ISPE 2021

NOV. 12–14, 2021

INTERNATIONAL SYMPOSIUM ON PRECISION ENGINEERING

HAN-HSIEN INTERNATIONAL HOTEL

KAOHSIUNG, TAIWAN

國立中興大學
NATIONAL CHUNG HSING UNIVERSITY
1919

GIPE 精密工程 研究所 Graduate Institute of Precision Engineering

IDCSA NCHU 永續農業創新發展中心 Innovation and Development Center of Sustainable Agriculture

COLLEGE OF ENGINEERING NCHU 國立中興大學工學院

SCIEI SCience and Engineering Institute

中華民國國立中興大學 精密工程研究所

Table of Contents

Organizers

National Chung Hsing University
http://www.nchu.edu.tw

College of Engineering
National Chung Hsing University
http://www.engineer.nchu.edu.tw

Innovation and Development Center
of Sustainable Agriculture
http://idcsa.nchu.edu.tw

Graduate Institute of Precision Engineering, GIPE
National Chung Hsing University
http://www.ipe.nchu.edu.tw

SCIence and Engineering Institute, SCIEI
http://sciei.org

Co-organizers

NCHU GIPE Alumni Association
http://alumnigipe.nchu.edu.tw

General Information

2021 International Symposium on Precision Engineering 2021 (ISPE 2021) will be held in Taiwan during November 12-14, 2021. The main objective of the ISPE 2021 conferences is to provide a major international platform for knowledge exchange and an interactive forum in integrated technologies, mechanical engineering, optics, electronics, electrical engineering and material engineering into precision manufacturing, precision measurement, precision inspection, MEMS, semiconductor and precision environmental control, etc. These are all fascinating topics related to future needs. On behalf of the ISPE 2021 organizing committee, we sincerely welcome you for participating this symposium to share your experience and research results. ISPE 2021 welcomes authors to submit papers on any branch of precision engineering and its applications, and other subjects.

Plenary Speakers

- Prof. Ming-Chang Lin
  Fellow of Academia Sinica, Taiwan
  Robert W. Woodruff Professor Emeritus, Emory University, U.S.A.

- Distinguished Prof. Ray-Hua Horng
  Fellows of SPIE, IEEE, OSA, IOP
  Distinguished Professor at the Institute of Electronics
  National Yang Ming Chiao Tung University

Keynote Speakers

- Chair Prof. Charles W. Tu
  Mount Jade Scholar and Research Professor
  Department of Electrical Engineering
  National Chung Hsing University, Taiwan
  Distinguished Professor Emeritus
  Department of Electrical and Computer Engineering
  University of California, San Diego, U.S.A.

- Distinguished Prof. Ying-Hao Chu
  Department of Material Science and Engineering
  National Yang Ming Chiao Tung University, Taiwan
  2014 Highly Cited Researchers in Materials Science (Thomson Reuters)

Invited Speakers

- Prof. Yu-Lin Shen
  Department of Mechanical Engineering
  University of New Mexico, U.S.A.
- Assoc. Prof. Dr. Jun Hieng Kiat
  Department of Mechanical and Material Engineering
  University Tunku Abdul Rahman, Malaysia
- Assoc. Prof. Yew-Hoong Wong
  Department of Mechanical Engineering
  Faculty of Engineering, University of Malaya, Malaysia
- Dr. Nabila A. Karim
  Fuel Cell Institute
  University Kebangsaan Malaysia, Malaysia
- Prof. Chengkuo Lee
  Department of Electrical and Computer Engineering
  National University of Singapore, Singapore
- Assoc. Prof. Dr. Huy-Tuan Pham
  Faculty of Mechanical Engineering
  Ho Chi Minh City University of Technology and Education, Vietnam.
- Prof. Ngoc Dang Khoa Tran
  Faculty of Mechanical Engineering
  Industrial University of Ho Chi Minh City, Vietnam
- Assoc. Prof. Dr. Teeranoot Chanthasopeephan
  Mechanical Engineering Department
  King Mongkut's University of Technology Thonburi, Thailand
- Prof. Bhaskar Kanseri
  Department of Physics
  Indian Institute of Technology Delhi, India

- Prof. Mohd Hafiz Dzarfan Othman
  Advanced Membrane Technology Research Centre
  Universiti Teknologi Malaysia, Malaysia

Honorary Chairs

- Prof. Fuh-Sheng Shieu
  President of National Chung Hsing University, Taiwan
- Prof. Ming-Der Yang
  Dean of College of Engineering
  National Chung Hsing University, Taiwan

Symposium Chair

- Prof. Po-Liang Liu
  Head of Graduate Institute of Precision Engineering
  National Chung Hsing University, Taiwan

Organizing Chair

- Prof. Vidar Gudmundsson
  Science Institute, University of Iceland, Reykjavik, Iceland

Program Chair

- Prof. Yu-Lin Shen
  Department of Mechanical Engineering
  University of New Mexico, U.S.A.

Organizing Committee

- Prof. Ming-Chang Lin
  Fellow of Academia Sinica, Taiwan
  Robert W. Woodruff Professor Emeritus of Emory University, U.S.A.
  Center for Emergent Functional Materials Science, Department of Applied Chemistry, National Yang Ming Chiao Tung University, Hsinchu, Taiwan

- Chair Prof. Charles W. Tu
  Department of Electrical Engineering
  National Chung Hsing University, Taiwan
- Distinguished Prof. Dong-Sing Wuu
  President of National Chi Nan University, Taiwan
- Distinguished Prof. and Head Ray-Hua Horng
  Institute of Electronic
  National Yang Ming Chiao Tung University, Taiwan
- Dr. Nabila A. Karim
  Fuel Cell Institute, Universiti Kebangsaan Malaysia, Malaysia
- Prof. Vidar Gudmundsson
  Science Institute, University of Iceland, Iceland
- Ts. Dr. Kean Long Lim
  Fuel Cell Institute, Universiti Kebangsaan Malaysia, Malaysia
- Prof. Ngoc Dang Khoa Tran
  Faculty of Mechanical Engineering
  Industrial University of Ho Chi Minh City, Vietnam
- Prof. Yu-Lin Shen
  Department of Mechanical Engineering
  University of New Mexico, U.S.A.
- Prof. Chengkuo Lee
  Department of Electrical and Computer Engineering
  National University of Singapore, Singapore
- Prof. Bhaskar Kanseri
  Department of Physics
  Indian Institute of Technology Delhi, New Delhi, India
- Prof. Ho Thanh Huy
  Department of Physics and Electronic Engineering
  VNU-Ho Chi Minh University of Science, Vietnam
- Prof. Ratchatin Chancharoen
  Department of Mechanical Engineering
  Chulalongkorn University, Thailand

- Distinguished Prof. Gou-Jen Wang
  College of Engineering
  National Chung Hsing University, Taiwan
- Distinguished Prof. His-Harng Yang
  Graduate Institute of Precision Engineering
  National Chung Hsing University, Taiwan
- Distinguished Prof. Pin Han
  Graduate Institute of Precision Engineering
  National Chung Hsing University, Taiwan
- Distinguished Prof. Dung-An Wang
  Graduate Institute of Precision Engineering
  National Chung Hsing University, Taiwan
- Prof. Chia-Feng Lin
  Department of Materials Engineering
  National Chung Hsing University, Taiwan
- Prof. and Head Po-Liang Liu
  Graduate Institute of Precision Engineering
  National Chung Hsing University, Taiwan
- Prof. Ming-Tzer Lin
  Graduate Institute of Precision Engineering
  National Chung Hsing University, Taiwan
- Prof. Cheng-Mu Tsai
  Graduate Institute of Precision Engineering
  National Chung Hsing University, Taiwan
- Prof. and Head Congo Tak-Shing Ching
  Graduate Institute of Biomedical Engineering
  National Chung Hsing University, Taiwan
- Prof. Cheng-Chung Chang
  Graduate Institute of Biomedical Engineering
  National Chung Hsing University, Taiwan
- Prof. Hui-Min David Wang
  Graduate Institute of Biomedical Engineering

National Chung Hsing University, Taiwan

- Assoc. Prof. Fu-Yuan Hsu
  Department of Materials Science and Engineering
  National United University, Taiwan
- Assoc. Prof. Sheng-Fang Huang
  Mechanical Engineering Department
  China University of Science and Technology, Taiwan
- Assoc. Prof. Kuo-Chih Liao
  Graduate Institute of Biomedical Engineering
  National Chung Hsing University, Taiwan
- Assoc. Prof. Shu-Ping Lin
  Graduate Institute of Biomedical Engineering
  National Chung Hsing University, Taiwan
- Assoc. Prof. Jen-Chuan Tung
  Center for General Education
  Chang Gung University, Taiwan
- Assoc. Prof. Chih-Liang Wang
  Graduate Institute of Precision Engineering
  National Chung Hsing University, Taiwan
- Assoc. Prof. Chian-Hui Lai
  Graduate Institute of Biomedical Engineering
  National Chung Hsing University, Taiwan
- Assist. Prof. Bill Cheng
  Graduate Institute of Biomedical Engineering
  National Chung Hsing University, Taiwan

Symposium Secretary

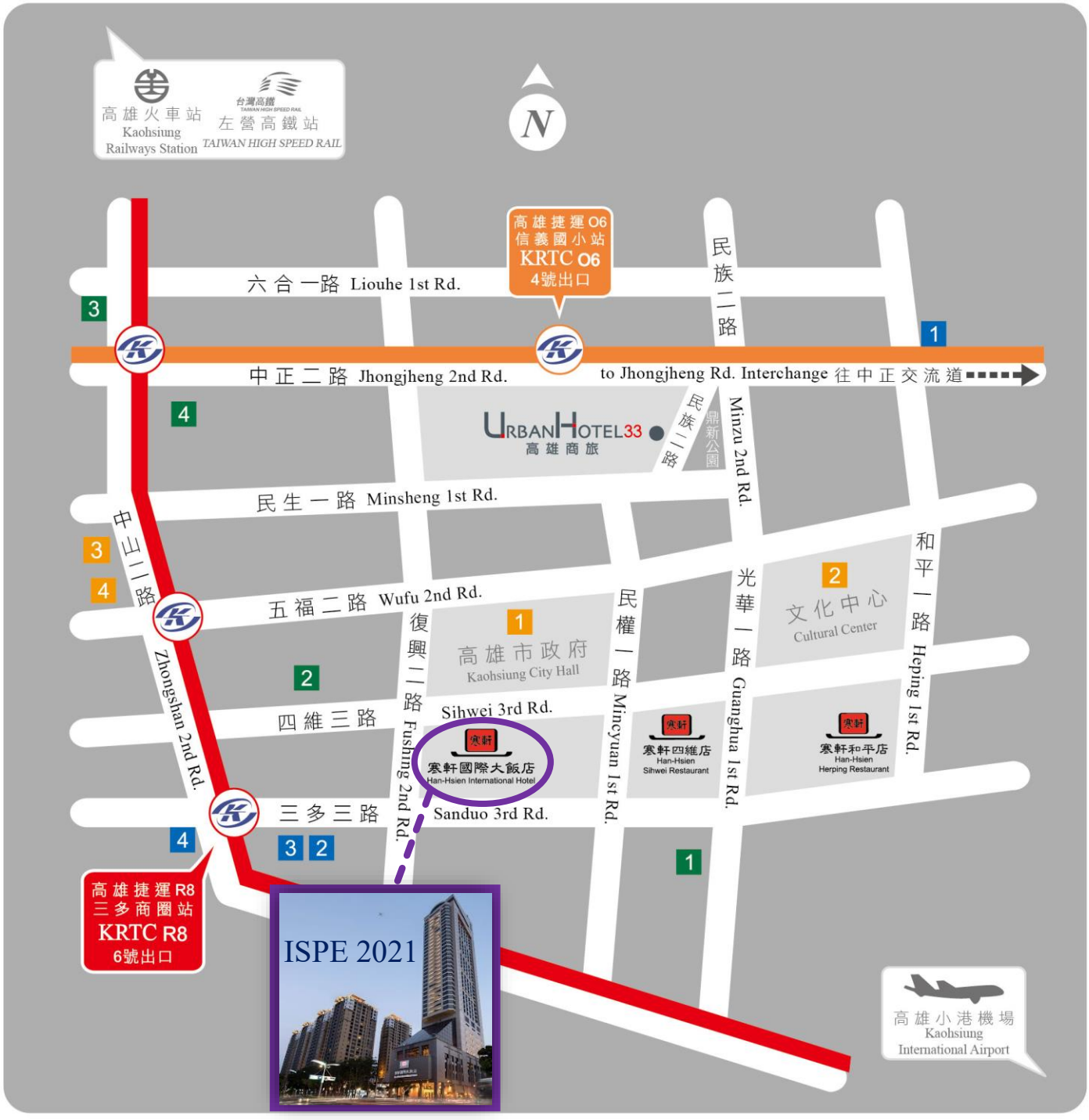
Dun-Ru Hung

Email: louie6515@gmail.com

Tel: +886-4-2284-0461 Ext.618 (Chinese & English)

