 August

Organizer: Zhen Zhang

Co-Organizer: Peng Yan



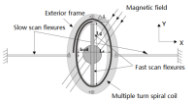
16-1 8:00–8:15

Stabilized control of Electromagnetic Micro-Mirror

Tianyu Wang[1] Guo Chai[1] Ruili Dong[2] Yonghong Tan[1]

1. Shanghai Normal University, China
2. Donghua University, China

- The stabilized control is proposed for angular control of electromagnetic scanning micro-mirror (EMSM) which has underdamped and hysteresis features leading to undesirable oscillation and positioning error.
- The Hammerstein model with hysteresis is established to describe the characteristic of EMSM system.
- The stability of controlled EMSM systems is presented.



Architecture of EMSM system

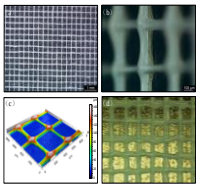
Notes

16-2 8:15–8:30

Electric Field – Assisted Micro/Nano Printing of Polystyrene Materials

Haodong Hong, Jiawen Xu, Wezhen Yang, Yu Liu*
School of Mechanical Engineering, Jiangnan University, Wuxi

- Electric – field driving hydrodynamic deposition of polystyrene in both of 2D and 3D environments.
- Correlation among material viscosity, concentration, electric field etc. and controlled pattern sizes from tens of microns down to submicron.
- Switching jetting modes by adjusting electric field, material property and pressure.
- Applications with this printing method are demonstrated including strain sensor, microfluidics…



Micropatterning of polystyrene materials in 3D environment

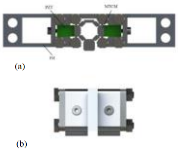
Notes

16-3 8:30–8:45

Design and Modeling of a Novel Push-pull Type Piezomotor with Infinite Stroke

Peiyuan Zhang and Hui Tang
The State Key Laboratory of Precision Electronics Manufacturing Technology and Equipment, Guangdong University of Technology, China

- A novel push-pull type piezomotor with infinite stroke is proposed in this work.
- The motor is driven by PZT actuators, which could produce precise displacements but its stroke is a demerit, which is compensated by friction.
- Kinematics, dynamic modeling, and FEA simulation are conducted.
- The fastest speed of the piezomotor illustrated could be about 1mm/s while infinite stroke is accomplished.



Two views of the piezomotor devise without slider in two visual angles: (a) Front view (b) Lateral view.

Notes

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

Room 4

08:00–10:00 Wednesday, 4 August

Organizer: Zhen Zhang

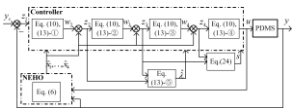
Co-Organizer: Peng Yan

16-4 8:45–9:00

Adaptive Output Feedback Tracking Control for PDMS via Hysteresis Observer

Chen Zhang, Yewei Yu, Miaolei Zhou*
College of Communication Engineering, Jilin University, China

- Presentation of an extended hysteresis observer
- Construction of an adaptive output feedback controller
- Experiment validation on tracking performance of proposed method



Architecture of proposed scheme.

- **Main contributions :** (1) a novel extended hysteresis observer (NEHO) based on Duhem model is proposed. The NEHO possesses the merits of facilitating state estimation and providing new idea for subsequent controller design; (2) With a combination of the designed NEHO and DSC technique, a novel adaptive output feedback control (NEHO-AOFC) method is developed to mitigate the hysteresis effect.

(PDMS: Piezoelectric-Driven Micropositioning Stage)

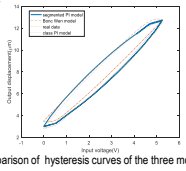
Notes

16-5 9:00–9:15

A segmented model of piezoelectric ceramics actuators

Zhuoli Yang, Ruili Dong
Department of Automation, Donghua University China
Yonghong Tan
the College of Mechanical and Electronic Engineering,
Shanghai Normal University China

1. A new dynamic hysteresis model is proposed in this paper.
2. The new dynamic hysteresis model consists of several static PI models.
3. The dynamic hysteresis model can reduce the model error at high frequencies



Comparison of hysteresis curves of the three models

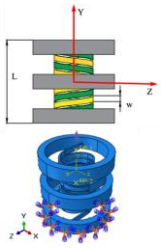
Notes

16-6 9:15–9:30

Design Of A Helix-Based Revolute Flexure Hinge with Large Stroke

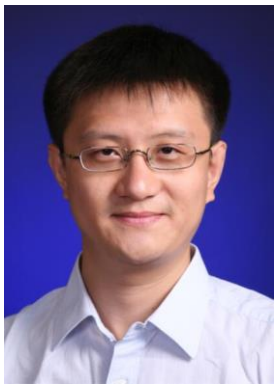
Pengbo Liu, Guoming Yao, Liangliang Yan
School of Mechanical & Automotive Engineering, Qilu University of Technology (Shandong Academy of Sciences), Jinan, China

- A novel revolute flexure hinge consisting of helical spring-like structures is developed.
- The developed flexure hinge achieves a large workspace (±150°) with high accuracy (zero axis drift).
- The stiffness model is derived based on the elastic beam theory to illustrate the load-deformation relationship.
- Finite element analysis verifies the mechanical performance of the developed flexure hinge.



Notes

Technical Special Session 16
Design, Analysis and Control of Nano-Manipulating Systems (ss)
Room 4
08:00–10:00 Wednesday, 4 August
Organizer: Zhen Zhang
Co-Organizer: Peng Yan

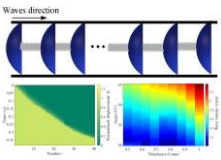


16-7 9:30–9:45

Design and Analysis of a Soft Shell Array Supporting Variable Velocity Propagation of Mechanical Waves

Xiaoyuan Ma[1], Pengbo Liu[2] and Peng Yan[1]
1. School of Mechanical Engineering, Shandong University, China
2. School of Mechanical and Automotive Engineering, Qilu University of Technology, China

- A novel method that achieves variable velocity of mechanical waves in soft media is proposed.
- The mechanical and energy characteristics of individual shells is quantified by Finite Element analyses.
- An analytical model is established based on Newmark-β and the controllability of waves is verified by numerical simulations.



Spherical shell array supporting variable wave velocity

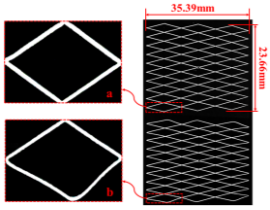
Notes

16-8 9:45–10:00

Robust tracking with FPGA for high-speed laser galvanometer scanning

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

- Modeling, analysis and control of a galvanometer scanner
- FPGA implementation of robust control for fast trajectory tracking
- Experimentally demonstration of enhanced tracking performances via embedded prototype



Comparison of processing results at 1.5 m/s
a) proposed control, b) PID control

Notes

Technical Special Session 17
Biomedical Sensors & Measurement for Micro/Nano Technology (ss)

Room 5

08:00–10:00 Wednesday, 4 August

Organizer: Jianping Li

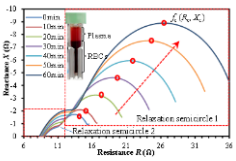
Co-Chair: Jingshi Huang

17-1 8:00–8:17

Real Time Erythrocyte Sedimentation Measurement Based on Electrical Impedance Spectroscopy

Jianping Li
College of Engineering, Zhejiang Normal University, China

- a real time and quantitative measurement for erythrocyte sedimentation based on electrical impedance spectroscopy (EIS)
- T-shape container is utilized and analyzed, which is confirmed to achieve stable linear relationship effectively
- FEM and modified HANAI calculations suggest that, the hematocrit (HCT) is responsible for the linear relationship



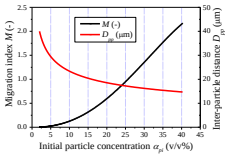
Notes

17-2 8:17–8:34

Measurement of Multiphase Flow by Electrical Process Tomography

Tong ZHAO
School of Mechanical and Precision Instrument Engineering
Xi'an University of Technology, China

- Particle inertial migration in the case of initial particle concentration up to 5.0 % is obvious.
- Migration phenomena completely disappear in the case of large initial particle concentration.
- Migration index below one order of magnitude less then unit denotes obvious particle inertial migration phenomena.
- Large migration index indicates the considerable particle interaction that prevents particle migration.



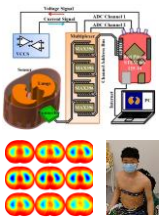
Notes

17-3 8:34–8:51

Development of a Portable Electrical Impedance Tomography System for Lung Imaging

Jiafeng Yao
College of Mechanical and Electrical Engineering,
Nanjing University of Aeronautics and Astronautics, China

- A portable electrical impedance tomography (EIT) system has been developed with Red Pitaya STEMlab for lung imaging. The EIT system includes a modified howland circuit as a voltage-controlled current source, a high-speed analogy multiplexer module, a 16-electrode array, and a personal computer. Finally, experiments were conducted to evaluate the developed system, which proved that the developed EIT system could reconstruct the lung shape with high accuracy and high speed.



Notes

Technical Special Session 17
Biomedical Sensors & Measurement for Micro/Nano Technology (ss)

Room 5

08:00–10:00 Wednesday, 4 August

Organizer: Jianping Li

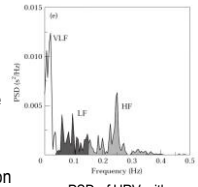
Co-Chair: Jingshi Huang

17-4 8:51–9:08

How to measure HRV (Heart Rate Variability) in Physiological Signal Detection

HUANG JINGSHI
Head of Humanomics Science Center,
Shanghai University of Engineering Science (SUES), China

- The standard processing of HRV test
- The physiological theory and background of HRV
- Common issues appeared in HRV test
- The application of HRV and how to comprehend the connotation of HRV
- This speech figure out the problems and connotation knowledges about HRV which is a hot topic recently.



PSD of HRV with Hanning window

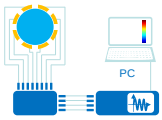
Notes

17-5 9:08–9:25

IEEE 3M-NANO 2021 Digest Template Micro Electrical Impedance Detection on Biofluid

Liu Xiayi, Wang Zhilong, Zhang An, Zhao Tong
School of Mechanical and Precision Instrument Engineering , Xi'an University of Technology, China

- Micro EIT is developed to detect the distribution of cell's sedimentation in microchannels.
- A new method of detecting the concentration of dead cell in mixed cell solution is developed based on micro EIS.
- Contact impedance on the interface of micro electrode affect the detection



Micro EIS and EIT detection devices

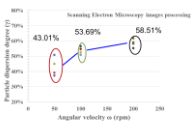
Notes

17-6 9:25–9:42

Investigation of particle dispersion degree in Lithium-ion battery (LIB) slurry with electrochemical impedance spectroscopy (EIS) method

Zhilong Wang, Xiayi Liu, Tong Zhao
School of Mechanical and Precision Instrument Engineering
, Xi'an University of Technology, China

- Resistances of LiCoO2 particles and PVDF-NMP solution are decreased with increasing of Particle dispersion degree.
- Particle dispersion degree of LIB slurry is quantitatively defined by SEM image processing method.
- The dispersion percentage D0.2 between 0.8μ and 1.2μ is increased with increasing of angular velocity.
- This manuscript can realize an on-line measurement of LIB slurry.



Variation of Particle dispersion degree increased with angular velocity

Notes

Technical Special Session 17
Biomedical Sensors & Measurement for Micro/Nano Technology (ss)

Room 5

08:00–10:00 Wednesday, 4 August

Organizer: Jianping Li

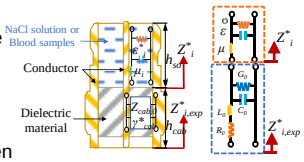
Co-Chair: Jingshi Huang

17-7 9:42–9:59

GHz electrical impedance spectroscopy (EIS) measurement method and application

An Zhang, Xiayi Liu, Zhilong Wang, Tong Zhao
School of mechanical and precision instrument engineering,
Xi'an University of Technology, China

- GHz EIS measurement method is established
- The complex permittivity of solutions is extracted from the experimental impedance
- The plasma with fibrinogen increases the permittivity of native blood.
- Injecting much more fibrinogen plasma solution reduces the blood permittivity, due to RBC aggregation reaction.



Equivalent circuit model For GHz EIS

Notes

Technical Session 18
AFM Applications

Room 1

10:20–12:20 Wednesday, 4 August

Chair: Can Cheng

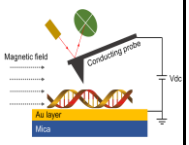
Co-Chair: Mingyan Gao

18-1 10:20–10:40

Study on the conductivity of DNA molecules under magnetic fields

Mingyan Gao
International Research Centre for Nano Handling and Manufacturing of China, Changchun University of Science and Technology, Changchun 130022, China

- The conductivity of DNA molecules under the effect of magnetic fields was studied
- The DNA molecules are stretched on the Au layer surface
- The conductive atomic force microscopy (C-AFM) was used in this work
- This study will contribute to the deeper application of DNA molecules in nanotechnology.



C-AFM was used to measure the DNA molecules conductivity under the effects of magnetic fields.

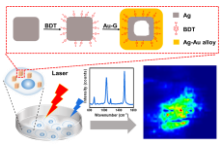
Notes

18-2 10:40–11:00

Silver Nanocubes-based Bimetallic Core-shell Surface-enhanced Raman Scattering Nanoprobes for Cell Imaging

Jiao Peng, Li Lin, Jian Ye*
School of Biomedical Engineering, Shanghai Jiao Tong University, P. R. China

- Synthesis of Ag core-Ag/Au alloy shell nanoprobes embedded with Raman reporters.
- The SERS performance can be optimized by controlling the alloy shell thickness.
- Improved SERS activity, chemical stability, and photostability than Ag@BDT.
- Excellent stability and biocompatibility allow the SERS nanoprobes for cell imaging under long-term irradiation.



Ag@BDT@Ag-Au nanocubes as SERS nanoprobes for cell imaging

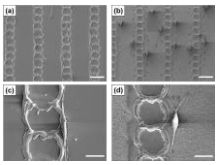
Notes

18-3 11:00–11:20

Growth Behavior of SHSY5Y Cells on Hybrid Micro-pit and Nano-pillar Arrays

Xiaomin Wu
CNM, Changchun University of Science and Technology, China

- A method of fabricating hybrid micro/nano structures is introduced to investigate cells behavior.
- The cells are captured, arranged orderly and grow independently on the hybrid micro/nano structures.
- The hybrid micro/nano structures are useful in the field of single neuron research.



SEM images of SHSY5Y cells cultured on the SiMP arrays (unetched) and hybrid SiMP/SiNP arrays (etched), respectively.

Notes

Technical Session 18
AFM Applications

Room 1

10:20–12:20 Wednesday, 4 August

Chair: Can Cheng

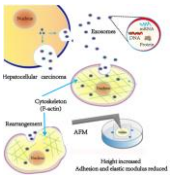
Co-Chair: Mingyan Gao

18-4 11:20–11:40

Effect of SMMC-7721-derived Exosomes on Hepatocytes Studied by AFM

Tuoyu Ju
CNM, Changchun University of Science and Technology, China

- The SMMC-7721-exos were able to promote the proliferation and rearrange the cytoskeleton of hepatocytes.
- AFM results showed that the height was increased, the adhesion and the elastic modulus were reduced.
- The changes of cell mechanical properties induced by exosomes were of great significance to further study the mechanism of exosomes.



The schematic diagram of HCC-derived exosomes changing the biological and physical properties of hepatocytes.

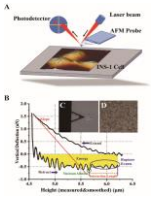
Notes

18-5 11:40–12:00

Multi-parameter AFM Characterization of INS-1 Cells

Fan Yang
CNM, CUST, China

- The data processing aspects of multi-parameter AFM quantitative imaging for the INS-1 cells were addressed.
- The dimensional topographies and mechanics of INS-1 cells were obtained to characterize the structural and physical properties.
- The results hold great potential as the biomarkers for this research of diabetes.



