The 2019 EITA Conference on New Materials, Nanotechnology, Healthcare, New Energy and Sustainable Smart Manufacturing

(EITA-New Materials 2019) or (EITA-EITC 2019)

"Recent Research Advances in New Materials, Nanotechnology, Healthcare, New Energy and Sustainable Smart Manufacturing: Challenges, Opportunities and Future Directions"

Conference Proceedings

National Chiao-Tung University
Hsinchu, Republic of China (Taiwan)

Wednesday-Thursday, September 11 and 12, 2019

<Draft as of 9/9/19>

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Welcome Message

Conference Themes

"Recent Research Advances in New Materials, Nanotechnology, Healthcare, New Energy and Sustainable Smart Manufacturing: Challenges, Opportunities and Future Directions"

The EITA-New Materials 2019 conference consists of three four workshops and student poster competition sessions:

- **Workshop 1 (W1):** Emerging Technologies and Applications in Materials for Healthcare and Medicine: Bio-Materials, Bio-SoC, Bio-Nanotech, Bio-NEMS/Bio-MEMS, Biomedical Optics and Imaging, Biomedical Engineering and Systems, Biomedical Informatics, Mobile Health, Virtual Reality (VR) and Healthcare
- **Workshop 2 (W2):** Emerging Technologies and Applications in Electronic, Photonic, and Magnetic Materials, Ceramic Materials, Metallurgy and Materials, Organic Polymer, Soft Materials, and Computational Materials
- **Workshop 3 (W3):** Emerging Technologies and Applications in New Energy Materials and Devices, Perovskite, Power Electronics, Smart Energy Systems and Technologies (SEST), Smart Homes, Smart Buildings, and Smart Communities, Energy Storage and Utilization, Clean/Intelligent Vehicle Technologies, and Artificial Intelligence (AI) Applications in New Materials and Energy
- **Workshop 4 (W4):** Smart Tools and Smart Services, Smart Machines, and Sustainable Smart Manufacturing for the Future: Vision, Strategies, and Implementation (Big Data and Intelligence, Advanced Sensors, Autonomous Robots, Robotic Process Automation, Smart Machines (Devices), Simulation, Horizontal and Vertical System Integration, Smart Cities, Smart Supply Chain Management and Logistics 4.0, Computer Networking, 5G Wireless Mobile Technology, Internet of Things (IoT), Cyber-Physical Systems, Cybersecurity, Additive and Advanced Manufacturing, Digital Manufacturing, Augmented Reality and Cloud Technologies)
- **Student Poster Competition**

Planning Committee

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Fang-Chung Chen	(陳方中)	National Chiao-Tung University

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Program Committee

Workshop Track Co-Chairs

Workshop 1 (W1): Emerging Technologies and Applications in Materials for Healthcare and Medicine: Bio-Materials, Bio-SoC, Bio-Nanotech, Bio-NEMS/Bio-MEMS, Biomedical Optics and Imaging, Biomedical Engineering and Systems, Biomedical Informatics, Mobile Health, Virtual Reality (VR) and Healthcare:

Chi-Kuang Sun	(孫啟光)	National Taiwan University

Workshop 2 (W2): Emerging Technologies and Applications in Electronic, Photonic, and Magnetic Materials, Ceramic Materials, Metallurgy and Materials, Organic Polymer, Soft Materials, and Computational Materials:

Chih-Wei Chu	(朱治偉)	Academia Sinica

Workshop 3 (W3): Emerging Technologies and Applications in New Energy Materials and Devices, Perovskite, Power Electronics, Smart Energy Systems and Technologies (SEST), Smart Homes, Smart Buildings, and Smart Communities, Energy Storage and Utilization, Clean/Intelligent Vehicle Technologies, and Artificial Intelligence (AI) Applications in New Materials and Energy

Jia-Min Shieh	(謝嘉民)	Taiwan Semiconductor Research Institute (TSRI)

Workshop 4 (W4): Smart Tools and Smart Services, Smart Machines, and Sustainable Smart Manufacturing for the Future: Vision, Strategies, and Implementation (Big Data and Intelligence, Advanced Sensors, Autonomous Robots, Robotic Process Automation, Smart Machines (Devices), Simulation, Horizontal and Vertical System Integration, Smart Cities, Smart Supply Chain Management and Logistics 4.0, Computer Networking, 5G Wireless Mobile Technology, Internet of Things (IoT), Cyber-Physical Systems, Cybersecurity, Additive and Advanced Manufacturing, Digital Manufacturing, Augmented Reality and Cloud Technologies)

George T. C. Chiu	(邱祚之)	Purdue University
Ta-Hui Lin	(林大惠)	National Cheng-Kung University
Liang-Chia Chen	(陳亮嘉)	National Taiwan University

Student Poster Competition

Fang-Chung Chen	(陳方中)	National Chiao-Tung University Homepage
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Fang-Chung Chen	(陳方中)	National Chiao-Tung University
Tsung Sheng Kao	(高宗聖)	National Chiao-Tung University

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<TBD>

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(新興資訊科技協會)

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Department of Photonics, National Chiao-Tung University
(國立交通大學電機學院光電系)

Co-Sponsors:

The Ministry of Science and Technology, R.O.C. (Taiwan)
(科技部)

Conference Program

Day 1 (Wednesday, September 11, 2019)

9/11 (Wed) 9:00 am - 5:00 pm: Registration

Room: Conference Hall, CPT Building 1F (交映樓 1F 國際會議廳)

9/11 (Wed) 9:30 am - 9:50 am: Opening Session

Chairs:

Dr. Fang-Chung Chen (陳方中), Professor and Deputy Director, Department of Photonics, National Chiao-Tung University

Dr. Tsung Sheng Kao (高宗聖), Assistant Professor, Department of Photonics, National Chiao-Tung University

Room: Conference Hall, CPT Building 1F (交映樓 1F 國際會議廳)

Welcome Remarks:

Dr. Edward Yi Chang (張翼)
Senior Vice President
National Chiao-Tung University

9/11 (Wed) 9:50 am - 10:40 am: Plenary Session (I):

Chair: Dr. Tien-Chang Lu (盧廷昌), Chairman of Tin Ka Ping Photonic Center, National Chiao-Tung University

Room: Conference Hall, CPT Building 1F (交映樓 1F 國際會議廳)

Plenary Speaker:

"New frontiers of GaN optoelectronic research"
Dr. Jung Han
William Norton Professor in Technological Innovation
Professor, Department of Electrical Engineering
Yale University

9/11 (Wed) 10:40 am - 10:50 am: Break

9/11 (Wed) 10:50 am – 11:40 am: Plenary Session (II):

Chair: Dr. Fang-Chung Chen (陳方中), Professor and Deputy Director, Department of Photonics, National Chiao-Tung University

Room: Conference Hall, CPT Building 1F (交映樓 1F 國際會議廳)

Plenary Speaker:

"Nanoscale interface engendering for functional hetero-junction"
Dr. Kazuhito Tsukagoshi (塚越 一仁)
Group Leader of Pi-electron electronics group
Principle Investigator, WPI-MANA, NIMS

9/11 (Wed) 11:40 am – 1:00 pm: Student Poster Competition: Presentations

Chair: Dr. Fang-Chung Chen (陳方中), Professor and Deputy Director, Department of Photonics, National Chiao-Tung University

Co-chair: Dr. Tsung Sheng Kao (高宗聖), Assistant Professor, Department of Photonics, National Chiao-Tung University

Room: CPT Building 1F (交映樓 1F)

9/11 (Wed) 11:40 am - 1:00 pm: Lunch

Parallel Sessions:

9/11 (Wed) 1:00 pm – 2:30 pm: Technical Session D1-W1-T1:Emerging Technologies and Applications in Materials for Healthcare and Medicine: Bio-Materials, Bio-SoC, Bio-Nanotech, Bio-NEMS/Bio-MEMS, Biomedical Optics and Imaging, Biomedical Engineering and Systems, Biomedical Informatics, Mobile Health, Virtual Reality (VR) in Healthcare

Chair: Dr. Chi-Kuang Sun (孫啟光), Life Distinguished Professor, Graduate Institute of Photonics and Optoelectronics and Chief Director, Molecular Imaging Center, National Taiwan University

Room: Conference Hall, CPT Building 1F

"Mining Perturbed Gene Expression Patterns for Drug Discovery"

Dr. Hsuan-Cheng Huang (黃宣誠)
Director and Professor, Institute of Biomedical Informatics
National Yang Ming University

"Design and Implementation of Wearable Eye Tracker"

Dr. Chih-Peng Fan (范志鵬)
Professor, Department of Electrical Engineering
National Chung Hsing University

Dr. Chih-Ting Lin (林致廷)
Associate Professor, Department of Electrical Engineering
National Taiwan University

9/11 (Wed) 1:00 pm – 2:30 pm: Technical Session D1-W2-T1: Emerging Technologies and Applications in Electronic, Photonic, and Magnetic Materials, Ceramic Materials, Metallurgy and Materials, Organic Polymer, Soft Materials, and Computational Materials

Chair: Dr. Chih-Wei Chu (朱治偉), Deputy Director and Research Fellow, Research Center for Applied Sciences, Academia Sinica

Room: R201, CPT Building

"Exquisite Ge/Si/O interactions enabled self-organized heterostructures of Ge nanodot/SiO2/SiGe-recess channel for Si electronic/photonic integrated circuits"

Dr. Pei-Wen Li (李佩雯)
Professor, Institute of Electronics
Director, Nano Facility Center
National Chiao Tung University

"Contact Engineering for 2D Field-effect Transistors"

Dr. Po-Wen Chiu (邱博文)
Professor, Department of Electrical Engineering
Director, Center for Nanotechnology, Materials Science, and Microsystem
National Tsing Hua University

"P-Channel SnO TFTs for Oxide-Semiconductor-Based CMOS Technology"

Dr. I-Chun Cheng (陳奕君)
Professor, Department of Electrical Engineering & Graduate Institute of Photonics and Optoelectronics
National Taiwan University

9/11 (Wed) 1:00 pm – 2:30 pm: Technical Session D1-W3-T1: Emerging Technologies and Applications in New Energy Materials and Devices, Perovskite, Power Electronics, Smart Energy Systems and Technologies (SEST), Smart Homes, Smart Buildings, and Smart Communities, Energy Storage and Utilization, Clean/Intelligent Vehicle Technologies, and Artificial Intelligence (AI) Applications in New Materials and Energy

Chair: Dr. Jia-Min Shieh (謝嘉民), Deputy Director General, Taiwan Semiconductor Research Institute (TSRI)
Room: R202, CPT Building

"ZnO-based Hybrid-structures for Optoelectronic and Sensing Devices"

Dr. Bohr-Ran Huang (黃柏仁)
Distinguished Professor, Graduate Institute of Electro-Optical Engineering and Department of Electronic Engineering
National Taiwan University of Science and Technology

"A Concept of applying the surface defect band from MoS2 2D nanoribbons for photon ratchet intermediate band solar cells"

Dr. Yuh-Renn Wu (吳育任)
Professor, Institute of Photonics and Optoelectronics and Department of Electrical Engineering
National Taiwan University

"Asymmetric Thermo-electrochemical Cell for Low-Grade-Heat-to-Electricity Conversion"

Dr. Shien-Ping Feng (馮憲平)
Associate Professor, Department of Mechanical Engineering
The University of Hong Kong

9/11 (Wed) 1:00 pm – 2:30 pm: Technical Session D1-W4-T1: Smart Tools and Smart Services, Smart Machines, and Sustainable Smart Manufacturing for the Future: Vision, Strategies, and Implementation (Big

Data and Intelligence, Advanced Sensors, Autonomous Robots, Robotic Process Automation, Smart Machines (Devices), Simulation, Horizontal and Vertical System Integration, Smart Cities, Smart Supply Chain Management and Logistics 4.0, 5G Wireless Mobile Technology, Internet of Things (IoT), Cyber-Physical Systems, Cybersecurity, Additive and Advanced Manufacturing, Digital Manufacturing, Augmented Reality and Cloud Technologies)

Chair: Dr. Liang-Chia Chen (陳亮嘉), Distinguished Professor, Department of Mechanical Engineering, National Taiwan University
Room: R203, CPT Building

"Quality Control Problems in Three-dimensional Printing-based Mass Production"

Dr. Tin-Chih Toly Chen (陳亭志)
Distinguished Professor, Department of Industrial Engineering and Management
National Chiao Tung University

Dr. Chun-Yeon Lin (林峻永)
Assistant Professor, Department of Mechanical Engineering
National Taiwan University

9/11 (Wed) 2:30 pm - 2:40 pm: Break

Parallel Sessions:

9/11 (Wed) 2:40 pm – 4:20 pm: Technical Session D1-W1-T2: Emerging Technologies and Applications in Materials for Healthcare and Medicine: Bio-Materials, Bio-SoC, Bio-Nanotech, Bio-NEMS/Bio-MEMS, Biomedical Optics and Imaging, Biomedical Engineering and Systems, Biomedical Informatics, Mobile Health, Virtual Reality (VR) in Healthcare

Chair: Dr. Hsueh-Fen Juan (阮雪芬), Professor, Department of Life Science; Graduate Institute of Biomedical Electronics and Bioinformatics, National Taiwan University
Room: Conference Hall, CPT Building 1F

Dr. Chi-Kuang Sun (孫啟光)
Life Distinguished Professor, Graduate Institute of Photonics and Optoelectronics and
Chief Director, Molecular Imaging Center
National Taiwan University

"Ultrafast Ultrasound Imaging of the Heart"

Dr. Wei-Ning Lee (李維寧)
Associate Professor, Department of Electrical and Electronic Engineering
The University of Hong Kong

9/11 (Wed) 2:40 pm – 4:10 pm: Technical Session D1-W2-T2: Emerging Technologies and Applications in Electronic, Photonic, and Magnetic Materials, Ceramic Materials, Metallurgy and Materials, Organic Polymer, Soft Materials, and Computational Materials

Chair: Dr. Pei-Wen Li (李佩雯) , Professor, Institute of Electronics, Director, Nano Facility Center, National Chiao Tung University
Room: R201, CPT Building

"An Inkjet Printing Technique for the Fabrication of Scalable Flexible Microsystems"
Dr. Yu-Ting Cheng (鄭裕庭)
Professor, Department of Electronics Engineering
National Chiao Tung University

"Efficiency Enhancement and Lifetime Elongation of Blue Organic Light-emitting Diodes"
Dr. Jiun-Haw Lee (李君浩) and Dr. **Tien-Lung Chiu (邱天隆)**
Professor, Graduate Institute of Photonics and Optoelectronics
National Taiwan University

"Non-Destructive Metrology Technology in PV Industry"
Dr. Shih-Hung Lin (林士弘)
Associate Professor, Department of Electrical Engineering
TungHai University

9/11 (Wed) 2:40 pm – 4:10 pm: Technical Session D1-W3-T2: Emerging Technologies and Applications in New Energy Materials and Devices, Perovskite, Power Electronics, Smart Energy Systems and Technologies (SEST), Smart Homes, Smart Buildings, and Smart Communities, Energy Storage and Utilization, Clean/Intelligent Vehicle Technologies, and Artificial Intelligence (AI) Applications in New Materials and Energy

Chair: Dr. Bohr-Ran Huang (黃柏仁), Distinguished Professor, Graduate Institute of Electro-Optical Engineering and Department of Electronic Engineering, National Taiwan University of Science and Technology
Room: R202, CPT Building

Dr. Jin-shyr Yang (楊金石)
Deputy General Manager
Taiwan Power Research Institute

Dr. Ming-Yuan Cho (卓明遠)
Professor, Department of Electrical Engineering.
National Kaohsiung University of Applied Sciences

Dr. Yu-Ting Wu (吳毓庭)
Assistant Professor, Department of Engineering Science
National Cheng Kung University

9/11 (Wed) 2:40 pm – 4:10 pm: Technical Session D1-W4-T2: Smart Tools and Smart Services, Smart Machines, and Sustainable Smart Manufacturing for the Future: Vision, Strategies, and Implementation (Big Data and Intelligence, Advanced Sensors, Autonomous Robots, Robotic Process Automation, Smart Machines (Devices), Simulation, Horizontal

and Vertical System Integration, Smart Cities, Smart Supply Chain Management and Logistics 4.0, 5G Wireless Mobile Technology, Internet of Things (IoT), Cyber-Physical Systems, Cybersecurity, Additive and Advanced Manufacturing, Digital Manufacturing, Augmented Reality and Cloud Technologies)

Chair: Dr. Liang-Chia Chen (陳亮嘉), Distinguished Professor, Department of Mechanical Engineering, National Taiwan University
Room: R203, CPT Building

Dr. Yung-Hui Li (栗永徽)
Associate Professor, Department of Computer Science and Information Engineering
National Central University

"Digital Fusion and Smart City"

Mr. Yonathan Joe (李金輝)
Research Fellow, The Center for IoT Innovation
National Taiwan University of Science and Technology

Dr. Shuo-Yan Chou (周碩彥)
Distinguished Professor, Department of Industrial Management
National Taiwan University of Science and Technology

9/11 (Wed) 4:10 pm – 4:20 pm: Break

Parallel Sessions:

9/11 (Wed) 4:20 pm – 5:50 pm: Technical Session D1-W1-T3: Emerging Technologies and Applications in Materials for Healthcare and Medicine: Bio-Materials, Bio-SoC, Bio-Nanotech, Bio-NEMS/Bio-MEMS, Biomedical Optics and Imaging, Biomedical Engineering and Systems, Biomedical Informatics, Mobile Health, Virtual Reality (VR) in Healthcare

Chair: Dr. Hsuan-Cheng Huang (黃宣誠), Director and Professor, Institute of Biomedical Informatics, National Yang Ming University
Room: Conference Hall, CPT Building 1F

"A CHF Detection System with ECG Signals"

Dr. Hsi-Pin Ma (馬席彬)
Professor, Department of Electrical Engineering
Vice Dean, College of Electrical Engineering and Computer Science
Director, IC Design Technology Center
National Tsing Hua University

"Imaging Mitochondria Dynamics"

Dr. Hsueh-Fen Juan (阮雪芬)
Professor, Department of Life Science; Graduate Institute of Biomedical Electronics and Bioinformatics
National Taiwan University

Dr. Han-Sheng Chuang (Oswald) (莊漢聲)
Associate Professor, Department of Biomedical Engineering
National Cheng Kung University

9/11 (Wed) 4:20 pm – 5:50 pm: Technical Session D1-W2-T3: Emerging Technologies and Applications in Electronic, Photonic, and Magnetic Materials, Ceramic Materials, Metallurgy and Materials, Organic Polymer, Soft Materials, and Computational Materials

Chair: Dr. I-Chun Cheng (陳奕君), Professor, Department of Electrical Engineering & Graduate Institute of Photonics and Optoelectronics, National Taiwan University
Room: R201, CPT Building

"TAO-DFT and Its Applications to Nanomaterials with Radical Nature"

Dr. Jeng-Da Chai (蔡政達)
Professor, Department of Physics
National Taiwan University

"Hydrogen Adsorption, Dissociation And Spillover On Supported Metal Clusters"

Dr. Hsin-Yi Tiffany Chen (陳馨怡)
Assistant Professor, Department of Engineering and System Science
National Tsing Hua University

Dr. Tsung Sheng Kao (高宗聖)
Assistant Professor, Department of Photonics
National Chiao-Tung University

9/11 (Wed) 4:20 pm – 5:50 pm: Technical Session D1-W3-T3: Emerging Technologies and Applications in New Energy Materials and Devices, Perovskite, Power Electronics, Smart Energy Systems and Technologies (SEST), Smart Homes, Smart Buildings, and Smart Communities, Energy Storage and Utilization, Clean/Intelligent Vehicle Technologies, and Artificial Intelligence (AI) Applications in New Materials and Energy

Chair: Dr. Ming-Yuan Cho (卓明遠), Professor, Department of Electrical Engineering. National Kaohsiung University of Applied Sciences
Room: R202, CPT Building

Dr. Yu-Bin Chen (陳玉彬)
Professor, Department of Power Mechanical Engineering
National Tsing Hua University

"Synchrotron-based X-ray spectroscopy in energy materials"

Dr. Yan-Gu Lin (林彥谷)
Associate Research Scientist
National Synchrotron Radiation Research Center

"Developing High Performance Perovskite Film and Universal Electrode Buffer Layers for Organic and Perovskite Optoelectronics"

Dr. Wei-Ting Wang (王瑋婷)
Postdoc Fellow, Department of Mechanical Engineering

Dr. Shien-Ping Feng (馮憲平)
Associate Professor, Department of Mechanical Engineering
The University of Hong Kong

9/11 (Wed) 4:20 pm – 5:50 pm: Technical Session D1-W4-T3: Smart Tools and Smart Services, Smart Machines, and Sustainable Smart Manufacturing for the Future: Vision, Strategies, and Implementation (Big Data and Intelligence, Advanced Sensors, Autonomous Robots, Robotic Process Automation, Smart Machines (Devices), Simulation, Horizontal and Vertical System Integration, Smart Cities, Smart Supply Chain Management and Logistics 4.0, 5G Wireless Mobile Technology, Internet of Things (IoT), Cyber-Physical Systems, Cybersecurity, Additive and Advanced Manufacturing, Digital Manufacturing, Augmented Reality and Cloud Technologies)

Chair: Dr. Tin-Chih Toly Chen (陳亭志), Distinguished Professor, Department of Industrial Engineering and Management, National Chiao Tung University
Room: R203, CPT Building

Dr. Liang-Chia Chen (陳亮嘉)
Distinguished Professor, Department of Mechanical Engineering
National Taiwan University

"Off-grid Photovoltaics for Smart Applications"

Dr. Fang-Chung Chen (陳方中)
Professor, Department of Photonics, College of Electrical and Computer Engineering and Center for Emergent Functional Matter Science
National Chiao Tung University

Day 2 (Thursday, September 12, 2019)

9/12 (Thu) 9:00 am - 5:00 pm: Registration

Room: Conference Hall, CPT Building 1F (交映樓 1F 國際會議廳)

9/12 (Thu) 9:30 am - 9:50 am: Opening Session

Chair: Dr. Fang-Chung Chen (陳方中), Professor and Deputy Director, Department of Photonics, National Chiao-Tung University

Dr. Tsung Sheng Kao (高宗聖), Assistant Professor, Department of Photonics, National Chiao-Tung University

Room: Conference Hall, CPT Building 1F (交映樓 1F 國際會議廳)

9/12 (Thu) 9:50 am - 10:40 am: Plenary Session (III):

Chair: Dr. Fang-Chung Chen (陳方中), Professor, Department of Photonics, National Chiao-Tung University

Room: Conference Hall, CPT Building 1F (交映樓 1F 國際會議廳)

Plenary Speaker:

"VLS growth of 2D Metal Chalcogenides and their Application in Artificial Photosynthesis"

Dr. Kuei-Hsien Chen (陳貴賢)
Distinguished Research Fellow & Director
Institute of Atomic & Molecular Sciences
Academia Sinica

9/12 (Thu) 10:40 am - 10:50 am: Break

9/12 (Thu) 10:50 am – 11:40 am: Plenary Session (IV):

Chair: **Dr. Tsung Sheng Kao (高宗聖)**, Assistant Professor, Department of Photonics, National Chiao-Tung University

Room: Conference Hall, CPT Building 1F (交映樓 1F 國際會議廳)

Plenary Speaker:

"Novel two dimensional material systems for photo-to-energy conversion and optoelectronics applications"

Dr. Chun-Wei Chen (陳俊維)
Distinguished Professor, Department of Materials Science and Engineering
National Taiwan University

9/12 (Thu) 11:40 am – 1:00 pm: Student Poster Competition: Award Ceremony

Chair: Dr. Fang-Chung Chen (陳方中), Professor and Deputy Director, Department of Photonics, National Chiao-Tung University

Co-chair: Dr. Tsung Sheng Kao (高宗聖), Assistant Professor, Department of Photonics, National Chiao-Tung University

Room: CPT Building 1F (交映樓 1F)

9/12 (Thu) 11:40 am - 1:00 pm: Lunch

Parallel Sessions:

9/12 (Thu) 1:00 pm – 2:30 pm: Technical Session D2-W1-T1: Emerging Technologies and Applications in Materials for Healthcare and Medicine: Bio-Materials, Bio-SoC, Bio-Nanotech, Bio-NEMS/Bio-MEMS, Biomedical Optics and Imaging, Biomedical Engineering and Systems, Biomedical Informatics, Mobile Health, Virtual Reality (VR) in Healthcare

Chair: Dr. Chi-Kuang Sun (孫啟光), Life Distinguished Professor, Graduate Institute of Photonics and Optoelectronics and Chief Director, Molecular Imaging Center, National Taiwan University
Room: Conference Hall, CPT Building 1F

"Detection of urinary miRNA biomarkers by transmission surface plasmon resonance"

Dr. Ji-Yen Cheng (鄭郅言)
Research Fellow, Research Center for Applied Sciences
Academia Sinica

"Application of Cross-linked Polypeptide Multilayer Films for Stem Cell Differentiation"

Dr. Chun-Min Lo (羅俊民)
Associate Professor, Department of Biomedical Engineering
National Yang-Ming University

Dr. Tzu-En Lin (林子恩)
Assistant Professor, Institute of Biomedical Engineering
National Chiao-Tung University

9/12 (Thu) 1:00 pm – 2:30 pm: Technical Session D2-W2-T1: Emerging Technologies and Applications in Electronic, Photonic, and Magnetic Materials, Ceramic Materials, Metallurgy and Materials, Organic Polymer, Soft Materials, and Computational Materials

Chair: Dr. Jia-Min Shieh (謝嘉民), Deputy Director General, Taiwan Semiconductor Research Institute (TSRI)
Room: R201, CPT Building