Phone: +886-978-285710

Han-Hsien International Hotel Map



1 大統百貨 President Department Store
2 SOGO百貨 SOGO Department Store
3 新光三越百貨 Shin Kong Department Store
4 大遠百 Far Eastern Department Store

1 高雄市政府 Kaohsiung City Hall
2 文化中心 Cututal Center
3 中央公園 Center Park
4 城市光廊 Urban Spotlight

1 光華夜市 Guanghua Night Market
2 忠孝夜市 Zhongxiao Night Market
3 六合夜市 Liouhe Night Market
4 新興夜市 Sinsing Night Market

How to take High Speed Rail to Hanxuan Hotel

台灣高鐵 TAIWAN HIGH SPEED RAIL

THSR Zuoying Station

高雄捷運 KAOHSIUNG Metro KEEP MOVING

KMRT Red Line Sanduo Shopping District

Walk to Zhongshan 2nd Road

(about 3 minutes)

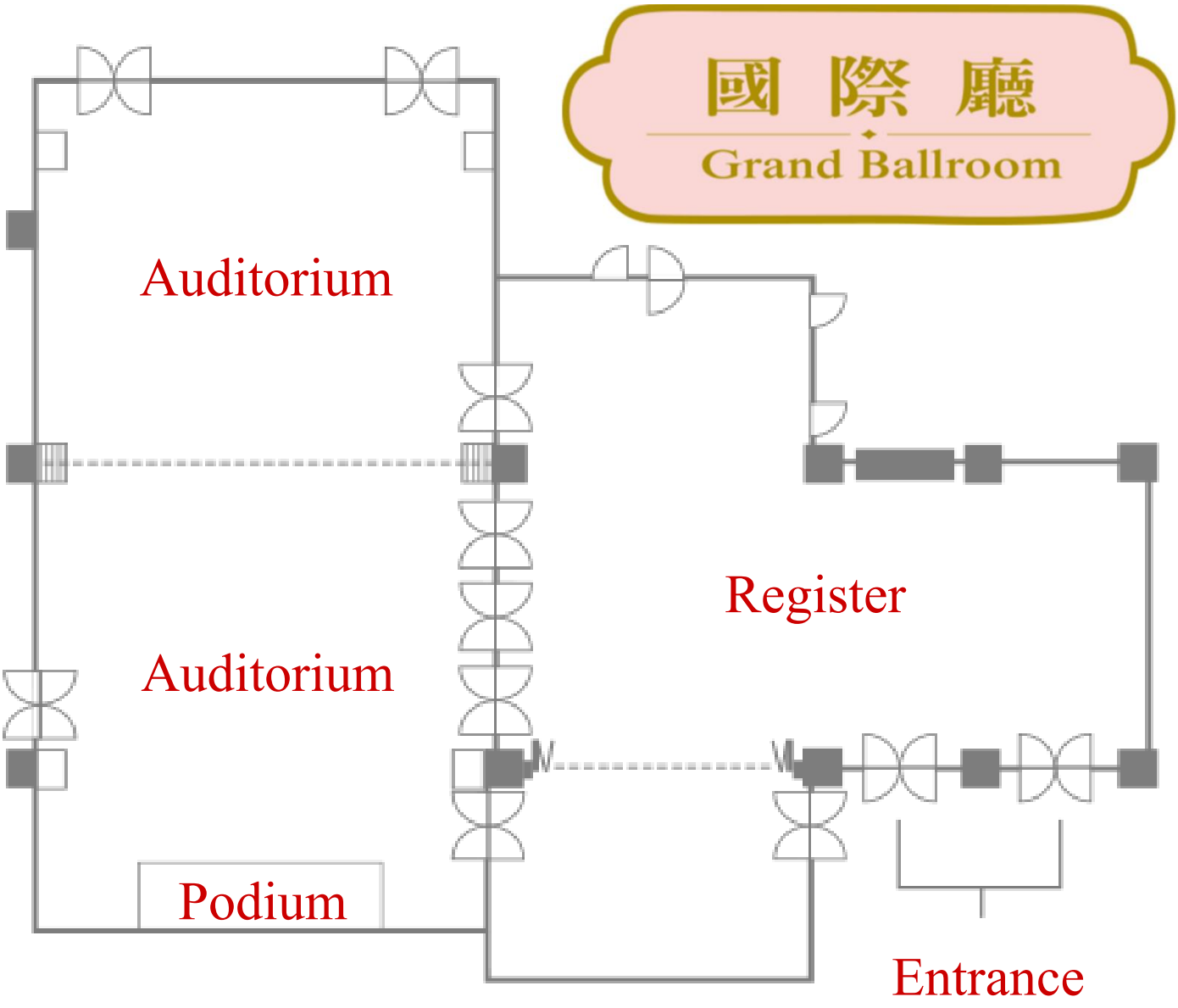
Take the bus Red 21

Kaohsiung City Government Station

Walk to Han-Hsien International Hotel

(about 3 minutes)

Floor Plan of the Second Basement Floor Map



◎B2 FLOOR PLAN

Auditorium

Register

Symposium Agenda

All academic events will be held at Han-Hsien International Hotel, Taiwan

Time	Activity	
12 November, 2021- Only Registration		
15:00~18:00	Registration & Welcome Reception	
13 November, 2021- Symposium Day		
08:00~09:00	Registration	
09:00~09:05	Symposium Opening Remarks	Poster Session
09:05~09:50	Plenary Speech (1)	
0950~10:15	Group Photo and Coffee Break	
10:15~11:00	Plenary Speech (2)	
11:00~11:30	Keynote Speech (1)	
11:30~12:00	Keynote Speech (2)	
12:00~13:00	Lunch Time	
13:00~14:00	Invited Talk and Oral Session (1)	
14:00~15:00	Invited Talk and Oral Session (2)	
15:00~15:15	Coffee Break	
15:15~16:15	Invited Talk and Oral Session (3)	
16:15~17:15	Invited Talk and Oral Session (4)	
17:15	Symposium Banquet	
14 November, 2021- Academic Visit		
9:00~11:00	Academic Visit - The Pier-2 Art Center	

Plenary Speaker 1

Prof. Ming-Chang Lin

Fellow of Academia Sinica, Taiwan
Robert W. Woodruff Professor Emeritus of Emory University, U.S.A.
Center for Emergent Functional Materials Science, Department of Applied Chemistry
National Yang Ming Chiao Tung University, Hsinchu, Taiwan

Title of Plenary Speech

Quantum-chemical Elucidation of Complex Chemical Processes of Practical Interest

Abstract of Plenary Speech

Mechanisms of complex chemical systems of practical interest occurring in the gas phase as well as in the condensed phases have been elucidated by quantum chemical modeling. Specifically, the kinetics and mechanism for the hypergolic ignition of trimethyl aluminum, $(CH_3)_3Al$, in air, which has been known to be industrially hazardous, the auto-ignition reactions of nitrogen tetroxide (NTO)-Hydrazine propellant systems, the O_2-(g) ion sanitation process, and some selected TiO_2 nano-materials functionalized in our laboratory for water splitting will be presented with available experimental data.

Plenary Speaker 2

Distinguished Prof. Ray-Hua Horng

Fellows of SPIE, IEEE, OSA, IOP
Distinguished Professor at the Institute of Electronics
National Yang Ming Chiao Tung University

Title of Keynote Speech

Micro-LED Technology Development

Abstract of Keynote Speech

The talk is to introduce the developing of microLED technology for display applications. There is a great improvement in the MicroLED technology. They contain the epilayer structure, processing, mass transferring, repairing and characteristic measurements. In this talk, two kinds of GaN-based microLEDs and related devices performance will be discussed. One in very mature blue GaN LEDs and another is new GaInN-based red light microLEDs. Even thy can be fabricated into microLEDs, there exist some defects and needed processing to repair them. After, the fabricated module microLEDs and related problems will be described. The technology trend will also be mentioned in this talk.

Keynote Speaker 1

Chair Prof. Charles W. Tu

Mount Jade Scholar and Research Professor
Department of Electrical Engineering, National Chung Hsing University, Taiwan
Distinguished Professor Emeritus
Department of Electrical and Computer Engineering, University of California
San Diego, U.S.A.

Title of Keynote Speech

Bandgap Engineering and Device Applications of Dilute Nitrides

Abstract of Keynote Speech

Incorporating ~1% nitrogen into GaAs, InP, and GaP results in a large bandgap bowing, a large change of conduction band lineup, and in GaP even a large change in the band structure from indirect to direct bandgap. These three bandgap engineering parameters from dilute ni-trides are used to improve the performance of electrical, optoelectronic, and photovoltaic devices. When GaInNAs is used as the base of a GaAs heterojunction bipolar transistor (HBT), the turn-on voltage is lowered than that of GaAs-base and GaInAs-base HBT due to the smaller bandgap. Similarly, GaInNAs can be lattice-matched to GaAs and can improve the conversion efficiency of a multijunction solar cell. Incorporating 0.5% of N into GaP results in a direct band gap material. Thus, GaNP solar cells achieve 3 times the conversion efficiency at one quarter of the thickness when compared to GaP solar cells. When InNAsP is the quantum well of an InNAsP/GaInAsP optically pumped quantum-well microcavity laser, the light output is larger than that of GaInAs/GaInAsP counterpart due to the larger conduction-band offset. Sim-ilarly, the light output of a GaNP/GaP light-emitting diode (LED) is larger than that of an Al-GaInP/GaAs LED at the same wavelength.

Keynote Speaker 2

Distinguished Prof. Ying-Hao Chu

Department of Materials Science & Engineering
National Yang Ming Chiao Tung University, Taiwan

Title of Plenary Speech

MICAtronics for Flex Sensors

Abstract of Plenary Speech

A new world is being formed based on the technologies composed of artificial intelligence, Internet of Things (IoT), and robots. Especially, in the research fields of IoT and robotics systems, a device with mechanical flexibility can deliver more degrees of freedom as far as the design aspects are concerned. Therefore, the development of soft and flexible electronics becomes an important research direction for wearable and IoT devices. Due to the mechanical flexibility, polymer materials and thin metal foils are commonly used in the fabrication of flexible electronic systems. However, the reliability issue under practical operations hinders the applications of these flexible electronics, especially for those on polymer based substrates. This is attributed to a mismatch of thermal expansion coefficient between substrate and functional materials or low thermal and chemical endurance of polymers and organic materials. A lot of researchers are working hard and together to expand the applicability of current flexible devices. However, new pathway to flexible electronics can also be developed in parallel to provide more subtle solutions, thus in need of new platform to integrate functional materials with good thermal and chemical stabilities together with mechanical flexibility. In this research field, oxides can play an important role due to their intriguing functionalities and superior thermal and chemical stabilities. To deliver high-quality thin films or structures based on oxides, heteroepitaxy is essential. However, the lack of a suitable approach remains an obstacle for flexible oxide heteroepitaxy. 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. In this study, we use a 2D material as the substrate. In this talk, we confine ourselves to the validity of vdWE of functional oxides on muscovite mica throughout this treatise. 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.

Invited Speaker 1

Prof. Yu-Lin Shen

Department of Mechanical Engineering
University of New Mexico, U.S.A.

Title of Invited Talk

Evolution of Wrinkle Patterns on Soft Substrate-Attached Thin Films - Direct Numerical Predictions

Abstract of Invited Talk

Surface wrinkling instability on thin films attached to a compliant substrate is a well-recognized form of deformation, which can develop under mechanical or thermal loading. Surface wrinkling in engineering systems has traditionally been viewed as a form of damage. Researchers in recent years, however, have increasingly exploited mechanical instabilities to create surface patterns with desirable optical, electronic, mechanical, or energy-harvesting functions. The prediction of film-substrate deformation instabilities is of importance, but the phenomenon is inherently complex and difficult to simulate using common analytical/numerical tools. In this presentation, we highlight our recent developments of a practical computational technique utilizing the embedded imperfections to trigger wrinkle formation. This approach leads to direct modeling from pre-instability to post-instability, including transitions of the instability modes, in a seamless manner, and gives new insights into the evolution of wrinkle patterns. The investigations feature large-scale 3D simulations under general in-plane compression, spanning the entire biaxial spectrum in between the extreme cases of uniaxial and equi-biaxial loading. The loading-unloading histories can also be directly analyzed. The state of biaxiality is found to influence the surface pattern significantly, and each instability mode can be traced back to certain abrupt changes in the overall load–displacement response.