Schematic illustration of a typica AFM force measurement

Notes

18-6 12:00–12:20

A Dynamic Feedback Algorithm of AFM Bas ed on Cell Morphology Changes

Can Cheng
CNM, Changchun University of Science and Technology, China

- An dynamic control method to improve the image quality of living human colon cancer cells (SW480).
- Especially in the down part of the living samples during the scanning.
- This algorithm can improve the scanning speed and obtain more detailed living cells morphology features.

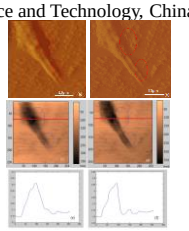


Fig. Comparison of the AFM images of SW480 cells by different algorithms

Notes

Technical Session 19
Nanofabrication Processes and Systems I

Room 2

10:20–12:20 Wednesday, 4 August

Chair:Jin Zhang

Co-Chair: Ding Zhao

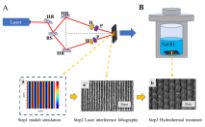
19-1 10:20–10:40

Fabrication of Hierarchical Ti6Al4V Structures by Hydrothermal Treatment and Laser Interference Lithography with Enhanced Ice Resistance

Ri Liu

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

- Combining direct laser interference lithography and hydrothermal treatment to make anti-icing hierarchical structure
- Discuss the influence of structure and wettability on ice resistance.
- Superhydrophobic surface with hierarchical structure has good anti-icing ability, even in extreme environments.



Flow chart for preparing hierarchical composite structure.

Notes

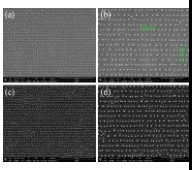
19-2 10:40–11:00

Laser interference field induced re-distribution of Ag nanoparticle arrays

Ming Yue

CNM, Changchun University of Science and Technology, China

- A method for preparing metal nanoparticles by two-beam laser interference is introduced.
- Controlling spot energy and exposure time to optimize surface characteristics of the Ag-Si material system.
- Periodic gradient Ag nanoparticle arrays (AgNPs) pattern can be controlled.



SEM images of interference on the substrate material treated with oxygen plasma and hydrofluoric acid.

Notes

19-3 11:00–11:20

Optimization method of phase-shift structure for polarization beam-splitter

Jin Zhang, Dacheng Jiang, Guobin Sun, etc.

School of Optoelectronic Engineering, Xi'an Technological University, China

- A polarization beam splitter based on subwavelength grating is theoretically analyzed.
- The design equations of phase-shift structure are given for separating the TE and TM polarized waves.
- The optimum parameters of phase-shift structure at the wavelength of 10.6μm with high extinction ratio are calculated.

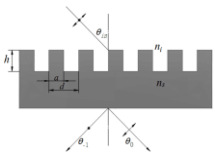


Fig. Sub-wavelength structure for polarization beam-splitter

Notes

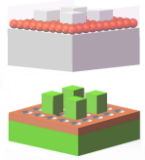
Technical Session 19
Nanofabrication Processes and Systems I
Room 2
10:20–12:20 Wednesday, 4 August
Chair: Jin Zhang
Co-Chair: Ding Zhao

19-4 11:20–11:40

The Research of NIR Absorption of Plasmonic Enhanced Silicon-Silver Composite Microstructure

Guobin SUN
School of Optoelectronic Engineering, Xi'an Technological University, China

- Discuss the optical absorption enhancement in NIR band of silicon grating composite microstructure
- Report two composite microstructures contain Ag nano-sphere or nano-pit based on surface plasmon resonance
- Simulate and analyze the absorption enhancement effect of composite microstructure



Composite microstructure of silicon grating combined with Ag nano-sphere and nano-pits

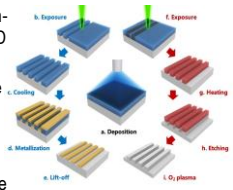
Notes

19-5 11:40–12:00

Ice-Assisted Electron-Beam Lithography for 3D Nanofabrication

Ding Zhao, Yu Hong and Min Qiu
School of Engineering, Westlake University, China

- Water ice or organic ice can act as an electron-beam resist, which has great advantages in 3D nanofabrication
- Observation of nanostructures under water ice is allowed through SEM imaging, which enables in-situ positioning and alignment during overlay exposure process
- Anisole ice has a very low contrast comparable to the standard SU-8 e-beam resist



Ice lithography process flow for positive and negative resists

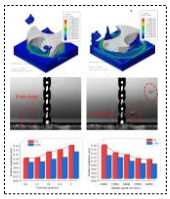
Notes

19-6 12:00–12:20

Dynamic Chip Formation of Ultrasonic-assisted Micro-drilling on AISI 4340 Steel

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

- The morphology of the chips in UAD and CD obtained by finite element simulation and experiment results have a good consistency.
- During UAD machining, the chips quickly move away from the machining area, which helps chip removal and improves machining quality.
- In UAD, the quality of the inner wall of the micro-holes has been greatly improved, and the surface finish is good.



FEM and experiment results in CD and UAD

Notes

Technical Session 20
Micro- and Nano-Structures and Characterization

Room 3

10:20–12:20 Wednesday, 4 August

Chair: Cunxiang Pan

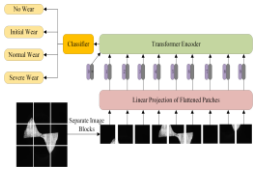
Co-Chair: Yongwei Yan

20-1 10:20–10:40

Wear Status Prediction of Micro Milling Tools by Transfer Learning and ViT Model

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

- Diameter reduction of the bottom edge can be used as an evaluation method
- Use of rear face wear of milling tools images as feature datasets
- Increase in accuracy by 2-4% compared to traditional models
- Accuracy of generalizability of the prediction model is 92.5000%



Principle diagram of image classification by ViT model

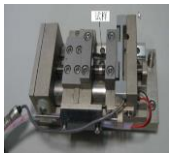
Notes

20-2 10:40–11:00

Bionic model design of aviation materials based on Coleoptera structure of dung beetle

Chunxiang Pan
Mechanical department of fundamental institute, Air force aviation university, Changchun

- In this paper, the Coleoptera of dung beetle is taken as the research object. After the Coleoptera is broken, the cross section is observed. It is found that the Coleoptera of dung beetle is composed of multi-layer fibers.
- Combined with previous studies, a new bionic aviation material structure model is proposed. The finite element analysis method is used for loading, and the control group is set for comparative analysis. The research results have significance for the development of new aviation material structure design It has certain guiding significance.



MTEST 300 module microtensile

Notes

20-3 11:00–11:20

Study on antireflection of titanium alloy based on different filling intervals of nanosecond laser

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

- The antireflective and superhydrophobic composite functional surfaces were fabricated by nanosecond laser.
- The reflectance of titanium alloy surface could be decreased by 3% in the broad wavelength range.
- The maximum contact angle is 153.8°when the laser filling interval was 0.01mm.

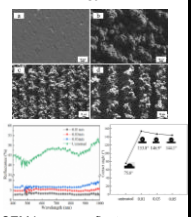


Figure. SEM images, reflectance curve, contact angle of laser-processed titanium alloy surface.

Notes

Technical Session 20
Micro- and Nano-Structures and Characterization

Room 3

10:20–12:20 Wednesday, 4 August

Chair: Cunxiang Pan

Co-Chair: Yongwei Yan

20-4 11:20–11:40

Localized Electrochemical Deposition of Bionic Salvinia Molesta Micro-Array Structure

Kun Tian
Department of Mechanical and Electrical Engineering,
Changchun University of Science and Technology, China

- Preparation of Microstructure on the Surface of Copper Alloy based on Pulse Electrolytic Machining.
- Exploring the effects of machining voltage and machining time on surface structure and surface contact angles.
- The surface of the electrolysis process does not need to be modified using a low surface energy to be modified.
- An environmentally friendly, fast, and efficient processing method is used.

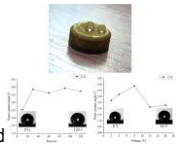


Diagram of hydrophobic characteristics of copper alloy.

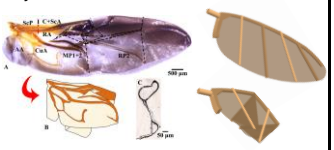
Notes

20-5 11:40–12:00

Bionic Deployable Wing Design Based on Asian Ladybird Beetle

Zelai Song, Yichen Wang, Wen Li,Yuchao Zhan,Pengpeng Li,Yongwei Yan,Jin Tong, Jiyu Sun
Key Laboratory of Bionic Engineering (Ministry of Education, China) Jilin University, P.R. China

- The structure morphologies of hind wing and the cross sections of veins.
- The folding progress of hind wing.
- Design the bionic deployable wing.
- Static analysis of the bionic wing.



The hind wing, the sketch map of folding wing and cross section of veins of *Harmonia axyridis*.
The design of the bionic deployable wing of FMAVs.

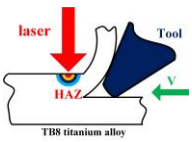
Notes

20-6 12:00–12:20

Study on microstructure and surface microhardness of laser-assisted machining of TB8 titanium alloy

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

- Laser-assisted cutting can effectively reduce the grain breakage of the processed profile.
- When the power is 60W and the cutting depth is 30μm, the grain damage is the least.
- Laser-assisted cutting can increase the surface microhardness by up to 16.9%.



Schematic diagram of laser-assisted micro-cutting

Notes

Technical Session 21
Nanomechanics and Nanomechatronics

Room 4

10:20–12:20 Wednesday, 4 August

Chair: Huiliang Liu

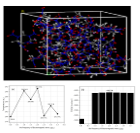
Co-Chair: Yujing Zhang

21-1 10:20–10:37

Simulation Analysis of Propellant in Electromagnetic Radiation Field

TUAN ZHAO
National Key Laboratory of Applied Physics and Chemistry, Shaanxi Applied Physics and Chemistry Research Institute, China

- The molecular structure of simulation models of three propellant was constructed in Material Studio.
- Completed electromagnetic simulation of Molecular Dynamics of propellant.
- Completed the analysis of radial distribution function of propellant.



Simulation models and simulation result of propellant

Notes

21-2 10:37–10:54

Combinatorial Optimization with Variational Approaches on Noisy Quantum Devices

Tsukasa Miki, Ryo Okita, Moe Shimada, Jun-ichi Shirakashi
Dept. of Electrical and Electronic Engineering
Tokyo University of Agriculture & Technology, Japan

- Variational quantum eigensolver (VQE) for ground-state searches has latent powers to leverage noisy quantum devices.
- VQE, a quantum-classical hybrid approach, suppresses the number of quantum operations (shown in right figure).
- Shorter-depth quantum circuit in VQE than conventional approach can solve the Max-Cut problem more accurately.
- The simplest case of our VQE-circuit can be realized enough using current quantum computers.

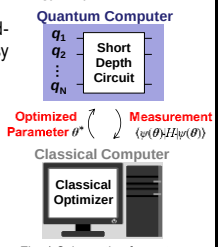


Fig. 1 Schematic of quantum-classical hybrid approach.

Notes

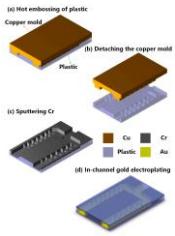
21-3 10:54–11:11

Error Tolerance Analysis and Multipaction Suppression of Micromachined E-band Duplexer

Huiliang Liu
Institute of Telecommunication and Navigation Satellites, CAST, CHINA

Three distinctive advancements have been achieved

- the design of a high-performance E-band duplexer and the corresponding fabrication process based on micromachining technology;
- the demonstration of the RF performance simulation and the error tolerance analysis of the proposed fabrication process; and
- the illustration of the multipaction phenomena and the counter measures to inhibit the effect.



Notes

Technical Session 21
Nanomechanics and Nanomechatronics

Room 4

10:20–12:20 Wednesday, 4 August

Chair: Huiliang Liu

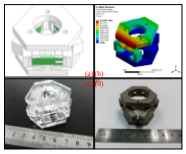
Co-Chair: Yujing Zhang

21-4 11:11–11:28

Modeling and Analysis of CEAH Revolute-notch Type Multi-axis Flexure Hinges for spatial compliant mechanisms

Jian Yang, Huaxian Wei, Yuanchao Li
Department of Mechanical engineering, Shantou University
Key Laboratory of Intelligent Manufacturing , Shantou, China

- Multi-axis flexure hinge
- Circular-Elliptical-Arc-Hybrid
- Revolute notch
- Micro/Nano-positioning



A novel spatial compliant mechanism based on the CEAH revolute-notch type flexure hinges for tip-tilt-z micro/nano-positioning

Notes

21-5 11:28–11:45

A Flexible Smart Glove for Pressure and Bending Signal Acquisition

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

- A flexible smart glove was fabricated in this paper to make it comfortable to wear.
- The glove can obtain the magnitude and distribution of the pressure of palm.
- The glove also can obtain the bending degree of five fingers.
- According to the displayed results, gesture judgments can also be made.

Physical diagrams of the flexible smart glove

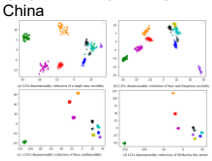
Notes

21-6 Poster 1

State recognition of motor pump based on multimodal homologous features and XGBoost

Dan Xian[1], Jianjun Ding[2], Zizhou He[2], Yangpeng Liu[2], Tao Li[2],Yang Bai[2], Zhuangde Jiang[2]
1 Collaborative Innovation Center of High-End Manufacturing Equipment, Xi'an Jiaotong University, China
2 The State Key Laboratory for Manufacturing Systems Engineering Xi'an Jiaotong University, China

- A motor pump state recognition algorithm.
- four modals multimodal homologous features .
- Using grid search to improve model hyperparameters .
- The deep analysis of the XGBoost model, improve the average accuracy of the fault diagnosis under various load states to over 99.77%, which has great significance to the motor pump state recognition.



The dimensionality reduction visualization of the multi-modal homologous feature in this paper compared with the traditional multi-modal homologous features

Notes

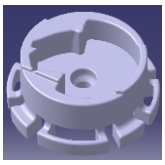
Technical Session 21
Nanomechanics and Nanomechatronics
Room 4
10:20–12:20 Wednesday, 4 August
Chair: Huiliang Liu
Co-Chair: Yujing Zhang

21-7 Poster 2

Research on High Precision Reverse Surface of Fastener Based on Polynomial Recursive Fitting

Yu Fan Lei Huang Hongli Li
JILIN INSTITUDE OF METROLOGY , JiLin PROVINCE, China

- Convert the fastener into Precision Reverse Surface
- The polynomial recursive fitting algorithm of closed curve for fastener Converting
- The quadratic polynomial to solve the polynomial recursive closed curve
- The results show that the detection results of each layer of the inner cavity surface are within 0.005mm.



Polynomial recursive closed curve fitting

Notes

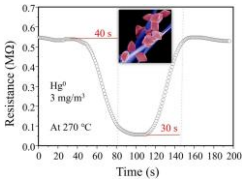
Technical Special Session 22
Nanoheterojunctions and Nanosensors (ss)
Room 5
10:20–12:20 Wednesday, 4 August
Organizer: Xuan Fang
Co-Chair: Chunhua Dong

22-1 10:20–10:37

Design and Synthesis of Nano Heterojunction for Elemental Mercury Sensor

Dong Wang
School of Chemical Engineering, Northeast Electric Power University, China

- Mixed stacking SnS nanosheets and SnO2 nano-octahedrons composite was synthesized using hydrothermal methord
- SnS–SnO2 composite sensor exhibits an ultra-Fast response and recovery sensing performance to elemental mercury.
- Elemental mercury sensing performance is attributed to adsorption of Hg on the SnS and heterojunction effect of SnS–SnO2.