Dr. Po-Liang Liu (劉柏良)
Professor and Chairman, Graduate Institute of Precision Engineering
National Chung Hsing University

"High-Performance GaN-based Ultraviolet Detectors"

Dr. Pinghui Sophia Yeh (葉秉慧)
Associate Professor, Department of Electronic and Computer Engineering
National Taiwan University of Science and Technology

"Development of Highly Stable Solution Processable Solar Cells"

Dr. Rathinam Raja
Postdoc Research Fellow, Center for Condensed Matter Sciences
National Taiwan University

Dr. Lee-Yih Wang (王立義)
Professor, Center for Condensed Matter Sciences
National Taiwan University

9/12 (Thu) 1:00 pm – 2:30 pm: Technical Session D2-W3-T1: Emerging Technologies and Applications in New Energy Materials and Devices, Perovskite, Power Electronics, Smart Energy Systems and Technologies (SEST), Smart Homes, Smart Buildings, and Smart Communities, Energy Storage and Utilization, Clean/Intelligent Vehicle Technologies, and Artificial Intelligence (AI) Applications in New Materials and Energy

Chair: Dr. Chih-Wei Chu (朱治偉), Deputy Director and Research Fellow, Research Center for Applied Sciences, Academia Sinica
Room: R202, CPT Building

"Photovoltaics and Optical characteristics of Low-dimensional Perovskites"

Dr. Chao-Yu (Peter) Chen (陳昭宇)
Professor, Department of Photonics
Hierarchical Green-Energy Materials (Hi-GEM) Research Center,
National Cheng Kung University

Dr. Yu-Lun Chueh (闕郁倫)
Professor, Department of Materials Science and Engineering
National Tsing Hua University

"Carbon-based counter electrodes for dye-sensitized solar cells"

Dr. Chih-Liang Wang (王致嘵)
Assistant Professor, Graduate Institute of Precision Engineering
National Chung Hsing University

9/12 (Thu) 2:30 pm – 2:40 pm: Break

Parallel Sessions:

9/12 (Thu) 2:40 pm – 4:10 pm: Technical Session D2-W1-T2: Emerging Technologies and Applications in Materials for Healthcare and Medicine: Bio-Materials, Bio-SoC, Bio-Nanotech, Bio-NEMS/Bio-MEMS, Biomedical Optics and Imaging, Biomedical Engineering and Systems, Biomedical Informatics, Mobile Health, Virtual Reality (VR) in Healthcare

Chair: Dr. Ji-Yen Cheng (鄭郅言), Research Fellow, Research Center for Applied Sciences Academia Sinica
Room: Conference Hall, CPT Building 1F

"2.5D polymer multilayer micromodel for geographic investigations"

Dr. Chia-Wen (Kevin) Tsao (曹嘉文)
Professor, Department of Mechanical Engineering
National Central University

"Triboelectrification as an Efficient Tool for the Development of Self-Powered Sensors and Systems"

Dr. Zong-Hong Lin (林宗宏)
Associate Professor, Institute of Biomedical Engineering, Department of Power Mechanical Engineering, Frontier Research Center on Fundamental and Applied Sciences of Matters, National Tsing Hua University

"Microfluidic Analytical Systems for Point-of-Care Diagnosis"

Dr. Chien-Fu Steve Chen (陳建甫)
Associate Professor, Institute of Applied Mechanics
Division Director, Nano-Electro-Mechanical-System Research Center
National Taiwan University

9/12 (Thu) 2:40 pm – 4:10 pm: Technical Session D2-W2-T2: Emerging Technologies and Applications in Electronic, Photonic, and Magnetic Materials, Ceramic Materials, Metallurgy and Materials, Organic Polymer, Soft Materials, and Computational Materials

Chair: Dr. Po-Liang Liu (劉柏良), Professor and Chairman, Graduate Institute of Precision Engineering, National Chung Hsing University
Room: R201, CPT Building

"MICAtronics: A New Platform for Flexible Electronics"

Dr. Ying-Hao Eddie Chu (朱英豪)
Distinguished Professor, Department Of Materials Science And Engineering
National Chiao Tung University

"Ab initio phase stability and electronic conductivity of the doped-$Li_4Ti_5O_{12}$ anode for Li-ion batteries"

Dr. Shih-Kang Lin (林士剛)
Associate Professor, Department of Materials Science and Engineering
Vice Director, Hierarchical Green-Energy Materials (Hi-GEM) Research Center
Vice Director, Research & Services Headquarters (RSH)
National Cheng Kung University

"Self-powered GaN-based Nanowire LEDs"

Dr. Chih-Yen Chen (陳智彥)
Assistant Professor, Department of Materials and Optoelectronic Science
National Sun Yat-sen University

9/12 (Thu) 2:40 pm – 4:10 pm: Technical Session D2-W3-T2: Emerging Technologies and Applications in New Energy Materials and Devices, Perovskite, Power Electronics, Smart Energy Systems and Technologies (SEST), Smart Homes, Smart Buildings, and Smart Communities, Energy Storage and Utilization, Clean/Intelligent Vehicle Technologies, and

Artificial Intelligence (AI) Applications in New Materials and Energy

Chair: Dr. Chao-Yu (Peter) Chen (陳昭宇), Professor, Department of Photonics, Hierarchical Green-Energy Materials (Hi-GEM) Research Center, National Cheng Kung University
Room: R202, CPT Building

"A facile, scalable and ecofriendly approach for the fabrication of high performance flexible all-solid-state supercapacitors"

Dr. Rong-Ho Lee (李榮和)

Professor, Department of Chemical Engineering
National Chung Hsing University

"Investigating an All-organic Battery Using Polyisothianaphthene as a Redox-active Bipolar Electrode Material"

Dr. Fu-Ming Wang (王復民)

Professor, Graduate Institute of Applied Science and Technology
National Taiwan University of Science and Technology

"Rendering Stable Metal–Organic Framework-Based Materials Electrochemically Active"

Dr. Chung-Wei Kung (龔仲偉)

Assistant Professor, Department of Chemical Engineering
National Cheng Kung University

9/12 (Thu) 4:10 pm – 4:20 pm: Break

Parallel Sessions:

9/12 (Thu) 4:20 pm – 5:50 pm: Technical Session D2-W1-T3: Emerging Technologies and Applications in Materials for Healthcare and Medicine: Bio-Materials, Bio-SoC, Bio-Nanotech, Bio-NEMS/Bio-MEMS, Biomedical Optics and Imaging, Biomedical Engineering and Systems, Biomedical Informatics, Mobile Health, Virtual Reality (VR) in Healthcare

Chair: Dr. Chia-Wen (Kevin) Tsao (曹嘉文), Professor, Department of Mechanical Engineering National Central University
Room: Conference Hall, CPT Building 1F

"Enriching Extracellular Vesicles from Small Samples"

Dr. Chihchen Chen (陳致真)

Associate Professor, Department of Power Mechanical Engineering,
Associate professor, Institute of Nanoengineering and Microsystems,
Department of Power Mechanical Engineering
National Tsing Hua University

"Clinical Feasibility and Mechanism Discussion of Plasma-activated Medium as Adjuvant Therapy on Malignant Pleural Effusion"

Dr. Yun-Chien Cheng (鄭雲謙)

Associate Professor, Department of Mechanical Engineering
National Chiao-Tung University

"Development of a Novel Targeted Drug Delivery System for Liver Tissue Regeneration"

Dr. Yung-Te Hou (侯詠德)
Assistant Professor, Department of Bio-Industrial Mechantronics Engineering
National Taiwan University

9/12 (Thu) 4:20 pm – 5:50 pm: Technical Session D2-W2-T3: Emerging Technologies and Applications in Electronic, Photonic, and Magnetic Materials, Ceramic Materials, Metallurgy and Materials, Organic Polymer, Soft Materials, and Computational Materials

Chair: Dr. Ying-Hao Eddie Chu (朱英豪), Distinguished Professor, Department Of Materials Science And Engineering, National Chiao Tung University
Room: R201, CPT Building

"Monolithic 3D-IC with Heterogeneous Integration of Light-energy Harvesters for Internet of Things"

Dr. Chang-Hong Shen (沈昌宏)
Researcher Fellow & Division Director of Planning and Promotion Division
Taiwan Semiconductor Research Insitute (TSRI)

"Enhanced Near-Infrared Photoresponse of Inverted Perovskite Solar Cells Through Rational Design of Bulk-Heterojunction Electron-Transporting Layers"

Dr. Chu-Chen Chueh (闕居振)
Assistant Professor, Department of Chemical Engineering
National Taiwan University

"Scalable low-power silicon photonic platform for all-solid-state beam steering"

Dr. You-Chia Chang (張祐嘉)
Assistant Professor, Department of Photonics and Institute of Electro-Optical Engineering, National Chiao-Tung University

9/12 (Thu) 4:20 pm – 5:50 pm: Technical Session D2-W3-T3: Emerging Technologies and Applications in New Energy Materials and Devices, Perovskite, Power Electronics, Smart Energy Systems and Technologies (SEST), Smart Homes, Smart Buildings, and Smart Communities, Energy Storage and Utilization, Clean/Intelligent Vehicle Technologies, and Artificial Intelligence (AI) Applications in New Materials and Energy

Chair: Dr. Rong-Ho Lee (李榮和), Professor, Department of Chemical Engineering, National Chung Hsing University
Room: R202, CPT Building

"Transfer Printing of Active Layers from controlled Swelling/De-Swelling of PDMS for realizing multilayer Polymer/Perovskite Solar Cells"

Dr. Chih-Wei Chu (朱治偉)
Deputy Director and Research Fellow, Research Center for Applied Sciences
Academia Sinica

"Dispersion Control Through Crystal Ordering: The Case of L11 Ag-Pt"

Dr. Yung-Tin (Frank) Pan (潘詠庭)
Assistant Professor, Department of Chemical Engineering

National Tsing Hua University

"Realization of Eco-Friendly and Scalable Radiative Cooling for Metal Substrates"

Dr. Jui-Yung Chang (張瑞永)
Assistant Professor, Department of Mechanical Engineering
National Chiao-Tung University

Abstracts and Biographies

Day 1 (September 11, 2019)

Opening Session

Conference Chair

Fang-Chung Chen (陳方中)

Professor and Deputy Director, Department of Photonics
National Chiao-Tung University
R313, CPT Building, 1001 Ta Hsueh Rd. Hsinchu, Taiwan
Tel: +886-3-513-1484, Fax: +886-3-573-5601
Email: fcchen@mail.nctu.edu.tw

BIOGRAPHY

Prof. Fang-Chung Chen was born on 4th June, 1974 in Taichung, Taiwan. He received the B.S. and master degree in Chemistry from National Taiwan University, Taiwan, in 1996 and 1998, respectively, and the Ph.D. degree in Materials Science and Engineering from University of California, Los Angeles (UCLA), USA, in 2003.

He was a teaching assistant in Department of Chemistry, National Taiwan University in 1998. He was a postdoctoral research associate in Department of Materials Science and Engineering, UCLA in 2003. He joined Department of Photonics (DoP) at National Chiao Tung University (NCTU) since Feb. 2004 as an assistant professor. He was also the chairman of Degree Program of Flat Panel Display Technology in NCTU. He is current vice-chairman of DoP. His research interests include flexible solar cells, organic electronics and materials, low-dimensional nanomaterials, perovskite materials and machine learning for optoelectronic materials and devices.

Prof. Chen is the recipient of Award for Junior Research Investigators of Academia Sinica 2008, which is one of the most important awards for junior research investigators in all research fields in Taiwan. He has published more than 117 SCI Journals papers, 120 conference papers, 5 book chapters, and owned more than 20 patents. He is the section editor (Organic Materials) of Encyclopedia of Modern Optics, edition II, Elsevier. He is also currently on the Editorial Boards of *Active and Passive Electronic Components* and *Current Smart Materials*. He frequently serves as a referee for many high-quality Journals, such as *JACS, Adv. Mat., Adv. Funct. Mat., ACS Nano, Energy Environ. Sci., J. Mat. Chem., APL* etc..

Opening Session

Project Manager

Tsung Sheng Kao (高宗聖)

, Assistant Professor, Department of Photonics
National Chiao-Tung University

BIOGRAPHY

Opening Session

Welcome Remarks

Edward Yi Chang (張翼)

Senior Vice President
National Chiao-Tung University

BIOGRAPHY

Plenary Session (I)

Session Chair

Tien-Chang Lu (盧廷昌)

Chairman of Tin Ka Ping Photonic Center
National ChiaoTung University

BIOGRAPHY

Plenary Session (I)

Plenary Speaker

New frontiers of GaN optoelectronic research

Jung Han

William Norton Professor in Technological Innovation
Professor of Electrical Engineering
Yale University
New Haven, Connecticut 06520, USA
email:jung.han@yale.edu

ABSTRACT

In the past 30 years, GaN has emerged as one of the most important semiconductors that has made real impact to our society. In this talk I will share my perspective regarding the key breakthroughs, major applications, and still under-explored opportunities and challenges associated with this material system. Especially I will focus on how nanotechnology based on electrochemistry can help to circumvent impasses and creates new dimensions in the exploration of optoelectronic devices using GaN. Examples will be given in edge-emitting lasers, micro-LEDs, and VCSELs.

The research is supported by US Department of Energy, National Science Foundation, DARPA, Saphlux Inc, and IP Groups.

BIOGRAPHY

Jung Han is the William Norton Professor in Technological Innovation and a Professor of Electrical Engineering at Yale University in New Haven, Connecticut. Professor Han's current research activities include blue, green, and ultraviolet (UV) light emitting devices for solid-state lighting and displays, synthesis of AlGaInN nanostructures, nanoscale phenomena in crystal growth, and AlGaInN power electronic devices. He has published more than 300 papers in peer-reviewed journals, and has served as editor of four books and special journal issues. He holds more than 20 U.S. patents and is the co-founder of Saphlux, a startup company based on his inventions for semipolar GaN LEDs and micro-LEDs. Prof. Han has received numerous awards including a Department of Commerce R&D 100 Award, MRS Ribbon Award, EMC Best Paper Award and the Electronics and Photonics Award from the Electrochemical Society (ECS). Prof. Han is a member of the Connecticut Academy of Science and Engineering, and a Fellow of the Institute of Physics (IoP), the Institute of Electrical and Electronic Engineers (IEEE), and the Optical Society of America (OSA).

Plenary Session (II)

Conference Chair & Session Chair

Fang-Chung Chen (陳方中)

Professor and Deputy Director, Department of Photonics
National Chiao-Tung University
R313, CPT Building, 1001 Ta Hsueh Rd. Hsinchu, Taiwan
Tel: +886-3-513-1484, Fax: +886-3-573-5601
Email: fcchen@mail.nctu.edu.tw

BIOGRAPHY

Prof. Fang-Chung Chen was born on 4th June, 1974 in Taichung, Taiwan. He received the B.S. and master degree in Chemistry from National Taiwan University, Taiwan, in 1996 and 1998, respectively, and the Ph.D. degree in Materials Science and Engineering from University of California, Los Angeles (UCLA), USA, in 2003.

He was a teaching assistant in Department of Chemistry, National Taiwan University in 1998. He was a postdoctoral research associate in Department of Materials Science and Engineering, UCLA in 2003. He joined Department of Photonics (DoP) at National Chiao Tung University (NCTU) since Feb. 2004 as an assistant professor. He was also the chairman of Degree Program of Flat Panel Display Technology in NCTU. He is current vice-chairman of DoP. His research interests include flexible solar cells, organic electronics and materials, low-dimensional nanomaterials, perovskite materials and machine learning for optoelectronic materials and devices.

Prof. Chen is the recipient of Award for Junior Research Investigators of Academia Sinica 2008, which is one of the most important awards for junior research investigators in all research fields in Taiwan. He has published more than 117 SCI Journals papers, 120 conference papers, 5 book chapters, and owned more than 20 patents. He is the section editor (Organic Materials) of Encyclopedia of Modern Optics, edition II, Elsevier. He is also currently on the Editorial Boards of *Active and Passive Electronic Components* and *Current Smart Materials*. He frequently serves as a referee for many high-quality Journals, such as *JACS, Adv. Mat., Adv. Funct. Mat., ACS Nano, Energy Environ. Sci., J. Mat. Chem., APL* etc..

Plenary Session (II)

Plenary Speaker

Nanoscale interface engendering for functional hetero-junction

Kazuhito Tsukagoshi (塚越 一仁)

Group Leader of Pi-electron electronics group
Principle Investigator, WPI-MANA, NIMS

ABSTRACT

BIOGRAPHY

Kazuhito Tsukagoshi studied experimental research on transport physics in semiconductor microstructure, completing his PhD in 1995. After that he worked as a visiting associate in Cavendish laboratory (University of Cambridge, U.K.) and then in Hitachi Cambridge Laboratory (Hitachi Europe Ltd, U.K.). In 1999, he joined RIKEN (Japan) where he carried out research on carbon nanotube and organic electronics. He continued this research in AIST in 2008, and moved to WPI-MANA, NIMS in 2009. His current research focuses on ultra-thin functional devices to realize the next generation electronics. He was awarded The MEXT Young Scientists' Prize (2006) and JSPS prize (2013).

Education and career

1993-1995	Physics Department, Graduate school of Science, Osaka University
1996-1997	Visiting researcher, Cambridge University, Cavendish Laboratory, Microelectronic Research centre
1997-1999	Researcher, Hitachi Cambridge Laboratory, Hitachi Europe Ltd.
1999-2008	Researcher/Senior researcher/Research unit leader, RIKEN
2008	Senior researcher, AIST
2009-	Group Leader of Pi-electron electronics group, Principle Investigator, WPI-MANA, NIMS

recent publication list (5-10 years will be fine)

1. Self-limiting layer-by-layer oxidation of atomically thin WSe_2,
   M.Yamamoto, S.Dutta, K. Wakabayashi, M. S. Fuhrer, K.Ueno, K.Tsukagoshi,
   Nano Letters 15 (3) 2067–2073 (2015).
2. Solution-assembled nanowires for high performance flexible and transparent solar-blind photodetectors,
   J.Wang, C. Yan, M.-F.Lin, K.Tsukagoshi, P.-S.Lee,
   Journal of Materials Chemistry C 3 (3), 596-600 (2015).
3. Dopant selection for control of charge carrier density and mobility in amorphous indium oxide thin-film transistors: Comparison between Si- and W-dopants

N.Mitoma, S.Aikawa, W.Ou-Yang, X.Gao, T.Kizu, M.-F.Lin, A.Fujiwara, T.Nabatame, K.Tsukagoshi
Applied Physics Letters 106 (4) 042106/1-5 (2015).

4. Site selection in single-molecule junction for highly reproducible molecular electronics
S.Kaneko, D.Murai, S.Marqués-González, H.Nakamura, Y.Komoto, S.Fujii, T.Nishino, KIkeda, K.Tsukagoshi, M.Kiguchi,
Journal of the American Chemical Society 138 (4) 1294-1300 (2016).
5. Self-Powered Graphene Thermistor
R.Bendia, V.Bhavanasia, K.Paridaa, V.C.Nguyena, A.Sumbojaa, K.Tsukagoshi, P.S.Lee, Nano Energy 26, 586–594 (2016).
6. Virtual substrate method for nanomaterials characterization
B.Da, J. W. Liu, M. Yamamoto, Y.Ueda, K.Watanabe, N.T.Choung, S.L. Li, K.Tsukagoshi, H.Yoshikawa, H.Iwai, S.Tanuma, H.X.Guo, Z.S. Gao, X.Sun, Z.J.Ding
Nature Communicarions 8, 15629/1-9 (2017).
7. Self-assembly atomic stacking transport layer of two-dimensional titania for perovskite solar cells
TzuPei Chen, Chung-Wei Lin, Shao-Sian Li, Yung-Han Tsai, Cheng-Yen Wen, Wendy Lin, Fei-Man Hsiao, Ya-Ping Chiu, Kazuhito Tsukagoshi, Minou Osada, Takayoshi Sasaki, Chun-Wei Chen,
Advanced Energy Materials 1701722/1-9 (2018).
8. Reversible and Precisely Controllable p/n-Type Doping of $MoTe_2$ Transistors through Electrothermal Doping
Y.-M.Chang, S.-H.Yang, C.-Y.Lin, C.-H.Chen, C.-H.Lien, W.-B.Jian, K.Ueno, Y.-W.Suen, K.Tsukagoshi, Y.-F.Lin
Advanced Materials 30 1706995/1-7 (2018).
9. Pronounced photogating effect in atomically thin WSe_2 with a self-limiting surface oxide layer
M.Yamamoto, K.Ueno, K.Tsukagoshi
Applied Physics Letters 112, (18) 181902/1-6 (2018).
10. Origin of extended UV stability of 2D atomic layer titania-based perovskite solar cells unveiled by ultrafast spectroscopy
A. P. Thilakan, J.-X. Li, T.-P. Chen, S.-S. Li, C.-W. Chen, M.Osada, K.Tsukagoshi, T.Sasaki, A.Yabushita, K.-H. Wu, C.-W. Luo,
ACS Applied Materials & Interfaces 11 (24) 21473−21480 (2019).

Technical Session D1-W1-T1: Emerging Technologies and Applications in Materials for Healthcare and Medicine: Bio-Materials, Bio-SoC, Bio-Nanotech, Bio-NEMS/Bio-MEMS, Biomedical Optics and Imaging, Biomedical Engineering and Systems, Biomedical Informatics, Mobile Health, Virtual Reality (VR) and Healthcarelity (VR) and Healthcare

Workshop Chair & Session Chair

Chi-Kuang Sun (孫啟光)

Life Distinguished Professor, Graduate Institute of Photonics and Optoelectronics and
Chief Director, Molecular Imaging Center
National Taiwan University

BIOGRAPHY

Technical Session D1-W1-T1: Emerging Technologies and Applications in Materials for Healthcare and Medicine: Bio-Materials, Bio-SoC, Bio-Nanotech, Bio-NEMS/Bio-MEMS, Biomedical Optics and Imaging, Biomedical Engineering and Systems, Biomedical Informatics, Mobile Health, Virtual Reality (VR) and Healthcarelity (VR) and Healthcare

Mining Perturbed Gene Expression Patterns for Drug Discovery

Hsuan-Cheng Huang (黃宣誠)

Professor, Institute of Biomedical Informatics
National Yang-Ming University
Email: hsuancheng@ym.edu.tw

ABSTRACT

Cancer is a complex disease that relies on both oncogenic mutations and non-mutated genes for survival, thereafter coined as oncogene and non-oncogene addictions. The need for more effective combination therapies to overcome drug resistance in oncology has been increasingly recognized, but the identification of potentially synergistic drugs at scale remains challenging. Here we propose a gene-expression-based approach, which uses the recurrent perturbation–transcript regulatory relationships inferred from a large compendium of chemical and genetic perturbation experiments across multiple cell lines, to engender a testable hypothesis for combination therapies. These transcript-level recurrences were distinct from known compound–protein target counterparts, reproducible in external datasets, and correlated with small-molecule sensitivity. We applied these recurrent relationships to predict synergistic drug pairs for cancer, and experimentally confirmed the synergistic effects of one combination of a retinoid and an mTOR inhibitor and the other combination of a protein synthesis inhibitor and a CDK inhibitor in two breast and two lung cancer cell lines. Our results corroborate a gene-expression-based strategy for combinatorial drug screening as a way to target non-mutated genes in complex diseases.

BIOGRAPHY

Hsuan-Cheng Huang received his B.A., M.A., and Ph.D. degrees in physics from National Taiwan University in 1992, 1994 and 1998, respectively. He was engaged in experimental high-energy physics research at Taiwan and at High Energy Accelerator Research Organization, Japan, and awarded NSC Distinguished Postdoctoral Fellowship in 2003. Encouraged by the emerging of systems biology, Dr. Huang joined National Yang-Ming University in 2004 and is currently a Professor of the Institute of Biomedical Informatics, of which he served as the director from 2013 to 2018. In 2007, he received the NSC Wu Ta-You Memorial Award, an honor for excellent young investigators in Taiwan. Now he serves as an Editorial Board Member of Scientific Reports, an Associate Editor and Deputy Section Editor of BMC Systems Biology, and a Board Member in Taiwan Society of Bioinformatics and Systems Biology. His research interests include bioinformatics, computational and systems biology, and network biology. Currently, Dr. Huang endeavors his research efforts to computational analysis and modeling of biomedical big data and biological networks, and applies them for drug discovery and to unravel molecular mechanisms of cancer cell response and non-coding RNA regulation.

Technical Session D1-W1-T1: Emerging Technologies and Applications in Materials for Healthcare and Medicine: Bio-Materials, Bio-SoC, Bio-Nanotech, Bio-NEMS/Bio-MEMS, Biomedical Optics and Imaging, Biomedical Engineering and Systems, Biomedical Informatics, Mobile Health, Virtual Reality (VR) and Healthcarelity (VR) and Healthcare

Design and Implementation of Wearable Eye Tracker

Chih-Peng Fan (范志鵬)

Professor, Department of Electrical Engineering
National Chung Hsing University

ABSTRACT

The eye/gaze tracking instruments were historically used to assess patients with eyesight and attention disorders. Lately, the eye/gaze tracking designs have been used for many up-to-date consumer applications. By eye trackers, the applications with intuitive human-computer interactions will be increased. Besides, the gaze tracking technology can be used to the non-contact password input methodology for the security and access control applications.

In this talk, the technologies of both NIR and visible-light based wearable eye tracker are introduced. The fast RANSAC based pupil ellipse fitting technology is developed to speed up the gaze tracking computations. Firstly, the background technologies of the RANSAC method and the ellipse fitting skill are reviewed for fast pupil fitting. Next, we describe the proposed fast pupil ellipse fitting based gaze tracking methodology. Finally, the experimental results for pupil and gaze tracking are revealed.