Invited Speaker 2

Assoc. Prof. Dr. Jun Hieng Kiat

Department of Mechanical and Material Engineering
University Tunku Abdul Rahman, Malaysia

Title of Invited Talk

Semiconductor Quantum Dot-sensitized Solar Cell: Challenges and Opportunities

Abstract of Invited Talk

Nanosized semiconductors have been demonstrated as viable sensitizers for the application of quantum dot-sensitized solar cells (QDSSC). These solar cells have much research interest in the past few years due to the excellent optical properties of the nanosized semiconductor sensitizers and the high performance produced by the solar cells. Generally, QDSSC works on the same principle as the dye-sensitized solar cell where quantum dot (QD) sensitizers such as semiconductor PbS, CdS or CdSe are used instead of the usual inorganic dye sensitizers. To date, QDSSCs have reached a power conversion efficiency of 15%. However, most of the reported high efficiency QDSSCs are Cd- or Pb-based. In order to elevate the application of emerging solar cell technologies in the mainstream photovoltaic market, low-cost, stable and non-toxic materials are crucial for the development of solar cell modules. Non-toxic QD sensitizers are usually termed as lead-free or cadmium-free materials. In this short review, "green" sensitizers are reviewed. Among the "green" materials that have been adopted as sensitizers in QDSSC included Sn- and Bi-based compounds. Although the performances of "green" QDSSCs such as Ag_2S and Bi_2S_3 QDSSCs are not as high as that of CdS or CdSe based QDSSCs, their performance can be enhanced with post-thermal annealing, carbon doping and the application of passivation layer. The effect of these techniques are discussed in the context of performance and fabrication techniques.

Invited Speaker 3

Assoc. Prof. Yew-Hoong Wong

Department of Mechanical Engineering
Faculty of Engineering, University of Malaya, Malaysia

Title of Invited Talk

Study of Trigonal-Sm_2O_3 as High-k Gate Dielectric on Ge-Based Metal-Oxide-Semiconductor (MOS) Device Structure

Abstract of Invited Talk

In this study, Sm_2O_3/Ge stack based capacitor prepared from thermally oxidized/nitrided sputtered metallic Sm on Ge semiconductor in N_2O ambient have been comprehensively investigated. The film crystallinity, chemical composition and interface chemical bonding states stability was characterized from X-ray diffraction (XRD), Raman spectroscopy and X-ray photoelectron spectroscopy (XPS). Formation of trigonal-Sm_2O_3 dielectric interface together with an interfacial layer containing asymmetrically distributed (Ge-O, Sm-O-Ge and Ge-N) species has been verified. Suppression of GeO (g) volatilization was evident from the XPS analysis due to germanate (Sm-O-Ge) formation. Structural morphology characterization using high resolution transmission electron microscope (HRTEM) also validated double stack amorphous interfaces obtaining physical oxide thickness (t_{ox}) from 4.25-6.91 nm. Band alignment and electrical measurements revealed the highest conduction band offset (CBO), ΔE_c of 2.60 eV and valence band offset (VBO) ΔE_v of 2.98 eV leading to lowest leakage current density $J_g \sim 8.38 \times 10^{-6}$ A cm^{-2} at enhanced breakdown field, E_{BD} of 13.31 MV cm^{-1}. The large breakdown field has been ascribed to fewest effective oxide charge (Q_{eff}), slow trap density, (Q_{it}) and interface traps density (D_{it}) at this duration. Additionally, a low equivalent oxide thickness, $t_{EOT} \sim 0.75$ nm with a high dielectric constant $k \sim 31.19$ was achieved but with high $D_{it} \sim 10^{13}$ eV^{-1}cm^{-2}. These properties render that Sm_2O_3 could serve as dielectric material for future high-k/Ge stack based metal oxide semiconductor technology, although requires further investigation for D_{it} improvement.

Invited Speaker 4

Dr. Nabila A. Karim

Fuel Cell Institute
University Kebangsaan Malaysia, Malaysia

Title of Invited Talk

Overview of the Research Progress and Challenges of the Application of Carbon-based Materials in Enzymatic Biofuel Cell (EBFC)

Abstract of Invited Talk

EBFC as micro-power sources successfully supplied power for the biosensor in the military and environmental application and implantable medical devices because it has advantages such as good bio-compatibility, easy miniaturization, and mild working conditions. The enzyme used as bio-catalyst shows high selectivity and specificity in the fuel oxidation, eliminating the membrane separator for easy EBFC miniaturization. The activity density obtained from the total enzyme loading on the electrode surface per unit area conducts the reaction in EBFC. Loading can be optimized using support materials that highly interact with the enzymes. Support materials require a high surface area to improve the electrochemical performance of the enzyme in EBFC. Support requires must show low aggregation for enzyme immobilization, good electrocatalytic activity, and electronic properties. Various supports have been used in EBFC; however, carbon-based supports have been widely applied in EBFC because they have various advantages. Among the carbon-based supports that have been developed in EBFC are single-wall and multi-wall carbon nanotubes, carbon nanoparticles, carbon black, mesoporous carbon, graphene, carbon spheres, and multiples carbon supports. All these types of carbon are commonly used in renewable energy conversion, alternative energies, and storage systems, and some carbon-based materials may have high potential that has not been applied in EBFC. This paper presented current research using carbon-based materials and challenges to produce high performance in applications in EBFC.

Invited Speaker 5

Prof. Chengkuo Lee

Department of Electrical and Computer Engineering
National University of Singapore, Singapore

Title of Invited Talk

AIoT based Sensing Technology for Future Smart Homes and Cities

Abstract of Invited Talk

With the high-speed data transmission capability enabled by the 5G wireless communication network, people have envisioned the Internet of Things (IoT) system towards smart homes and cities where numerous interrelated electronic devices are linked together in a vast and complicated network. The surging artificial intelligence (AI) technologies push forward the development of diversified smart sensors used at the smart homes in order to realize the advanced artificial intelligence of things (AIoT) technology. The human machine interfaces (HMI) have been improved from tactile sensors, such as touchpads and joysticks, to now including the accurate detection of dexterous body movements in more diversified and sophisticated sensors. In this talk, we discuss a few triboelectric based HMIs including gloves, socks, soft robotic manipulator, and exoskeleton for object recognition, gaming, VR/AR applications, rehabilitation, and digital twin applications. Besides, a smart floor monitoring system is reported with the merits of low cost and high scalability for smart home applications.

Invited Speaker 6

Assoc. Prof. Dr. Huy-Tuan Pham

Faculty of Mechanical Engineering
Ho Chi Minh City University of Technology and Education, Vietnam

Title of Invited Talk

Design and Optimization of High-Precision Compliant Mechanisms for Vibration-Assited Machining Methods

Abstract of Invited Talk

Ultrasonics and vibration-assisted machining are hybrid machining methods that combine small vibration with high or moderate frequency, respectively, into either the subtractive or additive machining approaches to enhance performance and efficiency. The integration of oscillation to the cutters or workpieces to vibrate them in one or more directions intermittently reduces the contact area between the blade and the workpiece. Recent researches show that the benefits of these advanced machining methods are the reduction in friction, machining force, cutting heat, reduction of tool wear, and extension of tool life. Therefore they improve the surface finish and quality, enhance chips removal, and suppression of burr formation. However, the challenges of establishing this manufacturing equipment are the vibration transferring from ultra-high precision actuators to the machining stages without damaging them. The compliant mechanism is a favorable solution for high-precision machines due to its spectacular advantages. This paper proposes a new 2-DOF XY vibration compliant stage using flexural hinges and leaf springs for a vibration-assisted milling application. The design uses a symmetrical two-stage lever mechanism to transfer and amplify vibrations from piezo-actuators. In the design process, the Taguchi method and finite element analysis are used to evaluate the influence of each design variable on the design optimization problem. The objectives of the design are to maximize the first-order natural frequency and minimize the parasitic motion while maintaining the equivalent stress under the allowable limit. Optimum designs are found which would be preferable for various vibration-assisted milling applications.

Invited Speaker 7

Prof. Ngoc Dang Khoa Tran

Faculty of Mechanical Engineering
Industrial University of Ho Chi Minh City, Vietnam

Title of Invited Talk

Design Compliant Bistable Gripper with Multiple Contact Points in Jaws

Abstract of Invited Talk

A new design of a compliant gripper is described that employed the bistable structure and the jaws with multiple contact points to grip and release the object. The benefit of the mechanism is free energy in the gripping action and increase the steady force holding. The investigation of the nonlinear behavior of the mechanism is estimated with the high value in minimum force compared with the maximum force to improve the gripping force. The contact force of the jaws is analyzed with many dimensions of the objects. Moreover, the dimension of the jaws is optimized to keep the objects by strong robustness. The finite element method is implemented to predict the motion characteristic and verify the maximum stress in the mechanism. A prototype is fabricated by the 3D printed method. The mechanism can work with a circular object with a maximum diameter is 75 mm. The mechanism has potential in many applications such as robotic, medical, agricultural and micro mechanism system.

Invited Speaker 8

Assoc. Prof. Dr. Teeranoot Chanthasopeephan

Mechanical Engineering Department
King Mongkut's University of Technology Thonburi, Thailand

Title of Invited Talk

Applied 3-PRS Parallel Manipulator for Stabilizing Platform: Kinematics and Control

Abstract of Invited Talk

In this paper, a 3-PRS (prismatic, revolute, and spherical) parallel manipulator for platform stabilization is designed. The main purpose of this device is to stabilize visual equipment, which is placed on top of a car to inspect electrical transmission cables as part of routine maintenance. Due to the bulky and heavy infrared cameras used during inspections, a stabilizer platform has been designed to handle the weight of camera equipment up to 10 kg. This device consists of two major mechanisms. The first mechanism is able to adjust the angle of the camera. Thus, the user can focus the camera along the electric transmission lines. The second mechanism is for stabilization. The mechanism serves to stabilize the orientation and position of the camera in roll, pitch, and heave directions. To test the performance of the stabilization mechanism, the device is fed with the known value of the angle as regards input. As such, the device is trying to compensate for the change in angle. Results show that errors between input angles and compensated angles are in the range of 0.4-3%. Errors are seen to be within an acceptable range. It is significant that the resultant errors do not affect the orientation of the camera.

Invited Speaker 9

Prof. Bhaskar Kanseri

Department of Physics,
Indian Institute of Technology Delhi, New Delhi, India

Title of Invited Talk

Quantum State Engineering for Science and Technology Applications

Abstract of Invited Talk

Engineering quantum states of light finds applications in several areas, such as in quantum communication and information technologies, in Quantum sensing and metrology, in fundamental testing etc. Quantum states such as single and entangled photons need to be generated at high rates along with best possible purity and fidelity for implementation in several quantum technologies and use of resonant optical cavities can help us in achieving high rates. The synchronized pulse optical cavities refer to those optical resonators which operate in pulsed regime and thus are having well defined mode properties in time domain. They may be used for fast generation of few photon Fock states and could also work as a short-time memory device, storing a weak pulse containing few photons for timescales ranging from several nanoseconds to several milliseconds. One can employ synchronized pulse optical cavities to approximate as an on-demand quantum source, for Fock state generation and realization of all cavity Schrödinger cat state for quantum information applications. In this talk, use of such cavities for single and few-photon Fock state generation and for quantum memories would be demonstrated.

The talk further aims to highlight some of our attempts towards realizing methods for secure quantum communication through free space and optical fibres. A lab realization of differential phase shift QKD protocol would be demonstrated using 2.5 GHz rate laser pulses. Our study also focuses to explore the effects of partial coherence of pump on spatial profile and polarization entanglement features of biphotons. Photon beams having partially spatially coherent features can be more robust against atmospheric losses and turbulence compared to their fully coherent counterparts, offering a way to achieve higher key rates in quantum communication applications.