Detection of elemental mercury in flue-gas by a chemiresistive SnS–SnO2 composite sensor

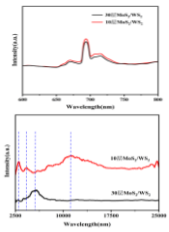
Notes

22-2 10:37–10:54

Broadband Few-Layer MoS_2 Heterojunction-Based Photodetectors

DongHao Liu Dongbo Wang
Department of Optoelectronic Information Science, Harbin Institute of Technology, Harbin 150001, China

- The WS_2/ graphene heterojunction was prepared
- The MoS_2/WS_2 heterojunction was prepared.
- By adjusting the thickness, the luminescent wavelength can be adjusted between medium and long infrared wave



Photoluminescence spectra of MoS2/WS2 heterojunction

Notes

22-3 10:54–11:11

Recent advances and future challenges in biomedical sensors

Hongbin Zhao
State Key Laboratory of Advanced Materials for Smart Sensing, General Research Institute for Nonferrous Metals, China

- Medical sensor development
- Clinical applications: diagnostic, guiding therapy, patient monitoring, disease prevention, and risk assessment
- Biomedical devices for disease diagnosis and treatment
- Biosensors and biochips in diagnostics and treatment

Notes

Technical Special Session 22
Nanoheterojunctions and Nanosensors (ss)

Room 5

10:20–12:20 Wednesday, 4 August

Organizer: Xuan Fang

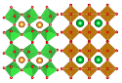
Co-Chair: Chunhua Dong

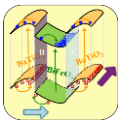
22-4 11:11–11:28

Interface effect and quantum state manipulation at oxide heterostructures

Liang Qiao
School of Physics, University of Electronics Science and Technology of China, Chengdu

- Intermixing can be an important hidden phenomena at complex oxide heterostructures.
- Symmetry engineering can work as a new strategy to tune functional properties of perovskites.
- Competing polarization mechanisms can induced unexpected charge separation in both real and energy spaces.





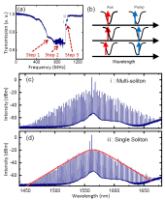
Notes

22-5 11:28–11:45

Dissipative Kerr solitons in the high-Q microresonators

Chunhua Dong
CAS Key Laboratory of Quantum Information, University of Science and Technology of China, Hefei 230026, China

- Dissipative Kerr solitons and Perfect soliton crystals in the high-Q microresonator
- Repetition rate tuning of soliton comb in high-Q microrod resonators
- Frequency stabilization of the soliton in high-Q integrated microresonators



(a) The evolution of the intracavity power as the laser frequency is scanning across the resonance mode. (b) Schematic of auxiliary-laser-assisted thermal response control method. The optical spectra of multi-soliton (c) and single soliton (d) state with the smooth envelope fitted by $sech^2$ function (red curve).

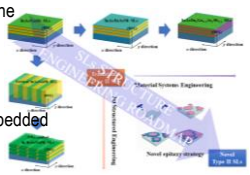
Notes

22-6 11:45–12:02

Structural engineering and optical properties of antimony based type II superlattices

Xuan Fang
State Key Laboratory of High Power Semiconductor Lasers, School of Science, Changchun University of Science and Technology

- The crystal quality Sb based type II superlattices have been performed, including InAs/GaSb, InAs/InAsSb and InAs/InGaAsSb.
- Novel epitaxy method is established, and the problem of high-In-content alloys in the immiscibility gap has been solved.
- Structured type II superlattices, such as vertical superlattice and nanowires embedded superlattice are demonstrated.



Notes

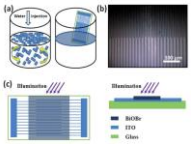
Technical Special Session 22
Nanoheterojunctions and nanosensors (ss)
Room 5
10:20–12:20 Wednesday, 4 August
Organizer: Xuan Fang
Co-Chair: Chunhua Dong

22-7 12:02–12:19

High-performance 2D BiOBr ultraviolet photodetector

Zhikun Xu
College of Science, Guangdong University of Petrochemical Technology

- A large-area BiOBr film has been prepared through a green and facile water–air interfacial self-assembly strategy.
- The UV photodetector based on the BiOBr film shows low dark current, high sensitivity, a fast response time and excellent stability.
- The results also indicate that BiOBr is a promising candidate for applications in optoelectronic devices.



BiOBr film at the water–air interface and the fabrication procedure of the BiOBr film photodetector.

Notes

Technical Special Session 23
Nanomaterials and Nanostructures for Plasmonic Effects and Applications (ss)

Room 1

8:00–10:00 Thursday, 5 August

Organizer: Hua Lu

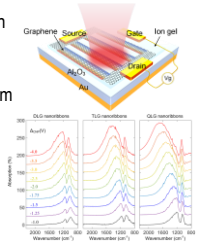
Co-Chair: Yinan Zhang

23-1 8:00–8:15

Enhanced Graphene Plasmonic Mode Energy for High-performance Mid-infrared Sensing

Wei Wei, Guilian Lan, Peng Luo, Jinpeng Nong
College of Optoelectronic Engineering, Chongqing University, China

- The absorption of graphene plasmonic device can be improved from 2.3% to 92% by employing a Fabry–Pérot like cavity.
- The wavelength can be modulated from 5 to 12 μm by designing graphene field effect transistor.
- The selective enhanced detection of molecular vibration modes was achieved with the enhancement factor of 162.
- Our work is expected to have the great potential applications in next-generation high sensitive infrared detector and sensor.



Cacity-enhanced graphene plasmonic device

Notes

23-2 8:15–8:30

Notes

2102581

23-3 8:30–8:45

Notes

2102591

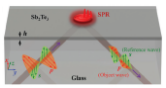
Technical Special Session 23
Nanomaterials and Nanostructures for Plasmonic Effects and Applications (ss)
Room 1
8:00–10:00 Thursday, 5 August
Organizer: Hua Lu
Co-Chair: Yinan Zhang

23-4 8:45–9:00

Topological insulator plasmonics for optical functionalities

Hua Lu, Dikun Li, Yangwu Li, Jianlin Zhao
School of Physical Science and Technology, Northwestern Polytechnical University, China.

- Magnetic plasmon resonance was observed experimentally in nanostructured topological insulators.
- Magnetic plasmon resonance was proposed to enhance the photoluminescence emission from monolayer MoS_2.
- Surface plasmon resonance in topological insulator nanofilm was used to realize the monitoring of refractive index variation by combining with digital holography.
- Our research will benefit for exploring plasmonic behaviors of topological insulators and their applications in optical functionalities .



Topological insulator plasmons

Notes

23-5 9:00–9:15

Notes

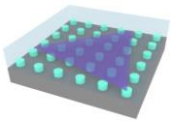
2102601

23-6 9:15–9:30

Strong Light-Matter Interactions in Dielectric Nanoantenna Arrays

Shaojun Wang
School of Optoelectronic Science and Enginnering
Soochow University, China.

- Dielectric nanoparticles offer an alternative platform to plasmonic nanostructures for nanophotonics.
- Electric and magnetic resonances in silicon nanoparticle arrays can both simultaneously strongly couple with organic molecules.
- However, the in-plane magnetic resonances is not sufficient to interact with in-plane excitons for monolayer semiconductors.
- We develop an unconventional method to fabricate a flexible single-crystal nanoantenna array.



Si nanoantenna array integrated with a monolayer semiconductor

Notes

Technical Special Session 23
Nanomaterials and Nanostructures for Plasmonic Effects and Applications (ss)

Room 1

8:00–10:00 Thursday, 5 August

Organizer: Hua Lu

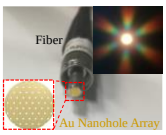
Co-Chair: Yinan Zhang

23-7 9:30–9:45

Flexible Integration of Metallic Nanostructures on Fiber Tips for Plasmonic Sensing

Bobo Du
School of Electronic Science and Engineering, Xi'an Jiaotong University
Xi'an, China

- Self-assembled integration of metallic nanostructures, i.e., nanohole array, on fiber tips was achieved for plasmonic sensing.
- Localized surface plasmon resonance sensitivity to ambience variation enables monitoring of refractive index and/or relative humidity changes with high performances.
- This work demonstrates the potential of self-assembled plasmonic fiber tips in cost efficiency, high throughput, application variety, etc.



Self-assembled plasmonic fiber tip

Notes

23-8 9:45–10:00

Advanced Aluminium Plasmonic Color Laser Printing and Hot Electron Intraband Luminescence

Yinan Zhang
Institute of Photonic Chips, University of Shanghai for Science and Technology, China.

- Shape transition of aluminium plasmonic nanostructures was exquisitely controlled by fs laser pules
- Anisotropic shape transition was achieved by polarization-controlled ultrafast thermoplasmonic heating of Al
- Plasmonic color display and holography image were multiplexed for encryption applications
- Extremely polarized hot electron intraband luminescence was demonstrated for the first time

Notes

Technical Special Session 24
Light Field Manipulation and Measurement in Ultrafast Optics (ss)

Room 2

08:00–10:00 Thursday, 5 August

Organizer: Dong Mao

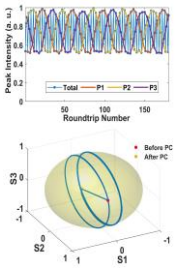
Co-Chair: Chao Zeng

24-1 8:00–8:24

Trios in Pulsating Soliton Fiber Lasers

Yueqing Du
School of Physical Science and Technology, Northwestern Polytechnial University, China

- Double-period pulsating soliton (DPPS) is studied experimentally and numerically.
- Three long-period pulsating soliton stagger mutually to form the DPPS, resembling the trios in music.
- The trios arises from the polarization-controller-induced orbit-transition on the Poincare sphere.



Upper: Evolution of the peak intensity
Lower: Intracavity evolution of polarization.

Notes

24-2 8:24–8:48

Q-switched instabilities in the formation and breaking dynamics of dissipative solitons

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

- Q-switched instabilities are observed in the formation and breaking dynamics of dissipative solitons.
- The characteristics and formation mechanism of Q-switched instabilities are discussed.
- These findings would facilitate an in-depth understanding of the formation and breaking dynamics of dissipative solitons.

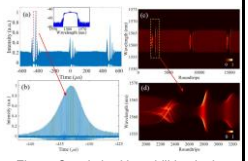


Figure Q-switched instabilities in the breaking dynamics of dissipative solitons

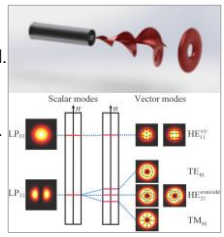
Notes

24-3 8:48–9:12

Generation of Singular Light Beams in Fiber Systems

Chao Zeng and Dong Mao
School of Physical Science and Technology, Northwestern Polytechnical University, China

- The formation mechanisms of singular light beams, including cylindrical vector beams and vortex beams, in few-mode fibers are discussed.
- Generating techniques based on long-period fiber gratings, mode-selective couplers, offset-spliced fibers, and tapered fibers are presented.
- Ultrafast singular light beams generated in fiber lasers are summarized.
- Novel spatiotemporal light field manipulations are outlooked.



Notes

Technical Special Session 24
Nanomaterials and Nanostructures for Plasmonic Effects and Applications (ss)

Room 2

08:00–10:00 Wednesday, 4 August

Organizer: Dong Mao

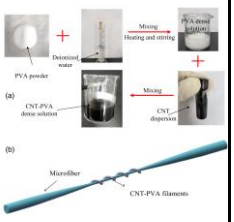
Co-Chair: Chao Zeng

24-4 9:12–9:36

Ultrafast fiber laser based on carbon-nanotube saturable absorber with a spiral scheme

Huiran Yang
School of Science, Xi'an University of Posts and Telecommunications, Xi'an

- A carbon-nanotube-based saturable absorber (CNT-SA) with a spiral scheme is proposed
- The proposed CNT-SA possesses high thermal damage threshold, excellent oxidation resistance,and long-distance evanescent field interaction
- The experimental results create a new type of SA for ultrafast lasers



Preparation process of CNT-SA

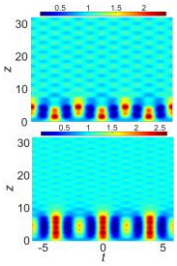
Notes

24-5 9:36–10:00

Pure-quartic Modulation Instability with Phase Transition

Xiankun Yao
School of Physics, Northwest University, China

- We show that in nonlinear optical systems with pure-quartic dispersion, the modulation instability (MI) undergoes phase transitions at two critical frequencies.
- The MI phase transitions lead to the emergence of completely new types of Fermi-Pasta-Ulam recurrences and Akhmediev breathers (ABs).
- These novel phase-transition behaviors will give new vitality to the study of MI.



Two new types of ABs.

Notes

Technical Session 25
Nanomaterials and Applications I

Room 3

8:00–10:00 Thursday, 5 August

Chair: Chunyang Wang

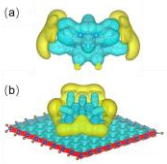
Co-Chair: Yingying Zhang

25-1 8:00–8:15

Theoretical Studies of Copper Azide/Graphene Nanocomposites based on Density Functional Theory

Lei Zhang, Jianhua Chen, Feipeng Lu, Rui Zhang, Fang Zhang,Yanlan Wang
Science and Technology on Applied Physical Chemistry Laboratory, Shaanxi Applied Physics-Chemistry Research Institute, China

- The bond length of Cu-N in $Cu(N_3)_2$ /graphene increased, and N-N becomes shorter and uniform.
- The average electrostatic potential of $Cu(N_3)_2$ /graphene distributes homogeneous, making $Cu(N_3)_2$ more stable.
- The electron density of $Cu(N_3)_2$ /graphene is also evenly distributed.
- The composite of graphene is beneficial to improve the sensitivity performance of $Cu(N_3)_2$.



Electrostatic potential diagram of $Cu(N_3)_2$ and $Cu(N_3)_2$/graphene

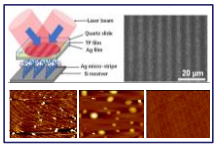
Notes

25-2 8:15–8:30

IEEE 3M-NANO 2021 Digest Template Effect of Triazene Polymer Film on the Ag Micro-stripe Prepared by LIIFT Technology

Huijuan Shen
CNM, Changchun University of Science and Technology, China

- Triazene polymer intermediate film was used to transfer the Ag micro-stripe in LIIFT.
- The effect of the TP film quality on the transferred micro-stripe was discussed.
- The regular micro-stripe with good wholeness was transferred with the homogeneous TP film.



Schematic of transferring the Ag micro-stripe with the TP intermediate film in LIIFT.

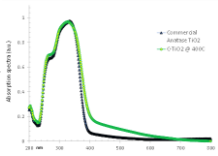
Notes

25-3 8:30–8:45

Visible light performance of carbon doped nano-porous titania photocatalysts

Fabrizia Ghezzo
Lulan Technologies, China

- To fight environmental degradation, we need to lower not only carbon emission but also NOx emissions
- UV- active TiO2 photocatalyst successfully removes NOx gaseous compounds from the air
- Doping TiO2 with carbon element extends the spectrum of light under which TiO2 is active to visible light
- Synthesis of anatase TiO2 from a precursor rich of carbon element leads to the presence of carbon on the surface of the lattice improving the photocatalytic performance.



UV-vis spectra of C-TiO_2 and TiO_2.

Notes

Technical Session 25
Nanomaterials and Applications I

Room 3

8:00–10:00 Thursday, 5 August

Chair: Chunyang Wang

Co-Chair: Yingying Zhang

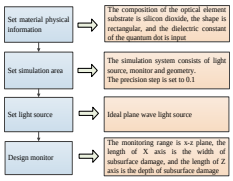
25-4 8:45–9:00

Study on the relationship between the fluorescence characteristics of quantum dots and the subsurface damage of fused silica

Chunyang，Wang

Xi’an Technological University，China

- Get the relationship between geometrical characteristics of subsurface damage and electromagnetic field of QDs.
- The fluorescence electromagnetic field intensity of QDs enhances with the increase of the subsurface cracks width .
- The fluorescence electromagnetic field intensity of QDs weakens with the increase of the crack depth.
- Provide important theoretical support for the development of non-destructive detection technology for subsurface damage.