For the proposed visible-light gaze tracking design, the average estimated errors of pupil ellipse centers are smaller than 7 pixels. By the head movement compensation based 4-point calibration, at training mode, the average gaze tracking errors are less than 3.0 degrees. At testing mode, the average gaze tracking errors are less than 3.5 degrees. Finally, the proposed core function performs up to 183 frames/sec by a personal computer with 3.4GHz operational frequency. In the future, more robust technologies for eye center estimation and calibration, e.g. deep learning and marker skills, will be evaluated to design and implement a user-friendly visible-light wearable eye tracker.

BIOGRAPHY

Chih-Peng Fan received the B.S., M.S., and, and Ph.D. degrees, all in electrical engineering, from the National Cheng Kung University, Taiwan, R.O.C., in 1991, 1993 and 1998, respectively. During October 1998 to January 2003, he was a design engineer with N100, Computer and Communications Research Laboratories (CCL), Industrial Technology Research Institute (ITRI), Hsinchu, Taiwan. In 2003, he joined the faculty of the Department of Electrical Engineering, National Chung Hsing University, Taichung city, Taiwan, where he is currently a full Professor. He has published more than 90 technical journals and conference papers. His teaching and research interests include digital image processing and pattern recognition, digital video processing,

baseband transceiver design, and VLSI design/FPGA prototype of DSP systems.

Technical Session D1-W1-T1: Emerging Technologies and Applications in Materials for Healthcare and Medicine: Bio-Materials, Bio-SoC, Bio-Nanotech, Bio-NEMS/Bio-MEMS, Biomedical Optics and Imaging, Biomedical Engineering and Systems, Biomedical Informatics, Mobile Health, Virtual Reality (VR) and Healthcarelity (VR) and Healthcare

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Associate Professor, Department of Electrical Engineering
National Taiwan University

ABSTRACT

BIOGRAPHY

Technical Session D1-W2-T1: Emerging Technologies and Applications in Electronic, Photonic, and Magnetic Materials, Ceramic Materials, Metallurgy and Materials, Organic Polymer, Soft Materials, and Computational Materials

Workshop Chair & Session Chair

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BIOGRAPHY

Dr. Chih Wei Chu was born on 4th November, 1972 in Taipei, Taiwan. He received the B.S. in Department of Chemical Engineering from Chung Yuan University, Taiwan in 1995, M.S. in Departemet of Civil and Environmental Engineering and Ph.D degrees in Department of Materials Science & Engineering from University of California, Los Angeles, USA, in 1998 and 2006, respectively. He was the senior research and development engineer at Inteplast Group, Texas, USA during 1998-2001. He joined Research Center for Applied Sciences (RCAS) at Academic Sinica and was promoted to associate research fellow and research fellow in 2010 and 2014, respectively. Currently, he served as Deputy Director in RCAS. He is also joint appointment professors of College of Engineering, Chang Gung University, Department of Photonics, National Chiao Tung University, and Department of Materials Science and Engineering, National Tsing Hua University. He was elected as associate academicians in the Asia Pacific Academy of Materials. He is a materials scientist with expertise in the fields of thin film electronics, such as photovoltaic cells, LEDs, batteries, and memory devices. He has published more than 200 refereed papers with over 10000 citations (H-index 51). Chu's research focuses on development of advanced materials for energy saving, conversion, and storage technologies.

Technical Session D1-W2-T1: Emerging Technologies and Applications in Electronic, Photonic, and Magnetic Materials, Ceramic Materials, Metallurgy and Materials, Organic Polymer, Soft Materials, and Computational Materials

Exquisite Ge/Si/O interactions enabled self-organized heterostructures of Ge nanodot/SiO_2/SiGe-recess channel for Si electronic/photonic integrated circuits

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ABSTRACT

Since the inception of the first transistors in 1940s, the immense body of work on the Group IV semiconductors Si and Ge has spearheaded spectacular advances in solid-state electronics development culminating in the modern integrated-circuit (IC) technology that has enabled a vast landscape of device applications in logic, memory, and computing. Although initially Si supplanted Ge as the material of choice for MOSFETs, more recently Ge-based devices are breaking new ground for widespread and innovative applications in nanoelectronics and photonics integrated circuits. Si and Ge, their alloys (Si_xGe_{1-x}) have numerous applications in CMOS technologies that are applicable for low-cost and high-density ICs, as well as for high-speed electronics and cost-effective photonics through bandgap and strain engineering.

In this talk, I would share our recent advances in a single-fabrication-step growth of Ge nanodot/SiO_2/SiGe-recess channel heterostructures, which is a key enabler for realizing Ge MOS devices supporting the Si nanoelectronics (MOSFETs and single-electron transistors) as well as Si nanophotonics (photodetectors and light sources). We sincerely believe that our discoveries on the formation of Ge nanodot/SiO_2/SiGe heterostructures have only scratched the "tip of the iceberg" in terms of the myriad, exciting device possibilities. We envisage further scientific exploration of our MOS heterostructures toward the ultimate goal of demonstrating advanced Ge-based nano-electronic and photonic devices.

BIOGRAPHY

PEI-WEN LI received her Ph.D. degree from Columbia University in New York city, in Electrical Engineering in 1994. She is a Professor in Institute of Electronics and served as the Director of Nano Facility Center at National Chiao Tung University (NCTU) in Hsinchu. Prior to joining NCTU in 2015, she has been the Distinguished Professor (2006–2015), the Chair of Electrical Engineering Department (2007–2010), Director of Nano Science and Technology (2012–2015), and Associate Dean of Academic Affair (2013–2015) in National Central University. She was a Research Visiting Scholar with Caltech in 2011–2012. She has also worked with Vanguard International Semiconductor Corporation on DRAM technology integration in 1995-1996. Her research themes focus on experimental silicon-germanium nanostructures and

devices, encompassing germanium quantum-dot single electron transistors, photodetectors, nonvolatile memory, and energy harvest devices, making use of self-assembly nanostructures in silicon integration technology.

She is an IEEE Distinguished Lecturer and serves VLSI Technology and Education committees of IEEE EDS. She has served on various important conference committees, e.g., SNW, EDTM, SSDM etc. She was awarded Distinguished Professor from Chinese Electrical Engineering Society (2015) and Top 10 Rising Stars in Taiwan (Science and Technology) from Central News Agency in 2008.

Technical Session D1-W2-T1: Emerging Technologies and Applications in Electronic, Photonic, and Magnetic Materials, Ceramic Materials, Metallurgy and Materials, Organic Polymer, Soft Materials, and Computational Materials

Contact Engineering for 2D Field-effect Transistors

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ABSTRACT

Moving beyond the limits of silicon transistors requires both a high-performance channel and high-quality electrical contacts. The type of barrier at a metal/TMD junction is one of the key issues in TMD field-effect transistors (FETs). It is important to design contacts such that the transmission is dictated by intrinsic properties of the TMD channel rather than by details of the contacts. In this work, we report a systematic study of metal/TMD contacts, with monolayer channel materials WSe2 and MoS2 grown by chemical vapor deposition. We show how the contact barrier can be modulated by the work function of contact metals, defects, and contact geometry on “clean” surface of TMD. The Fermi level pinning can be effectively mitigated or eliminated through the proper contact engineering. The p-type end-bonded contact, formed through the reaction of transition metals with the TMD channel, exhibited no Schottky barrier and holds great promise for high-performance TMD FETs, enabling future ultimately scaled device technologies.

BIOGRAPHY

P. W. Chiu received his B.S. and M.S. in Materials Science from National Tsing Hua University, Taiwan. He joined Prof. Klaus von Klitzing’s research team for his PhD studyat the Max-Planck Institut für Festkörperforschung in Stuttgart in 2000 and received his Ph.D in Physics at the Technische Universität München (TUM) in 2003. Upon graduation, he stayed at the Max-Planck Institute for one more year of postdoctoral research, exploring spin-dependent electronics using ballistic carbon nanotubes. Afterwards, he worked as a researcher at the Tohoku University, Japan. He joined the faculty of Electrical Engineering at the National Tsing Hua University as Assistant Professor since 2005. He is currently a Full Professor and the Director of the Center for Nanotechnology, Materials Science, and Microsystem. His current research interest spans widely from materials science to fundamental physics and electronic applications, with particular focus on the realization of 2D material-based (graphene and TMDs) electronic and optoelectronic devices.

Technical Session D1-W2-T1: Emerging Technologies and Applications in Electronic, Photonic, and Magnetic Materials, Ceramic Materials, Metallurgy and Materials, Organic Polymer, Soft Materials, and Computational Materials

P-Channel SnO TFTs for Oxide-Semiconductor-Based CMOS Technology

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ABSTRACT

Oxide-semiconductor-based thin-film transistors (TFTs) are key enablers for advanced backplane technology today. Complementary-oxide-semiconductor (CMOS) inverters are essential building blocks for versatile large-area electronic circuits with low static power consumption. Because the electrical performance of p-channel oxide TFTs lags far behind that of n-channel counterparts, up to the present time most of the reported oxide logic circuits are based upon pseudo-NMOS architecture or constructed by using n-channel oxide TFTs in conjunction with p-channel organic TFTs. Tin monoxide (SnO) has been considered as one of the most promising p-channel candidates for oxide-semiconductor-based CMOS technology. It possesses desirable features, such as relatively high hole mobility, good electrical bias-stress stability, and low-temperature processability. In this talk, I'll give an overview of the development of p-channel SnO TFTs and the current status of oxide-semiconductor-based CMOS technology. Next, low-temperature SnO TFTs and oxide-semiconductor-based CMOS circuits, such as inverters, ring oscillators, or amplifiers, comprised of p-channel SnO TFTs and n-channel oxide TFTs, such as ZnO, SnOx or IGZO TFTs, will be demonstrated on either glass substrates or flexible polymeric foil substrates. Finally, the influence of mechanical bending strains on the electrical performance of the flexible SnO TFTs and flexible CMOS circuits will be discussed.

BIOGRAPHY

I-Chun Cheng received the B.S. and M.S. degrees in mechanical engineering from the National Taiwan University in 1996 and 1998, respectively. In 2004, she received a Ph.D. degree in electrical engineering from Princeton University. She was with the Macroelectronic Lab of Princeton University from 2004 to 2007 as a postdoctoral research associate, working on novel silicon thin-film devices and backplane technology for flexible displays. In 2007, she joined the Department of Electrical Engineering and Graduate Institute of Photonics and Optoelectronics at the National Taiwan University, where she is currently a professor. Her current research interests include oxide-semiconductor thin-film technology, photovoltaic devices and flexible large-area electronics. She is a member of the Institute of Electrical and Electronics Engineers (IEEE), Material Research Society (MRS), Electrochemical Society (ECS),

and the Society for Information Display (SID). She has published over 100 journal articles, more than 200 conference papers and 5 book chapters and co-authored a book.

Technical Session D1-W3-T1: Emerging Technologies and Applications in New Energy Materials and Devices, Perovskite, Power Electronics, Smart Energy Systems and Technologies (SEST), Smart Homes, Smart Buildings, and Smart Communities, Energy Storage and Utilization, Clean/Intelligent Vehicle Technologies, and Artificial Intelligence (AI) Applications in New Materials and Energy

Workshop Chair & Session Chair

Jia-Min Shieh (謝嘉民)

Deputy Director General
Taiwan Semiconductor Research Institute (TSRI)

BIOGRAPHY

Technical Session D1-W3-T1: Emerging Technologies and Applications in New Energy Materials and Devices, Perovskite, Power Electronics, Smart Energy Systems and Technologies (SEST), Smart Homes, Smart Buildings, and Smart Communities, Energy Storage and Utilization, Clean/Intelligent Vehicle Technologies, and Artificial Intelligence (AI) Applications in New Materials and Energy

ZnO-based Hybrid-structures for Optoelectronic and Sensing Devices

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ABSTRACT

Zinc oxide (ZnO) is a versatile metal oxide semiconductor and has attracted considerable attention over the past few decades due to its wide direct band gap (3.37 eV), large exciton binding energy (60 meV at room temperature), high mechanical, chemical, thermal stabilities, piezoelectric characteristics, and biocompatibility. Optoelectronic and sensing properties of ZnO is dominated by surface morphology and nanoscale dimension, which can be affected dramatically by its morphology.

The simple and cost-effective techniques have been developed for fabricating ZnO-based nanostructures. The nanostructures provide a number of combined properties including a large surface area, improved crystallinity, work function, electrical properties, effective surface passivation, and antireflection layer. The ZnO-based nanostructures propose an effective way to enhance the efficiency of ZnO-based optoelectronic and sensing devices and will be useful for the development of next-generation devices.

BIOGRAPHY

Bohr-Ran Huang (黃柏仁) was born in Nantou in August, 1961. He got his bachelor degree in department of Electrophysics from National Chiao-Tung University, Hsin-chu, Taiwan, in 1983. He served as the second lieutenant during his military service between 1983 and 1985. Then he received the M.S. and Ph.D degree in Electrical Engineering from Michigan State University, East Lansing, U.S.A, 1986 and 1992, respectively.

In 1992, he joined the National Yunlin University of Science and Technology (NYUST) as Associate Professor of Electronic Engineering and became a Full Professor in 2000. He served as Chairperson of Electronic Engineering and Director of Optoelectronic Institute in National Yunlin University of Science and Technology between 2002 and 2007. Then he was recruited to the graduate Institute of Electro-optical engineering and department of Electronic Engineering in National Taiwan University of Science and Technology(NTUST) since August, 2007. He served as the Vice-Dean(2011-2014) and Dean(2015-2017) for College of Electrical Engineering and Computer Science(EECS). Currently,

he is a Distinguished Professor in NTUST.

Professor Huang's multidisciplinary research areas are synthesis of nanomaterials (including carbon nano tubes, silicon nanowires, ZnO, WO3, and Nanodiamond), silicon based solar cells and nano-optoelectronic sensing devices. Currently, he has published more than 180 papers in referred journal publications and over 200 conference proceedings. Professor Huang is a senior member of Electronic Device Society of IEEE. He received the Outstanding Electrical Engineering Award from Chinese Institute of Electrical Engineering at 2013. Currently, Professor Huang is a Fellow of Institution of Engineering and Technology (IET).

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A Concept of applying the surface defect band from MoS_2 2D nanoribbons for photon ratchet intermediate band solar cells

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ABSTRACT

An idea of increasing the efficiency of the MoS_2 solar cells with special band structure of intermediate band in MoS_2 nanoribbon structures was presented in this work. From band structure calculation of MoS_2 armchair nanoribbon structures by tight-binding method, we found that there are bands forming in the middle bandgap and the bands has lowest energy states at X valley. The special E-K relation of intermediate band allows the phonons rapidly scatter electrons to the lower X valley of intermediate band in pico-second scale and can prevent electrons in intermediate bands from being recombined with holes at Γ valley. After modeling of transition rate of photon absorption and emission, the MoS_2 in nanoribbons structure can enhance maximum photo current by 37% compared with MoS_2 bulk and the power conversion of MoS_2 nanoribbon intermediate band solar cell will be around 30.7%, it shows that the MoS_2 nanoribbon is probably a promising material for intermediate band solar cells. Then we further check the other similar 2D material such as WS_2. Similar properties are also found. In the future work, we will show our work on these 2D material based nanoribbons and their alloys.

BIOGRAPHY

Dr. Yuh-Renn Wu received his B.S. in Physics and M.S. degree in Electrical Engineering in National Taiwan University, Taiwan, in 1998 and 2000, respectively, and the Ph.D. degree in Electrical Engineering at Department of Electrical Engineering and Computer Science at University of Michigan, Ann Arbor in 2006. He is currently a full professor in Graduate Institute of Photonics and Optoelectronic and Department of Electrical Engineering, National Taiwan University. His area of research is in physics, design of optoelectronic devices and high power electronics. His current research includes the studies of nitride based LEDs, HEMT, Laser diode, solar cell, and 2D material.

Dr. Yuh-Renn Wu's team has developed 1D-3D Poisson, Schrodinger, and drift-diffusion solver. They have distributed their software on their website with graphical user interface. Their developed software can be downloaded at http://yrwu-wk.ee.ntu.edu.tw for free academic usage.

Technical Session D1-W3-T1: Emerging Technologies and Applications in New Energy Materials and Devices, Perovskite, Power Electronics, Smart Energy Systems and Technologies (SEST), Smart Homes, Smart Buildings, and Smart Communities, Energy Storage and Utilization, Clean/Intelligent Vehicle Technologies, and Artificial Intelligence (AI) Applications in New Materials and Energy

Asymmetric Thermo-electrochemical Cell for Low-Grade-Heat-to-Electricity Conversion

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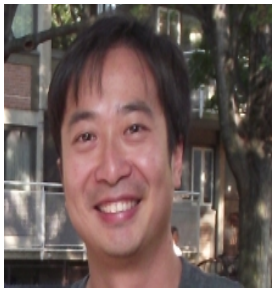
ABSTRACT

Low-grade thermal energy (<100 °C) is abundantly available in the form of waste heat or in the environment1, 2. Current technologies using liquid-based thermo-electrochemical cells (TECs) is both cost-effective and scalable for low-grade heat harvesting, and their temperature coefficient (mV/K) is one order of magnitude higher than that of solid-state thermoelectrics. The research on TECs has mainly focused on the exploit of thermal gradient or thermal cycle, but the potential of these approaches has been limited by the poor energy conversion efficiency or the need of external electricity. We invent a new asymmetric thermoelectrochemical cell (a-TEC) for low-grade-heat-to-electricity conversion under an isothermal condition without the aid of the thermal gradient across two electrodes or the thermal cycle. The a-TEC consists of graphene oxide (GO)/platinum nanoparticles (PtNPs) cathode and polyaniline (PANI) anode and an aqueous Fe2+/Fe3+ electrolyte, which can be thermally charged in the open circuit condition. Under isothermal operation, the pouch cell configuration of a-TEC with a short distance between two electrodes can be employed for improving electrolyte conductance and rapid heating. Notably, the thermal voltage is generated based on thermo-pseudocapacitive reaction at the GO-electrolyte interface, demonstrating a very high temperature coefficient of 5.0 mV/K and the a-TEC exhibits the energy conversion efficiency of 5.19% at 70 oC (39.6% of Carnot efficiency). The great applicability of this new thermo-electrochemical system has been demostrated on supplying power for an electrochromic smart window by immerimg a-TECs in a hot water and lightening up an organic light emitting diode by placing a-TECs on a running compressor.

BIOGRAPHY



Shien-Ping Feng is an Associate Professor in the Department of Mechanical Engineering in the University of Hong Kong. He received his Ph.D. in chemical engineering from National Tsing-Hua University (2003–2008) and was a postdoctoral associate at Massachusetts Institute of Technology (2009–2011). Prior to his appointment, he has been working over 8 years in semiconductor industry. He was a principal engineer, section manager and technical manager (2001-2008) at Taiwan Semiconductor Manufacturing Company which is the world's first and largest semiconductor foundry, and a deputy director at Tripod Research Center (2008-2009). His current research focuses on the

electrochemical fabrication of nanostructured materials and their applications in photo-thermo-electrochemical energy conversion. He is a team member in Strategic Research Theme (SRT) on Clean Energy at HKU and serves as associate director for laboratory of nanofluids and thermal engineering in HKU Zhejiang Institute of Research and Innovation (HKU-ZIRI). Through the development of his research work, two start-up companies, FLectrode Technology Limited and High-Performance Solution Limited, have been established and funded by Technology Startup Support Scheme for Universities (TSSSU).

Technical Session D1-W4-T1: Smart Tools and Smart Services, Smart Machines, and Sustainable Smart Manufacturing for the Future: Vision, Strategies, and Implementation (Big Data and Intelligence, Advanced Sensors, Autonomous Robots, Robotic Process Automation, Smart Machines (Devices), Simulation, Horizontal and Vertical System Integration, Smart Cities, Smart Supply Chain Management and Logistics 4.0, Computer Networking, 5G Wireless Mobile Technology, Internet of Things (IoT), Cyber-Physical Systems, Cybersecurity, Additive and Advanced Manufacturing, Digital Manufacturing, Augmented Reality and Cloud Technologies)

Workshop Co-Chair & Session Chair

Liang-Chia Chen (陳亮嘉)

Distinguished Professor, Department of Mechanical Engineering
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BIOGRAPHY

Technical Session D1-W4-T1: Smart Tools and Smart Services, Smart Machines, and Sustainable Smart Manufacturing for the Future: Vision, Strategies, and Implementation (Big Data and Intelligence, Advanced Sensors, Autonomous Robots, Robotic Process Automation, Smart Machines (Devices), Simulation, Horizontal and Vertical System Integration, Smart Cities, Smart Supply Chain Management and Logistics 4.0, Computer Networking, 5G Wireless Mobile Technology, Internet of Things (IoT), Cyber-Physical Systems, Cybersecurity, Additive and Advanced Manufacturing, Digital Manufacturing, Augmented Reality and Cloud Technologies)

Quality Control Problems in Three-dimensional Printing-based Mass Production

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ABSTRACT

Because quality issues may discourage customers from buying three-dimensional (3D)-printed products, enhancing 3D printing quality is imperative. In addition, 3D printing can be used to manufacture diverse products with a reduced investment in machines, tools, assembly, and materials. Production economics issues can be addressed by successfully implementing quality control (QC). This study investigated issues of quality and QC in 3D printing by reviewing past work and current practices. Possible future developments are also discussed.

After a discussion of the major quality dimensions of 3D-printed objects, the applications of some QC techniques at various stages of the product life cycle (including product design, process planning, incoming QC, in-process QC, and outgoing QC) are reviewed. It is concluded that the application of QC techniques to 3D printing is not uncommon. Some techniques (e.g., cause-and-effect analysis) have been applied extensively; others, such as design of experiments, have not been used accurately and completely and therefore cannot optimize quality. Taguchi's method and control charts can enhance the quality of 3D-printed objects; however, these techniques require repetitive experimentation, which may not fit the workflow of 3D printing.

BIOGRAPHY

Tin-Chih Toly Chen received the Ph. D. degree in industrial engineering from National Tsin Hua University. Dr. Chen is currently a Distinguished Professor in the Department of Industrial Engineering and Management at National Chiao Tung University. His research interests include fuzzy and neural computing, competitiveness analysis, cloud and ubiquitous manufacturing, operations research, semiconductor manufacturing, and ambient intelligence. He has been the editor or guest editor of several international journals.

Technical Session D1-W4-T1: Smart Tools and Smart Services, Smart Machines, and Sustainable Smart Manufacturing for the Future: Vision, Strategies, and Implementation (Big Data and Intelligence, Advanced Sensors, Autonomous Robots, Robotic Process Automation, Smart Machines (Devices), Simulation, Horizontal and Vertical System Integration, Smart Cities, Smart Supply Chain Management and Logistics 4.0, Computer Networking, 5G Wireless Mobile Technology, Internet of Things (IoT), Cyber-Physical Systems, Cybersecurity, Additive and Advanced Manufacturing, Digital Manufacturing, Augmented Reality and Cloud Technologies)

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ABSTRACT

BIOGRAPHY

Technical Session D1-W1-T2: Emerging Technologies and Applications in Materials for Healthcare and Medicine: Bio-Materials, Bio-SoC, Bio-Nanotech, Bio-NEMS/Bio-MEMS, Biomedical Optics and Imaging, Biomedical Engineering and Systems, Biomedical Informatics, Mobile Health, Virtual Reality (VR) and Healthcarelity (VR) and Healthcare

Session Chair

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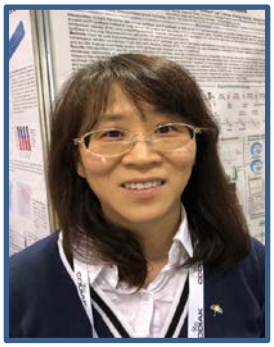
BIOGRAPHY



Hsueh-Fen Juan was born in 1969, Miao-Li, Taiwan. She received her BS and MS degree in Botany and PhD in Biochemical Sciences from National Taiwan University (NTU) in 1999. She worked as a research scientist in the Japan International Research Center for Agricultural Sciences (Tsukuba, Japan) during 2000-2001 and a postdoctoral research fellow in the Institute of Biological Chemistry, Academia Sinica (Taipei, Taiwan) during 2001-2002.

She started her academic career in the Department of Chemical Engineering, National Taipei University of Technology as an assistant professor and in the Department of Computer Science and Information Engineering at NTU as an adjunct assistant professor in 2002. She moved to NTU in 2004 as an assistant professor in the Department of Life Science and the Institute of Molecular and Cellular Biology. She was promoted to be an associate professor in 2006 and full professor in 2009 in the Department of Life Science, Institute of Molecular and Cellular Biology and Graduate Institute of Biomedical Electronics and Bioinformatics, NTU. Dr. Juan studied synthetic biology with Professor Hirotada Mori (NIST, Japan) in 2006 and Dr. James C. Liao (UCLA, USA) during 2007-2008. She is currently working on synthetic biology and systems biology by integrating genomics, transcriptomics, proteomics and bioinformatics for molecular signaling as well as biomarker and drug discovery.

Prof. Juan has developed a number of novel methods to advance systems-biology research and applied such approach for drug discovery and elucidating molecular mechanism of drug responses in cancer cells. She has published more than 110 journal papers including prestigious journals such as Proc. Natl. Acad. Sci. U S A, Bioinformatics, Briefings in Bioinformatics, Cancer Res., Nucleic Acids Res., Oncogene, Drug Discovery Today, Mol. Cell. Proteomics. Among these publications, Prof. Juan has breakthrough research achievement in targeting ectopic ATP synthase for cancer therapy, therefore Science Daily & American Chemical Society weekly news reported these results; additionally, she has two papers selecting as ESI highly cited papers in 2013. She edited two scientific books entitled as Systems Biology: Applications in cancer-related research (2012) and A Practical Guide to Cancer Systems Biology (2018). She is now the editor of Scientific Reports (Nature Publishing Group), Computational and Mathematical Methods in Medicine (Hindawi Publishing

Corporation), PeerJ, and PeerJ Computer Science. She also serves as the reviewer more than 50 various journals.