Invited Speaker 10

Prof. Mohd Hafiz Dzarfan Othman

Advanced Membrane Technology Research Centre (AMTEC)
University Teknologi Malaysia, Malaysia

Title of Invited Talk

Fabrication of Inexpensive Ceramic Membranes via Phase Inversion/Sintering Process and Their Application in Water & Wastewater Treatment

Abstract of Invited Talk

Membrane technology has been widely embraced in water and wastewater treatments due to high efficiency and excellent product output, which ensures the consistent delivery of clean and safe water to meet the ever-increasing global water demand. Polymeric membranes have been the most commonly used materials in membrane applications attributed to low material cost and high market availability. Since the last two decades, ceramic membranes have gradually emerged as an excellent alternative to polymeric membranes as these membranes exhibit excellent chemical and thermal resistance, superior mechanical properties, and longer operational lifetime, which could not be achieved by some conventional polymeric membranes. However, ceramic membranes suffer from high material costs that hinder their uses in real applications. Recently, our research group have successfully developed various types of low-cost high-performance ceramic membranes from alternative ceramic materials, such as natural occurring clays, agricultural and industrial waste, and animal bones via phase inversion/sintering process. These membranes have shown some impressive performance in several membrane applications, such as microfiltration, photocatalytic membrane, and membrane distillation. With these successful breakthroughs, ceramic membranes have been made to be more affordable and economically feasible for real membrane applications with enhanced performance efficiency.

Oral Sessions

Nov. 13, 2021

Session 1

Catalyst Material Synthesis
Precision Measurement
Micro-manufacturing and Assembly Technologies
Applied Science, Engineering and Technology

Session Chair: Prof. Chih-Liang Wang

13:00~14:15	**O-1**	**Machine-learned Potential Model for Atomistic Simulations of Mechanical Properties of Chemically Complex Alloy** *Po-Yu Yang, Cheng-Lun Wu, and Chun-Wei Pao*,†* Research Center for Applied Sciences, Academia Sinica, Taiwan
	I-1	**Evolution of Wrinkle Patterns on Soft Substrate-Attached Thin Films - Direct Numerical Predictions** *Yu-Lin Shen* Department of Mechanical Engineering University of New Mexico, U.S.A.
	I-2	**Semiconductor Quantum Dot-sensitized Solar Cell: Challenges and Opportunities** *Jun Hieng Kiat* Department of Mechanical and Material Engineering University Tunku Abdul Rahman, Malaysia
	I-3	**Study of Trigonal-Sm_2O_3 as High-*k* Gate Dielectric on Ge-Based Metal-Oxide-Semiconductor (MOS) Device Structure** *Yew-Hoong Wong* Department of Mechanical Engineering, Faculty of Engineering, University of Malaya, Malaysia

Nov. 13, 2021

Session 2

Precision Manufacturing
Characterization and Modeling of Fuel Cell
Intelligent Sensors
Applied Science, Engineering and Technology

Session Chair: Prof. Jen-Chuan Tung

14:15~15:30	**I-4**	**Overview of the research progress and challenges of the application of carbon-based materials in Enzymatic Biofuel Cell (EBFC)** *Nabila A. Karim* Fuel Cell Institute, University Kebangsaan Malaysia, Malaysia
	I-5	**AIoT based Sensing Technology for Future Smart Homes and Cities** *Chengkuo Lee* Department of Electrical and Computer Engineering National University of Singapore, Singapore
	I-6	**Design and Optimization of High-Precision Compliant Mechanisms for Vibration-Assited Machining Methods** *Huy-Tuan Pham* Faculty of Mechanical Engineering Ho Chi Minh City University of Technology and Education, Vietnam
	O-2	**InGaN Light-Emitting Diodes with Embedded Porous Reflector and Tunneling Junction** *Chia-Feng Lin* Department of Materials Science and Engineering National Chung Hsing University, Taiwan

Nov. 13, 2021

Session 3

Electronics
Electrical Engineering
Computer Engineering
Applied Science, Engineering and Technology

Session Chair: Prof. Chia-Feng Lin

15:45~17:00	**I-7**	**Design Compliant Bistable Gripper with Multiple Contact Points in Jaws** *Ngoc Dang Khoa Tran* Faculty of Mechanical Engineering Industrial University of Ho Chi Minh City, Vietnam
	I-8	**Applied 3-PRS Parallel Manipulator for Stabilizing Platform: Kinematics and Control** *Teeranoot Chanthasopeephan* Mechanical Engineering Department King Mongkut's University of Technology Thonburi, Thailand
	I-10	**Fabrication of Inexpensive Ceramic Membranes via Phase Inversion/Sintering Process and Their Application in Water & Wastewater Treatment** *Mohd Hafiz Dzarfan Othman* Advanced Membrane Technology Research Centre (AMTEC) University Teknologi Malaysia, Malaysia
	O-3	**Rare earth based quarternary Heusler compounds RXVZ(R=Lu, Yb; X=Fe, Co, Ni; Z=Al, Si)** *Hung-Lung Huang[1], Jen-Chuan Tung[2,†], and Horng-Tay Jeng[1,*]* [1] Department of Physics, National Tsing Hua University, Taiwan [2] Center for General Education, Chang Gung University, Taiwan

Nov. 13, 2021

Session 4

Optics
Computer Engineering
Applied Science, Engineering and Technology

Session Chair: Distinguished Prof. Pin Han

17:00~18:15	**I-9**	**Quantum state engineering for science and technology applications** *Bhaskar Kanseri* Department of Physics, Indian Institute of Technology Delhi, India
	O-4	**Quantum dot-based white organic light-emitting diodes excit-ed by a blue OLED** *Krishn Das Patel* Department of Electro-Optical Engineering National Formosa University, Taiwan
	O-5	**FIB-DIC method for the Residual stress measurement of HiPIMs TiN, TiN/Ti duplex coating on cold spray Ti coating subtrates** *Nhat Minh Dang† and Ming-Tzer Lin** Graduate Institute of Precision Engineering, National Chung Hsing University, Taiwan

Poster Session

Poster No.	Paper Title
P-1	**Using Material Gene of Machine Learning to Predict Interface for Heterostructures** *Po-Liang Liu[1,*], Yu-Hsuan Wu[1], Yu-Cheng Lin[1], and Sheng-Lun Liao[2]* [1] Graduate Institute of Precision Engineering, National Chung Hsing University, Taichung 402, Taiwan [2] Molecular Digital Center, Genetics Generation Advancement Corporation, Taiwan
P-2	**Development of low-dimensional hybrid perovskite solar cells by the two-step deposition** *Tung-Yu Hung, Sih-Yu Ke, and Chih-Liang Wang[*]* Graduate Institute of Precision Engineering National Chung Hsing University, Taiwan
P-3	**A First-Principles study of normal- and inverse- Heusler com-pounds: X2YZ (X, Y= Cr, Mn Fe, Co; Z=Al, Ga, Si)** *Hung-Lung Huang[1], Jen-Chuan Tung[2], and Horng-Tay Jeng[1,*]* [1] Department of Physics, National Tsing Hua University, Taiwan [2] Center for General Education, Chang Gung University, Taiwan
P-4	**Non-precious metal catalysts to enhance hydrogen production in anion exchange membrane water electrolysis** *Shang-Fu Wang[1], Kean Long Lim[2], and Hisharng Yang[1,*]* [1] Graduate Institute of Precision Engineering, National Chung Hsiing University, Taiwan [2] Fuel Cell Institute, Universiti Kebangsaan Malaysia, Malaysia

P-5	***Ab initio* Study of Triazole as Copper Corrosion Inhibitors in Chemical Mechanical Planarization** *Ying-Hao Chen[1], Yi-Ke Yang[1], Jen-Chuan Tung[2], Jhih-Hong Sha[1], Kwo-Hung Shen[3], and Po-Liang Liu[1,*]* [1] Graduate Institute of Precision Engineering, National Chung Hsing University, Taichung 402, Taiwan [2] Center for General Education, Chang Gung University, Taoyuan 33302, Taiwan [3] Department of Interdisciplinary Engineering Science, Clarkson University, Potsdam, NY, United States
P-6	**Study of the electrolyte life indicator to optimize plasma elec-trolytic polishing** *Fa-Cheng Su[1], Hisharng Yang[1,*], Wen-Chieh Wu[2], and Yu-Kai Chen[2]* [1] Graduate Institute of Precision Engineering, National Chung Hsing University, Taiwan [2] Intelligent Technology Development Section, Metal Industries Research and Development Centre, Taiwan
P-7	***Ab Initio* Study of Atomic Structures of Ga(Zn) doped ZnO(Ga_2O_3)** *Jen-Chuan Tung[1], Jian-Sheng Xie Su[2], Yi-Che Chen[2], Ray-Hua Horng[3], and Po-Liang Liu[2,*]* [1] Center for General Education, Chang Gung University, Taoyuan 33302, Taiwan [2] Graduate Institute of Precision Engineering, National Chung Hsing University, Taichung 402, Taiwan [3] Institute of Electronics, National Yang Ming Chiao Tung University, Hsinchu 30010, Taiwan
P-8	**Microfluidic gold nanoparticle aptasensor platform for blood potassium detection in chronic kidney disease patients** *Chien-Hsuan Ko[1] and Lung-Ming Fu[1,2,*]* [1] Department of Engineering Science, National Cheng Kung University, Taiwan [2] Graduate Institute of Materials Engineering, National Pingtung University of Science and Technology, Taiwan

P-9	***Ab Initio* Study of Electronic Structures and Defect Formation Energy of Sb Doped ZnO** *Jen-Chuan Tung[1], Yen-Jui Teseng[2], Yi-Cheng Tang[2], Ray-Hua Horng[3], and Po-Liang Liu[2,*]* [1] Center for General Education, Chang Gung University, Taoyuan 33302, Taiwan [2] Graduate Institute of Precision Engineering, National Chung Hsing University, Taiwan [3] Institute of Electronics, National Yang Ming Chiao Tung University, Hsinchu 30010, Taiwan
P-10	**High temperature coefficient of resistance in $Mo_xW_{1-x}S_2$ thin film** *En-Ting Lin[1], Wenqi Zhang[2], Yi-Lin Yang[2], and Tsung-Shine Ko[1,*]* [1] Department of Electronic Engineering, National Changhua University of Education, Taiwan [2] Department of Electronic Engineering, National Kaohsiung Normal University, Taiwan
P-11	**First-principles Calculation to Study the Anomalous Hall Effect of $Co_{3-x}Cr_xAl$ (x = 0, 1, 2, 3) Heusler Compounds** *Jen-Chuan Tung[1], Bo-En Wu[2], Jia-Wei Dai[2], and Po-Liang Liu[2,*]* [1] Center for General Education, Chang Gung University, Taoyuan 33302, Taiwan [2] Graduate Institute of Precision Engineering, National Chung Hsing University, Taichung 402, Taiwan
P-12	**Dielectric Properties of $Mg_2(Sn_{1-x}Zr_x)O_4$ Ceramics at Millimeter wave Frequency for antenna application in 5G FR2 Band** *Yih-Chien Chen[*], Chun-Hao Tai, and Rei-Shin Chen* Department of Electrical Engineering Lunghwa University of Science and Technology, Taiwan

P-13	**Optical Measurement and Manufacturing Process of Thermal Module for LED Automobile Light** *Kuo-Wei Lin, Hsun-Ching Hsu, Fu-Yu Xie, and Pin Han*[*] Graduate Institute of Precision Engineering National Chung Hsing University, Taiwan
P-14	***Ab Initio* Study of WTe_2 Band Structures with Vertical Electric Field Applied in MOSFETs** *Jen-Chuan Tung[1], Po-Chun Shih[2], Jine-Du Fu[2], and Po-Liang Liu[2,*]* [1] Center for General Education, Chang Gung University, Taoyuan 33302, Taiwan [2] Graduate Institute of Precision Engineering, National Chung Hsing University, Taichung 402, Taiwan
P-15	***Ab initio* Study of Copper Corrosion Inhibitors on Cu_2O(111) Surfaces for Chemical Mechanical Planarization** *Ying-Hao Chen[1], Jen-Chuan Tung[2], Dun-Ru Hung[1], Kwo-Hung Shen[3], and Po-Liang Liu[1,*]* [1] Graduate Institute of Precision Engineering, National Chung Hsing University, Taichung 402, Taiwan [2] Center for General Education, Chang Gung University, Taoyuan 33302, Taiwan [3] Department of Interdisciplinary Engineering Science, Clarkson University, Potsdam, NY, United States
P-16	**Improvement in 80×160 Passive-Matrix μ-LED Display via Pas-sivation Coatings** *N.R. Chang[1], P.H. Chen[2], Po-Liang Liu[1], and D.S. Wuu[2,3*]* [1] Department of Graduate Institute of Precision Engineering, National Chung Hsing University, Taichung, Taiwan [2] Department of Materials Science and Engineering, National Chung Hsing University, Taichung, Taiwan [3] Department of Applied Materials and Optoelectronic Engineering, National Chi Nan University, Nantou 54561, Taiwan