Simulation steps

Notes

25-5 9:00–9:15

Interactions of moving charge with supported graphene in the presence of strain-induced pseudomagnetic field

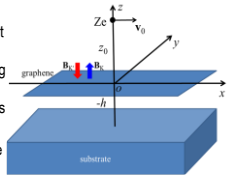
Ying-Ying Zhang，Zoran L. Mišković，Ivan Radović，Yuan-Hong Song

School of Physics, Dalian University of Technology, P.R.China

Department of Applied Mathematics, University of Waterloo, Canada

Vinca Institute of Nuclear Sciences, University of Belgrade, Serbia

- Based on a two-component hydrodynamic model, we investigated the dynamical polarization forces on a point charge moving parallel to graphene and the total electrostatic potential in the graphene plane, considering both the strain-induced pseudomagnetic field and the effect of supporting substrate on the plasmon excitations in monolayer graphene[1].
- . The effects of the plasmon–phonon hybridization in the presence of the pseudomagnetic field in graphene on the wake potential in graphene, and the stopping and image forces are studied[2].



Schematic illustration of the theoretical mode

[1] Xian-Long He, Ying-Ying Zhang*, Zoran L. Miskovic, et al. Eur. Phys. J. D, 2020, 74: 18;
[2] Xiang-Jia Bai, Ying-Ying Zhang*, Zoran L. Miskovic, et al. Plasmonics, Published online;

Notes

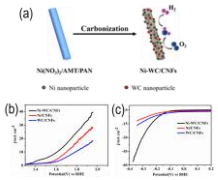
25-6 Poster 1

Ni and WC Nanoparticles Co-embedded in CNFs as Robust Bifunctional Electrocatalyst for OER and HER

Wurigamula He, Helin Zhang, Lili Wang, Wensheng Yu, Duanduan Yin*, Xiangting Dong*

Changchun University of Science and Technology, China

- Ni-WC/CNFs electrocatalysts were successfully synthesized by electrospinning followed by subsequent carbonization process.
- Ni and WC nanoparticles were successfully uniformly dispersed on carbon nanofibers.
- The Ni-WC/CNFs electrocatalysts exhibit excellent electrocatalytic activity towards OER and HER in alkaline media.



(a) Schematic illustration for the fabrication process of Ni-WC/CNFs, (b) OER and (c) HER polarization curves for different electrocatalysts.

Notes

Technical Session 25
Nanomaterials and Applications I

Room 3

8:00–10:00 Thursday, 5 August

Chair: Chunyang Wang

Co-Chair: Yingying Zhang

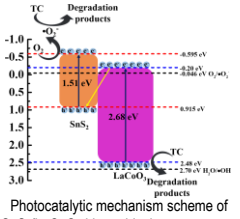
25-7 Poster 2

Visible-light Responsive SnS_2 Nanosheets/$LaCoO_3$ Nanobelts Hierarchical Nanostructures for Photocatalytic Degradation of Tetracycline

Da Xu, Feng Liu, Feng Sun, Qianli Ma, Wensheng Yu, Xiangting Dong*

Changchun University of Science and Technology, China

- SnS_2/$LaCoO_3$ hierarchical nanostructure was successfully prepared by combining electrospinning with subsequent solvothermal method.
- A direct Z-scheme SnS_2/$LaCoO_3$ hierarchical nanostructure was successfully prepared.
- SnS_2/$LaCoO_3$ hierarchical nanostructure displays excellent photocatalytic performances.



Photocatalytic mechanism scheme of SnS_2/$LaCoO_3$ hierarchical nanostructure under visible-light irradiation.

Notes

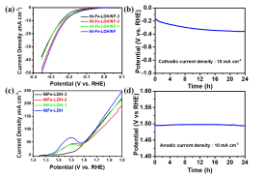
25-8 Poster 3

Hierarchical NiFe Layered Double Hydroxides: a bifunctional electrocatalyst for overall water splitting

Lili Wang, Helin Zhang, Wurigamula He, Qianli Ma, Wensheng Yu, Shuang Gao, Da Xu, Duanduan Yin*, Xiangting Dong*

Changchun University of Science and Technology, China

- Layered dihydroxides (LDHs) of 2D nanosheets exhibit strong synergistic effect.
- Layered structure facilitates electrons/ions transport and rapid release of gas products.
- LDHs display excellent HER and OER performances and stability in alkaline environment.



Performances of HER and OER: (a, c) LSV curves and (b, d) chronopotentiometry curves.

Notes

Technical Session 26
Biological Applications I

Room 4

8:00–10:00 Thursday, 5 August

Chair: Haiyun Wu

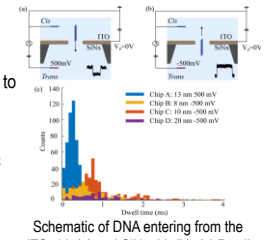
Co-Chair: Hongtao Huang

26-1 8:00–8:24

Dwell Time Characterization of DNA Translocation through ITO-SiN_x Nanopores

Xiaojie Li, Xin Zhu, Chaoming Gu, Zhen Cao, Zhi Ye, Yang Liu
College of Information Science and Electronic Engineering,
Zhejiang University, China

- DNA translocations using 4 ITO-SiN_x nanopores with various pore sizes.
- Dwell time of DNA translocation observed to be shorter for smaller nanopores.
- Shorter dwell time for DNAs entering from ITO side compared to those from the SiN_x side.
- Provides basic information on DNA translocation velocity in gated nanopores.



Schematic of DNA entering from the ITO side(a) and SiN_x side(b). (c) Dwell time distributions of 4 devices.

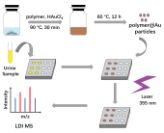
Notes

26-2 8:24–8:48

IEEE 3M-NANO 2021 Digest
Raspberry-like Polymer@Au as Matrix in Mass Spectrometry for Urine Metabolic Fingerprinting

Hongtao Huang
School of Biomedical Engineering, Institute of Medical Robotics and Med- X Research Institute, Shanghai Jiao Tong University, China

- Polymer@Au nanoparticles are demonstrated for the detection of small metabolites using **LDI-MS**.
- Polymer@Au nanoparticles are used as matrices for **metabolic fingerprinting** of urine sample.
- This work sheds light on the simple metabolic analysis of urine by LDI-MS.
- Our technique displayed a promising prospect in clinical use.



Scheme figure

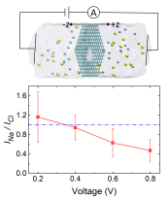
Notes

26-3 8:48–9:12

Computational Design of a Hydrogenated Porous Graphene Membrane for Anion Selective Transport

Zhenyu Zhang, Han Qi, Shu Zhou,
Mu Chen, Zhongwu Li, Yunfei Chen
School of Mechanical Engineering, Southeast University, China

- A hydrogenated porous graphene membrane was designed and modeled theoretically in all-atom details
- Anion selective ion transport through membrane with electronegative pore surface
- High anion selectivity was achieved under high electric field
- A tug-of-war mechanism with ion hydration layer peeling off and electrostatic alternation



Notes

Technical Session 26
Biological Applications I

Room 4

8:00–10:00 Thursday, 5 August

Chair: Haiyun Wu

Co-Chair: Hongtao Huang

26-4 9:12–9:36

A Polyaniline-modified Immunosensor for *E.coli* O157:H7 Detection Based on Electrical Parameters and Support Vector Regression

Haiyun Wu, Yanan Zeng, Yong Wei, Renjie Yang, Yaping Yu, Huiyong Shan and Xuemei Sun

College of Engineering and Technology，Tianjin Agricultural University, China

- A polyaniline-modified immunosensor for *E.coli* O157:H7 detection was developed.
- An electronic equivalent circuit was introduced for modeling the performance of the immunosensor.
- Seven electrical parameters were input to build support vector regression (SVR) model.
- Established a quantitative prediction method of *E.coli* O157:H7 by using electrical parameters and SVM.

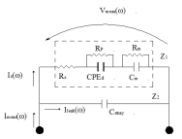


Figure 1 Equivalent circuit

Notes

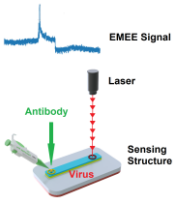
26-5 9:36–10:00

Registration Approach of Viruses by Using the Electromagnetic Echo Effect

Ognyan Ivanov et al.

Electro-magnetic sensors, Bulgarian Academy of Sciences, Bulgaria

- A novel sensing approach for a timely viral detection is proposed
- A new biosensor is presented, which offers rapid and precise diagnostics
- The proposed technique can be used for reliable control of viral outbreaks



Notes

Technical Session 27
MEMS

Room 5

8:00–10:00 Thursday, 5 August

Chair: Qiuyue Yu

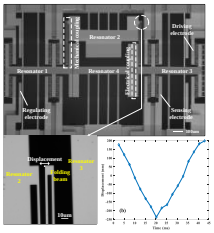
Co-Chair: Bo Peng

27-1 8:00–8:20

Effect of residual stress on modes of coupled MEMS resonator array

Bo Peng，Kai-Ming Hu，Xiao-Yong Fang, Wen-Ming Zhang
State Key Laboratory of Mechanical System and Vibration
Shanghai Jiao Tong University, Shanghai, China

- The influence of residual stress on the modal characteristics of MEMS resonator array is analyzed by laser Doppler.
- The local vibration of coupling beam with 432nm amplitude is measured by stroboscopic method.
- Local mode coupling caused by residual stress is observed.



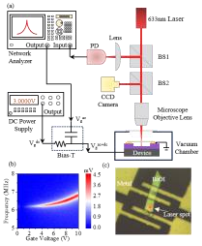
Notes

27-2 8:20–8:40

Frequency Tuning in Resonant Nano-Electro-Mechanical Devices Based on Centrosymmetric Two-Dimensional Semiconductor BiOI

Song Wu
Institute of Fundamental and Frontier Sciences
University of Electronic Science and Technology of China, China

- NEMS resonators based on a type of 2D ternary layered compounds (BiOI)
- Resonant motion can be effectively excited and continuously tuned under optical and electrical driving schemes
- The devices exhibit clear frequency tuning with electrostatics gating
- Our finding demonstrates the potential of NEMS devices based on 2D ternary layered compounds as frequency tunable resonators



Notes

27-3 8:40–9:00

Design and Test of a MEMS Magnetic-Free Circulator Based on Bulk Acoustic-Wave Resonators

ZHANG Bing-bin, WU Cheng-feng, GAO Yang*
School of information engineering, Southwest University of science and technology, China

- The circuit structure of MEMS magnetic-free circulator is introduced;
- A hybrid frequency-time domain simulation analysis for MEMS circulator is proposed;
- A MEMS magnetic-free circulator at 1.752 GHz is fabricated;
- The circulator has high isolation and low insertion loss under reasonable modulation requirements.

Fabricated MEMS magnetic-free circulator

Test results and comparisons

	Technology	Modulation frequency (MHz)	IL (dB)	IS (dB)	RL (dB)
This work	FBAR	3	7.6	14	5
Ref.[4]	FBAR	3	11	17	8.5
Ref.[9]	CMR	0.12	8	30	N/A
Ref.[3]	LC	40	9	65	4

Notes

Technical Session 27
MEMS

Room 5

8:00–10:00 Thursday, 5 August

Chair: Qiuyue Yu

Co-Chair: Bo Peng

27-4 9:00–9:20

Design and implementation of high sensitivity bullet shaped cilia vector turbulence sensor

Shasha Yang
School of instruments and electronics, North university of china, China

- a bullet shaped cilia vector turbulence sensor is proposed for the first time
- The sensor adopts MEMS piezoresistive technology to realize the miniaturization and low cost of the product
- The sensor can be used for two-dimensional turbulence observation and has high sensitivity

Physical diagram of turbulence sensor

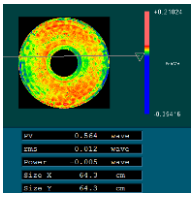
Notes

27-5 9:20–9:40

Ultra-precision Processing and Detection Technology for Space Lightweight Mirror

Qiuyue Yu; Xiaohui Meng; Ang Li; Jiancheng Chen; Zhaojian Zhang; Yong Liu
Beijing institute of space Mechanics & Electricity, China

- An efficient and fast processing flow for 650 mm aperture space lightweight ULE mirror was given;
- Design an active supporting gravity compensation device ;
- the final machining surface precision of the mirror was better than 1/80 λ-RMS (about 7.9 nm);
- fully met the requirements of the optical system.



The surface shape result of mirror

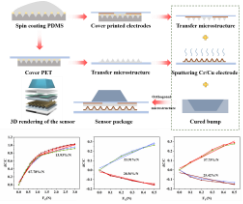
Notes

27-6 Poster 1

A flexible triaxial force capacitive sensor with microstructure electrode and orthogonal microstructure

Zhiyong Wu, Ting Huang, Cheng Hou, Fengxia Wang*, Huicong Liu, Zhan Yang, Tao Chen. Lining Sun*
School of Mechanical and Electric Engineering, Jiangsu Provincial Key Laboratory of Advanced Robotics, Soochow University.Suzhou, China

- A novel flexible triaxial force sensor based on the capacitive pressure sensor array
- The triangular pyramid microstructure electrode and the orthogonal triangular pyramid microstructure
- A large pressure detection range and high sensitivity



Notes

Technical Session 28
Nanofabrication applications

Room 1

10:20–12:20 Thursday, 5 August

Chair: Jinkai Xu

Co-Chair: Yanling Wan

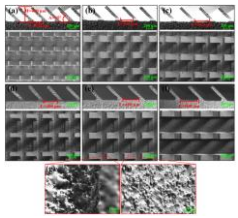
28-1 10:20–10:40

Fabrication of Superhydrophobic NiTi Shape Memory Alloy Surface with Inclined Microstructure by Wire Electrical Discharge Machining

Hou Yonggang

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

- A superhydrophobic NiTi-SMA surface with a controllable anisotropic tilted micropillar structure was successfully fabricated by WEDM.
- This functional surface with anisotropic microstructures is expected to have potential droplet direction transportation and fluid control applications.
- It provides a new idea for NiTi-SAM in the development of new multifunctional components.



SEM images of NiTi-SAM surfaces with different morphology (A=45°) : (a) L= 250 μm, (b)L=300 μm, (c) L=350 μm, (d) L=400 μm, (e) L=450 μm and (f) L=500 μm. (g) and (h) micron-level structures formed by WEDM processing.

Notes

28-2 10:40–11:00

Magnesium alloy surface with corrosion resistance

Qianqian Cai, Jinkai Xu, Zhongxu Lian, Zhanjiang Yu, Huadong Yu, Jian Li

Ministry of Education Key Laboratory for Cross-Scale Micro and Nano Manufacturing, Changchun University of Science and Technology, Changchun 130022, China

- A corrosion-resistant superhydrophobic surface was prepared on the surface of AZ91D alloy.
- The corrosion current density of the superhydrophobic surface is reduced by 3 orders of magnitude.
- The resistance radius of the superhydrophobic surface is increased by about 2 orders of magnitude.

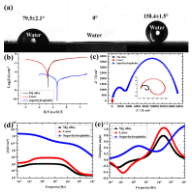


Figure Wettability and corrosion resistance of sample surface.

Notes

28-3 11:00–11:20

Preparation of Low Adhesion Superhydrophobic Self-Cleaning Surface of 316L Stainless Steel

Caiyun Zhang

Key Laboratory of Cross-scale micro and nano manufacturing Ministry of Education, Changchun University of Science and Technology, China

- The micro-nano composite structure is realized by designing a step like micro cylinder array.
- After EDM micro cylinder and nano spatter deposited on the surface.
- Under the effect of gradient effect, the droplet forms discontinuous TCL with low adhesion.
- Without chemical modification, low adhesion and self-cleaning can be achieved by simple structure design.