To promote systems biology field, she has organized several international systems biology and bioinformatics symposiums. She is one of the founders of Center for Systems Biology and Bioinformatics (NTU), and currently the Council Member of four societies, Taiwan Bioinformatics and Systems Biology Society, Taiwan Proteomics Society, Taiwan Society of Evolution and Computational Biology and Taiwan Society for Extracellular Vesicles as well as Supervisor of The Taiwan Society for Biochemistry and Molecular Biology. Since Dr. Juan made significant contributions through systems biology approach to development of methodology and cancer therapy; she received the awards “Taiwan's Ten Outstanding Young Persons” (2008), FY2011 JSPS Invitation Fellowship Program for Research in Japan (2011), K. T. Li Breakthrough Award by Institute of Information and Computing Machinery (2012), and National Science Council (NSC) Award for Special Talents of the Colleges (2010-2015, 2017-2018), NTU Academic Performance Reward (2015-2017) and 2015 USA Emerging Information and Technology Association (EITA) Service Award. Additionally, she has been invited to give more than 160 talks worldwide and led her team members to obtain around 80 research awards.

Technical Session D1-W1-T2: Emerging Technologies and Applications in Materials for Healthcare and Medicine: Bio-Materials, Bio-SoC, Bio-Nanotech, Bio-NEMS/Bio-MEMS, Biomedical Optics and Imaging, Biomedical Engineering and Systems, Biomedical Informatics, Mobile Health, Virtual Reality (VR) and Healthcarelity (VR) and Healthcare

Chi-Kuang Sun (孫啟光)

Life Distinguished Professor, Graduate Institute of Photonics and Optoelectronics and
Chief Director, Molecular Imaging Center
National Taiwan University

BIOGRAPHY

Technical Session D1-W1-T2: Emerging Technologies and Applications in Materials for Healthcare and Medicine: Bio-Materials, Bio-SoC, Bio-Nanotech, Bio-NEMS/Bio-MEMS, Biomedical Optics and Imaging, Biomedical Engineering and Systems, Biomedical Informatics, Mobile Health, Virtual Reality (VR) and Healthcarelity (VR) and Healthcare

Ultrafast Ultrasound Imaging of the Heart

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ABSTRACT

Ultrafast ultrasound imaging of the heart has emerged in recent years, enabling measurement of transient dynamics inside the heart, such as myocardial deformation, electromechanical waves, and chamber blood flow, and estimation of muscle material properties for the diagnosis of cardiovascular diseases. However, existing transthoracic ultrafast ultrasound imaging techniques are based on pulsed and unfocused ultrasound waves for significance increase in frame rates, and therefore they suffer from limited sonographic signal-to-noise ratio (SNR) and penetration due to the insufficient delivery of ultrasound waves through the chest wall to interrogate the entire heart. In this talk, I will introduce our latest development of an unprecedented ultrafast ultrasound cascaded-wave synthetic aperture (CaSA) imaging method, whose core is a specially-encoded transmission and reception model, to achieve superior SNR and thus greater penetration at frame rates higher than 3000 frames per second to map myocardial motion and chamber blood flow with high quality. The same ultrafast ultrasound imaging method also permits nondestructive mechanical assessment of the arterial wall.

BIOGRAPHY

Wei-Ning Lee received her B.S. and M.S. degrees in electrical engineering from National Taiwan University, Taipei, Taiwan, R.O.C., and her Ph.D. degree in biomedical engineering from Columbia University, New York, USA in 2010. Her current research interests focus on functional ultrafast ultrasound imaging methods to investigate microstructure, mechanics, and hemodynamics of cardiovascular and musculoskeletal tissues.

She worked as a postdoctoral fellow at Institut Langevin in ESPCI ParisTech, Paris, France from January 2010 to June 2012. She subsequently joined as an assistant professor with the Department of Electrical and Electronic Engineering at The University of Hong Kong, Hong Kong and is now associate professor with tenure.

Dr. Lee won a New Investigator Award at the American Institute of Ultrasound in Medicine (AIUM) Annual Convention in 2009 and an Early Career Award from the Hong Kong Research Grands Council in 2013. She is an IEEE member and currently serves as an academic editor for PLOS ONE as well as on the International Advisory Board of Physics in Medicine and Biology and on the Advisory Editorial Board of Ultrasound in Medicine and Biology.

Technical Session D1-W2-T2: Emerging Technologies and Applications in Electronic, Photonic, and Magnetic Materials, Ceramic Materials, Metallurgy and Materials, Organic Polymer, Soft Materials, and Computational Materials

Session Chair

Pei-Wen Li (李佩雯)

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BIOGRAPHY

PEI-WEN LI received her Ph.D. degree from Columbia University in New York city, in Electrical Engineering in 1994. She is a Professor in Institute of Electronics and served as the Director of Nano Facility Center at National Chiao Tung University (NCTU) in Hsinchu. Prior to joining NCTU in 2015, she has been the Distinguished Professor (2006–2015), the Chair of Electrical Engineering Department (2007–2010), Director of Nano Science and Technology (2012–2015), and Associate Dean of Academic Affair (2013–2015) in National Central University. She was a Research Visiting Scholar with Caltech in 2011–2012. She has also worked with Vanguard International Semiconductor Corporation on DRAM technology integration in 1995-1996. Her research themes focus on experimental silicon-germanium nanostructures and devices, encompassing germanium quantum-dot single electron transistors, photodetectors, nonvolatile memory, and energy harvest devices, making use of self-assembly nanostructures in silicon integration technology.

She is an IEEE Distinguished Lecturer and serves VLSI Technology and Education committees of IEEE EDS. She has served on various important conference committees, e.g., SNW, EDTM, SSDM etc. She was awarded Distinguished Professor from Chinese Electrical Engineering Society (2015) and Top 10 Rising Stars in Taiwan (Science and Technology) from Central News Agency in 2008.

Technical Session D1-W2-T2: Emerging Technologies and Applications in Electronic, Photonic, and Magnetic Materials, Ceramic Materials, Metallurgy and Materials, Organic Polymer, Soft Materials, and Computational Materials

An Inkjet Printing Technique for the Fabrication of Scalable Flexible Microsystems

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ABSTRACT

Inkjet printing technology has been categorized to “Green Manufacturing”, which can provide lots of advantages including high process flexibility, low cost, less chemical waste, etc. for microsystem fabrication. One of the technical challenges in the technology for mass production is the predicament in the realization of fine or thick line features due to the size limitation of inkjet printer nozzles. In this talk, I will present a process platform called combined process of lift-off and printing process (CPLoP) to resolve this issue and well advance the fabrication and integration of flexible biomedical sensors and actuators. As-fabricated devices such as flexible ionic sensor, tactile sensor, and ischemia muscle probe etc. for biomedical applications will be demonstrated. Owing to the characteristics of low temperature, low manufacture cost and process and size scalable, it is our belief that the process platform can continue the application of the inkjet printing technology for future microsystem fabrication.

BIOGRAPHY

Yu-Ting Cheng received his Ph.D. degree from the Department of Electronics Engineering in the University of Michigan, Ann Arbor, in 2000. After graduation, he worked for IBM Thomas J. Watson Research Center, as a research staff member. In 2002, he joined the Department of Electronics Engineering, National Chiao Tung University, Hsinchu, Taiwan and has been promoted as a Professor since 2009. His research interests include the design and fabrication of microsensors and microactuators and heterogeneous integration technology for biomedical applications. Dr. Cheng was a co-recipient of the Best Paper Award presented at IEEE ICECS. He has served as a TPC member in many international conferences including IEEE Transducers, Sensors, NEMS, ISMM, ISSNIP, and APCOT. He is a senior member of IEEE and also a member of IOP, and Phi Tau Phi.

Technical Session D1-W2-T2: Emerging Technologies and Applications in Electronic, Photonic, and Magnetic Materials, Ceramic Materials, Metallurgy and Materials, Organic Polymer, Soft Materials, and Computational Materials

Efficiency Enhancement and Lifetime Elongation of Blue Organic Light-emitting Diodes

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ABSTRACT

In this talk, we demonstrated the efficiency enhancement and lifetime elongation of blue organic light-emitting diode (OLED), which is one of most important bottlenecks, from the viewpoints of materials, device structures, and emission mechanisms. Wide bandgap material, especially the host material of the emitting layer (EML), was required and crucial to efficiency for the phosphorescent and thermally-activated delayed fluorescence emitters. Blue OLED with triplet-triplet annihilation (TTA) was used for pursuing long lifetime, but with lower efficiency. Triplet-triplet annihilation upconversion (TTAUC) was proposed for possibly improving the power efficiency and elongating the operation lifetime of blue OLED at the same time.

BIOGRAPHY

Jiun-Haw Lee received the B.S.E.E., M.S.E.E., and Ph.D. degrees in electrical engineering in 1994, 1995, and 2000, respectively, all from National Taiwan University, Taipei, Taiwan. From 2000 to 2003, he was with the RiTdisplay Corporation as the director. Since 2003, he joined the faculty of National Taiwan University in the Graduate Institute of Photonics and Optoelectronics and the Department of Electrical Engineering, where he is currently an professor. His research interests include organic optoelectronic devices, display technologies, and solar cells. He has published 1 book, 2 invited book chapter, >100 referred journal articles, >300 conference papers, and >60 patents. He served as Editor-in-Chief (2018 Jul.-Now) of Journal of the Society for Information Display, Associate Editor of IEEE Photonics Journal (2018- Now), Asian Committee member, Display Week, SID (2017-Now), and Conference chair of “Advances in Display Technologies” in SPIE Photonics West (2018-Now).

Technical Session D1-W2-T2: Emerging Technologies and Applications in Electronic, Photonic, and Magnetic Materials, Ceramic Materials, Metallurgy and Materials, Organic Polymer, Soft Materials, and Computational Materials

Non-Destructive Metrology Technology in PV Industry

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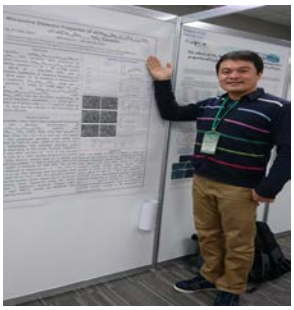
ABSTRACT

With the progress of photovoltaic industry, efficiency issue related to process attracted more and more attention. Thus, the non-destructive metrologies such as photoluminescence (PL), Electroluminescence (EL), external quantum efficiency (EQE), and depth-resolved photovoltage are used to characterize the quality of solar cell. The qualitative analysis of non-destructive metrologies can apply for process correlation to stabilize the production line and/or further improve the efficiency.

CIGS solar cells show high opportunity to achieve high efficiency. Photoluminescence (PL) image and Electroluminescence (EL) of CIGS solar cells has the ability for quality evaluation and defect analysis. The PL image of solar cells can be used to analyze the uniformity distribution including material band gap, recombination coefficient, and defect distribution. The EL image of solar cells can reveal the junction quality and current spreading including resistance distribution. The combination of PL and EL images can decouple different issues of junction quality, interface, or contact layers. Qualitative analysis of PL and EL images for CIGS solar cell can help to determine the resistance distribution. The defect / shunting points can also be observed. The luminescence method can be used to identify the TCO uniformity of thin film CIGS modules.

BIOGRAPHY



Shih-Hung Lin (林士弘) received the B.S. and M.S. degree in electrical engineering from National Chi Nan University and Cheng Kung University, in 2003 and 2005, respectively. He received Ph.D. degree in electronic engineering from National Taiwan University, Taipei, Taiwan, in 2011. After Ph.D program, he served as postdoctoral researcher fellow in Tohoku University, Sendai, Japan. He has also worked with UMC and Winbond Semiconductor Corporation on nanodevices design in 2010-2013. Since 2015, he has been with the Department of Electrical Engineering, Tunghai University, Taichung, Taiwan, as an Assistant Professor, where he became an Associate Professor, in 2017. His research interests include the electronic materials, semiconductor/optoelectronic devices and bioelectronics.

Currently, he has published more than 30 papers in referred journal publications, over 30 conference proceedings and 3 patents. He was awarded Super Teacher of Taichung City and Excellent Young Engineer from Chinese Institute of engineers in 2018.

Technical Session D1-W3-T2: Emerging Technologies and Applications in New Energy Materials and Devices, Perovskite, Power Electronics, Smart Energy Systems and Technologies (SEST), Smart Homes, Smart Buildings, and Smart Communities, Energy Storage and Utilization, Clean/Intelligent Vehicle Technologies, and Artificial Intelligence (AI) Applications in New Materials and Energy

Session Chair

Bohr-Ran Huang (黃柏仁)

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BIOGRAPHY

Bohr-Ran Huang (黃柏仁) was born in Nantou in August, 1961. He got his bachelor degree in department of Electrophysics from National Chiao-Tung University, Hsin-chu, Taiwan, in 1983. He served as the second lieutenant during his military service between 1983 and 1985. Then he received the M.S. and Ph.D degree in Electrical Engineering from Michigan State University, East Lansing, U.S.A, 1986 and 1992, respectively.

In 1992, he joined the National Yunlin University of Science and Technology (NYUST) as Associate Professor of Electronic Engineering and became a Full Professor in 2000. He served as Chairperson of Electronic Engineering and Director of Optoelectronic Institute in National Yunlin University of Science and Technology between 2002 and 2007. Then he was recruited to the graduate Institute of Electro-optical engineering and department of Electronic Engineering in National Taiwan University of Science and Technology(NTUST) since August, 2007. He served as the Vice-Dean(2011-2014) and Dean(2015-2017) for College of Electrical Engineering and Computer Science(EECS). Currently, he is a Distinguished Professor in NTUST.

Professor Huang's multidisciplinary research areas are synthesis of nanomaterials (including carbon nano tubes, silicon nanowires, ZnO, WO3, and Nanodiamond), silicon based solar cells and nano-optoelectronic sensing devices. Currently, he has published more than 180 papers in referred journal publications and over 200 conference proceedings. Professor Huang is a senior member of Electronic Device Society of IEEE. He received the Outstanding Electrical Engineering Award from Chinese Institute of Electrical Engineering at 2013. Currently, Professor Huang is a Fellow of Institution of Engineering and Technology (IET).

Technical Session D1-W3-T2: Emerging Technologies and Applications in New Energy Materials and Devices, Perovskite, Power Electronics, Smart Energy Systems and Technologies (SEST), Smart Homes, Smart Buildings, and Smart Communities, Energy Storage and Utilization, Clean/Intelligent Vehicle Technologies, and Artificial Intelligence (AI) Applications in New Materials and Energy

Jin-shyr Yang (楊金石)

Deputy General Manager
Taiwan Power Research Institute

ABSTRACT

BIOGRAPHY

Technical Session D1-W3-T2: Emerging Technologies and Applications in New Energy Materials and Devices, Perovskite, Power Electronics, Smart Energy Systems and Technologies (SEST), Smart Homes, Smart Buildings, and Smart Communities, Energy Storage and Utilization, Clean/Intelligent Vehicle Technologies, and Artificial Intelligence (AI) Applications in New Materials and Energy

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ABSTRACT

BIOGRAPHY

Technical Session D1-W3-T2: Emerging Technologies and Applications in New Energy Materials and Devices, Perovskite, Power Electronics, Smart Energy Systems and Technologies (SEST), Smart Homes, Smart Buildings, and Smart Communities, Energy Storage and Utilization, Clean/Intelligent Vehicle Technologies, and Artificial Intelligence (AI) Applications in New Materials and Energy

Yu-Ting Wu (吳毓庭)

Assistant Professor, Department of Engineering Science
National Cheng Kung University

ABSTRACT

BIOGRAPHY

Technical Session D1-W4-T2: Smart Tools and Smart Services, Smart Machines, and Sustainable Smart Manufacturing for the Future: Vision, Strategies, and Implementation (Big Data and Intelligence, Advanced Sensors, Autonomous Robots, Robotic Process Automation, Smart Machines (Devices), Simulation, Horizontal and Vertical System Integration, Smart Cities, Smart Supply Chain Management and Logistics 4.0, Computer Networking, 5G Wireless Mobile Technology, Internet of Things (IoT), Cyber-Physical Systems, Cybersecurity, Additive and Advanced Manufacturing, Digital Manufacturing, Augmented Reality and Cloud Technologies)

Workshop Co-Chair & Session Chair

Liang-Chia Chen (陳亮嘉)

Distinguished Professor, Department of Mechanical Engineering
National Taiwan University

BIOGRAPHY

Technical Session D1-W4-T2: *Smart Tools and Smart Services, Smart Machines, and Sustainable Smart Manufacturing for the Future: Vision, Strategies, and Implementation (Big Data and Intelligence, Advanced Sensors, Autonomous Robots, Robotic Process Automation, Smart Machines (Devices), Simulation, Horizontal and Vertical System Integration, Smart Cities, Smart Supply Chain Management and Logistics 4.0, Computer Networking, 5G Wireless Mobile Technology, Internet of Things (IoT), Cyber-Physical Systems, Cybersecurity, Additive and Advanced Manufacturing, Digital Manufacturing, Augmented Reality and Cloud Technologies)*

Yung-Hui Li (栗永徽)

Associate Professor, Department of Computer Science and Information Engineering
National Central University

ABSTRACT

BIOGRAPHY

Technical Session D1-W4-T2: Smart Tools and Smart Services, Smart Machines, and Sustainable Smart Manufacturing for the Future: Vision, Strategies, and Implementation (Big Data and Intelligence, Advanced Sensors, Autonomous Robots, Robotic Process Automation, Smart Machines (Devices), Simulation, Horizontal and Vertical System Integration, Smart Cities, Smart Supply Chain Management and Logistics 4.0, Computer Networking, 5G Wireless Mobile Technology, Internet of Things (IoT), Cyber-Physical Systems, Cybersecurity, Additive and Advanced Manufacturing, Digital Manufacturing, Augmented Reality and Cloud Technologies)

Digital Fusion and Smart City

Yonathan Joe (李金輝)

Research Fellow, Center for IoT Innovation
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Shuo-Yan Chou (周碩彥)

Distinguished Professor, Department of Industrial Management
National Taiwan University of Science and Technology

ABSTRACT

Smart city development has picked up its momentum in recent years due to the prevalence of the connectivity brought along by the Internet of Things (IoT). The objective of making a city smart should however not be making the job of governance easier but to empower the citizen. Together with blockchain and artificial intelligence (AI), not only can activities in cities be captured holistically but also the integrity and the characterization of those activities can be established effectively. With the physical city integrated seamlessly into the digital world, streamlined and data-driven solutions solving the pain points in cities can be developed and deployed accordingly. Furthermore, the frameworks of Industry 4.0 and Industrial Internet help to enable an integral approach for resolving problems precisely. In this talk, the notion of smart in the context of cities and the newly formed digital fusion are elaborated. Subsequent smart applications and services supporting the evolutional goals of cities are illustrated.

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Technical Session D1-W1-T3: Emerging Technologies and Applications in Materials for Healthcare and Medicine: Bio-Materials, Bio-SoC, Bio-Nanotech, Bio-NEMS/Bio-MEMS, Biomedical Optics and Imaging, Biomedical Engineering and Systems, Biomedical Informatics, Mobile Health, Virtual Reality (VR) and Healthcarelity (VR) and Healthcare

Session Chair

Hsuan-Cheng Huang (黃宣誠)

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BIOGRAPHY

Hsuan-Cheng Huang received his B.A., M.A., and Ph.D. degrees in physics from National Taiwan University in 1992, 1994 and 1998, respectively. He was engaged in experimental high-energy physics research at Taiwan and at High Energy Accelerator Research Organization, Japan, and awarded NSC Distinguished Postdoctoral Fellowship in 2003. Encouraged by the emerging of systems biology, Dr. Huang joined National Yang-Ming University in 2004 and is currently a Professor of the Institute of Biomedical Informatics, of which he served as the director from 2013 to 2018. In 2007, he received the NSC Wu Ta-You Memorial Award, an honor for excellent young investigators in Taiwan. Now he serves as an Editorial Board Member of Scientific Reports, an Associate Editor and Deputy Section Editor of BMC Systems Biology, and a Board Member in Taiwan Society of Bioinformatics and Systems Biology. His research interests include bioinformatics, computational and systems biology, and network biology. Currently, Dr. Huang endeavors his research efforts to computational analysis and modeling of biomedical big data and biological networks, and applies them for drug discovery and to unravel molecular mechanisms of cancer cell response and non-coding RNA regulation.

Technical Session D1-W1-T3: Emerging Technologies and Applications in Materials for Healthcare and Medicine: Bio-Materials, Bio-SoC, Bio-Nanotech, Bio-NEMS/Bio-MEMS, Biomedical Optics and Imaging, Biomedical Engineering and Systems, Biomedical Informatics, Mobile Health, Virtual Reality (VR) and Healthcarelity (VR) and Healthcare

A CHF Detection System with ECG Signals

Hsi-Pin Ma (馬席彬)

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ABSTRACT

In this talk, a wearable prototype with detection and quantification system of congestive heart failure (CHF) based on heart rate variability was proposed. Since the majority of studies focused on 24-hour electrocardiogram (ECG) data analysis for risk assessment, we offered a faster manner to achieve this goal with the data size of short-term segment of ECG signal. The proposed detection and quantification system is composed of four portions: data processing, feature extraction, feature selection, and classification. We adopted SVM and neural networks for the classification. The classification accuracy of proposed detection system is up to 93.76% for training set, and 86.74% for testing set.

BIOGRAPHY

Hsi-Pin Ma received the B.S. and Ph.D. degrees in electrical engineering from the National Taiwan University, Taiwan, in 1995 and 2002. At the summer of 2000, he interned at Siemens Telecommunication Systems Limited, for feasibility study and establishment of a dual-mode base station for WCDMA and cdma2000. Since 2003, he has been with the Department of Electrical Engineering and Institute of Communications Engineering, National Tsing Hua University, Hsinchu, Taiwan, where he is currently as a Professor. In NTHU, Dr. Ma has served as Associate Chair and Interim Chair of EE Department, and is currently Vice Dean of College of Electrical Engineering and Computer Science. He has served previously Secretary of Asia Pacific Region in IEEE Communications Society (ComSoc), TC Liaison for Standard Development Board, secretary, and vice chair of e-Health Technical Committee in IEEE ComSoc. He is currently the chair of e-Health Technical Committee. Dr. Ma's research interests include biomedical electronics and signal processing, telemedicine, wearable and implantable technologies, and health informatics.

Technical Session D1-W1-T3: Emerging Technologies and Applications in Materials for Healthcare and Medicine: Bio-Materials, Bio-SoC, Bio-Nanotech, Bio-NEMS/Bio-MEMS, Biomedical Optics and Imaging, Biomedical Engineering and Systems, Biomedical Informatics, Mobile Health, Virtual Reality (VR) and Healthcarelity (VR) and Healthcare

Imaging Mitochondria Dynamics

Hsueh-Fen Juan (阮雪芬)

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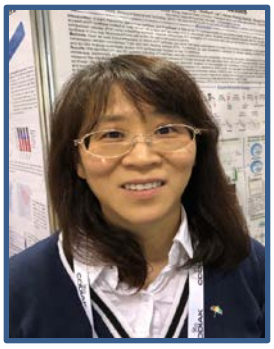
ABSTRACT

Mitochondria are crucial organelles that provide energy through oxidative phosphorylation in eukaryotic cells and also play critical roles in biological processes including growth, division, cell cycle, apoptosis and calcium homeostasis, as well as rapid adaptation to meet the metabolic needs of the cells. Mitochondrial morphologies have dynamic changes with fission (fragmentation) and fusion (elongation) in different cell types and stress such as hypoxia and nutrient starvation. Mitochondria in cancer cells often exhibit fragmented and rounded structures, while fission enhancement or fusion reduction promotes cancer proliferation, invasion and metastasis. Modulating mitochondrial dynamics could be a potential therapeutic target. Hence imaging mitochondria dynamics become an important issue to understand biological processes and disease progression. In this talk, I will present the imaging mitochondria dynamics for analysis of key protein trafficking in cancer cells and study of cyclic stretching.

BIOGRAPHY



Hsueh-Fen Juan was born in 1969, Miao-Li, Taiwan. She received her BS and MS degree in Botany and PhD in Biochemical Sciences from National Taiwan University (NTU) in 1999. She worked as a research scientist in the Japan International Research Center for Agricultural Sciences (Tsukuba, Japan) during 2000-2001 and a postdoctoral research fellow in the Institute of Biological Chemistry, Academia Sinica (Taipei, Taiwan) during 2001-2002.

She started her academic career in the Department of Chemical Engineering, National Taipei University of Technology as an assistant professor and in the Department of Computer Science and Information Engineering at NTU as an adjunct assistant professor in 2002. She moved to NTU in 2004 as an assistant professor in the Department of Life Science and the Institute of Molecular and Cellular Biology. She was promoted to be an associate professor in 2006 and full professor in 2009 in the Department of Life Science, Institute of Molecular and Cellular Biology and Graduate Institute of Biomedical Electronics and Bioinformatics, NTU. Dr. Juan studied synthetic biology with Professor Hirotada Mori (NIST, Japan) in 2006 and Dr. James C. Liao (UCLA, USA) during 2007-2008. She is currently working on synthetic biology and systems

biology by integrating genomics, transcriptomics, proteomics and bioinformatics for molecular signaling as well as biomarker and drug discovery.