P-17	***Ab initio* Studies of Work function Changes of CO_2 Adsorption on Pure and Pd-doped $ZnGa_2O_4$(111) Surface for Gas Sensor** *Jen-Chuan Tung[1], Min-Hsun Tsai[2], Jine-Du Fu[2], and Po-Liang Liu[2,*]* [1] Center for General Education, Chang Gung University, Taoyuan 33302, Taiwan [2] Graduate Institute of Precision Engineering, National Chung Hsing University, Taichung 402, Taiwan
P-18	***Ab initio* Studies of Work function Changes of CO Adsorption on Clean and Pd-doped $ZnGa_2O_4$(111) Surface for Gas Sensor** *Jen-Chuan Tung[1], Che-An Pai[2], Yu-Hsuan Chen[2], and Po-Liang Liu[2,*]* [1] Center for General Education, Chang Gung University, Taoyuan 33302, Taiwan [2] Graduate Institute of Precision Engineering, National Chung Hsing University, Taichung 402, Taiwan
P-19	**Investigation of Non-contact Surface Topography Measurement 3 System for Transparent Polymer Materials** *Yu-Jung Lee[*] and Yu-Ching Lee* Southern Taiwan University of Science and Technology, Tainai 712, Taiwan
P-20	**An Immunobiosensor Based on Titanium Oxide Nano-Tubes for Liver Cancer Screening** *Thien Luan Phan[1,2], Nguyen Van Hieu[2], Hou-Wei Tsai[3] and Congo Tak-Shing Ching[1,3,*]* [1] Graduate Institute of Biomedical Engineering National Chung Hsing University, Taiwan [2] Department of Physics and Electronic Engineering Vietnam National University, Vietnam [3] Department of Electrical Engineering, National Chi Nan University, Taiwan
P-21	**Acousto-optic Modulated LD Sources Designed for Multi-color Photo-acoustic Imaging** *Bor-Wen Yang[*]* Department of Electro-Optical Engineering Minghsin University of Science and Technology, No.1, Xinxing Rd., Xinfeng Hsinchu, Hsin-Chu, Taiwan

P-22	**Skin Absorption and Restoring Effects of Collagen and L-ascorbic Acid Explored by Fluorescence and Reflection Spectroscopy** *Bor-Wen Yang* and Yen-Chun Chen* Department of Electro-Optical Engineering Minghsin University of Science and Technology, No.1, Xinxing Rd., Xinfeng Hsinchu, Hsin-Chu, Taiwan
P-23	**Non-invasive Tissue Recognition Imaging for Cosmetology and Industry** *Bor-Wen Yang* and Guan-Yu Chen* Department of Electro-Optical Engineering Minghsin University of Science and Technology, No.1, Xinxing Rd., Xinfeng Hsinchu, Hsin-Chu, Taiwan
P-24	**Inspection of Micro-Structure by Tissue Recognition Imaging** *Bor-Wen Yang* and Yi-Yan Su* Department of Electro-Optical Engineering Minghsin University of Science and Technology, No.1, Xinxing Rd., Xinfeng Hsinchu, Hsin-Chu, Taiwan
P-25	**Non-invasive Multi-color Skin Imaging Using Multi-color LED Source Module and Floating Lens** *Bor-Wen Yang** Department of Electro-Optical Engineering Minghsin University of Science and Technology, No.1, Xinxing Rd., Xinfeng Hsinchu, Hsin-Chu, Taiwan
P-26	**Multi-color Optical Coherence Tomography Apparatus Powered by LED Source** *Bor-Wen Yang** Department of Electro-Optical Engineering Minghsin University of Science and Technology, No.1, Xinxing Rd., Xinfeng Hsinchu, Hsin-Chu, Taiwan

Abstract Collections

No. O-1

TITLE: Machine-learned Potential Model for Atomistic Simulations of Mechanical Properties of Chemically Complex Alloy

Po-Yu Yang, Cheng-Lun Wu, and Chun-Wei Pao[*,†]

Research Center for Applied Sciences, Academia Sinica 128 Sec. 2, Academia Rd., Nankang, Taipei 11529, Taiwan

[†]Presenter
[*]Corresponding author's e-mail: *cwpao@gate.sinica.edu.tw*

ABSTRACT

The increasing demands for developing novel chemically complex alloys has imposed a significant challenge to the modeling and simulation community. The mechanical properties of these complex alloys are essential for their applications; however, the length scale required for studying the plasticity of these alloys is beyond the reach of conventional quantum chemistry calculations. In this study, we harnessed the power of machine learning and trained a potential model for the chemically complex Ni/Co/Ti/Zr/Hf alloy system by combining the spectral neighbor analysis (SNAP) model and the Bayesian optimization based on a large data set of training images labeled with energies and atomic forces computed from the density functional theory (DFT). We demonstrate that the trained potential model can predict the energies and atomic forces of this chemically-complex alloy with high fidelity to the DFT calculations. A series of large-scale (over 10^5 atoms) molecular dynamics simulations were performed to examine the deformation and dislocation dynamics of both nanowires and bulk structures, and the formation of amorphous, shear band-like region following dislocation pinning was observed, which is in excellent agreement with experiments. Hence, the present study demonstrate that the machine-learned SNAP model yields quantum accuracy even for complex alloy comprised of five constituents, allowing for investigating the plasticity deformation of chemically complex alloys with atomistic insights

Keywords: Atomistic simulation, machine learning, cemically complex alloy, plasticity

No. O-2

TITLE: InGaN Light-Emitting Diodes with Embedded Porous Reflector and Tunneling Junction

Chia-Feng Lin

Department of Materials Science and Engineering National Chung Hsing University, Taiwan

†Presenter
*Corresponding author's e-mail: *cflin@dragon.nchu.edu.tw*

ABSTRACT

The InGaN Light-emitting diodes (LEDs) with the embedded porous-GaN distributed Bragg reflectors (DBR) and the tunneling junction had been demonstrated through the epitaxial growth process and electrochemical (EC) wet etching process. High refractive index n^+-GaN:Si layers in the n^+-GaN:Si/n-GaN:Si stack structures were transformed into the low refractive index porous-GaN:Si layers that formed the porous-GaN DBR structure. The 20 pairs of the n^+-GaN:Si/n-GaN:Si stack structure had been transformed into the porous-GaN/n-GaN DBR structure that embedded in the InGaN-based LED structure. The light output power of the InGaN LED with the porous-GaN reflector has been improved through the light reflected process and short cavity effect in the air/InGaN-LED/porous-DBR structure. The n^+-GaN:Si/p^+-GaN:Mg structure as the tunneling junction has been used to replace the reduce the internal loss of the indium tin oxide (ITO) transparence contact layer. The injection current density of the InGaN LED was increased by forming the porous n^+-GaN:Si/p^+-GaN:Mg tunneling junction structure. The electroluminescence (EL) emission properties of the InGaN LED was demonstrated which had the top/bottom conductive porous-GaN DBRs and the n^+-porous GaN:Si/p^+-GaN:Mg tunneling junction. Full epitaxial InGaN cavity structure with top/bottom porous-GaN DBR structure has been demonstrated which has potential for the vertical cavity surface-emitting laser applications.

Keyword: InGaN, porous reflector, tunneling junction

REFERENCES

[1] C. F. Lin, Y. T. Zhang, C. J. Wang, Y. Y. Chen, G. Y. Shiu, Y. K., and J. Han, InGaN Resonant Microcavity With n^+-Porous-GaN/p^+-GaN Tunneling Junction, IEEE Electron Device Letters, 42(11), 2021.
[2] C. J. Wang, Y. K., G. Y. Shiu, Y. Y. Chen, Y. S. Lin, H. Chen, and C. F. Lin, InGaN Resonant-Cavity Light-Emitting Diodes with Porous and Dielectric Reflectors, Applied Sciences, 11, 8 (2021).

No. O-3

TITLE: Rare earth based quarternary Heusler compounds RXVZ(R=Lu, Yb; X=Fe, Co, Ni; Z=Al, Si)

Hung-Lung Huang[1], Jen-Chuan Tung[2,†], and Horng-Tay Jeng[1,*]

[1] Department of Physics, National Tsing Hua University, Taiwan
[2] Center for General Education, Chang Gung University, Taiwan

[†]Presenter
[*]Corresponding author's e-mail: *jeng@phys.nthu.edu.tw*

ABSTRACT

Rare earth equiatomic quaternary Heusler (EQH) compounds with chemical formula RXVZ (R = Yb, Lu; X = Fe, Co, Ni; Z = Al, Si) have recently attracted much attention since these materials are easily prepared and they also provide interesting properties for future spintronic applications[1,2] In this work, rare Earth-based EQH compounds in three types of structures are theoretically investigated through first-principles calculations based on density functional theory. We find that most of the studied rare Earth EQH compounds exhibit magnetic ground states including ferro-, antiferro-, and ferri-magnetic phases. Owing to the nearly closed shell *f* orbital in Lu and Yb, the spin magnetic moments mainly come from the 3*d* transition metal elements. In particular, in the type I structure, a large portion (7 out of 12) of EQH compounds are ferromagnetic half-metals (HMs) with integer magnetic moments ranging from 1 to 3 μ_B. In the type II structure, YbFeVAl is found to be a rare case of antiferro-magnetic (AFM) halfmetal with zero total magnetic moments. Surprisingly, we also discover an unusual magnetic semiconductor LuCoVSi in the type III structure with a total spin magnetic moment of 3.0 μ_B and an indirect band gap of 0.2 eV. The structural and magnetic stabilities such as formation energy, magnetization energy as well as the mechanical stabilities such as the bulk, shear, and Young's moduli, and Poisson's, and Pugh's ratios of these EQH compounds are also investigated. Most of the studied compounds exhibit mechanical stability under the mechanical stability criteria and show elastic anisotropy. Our work[3] provides guidelines for experimental researchers to synthesize useful materials in future spintronic applications.

Keyword: Heusler alloys, rare alloys, elastic constants, magnetic semiconductor, first-principles calculation

REFERENCES

[1] T. Graf, C. Felser and S. S. P. Parkin, Prog. Solid State Chem., Vol. 39, pp. 1 (2011).
[2] C. Felser and A. Hirohata, Heusler Alloys, properties, growth, applications, Springer Series in Materials Science, pp. 222 (2016).
[3] H.-L. Huang, J.-C. Tung, and H.-T. Jeng, A first-principles study of rare earth quaternary Heusler compounds: RXVZ (R= Yb, Lu; X=Fe, Co, Ni; Z=Al, Si). Phys. Chem. Chem. Phys., Vol. 23, pp. 2264 (2021).

No. O-4

TITLE: Quantum dot-based white Organic light-emitting Diodes Excit-ed by a Blue OLED

Krishn Das Patel[*,†]

Department of Electro-Optical Engineering, National Formosa University, Taiwan

[†]Presenter
[*]Corresponding author's e-mail: *d0977108@gm.nfu.edu.tw*

ABSTRACT

In this study, we investigated white organic light-emitting diodes (WOLEDs) consisting of RQD and GQD. These are the most exciting new lighting technologies that have grown rapidly in re-cent years. Our WOLEDs development process consisted of the following methods: (a) Genera-tion of Single-emitting layer blue OLED, (b) Nanoimprinting into quantum dot QD photoresist, (c) A white light that consists of green and red QD photoresist color conversion layers (CCL) ex-cited by a blue OLED, fabricated as flexible white light, (d) To manufacture flexible white light, GQD+RQD are mixed, then directly spin-coated onto a PET/blue OLED substrate. First, to create the BOLED, HATCN was selected for the hole injection layer (HIL) on ITO, TAPC for the hole transport layer, TPBi for the electron transport layer materials, and for blue-emitting material we used a novel polycyclic framework of thermally activated delayed fluorescence (TADF) ma-terial, ν-DABNA, which does not utilize any heavy metals and has a sharp and narrow (FWHM 28 nm) electro-luminescence spectrum. The optimum device structure is ITO/HATCN (20 nm)/TAPC (30 nm)/MADN: ν-DABNA (40 nm)/TPBi (30 nm)/LiF (0.8 nm)/Al (150 nm) with emit-ting area 1 cm x 1 cm. It has a current density of 87.68 mA/cm^2, a luminance of 963.9 cd/m^2, and an efficiency of 1.10 cd/A at 9 V. Next, the red and green quantum dots (RQD, RQD) photo-resist (PR) color conversion layers (CCL) were excited by blue OLEDs to produce white light generated by the R+G+B pair. Moreover, the Nanoimprinting technology was used to roughen the surface of the QD photoresist by using the commercialized patterned sapphire. Finally, the GQD and the RQD photoresists are mixed in the proper ratio (GRQD), The luminance and effi-ciency of the three-layer GRQD PRs/PET/ITO/blue OLED assembled device are 108 cd/m^2 and 0.85 cd/A, respectively, at 9 V. The flexible blue OLED biased at 6-9 V successfully excited the GRQD CCL to obtain a three-band white color. The EL spectra have three peaks at 456, 528, and 620 nm. The CIE coordinates of the flexible GRQD CCL/blue OLED are stably fixed at (0.35, 0.35) during 6-9 V no effect was caused by the applied voltage.