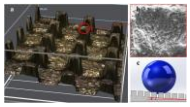


Figure (a) ultra-depth of field photos of processed samples. (b) Local SEM. (c) Schematic diagram of ladder structure design

Notes

Technical Session 28
Nanofabrication applications

Room 1

10:20–12:20 Thursday, 5 August

Chair: Jinkai Xu

Co-Chair: Yanling Wan

28-4 11:20–11:40

Wettability Study of Sensing Electrodes based on MoS_2 Nanosheets

Xiaona Zhu
International Research Center for Nano Handling and Manufacturing of China, Changchun University of Science and Technology, China

- MoS_2 nanosheets were prepared by liquid exfoliation.
- The surface roughness and wettability of MoS_2 nanosheets-based electrodes were studied.
- The dependence of wettability on the coating thickness of sensing electrodes was further explored.

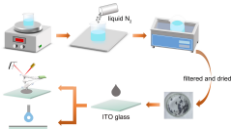


Illustration of fabrication, characterization and wettability study of sensing electrodes based on MoS_2 nanosheets.

Notes

28-5 11:40–12:00

Superhydrophobic Aluminum Alloy Surface with Self-Cleaning and Anti-Corrosion Properties

Jian Li, Yiquan Li, Zhongxu Lian, Zhanjiang Yu, Huadong Yu, Qianqian Cai
Ministry of Education Key Laboratory for Cross-Scale Micro and Nano Manufacturing, Changchun University of Science and Technology, Changchun 130022, China

- 7075 superhydrophobic surface was fabricated by laser processing.
- The corrosion current density of the superhydrophobic surface reached 4.04×10^{-6} A/cm^2, decreased by 1 orders of magnitude as compared to the AZ91D alloy substrate.
- Superhydrophobic surface has good self-cleaning performance

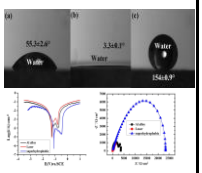


Figure Wettability and corrosion resistance of sample surface.

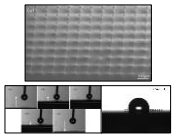
Notes

28-6 12:00–12:20

Localized Electrochemical Deposition of Bionic Salvinia Molesta Micro-Array Structure

Xiaoqing Sun
Department of Mechanical and Electrical Engineering, Changchun University of Science and Technology, China

- A localized electrochemical micro additive manufacturing technique(LECD-μAM) is proposed.
- The bionic Salvinia molesta structure can be completely manufactured by LECD-μAM without any supporting structure.
- The surface of the bionic Salvinia molesta structure has low adhesion property.
- The surface of the bionic Salvinia molesta structure is hydrophobic without any surface modification.



The bionic Salvinia molesta structure and its properties.

Notes

Technical Session 29
Nanofabrication Processes and Systems II

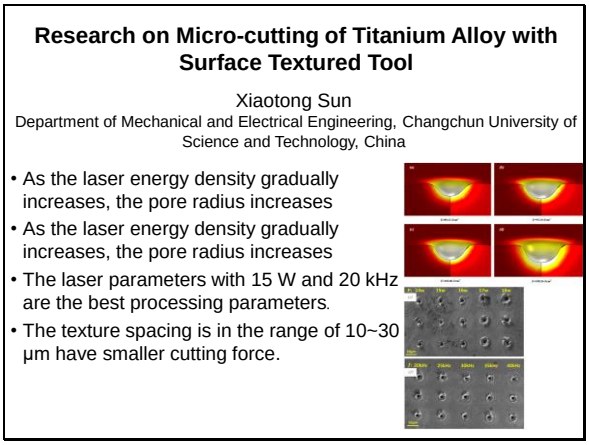
Room 2

10:20–12:20 Thursday, 5 August

Chair: Yiquan Li

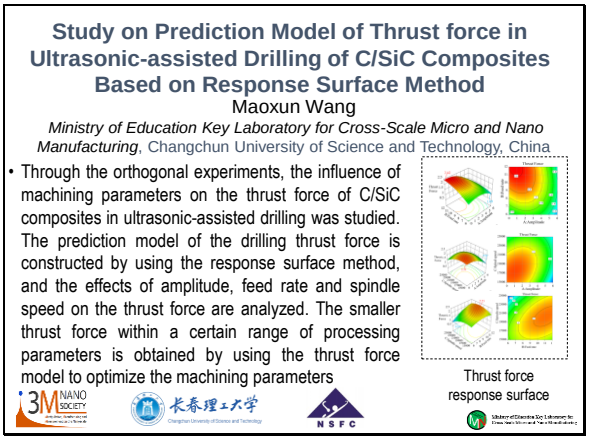
Co-Chair: Xu Wang

29-1 10:20–10:40



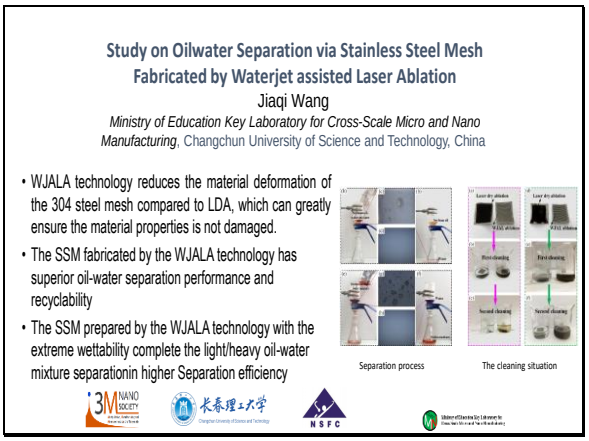
Notes

29-2 10:40–11:00



Notes

29-3 11:00–11:20



Notes

Technical Session 29
Nanofabrication Processes and Systems II

Room 2

10:20–12:20 Thursday, 5 August

Chair: Jinkai Xu

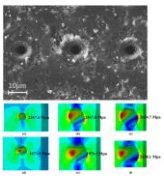
Co-Chair: Yanling Wan

29-4 11:20–11:40

Study on the micro-hole texture forming of PCD tool surface

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

- In this paper, in order to improve the tool life, nanosecond laser is used to prepare the micro-holes texture on the surface of the PCD tool. By studying the influence of laser parameters on the hole diameter and morphology of the micro-hole texture, the stress distribution is further studied at the texture during cutting, and finally the wear of the PCD texture tool during machining is analyzed.



Preparation and Cutting Simulation of Micro-holes on PCD Tool Surface

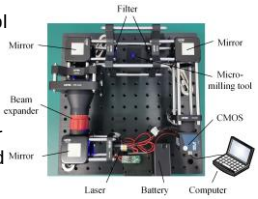
Notes

29-5 11:40–12:00

Selection of Laser Power in Digital Coaxial Holographic Tool Setting

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

- The laser coaxial holographic tool setting device is built.
- The tool contour is extracted by auto-focusing, self - snake filter and Sobel operator.
- The tool contour extraction under different laser power is compared under the maximum threshold.
- The laser power at average image of 140 is most suitable for this device.



Structure diagram of laser coaxial digital holographic tool setting device

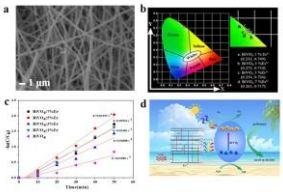
Notes

29-6 Poster 1

Highly Efficient NIR Responsive and Upconversion Enhanced $BiVO_4:Er^{3+}$ Nanofibers for Photocatalytic Degradation of RhB

Feng Liu, Jing Meng, Da Xu, Wensheng Yu, Xiangting Dong*
School of Materials Science and Engineering ,Changchun University of Science and Technology, Changchun, China; College of Environmental Science and Engineering, Jilin Normal University, Siping, China

- Er^{3+} doping in semiconductor lattice is a highly potential approach to harvest NIR light.
- $BiVO_4:Er^{3+}$ nanofibers are prepared by simple and facile electrospinning.
- $BiVO_4:Er^{3+}$ nanofibers exhibit highly efficient upconversion luminescence and photocatalytic performance.



SEM image (a), CIE chromaticity coordinates diagram (b), $\ln(C_0/C)$ vs t curves (c) and photocatalytic mechanism scheme (d) of $BiVO_4:Er^{3+}$ nanofibers.

Notes

Technical Session 30
Nanomaterials and Applications II

Room 3

10:20–12:20 Thursday, 5 August

Chair: Chunyang Wang

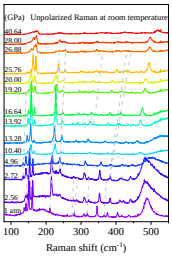
Co-Chair: Ji Zhang

30-1 10:20–10:35

In-situ spectroscopic study on 2D ReS2 crystals by pressure engineering

Ting Wen
Institute of Fundamental and Frontier Sciences
University of Electronic Science and Technology of China, China

- We show efficient tuning of the structural and optical properties in ReS_2 crystals by hydrostatic pressure.
- With in-situ spectroscopic study, we demonstrate the direct-bandgap nature in these ReS_2 crystals.
- We observe clear transitions among three excitons due to pressure-induced enhancement of interlayer interactions
- Our findings can offer new insights in tuning and optimizing the material property of this 2D semiconductor, which can lead to future electronic and optoelectronic applications.



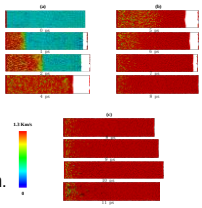
Notes

30-2 10:35–10:50

Investigation of shock front in nanocrystalline CuTa alloy via molecular dynamics method

Xiao Wang[a], Weidong Wang[a], Weibing Li [b]
a School of Mechano-Electronic Engineering, Xidian University, China
b school of Mechanical Engineering, Nanjing University of Science and Technology, China

- The thermal and mechanical responses of CuTa alloys under high velocity impact was revealed.
- Two different methods to build polycrystalline were introduced.
- The shock propagation in CuTa alloys was divided into three stages, namely elastic deformation, dislocation emission and double-wave transmission.



Shock propagation in CuTa alloy

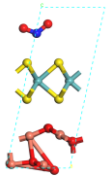
Notes

30-3 10:50–11:05

The first principle calculation of NO_2 gas adsorption on CuO-MoS_2 heterojunction surface

Shirui Xue, Zhaoling Huang, Sicheng Cao, Jiali Tong, Dan Zheng, and Daoguo Yang*
School of Mechanical and Electrical Engineering,
Guilin University of Electronic Technology, Guilin

- The feasibility of CuO-MoS_2 heterojunction to detect NO_2
- The best adsorption site is Bridge site of Mo-S bond
- The NO_2 adsorption is chemical adsorption



The bridge site adsorption

Notes

Technical Session 30
Nanomaterials and Applications II

Room 3

10:20–12:20 Thursday, 5 August

Chair: Yingying Zhang

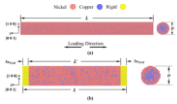
Co-Chair: Ji Zhang

30-4 11:05–11:20

Effect of Grain Number on The Uniaxial Tensile Properties of Polycrystalline Nickel Nanowires

Mengjie Wang[1], Ji Zhang[1], Tarek Ragab[1], Weidong Wang[1]
[1]School of Mechano-Electronic Engineering, Xidian University, China
[1]Department of Civil Engineering, Arkansas State University, State University, AR, USA

- The fracture strength of polycrystalline nickel nanowires is 3.2~5.7 GPa.
- The overall tensile property of polycrystalline nickel nanowires is lower than that of single crystalline nickel nanowires.
- The fracture strength of polycrystalline nickel nanowires with the same diameter decreases with the increase of the number of grains.



Notes

30-5 Poster 1

Design Method of Gradient Porous Support Based on Triply Periodic Minimal Surfaces

Minsheng Chen
School of mechanical and electrical engineering and automation, Foshan University, China

- A design method of gradient porous structure based on TPMS is proposed.
- Four kinds of TPMS gradient porous support models of methanol steam reforming for hydrogen production were designed, and the smooth transition of the gradient surface of the porosity change of the support was realized.
- There is a great reference significance in the fields of porous medical implants, aerospace and architecture.

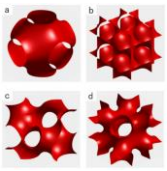


Fig. Four types of TPMS unit surface models.
(a) P type, (b) D type, (c) G type, (d) I-WP type.

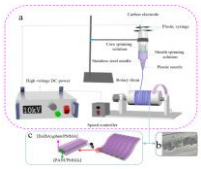
Notes

30-6 Poster 2

Electrospinning Fabrication and Performances of Flexible Co-axial Microbelts and Arrays Endowed with Luminescence-conduction Bifunctionality

Yinghe Wang[1, 2] , Xinyao Li [1], Haina Qi[1] , Qianli Ma [1], Xiangting Dong[1, *]
[1]Changchun University of Science and Technology , China
[2]Baicheng Normal University , China

- Flexible co-axial microbelts and arrays are designed and constructed *via* electrospinning.
- Luminescence and conduction are highly integrated and mutually independent in the special microbelt.
- Microbelts arrays display excellent luminescent-conductive dual function.
- Design concept and technique can be popularized to construct other polyfunctional materials.



Schematic diagram of electrospinning device (a), OM images (b) and structure diagram (c) of co-axial microbelt

Notes

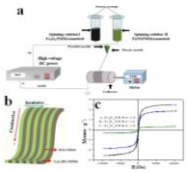
Technical Session 30
Nanomaterials and Applications II
Room 3
10:20–12:20 Thursday, 5 August
Chair: Yingying Zhang
Co-Chair: Ji Zhang

30-7 Poster 3

Magnetically Functionalized Anisotropic Conductive Janus Nanobelts Array Made by Electrospinning

Liu Yang, Bing Liu, Qianli Ma , Wensheng Yu ,
Guixia Liu , Xiangting Dong*
Changchun University of Science and Technology, China

- Electrical conduction and superparamagnetism were integrated into Janus nanobelts *via* electrospinning.
- Janus nanobelts array has excellent conductive anisotropy and magnetic properties.
- Conductive anisotropy and magnetism can be respectively adjusted by changing the contents of PANI and Fe_3O_4.



Schematic diagram of electrospinning device (a), conductive mechanism of the Janus nanobelts array (b) and hysteresis loops of Janus nanobelts array with different content of Fe_3O_4 NPs

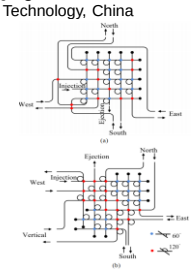
Notes

30-8 Poster 4

Exploring and optimizing Crosstalk effect in VCmesh-based Optical networks-on-chip

Ye Su, Chunxu Jiang and Qing Xia
Chongqing Institute of CEPREI Industrial Technology, China

- We employ an angle optimization strategy that uses 60º or 120º crossing waveguide instead of traditional 90º.
- The method to calculate the BER of VCmesh-based ONoCs is established.
- Through numerical simulation show the worst-case OSNR increased by 4.68dB, 3.31dB and 2.94dB, respectively.



The (a) 5-port and (b) 6-port crossbar router using angle optimization.

Notes

Technical Session 31
Biological Applications II

Room 4

10:20–12:20 Thursday, 5 August

Chair: Jiahua Sun

Co-Chair: Yuxin Zhang

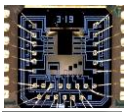
31-1 10:20–10:40

Piezoresistive Cantilevers' Platform for Bio-Chemical Sensing

Vladimir Stavrov (Kostadin Kostadinov)
AMG Technology Ltd., Bulgaria (IMech-BAS)
Zuobin Wang
CUST, China

Abstract

- Recent progress in exploitation of self-sensing micro cantilevers for bio-chemical sensing, is reported.
- Sensor modules that comprise application specific configuration of active and spacer carriers, were developed.
- Small volume of the gas sampling and x400 reduced power consumption - demonstrated.
- High performance of the sensor modules enable complex bio-chemical applications like AQM.



Top: On-chip integrated multi-cantilever sensor; Bottom: module for AQM

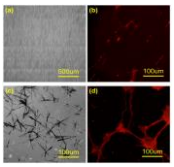
Notes

31-2 10:40–11:00

Patterned Diphenylalanine Nanotubes Regulate the Behavior of Hippocampal Neurons

Lipeng Zu, Huiyao Shi, Jia Yang, Yuanyuan Fu, Wenxue Wang*, Ning Xi, and Lianqing Liu*
Shenyang Institute of Automation, Chinese Academy of Sciences, China

- Different FF nanotubes patterned substrates produced induced two different behaviors of hippocampal neurons.
- The unidirectional arranged FF can dissolve in the medium after inducing the directional neurons
- Neurons quickly migrated into clusters under the induction of radial FF nanotubes
- A complex patterned connection network is forming between clusters.