Prof. Juan has developed a number of novel methods to advance systems-biology research and applied such approach for drug discovery and elucidating molecular mechanism of drug responses in cancer cells. She has published more than 110 journal papers including prestigious journals such as Proc. Natl. Acad. Sci. U S A, Bioinformatics, Briefings in Bioinformatics, Cancer Res., Nucleic Acids Res., Oncogene, Drug Discovery Today, Mol. Cell. Proteomics. Among these publications, Prof. Juan has breakthrough research achievement in targeting ectopic ATP synthase for cancer therapy, therefore Science Daily & American Chemical Society weekly news reported these results; additionally, she has two papers selecting as ESI highly cited papers in 2013. She edited two scientific books entitled as Systems Biology: Applications in cancer-related research (2012) and A Practical Guide to Cancer Systems Biology (2018). She is now the editor of Scientific Reports (Nature Publishing Group), Computational and Mathematical Methods in Medicine (Hindawi Publishing Corporation), PeerJ, and PeerJ Computer Science. She also serves as the reviewer more than 50 various journals.

To promote systems biology field, she has organized several international systems biology and bioinformatics symposiums. She is one of the founders of Center for Systems Biology and Bioinformatics (NTU), and currently the Council Member of four societies, Taiwan Bioinformatics and Systems Biology Society, Taiwan Proteomics Society, Taiwan Society of Evolution and Computational Biology and Taiwan Society for Extracellular Vesicles as well as Supervisor of The Taiwan Society for Biochemistry and Molecular Biology. Since Dr. Juan made significant contributions through systems biology approach to development of methodology and cancer therapy; she received the awards “Taiwan's Ten Outstanding Young Persons” (2008), FY2011 JSPS Invitation Fellowship Program for Research in Japan (2011), K. T. Li Breakthrough Award by Institute of Information and Computing Machinery (2012), and National Science Council (NSC) Award for Special Talents of the Colleges (2010-2015, 2017-2018), NTU Academic Performance Reward (2015-2017) and 2015 USA Emerging Information and Technology Association (EITA) Service Award. Additionally, she has been invited to give more than 160 talks worldwide and led her team members to obtain around 80 research awards.

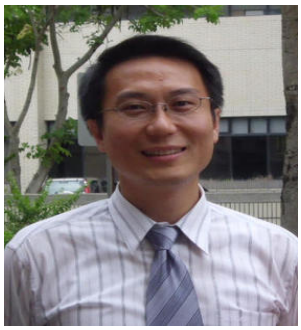
Technical Session D1-W1-T3: Emerging Technologies and Applications in Materials for Healthcare and Medicine: Bio-Materials, Bio-SoC, Bio-Nanotech, Bio-NEMS/Bio-MEMS, Biomedical Optics and Imaging, Biomedical Engineering and Systems, Biomedical Informatics, Mobile Health, Virtual Reality (VR) and Healthcarelity (VR) and Healthcare

Han-Sheng Chuang (Oswald) (莊漢聲)

Associate Professor, Department of Biomedical Engineering
National Cheng Kung University

ABSTRACT

BIOGRAPHY



Technical Session D1-W2-T3: Emerging Technologies and Applications in Electronic, Photonic, and Magnetic Materials, Ceramic Materials, Metallurgy and Materials, Organic Polymer, Soft Materials, and Computational Materials

Session Chair

I-Chun Cheng (陳奕君)

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BIOGRAPHY

I-Chun Cheng received the B.S. and M.S. degrees in mechanical engineering from the National Taiwan University in 1996 and 1998, respectively. In 2004, she received a Ph.D. degree in electrical engineering from Princeton University. She was with the Macroelectronic Lab of Princeton University from 2004 to 2007 as a postdoctoral research associate, working on novel silicon thin-film devices and backplane technology for flexible displays. In 2007, she joined the Department of Electrical Engineering and Graduate Institute of Photonics and Optoelectronics at the National Taiwan University, where she is currently a professor. Her current research interests include oxide-semiconductor thin-film technology, photovoltaic devices and flexible large-area electronics. She is a member of the Institute of Electrical and Electronics Engineers (IEEE), Material Research Society (MRS), Electrochemical Society (ECS), and the Society for Information Display (SID). She has published over 100 journal articles, more than 200 conference papers and 5 book chapters and co-authored a book.

Technical Session D1-W2-T3: Emerging Technologies and Applications in Electronic, Photonic, and Magnetic Materials, Ceramic Materials, Metallurgy and Materials, Organic Polymer, Soft Materials, and Computational Materials

TAO-DFT and Its Applications to Nanomaterials with Radical Nature

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ABSTRACT

I will briefly describe thermally-assisted-occupation density functional theory (TAO-DFT) [J.-D. Chai, J. Chem. Phys. 136, 154104 (2012)], density functional approximations in TAO-DFT (TAO-DFAs), hybrid TAO-DFT schemes (i.e., inclusion of exact exchange in TAO-DFT), self-consistent fictitious temperature scheme in TAO-DFT, and the applications of TAO-DFT to nanomaterials with radical nature (e.g., acenes, zigzag graphene nanoribbons, cyclacenes, Möbius cyclacenes, PAHs, linear carbon chains, linear boron chains, etc.). In contrast to Kohn-Sham density functional theory (KS-DFT), TAO-DFT is a density functional theory with fractional orbital occupations given by the Fermi-Dirac distribution (controlled by a fictitious temperature), for the study of large electronic systems with radical nature. Due to its computational efficiency and reasonable accuracy, TAO-DFT has been recently applied to the study of various nanomaterials with radical nature (i.e., challenging systems for conventional electronic structure methods). Some interesting results will be presented.

BIOGRAPHY

Jeng-Da Chai received his B.S. degree in Physics from National Taiwan University (June 1997), M.S. degree in Physics from The Ohio State University (June 2002), and Ph.D. degree in Chemical Physics from the University of Maryland, College Park (December 2005). He performed postdoctoral research at the University of California, Berkeley (January 2006 ~ June 2009). He joined the Department of Physics at National Taiwan University as an Assistant Professor in August 2009. He was promoted to Associate Professor in August 2013, and to Full Professor in August 2017. His group has focused on the development of new quantum-mechanical methods suitable for the study of nanoscale systems, and their applications to materials for new energy (e.g., solar cells and hydrogen storage materials). He currently serves in the Editorial Boards of "Chinese Journal of Physics" and "International Journal of Quantum Chemistry". He was elected as a "TWAS Young Affiliate" by The World Academy of Sciences (TWAS) - for the advancement of science in developing countries in 2013. He received "EPSON Scholarship Award" from The International Society for Theoretical Chemical Physics in 2011, "Young Theorist Award" from the National Center for Theoretical Sciences of Taiwan in 2012, "Career Development Award" twice from National Taiwan University in 2013 and 2015, respectively, "Youth Medal" from the China Youth Corps of Taiwan in 2015, "Project for Excellent Junior

Research Investigators" twice from the Ministry of Science and Technology of Taiwan in 2015 and 2018, respectively, "Outstanding Young Physicist Award" from The Physical Society of the Republic of China (Taiwan) in 2016, "Junior Research Investigators Award" from Academia Sinica in 2017, and "Excellence in Teaching Award" twice from National Taiwan University in 2018 and 2019, respectively.

Technical Session D1-W2-T3: Emerging Technologies and Applications in Electronic, Photonic, and Magnetic Materials, Ceramic Materials, Metallurgy and Materials, Organic Polymer, Soft Materials, and Computational Materials

Hydrogen Adsorption, Dissociation And Spillover On Supported Metal Clusters

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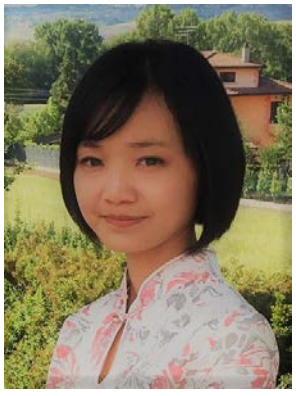
ABSTRACT

The scope of this work is to study the mechanism of hydrogen spillover promoted by metal particles on oxide surfaces at the atomistic level. By means of Density Functional Theory calculations with Hubbard corrections (DFT+U), we have analyzed the adsorption and dissociation of molecular hydrogen on anatase titania, a-TiO_2, (101) surfaces in the presence of a supported Ru_{10} nanocluster. The role of the supported metal particle is essential as it favours the spontaneous dissociation of H_2, a process which does not occur on the bare oxide surface. At low hydrogen coverage, the H atoms prefer to stay on the Ru_{10} particle, charge accumulates on the metal cluster, and reduction of the oxide does not take place. On an hydroxylated surface, the presence of a Ru nanoparticle is expected to promote the reverse effect, i.e. hydrogen reverse spillover from the oxide to the supported metal. It is only at high hydrogen coverage, resulting in the adsorption of several H_2 molecules on the metal cluster, that it becomes thermodynamically favourable to have a hydrogen transfer from the metal to the O sites of the oxide surface. The migration of an H atom from the Ru cluster to the a-TiO_2 (101) surface is accompanied by an electron transfer to the empty states of the support with reduction of the oxide surface —the formation of Ti^{3+} center is therefore observed.

BIOGRAPHY



Dr. H-Y T Chen received her BEng (Honors) in Resource Engineering from National Cheng Kung University and MSc in Materials Science and Engineering from National Taiwan University in Taiwan, before obtaining my PhD in Chemistry from University College London in the UK in 2012 under the supervision of Prof. C. Richard A. Catlow FRS (EPSRC Studentship, UK and Elite Overseas Study Scholarship from the Ministry of Education, Taiwan). The doctoral thesis title is “Hydrogenation reactions catalysed by organometallic complexes”. She worked as a Postdoctoral Researcher in Materials Science at University of Milano-Bicocca in Italy, working on the CASCATBEL Project (relative to biomass conversion) in the group of Prof. Gianfranco Pacchioni from 2012-2016. From August 2016, she started her assistant professor career in the Department of Engineering System and Science at National Tsing Hua University. Her research interests include quantum mechanical simulation of homo- and heterogeneous catalysis, oxides surfaces, interfaces, 2D materials (thin films), metal clusters, and the

search for transition states. Most of the topics are associated with energy conversion and storage such as fuel cells, batteries, ammonia production, biomass conversion, CO_2 conversion, H storage and etc. The core idea/ultimate goal of her research focus on materials design and optimize their performance.

Technical Session D1-W2-T3: Emerging Technologies and Applications in Electronic, Photonic, and Magnetic Materials, Ceramic Materials, Metallurgy and Materials, Organic Polymer, Soft Materials, and Computational Materials

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BIOGRAPHY

Technical Session D1-W3-T3: Emerging Technologies and Applications in New Energy Materials and Devices, Perovskite, Power Electronics, Smart Energy Systems and Technologies (SEST), Smart Homes, Smart Buildings, and Smart Communities, Energy Storage and Utilization, Clean/Intelligent Vehicle Technologies, and Artificial Intelligence (AI) Applications in New Materials and Energy

Session Chair

Ming-Yuan Cho (卓明遠)

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BIOGRAPHY

Technical Session D1-W3-T3: Emerging Technologies and Applications in New Energy Materials and Devices, Perovskite, Power Electronics, Smart Energy Systems and Technologies (SEST), Smart Homes, Smart Buildings, and Smart Communities, Energy Storage and Utilization, Clean/Intelligent Vehicle Technologies, and Artificial Intelligence (AI) Applications in New Materials and Energy

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ABSTRACT

BIOGRAPHY

Technical Session D1-W3-T3: Emerging Technologies and Applications in New Energy Materials and Devices, Perovskite, Power Electronics, Smart Energy Systems and Technologies (SEST), Smart Homes, Smart Buildings, and Smart Communities, Energy Storage and Utilization, Clean/Intelligent Vehicle Technologies, and Artificial Intelligence (AI) Applications in New Materials and Energy

Synchrotron-based X-ray spectroscopy in energy materials

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ABSTRACT

Global climate warming and environment pollution have spurred scientists to develop new high-efficient and environmental-friendly energy technologies. Sunlight is a clean, renewable and abundant energy source on the earth. Its conversion to hydrogen has been considered an ideal solution to counter the depletion and environmental problems of fossil fuels. Hydrogen is an ideal fuel for fuel cell applications. Hydrogen has to be produced from renewable and carbon-free resources using nature energies such as sunlight if one thinks of clean energy and environmental issues. In this regard, a photoelectrochemical cell consisting of semiconductor photoelectrodes that can harvest light and use this energy directly for splitting water is a more promising way for hydrogen generation. Photocatalysis utilizes the energy delivered by light and enables chemical reactions that otherwise cannot take place. When used to power thermodynamically uphill reactions, photocatalysis offers a solution to large-scale solar energy storage. Despite over four decades of intense research, however, photocatalysis remains either too expensive or too inefficient or both. Poor understanding of the mechanisms behind the low performance is a key reason that limits the progress of this important field. To address this critical challenge, and to complement existing efforts focused on discovering new materials for photocatalysis, we present here a series of experiments designed to elucidate the working principles of photocatalysis.

BIOGRAPHY

Yan-Gu Lin received his PhD degree from Materials Science and Engineering at National Chiao-Tung University, Taiwan, in 2010. After graduation, he became a Postdoctoral Fellow in Institute of Atomic and Molecular Science at Academia Sinica, Taiwan, in 2011. Thereafter, he joined Dr. Jeffrey T. Miller's group in Chemical Sciences and Engineering Division at Argonne National Laboratory, United States, as a postdoctoral researcher from 2012 to 2013. Currently, He is the associate research scientist in National Synchrotron Radiation Research Center, Taiwan. His major research is focused on the field of energy conversion and storage application.

Technical Session D1-W3-T3: Emerging Technologies and Applications in New Energy Materials and Devices, Perovskite, Power Electronics, Smart Energy Systems and Technologies (SEST), Smart Homes, Smart Buildings, and Smart Communities, Energy Storage and Utilization, Clean/Intelligent Vehicle Technologies, and Artificial Intelligence (AI) Applications in New Materials and Energy

Developing High Performance Perovskite Film and Universal Electrode Buffer Layers for Organic and Perovskite Optoelectronics

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Shien-Ping Feng (馮憲平)[1,*]

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ABSTRACT

Organic and perovskite optoelectronics such as organic light-emitting diodes, organic and perovskite photovoltaics are potentially promising candidates for the highly efficient and low-cost energy saving and harvest technologies in next generation. Improving their performance relies on optimizing the electronic properties of building blocks including electrode buffer layers and active layers. Herein, we report facile processes producing high quality perovskite films and a universal electrode buffer layer material for various advanced optoelectronics. Specifically, solvent and composition engineering techniques are developed to improve the crystallinity, morphology, and electronic properties of perovskite films. In particular, lead iodide films were treated with isopropanol (IPA) or zinc oxide nanoparticles (ZnO NPs), facilitating the formation of highly crystalline, smooth and pin-hole free perovskite. On the other hand, amino-containing polytriphenylamine was prepared and self-assembled as two kinds of distinct nanospheres, which could be either acting as anode buffer layer to transport holes or cathode buffer layer to promote electron extraction. On the basis of above techniques, the power conversion efficiency (PCE) of perovskite solar cells could be raised up to 18% and the fabrication processes of optoelectronics could be simplified.

BIOGRAPHY

Wei-Ting Wang has received her Ph.D. degree in chemical engineering from National Taiwan University of Science and Technology (Taiwan Tech) in 2018, followed by postdoctoral study under the supervision of Dr. Shien-Ping Feng, Department of Mechanical Engineering, HKU. Her research interests are in the field of organic and inorganic (hybrid) solar cells focusing on the development of novel materials and processes.

BIOGRAPHY

Shien-Ping Feng is an Associate Professor in the Department of Mechanical Engineering in the University of Hong Kong. He received his Ph.D. in chemical engineering from National Tsing-Hua University (2003–2008) and was a postdoctoral associate at Massachusetts Institute of Technology (2009–2011). Prior to his appointment, he has been working over 8 years in semiconductor industry. He was a principal engineer, section manager and technical manager (2001-2008) at Taiwan Semiconductor Manufacturing Company which is the world's first and largest semiconductor foundry, and a deputy director at Tripod Research Center (2008-2009). His current research focuses on the electrochemical fabrication of nanostructured materials and their applications in photo-thermo-electrochemical energy conversion. He is a team member in Strategic Research Theme (SRT) on Clean Energy at HKU and serves as associate director for laboratory of nanofluids and thermal engineering in HKU Zhejiang Institute of Research and Innovation (HKU-ZIRI). Through the development of his research work, two start-up companies, FLectrode Technology Limited and High-Performance Solution Limited, have been established and funded by Technology Startup Support Scheme for Universities (TSSSU).

Technical Session D1-W4-T3: Smart Tools and Smart Services, Smart Machines, and Sustainable Smart Manufacturing for the Future: Vision, Strategies, and Implementation (Big Data and Intelligence, Advanced Sensors, Autonomous Robots, Robotic Process Automation, Smart Machines (Devices), Simulation, Horizontal and Vertical System Integration, Smart Cities, Smart Supply Chain Management and Logistics 4.0, Computer Networking, 5G Wireless Mobile Technology, Internet of Things (IoT), Cyber-Physical Systems, Cybersecurity, Additive and Advanced Manufacturing, Digital Manufacturing, Augmented Reality and Cloud Technologies)

Session Chair

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Tin-Chih Toly Chen received the Ph. D. degree in industrial engineering from National Tsin Hua University. Dr. Chen is currently a Distinguished Professor in the Department of Industrial Engineering and Management at National Chiao Tung University. His research interests include fuzzy and neural computing, competitiveness analysis, cloud and ubiquitous manufacturing, operations research, semiconductor manufacturing, and ambient intelligence. He has been the editor or guest editor of several international journals.

Technical Session D1-W4-T3: Smart Tools and Smart Services, Smart Machines, and Sustainable Smart Manufacturing for the Future: Vision, Strategies, and Implementation (Big Data and Intelligence, Advanced Sensors, Autonomous Robots, Robotic Process Automation, Smart Machines (Devices), Simulation, Horizontal and Vertical System Integration, Smart Cities, Smart Supply Chain Management and Logistics 4.0, Computer Networking, 5G Wireless Mobile Technology, Internet of Things (IoT), Cyber-Physical Systems, Cybersecurity, Additive and Advanced Manufacturing, Digital Manufacturing, Augmented Reality and Cloud Technologies)

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ABSTRACT

BIOGRAPHY

Technical Session D1-W4-T3: Smart Tools and Smart Services, Smart Machines, and Sustainable Smart Manufacturing for the Future: Vision, Strategies, and Implementation (Big Data and Intelligence, Advanced Sensors, Autonomous Robots, Robotic Process Automation, Smart Machines (Devices), Simulation, Horizontal and Vertical System Integration, Smart Cities, Smart Supply Chain Management and Logistics 4.0, Computer Networking, 5G Wireless Mobile Technology, Internet of Things (IoT), Cyber-Physical Systems, Cybersecurity, Additive and Advanced Manufacturing, Digital Manufacturing, Augmented Reality and Cloud Technologies)

Off-grid Photovoltaics for Smart Applications

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ABSTRACT

Conventional photovoltaic devices, such as crystalline Si cells, exhibit poor efficiency under indoor or low level outdoor lighting. Many applications, however, require efficient, low cost light harvesting ability under dim-light conditions, e.g. wireless sensor nodes in smart cities, smart supply chain management, home security and automation. Therefore, while Si solar cells dominate the solar panel market, there remains a need for developing of low-cost photovoltaic technology which can efficiently harvest photon energy under indoor or low-level lighting conditions. Herein, we will present our recent progress on the development of organic and organic/inorganic hybrid perovskite solar cells especially for indoor applications. First, assuming that the radiative recombination would be the only loss mechanism, we calculated the Shockley–Queisser limits using two representative indoor light sources (fluorescent tube and white light-emitting diodes). The results indicate that more than 50% of photonic energy can be recycled. Further, the details of the device characterization will be also described. Further, we have found that organic photovoltaic devices and perovskite solar cells exhibited extremely high performance under the indoor illumination conditions, thereby making them suitable for low-power indoor applications. Different methods for further enhancing the device performance, such as introduction of metal nanoparticles for triggering plasmonic effects upon illumination, will be also discussed.

BIOGRAPHY

Prof. Fang-Chung Chen was born on 4th June, 1974 in Taichung, Taiwan. He received the B.S. and master degree in Chemistry from National Taiwan University, Taiwan, in 1996 and 1998, respectively, and the Ph.D. degree in Materials Science and Engineering from University of California, Los Angeles (UCLA), USA, in 2003.

He was a teaching assistant in Department of Chemistry, National Taiwan University in 1998. He was a postdoctoral research associate in Department of Materials Science and Engineering, UCLA in 2003. He

joined Department of Photonics (DoP) at National Chiao Tung University (NCTU) since Feb. 2004 as an assistant professor. He was also the chairman of Degree Program of Flat Panel Display Technology in NCTU. He is current vice-chairman of DoP. His research interests include flexible solar cells, organic electronics and materials, low-dimensional nanomaterials, perovskite materials and machine learning for optoelectronic materials and devices.

Prof. Chen is the recipient of Award for Junior Research Investigators of Academia Sinica 2008, which is one of the most important awards for junior research investigators in all research fields in Taiwan. He has published more than 117 SCI Journals papers, 120 conference papers, 5 book chapters, and owned more than 20 patents. He is the section editor (Organic Materials) of Encyclopedia of Modern Optics, edition II, Elsevier. He is also currently on the Editorial Boards of *Active and Passive Electronic Components* and *Current Smart Materials*. He frequently serves as a referee for many high-quality Journals, such as *JACS, Adv. Mat., Adv. Funct. Mat., ACS Nano, Energy Environ. Sci., J. Mat. Chem., APL* etc..

Day 2 (September 12, 2019)

Opening Session

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He was a teaching assistant in Department of Chemistry, National Taiwan University in 1998. He was a postdoctoral research associate in Department of Materials Science and Engineering, UCLA in 2003. He joined Department of Photonics (DoP) at National Chiao Tung University (NCTU) since Feb. 2004 as an assistant professor. He was also the chairman of Degree Program of Flat Panel Display Technology in NCTU. He is current vice-chairman of DoP. His research interests include flexible solar cells, organic electronics and materials, low-dimensional nanomaterials, perovskite materials and machine learning for optoelectronic materials and devices.

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Opening Session

Project Manager

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National Chiao-Tung University

BIOGRAPHY

Plenary Session (III)

Conference Chair & Session Chair

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BIOGRAPHY

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He was a teaching assistant in Department of Chemistry, National Taiwan University in 1998. He was a postdoctoral research associate in Department of Materials Science and Engineering, UCLA in 2003. He joined Department of Photonics (DoP) at National Chiao Tung University (NCTU) since Feb. 2004 as an assistant professor. He was also the chairman of Degree Program of Flat Panel Display Technology in NCTU. He is current vice-chairman of DoP. His research interests include flexible solar cells, organic electronics and materials, low-dimensional nanomaterials, perovskite materials and machine learning for optoelectronic materials and devices.

Prof. Chen is the recipient of Award for Junior Research Investigators of Academia Sinica 2008, which is one of the most important awards for junior research investigators in all research fields in Taiwan. He has published more than 117 SCI Journals papers, 120 conference papers, 5 book chapters, and owned more than 20 patents. He is the section editor (Organic Materials) of Encyclopedia of Modern Optics, edition II, Elsevier. He is also currently on the Editorial Boards of *Active and Passive Electronic Components* and *Current Smart Materials*. He frequently serves as a referee for many high-quality Journals, such as *JACS, Adv. Mat., Adv. Funct. Mat., ACS Nano, Energy Environ. Sci., J. Mat. Chem., APL* etc..

Plenary Session (III)

Plenary Speaker

VLS growth of 2D Metal Chalcogenides and their Application in Artificial Photosynthesis

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BIOGRAPHY

Dr. Kuei-Hsien Chen obtained his BS degree in 1981 from Electrical Engineering, NTU, Taiwan and his MS and Ph.D. degrees from Applied Physics, Harvard University in 1989. He worked on CVD diamond synthesis at General Electric R&D Center till 1992 before he joined the Institute of Atomic and Molecular Sciences (IAMS), Academia Sinica, Taiwan in 1993.

He is currently the Distinguished Research Fellow and Director of IAMS, and adjunct research fellow in the Center for Condensed Matter Sciences (CCMS) in National Taiwan University. He works on the synthesis and applications of advanced materials, particularly their energy applications including photovoltaic, thermoelectricity, and solar fuels.

Dr. Chen is a member of Materials Research Society (MRS) and Electrochemistry Society (ECS). He won Academia Sinica Young Scholar Research Award (2000), National Science Council Outstanding Research Award (2004), Best Poster Award in MRS-2009, Outstanding Scholar Awards of the Foundation for the Advancement of Outstanding Scholarship (2008-2013), Ho Chin Tui Outstanding Honorary *Award in Materials Science* (2012). Dr. Chen has published more than 450 paper, 111 International conference Invited/Keynote/Plenary talks, 10 book chapters, and 16 patents; Total citation: 14000+; H-index: 62; Average citation: 32.3. Among all the publications, 12 of them has been listed by Thomson Reuters Essential Science Indicators as highly cited papers.

ABSTRACT

Solar photoreduction of CO_2 to produce value added hydrocarbons is highly desirable to tackle environmental and energy issues.[1-2] Despite the great improvement in the efficiency and cost of solar cells, the efficiency in artificial photosynthesis is much lower than the >15% of solar cells. Recent progress in 2D chalcogenides with tunable bandgap and layer numbers offers great opportunity for the investigation in this field. In this work, two metal chalcogenides, SnS_2 and MoS_2 have been synthesized for the study. Hydrothermal synthesis of carbon-containing SnS_2 exhibits a highly active photocatalytic conversion of CO_2 to selective hydrocarbons under

visible-light irradiation. Overall, the carbon doping in the SnS_2 nanostructure plays a key role and significantly enhance the visible light photocatalytic activity with a photochemical quantum efficiency above 0.7%.[3-4] Meanwhile, VLS growth of MoS_2 has developed in our lab offers the opportunity for mechanism study of the CO_2 reduction process. By plasma treatment of the few-layered MoS_2 to create defects on the surface, we observed enhanced CO_2 reduction under solar illumination. FTIR, Raman, NMR, BET, SECM, and synchrotron based facilities including APXPS and XAS have been used to investigate this issue.