Keyword: quantum dots, Color conversion layer, photoresis, Nanoimprint

No. O-5

TITLE: FIB-DIC Method for the Residual Stress Measurement of HiPIMs TiN, TiN/Ti Duplex Coating on Cold Spray Ti Coating Subtrates

Nhat Minh Dang[†] and Ming-Tzer Lin[*]

Graduate Institute of Precision Engineering, National Chung Hsing University, Taichung 402, Taiwan

[†]Presenter
[*]Corresponding author's e-mail: *mingtlin@dragon.nchu.edu.tw*

ABSTRACT

In this study, the combination of focused ion beam (FIB) and digital image correlation (DIC) was used to measure the residual stress of cold spray titanium coating and HiPIMS TiN cap. The cold spray titanium coating (5mm) was deposited on the titanium substrate, which prepared in three different numbers of layers (i.e., 2, 8, and 14, respectively). The titanium nitride (TiN) and TiN plus Ti adhesion layer (TiN/Ti) (50 nm) thin film with a thickness of approximately 600 nm was deposited on three titanium cold-sprayed substrates by using a high-power impulse magnetron sputtering process separately. The ring-core drilling method was conducted with various depth steps, and the corresponding images were obtained with a scanning electron microscope. DIC method was used to measure the displacement. The residual stress was finally obtained by using the relationship between the displacement and the strain after calibration and then differentiating the displacement of each pixel in the image. The residual stress of the cold spray titanium measured by FIB-DIC was 78 MPa. which the deviation is about 4-7% compared with the MTS3000-Ringcore system. The residual stress of three TiN/Ti 2*p*, 8*p*, 14*p*, samples are 4124, 4407, and 4150 MPa, the TiN/Ti 8*p* had the highest residual stress, but the disparity with the other two samples was not very significant. The study provide a reliability method for the residual stress measurement of HiPIMs TiN, TiN/Ti duplex cold spray Ti coating samples.

No. P-1

TITLE: Using Material Gene of Machine Learning to Predict Interface for Heterostructures

Po-Liang Liu[1,*], Yu-Hsuan Wu[1], Yu-Cheng Lin[1,†], and Sheng-Lun Liao[2]

[1] Graduate Institute of Precision Engineering, National Chung Hsing University, Taichung 402, Taiwan
[2] Molecular Digital Center, Genetics Generation Advancement Corporation, Taiwan

[†]Presenter
[*]Corresponding author's e-mail: *pliu@dragon.nchu.edu.tw*

ABSTRACT

Successful heteroepitaxial film growth can integrate heterogeneous films with lattice mismatches. Excellent heteroepitaxial films can reduce lattice mismatch stress and reduce material defect density, thereby providing subsequent smooth surfaces of heteroepitaxial films and reducing deposition time during epitaxial growth of subsequent thin films. The interfacial structure of the heteroepitaxial film and its chemical stability havs become widely used in the prediction of heterogeneous films. However, it is extremely difficult for scientists to predict the interfacial structure of heteroepitaxial thin films by comparing the first-principles models or not by directly observing the experimental results. Recently, we proposed a materials genome approach to calculate heterostructure predictions. The materials genome approach was accepted to be published in a peer reviewed journal of Materials Today Communications [1]. In this research, the materials genome approach is started with Pipeline Pilot and programmed into machine language to compute thin-film heterostructure predictions. Pipeline Pilot is a tool to generate the crystal structures with crystallographic information frameworks. Our current project dealed with thin-film heterostructure predictions using Python software. The Heterostructures Open Database (HOD) is a database that can predict the crystal structure model of heterostructures of semiconductor materials. By inputting the crystal structures of the thin film and the substrate, and the orientation relationship between the thin film and the substrate, the HOD can combine the thin film and the substrate into a heterostructure. The HOD interfaces includes five modules: the c-axis position search module, the creating a vacuum slab along c-axis, the vacuum slab displacement module, the crystal structure combination module, and the interfacial bonded-atom search module. We take the GaN(0001)/ZrB_2(0001) heterostructures as an example, and use HOD to prove that the most favorable interface of GaN(0001)/ZrB_2(0001) heterostructures consists of tetrahedrally coordinated N with one Ga-N bond and three N-Zr bonds, which gives rise to N-polarity in the GaN epitaxial film, in agreement with previous observations [2].

Keyword: Materials genome, thin film, heterostructure, semiconductor, first-principles calculation

REFERENCES

[1] P.-L. Liu , Materials Today Communications, Vol. 23, pp. 100866 (2020).
[2] P.-L. Liu *et al.*, Physical Review B, Vol. 72, pp. 245335 (2005).

No. P-2

TITLE: Development of low-dimensional hybrid perovskite solar cells by the two-step deposition

Tung-Yu Hung[†], Sih-Yu Ke, and Chih-Liang Wang[*]

Graduate Institute of Precision Engineering, National Chung Hsing University, Taiwan

[†]Presenter
[*]Corresponding author's e-mail: *clwang@email.nchu.edu.tw*

ABSTRACT

Hybrid organic-inorganic perovskite is one of the promising solar cell materials due to its achievable high conversion efficiency. However, the three-dimensional $MAPbI_3$ perovskite typically suffers from its unstable nature and limits the commercialization. In this regard, we develop a high stable, low-dimensional hybrid perovskite, prepared by the two-step deposition and surface passivation, on the hydrothermally synthesis of TiO_2 nanorods. The preparation of low-dimensional hybrid perovskite via the two-step deposition is conducted by mixing the PbI_2 and phenylethylamine iodide (PEAI), followed by the immersion of MAI solution. The surface passivation is carried out by dropping the PEAI solution on the surface of two-step deposited three-dimensional $MAPbI_3$ perovskite. The experimental results show that the low-dimensional hybrid perovskite can be successfully synthesized by the two-step deposition and its surface morphology and residual PbI_2 can be effectively controlled by the PbI_2/PEAI ratio and the heat treatment time. On the other hand, the dropping of PEAI solution using different concentration as the surface passivation can also control the surface morphology and the amount of residual PbI_2 in the film. More details related to the characterization of materials and device performance will be discussed in the presentation.

Keyword: TiO_2 nanorods; hybrid perovskite; two-step deposition; surface passivation; PEAI

No. P-3

TITLE: A First-Principles study of normal- and inverse- Heusler compounds: X2YZ (X, Y= Cr, Mn Fe, Co; Z=Al, Ga, Si)

Hung-Lung Huang[1], Jen-Chuan Tung[2,†], and Horng-Tay Jeng[1,*]

[1] Department of Physics, National Tsing Hua University, Taiwan
[2] Center for General Education, Chang Gung University, Taiwan

[†]Presenter
[*]Corresponding author's e-mail: *jeng@phys.nthu.edu.tw*

ABSTRACT

Heusler compounds [1,2] are a remarkable class of materials with more than 1000 members and a wide range of extraordinary multi-functionalities including halfmetallic, high-temperature ferri- and ferro-magnets [3-5], multi-ferroics, shape memory alloys, and tunable topological insulators with a high potential for spintronics, energy technologies, and magneto-caloric applications. Magnetic Heusler compounds (MHCs) have recently attracted great attention since these types of material provide novel functionalities in spintronic and magneto-electronic devices. Finding novel MHCs and halfmetallic (HM) materials with Heusler structure is a focus of current research. Therefore, we give a comprehensive study and prospective on the magnetic and half-metallic properties of some selected Heusler compounds. Based on high throughout density functional theory calculations, we investigated a series Heusler compounds X2YZ (X, Y= Cr, Mn, Fe, Co; Z= Al, Ga, Si) with L21- and XA-structure. Furthermore, the structural stability of these Heusler compounds is also examined from the points of view of formation energy, cohesive energy and mechanical behavior, such as bulk, shear, and Young's modulus. This work is likely to predict and inspire consideration of Heusler compounds for application in future spintronic and magnetoelectronic devices.

Keyword: Heusler alloys, density functional theory, half metal, elastic constants, first-principles calculation

REFERENCES

[1] T. Graf, C. Felser and S. S. P. Parkin, Prog. Solid State Chem., Vol. 39, pp. 1 (2011)
[2] C. Felser and A. Hirohata, Heusler Alloys, properties, growth, applications, Springer Series in Materials Science, p. 222 (2016).
[3] I. Galanakis and E. S- as-ioglu, Appl. Phys. Lett., Vol. 99, pp. 052509 (2011).
[4] I. Asfour, H. Rached, S. Benalia and D. Rached, J. Alloys Compd., Vol. 676, pp. 440451 (2016).
[5] A. Kundu, S. Ghosh, R. Banerjee, S. Ghosh and B. Sanyal, Sci. Rep., Vol. 7, pp. 1803 (2017).

No. P-4

TITLE: Non-precious metal catalysts to enhance hydrogen production using anion exchange membrane water electrolysis

Shang-Fu Wang[1,†], Kean Long Lim[2], and Hisharng Yang[1,*]

[1] Graduate Institute of Precision Engineering, National Chung Hsiing University, Taiwan
[2] Fuel Cell Institute, Universiti Kebangsaan Malaysia, Malaysia

[†]Presenter
[*]Corresponding author's e-mail: *hsiharng@nchu.edu.tw*

ABSTRACT

This work mainly used nickel-copper catalysts as cathode catalysts in anion exchange membrane (AEM) water electrolysis that replaced Pt/C to completely achieve the use of non-precious metal catalysts. In this experiment, NiCu mixed metal oxide (MMO) and 40wt% NiCu MMO/C were successfully synthesized by chemical reduction. In the AEM electrolyzer performance, when using FeCo as the anode and the 40wt% NiCu MMO/C cathode showed the AEM electrolyzer performance of 208 mA/cm^2 and 26 ml/min of hydrogen production at 2.2 V in 1 M KOH at 25℃. Compared to the 40wt% Pt/C performance of 160 mA/cm^2 with 23 ml/min of hydrogen production at 2V, it shows the feasibility of NiCu MMO/C to replace Pt/C. However, due to the high content of NiCu MMO/C oxide synthesized in this experiment, it has a higher overvoltage that requires 2.2V to work. The non-precious metal as catalyst can be realized in this study.

Keyword: Hydrogen production; anion exchange membrane; water electrolzyer; metal oxide; non-precious metal catalyst

REFERENCES

[1] A. Y. Faid, A. O. Barnett, F. Seland, et al. NiCu mixed metal oxide catalyst for alkaline hydrogen evolution in anion exchange membrane water electrolysis, Electrochimica Acta, Vol. 371, (2021).
[2] A. Lim, H.J. Kim, D. Henkensmeier, et al. A study on electrode fabrication and operation variables affecting the performance of anion exchange membrane water electrolysis. Journal of Industrial and Engineering Chemistry, Vol. 76, pp. 410-418, (2019)

No. P-5

TITLE: *Ab initio* Study of Triazole as Copper Corrosion Inhibitors in Chemical Mechanical Planarization

Ying-Hao Chen[1], Yi-Ke Yang[1], Jen-Chuan Tung[2], Jhih-Hong Sha[1,†], Kwo-Hung Shen[3], and Po-Liang Liu[1,*]

[1] Graduate Institute of Precision Engineering, National Chung Hsing University, Taichung 402, Taiwan
[2] Center for General Education, Chang Gung University, Taoyuan 33302, Taiwan
[3] Department of Interdisciplinary Engineering Science, Clarkson University, Potsdam, New York, U.S.A.

[†]Presenter
[*]Corresponding author's e-mail: *pliu@dragon.nchu.edu.tw*

ABSTRACT

This study conducted first-principles density functional theory calculation to investigate the adsorption behavior at Cu(111) surface for several kinds of triazole molecules, including 1, 2, 3-triazole(123TA), 1, 2, 4-trazole(124TA) and Benzotriazole(BTAH) before and after being deprotonated in chemical mechanical planarization(CMP) process. The calculation of adsorption energy shows that 123TA can be absorbed onto Cu(111) surface by forming bridge bonds between it's single or twin nitrogen atoms and copper. The adsorption energy of 123TA is the highest than those of 124TA and BTAH, which is −0.335 eV while the distance of atomic bond between nitrogen atoms and copper is 2.61 Å. After deprotonation, the adsorption energy of 123TA is −3.065 eV with 1.974 Å atomic bond between nitrogen atoms and copper.