(a) unidirectional arranged FF nanotubes (b) the directional neurons (c) radial arranged FF nanotubes (d) neural clusters.

Notes

31-3 11:00–11:20

Antimicrobial activity in Vitro of Flower-like Cu_2O

Miaomiao Yu, Zhankun Weng*, Jing Hu, Wenyu Zhu, Siyuan Cao, Wenxiao Zhang, Zuobin Wang

International Research Centre for Nano Handling and Manufacturing of China, Changchun University of Science and Technology
Changchun 130022, China

- The flower-like cuprous oxide had been successfully obtained by one-pot hydrothermal method.
- The flower-like Cu_2O significantly inhibited the growth of *E. coli* in a concentration-dependent manner.
- The as-prepared Cu_2O could be regarded as a promising bacteriostatic candidate.

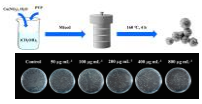


Figure Schematic drawing for the preparation of the flower-like Cu_2O. Photographs of the *E. coli* colonies formed on the surface of the plate treatment with the flower-like Cu_2O at different concentration.

Notes

Technical Session 31
Biological Applications II

Room 4

10:20–12:20 Thursday, 5 August

Chair: Jiahua Sun

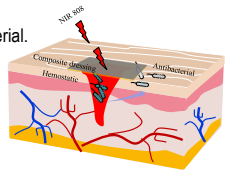
Co-Chair: Yuxin Zhang

31-4 11:20–11:40

Electrospinning nanofiber onto chitosan nonwoven fabric for hemostasis and disinfection treatment

Jiahua Sun
College of Materials Science and Engineering, Jiangsu University, China

- Quickly active hemostatic cascade and achieve bleeding control.
- High efficiency in photothermal assist antibacterial.
- Reduce blood loss from injury wound.



Antibacterial hemostatic schematic illustration of composite dressing.

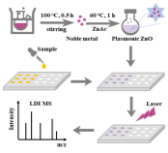
Notes

31-5 11:40–12:00

Plasmonic ZnO Nanocomposite-assisted Mass Spectrometry for Detection of Low Molecular Compounds

Yuxin Zhang
Center for Bio-Nano-Chips and Diagnostics in Translational Medicine, Shanghai Jiao Tong University, China

- Polygonal plasmonic ZnO nanocomposites are constructed and **firstly** applied in LDI MS.
- Clear spectra background, **superior salt, and protein tolerance** were achieved for detection of small molecules.
- Plasmonic ZnO nanocomposites can open up a new era of minimally invasive bio-fluid analysis.



Direct detection of small molecules using p-ZnO as matrix by LDI MS.

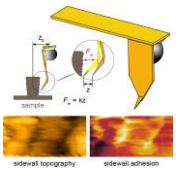
Notes

31-6 12:00–12:20

Characterization of Topography and Adhesion of Sidewall Using an Orthogonal Cantilever Probe

Junyuan Geng, Shishi Li, Hao Zhang, Xianghe Meng, Haibo Gao and Hui Xie
The State Key Laboratory of Robotics and Systems, Harbin Institute of Technology, Harbin, China

- Proposing a magnetic-drive force-distance curve-based atomic force microscopy using an orthogonal cantilever probe;
- Characterizing the surface topography and adhesion of micro-nano devices' sidewall;
- The measurement of sidewall adhesion is helpful to provide reference for micro-manipulation and micro-assembly.



Structrue of the orthogonal cantilever probe and imaging results of sidewall topography and adhesion

Notes

Technical Special Session 32
Functional Nanomaterials for Microelectronics and Biotechnology (ss)

Online

14:00–16:00 Thursday, 3 August

Organizer: Artemy Irzhak

Co-Organizer: Victor Koledov

32-1 14:00–14:10

Adaptive optics elements based on SME materials

Zhankun Weng

International Research Centre for Nano Handling & Manufacturing of China Changcun, China

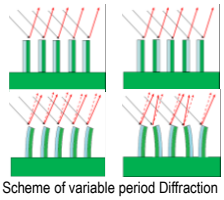
Victor Koledov

IRE RAS, Moscow, Russia

Artemy Irzhak

IMT RAS, Chernogolovka, Russia

- A diffraction grating based on SME materials with an in situ variable parameter is proposed.
- Such device will be sensitive to temperature changes
- Temperature changes on dT~10°C could change wavelength from 1,5 to 0,5 um



Scheme of variable period Diffraction Grating Top – cold, Bottom – hot state

Notes

32-2 14:10–14:20

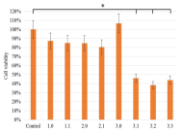
Nanostructured surface's cytotoxicity study of silicon wafers to mammalian cells

Ekaterina Gosteva [1], Artem Iliasov [1], Sedlovets Daria [2], Vitaly Starkov [2]

[1] MISIS National University of Science and Technology Moscow, Russia

[2] Russian Academy of Sciences Institute of Microelectronics Technology and High Purity Materials Chernogolovka, Russia

- Samples of pure silicon, as well as porous silicon, are not cytotoxic. At the same time, there is a noticeable trend towards an increase in the viable cells incubated with porous samples (NPSi) compared to the control. This may indicate that the resulting porous developed surface favors cell growth. At the same time, an increase in the surface area due to the coating of samples with graphene does not cause such an effect. In the case of porous silicon, the synthesis of a graphene coating decreases cell viability.



Viability of SC1 cells for 48 hours

Notes

32-3 14:20–14:30

Composite materials based on porous semiconductors and metal organic perovskites for solar electronic applications

Guo Q [1], Ilya M. Pleshanov [2], Zhankun Weng, Belorus Anton, Veniamin Koshevoi, Ekaterina Gosteva

[1] MISIS National University of Science and Technology Moscow, Russia

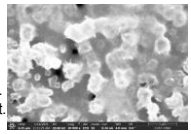
[2] St. Petersburg Mining University St. Petersburg, Russia

[3] University of Science and Technology International Research Centre for Nano Handling and Manufacturing of China Changchun, Jilin, CN

[4] Saint Petersburg Electrotechnical University "LETI" St. Petersburg, Russia

[5] St. Petersburg National Research University of Information Technologies, Mechanics and Optics (ITMO), St. Petersburg, Russia

- During the deposition of a sprayed material on a substrate with ITO, agglomerates of perovskite cubic nanostructures are formed.
- In the case of deposition on AZO, the cubic nanocrystals of perovskites CH3NH3PbBr3 are bigger than deposition on ZnO. Formation of ZnO strongly affects choice of surface of stubstrat.
- Porous silicon matrices with deposited zinc oxide (ZnO) nanoparticles studied in this work are suitable for the formation of nanocrystals of perovskite structures of the composition CsPbBr3



Composite materials: por-Si + zinc oxide ZnO + perovskites CsPbBr3

Notes

Technical Special Session 32
Functional Nanomaterials for Microelectronics and Biotechnology (ss)

Online

14:00–16:00 Thursday, 3 August

Organizer: Artemy Irzhak

Co-Organizer: Victor Koledov

32-4 14:30–14:40

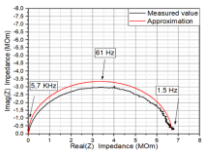
Impedance spectroscopy of porous silicon layers

Andrey Shportenko[1], Vitaly Starkov[2], Vladimir Volkov[2], Ekaterina Gosteva[1]

[1] MISIS National University of Science and Technology Moscow, Russia

2 Russian Academy of Sciences Institute of Microelectronics Technology and High Purity Materials Chernogolovka, Russia

- The first results of the values of the resistive and capacitive characteristics of the GPSi-var structure are obtained GPSi-var structure.
- As the results obtained have shown, the used technique allows one to adequately assess the characteristics of the formed porous structures and can be successfully applied to determine the dependences of the resistivity. on the modes of formation and modification of porous silicon layers.



Nyquist plot for GPSi-var structure

Notes

32-5 14:40–14:50

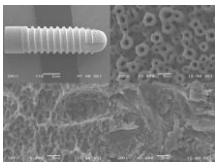
Dependence of the biocompatibility of dental implants on the surface morphology

Ekaterina Gosteva [1], Dymnikov Alexander[2], Tumanyan Gurgen[2], Maxim Chichkov [1]

[1] MISIS National University of Science and Technology Moscow, Russia

[2]The Peoples' Friendship University of Russia Moscow, Russia

- To date, there is no single accepted worldwide algorithm for processing the surface of dental implants, however, the properties that the surface of a dental implant should have at the macro-, micro- and nano-level are already clear. This work is devoted to the search for new, progressive methods of titanium surface processing.



Different morphology of the surface of dental implants

Notes

32-6 14:50–15:00

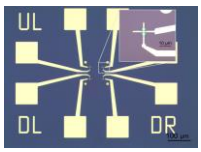
Dielectric Strength of Cross-linked Thin-film Poly(methyl methacrylate)

Alexey Ilin[1], Alla Kovalenko[1], Alexey Frolov[1], Dmitry Labutov[2]

[1]Kotelnikov IRE RAS, Russia

[2]Moscow Institute of Physics and Technology, Russia

- A series of samples for the thin-film electron-beam cross-linked PMMA dielectric strength study was fabricated
- The calculated dielectric strength of the thin-film cross-linked PMMA was 3.6 MV/cm to 5.2 MV/cm, mean value 4.4 MV/cm and median 4.3 MV/cm
- The results allow to estimate the cross-linked PMMA nanoscale insulation elements parameters



The sample for the breakdown voltage measurement, the green color area in the central part is the cross-linked PMMA insulation layer

Notes

Technical Special Session 32
Functional Nanomaterials for Microelectronics and Biotechnology (ss)

Online

14:00–16:00 Thursday, 3 August

Organizer: Artemy Irzhak

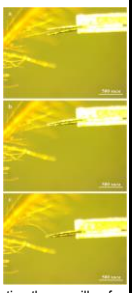
Co-Organizer: Victor Koledov

32-7 15:00–15:10

Development of a Method of Inactivation of Individual Sensilla of Insects Using Microtool with Shape Memory Effect

Kirill Borodako, Victor Koledov
Kotelnikov IRE RAS, Moscow, Russia
Marianna Zhukovskaya, Alexander Lunichkin
Sechenov IEPhB RAS, Saint-Petersburg, Russia
Alexander Shelyakov
NRNU MEPhI , Moscow, Russia
YaroslavProshin
Bauman MSTU, Moscow, Russia

The paper proposes a method for studying mechanosensitive sensilla of insects, which consists in recording the electrophysiological response from single sensilla under the influence of periodic and non-periodic mechanical stimuli. Inactivation of an individual sensilla was carried out due to its precise deflection using microtweezers based on a TiNiCu alloy ribbon with the two-way shape memory effect. The possibility of implementing the method is demonstrated by the example of manipulating the sensilla of the cricket Phaeophilacris bredoides using the developed microtweezers.



Manipulating the sensilla of Pedophiliacs bredoides cricket with micro tweezers: a – seek, b - capture, c – deflecting

Notes

32-8 15:10–15:20

Optimization of the control system for the nanomechanical devices based on alloys with SME

A. Prokunin
Moscow Institute of Physics and Technology, Moscow, Russia
V. Koledov, P. Lega, A. Orlov, A. Irzhak, V. Shavrov, D. Kuznetsov
Kotelnikov IRE RAS, Moscow, Russia
I. Musabirov
Institute of Problems of Metal Superplasticity RAS, Ufa, Russia
Hong Le
Institute of Materials Science of VAST, Hanoi, Vietnam

- Numerical modeling and experimental data on the thermal expansion of a tungsten needle
- Thermal expansion depending on the tip geometry
- Heating system

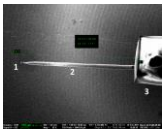


Image of the needle-diode-nanotweezers system in SEM

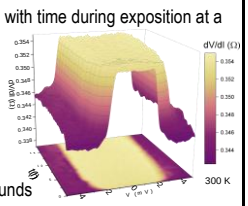
Notes

32-9 15:20–15:30

Modifying the Pinning of the Charge Density Wave in RTe_3 Compounds by Temperature, Current, Time Evolution

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

- Single-crystal bridge-like structures of $TbTe_3$
- The effect of an increase in the threshold field with time during exposition at a certain temperature T_0.
- Creating of ordered pinning structure
- Pinning control
  - Time
  - Current
  - Temperature
- The effect could be universal for RTe3 compounds



differential I-V, time evolution

Notes

Technical Special Session 32
Functional Nanomaterials for Microelectronics and Biotechnology (ss)

Online

14:00–16:00 Thursday, 3 August

Organizer: Artemy Irzhak

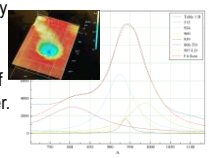
Co-Organizer: Victor Koledov

32-10 15:30–15:40

Synthesis of Silicon Carbide Nanoparticles on the Nanoporous Silicon

Jin Yang, Ekaterina Gosteva, Mikhail Konuhov
NUST MISiS, Moscow, Russia
Artemy Irzhak, Vasily Starkov
IMT RAS, Chernogolovka, Russia

- SiC particles are formed on the silicon surface by a combination of electrolytic etching, graphene deposition and laser irradiation,.
- 2. Raman spectroscopy showed the presence of SiC particles in the region of the irradiation crater.
- 3. The position of the LO-SiC peak varies depending on the position in the crater. This is due to a change in the size of the formed particles and size effects



Raman spectrum with LO-SiC

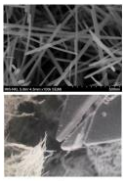
Notes

32-11 15:40–15:50

Development of a Method of 3D Manipulation of Individual ZnO Nanowires Using Shape Memory Nanotweezers

Victor Koledov
Kotelnikov Institute of Radioengineeringand Electronics of the Russian Academy of Sciences
Moscow, Russian Federation

- ZnO nanowires with hexagonal wurtzite structure were prepared by hydrothermal method.
- Kleiniek nanomanipulator equipped with Ti2NiCu composite nanotweezers with shape memory effect.
- The parameters of the nanotweezers ,the characteristics of the nanomanipulation and nano-assembly procedure are considered.



SEM image of the ZnO nanowires and Manipulating ZnO nanowires.

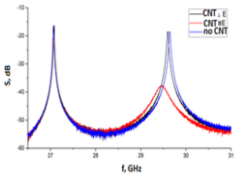
Notes

32-12 15:50–16:00

Electrodynamic Properties of CNTs Based Metasurface Created Using 3D Nano-Manipulation

D. Kurzmanbaev, V. Mordkovich, A. Karaeva, E. Mitberg
Technological Institute for Superhard and Novel Carbon Materials TISNUM, Moscow
V. Koledov, D. Kalenov, A. Prokinin, M. Parkhomenko, S. von Gratowski Kotelnikov IRE RAS, Moscow

- Metasufaces based on individual super long CNTs were created using 3D nanomanipulation.
- Electromagnetic waves interaction with CNT based metasurfaces in MM range were studied theoretically and experimentally.
- CNTs based metasurfaces are proved to be polarization sensitive absorbers.



Polarization dependent electromagnetic wave absorption by CNT metasurface.

Notes

Special Session: Junior Researcher Education and Development Forum

Established in 2019 by a partnership between IEEE 3M Nano International Conference and iBowu-JSA, Junior Researcher Education and Development Forum organizes a special session in the Conference, aiming to popularize the nanotechnology and interdisciplinary research among young students. The forum provides a platform for academically outstanding teenagers to demonstrate their participation in scientific research and to broaden their horizons by establishing scientific ideals.

The forum features presentations on original scientific research work conducted by teenagers who are actively involved in the cross section of physics, chemistry, molecular biology, bioinformatics and nanotechnology. Furthermore, the forum serves as a platform for the young talents to meet and learn from the world's leading scientists.