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Plenary Session (IV)

Project Manager & Session Chair

Tsung Sheng Kao (高宗聖)

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BIOGRAPHY

Plenary Session (IV)

Plenary Speaker

Novel two dimensional material systems for photo-to-energy conversion and optoelectronics applications

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ABSTRACT

In this talk, I would like to present several novel 2D material systems for energy conversion and optoelectronics applications. These 2D materials systems include 2D atomic layer materials and 2D organic-inorganic hybrid perovskites. In the first part, I would like to address the energy conversion systems based on graphene and other 2D atomic layer materials. Strong light-matter interaction at the graphene-heterostructures results in novel functionality in photovoltaic and photochemical conversions. Here, we demonstrate the examples of "crack-filled graphene (CFG) films" [1] and "sunlight-activated" transparent electrodes"[2,3,4] for high-performance solar cell applications. I would like to address the new application of using 2D atomic oxides as efficient electron or hole transporting layers in polymer solar cells and organic-inorganic perovskite solar cells developed in our lab.[5,6,7] I would like to present several systems of 2D materials used in electrochemical (EC) photoelectrochemical (PEC) cells including graphene, $PtSe_2$ and MoS_2 for hydrogen production. A stable and high-performance photochemical cell for hydrogen evolution based on the 3D nanostructured graphene/Si Schottky junction is present, providing a new direction for photochemical application based on 2D materials.[8] A new type of 2D material $PtSe_2$ grown by CVD exhibits interesting "semiconductor-to-metal" transition with increasing the layer number. It also shows promising performance in water splitting.

In the second part, I would like to address some interesting results related to the emerging field of 2D layered perovskites. The 2D layered organic–inorganic hybrid perovskites have a naturally formed 'quantum well (QW)-like' structure consisting of a self-assembled periodic array of inorganic perovskite layers separated by organic spacers in their lattice framework. Due to their inherent QW structure, the 2D layered perovskites have shown intriguing optoelectronic characteristics, such as strong excitons and high luminescence quantum yields. Here, I would like several interesting optoelectronic and spin-related optoelectronic properties of 2D organic-inorganic hybrid perovskites, including low-threshold lasing[9], optical properties controlled by structural-phase-transition dependent optical properties[10]. Most interesting, I would like to show our recent discovery of intriguing room temperature Zeeman splitting and strong magnetic-optical effects of 2D organic-inorganic hybrid perovskites.[11]

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BIOGRAPHY

Prof. Chun-Wei Chen is currently Distinguished Professor, Department of Materials Science and Engineering, National Taiwan University (NTU), Taiwan. He received his B.S. degree in electrical engineering, NTU (1993) and M. Phil degree from Cavendish laboratory, Department of Physics (1995), and Ph.D. degree from Engineering department (1998), both from Cambridge University, U.K. His major research interests include (1) the development of graphene and 2D atomic layer materials and (2) the development of next-generation energy materials based on nanomaterials and devices. He was a recipient of Outstanding Research Award, Ministry of Science and Technology, Taiwan (2011 and 2015). He was also the recipient of "Outstanding Scholar Awards, Foundation for the Advancement of Outstanding Scholarship (2017)". Currently, he is the director of International Graduate Program of Molecular Science and Technology, NTU-MST. (Email: chunwei@ntu.edu.tw)

Technical Session D2-W1-T1: Emerging Technologies and Applications in Materials for Healthcare and Medicine: Bio-Materials, Bio-SoC, Bio-Nanotech, Bio-NEMS/Bio-MEMS, Biomedical Optics and Imaging, Biomedical Engineering and Systems, Biomedical Informatics, Mobile Health, Virtual Reality (VR) and Healthcarelity (VR) and Healthcare

Workshop Chair & Session Chair

Chi-Kuang Sun (孫啟光)

Life Distinguished Professor, Graduate Institute of Photonics and Optoelectronics and
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National Taiwan University

BIOGRAPHY

Technical Session D2-W1-T1: Emerging Technologies and Applications in Materials for Healthcare and Medicine: Bio-Materials, Bio-SoC, Bio-Nanotech, Bio-NEMS/Bio-MEMS, Biomedical Optics and Imaging, Biomedical Engineering and Systems, Biomedical Informatics, Mobile Health, Virtual Reality (VR) and Healthcarelity (VR) and Healthcare

Detection of urinary miRNA biomarkers by transmission surface plasmon resonance

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ABSTRACT

The clinical assessment of short-stranded nucleic acid biomarkers such as miRNAs could potentially provide useful information for monitoring disease progression, prompting definitive treatment decisions. In the past decade, advancements in biosensing technology have led to a shift towards rapid, real-time and label-free detection systems; as such, surface plasmon resonance (SPR) biosensor-based technology has become of high interest. Here, we developed an automated multiplex transmissive surface plasmon resonance (t-SPR) platform with the use of a capped gold nanoslit integrated microfluidic surface plasmon resonance (SPR) biosensor. The automated platform was custom designed to allow the analysis of spectral measurements using wavelength shift (dλ), intensity (dI) and novel area change (dA) for surface binding reactions. A simple and compact nanostructure based biosensor was fabricated with multiplex real-time detection capabilities. The sensitivity and specificity of the microfluidic device was demon- strated through the use of functionalised AuNPs for target molecule isolation and signal enhancement in combination with probes on the CG nanoslit surface. Our work allows for the multiplex detection of miRNA at femtomolar concentrations in complex media such as urine

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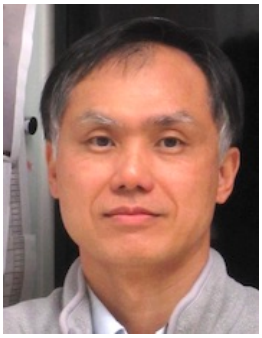

Dr. Ji-Yen Cheng was born in 1968. He received his B.S (1990) and M.S. (1992) in Department of Chemisyry, National Taiwan University, Taiwan. He then completed two years of military service as a training officer. He received Ph.D. in 1998 from Department of Chemistry in National Taiwan University. Currently he is a research fellow in Research Center for Applied Sciences, Academia Sinica Taiwan.

Dr. Cheng's started his post-doc research (1998-2001) on the development of DNA microarray in Institute of Biomedical Sciences in Academia Sinica Taiwan. In 2001 he was appointed as a faculty as an assistant research fellow in Research Center for Applied Sciences in Academia Sinica and was promoted to associate research fellow in 2007 and full research fellow in 2013. His research interest is in the biological applications of microfluidics. Some specific topics include the following:

Cell-based micro analysis, especially cell response in weak DC EF, cell-cell interaction co-culture chip, cellular chemotaxis, electrotaxis and metastasis, affinity binding and separation.
Rapid prototyping of microfluidic biochip using laser micromachining.
Microarray technologies such as flexible in-situ array synthesis, rapid hybridization, mRNA labeling chip, and portable DNA amplification chip.
Laser micromachining – mechanism and applications.

His innovative works in rapid prototyping and DNA amplification chip have been reported in Lab-on-chip in 2005 Sep and 2005 Oct.

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Application of Cross-linked Polypeptide Multilayer Films for Stem Cell Differentiation

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ABSTRACT

Polyelectrolyte multilayer film is an emerging method for substrate coating to regulate cellular behaviors. This material allows for modulation of thickness, stiffness, and adhesiveness. In this study, polypeptide multilayer films were fabricated by the alternate deposition of cationic poly-L-lysine and anionic poly-L-glutamic acid and cross-linked with EDC/sulfo-NHS. The characteristics of film thickness, surface roughness, and Young's modulus were measured by AFM. Human mesenchymal stem cells (hMSCs) and human dental pulp stem cells (hDPSCs) cultured on these films were induced for cardiac differentiation and osteogenic differentiation respectively. Cardiac differentiation of hMSCs was evaluated by q-PCR analysis and immunostaining of cardiac markers. Osteogenic differentiation of hDPSCs was evaluated by calcium deposition staining and q-PCR analysis of osteogenic specific genes, such as ALP (alkaline phosphatase), OCN (osteocalcin), and OPN (osteopontin). In addition, both cardiac and osteogenic differentiations were monitored by cross-linked polypeptide multilayer-coated electrodes using electric cell-substrate impedance sensing (ECIS) method. Our results showed that hMSCs and hDPSCs demonstrated better cell attachment and spreading on even number layer of films, where the top layers are poly-L-glutamic acid films. In addition, significantly higher cardiac and osteogenic differentiation rates were observed on cross-linked films than on culture dishes or cover glasses. Thus, we described a practical approach for the application of cross-linked polypeptide multilayer coatings in tissue engineering and regenerative medicine.

BIOGRAPHY

Chun-Min Lo was born in Chia-Yi, Taiwan. He received his BS (1985) in physics from National Taiwan Normal University and MS (1987) in physics from National Tsing Hua University. He received his Ph.D. (1994) in physics from Rensselaer Polytechnic Institute, Troy, NY. He was a postdoctoral associate at the University of Toronto and the University of Massachusetts Medical School. He was an Assistant Professor at the Cleveland State University and at the University of South Florida. He is currently an Associate Professor in the Department of Biomedical Engineering at the National Yang-Ming University, Taipei, Taiwan. His research interests presently include electric cell-substrate impedance sensing, mechanobiology, and the application of polypeptide multilayer films for

stem cell differentiation. Dr. Lo is a member of American Physical Society, Biophysical Society, Biomedical Engineering Society, and the American Society for Cell Biology.

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Tzu-En Lin (林子恩)

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ABSTRACT

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Technical Session D2-W2-T1: Emerging Technologies and Applications in Electronic, Photonic, and Magnetic Materials, Ceramic Materials, Metallurgy and Materials, Organic Polymer, Soft Materials, and Computational Materials

Workshop Chair & Session Chair

Jia-Min Shieh (謝嘉民)

Deputy Director General
Taiwan Semiconductor Research Institute (TSRI)

BIOGRAPHY

Technical Session D2-W2-T1: Emerging Technologies and Applications in Electronic, Photonic, and Magnetic Materials, Ceramic Materials, Metallurgy and Materials, Organic Polymer, Soft Materials, and Computational Materials

Po-Liang Liu (劉柏良)

Professor and Chairman, Graduate Institute of Precision Engineering
National Chung Hsing University

ABSTRACT

BIOGRAPHY

Technical Session D2-W2-T1: Emerging Technologies and Applications in Electronic, Photonic, and Magnetic Materials, Ceramic Materials, Metallurgy and Materials, Organic Polymer, Soft Materials, and Computational Materials

High-Performance GaN-based Ultraviolet Detectors

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ABSTRACT

The scope of this work is to study the mechanism of hydrogen spillover promoted by metal particles on oxide surfaces at the atomistic level. By means of Density Functional Theory calculations with Hubbard corrections (DFT+U), we have analyzed the adsorption and dissociation of molecular hydrogen on anatase titania, a-TiO_2, (101) surfaces in the presence of a supported Ru_{10} nanocluster. The role of the supported metal particle is essential as it favours the spontaneous dissociation of H_2, a process which does not occur on the bare oxide surface. At low hydrogen coverage, the H atoms prefer to stay on the Ru_{10} particle, charge accumulates on the metal cluster, and reduction of the oxide does not take place. On an hydroxylated surface, the presence of a Ru nanoparticle is expected to promote the reverse effect, i.e. hydrogen reverse spillover from the oxide to the supported metal. It is only at high hydrogen coverage, resulting in the adsorption of several H_2 molecules on the metal cluster, that it becomes thermodynamically favourable to have a hydrogen transfer from the metal to the O sites of the oxide surface. The migration of an H atom from the Ru cluster to the a-TiO_2 (101) surface is accompanied by an electron transfer to the empty states of the support with reduction of the oxide surface —the formation of Ti^{3+} center is therefore observed.

BIOGRAPHY

Dr. Pinghui Sophia Yeh is an associate professor at Department of Electronic and Computer Engineering and Graduate Institute of Electro-Optical Engineering, National Taiwan University of Science and Technology. Her team demonstrated a GaN-based single-mode vertical-cavity surface-emitting laser (VCSEL) that has a submilliamp threshold current and a record-low divergence angle. Dr. Yeh received her B.S. degree in Physics from National Taiwan University and Ph.D. degree in Electrical Engineering from University of Maryland, College Park, USA. Afterwards, she had worked six years for *SDL Inc.*, a world leader in making high-power laser diodes and Er-doped fiber amplifier (EDFA) pump modules, located at San Jose, California. She was in charge of engineering and development of GaAs-based laser diodes including master oscillator power amplifier and high-speed high-temperature laser-diode transmitter. Dr. Yeh was promoted in 1999 as an engineering section manager. After *SDL* was acquired by *JDS Uniphase* in 2001, Dr. Yeh founded a high-tech startup, *Optospace Technologies Inc.*, aimed at making novel optical components for applications in optical communications and/or biophotonics. She received several SBIR (small business innovation research) awards from National Science Foundation

(in 2003 and 2005), and National Institutes of Health (in 2006). Her current research interests include GaN-based LEDs, laser diodes and photodetectors, and fiber-based light sources.

Technical Session D2-W2-T1: Emerging Technologies and Applications in Electronic, Photonic, and Magnetic Materials, Ceramic Materials, Metallurgy and Materials, Organic Polymer, Soft Materials, and Computational Materials

Development of Highly Stable Solution Processable Solar Cells

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Lee-Yih Wang (王立義)

Professor, Center for Condensed Matter Sciences
National Taiwan University

ABSTRACT

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Technical Session D2-W3-T1: Emerging Technologies and Applications in New Energy Materials and Devices, Perovskite, Power Electronics, Smart Energy Systems and Technologies (SEST), Smart Homes, Smart Buildings, and Smart Communities, Energy Storage and Utilization, Clean/Intelligent Vehicle Technologies, and Artificial Intelligence (AI) Applications in New Materials and Energy

Workshop Chair & Session Chair

Chih-Wei Chu (朱治偉)

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BIOGRAPHY

Dr. Chih Wei Chu was born on 4th November, 1972 in Taipei, Taiwan. He received the B.S. in Department of Chemical Engineering from Chung Yuan University, Taiwan in 1995, M.S. in Departemet of Civil and Environmental Engineering and Ph.D degrees in Department of Materials Science & Engineering from University of California, Los Angeles, USA, in 1998 and 2006, respectively. He was the senior research and development engineer at Inteplast Group, Texas, USA during 1998-2001. He joined Research Center for Applied Sciences (RCAS) at Academic Sinica and was promoted to associate research fellow and research fellow in 2010 and 2014, respectively. Currently, he served as Deputy Director in RCAS. He is also joint appointment professors of College of Engineering, Chang Gung University, Department of Photonics, National Chiao Tung University, and Department of Materials Science and Engineering, National Tsing Hua University. He was elected as associate academicians in the Asia Pacific Academy of Materials. He is a materials scientist with expertise in the fields of thin film electronics, such as photovoltaic cells, LEDs, batteries, and memory devices. He has published more than 200 refereed papers with over 10000 citations (H-index 51). Chu's research focuses on development of advanced materials for energy saving, conversion, and storage technologies.

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Photovoltaics and Optical characteristics of Low-dimensional Perovskites

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ABSTRACT

The halide perovskites materials have received exceptional attention for various photonics applications due to their unique materials characteristics. In this talk, we will present halide perovskites thin film made of low-dimensional structure. Their performance in photovoltaic and non-linear optical properties will be presented and discussed. Such families of hybrid organic-inorganic halide perovskite semiconductors are promising candidates for next generation photonic and applications such as solar cells, light-emitting diode, and lasing devices. The slightly 2D doped perovskite showed larger grain size and better photovoltaic performances in both power conversion efficiency and stability. Low-dimensional perovskite made with Low-pressure vapor-assisted solution process (LP-VASP) and solution process will be presented. For highly 2D doped perovskite thin film, we observed multiple PL emission spectra with significant multiphoton absorption characteristics, which implies the co-existence of multiple n-layered perovskites domains in one film. The nonlinear optical effects are characterized by multiphoton spectroscopy KPFM, TR-PL, and PL mapping.

BIOGRAPHY

Born in Tounan, Yunlin County, Dr. Chen completed his high school in Taipei (Chien-Kuo High School) and BS in NCKU Tainan (major in Materials Sci. & Engineering, minor in Foreign Languages and Literature). Before going to Switzerland for Ph. D study at 2004, he has worked in tsmc and CCMS (Center of Condensed matter Sciences) NTU. He received Ph. D. from the Photonic Program in EPFL Switzerland at 2009 focusing on solid-state dye sensitized solar cells under the supervision of Prof. Michael Grätzel. Then he moved to Monash University in Australia as a post-doctoral research fellow with Prof. Udo Bach.

Dr. Chen joined the Dept. of Photonic in National Cheng Kung University (NCKU, Tainan, Taiwan) in 2010 and became associate Professor and Professor in 2014 and 2017 respectively. He was the director of the research and education division in the Center for Micro/Nano Science and technology (CMNST) in NCKU between Aug. 2017~ Jan. 2019. Currently his research interests are in the area of various photovoltaic materials and devices including dye-

sensitized solar cells (DSCs), hybrid organic-inorganic perovskite-based solar cells (HOIPs) and novel semiconductor compounds. Meanwhile, he also involved in developing synthetic and characterization methods for TCO material, thin film, and semiconductor materials.

Prof. Chen is currently in the editorial board member for Scientific Reports (NPG) and energies (MDPI). He is the recipient of several awards including 2005-2008 Taiwan Merits Scholarships Program, 2017 Young Researcher Innovation Award of Taiwan Comprehensive University, 2017 NCKU Teaching Excellence Award and 2019 Y. Z. Hsu Science Paper Award (Optoelectronics Science & Technology). He has been identified in the list of 2018 Clarivate highly cited researchers.

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Yu-Lun Chueh (闕郁倫)

Professor, Department of Materials Science and Engineering
National Tsing Hua University

ABSTRACT

BIOGRAPHY

Technical Session D2-W3-T1: Emerging Technologies and Applications in New Energy Materials and Devices, Perovskite, Power Electronics, Smart Energy Systems and Technologies (SEST), Smart Homes, Smart Buildings, and Smart Communities, Energy Storage and Utilization, Clean/Intelligent Vehicle Technologies, and Artificial Intelligence (AI) Applications in New Materials and Energy

Carbon-based counter electrodes for dye-sensitized solar cells

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ABSTRACT

The ultimate goal of renewable solar energy is aimed at developing low-cost, high-efficiency photovoltaic technologies that can satisfy the demand for future terawatt-scale solar energy. The dye-sensitized solar cells (DSSCs) with the facile assembly, cost-effectiveness, and environmental friendliness are considered to be one of the most promising candidates for next-generation solar cells. However, the typical Pt counter electrode suffers from the noble and rare nature as well as the poor stability in the electrolyte, which make it challenging for the commercialization of DSSC. Accordingly, the carbonaceous material becomes an alternative for Pt-free counter electrodes due to the multiple advantages of low cost, high electrical conductivity, high catalytic activity, and good corrosion resistance. In this talk, the working principle of DSSC will be explained firstly and followed by a brief overview of carbon-based counter electrodes. A new approach to prepare a low-cost, high-conductivity carbon-based counter electrode with tunable catalytic activity via atomic layer deposition will be introduced in the presentation.

BIOGRAPHY

Chih-Liang Wang received his B.S. (2005) and M.S. (2007) from National Tsing Hua University and Ph.D. (2014) from The University of Texas at Austin, all in Materials Science and Engineering. He then served as a Principal Engineer in the Department of Chemical Vapor Deposition (CVD) and Epitaxy (EPI) at Taiwan Semiconductor Manufacturing Company (TSMC) between 2015 and 2016 and joined the Graduate Institute of Precision Engineering at National Chung Hsing University as an Assistant Professor in August of 2016. His current research focuses on the application and development of the thin-film materials and syntheses regarding solar cells, energy storages, and electronic devices. He is a member of the Materials Research Society (MRS), International Solar Energy Society (ISES), Taiwan Association for Coating and Thin Film Technology (TACT), Materials Research Society Taiwan (MRST), Taiwan Vacuum Society (TVS).

Technical Session D2-W1-T2: Emerging Technologies and Applications in Materials for Healthcare and Medicine: Bio-Materials, Bio-SoC, Bio-Nanotech, Bio-NEMS/Bio-MEMS, Biomedical Optics and Imaging, Biomedical Engineering and Systems, Biomedical Informatics, Mobile Health, Virtual Reality (VR) and Healthcarelity (VR) and Healthcare

Session Chair

Ji-Yen Cheng (鄭郅言)

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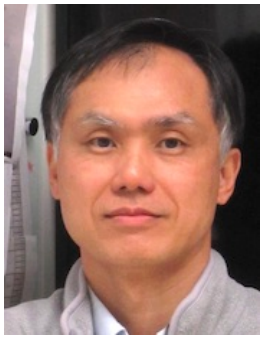
BIOGRAPHY



Dr. Ji-Yen Cheng was born in 1968. He received his B.S (1990) and M.S. (1992) in Department of Chemisyry, National Taiwan University, Taiwan. He then completed two years of military service as a training officer. He received Ph.D. in 1998 from Department of Chemistry in National Taiwan University. Currently he is a research fellow in Research Center for Applied Sciences, Academia Sinica Taiwan.

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Rapid prototyping of microfluidic biochip using laser micromachining.
Microarray technologies such as flexible in-situ array synthesis, rapid hybridization, mRNA labeling chip, and portable DNA amplification chip.
Laser micromachining – mechanism and applications.

His innovative works in rapid prototyping and DNA amplification chip have been reported in Lab-on-chip in 2005 Sep and 2005 Oct.

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2.5D polymer multilayer micromodel for geographic investigations

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ABSTRACT

Microfluidic micromodel is an attractive approach for the studies relate to fundamental flow phenomena in porous media. Most of the current microfluidic model processes are limited by the 2D geometry, so the fluid in the micromodel cannot fully represent the flow conditions in the real porous medium. Compared to a 2-D micromodel, the quasi 3-D micromodel can better represent the 3-D features of multi-phase flow in real porous media. Quail 3-D (also refer to 2.5D) micromodel has proposed recently. However, most recent quasi 3-D micromodel were fabricated either by silicon-based microfabrication techniques or by 3D printer. These processes require expensive high-end fabrication facilities or clean room to fabricate the 3-D micromodel which limits researcher investigating the fluidic behavior in natural porous media. In this talk, we first report using simple and low-cost desktop CNC micromiller fabricating quasi-3D microfluidic model for geographic and biological analysis. The2.5D geographic micromodel was defined by the micro X-Ray computed tomography scan (X-Ray CT scan) from a natural soil model. And the biological microfluidics model was obtained from rat brain tissue imaging. The enlarged bio-intimating microfluidic model can be used as preliminary study of flow phenomena investigating the morphology and structural conformation of Aβ understanding the clearance mechanism. Fabrication of the multilayer micromodel was using 100 μm thick thin cyclic block copolymer (CBC) polymer films. The CBC film was first engraved by a micromiller then attached to a PMMA holder transferring the pattern to the base substrate as a single micromodel. By repeating the fabricating steps, one, four, and eight layers were generated as quasi-3D micromodel. For geographic analysis, five different flow rates and five different micromodels designs were investigated. We first performed imbibition and imbibition-drainage experiments on single-layer, 4-layer and 8-layer micromodels at a flow rate of $3, 6, 60, 150$ and $300\ \mu l/min$.

BIOGRAPHY

Dr. Chia-Wen Tsao is a Professor in Department of Mechanical Engineering, National Central University, Taiwan. And Director of CAIC (Center for Academia and Industrial Collaboration), National Central University, Taiwan. Dr. Tsao got his M.S. degree in Department of Mechanical Engineering in University of Colorado at Boulder and Ph.D. degree in Department of Mechanical Engineering in University of Maryland at College Park. His research interests includes micro/nano-

fluidics, Micro/Nanofabrication, Lab-on-chips device, MEMS, mass spectrometry technologies and head of Microfluidics and Microfabrication Laboratory in National Central University. Before joining the National Central University, Taiwan. He assists organizing numerous international conference including, MicroTAS, Annual World Congress of Nano Science and Technology, Nano Engineering and Microsystem Technology Conference, International Conference on Optofluidics, and etc… He also services as Associate Editor of of IET Micro & Nano Letters. Dr. Tsao received Young Faculty Award, and National Central University Outstanding Research Award in year of 2008, 2013 and 2017.

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Triboelectrification as an Efficient Tool for the Development of Self-Powered Sensors and Systems

Zong-Hong Lin (林宗宏)

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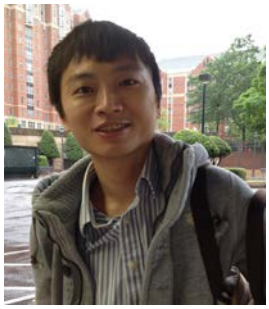
ABSTRACT

The solid-liquid contact electrification based triboelectric nanogenerators have been widely utilized for energy harvesting applications. So far, its potential to outperform as facile and highly efficient nanosensor have not been explored and reported. Here, we have designed the first solid-liquid contact electrification based triboelectric nanosensor for self-powered chemical sensing. The unprecendently innovative nanosensor is based on the contact electrification between tellurium nanowires (Te NWs) and a liquid solvent where Te NWs served as a triboelectric performance enhancer and as recognition element for the selective detection of Hg2+ ions. Different solvents like deionized (DI) water and Acetone were employed as the liquid triboelectric layer to evaluate the sensor performance by changing the liquid property. The output voltage was increased by a factor of 3.0 for highest Hg2+ concentrations when DI water was replaced by Acetone as the liquid triboelectric layer. Moreover, change in the surfaces properties like the hydrophilicity and hydrophobicity also influences the triboelectric output signals of the sensor. Owing to the highly specific reaction between Te and Hg2+, the as-fabricated single electrode mode nanosensor can detect mercury concentrations as low as 1.1 nM and offers a good linear range (10 nM-10 mM). Importantly, this study is the first to fully integrate the solid-liquid contact electrification effect with a highly efficient chemical sensor. In addition, this work is believed to present a novel paradigm of designing a fully integrated, rapid, stand-alone, portable, low-cost self-powered sensor systems for highly selective and sensitive detection of mercury ions in the complex environmental samples.