Keyword: Copper, cuprous oxide, adsorption energy, triazole molecules, first-principles calculation

No. P-6

TITLE: Study of the Electrolyte Life Indicator to Optimize Plasma Elec-trolytic Polishing

Fa-Cheng Su[1,†], Hsiharng Yang[1,*], Wen-Chieh Wu[2], Yu-Kai Chen[2]

[1] Graduate Institute of Precision Engineering, National Chung Hsing University, Taiwan
[2] Intelligent Technology Development Section, Metal Industries Research and Development Centre, Taiwan

[†]Presenter
[*]Corresponding author's e-mail: *hsiharng@nchu.edu.tw*

ABSTRACT

This work mainly investigated the current density of electrolyte as indicator that acquired the timing of adding electrolyte in plasma electrolytic polishing (PEP). In this experiment, 2wt% ammonium sulfate with 2wt.% was used as electrolyte to polish 1cm×1cm stainless steel SUS_30_4. It's successfully used hot water surrounding heating method to heat it up from 60 to 90˚C and made use of suction filtration. The cathode was fixed at the beaker boarder in electrolyte and the input voltage 340 volts resulted the gas phase layer to form stably around the work piece. The plasma went through electrolyte to polish the workpiece surface. Then the anode was slowly immersed into the electrolyte and measured the current density. Based on the current density with temperature curve, if the measured current density is below the curve, 2wt.% ammonium sulfate solution needs to be supplemented; if the measured current density is above the curve, 2wt.% ammonium sulfate solution will not be supplemented. The current density as indicator for plasma electrolytic polishing can be realized in this study.

Keyword: plasma electrolytic polishing; electrolyte; ammonium sulfate, electrochemical polishing

REFERENCES

[1] P.N. Belkina, S.A.Kusmanova and E.V.Parfenovb. Mechanism and technological opportunity of plasma electrolytic polishing of metals and alloys surfaces, Applied Surface Science Advances, Vol.1,100016, Nov. (2020).
[2] M. Kaseem, S. Fatimah, N. Nashrah, Y.G. Ko. Recent progress in surface modification of metals coated by plasma electrolytic oxidation: Principle, structure, and performance, Progress in Materials Science, Vol. 117, Apr. (2021).

No. P-7

TITLE: *Ab Initio* Study of Atomic Structures of Ga(Zn) doped ZnO(Ga_2O_3)

Jen-Chuan Tung[1], Jian-Sheng Xie Su[2], Yi-Che Chen[2,†], Ray-Hua Horng[3], and Po-Liang Liu[2,*]

[1] Center for General Education, Chang Gung University, Taoyuan 33302, Taiwan
[2] Graduate Institute of Precision Engineering, National Chung Hsing University, Taichung 402, Taiwan
[3] Institute of Electronics, National Yang Ming Chiao Tung University, Hsinchu 30010, Taiwan

[†]Presenter
[*]Corresponding author's e-mail: *pliu@dragon.nchu.edu.tw*

ABSTRACT

In this study, the atomic structures of Ga-doped ZnO and Zn-doped Ga_2O_3 were simulated through density functional theory-based calculation. Total energy, lattice constants, bond length, and *X*-ray diffraction pattern were evaluated to determine the most stable structure. The simulation results revealed that one of the atomic structures derived from Ga-doped ZnO has lower total energy and more reasonable lattice constants and bond length than in those derived from Zn-doped Ga_2O_3. Furthermore, the position of the major peak in the *X*-ray diffraction pattern from Ga-doped ZnO shifts toward that from $ZnGa_2O_4$ when Ga concentration is increased. Consequently, we consider Ga-doped ZnO more suitable material than Zn-doped Ga_2O_3 to form $ZnGa_2O_4$.

Keyword: $ZnGa_2O_4$, doped, ZnO, Ga_2O_3, *X*-ray diffraction, first-principles calculation

No. P-8

TITLE: Microfluidic Gold Nanoparticle Aptasensor Platform for Blood Potassium Detection in Chronic Kidney Disease Patients

Chien-Hsuan Ko[1] and Lung-Ming Fu[1,2*,†]

[1] Department of Engineering Science, National Cheng Kung University, Taiwan
[2] Graduate Institute of Materials Engineering, National Pingtung University of Science and Technology, Taiwan

[†]Presenter
[*]Corresponding author's e-mail: *loudyfu@ncku.edu.tw*

ABSTRACT

An integrated microfluidic Au nanoparticle (AuNP) aptasensor platform is proposed for moni-toring the concentration of potassium (K^+) ions in the bloodstream patients with chronic kidney disease (CKD). In the proposed detection platform, the AuNPs in the AuNP/aptamer complex are displaced by the serum K^+ ions and react with NaCl to produce a color change in the detection region from which the K^+ ion concentration is then inversely derived. The microfluidic platform comprises three main components, namely a centrifugal device for separating the serum from the whole blood sample, an AuNP aptasensor PMMA/paper-microchip for reagent storage and K^+ ion/aptamer reaction, and a colorimetric analysis system for the quantitative detection of the serum K^+ ion concentration. The experimental results show that the microfluidic platform provides a linear response over the K^+ ion concentration in range of 1~8 mM in artificial serum and has a detection limit of 1 mM. Moreover, the detection results obtained for 80 CKD patients with a total of 100 samples are in good agreement (R_2 = 0.958) with the measurement results obtained using an ion-selective electrodes method. Results confirm that the current microfluidic aptasensor platform provides a highly-sensitive and convenient method for performing the point-of-care (POC) monitoring of the K^+ ion concentration in human serum.

Keyword: microfluidic, paper-based, microchip, serum potassium ion

No. P-9

TITLE: *Ab Initio* Study of Electronic Structures and Defect Formation Energy of Sb Doped ZnO

Jen-Chuan Tung[1], Yen-Jui Teseng[2], Yi-Cheng Tang[2,†], Ray-Hua Horng[3], and Po-Liang Liu[2,*]

[1] Center for General Education, Chang Gung University, Taoyuan 33302, Taiwan
[2] Graduate Institute of Precision Engineering, National Chung Hsing University, Taichung 402, Taiwan
[3] Institute of Electronics, National Yang Ming Chiao Tung University, Hsinchu 30010, Taiwan

[†]Presenter
[*]Corresponding author's e-mail: *pliu@dragon.nchu.edu.tw*

ABSTRACT

The electronic structure and defect formation energy of undoped ZnO and Sb^{X+}(X = 3, 5)-doped ZnO were simulated with the first-principle study based on the density expansion theory. According to the simulation, a shallow impurity level at the top of the valence band and the the button of the conclusion band simultaneously in because of the compensation mechanism in semiconductor while Sb^{X+} replacing Zn in ZnO.The fermi level is lower than the valence band when Sb^{X+} replaces oxygen in ZnO. A shallow acceptor impurity level is about 0.7-1 eV higher than the fermi level in the Sb_{Zn}^{X+}−$2V_{Zn}$(X = 3, 5) complex, which's a typical *p*-type semiconductor. The deep impunity level of Sb_{Zn}^{5+}-$2V_{Zn}$ is 1.2 eV. The formation of oxygen vacancies as a result of the substitution of Zn whit Sb, moves the fermi level into the conductive band and thus forming a shallow donor energy level at the bottom of the conductive band, turning the semiconductor into *n*-type. A doped impurity energy level located at 1.6 eV higher than the valence band in generated in Sb^{5+} gets into the octahedral gap of ZnO, which reduces the band gap to 2.72 eV. The formation energy of defect due to the doping of Sb^{3+} and Sb^{5+} is also calculated in this work. The lowest defect formation energy at −9.45 eV is obtained when Sb^{5+} replace Zn, while the highest one is 9.36 eV when Sb replaces Zn and thus forming the oxygen vacancies.

Keyword: First-principles study, transparent conducting oxide, Sb-doped ZnO, *p*-type ZnO, defect formation energy

No. P-10

TITLE: High Temperature Coefficient of Resistance in $Mo_xW_{1-x}S_2$ Thin Film

En-Ting Lin[1], Wenqi Zhang[2], Yi-Lin Yang[2], and Tsung-Shine Ko[1,*,†]

[1] Department of Electronic Engineering, National Changhua University of Education, Taiwan
[2] Department of Electronic Engineering, National Kaohsiung Normal University, Taiwan

[†]Presenter
[*]Corresponding author's e-mail: *tsko@cc.ncue.edu.tw*

ABSTRACT

Despite transition metal dichalcogenides have seen widespread usage in various applica-tions, relevant knowledge and application about $Mo_xW_{1-x}S_2$ alloy is still limited. In this study, we deposited Mo and W alloy on a SiO_2/Si substrate using a sputter system. Consequently, we success-fully utilized a furnace to sulfurize Mo and W alloy from 800 to 950 ˚C which transferred into $Mo_xW_{1-x}S_2$ ternary compound. X-ray diffraction shows the samples possesses preferable (002) crystal orien-tation. Raman spectra of the $Mo_xW_{1-x}S_2$ samples indicates an additional hybridized Raman peak at 375 cm^{-1} which are not present in typical MoS_2 and WS_2. Temperature dependent I-V characteristics reveal a semiconductor trend that the resistance of the $Mo_xW_{1-x}S_2$ decreases with increasing ambient temperature from 300 K to 400 K. In addition, I-V results show that the resistance of $Mo_xW_{1-x}S_2$ in-creases when the samples were sulfurized at higher temperature, which could be attributed to defect generation at high sulfurization temperature. Furthermore, a high temperature coefficient of re-sistance about 1.04 %/K^{-1} was obtained for the $Mo_xW_{1-x}S_2$ thin film sulfurized at 800 ˚C. Such high temperature coefficient of resistance in $Mo_xW_{1-x}S_2$ thin film would be useful for the fabrication of high thermal sensor.

Keyword: resistance, temperature coefficient

No. P-11

TITLE: First-principles Calculation to Study the Anomalous Hall Effect of $Co_{3-x}Cr_xAl$ (x= 0, 1, 2, 3) Heusler Compounds.

Jen-Chuan Tung[1], Bo-En Wu[2], Jia-Wei Dai[2,†], and Po-Liang Liu[2,*]

[1] Center for General Education, Chang Gung University, Taoyuan 33302, Taiwan
[2] Graduate Institute of Precision Engineering, National Chung Hsing University, Taichung 402, Taiwan

[†]Presenter
[*]Corresponding author's e-mail: *pliu@dragon.nchu.edu.tw*

ABSTRACT

Based on the density functional theory, we have studied the electronic and magnetic properties of the $Co_{3-x}Cr_xAl$ (x=0,1,2,3) Heusler compounds with the generalized gradient approximation (GGA) for the exchange correlation potential. In this study, we perform two principal spin-related phenomena, namely, anomalous Hall effect (AHE)[1] and current spin polarization of the $Co_{3-x}Cr_xAl$ Heusler compounds in the cubic $L2_1$ structure. The Heusler compounds in both ideally and inversely ordered structure are considered. We found that calculated spin magnetic moment of $Co_{3-x}Cr_xAl$ is decreased with the increasing of Cr concentration for both ideal and inverse structure, except for the Cr_3Al. We also found that the spin polarization of all $Co_{3-x}Cr_xAl$ is larger than 50% except Cr_2CoAl in the inverse structure. We found that Cr_2CoAl in the $L2_1$ structure has the largest anomalous Hall conductivity (AHC) of 490 S/cm. Our calculated AHC of Co_2CrAl is 155 S/cm which is in very good agreement of experimental result, 125 S/cm[2]. The Hall current spin polarization is also calculated, and we found that Co_2CrAl has the largest magnitude of Hall current spin polarization of 621%. The mechanical stabilities of $Co_{3-x}Cr_xAl$ are also discussed. The Debye temperature of the $Co_{3-x}Cr_xAl$ compounds are all smaller than 100K.

Keyword: Heusler alloys, spin polarization, anomalous Hall conductivity, first-principles calculation

REFERENCES

[1] J.-C. Tung, and G.-Y. Guo, New J. of Phys. Vol. 15 pp. 033014 (2013)
[2] A. Husmann and L. J. Singh, Phys. Rev. B Vol. 73 pp. 172417 (2006).