About iBowu-JSA

Juvenile Science Academy (JSA) is the first scientific research academy for juniors in China, operated solely by the civil forces. JSA is initiated by iBowu, a domestic platform for youth scientific activities and academic research projects. JSA is aimed at providing Chinese young talents with high-quality scientific practice opportunities.

JSA received scientific support and capital investment from BGI and Good Future Education Industry Fund. With a strong scientific and capital background, JSA has assembled a cohort of top scientists working in a variety of multidisciplinary research fronts around the world, including China, the United States, Denmark, Norway, Singapore, Australia, etc. With the help of the scientists, we compiled joint laboratory resources from dozens of universities and research institutions in several countries for our future scientists. JSA provides students with state-of-the-art STEM research programs and elite training programs. We strive to cultivate the scientific spirit of Chinese youth, developing future scientific talents for China and for the global scientific and technological community.

Student Contributing Talks Abstract

Bomin Wei

Princeton International School of Mathematics and Science

Title: Modeling the SARS-CoV-2 Mutation Based on Geographical Regions and Time

The Coronavirus Disease 2019 (COVID-19), which is caused by a novel RNA virus, called severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has led to more than one hundred million confirmed cases and over two million deaths in the world. The genetic information of SARS-CoV-2 mutates quickly and thus makes vaccine development difficulty. This project studies the mutation patterns of SARS-CoV-2 in the world and attempts to predict the mutation trend. I analyzed 150,659 entries of publicly accessible genome sequence data, divided them into three major branches located in Asia, America, and Europe. I selected high mutation rate sites, treat the data as time series and predicted the short-term mutation trends using ARIMA model with high accuracy.

Maidou Wang

RDFZ International Curriculum Center，ICC

Title: Evaluation of Chitosan-Arginine Based Gene Delivery System for Cancer Treatment

One direction in the research frontier of cancer treatment and management focuses on the small non-encoding RNA segments in the cancer cells. Evidence have confirmed these microRNA can regulate cancer cell biochemistry and they are potential therapeutic targets for cancer treatment. Though effective RNA or DNA agents can be designed to target specific cancer microRNA segments, the cell uptake of these agents has been too low to be effective. Chitosan is a common polysaccharide derived from chitin shells of shrimp, a material with high biocompatibility, biodegradability and biosafety. When formed into nanospheres and decorated with arginine, the complex can serve as a gene delivery system with high cell uptake. In this work, we study the complex particle formation, its cytotoxicity, and its effect in treating cancer cells.

Xi Chen

The Second High School Attached to Beijing Normal University International Department

Title: Optimization of GML Programming Interface for Game and Music Applications

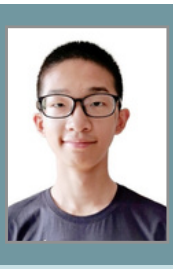
The GML language is a closed-source language specialized for game production. It can only be used in a dedicated IDE. In this project, the functions and GUI of the open-source music production software Minecraft Note Block Studio using GML was optimized. The main function is to use the sound effects in the game "Minecraft" to compose music and import into the game; techniques can also be used for independent music production. I optimized the software functions and interface, added new themes and modern design, updated user elements, added new practical functions such as beat measurer and shifting times, fixed reported bugs in the software. At the same time, the changes were communicated with its developers and received the developers' affirmation.

Meiyi Chen

Chongqing Nankai Middle School

Title: Study of Liposome Nanoparticle Drug Delivery for siRNA Gene Silencing

Nanomedicine has unique advantages stemming from its cross-discipline roots of nanoscience and medicine. During the COVID-19 period, a new generation of vaccine technology represented by mRNA vaccines has demonstrated a new prospect for nanotechnology applications in pharmaceuticals in the future. Small RNA molecules regulate gene expression through mRNA cleavage or translational repression. siRNA is one of the most effective RNA-based gene regulators. In this project, I prepared siRNA gene silencing delivery systems for anti-inflammatory drugs applications. Three different kinds of nanoparticles carriers were synthesized and tested, including lipofectamine, D114 and T114. Transfection efficiency and in vivo silencing in macrophages were measured and compared to conventional systems.



Taiyu Zhang

159th Middle School

Title: Unextendible Product Bases in Multiqubits Systems for Quantum Information

Quantum information is a cutting-edge research and development frontier, involving multidisciplinary fields such as physics, mathematics, and information theory and technology. To study the fundamental concept of quantum entanglement in this field, one key task is to study the unextendible product basis, or UPB. Unextendible product basis can be used to establish quantum entanglement states, as well as indistinction between states under local operation and classical communication conditions. This theoretical investigation is important for constructing and understanding the basic structure in quantum computing and quantum communications. In this work, we study how to construct different forms of the UPB in a system composed of multiple qubits and evaluate their characteristics for potential quantum information applications.

Xiyuan Yao

Dana Hall School

Hanpeng Chen

RDFZ International Curriculum Center，ICC

Mi Li

Beijing World Youth Academy

Title: Gene Editing with CRISPR to Create Genetic Spinal Disease Models in Zebrafish

Zebrafish is a vertebrate model that has been widely used in embryonic development, disease research, and drug screening in the past ten years. Especially in recent years, the zebrafish gene knockout technology CRISPR/Cas9 has matured, making zebrafish mutants easy to obtain, and some of the existing mutants are similar to human disease phenotypes. We completed the experimental operation of using CRISPR technology to knock out specific genes to construct a zebrafish model of a special genotype.

Youming Liu
RDFZ Chaoyang Branch School

Li Ding Mingyu
RDFZ Chaoyang Branch School

Title: Confronting CRISPR: The Scientific, Ethical, Legal and Social Issues of Gene Editing

CRISPR technology won the 2020 Nobel Prize in Chemistry. It has become one of the biotechnologies that have received much attention. The underlying bioethical issues behind it have also attracted attention, and even gene-edited babies have even occurred. How to consider the bioethical issues brought about by gene editing technology, how can CRISPR be used correctly, and what are the potential risks? These issues are very worthy of consideration and discussion by biologists.

Yiyang Jiang
Stevenson School

Naixin Tang
Culver Academies

Xiyuan Zhang
Tanglin Trust School

Title：Facile Synthesis of Glycyrrhetinic Acid by Optimizing Gus Gene for Beta-Glucuronidase Enzyme Expression in E.coli.

Glycyrrhetinic Acid, or GA, is a compound usually found in licorice root extract. It has a broad range of applications in pharmaceutical, food additive and cosmetic industries. The low concentration of GA in the natural herb limited its applications on a large scale. In this study, GA was synthesized by hydrolyzing glycyrrhizin with the beta-glucuronidase protein. The beta-glucuronidase protein was overexpressed in E. coli. BL21(DE3) by modified pet28a(+) plasmid. The expression vector was optimized by testing 5 promoters and various induction conditions. The enzymic activity of beta-glucuronidase was measured on the standard test substrate for E. coli. inspection. We reviewed beta-glucuronidase genetic sequence from different sources to assess the potential beta-glucuronidase production optimizations. Human practices feedbacks will be presented, including interviews of stakeholders and experts in the field of synthetic biology and herbal medicine study.

Enshi Xu
iBOWU-JSA

JSA Academic Advisor
Forum Chair

He Zhu
University College London

Assistant Tutor
iGEM Advisor

Yingxin Liu
Beijing World Youth Academy

Forum Assistant

Nanofabrication and Nanomeasurement

Xueyong Wei received his Ph.D. degree in the University of Birmingham in 2009. Professor Wei is Senior Member of IEEE, Youth Committee Member of both China Instrument and Control Society (CIS) and Chinese Society of Micro/Nano Technology (CSMNT). He won the FK Bannister Prize of University of Birmingham (2009), Young Scientist Award of Microsystem and Nanoengineering Summit (2017) and Shanxi Science & Technology Award for Young Talents (2020). He serves as the Associate Editor of IET Micro & Nano Letters, Section Executive Editor-in-Chief of Engineering, an international journal launched by the Chinese Academy of Engineering in 2015. He has also served as session chair, organization chair of several home and international conferences.

"All-in-One" Self-Powered Smart Microsystems

Xiaosheng Zhang

Professor

University of Electronic Science and Technology of China (UESTC)

Sophisticated Microstructures Utilizing Femtosecond Laser Wet Etching Processing

Hao Bian

vice professor

School of Electronic Science and Engineering, Xi’an Jiaotong University

Challenges on the Ultimate FIB Etching and Deposition Fabrications

Dengji Guo

Associate Professor & Deputy Director

Institute of Semiconductor Manufacturing Research

Application of the 3rd Generation Semiconductor SiC in MEMS Sensors

Fang Xudong

Associate professor

School of Mechanical Engineering, Xi'an Jiaotong University

Observation of Tunable Opto-Mechanical Responsivity in Two-Dimensional Semiconducting Nanoelectromechanical Resonators

Zenghui Wang

Professor

University of Electronic Science and Technology of China

Robotic Cell Manipulation and Characterization for Clinical Infertility Treatment

Zhuoran Zhang

Assistant Professor

School of Science and Engineering, The Chinese University of Hong Kong

SERS Chips for Rapid Detection of Biochemical Samples

Li Chen

Professor

College of Photoelectric Engineering, Chongqing University

General Information

Xi’an’s History

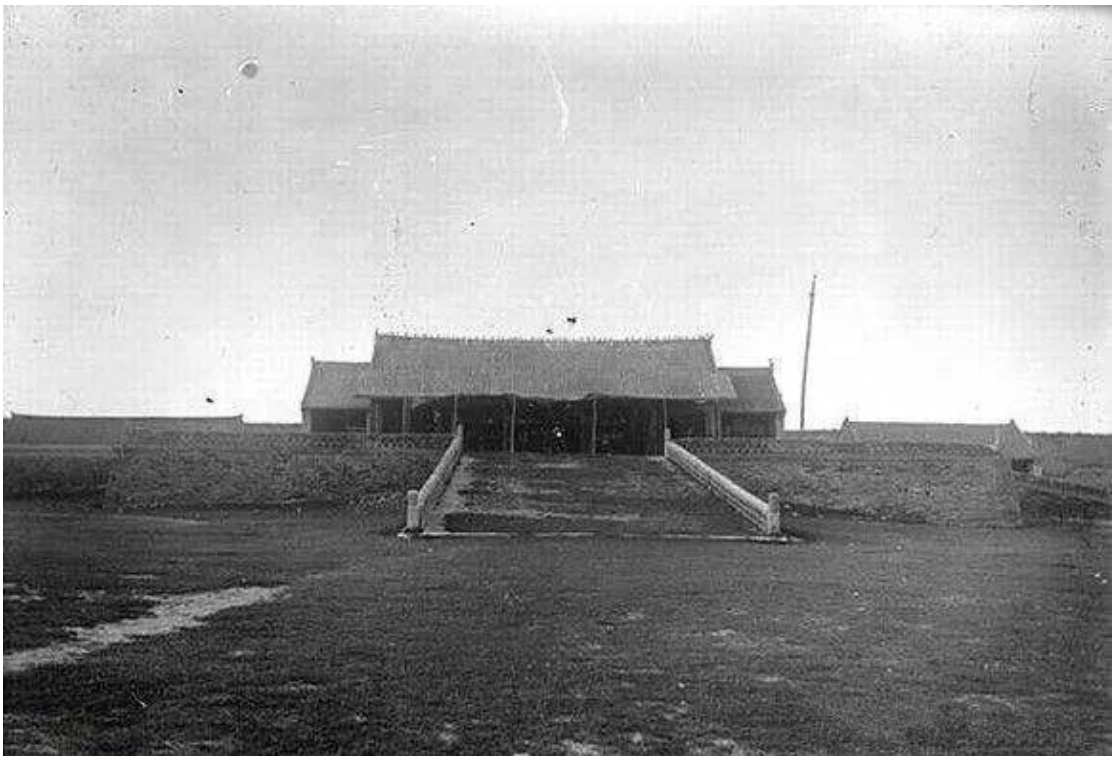
Xi'an is among the Top Four Ancient Capitals of the world, in the company of Athens, Rome and Cairo. It once functioned as the political, economic and cultural center of China and as the starting point of the Silk Road.

In China’s remote antiquity, “Lantian Ape Man” lived in its region; in the Neolithic Period, “Banpo Villagers” settled there to set up their tribes. In the year 1046 BC in the Western Zhou dynasty, Xi'an was called Fenghao, which was the combination of two cities, Fengjing and Haojing, established by the Emperor Wen and Emperor Wu of Zhou respectively. In the history of China, the two cities were the first national capitals to rule the entire state.

In the early Western Han Dynasty (206 BC- AD 220), Liu Bang established his capital in Xi'an and named it Chang'an, which means “eternal ruling and permanent peace”; from then to the late Tang dynasty (618-907) the city took the name of Chang'an.

After the Tang dynasty, Chang'an was renamed Jingzhou Prefecture during the Later Tang dynasty, Shaanxi Province during the Song dynasty (960-1279), Anxi Province during the Yuan dynasty (1271-1368), and Fengyuan Province later in the Yuan dynasty. It functioned as the political, economic and cultural center of northwestern China. In the spring of 1369, the second year of the Ming dynasty, Xu Da, a general under the Hongwu emperor, occupied Fengyuan province and renamed it Xi'an, meaning “to pacify northwest”. Since then, the name of Xi'an has been adopted.

May 20, 1949 celebrated the liberation of Xi'an city. Upon the founding of the People's Republic of China, Xi’an has become a key center for scientific research, higher education, national defense and hi-tech industry in China. It is also a hub of finance, science and technology, education, tourism, and trade in the country's mid-western northern region.



Xi 'an government agency(1907)

Andingmen(1907)

Xi’an’ Climate

Xi'an has a temperate climate that is influenced by the East Asian monsoon, classified under the Köppen climate classification as situated on the borderline between a semi-arid climate (BSk) and humid subtropical climate (Cwa). The Wei River valley is characterised by hot, humid summers, cold, dry winters, and dry springs and autumns. Most of the annual precipitation is delivered from July to late October. Snow occasionally falls in winter but rarely settles for long. Dust storms often occur during March and April as the city rapidly warms up. Summer months also experience frequent but short thunderstorms. The monthly 24-hour average temperature ranges from around the freezing mark in January to 27.0 C (80.6 F) in July, with an annual mean of 14.08 C (57.3 F). With monthly percent possible sunshine ranging from 31 percent in December to 47 percent in August, the city receives 1,536 hours of bright sunshine annually.

Take august as an example, data provided by the world meteorological organization recorded in 2019 are as follows:

Absolute Highest Temperature: 38°C (August 15, 2019)

Absolute Lowest Temperature: 17°C (August 29, 2019)

Affected by terrain and monsoons, Xi’an’s climate is generally characterized as cold in the winter and hot in the summer.