BIOGRAPHY



Zong-Hong Lin received his Ph.D. (2009) in Department of Chemistry from the National Taiwan University. After one year in the army (2009-2010), he started his postdoctoral career at the National Taiwan University between 2010 and 2012. Then he joined Georgia Institute of Technology as a postdoctoral researcher between 2012 and 2014. He was an Assistant Professor in Institute of Biomedical Engineering, National Tsing Hua University from 2014 to 2017. Since 2017, he was promoted to Associate Professor. Dr. Lin's main research interests are in the field

of self-powered nanosensors, disinfection nanomaterials/systems, and wearable electronics. He has published over 80 SCI papers (sum of the times cited: 6758, h-index: 43) and has been awarded with Yong Investigator Award of the 5th Asian Biomaterials Congress (ABMC5), Yong Investigator Award of the 21th Symposium of Association for Chemical Sensors in Taiwan (2016 SACST) and Yong Investigator Award of the National Tsing Hua University (2018).

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Microfluidic Analytical Systems for Point-of-Care Diagnosis

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ABSTRACT

Healthcare issues are keeping increased substantially in recent years. Such research and investment have focused on fighting major diseases, enabled by the novel invention of efficient drug development for treatment and side effect reduction, along with the improved vector control. However, classic diagnostic technologies are not completely suited to meet the expanded testing requirement because they rely on complicated sample purification and sophisticated instruments which are complicated, time-consuming, expensive and requirement of well-trained technicians.

In order to the improved efficiency in laboratory diagnostics, there has been a trend towards more decentralized diagnostics which occurs directly at patients' bedside, in outpatient clinics or at sites of accidents, so-called point-of-care (POC) systems. The concept of POC testing is mainly by the patient, so short turnaround time, minimum sample preparation, long-term reagent storage, user-friendly analytical instruments and visible quantitative or semi-quantitative single readout is crucial. In our research group, we address the need using polymer and paper-based analytical platforms. They have been developed for biomedical sensing and analysis in resource-limited settings based on their advantages of low sample volume requirement, rapid detection, cost effectiveness, portable and highly integrated. Moreover, different sensing components, including device fabrication, surface chemistry, signal amplification and biomolecular recognition are also investigated.

BIOGRAPHY

Chien-Fu Chen is an Associate Professor in the Institute of Applied Mechanics at National Taiwan University, Taiwan. He obtained his Ph.D. at the Institute of Applied Mechanics from National Taiwan University in 2007. He then did his postdoctoral research at the University of Maryland, College Park from 2007 to 2011. As an independent PI, he received the Youth Scholar Grant Award from the Ministry of Science and Technology, Taiwan in 2018. Prof. Chen's research focuses on portable and miniaturized systems utilizing micro/nanomaterials for biomedical point-of-care sensing applications based on affordability, sensitivity, specificity, user-friendliness, rapid and robust features.

Technical Session D2-W2-T2: Emerging Technologies and Applications in Electronic, Photonic, and Magnetic Materials, Ceramic Materials, Metallurgy and Materials, Organic Polymer, Soft Materials, and Computational Materials

Session Chair

Po-Liang Liu (劉柏良)

Professor and Chairman, Graduate Institute of Precision Engineering
National Chung Hsing University

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Technical Session D2-W2-T2: Emerging Technologies and Applications in Electronic, Photonic, and Magnetic Materials, Ceramic Materials, Metallurgy and Materials, Organic Polymer, Soft Materials, and Computational Materials

MICAtronics: A New Platform for Flexible Electronics

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ABSTRACT

In the present era of "Internet-of-Things", the demand for flexible, light-weight, low-cost, low-power consumption, multifunctional, and environmentally friendly electronics has moved to the forefront of materials science research. Numerous compounds with unique material properties in epitaxial thin film form hold key to future technologies. van der Waals epitaxy (vdWE) involving two-dimensional layered materials can play a crucial role in the expansion of thin film epitaxy by overcoming the bottleneck of material combinations due to lattice/thermal matching conditions inherent to conventional epitaxy. Among the layered materials, mica is a well-known phyllosilicate mineral that can have a remarkable impact on flexible electronics. We confine ourselves to the validity of vdWE of functional oxides on muscovite mica throughout this treatise. These heterostructures with excellent properties are flexible and exhibit high-temperature stability. With such demonstrations, it is anticipated that MICAtronics, vdWE on mica, can reveal unusual properties and emergent phenomena in the realm of high-performance flexible device applications.

BIOGRAPHY

Ying-Hao Chu was born in Kaohsiung in 1976. He obtained a bachelor degree in 1999 and a PhD degree in 2004 from National Tsing Hua University, Taiwan. His major field of study was Materials Science and Engineering. Then, he joined University of California, Berkeley as a postdoc. In 2008, he acquired an assistant professorship in Department of Materials Science & Engineering at National Chiao Tung University. He was promoted to an associate professor in 2015, and then he was promoted to a professor in 2018. From 2019, he was appointed as a distinguished professor. Since 2013, he has an adjunct position in institute of physics, Academia Sinica. In 2014. he started an adjunct position in Department of Electrophysics, National Chiao Tung University. From 2016 to 2018, he had the adjunct position in the Material and Chemical Research Laboratories, Industrial Technology Research Institute and the International College of Semiconductor Technology at National Chiao Tung university. From 2019, he has an appointment with ACS Applied Electronic Materials to be an associate editor. His research is highly focused on complex functional oxides and strongly correlated electron systems. He has extensive experience in the use of advanced characterization techniques to understand and manipulate functional oxide heterostructures, nanostructures, and interfaces. His current goal is try to create a pathway to use high quality oxide heteroepitaxy for soft transparent technology. Now, he is a pioneer with

the most publication along this research direction. Due to his excellent research performance, he was awarded with: 1. Thomson Reuters Highly Cited Researchers in Materials Science (2014, 2016, 2018), 2. The Academia Sinica Research Award for Junior Research Investigators, 3. Outstanding Research Award of Ministry of Science and Technology of Taiwan, 4. Futuristic Breakthrough Technology Award, 5. Young Researcher Award of The Physical Society of Taiwan, 6. Wu Ta-You Award, 7. Young Researcher Award of the Materials Research Society Taiwan, 8. Young Researcher Award of the Taiwan Vacuum Society, 9. Y. Z. Hsu scientific paper award in Nanotechnology.

Technical Session D2-W2-T2: Emerging Technologies and Applications in Electronic, Photonic, and Magnetic Materials, Ceramic Materials, Metallurgy and Materials, Organic Polymer, Soft Materials, and Computational Materials

Ab initio phase stability and electronic conductivity of the doped-$Li_4Ti_5O_{12}$ anode for Li-ion batteries

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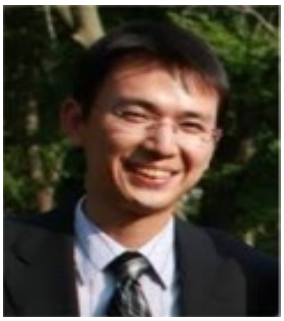
BIOGRAPHY



Dr. Shih-kang Lin is an associate professor in dept. Mater. Sci. Eng. at National Cheng Kung University in Taiwan. His researches focus on computational thermodynamics-assisted design of advanced processes and materials, including Li-ion and solid-state batteries, lead-free solders, steels and multi-principal element alloys. He currently serves as the vice chairperson of the Alloy Phase Committee of TMS, an advisor as well as a guest editor for JOM, and the vice director of Hierarchical Green-Energy Materials (Hi-GEM) Research Center, NCKU.

ABSTRACT

The Li4Ti5O12 (LTO) defect spinel is a promising anode material for lithium-ion batteries (LIBs), but it shows an intrinsic insulating property and poor electrochemical kinetics. Doping is a direct approach to manipulate the electronic conductivity of LTO. However, doping may induce multiple effects influencing the overall electrochemical kinetics, e.g., changing the size of particles and the ionic and electronic conductivities. Here we systematically investigated the phase stability, electronic conductivity, and electrochemical kinetics of M-doped LTO (M = Na, K, Mg, Ca, Sr, Al, and Ga). With both ab initio calculations and experiments, the mechanism of electron transport within LTO is elucidated, the desired type of dopants for improving electronic conductivity of LTO is clarified, and the role of electronic conductivity in the electrochemical kinetics of LTO is revealed. These results provide mechanistic insight into the doping approach to LTO and would guide the development of a variety of electrode materials.

References

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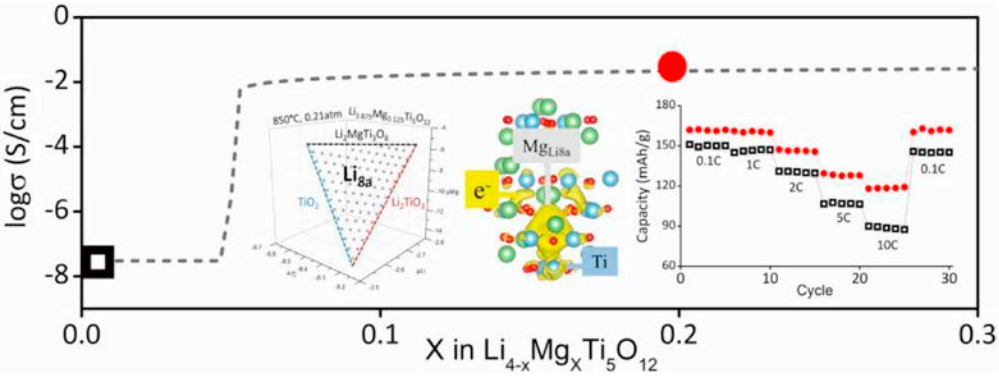

Figure 1. The enhancement of electronic conductivity as well as the role of electron transport in electrochemical kinetics are demonstrated for doped-$Li_4Ti_5O_{12}$

Technical Session D2-W2-T2: Emerging Technologies and Applications in Electronic, Photonic, and Magnetic Materials, Ceramic Materials, Metallurgy and Materials, Organic Polymer, Soft Materials, and Computational Materials

Self-powered GaN-based Nanowire LEDs

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ABSTRACT

Single-crystal n-type GaN nanowires have been grown epitaxially on a Mg-doped p-type GaN substrate. Piezoelectric nanognerators based on GaN nanowires are investigated by conductive AFM, and the results showed an output power density of nearly 12.5 mW/m2. Luminous LED modules based on n-GaN nanowires/p-GaN substrate have been fabricated. CCD images of the lighted LED and the corresponding electroluminescence spectra are recorded at a forward bias. Moreover, the GaN nanowire LED can be lighted up by the power provided by a ZnO nanowire based nanogenerator, demonstrating a self-powered LED using wurtzite-structured nanomaterials.

BIOGRAPHY

Dr. Chih-Yen Chen is currently an Assistant Professor in the Department of Materials and Optoelectronic Science, National Sun Yat-sen University (NSYSU), Taiwan. He received his Doctor of Philosophy degree (2012) in National Tsing Hua University (NTHU), Taiwan, and then enrolled one-year compulsory military service. From 2014 to 2016, he was also a researcher in the Department of Material Science and Engineering, University of California, Los Angeles and a research scientist at Georgia Institute of Technology in the USA. His main research interests focus on the fields of wearable nanogenerators, hybrid nanogenerators, and energy storage such as lithium batteries and supercapacitors for fabricating new electronic and optoelectronic devices.

Technical Session D2-W3-T2: Emerging Technologies and Applications in New Energy Materials and Devices, Perovskite, Power Electronics, Smart Energy Systems and Technologies (SEST), Smart Homes, Smart Buildings, and Smart Communities, Energy Storage and Utilization, Clean/Intelligent Vehicle Technologies, and Artificial Intelligence (AI) Applications in New Materials and Energy

Session Chair

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BIOGRAPHY

Born in Tounan, Yunlin County, Dr. Chen completed his high school in Taipei (Chien-Kuo High School) and BS in NCKU Tainan (major in Materials Sci. & Engineering, minor in Foreign Languages and Literature). Before going to Switzerland for Ph. D study at 2004, he has worked in tsmc and CCMS (Center of Condensed matter Sciences) NTU. He received Ph. D. from the Photonic Program in EPFL Switzerland at 2009 focusing on solid-state dye sensitized solar cells under the supervision of Prof. Michael Grätzel. Then he moved to Monash University in Australia as a post-doctoral research fellow with Prof. Udo Bach.

Dr. Chen joined the Dept. of Photonic in National Cheng Kung University (NCKU, Tainan, Taiwan) in 2010 and became associate Professor and Professor in 2014 and 2017 respectively. He was the director of the research and education division in the Center for Micro/Nano Science and technology (CMNST) in NCKU between Aug. 2017~ Jan. 2019. Currently his research interests are in the area of various photovoltaic materials and devices including dye-sensitized solar cells (DSCs), hybrid organic-inorganic perovskite-based solar cells (HOIPs) and novel semiconductor compounds. Meanwhile, he also involved in developing synthetic and characterization methods for TCO material, thin film, and semiconductor materials.

Prof. Chen is currently in the editorial board member for Scientific Reports (NPG) and energies (MDPI). He is the recipient of several awards including 2005-2008 Taiwan Merits Scholarships Program, 2017 Young Researcher Innovation Award of Taiwan Comprehensive University, 2017 NCKU Teaching Excellence Award and 2019 Y. Z. Hsu Science Paper Award (Optoelectronics Science & Technology). He has been identified in the list of 2018 Clarivate highly cited researchers.

Technical Session D2-W3-T2: Emerging Technologies and Applications in New Energy Materials and Devices, Perovskite, Power Electronics, Smart Energy Systems and Technologies (SEST), ***Smart Homes, Smart Buildings, and Smart Communities, Energy Storage and***

Utilization, Clean/Intelligent Vehicle Technologies, and Artificial Intelligence (AI) Applications in New *Materials and Energy*

A facile, scalable and ecofriendly approach for the fabrication of high performance flexible all-solid-state supercapacitors

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ABSTRACT

In this study, freestanding paper-like composite films were fabricated using a simple, but scalable and efficient, approach: an environmentally friendly freeze-and-thaw process giving a porous fibrous matrix of cellulose and functionalized carbon nanotubes (f-CNTs), followed by in situ chemical polymerization for the incorporation of polypyrrole (PPy). A homogeneous porous fibrous matrix was formed as a result of strong hydrogen bonding between the f-CNTs and the regenerated cellulose; this material served as an excellent template for the uniform coating of PPy. The structural, morphological, thermal, and electrochemical properties of the as-prepared PPy/f-CNT/cellulose composite films were investigated to evaluate their potential for use as flexible, lightweight, and inexpensive freestanding electrode materials within flexible supercapacitors. The unique microstructure—with high electrical conductivity, good wettability, and a porous architecture—provided large interfacial areas for the storage/release of charge carriers and for the facile diffusion of electrolyte ions in the prepared composite electrodes. With these attributes, the freestanding electrode having the optimal PPy loading exhibited not only an excellent areal capacitance (2147 mF cm-2 at a current density of 1 mA cm-2) but also a good rate capability and an outstanding cycling stability. Moreover, the flexibility, environmental friendliness, and biodegradability of the PPy/f-CNT/cellulose composite films suggest that they will be suitable for use as green and sustainable electrode materials within flexible supercapacitors.

BIOGRAPHY

Rong-Ho Lee received his BS (1991) in Textile Engineering Department from Feng-Chia University (Taichung, Taiwan), MS (1993) in Chemical Engineering Department from Yuan-Ze University (Taoyuan, Taiwan), and Ph. D. (1998) in Chemical Engineering Department from National Tsing Hua University (Hsinchu, Taiwan). From 1999 to 2003, he was an engineer at Industrial Technology Research Institute (ITRI, Hsinchu, Taiwan). In 2004, he worked as an Assistant Professor of Chemical and Materials Engineering at National Yunlin University of Science and Technology (NYUST, Yulin County, Taiwan). In 2008, he was promoted to be an Associate Professor of Chemical and Materials Engineering at NYUST, and subsequently moved to Chemical Engineering Department of National Chung Hsing University (NCHU, Taichung, Taiwan) two years later. In 2014, he was promoted to the rank of full Professor of Chemical Engineering Department at NCHU. His current research emphasizes on the synthesis and electro-optical properties of conjugated

polymers. He has published over 90 articles in scientific journals until now.

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Investigating an All-organic Battery Using Polyisothianaphthene as a Redox-active Bipolar Electrode Material

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ABSTRACT

Polyisothianaphthene has the smallest bandgap among all conjugated polymers and delivers high electrical conductivity. This study uses polyisothianaphthene as an active material to accept both lithium ions and PF6− on its cyclic C–S–C bond and benzene ring during the processes of n-doping and p-doping. This study discovers that lithium polysulfide and lithium sulfide are formed during the first electrochemical reaction; however, the impedance, rate performance, and energy density of polyisothianaphthene cells are not affected by those side products. By contrast, an increment of superior rate (10 C) testing is significantly improved by those new sulfur-based solid electrolyte interphase formations compared with transitional anode materials, such as graphite, silicon, and other conjugate polymers. The surface characteristics of the polyisothianaphthene electrode are investigated through in situ X-ray absorption spectroscopy, in operando Fourier transform infrared spectroscopy, scanning electron microscopy, and X-ray photoelectron spectroscopy. Furthermore, the reaction mechanisms of n-doping and p-doping on polyisothianaphthene are discussed. The polyisothianaphthene electrode's acceptance of lithium ions exhibits a specific capacity of 730 mAh g−1 at the second cycle as well as of 106 mAh g−1 when it reacts with PF6−. The battery performance exhibits a capacity of approximately 92 mAh g−1 in the bipolar mode. The low-bandgap–conjugated polyisothianaphthene is shown to have high reversibility in terms of bipolar electrochemical reactions, which indicates that it can be a promising bipolar organic material for use in lithium ion batteries.

BIOGRAPHY

Education/Career:

2018-present Professor, National Taiwan University of Science and Technology
2014-2018 Associate Professor, National Taiwan University of Science and Technology
2010-2014 Assistant Professor, National Taiwan University of Science and Technology
2009-2010 Researcher, Industrial Technology Research Institute
2009 Doctor of Chemical Engineering, National Tsing Hua University
2005-2009 Associate Researcher, Industrial Technology Research Institute
2004 M. S., National Taiwan University of Science and Technology
2002 B. S., National Taipei University of Technology

Research Interests:

Lithium ion battery, Polymer electrolyte/ Electrolyte additive, Electrochemical interfacial, *In-situ*/ *In-operando* observations and Biosensor

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Rendering Stable Metal–Organic Framework-Based Materials Electrochemically Active

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ABSTRACT

Given several advantages of metal–organic frameworks (MOFs) including regular porosity, ultrahigh specific surface area, and periodic intra-framework functionality, MOFs have been served as the porous supports and utilized in a range of applications. Among various MOFs, zirconium-based MOFs (Zr-MOFs) are generally water-stable, which opens the opportunity of utilizing these MOFs in various applications needing to be operated in aqueous media. However, the electrically insulating nature of these MOFs limits their use in electrochemical applications.

In this talk, various strategies that render the use of Zr-MOFs for electrochemical applications will be highlighted, including the utilization of redox hopping pathway in Zr-MOFs, the design of electrically conducting Zr-MOFs, and the harnessing of Zr-MOF-based nanocomposites. With the improved charge-transport rate and a high density of accessible active sites supported by the highly porous Zr-MOFs, the resulting MOF materials reveal promising performances in a range of electrochemical applications including charge storage, electroanalysis, and electrocatalysis.

BIOGRAPHY

Prof. Chung-Wei Kung, born in Taipei in Jan. 6, 1989, earned his B.S. degree from National Taiwan University (NTU), Department of Chemical Engineering in 2011, and enrolled in the Ph.D. program in the same department in Prof. Kuo-Chuan Ho's group. From March 2013 to March 2014, he joined The Hupp Group in Department of Chemistry, Northwestern University, United States as a visiting scholar. After earning his Ph.D. degree in NTU, he returned to Northwestern as a postdoctoral researcher from September 2016 in The Hupp and Farha Groups. He joined Department of Chemical Engineering, National Cheng Kung University (NCKU), Taiwan as an assistant professor and launched an independent research group in August 2018.

His research focuses on the design and synthesis of metal–organic frameworks (MOFs), MOF-based nanocomposites and relevant porous materials for various electrochemical applications. He has published more than 50 articles on SCI peer-reviewed journals since 2010, with an h-index of 27 according to Scopus Database. He is one of the twenty-five Yushan Young Scholars of 2018, awarded by Ministry of Education (MOE), Taiwan.

Technical Session D2-W1-T3: Emerging Technologies and Applications in Materials for Healthcare and Medicine: Bio-Materials, Bio-SoC, Bio-Nanotech, Bio-NEMS/Bio-MEMS, Biomedical Optics and Imaging, Biomedical Engineering and Systems, Biomedical Informatics, Mobile Health, Virtual Reality (VR) and Healthcarelity (VR) and Healthcare

Session Chair

ABSTRACT

BIOGRAPHY

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BIOGRAPHY

Dr. Chia-Wen Tsao is a Professor in Department of Mechanical Engineering, National Central University, Taiwan. And Director of CAIC (Center for Academia and Industrial Collaboration), National Central University, Taiwan. Dr. Tsao got his M.S. degree in Department of Mechanical Engineering in University of Colorado at Boulder and Ph.D. degree in Department of Mechanical Engineering in University of Maryland at College Park. His research interests includes micro/nano-fluidics, Micro/Nanofabrication, Lab-on-chips device, MEMS, mass spectrometry technologies and head of Microfluidics and Microfabrication Laboratory in National Central University. Before joining the National Central University, Taiwan. He assists organizing numerous international conference including, MicroTAS, Annual World Congress of Nano Science and Technology, Nano Engineering and Microsystem Technology Conference, International Conference on Optofluidics, and etc… He also services as Associate Editor of of IET Micro & Nano Letters. Dr. Tsao received Young Faculty Award, and National Central University Outstanding Research Award in year of 2008, 2013 and 2017.

Technical Session D2-W1-T3: Emerging Technologies and Applications in Materials for Healthcare and Medicine: Bio-Materials, Bio-SoC, Bio-Nanotech, Bio-NEMS/Bio-MEMS, Biomedical Optics and Imaging, Biomedical Engineering and Systems, Biomedical Informatics, Mobile Health, Virtual Reality (VR) and Healthcarelity (VR) and Healthcare

Enriching Extracellular Vesicles from Small Samples

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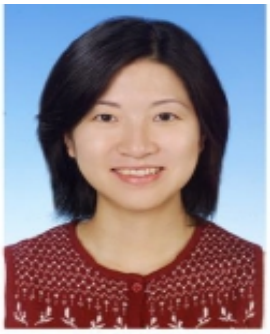
ABSTRACT

Extracellular vesicles (EVs) have great potentials as diagnostic and prognostic biomarkers. This presentation reports methods that utilize functionalized magnetic beads or cellulose fibers to enrich EVs from 10-100 µl of biofluids. Simultaneous quantifications of EV-associated microRNAs and cardiac troponin I (cTN-I) and N-terminal pro-B-type natriuretic peptide (NTproBNP) in clinical samples reveal negative correlations, suggesting that EV-associated microRNAs may be potential biomarkers for cardiovascular diseases (CVDs).

BIOGRAPHY



Chihchen Chen received her B.S. (1995) and M.S. (1997) in Electrical Engineering from the National Taiwan University. She received her Ph.D. (2006) from the University of Washington at Seattle, WA, with dual degrees in Bioengineering and Nanotechnology. She was a postdoctoral associate at the Massachusetts General Hospital between 2006 and 2009. Currently she is an Associate Professor of the Institute of NanoEngineering and MicroSystems, Department of Power Mechanical Engineering at the National Tsing Hua University, Hsinchu, Taiwan. Dr. Chen's areas of expertise and research interests are micro- and nano-fluidic technologies for applications in biology and medicine, with a focus on the isolation and characterization of the cellular and sub-cellular components. She is a member of the International Society for Extracellular Vesicles.

Technical Session D2-W1-T3: Emerging Technologies and Applications in Materials for Healthcare and Medicine: Bio-Materials, Bio-SoC, Bio-Nanotech, Bio-NEMS/Bio-MEMS, Biomedical Optics and Imaging, Biomedical Engineering and Systems, Biomedical Informatics, Mobile Health, Virtual Reality (VR) and Healthcarelity (VR) and Healthcare

Clinical Feasibility and Mechanism Discussion of Plasma-activated Medium as Adjuvant Therapy on Malignant Pleural Effusion

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ABSTRACT

In the past, MPE associated lung adenocarcinoma was regarded as terminal cancer, meaning that there was no radical treatment and that survival rate was low. Traditionally, patients underwent palliative treatment, such as serial thoracentesis, pleural catheter, and pleurodesis. Besides, intrapleural perfusion hyperthermo-chemotherapy and photodynamic therapy (PDT), can inhibit tumor growth and improve survival rate. Nevertheless, methods mentioned above have an impact on surrounding healthy tissue or cause systemic side effects. As a result, another way to cure lung cancer with MPE is needed. Studies have shown that reactive oxygen/nitrogen species (RONS) of NTAPPJ and plasma-activated medium (PAM) induce tumor cells apoptosis and have short half-life. Comparing it with chemotherapy and radiation therapy, NTAPPJ and PAM can cause less harm to patients.