Contact Information

Conference Secretariat

Email: 3M-NANO@cust.edu.cn

3m.nano.secretariat@gmail.com

Phone: +86 431 85582926

FAX: +86 431 85582925

Postal Address: IEEE 3M-NANO 2021 International Conference

Address:

Main Building, Room 204

International Research Center for Nano Handling and Manufacturing of China,

Changchun University of Science and Technology

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

Conference Venue

All sessions will be held at Xi'an Jianguo Hotel

Address: No.2 Huzhu Road, Xi’an, Shaanxi 710048, 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

Xi’an’s Local Area Code: 029

Index of Authors

-A-			Dong,Siyan	8-5
			Dong,Xiangting	25-6
Alexander,Dymnikov	32-5		Dong,Xiangting	25-7
Anton,Belorus	32-3		Dong,Xiangting	25-8
-B-			Dong,Xiangting	5-3
			Dong,Xiangting*	30-6
Bai,Yang	21-6		Dong,Xiangting*	30-7
Bao,Wenzhong	4-7		Dong,Xiangting*	29-6
Borodako,Kirill	32-7		Du,Bobo	23-7
-C-			Du,Yueqing	24-1
			-F-	
Cai,Qianqian	28-5			
Cai,Qianqian	28-2		Fan,Yu	21-7
Cao,Liang	9-1		Fang,Xiao-Yong	27-1
Cao,Sicheng	30-3		Fang,Xuan	22-6
Cao,Siyuan	31-3		Fang,Yongchun	9-6
Cao,Siyuan	5-4		Feng,Qingliang*	10-4
Cao,Zhen	26-1		Fleetwood,Daniel M.	1-6
Chai,Guo	16-1		Frolov,Aleksei	32-9
Chai,Yang	10-2		Frolov,Alexey	32-6
Chang,Bo	13-3		Fu,Yuanyuan	31-2
Chen,Guangjun	19-6		-G-	
Chen,Jiancheng	27-5			
Chen,Jianhua	25-1		Gao,Haibo	31-6
Chen,Minsheng	30-5		Gao,Mingyan	18-1
Chen,Mu	26-3		Gao,Shuang	25-8
Chen,Qi	10-6		Gao,Yang	27-3
Chen,Qing	10-2		Geng,Junyuan	31-6
Chen,Rui	2-1		Ghezzo,Fabrizia	25-3
Chen,Tao	27-6		Gong,Jiamin	24-2
Chen,Yangyang	10-6		Gosteva,Ekaterina	32-10
Chen,Yunfei	26-3		Gosteva,Ekaterina	32-2
Cheng,Can	18-6		Gosteva,Ekaterina	32-3
Chichkov,Maxim	32-5		Gosteva,Ekaterina	32-5
Chu,Xueying	8-4		Gosteva,Ekaterina	32-4
Cui,Mengjia	5-6		Gratowski,S.von	32-12
-D-			Gu,Chaoming	26-1
			Guo,Bin	1-6
Daria,Sedlovets	32-2		Guo,Bo	15-2
Deng,Ningqin	1-6		Guo,Yao	10-2
Deng,Tao*	1-2		Gurgen,Tumanyan	32-5
Ding,Jianjun	21-6		-H-	
Dong,Chunhua	22-5			
Dong,Ruili	16-5		Han,Chirui	13-2
Dong,Ruili	16-1		Han,Dongdong	24-2

Han,Xiaojun	1-8		Kalenov,D.	32-12
Han,Ying	14-4		Karaeva,A.	32-12
Hao,Zhiming	13-6		Koledov,V.	32-12
He,Peng	5-2		Koledov,V.	32-8
He,Peng	5-1		Koledov,Victor	32-1
He,Tingchao	2-2		Konuhov,Mikhail	32-10
He,Wurigamula	25-8		Koshevoi,Veniamin	32-3
He,Wurigamula	25-6		Kostadino,Kostadin	
He,Yuhui	10-6		Kovalenko,Alla	32-6
He,Zizhou	21-6		Kurzmanbaev,D.	32-12
Hong,Haodong	16-2		Kuznetsov,D.	32-8
Hong,Yu	19-5		-L-	
Hou,Cheng	27-6			
Hou,Meng	20-3		Labutov,Dmitry	32-6
Hou,Yonggang	28-1		Lai,Zhengyu	13-6
Hu,Jing	31-3		Lan,Guilian	23-1
Hu,Kai-Ming	27-1		Lau,Shu Ping	4-2
Hu,Siyi	3-5		Le,Hong	32-8
Huang,Chengyang	13-6		Lega,P.	32-8
Huang,Hongtao	26-2		Lega,Peter	32-11
Huang,Jingshi	17-4		Li,Ang	27-5
Huang,Lei	21-7		Li,C.*,	14-6
Huang,Ting	27-6		Li,Dehong	1-6
Huang,Ying	1-5		Li,Dikun	23-4
Huang,Zhaoling	30-3		Li,Hongli	21-7
Hui,Zhanqiang	24-2		Li,Jian	28-2
Huo,Zhichen	13-4		Li,Jian	28-5
Huo,Zimin	8-5		Li,Jianping	17-1
-I-			Li,Jinhua	8-4
			Li,Li	15-4
Iliasov,Artem	32-2		Li,Lu	15-5
Ilin,Alexey	32-6		Li,Pengpeng	20-5
Irzhak,A.	32-8		Li,Shasha	1-2
Irzhak,Artemy	32-10		Li,Shishi	31-6
Irzhak,Artemy	32-1		Li,Tao	21-6
Ivanov,Ognyan	26-5		Li,Weibing	30-2
-J-			Li,Wen	20-5
			Li,Wenjun	5-4
Ji,Deyang	7-5		Li,Xiaojie	26-1
Jiang,Chunxu	30-8		Li,Xinyao	30-6
Jiang,Dacheng	19-3		Li,Yangwu	23-4
Jiang,Jie	7-2		Li,Yiquan	28-5
Jiang,Zhuangde	21-6		Li,Yuanchao	21-4
Jiao,Niandong*	13-5		Li,Yuning	1-2
Jin,Fangjun	8-4		Li,Zhenfeng	5-1
Jin,Jialong	13-3		Li,Zhenfeng	5-2
Ju,Tuoyu	18-4		Li,Zhongwu	26-3
-K-			Lian,Zhongxu	28-2
			Lian,Zhongxu	28-5

Lin,Li	18-2		Mitberg,E.	32-12
Liu,Bing	30-7		Mordkovich,V.	32-12
Liu,Caixia	1-5		Musabirov,I.	32-8
Liu,Cunhuan	9-6		-N-	
Liu,DongHao	22-2			
Liu,Feng	25-7		Nong,Jinpeng	23-1
Liu,Feng	29-6		-O-	
Liu,Guixia	30-7			
Liu,Huicong	27-6		Okita,Ryo	21-2
Liu,Huiliang	21-3		Orlov,A.	32-8
Liu,J.	14-6		-P-	
Liu,Lei	1-9			
Liu,Lianqing*	31-2		Pan,Chunxiang	20-2
Liu,Min	8-5		Pan,Yixuan	9-5
Liu,Pengbo	16-7		Parkhomenko,M.	32-12
Liu,Pengbo	16-6		Peng,Bo	27-1
Liu,Ping	1-5		Peng,Jiao	18-2
Liu,Ri	19-1		Peng,Yitian	14-3
Liu,Xiaomin*	3-1		Pleshanov,Ilya M.	32-3
Liu,Xiayi	17-7		Prokinin,A.	32-12
Liu,Xiayi	17-6		Prokunin,A.	32-8
Liu,Xiayi	17-5		Proshin,Yaroslav	32-7
Liu,Yang	26-1		-Q-	
Liu,Yangpeng	21-6			
Liu,Yong	27-5		Q,Guo	32-3
Liu,Yu	16-2		Qi,Haina	30-6
Lu,Feipeng	25-1		Qi,Haina	5-3
Lu,Hua	23-4		Qi,Han	26-3
Lu,Yang	14-2		Qi,Ningning	9-6
Lu,Zhengcheng	9-4		Qiao,Liang	22-4
Lua,Geyu	3-1		Qiu,Min	19-5
Lunichkin,Alexander	32-7		-R-	
Luo,Peng	23-1			
M			Radović,Ivan	25-5
			Ragab,Tarek	30-4
Ma,Boxuan	1-6		-S-	
Ma,Hanbin	3-5			
Ma,Qianli	25-7		Sha,Jingjie	8-3
Ma,Qianli	25-8		Shan,Huiyong	26-4
Ma,Qianli	30-6		Shao,Hong	5-3
Ma,Qianli	30-7		Shavrov,V.	32-8
Ma,Qianli	5-3		Shelyakov,Alexander	32-7
Ma,Xiaoyuan	16-7		Shen,Huijuan	25-2
Mao,Dong	24-3		Shi,Beichao	13-4
Meng,Jing	29-6		Shi,Huiyao	31-2
Meng,Xianghe	31-6		Shi,Subao	3-5
Meng,Xiaohui	27-5		Shi,Zhongqi Wei,Zhilei	2-3
Miki,Tsukasa	21-2		Shimada,Moe	21-2
Mišković,Zoran L.	25-5		Shirakashi,Jun-ichi	21-2

Shportenko,Andrey	32-4		Wang,Jiangwei	14-5
Song,Yuanhong	25-5		Wang,Jiaqi	29-3
Song,Zelai	20-5		Wang,Jingli	10-5
Starkov,Vasily	32-10		Wang,Lili	25-6
Starkov,Vitaly	32-2		Wang,Lili	25-8
Starkov,Vitaly	32-4		Wang,Maoxun	29-2
Stavrov,Vladimir	31-1		Wang,Mengjie	30-4
Su,Fang	1-2		Wang,Ning	10-4
Su,Ye	30-8		Wang,Pan	1-6
Sun,Baishun	9-3		Wang,Ruoxing	15-4
Sun,Feng	25-7		Wang,Shaojun	23-6
Sun,Guibin	5-5		Wang,Shuangpeng	2-5
Sun,Guibin	20-6		Wang,Tianyu	16-1
Sun,Guobin	19-3		Wang,Weidong	30-2
Sun,Guobin	19-4		Wang,Weidong	8-5
Sun,Jiahua	31-4		Wang,Weidong	30-4
Sun,Jingye	1-2		Wang,Wenxue*	31-2
Sun,Jiyu	20-5		Wang,Xiao	7-3
Sun,Lining*	27-6		Wang,Xiao	30-2
Sun,Qiang	20-1		Wang,Yanlan	25-1
Sun,Xiaoqing	28-6		Wang,Yichen	20-5
Sun,Xiaotong	29-1		Wang,Yinghe	5-3
Sun,Xuemei	26-4		Wang,Yinghe	30-6
Sun,Yiyang	29-5		Wang,Zegao	7-7
-T-			Wang,Zhilong	17-7
			Wang,Zhilong	17-5
Tan,Yonghong	16-5		Wang,Zhilong	17-6
Tan,Yonghong	16-1		Wang,Ziheng	8-4
Tang,Hui	16-3		Wang,Zuobin	31-3
Tao,Yi	8-3		Wang,Zuobin	5-4
Tian,He	1-6		Wang,Zuobin	31-1
Tian,He	1-1		Wei,Huaxian	21-4
Tian,Kun	20-4		Wei,Wei	23-1
Tian,Yanling	13-4		Wei,Yong	26-4
Tong,Jiali	30-3		Wen,Ting	30-1
Tong,Jin	20-5		Weng,Zhankun	32-3
-V-			Weng,Zhankun	5-4
			Weng,Zhankun	32-1
Victor,Koledov	32-7		Weng,Zhankun *	31-3
Volkov,Vladimir	32-4		Wu,Chengfeng	27-3
-W-			Wu,Haiyun	26-4
			Wu,Qianchao	15-1
Wang,Binkai	13-3		Wu,Qianchao	15-3
Wang,Bowei	9-2		Wu,Song	27-2
Wang,Chunyang	25-4		Wu,Xiaomin	18-3
Wang,Dong	22-1		Wu,Xing	1-4
Wang,Dongbo	22-2		Wu,Xinyu	13-6
Wang,Fengxia*	27-6		Wu,Zhiyong	27-6
Wang,Fujun	13-4		-X-	

Xi,Ning	31-2		Yao,Jiafeng	17-3
Xia,Qing	30-8		Yao,Xiankun	24-5
Xia,Wenjie	14-1		Yao,Yong	15-1
Xian,Dan	21-6		Yao,Yong	15-3
Xie,Hui	31-6		Ye,Jian*	18-2
Xie,Shuangxi	13-5		Ye,Jingmin	3-5
Xie,Yunrui	5-3		Ye,Zhi	26-1
Xiong,Feng	7-9		Yin,Duanduan	25-6
Xiong,Xuya	7-8		Yin,Duanduan	25-8
Xu Wang	29-4		Yin,Jianhua	3-2
Xu,Da	25-8		Yin,Weijie	1-2
Xu,Da	29-6		Yu, Wensheng	5-3
Xu,Da	25-7		Yu,Hongyang	8-3
Xu,Hua	10-3		Yu,Huadong	28-2
Xu,Jiawen	16-2		Yu,Huadong	28-5
Xu,Jinkai	28-2		Yu,Jin	2-4
Xu,Jinkai*	5-5		Yu,Miaomiao	31-3
Xu,JinLong	8-1		Yu,Qiuyue;	27-5
Xu,Meng	1-1		Yu,Wensheng	25-6
Xu,Meng	1-7		Yu,Wensheng	25-7
Xu,Mingze	8-4		Yu,Wensheng	25-8
Xu,Qingsong	13-1		Yu,Wensheng	30-7
Xu,S.	14-6		Yu,Wensheng	29-6
Xu,Tiantian	13-6		Yu,Yaping	26-4
Xu,Zhikun	22-7		Yu,Yewei	16-4
Xue,Shirui	30-3		Yu,Zhanjiang	28-2
-Y-			Yu,Zhanjiang	28-5
			Yue,Ming	19-2
Yan,Liangliang	16-6		-Z-	
Yan,Peng	16-7			
Yan,Xu	3-1		Zekui,Lyu	13-1
Yan,Yongwei	20-5		Zeng,Chao	24-3
Yang,Daoguo*	30-3		Zeng,Yanan	26-4
Yang,Fan	18-5		Zhai,Changtai	5-5
Yang,Huiran	24-4		Zhai,Yingjiao	8-4
Yang,Jia	31-2		Zhan,Yuchao	20-5
Yang,Jian	21-4		Zhang,An	17-5
Yang,Jin	32-10		Zhang,An	17-7
Yang,Kuai	16-8		Zhang,Bingbin	27-3
Yang,Lei	1-10		Zhang,Caiyun	28-3
Yang,Liu	5-3		Zhang,Chen	16-4
Yang,Liu	30-7		Zhang,Dawei	13-4
Yang,Renjie	26-4		Zhang,Enxia	1-6
Yang,Shasha	27-4		Zhang,Fang	25-1
Yang,Wezhen	16-2		Zhang,Haiyan	8-5
Yang,Yong	7-1		Zhang,Haiyuan	3-3
Yang,Zhan	27-6		Zhang,Hao	31-6
Yang,Zhuoli	16-5		Zhang,Helin	25-6
Yao,Guoming	16-6		Zhang,Helin	25-8

Zhang,Ji	30-4		Zhu,Wenyu	5-4
Zhang,Jian	1-6		Zhu,Xiaona	28-4
Zhang,Jin	19-3		Zhu,Xin	26-1
Zhang,Lei	25-1		Zhu,Yingmin	8-5
Zhang,Li	13-6		Zhukovskaya,Marianna	32-7
Zhang,Ling	3-1		Zu,Lipeng	31-2
Zhang,Peiyuan	16-3			
Zhang,Qian	1-5			
Zhang,Rufan	1-3			
Zhang,Rui	25-1			
Zhang,Shanxiu	13-6			
Zhang,Shuye	5-1			
Zhang,Shuye	5-2			
Zhang,Wen-Ming	27-1			
Zhang,Wenxiao	31-3			
Zhang,Xiaoxian	4-6			
Zhang,Y.M.	14-6			
Zhang,Yinan	23-8			
Zhang,Yingying	25-5			
Zhang,Yujing	21-5			
Zhang,Yuxin	31-5			
Zhang,Zhaojian	27-5			
Zhang,Zhen	5-6			
Zhang,Zhen*	16-8			
Zhang,Zheng	10-1			
Zhang,Zhenyu	26-3			
Zhao,Beibei	5-5			
Zhao,Ding	19-5			
Zhao,Hongbin	22-3			
Zhao,Jianlin	23-4			
Zhao,Jing	7-6			
Zhao,Tong	17-7			
Zhao,Tong	17-6			
Zhao,Tong	17-5			
Zhao,Tong	17-2			
Zhao,Tuan	21-1			
Zhao,Xiaolu	13-4			
Zhao,Xingyu	13-4			
Zhao,Xu	3-1			
Zhao,Yu	8-3			
Zhao,Yuda	7-4			
Zheng,Dan	30-3			
Zhou,Miaolei*	16-4			
Zhou,Quan	13-3			
Zhou,Shu	26-3			
Zhou,Yue	10-6			
Zhou,Yujie	8-2			
Zhu,Mingqiang	1-2			
Zhu,Wenyu	31-3			

MEMO

MEMO

MEMO