In the experiment, RPMI medium was treated with NTAPPJ for PAM preparation. Then, RONS in PAM were detected. The cells were treated with PAM and then their activity, proliferation and migration ability were measured. The results showed that, the lung adenocarcinoma cells were more sensitive to PAM than non-cancer cells in the cell viability, proliferation, and migration assay. Between cancer cells and non-cancer cell, PAM at 37 degree has higher lethal selectivity than hyperthermia with CDDP. The relative viability of the cells treated with low-intensity PAM for 120 minutes was close to that treated with low-intensity PAM for 90 minutes, indicating that the PAM treatment time can be shortened. The FGF-1 test show that PAM would slightly enhance production of FGF-1, but the FGF-1 concentration is still much lower than effective FGF-1 concentration (400 pg/ml).

Keywords: non-thermal atmospheric-pressure plasma jets (NTAPPJ), adenocarcinoma cell, non-cancer cell, and cancer therapy....

BIOGRAPHY

Dr. Yun-Chien Cheng received his B.S. (2004) and M.S. (2006) in Electrical Engineering from the National Taiwan University. He worked jointly in German Cancer Research Center, Darmstadt University of Technology, and Karlsruhe Institute of Technology, Germany, and received Dr. Ing. in 2012. Currently he is an Associate Professor of Mechanical Engineering Department, National Chiao Tung University. Dr. Cheng's research interests include low-temperature atmospheric-pressure plasma based medical application and biofilm manufacture.

Technical Session D2-W1-T3: Emerging Technologies and Applications in Materials for Healthcare and Medicine: Bio-Materials, Bio-SoC, Bio-Nanotech, Bio-NEMS/Bio-MEMS, Biomedical Optics and Imaging, Biomedical Engineering and Systems, Biomedical Informatics, Mobile Health, Virtual Reality (VR) and Healthcarelity (VR) and Healthcare

Development of a Novel Targeted Drug Delivery System for Liver Tissue Regeneration

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ABSTRACT

Mesoporous silica nanoparticles (MSNs) are solid materials possessing a honeycomb-like porous structure and hundreds of empty channels. Developed recently, they are regarded as an efficient drug carrier in the targeted drug delivery system (TDDS). However, most TDDS designs aim to kill tumor cells, and there are fewer related reports about the cell-targeted strategy for enhancing the function of targeted cells. In this study, we applied MSNs to carry lysine for hepatocyte cultures because lysine has been proved to enhance cell mitosis. Moreover, MSNs were encapsulated with chitosan (CS) to enhance the biocompatibility, and glycyrrhizin (GL) was conjugated to MSNs to target hepatocytes. The results showed that (1) MSNs had no cytotoxicity to the hepatocytes in a low concentration (<0.1 mg/mL); (2) the albumin synthesis in hepatocyte cultures with 0.1 mg/mL of lysine increased to a level 30% higher than that in the control; (3) the maximum loading capacity of lysine on MSNs, CS-MSNs, and GL-CS-MSNs was 80%, 70% and 70%, respectively; (4) MSN particles revealed a negative zeta potential of -31.8 mV compared to the CS-MSNs and GL-CS-MSNs, which showed highly positive zeta potentials of 48.9 mV and 34.4 mV, respectively. The average particle size of GL-CS-MSNs and CS-MSNs was relatively larger than that of MSNs (246 nm, 222 nm and 148 nm, respectively); (5) Glycyrrhizin-conjugated, chitosan-coated, lysine-embedded MSNs (GL-CS-ML) were mainly found in hepatocytes; (6) GL-CS-ML enhanced hepatic functions in 7 d of cultures. In conclusion, GL-CS-ML may have a high potential in hepatocyte-targeted research in the near future.

BIOGRAPHY

Dr. Yung-Te, Hou is currently an Assistant Professor in Department of Bio-Industrial Mechatronics Engineering at National Taiwan University, Taiwan. He received his BS degree and MS degree in Department of Bio-Industrial Mechatronics Engineering, Taiwan University in 2004 and 2006, and received his PhD degree from Department of Chemical Engineering, Kyushu University in 2011. After serving as a postdoctoral research fellow in Kyushu University Innovation Training Program in 2011, he worked at Placenta-Aloe Research Institute, JAPAN BIO PRODUCTS CO., LTD from 2011-2013. His research interests focus on Liver tissue engineering, Liver-on-a chip, 3D bio-printed liver and Biomaterials.

Technical Session D2-W2-T3: Emerging Technologies and Applications in Electronic, Photonic, and Magnetic Materials, Ceramic Materials, Metallurgy and Materials, Organic Polymer, Soft Materials, and Computational Materials

Session Chair

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BIOGRAPHY

Ying-Hao Chu was born in Kaohsiung in 1976. He obtained a bachelor degree in 1999 and a PhD degree in 2004 from National Tsing Hua University, Taiwan. His major field of study was Materials Science and Engineering. Then, he joined University of California, Berkeley as a postdoc. In 2008, he acquired an assistant professorship in Department of Materials Science & Engineering at National Chiao Tung University. He was promoted to an associate professor in 2015, and then he was promoted to a professor in 2018. From 2019, he was appointed as a distinguished professor. Since 2013, he has an adjunct position in institute of physics, Academia Sinica. In 2014. he started an adjunct position in Department of Electrophysics, National Chiao Tung University. From 2016 to 2018, he had the adjunct position in the Material and Chemical Research Laboratories, Industrial Technology Research Institute and the International College of Semiconductor Technology at National Chiao Tung university. From 2019, he has an appointment with ACS Applied Electronic Materials to be an associate editor. His research is highly focused on complex functional oxides and strongly correlated electron systems. He has extensive experience in the use of advanced characterization techniques to understand and manipulate functional oxide heterostructures, nanostructures, and interfaces. His current goal is try to create a pathway to use high quality oxide heteroepitaxy for soft transparent technology. Now, he is a pioneer with the most publication along this research direction. Due to his excellent research performance, he was awarded with: 1. Thomson Reuters Highly Cited Researchers in Materials Science (2014, 2016, 2018), 2. The Academia Sinica Research Award for Junior Research Investigators, 3. Outstanding Research Award of Ministry of Science and Technology of Taiwan, 4. Futuristic Breakthrough Technology Award, 5. Young Researcher Award of The Physical Society of Taiwan, 6. Wu Ta-You Award, 7. Young Researcher Award of the Materials Research Society Taiwan, 8. Young Researcher Award of the Taiwan Vacuum Society, 9. Y. Z. Hsu scientific paper award in Nanotechnology.

Technical Session D2-W2-T3: Emerging Technologies and Applications in Electronic, Photonic, and Magnetic Materials, Ceramic Materials, Metallurgy and Materials, Organic Polymer, Soft Materials, and Computational Materials

Monolithic 3D-IC with Heterogeneous Integration of Light-energy Harvesters for Internet of Things

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ABSTRACT

IoT devices require low-power consumption, low cost fabrication process and self-powered function to emerge in various applications. Advanced monolithic three dimensional integrated circuits (3D$^+$-IC) have the advantages of (1) cost-effective manufacturing (2) compact chip small area, and (3) highly heterogeneous integration capability, including circuits, memory, sensors and energy harvesters. In this article, low temperature Si thin film photovoltaic (TFPV) ambient light-energy harvesters monolithically integrated with high performance 3D sequentially stackable device were demonstrated. The monolithically stacking of Si thin-film energy harvester, which provide good output power under indoor illumination, envisions self-power and low cost 3D$^+$IC for internet of things.

BIOGRAPHY

1. Personal information.

Chang-Hong Shen received his Ph.D. in Physics at National Tsing-Hua University in 2006. From 2007, he joined MOSEL VITELIC INC in Taiwan. From 2009, he jointed National Nano Device Laboratories (NDL) as associate researcher. Currently he is a Researcher Fellow and Division Director of Planning and Promotion Division in Taiwan Semiconductor Research Insitute (TSRI). His academic interests include photovoltaic devices, flexible electronics, and low-temperature laser/plasma processing. His current research focuses on developing low-cost, third-generation Si and CIGS thin-film solar cells, and low-temperature 3D nanoelectronics.

2. Education.
2006, Ph.D. (Physics), National Tsing-Hua University, Hsinchu, Taiwan, ROC
2002, M.S. (Physics), National Tsing-Hua University, Hsinchu, Taiwan, ROC
2000, B.S. (Physics), National Sun Yat-sen University, Kaohsiung, Taiwan, ROC

3. Current position and relevant experience.

- Taiwan Semiconductor Research Insitute, Division Director of Planning and Promotion Division, 2018/09 to date.
- National Nano Device Laboratories (NDL), Division Director of Emerging Device Division, 2014/08 to 2018/08.
- National Nano Device Laboratories (NDL), Researcher Fellow, 2014/01 to date.
- National Nano Device Laboratories (NDL), Deputy Division Director of Emerging Device Division, 2013/01 to 2014/07.
- National Nano Device Laboratories (NDL), Associate researcher, 2009/01 to 2013/12

4. Fields of specialty (limit to fields related to research).
   - ☐Thin-film PVs and thin-body HIT PVs
   - ☐ High-performance flexible Si/Ge electronics
   - ☐ Heterogeneously integrated 3D ICs and IoTs
5. Major awards and honors.
   (1) 2010,and 2013 National Applied Research Laboratories (NARL) Outstanding Research Award.
   (2) The first paper of Si thin film solar cell published as an **invited talk** in 2010 Conference on Lasers and Electro-Optics **(CLEO)**
   (3) Monolithic 3D Chip Integrated with 500ns NVM, 3ps Logic Circuits and SRAM" published in IEEE International Electron Devices Meeting, 2013 (**IEDM2013**) and selected as **publicity materials** for the conference. In 2015, "Low-Cost and TSV-free Monolithic 3D-IC with Heterogeneous Integration of Logic, Memory and Sensor Analogy Circuitry for Internet of Things" selected as the **highlighted IEDM 2015 paper**.
   (4) IEDM 2018 and IEDM 2019 committee and section chair

Technical Session D2-W2-T3: Emerging Technologies and Applications in Electronic, Photonic, and Magnetic Materials, Ceramic Materials, Metallurgy and Materials, Organic Polymer, Soft Materials, and Computational Materials

Enhanced Near-Infrared Photoresponse of Inverted Perovskite Solar Cells Through Rational Design of Bulk-Heterojunction Electron-Transporting Layers

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ABSTRACT

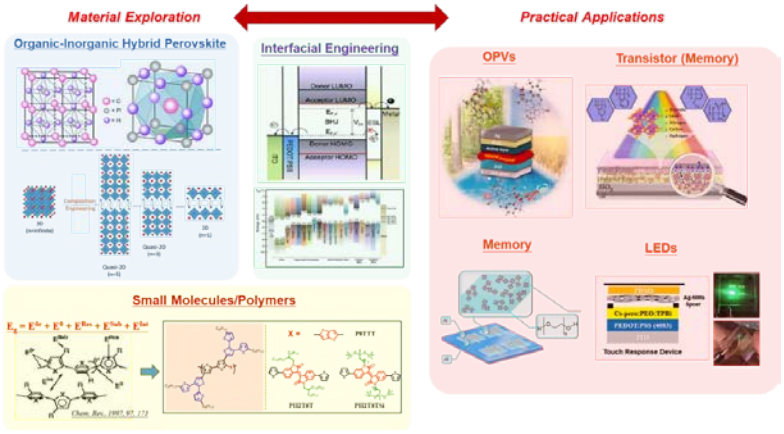
Organic-inorganic hybrid perovskites solar cell (PVSC) has received worldwide attention in the past decade. Its power conversion efficiency (PCE) has struck to 24.2% from 3.8% since its first debut in 2009. Even though the perovskite materials possess exceptional semiconducting properties, such as ambipolar charge-transporting capability, low exciton binding energy, long carrier diffusion length, their generally light-harvesting range is limited in the visible-light region, from 300 nm to 800 nm, which engender great loss in spectral while illumination pass through the device. The enhancement in near-IR (NIR) region usually could be attained by composition engineering but the results were not significant, on the other hand, it could also be reached through device engineering but the researches mostly focused on conventional configuration. Herein, we describe a simple and accessible method to enhance the NIR photoresponse of inverted PVSC by rational design of electron-transporting layer.

In general, fullerene is the most commonly used ETL for inverted PVSCs. However, owing to it symmetric geometric, the light absorption of fullerene is quite weak. Recently, low bandgap non-fullerene acceptor (NFAs) with NIR light absorption has been vigorously develop in the field of organic photovoltaics. As inspired by this impressive progress, we herein conceive a study to enhance the NIR response of inverted PVSC by engineering the fullerene ETL with NFAs with NIR light absorption. Owing to the low bandgap, the NFA can form type II charge transfer with fullerene to dissociate the photoexction induced by NIR absorption. However, our result manifests that such binary blend is not sufficient to enhance the NIR photoresponse of derived inverted PVSCs. The ETL consisting of PCBM and NFA blend could not convert any near-IR photons into resulting photocurrent, as evidenced by the corresponding EQE spectrum. Intriguingly, we demonstrated a strategy to efficiently intercept the near-IR light and convert the photons into current through further modification of this hybrid ETL with NIR absorbing capability. As a result, the optimized near-IR ETL can enable its derived inverted PVSC to possess an extended photoresponse from visible region to 950 nm and present 40% EQE in the NIR region, contributing to 8.4% of the overall photocurrent (22.5 mA/cm^2). Combined with the high Voc of 1.14 V and decent FF of 70%, an inverted PVSC with a high PCE of ~18.1% was finally demonstrated. Our study unveils an effective approach to enhance the NIR photoresponse of inverted PVSCs through simple design of compatible charge-transporting layer.

BIOGRAPHY

Name	Chu-Chen Chueh
2004	B.Sc. National Taiwan University
2010	Ph.D. National Taiwan University
2011-2016	Post-Doc. Alex K.-Y. Jen, University of Washington, USA
2017-Present	Assistant Professor, National Taiwan University

Dr. Chu-Chen Chueh received his Ph.D. in Chemical Engineering from the National Taiwan University (NTU) in 2010 and then conducted his postdoctoral research at the University of Washington from 2011 to 2016. He joined NTU as an Assistant Professor of Department of Chemical Engineering in 2017. His research is focused on the organic/hybrid semiconductors and applications in memory, light-emitting diode, transistors, and solar cells. He has coauthored over 130 papers in the area of organic/hybrid optoelectronics with citation > 10100 and H-index of 53 (recorded by Google scholar).



Reference: http://chuehslab2016.wixsite.com/ccchueh

Technical Session D2-W2-T3: Emerging Technologies and Applications in Electronic, Photonic, and Magnetic Materials, Ceramic Materials, Metallurgy and Materials, Organic Polymer, Soft Materials, and Computational Materials

Scalable low-power silicon photonic platform for all-solid-state beam steering

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ABSTRACT

Solid-state beam steering is the key to realize miniature, mass-producible LIDAR. The required huge power consumption, however, prevents this technology from further scalability. Here we show two different approaches to enable low-power beam steering. In the first approach, we use spatial-mode multiplexing to reduce the power consumption of the phase shifters in a large-scale phased array. This approach enhances the power efficiency without sacrificing optical bandwidth or operation speed. Using this approach, we demonstrate 2D beam steering with a phased array containing 512 elements. This phased array consumes only 1.9 W of power while steering over a 70°× 6° field of view. In the second approach, we achieve 2D beam steering with an optical switch array that forms switchable point emitters and a metalens that collimates the emitted light. The power consumption of this approach scales logarithmically with the number of emitters and therefore favors large-scale systems.

BIOGRAPHY

Dr. You-Chia Chang received his Ph.D. in Applied Physics at University of Michigan in 2016. He also received a M. S. degree in Applied Mechanics in 2004 and a B. S. degree in Mechanical Engineering in 2002 at National Taiwan University. His research interests include silicon photonics, metamaterials and 2D materials.

He is currently an Assistant Professor in the Department of Photonics and Institute of Electro-Optical Engineering at National Chiao Tung University, Hsinchu, Taiwan. From 2016 to 2018, he worked as a postdoctoral research scientist in the Department of Electrical Engineering at Columbia University. He had also worked as an associated researcher in Material and Chemical Research Laboratories of Industrial Technology Research Institute in Taiwan from 2004 to 2008.

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BIOGRAPHY

Rong-Ho Lee received his BS (1991) in Textile Engineering Department from Feng-Chia University (Taichung, Taiwan), MS (1993) in Chemical Engineering Department from Yuan-Ze University (Taoyuan, Taiwan), and Ph. D. (1998) in Chemical Engineering Department from National Tsing Hua University (Hsinchu, Taiwan). From 1999 to 2003, he was an engineer at Industrial Technology Research Institute (ITRI, Hsinchu, Taiwan). In 2004, he worked as an Assistant Professor of Chemical and Materials Engineering at National Yunlin University of Science and Technology (NYUST, Yulin County, Taiwan). In 2008, he was promoted to be an Associate Professor of Chemical and Materials Engineering at NYUST, and subsequently moved to Chemical Engineering Department of National Chung Hsing University (NCHU, Taichung, Taiwan) two years later. In 2014, he was promoted to the rank of full Professor of Chemical Engineering Department at NCHU. His current research emphasizes on the synthesis and electro-optical properties of conjugated polymers. He has published over 90 articles in scientific journals until now.

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Transfer Printing of Active Layers from controlled Swelling/De-Swelling of PDMS for realizing multilayer Polymer/Perovskite Solar Cells

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BIOGRAPHY

Dr. Chih Wei Chu was born on 4th November, 1972 in Taipei, Taiwan. He received the B.S. in Department of Chemical Engineering from Chung Yuan University, Taiwan in 1995, M.S. in Departemet of Civil and Environmental Engineering and Ph.D degrees in Department of Materials Science & Engineering from University of California, Los Angeles, USA, in 1998 and 2006, respectively. He was the senior research and development engineer at Inteplast Group, Texas, USA during 1998-2001. He joined Research Center for Applied Sciences (RCAS) at Academic Sinica and was promoted to associate research fellow and research fellow in 2010 and 2014, respectively. Currently, he served as Deputy Director in RCAS. He is also joint appointment professors of College of Engineering, Chang Gung University, Department of Photonics, National Chiao Tung University, and Department of Materials Science and Engineering, National Tsing Hua University. He was elected as associate academicians in the Asia Pacific Academy of Materials. He is a materials scientist with expertise in the fields of thin film electronics, such as photovoltaic cells, LEDs, batteries, and memory devices. He has published more than 200 refereed papers with over 10000 citations (H-index 51). Chu's research focuses on development of advanced materials for energy saving, conversion, and storage technologies.

ABSTRACT

The best solution-processed organic solar cells are based on bulk heterojunction (BHJ) structures, in which the active layer is a blend of a donor and acceptor in a bulk film. The efficiency of a BHJ OSCs depends on nanoscale phase-separation of the donor and acceptor to provide a large heterojunction interface for efficient dissociation of excitons. A random distribution of the donor and acceptor phases in such a structure would, however, enhance carrier recombination and lead to unbalanced charge transport, thereby limiting the efficiency. As an alternative to the BHJ structure, the sequential processing of the donor and acceptor into a multilayer structure has several advantages: greater morphological control, balanced charge transport, and direct pathways for charge collection from the interfaces to the

electrodes. Nevertheless, the fabrication of multilayer structures through solution-processing is susceptible to partial dissolution of the underlying layers, disrupting the formation of stacked layers. We demonstrate a facile method for transferring thin films to achieve polymer solar cells having stacked structures. By controlling the swelling/de-swelling properties of Polydimethylsiloxane (PDMS) via solvent treatment, we formed uniform organic films upon the PDMS surface and then transferred them to target substrates. We prepared bilayer and graded bilayer structures after transferring indene-C60 bis-adduct (ICBA) and ratio-controlled poly(3-hexylthiophene) (P3HT:ICBA) blends, respectively, onto the P3HT layer. The optimal graded bilayer solar cell exhibited a power conversion efficiency (PCE) of 5.13% an impressive value compared with that obtained for the corresponding bilayer cell (3.67%). We attribute this enhancement in PCE to the greater number of junction interfaces and the balanced carrier transfer properties. This residue-free and place lift-off transferring method appears to have great promise in the solution processing of multilayer stacked thin film optoelectronics.

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Dispersion Control Through Crystal Ordering: The Case of L11 Ag-Pt

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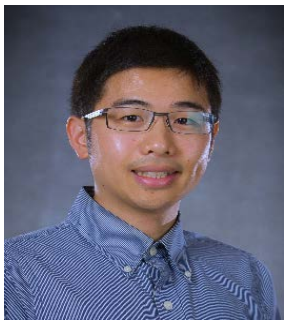
ABSTRACT



Intermetallics are stable compounds composed of metal atoms organized in a long range order. They are favored structures for their mechanical, catalytic and other properties due to the high dispersion of one metal in another. However, the formation of intermetallic compounds is often elemental specific. For example, Cu forms alloys and intermetallic compounds with Au but it is immiscible with Ag based on the binary phase diagram. Like Cu, Pt is also immiscible with Ag. Previous studies showed the existence of an intermetallic L11 phase within a very narrow composition window. However, due to the limitations in traditional metallurgy process, phase pure Ag-Pt intermetallic has never been observed. Here, we demonstrated a bottom-up approach for the preparation of Ag-Pt compositional intermetallic phase. By thermally treating the alloy nanoparticles in an inert atmosphere, we successfully obtained an Ag-Pt intermetallic judging from the powder X-ray diffraction patterns of the thermally treated samples. Powder pattern simulations show this structure best resembles the synthetic materials constructed from unique stacking of interchangeable close-packed Ag and Pt layers. This rather unique stacking results in wavy patterns of Ag and Pt planes in the scanning transmission electron microscopy (STEM) micrographs. The intermetallic Ag-Pt obtained is highly active for the electrochemical oxidation of formic acid at low anodic potentials, 5 times higher than its alloy nanoparticles, and 29 times higher than the commercial Pt/C at 0.4 V (vs RHE) in current density. The high activity is very likely due to the high dispersity of Pt atoms in the intermetallic compound.

References

[1] Y-T. Pan, Y. Yan, Y-T. Shao, J-M. Zuo, H. Yang, Ag-Pt compositional intermetallics made from alloy nanoparticles, Nano Lett., 2016, 16, 6599-6603.

BIOGRAPHY

Yung-Tin (Frank) Pan is an assistant professor of the Chemical Engineering Department, National Tsing Hua University. He received his PhD. degree in Chemical Engineering from the University of Illinois Urbana-Champaign, USA at 2017. Before joining NTHU Chemical

Engineering, he worked as a postdoc researcher at Los Alamos National Laboratory.

Yung-Tin's research interest stems from catalytic materials to reaction systems. Specifically, his thesis works focused on the structural behaviors of bimetallic nanocrystals under reactive environments and its implications to catalyst preparation and structure-property relations utilizing advanced characterization technologies such as in-situ environmental transmission electron microscopy (ETEM). Due to his expertise in multi-metallic systems, Yung-Tin was recruited by the Fuel Cell Program at Los Alamos National Laboratory to carry out researches on Pt-M L1¬0 intermetallic nanocatalyst and its responses under practical fuel cell working conditions when fabricated into a membrane electrode assembly (MEA). His work demonstrated an active and durable catalyst that meets the US Department of Energy (US-DOE) 2020 targets through designed crystal engineering.

Yung-Tin's current research interest lies in the development of active and durable catalyst materials for polymer electrolyte membrane (PEM) reaction systems such as fuel cell (PEMFC), water electrolysis (PEMWE), and other gas phase electrochemical reactions.

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Realization of Eco-Friendly and Scalable Radiative Cooling for Metal Substrates

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ABSTRACT

Over the past few years, wavelength selective radiative cooling has become a popular topic in the field of heat dissipation as it is a passive method that consumes no extra energy. However, it is also due to the selective emission required to fit the atmospheric window that gives restrains to its real world application. Namely, whether if large area fabrication is possible, cost effective, and the material used is eco-friendly. In this study, an electrophoretic deposited chitosan layer is applied to enhance wavelength selective emission of metal substrates which is one of the most commonly seen materials in our lives. As a result, based on the optical properties measured by integrating spheres, the heat emission of stainless steel and platinum substrates can be enhanced by 52.4 W/m2 (9 times) and 51.5 W/m2 with chitosan deposition, respectively. Furthermore, the temperature of a stainless steel plate dropped at most 2.4℃ during day time experiment after depositing chitosan while the radiative cooling effect shows correlation with relative humidity. In addition, the optical properties of chitosan deposited samples barely changed after sunlight exposure. The results gained here would facilitate the applicability of eco-friendly radiative cooling in the real world.

BIOGRAPHY

Dr. Jui-Yung Chang received his Ph.D. in mechanical engineering from Arizona State University in 2017, and M.S. and B.S. in mechanical and electro-mechanical engineering from Tam Kang University in 2009 and 2005, respectively. He studies radiative heat transfer in both far and near fields, specifically focuses on energy harvesting applications such as thermophotovoltaic cells, radiative cooling systems, and wavelength selective thermal emitters/absorbers. Furthermore, he also works on the electrical responses and artificial magnetic responses of metamaterials along with their effects on radiative heat transfer.

He is currently an assistant professor at National Chiao Tung University in Hsinchu, Taiwan. He worked as a Postdoctoral Research Fellow of mechanical engineering at Arizona State

University in 2018 right after his graduation and also serves as a reviewer for Journal of Applied Physics, Entropy, Energies, Heat Transfer Engineering, etc. He had also published 8 SCI journal papers.

Dr. Chang received University Graduate Fellowship Award from 2015 to 2017 and is awarded with Outstanding Student Research Award from Arizona State University upon his PhD graduation.