No. P-12

TITLE: Dielectric Properties of $Mg_2(Sn_{1-x}Zr_x)O_4$ Ceramics at Millimeter wave Frequency for antenna application in 5G FR2 Band

Yih-Chien Chen[*,†], Chun-Hao Tai, and Rei-Shin Chen

Department of Electrical Engineering Lunghwa University of Science and Technology, Taiwan

[†]Presenter
[*]Corresponding author's e-mail: *EE049@mail.lhu.edu.tw*

ABSTRACT

Materials that are to be used in microwave devices must have three dielectric characteristics - a high dielectric constant, a high quality factor, and a near-zero temperature coefficient of resonant frequency. These enable small devices with low loss and high temperature stability, respectively, to be fabricated[1-3]. Since the shortage of radio frequency resources, the carrier frequency of interestis from ISM (industrial, scientific and medical) band to the millimeter wave range. Low dielectric constant materials are being introduced to replace the high dielectric constant materials in the millimeter wave range. Low dielectric constant materials increase signal propagation velocity, reducing the cross coupling effect and transmission attenuation. These facts motivate this investigation of the $Mg_2(Sn_{1-x5}Zr_x)O_4$ ceramics for application in 5G FR2 band antennas. The effect of the sintering temperature on the millimeter wave dielectric properties of the $Mg_2(Sn_{1-x5}Zr_x)O_4$ ceramics were explored. A dielectric constant (ε_r) of 7.8, quality factor ($Q \times f$) of 79,000 GHz, and temperature coefficient of resonant frequency ($^{\tau f}$) of −57 ppm/ were obtained for $Mg_2(Sn_{0.97}Zr_{0.03})O_4$ ceramics that were sintered at 1550˚C for 4hr. For further understanding of these dielectric properties, they were analyzed by densification, X-ray diffraction (XRD), and by making microstructural observations.

Keyword: Microfluidic, Paper-Based, Microchip, Serum Potassium Ion

No. P-13

TITLE: Optical Measurement and Manufacturing Process of Thermal Module for LED Automobile Light

Kuo-Wei Lin, Hsun-Ching Hsu[†], Fu-Yu Xie, and Pin Han[*]

Graduate Institute of Precision Engineering National Chung Hsing University, Taiwan

[†]Presenter
[*]Corresponding author's e-mail: *pin@dragon.nchu.edu.tw*

ABSTRACT

This study proposes a optical measurement and manufacturing process of the thermal module for LED Automobile Light. There are three different cooling fin: (1) black cooling fin (6 cm X 5 cm X 3cm). (2) rectangular aluminum block cooling fin (6 cm X 5 cm X 1 cm). (3) Al-matrix aciculate composite cooling fin(6 cm X 5 cm X 1 cm). The black cooling fin and rectangular aluminum block cooling fin are both of traditional thermal materials, and the Al-matrix aciculate composite cooling fin is a new composite material. There are three main experimental pictures and the results of LED intensity attenuation due to temperature rise. The light intensity of reaching the steady state (30 minutes) can be used as the basis for judging the ability of the cooling fin.

Keyword: LED lights, results of measurement

No. P-14

TITLE: *Ab initio* Study of WTe_2 Band Structures with Vertical Electric Field Applied in MOSFETs

Jen-Chuan Tung[1], Po-Chun Shih[2], Jine-Du Fu[2,†], and Po-Liang Liu[2,*]

[1] Center for General Education, Chang Gung University, Taoyuan 33302, Taiwan
[2] Graduate Institute of Precision Engineering, National Chung Hsing University, Taichung 402, Taiwan

[†]Presenter
[*]Corresponding author's e-mail: *pliu@dragon.nchu.edu.tw*

ABSTRACT

In this study, first-principles study was used to calculate the band structure of WTe_2 and to analyse the structure in a vertical electric field. The calculation model determined that the bond length between W and Te atoms was 2.696 Å and the distance between layers was 3.267 Å. The results indicate that the energy band structure of a single-layer WTe_2 model in no vertical electric field and a 3 V/nm vertical electric field was a direct and indirect energy gap of 0.93 eV and 0.941 eV, respectively; the energy gap of single-layer WTe_2 did not change significantly with an increase in electric field strength. By contrast, the energy band structure of the two-layer WTe_2 model without a vertical electric field and in a vertical electric field of 3 V/nm was an indirect and direct energy gap of 0.82 eV and 0.08 eV, respectively. The energy band structure of double-layer WTe_2 was partially lower than the Fermi level when the electric field was 5 V/nm. Double-layer WTe_2 was converted from a semiconductor to a conductor within a vertical electric field. This study proved that an applied vertical electric field can make the energy band structure of double-layer WTe_2 close.

Keyword: WTe_2, vertical electric field, band gap, first-principles calculation

No. P-15

TITLE: *Ab initio* Study of Copper Corrosion Inhibitors on $Cu_2O(111)$ Surfaces for Chemical Mechanical Planarization

Ying-Hao Chen[1], Jen-Chuan Tung[2], Dun-Ru Hung[1,†], Kwo-Hung Shen[3], and Po-Liang Liu[1,*]

[1] Graduate Institute of Precision Engineering, National Chung Hsing University, Taichung 402, Taiwan
[2] Center for General Education, Chang Gung University, Taoyuan 33302, Taiwan
[3] Department of Interdisciplinary Engineering Science, Clarkson University, Potsdam, NY, United States

[†]Presenter
[*]Corresponding author's e-mail: *pliu@dragon.nchu.edu.tw*

ABSTRACT

On the basis of density functional theory, this study employs the first-principle calculations to investigate the adsorption energy of copper corrosion inhibitors on $Cu_2O(111)$ surfaces. The copper corrosion inhibitors discussed in this study are 1, 2, 3-Triazole molecules, 1, 2, 4-Triazole molecules, Benzotriazole molecules, 1-hydroxybenzotriazole molecules, and Naphthotrizole molecule. Studies discussing the adsorption of copper corrosion inhibitors on $Cu_2O(111)$ surfaces have indicated that 1, 2, 4-Triazole molecules exhibits the greatest adsorption energy on $Cu_2O(111)$ surfaces (−1.626 eV), followed by 1, 2, 3-Triazole molecules (−1.562 eV). Additionally, the adsorption energy of Benzotriazole molecules, 1-hydroxybenzotriazole molecules, and Naphthotrizole molecules on $Cu_2O(111)$ surfaces is −1.071, −1.264, and −1.524 eV, respectively. The study results indicated that 1, 2, 4-Triazole exhibited the greatest adsorption effect on $Cu_2O(111)$ surfaces, thereby demonstrating its fitness as a copper corrosion inhibitor.

Keyword: Copper, cuprous oxide, adsorption energy, triazole molecules, first-principles calculation

No. P-16

TITLE: Improvement in 80×160 Passive-Matrix μ-LED Display via Pas-sivation Coatings

N.R. Chang[1,†], P.H. Chen[2], Po-Liang Liu[1], and D.S. Wuu[2,3*]

[1] Department of Graduate Institute of Precision Engineering, National Chung Hsing University, Taichung, Taiwan
[2] Department of Materials Science and Engineering, National Chung Hsing University, Taichung, Taiwan
[3] Department of Applied Materials and Optoelectronic Engineering, National Chi Nan University, Nantou 54561, Taiwan

[†]Presenter
[*]Corresponding author's e-mail: *dsw@dragon.nchu.edu.tw*

ABSTRACT

The micro-light-emitting diode (μ-LED) is the LED in the micron-scale size for reaching a high-resolution display application. The μ-LED's benefits include high brightness, high color saturation, fast response, and low power consumption [1]. However, during the MESA and isola-tion process with a high-power plasma condition, the ion bombardment created the surface de-fects on the sidewalls of the μ-LED chip[2]. Compared with the traditional LEDs, the impact of surface defects on μ-LEDs cannot be ignored because the injected current could spread across the whole μ-LED chip including the sidewall area [3]. This will lead to the increased leakage current under the reverse bias and the decreased emission efficiency under the forward bias. Therefore, the passivating defects are critical improvement in the μ-LED development. The benefit of ALD system also have the high surface coverage, which can efficiently passivate the sidewall defects leading to the reduced non-radiative recombination and the improved EQE [4]. The 80×160 pas-sive-matrix μ-LED display was fabricated by using the laser direct writing and ALD techniques. The leakage current from sidewall defects were suppressed by an Al_2O_3 passivation layer from ALD system because of the non-plasma process and high surface coverage features. The illumi-nance of 866 cd/m^2 was obtained.

Keyword: ALD, leakage current, passive-matrix, μ-LED, display

REFERENCES

[1] P.-L. Liu, Materials Today Communications, Vol. 23, pp. 100866 (2020).
[2] P.-L. Liu et al., Physical Review B, Vol. 72, pp. 245335 (2005).

No. P-17

TITLE: *Ab initio* Studies of Work function Changes of CO_2 Adsorption on Pure and Pd-doped $ZnGa_2O_4$(111) Surface for Gas Sensors

Jen-Chuan Tung[1], Min-Hsun Tsai[2], Jine-Du Fu[2,†], and Po-Liang Liu[2,*]

[1] Center for General Education, Chang Gung University, Taoyuan 33302, Taiwan
[2] Graduate Institute of Precision Engineering, National Chung Hsing University, Taichung 402, Taiwan

[†]Presenter
[*]Corresponding author's e-mail: *pliu@dragon.nchu.edu.tw*

ABSTRACT

We performed first-principles calculations to analyze the reactions of CO_2 molecules on the pure and Pd-doped $ZnGa_2O_4$(111) surfaces. The adsorption reaction and work functions of CO_2 adsorption models were examined. CO2 molecules on the pure $ZnGa_2O_4$(111) surface exhibited a minimum work function change of −1.27 eV. However, the maximum work function increases to -1.10 eV for CO_2 molecules on the Pd-doped $ZnGa_2O_4$(111) surface. The results demonstrate $ZnGa_2O_4$-based gas sensors are suitable to sense CO_2 molecules without doped Pd atoms.

Keyword: Gas sensor, work function, $ZnGa_2O_4$, first-principles calculation

No. P-18

TITLE: *Ab initio* Studies of Work function Changes of CO Adsorption on Clean and Pd-doped $ZnGa_2O_4$(111) Surface for Gas Sensor

Jen-Chuan Tung[1], Che-An Pai[2], Yu-Hsuan Chen[2,†], and Po-Liang Liu[2,*]

[1] Center for General Education, Chang Gung University, Taoyuan 33302, Taiwan
[2] Graduate Institute of Precision Engineering, National Chung Hsing University, Taichung 402, Taiwan

[†]Presenter
[*]Corresponding author's e-mail: *pliu@dragon.nchu.edu.tw*

ABSTRACT

Following our previous studies of NO_2 and H_2S adsorption on $ZnGa_2O_4$(111) surface [1, 2], and based on the framework of density functional theory, the work function variations of carbon monoxide molecule on both clean and Pd-adsorbed $ZnGa_2O_4$(111) surface were calculated. We considered three types of CO adsorption and four major adsorption sites. Type 1 is CO molecule lies out-of-plane direction of $ZnGa_2O_4$ (111) surface with carbon atom near the surface; whereas type 2 is oxygen atom near the $ZnGa_2O_4$(111) surface. Type 3 is the CO molecule lies parallel to the in-plane direction of $ZnGa_2O_4$(111) surface. We found that CO molecule adsorb on clean $ZnGa_2O_4$(111) has the largest work function changes of -0.55 eV. Indeed, the work function changes corresponds to the adsorption sites of CO on $ZnGa_2O_4$(111) and ranges from -0.55 to 0.07 eV. We also calculate the adsorption energy in type 1, 2 and 3. We found that the lowest adsorption energy of -1.88 eV occurs in type 1. In type 2 and 3 structures, the lowest adsorption energy is −0.44 eV and -1.55 eV, respectively. Very interestingly, the work function changes of CO adsorption are enhanced on Pd-doped $ZnGa_2O_4$(111) surface. The largest work function variant becomes -0.79 eV indicates the sensitivity for detecting CO molecule is increased. The lowest adsorption energy is also enhanced to -3.36 eV, meaning that CO molecule is easily to adsorb on Pd-adsorbed $ZnGa_2O_4$(111).

Keyword: CO gas sensor; $ZnGa_2O_4$; work function, first-principles calculation

REFERENCES

[1] J.-C. Tung, D.-Y. Wang, Y.-H. Chen, and P.-L. Liu, Appl. Sci., Vol. 11, pp. 5259 (2021).
[2] J.-C. Tung, Y.-H. Chiang, D.-Y. Wang, and P.-L. Liu, Appl. Sci., Vol. 10, pp. 8822 (2020).

No. P-19

TITLE: Investigation of Non-contact Surface Topography Measurement 3 System for Transparent Polymer Materials.

Yu-Jung Lee[*,†] and Yu-Ching Lee

Southern Taiwan University of Science and Technology, Tainai 712, Taiwan

[†]Presenter
[*]Corresponding author's e-mail: *yjlee@stust.edu.tw*

ABSTRACT

For satisfying the characteristic requirements for liquid crystal displays, the liquid optical clear adhesive must be able to retain high transmittance and meet the specification of various optical characteristics (including haze, transparency, yellowing resistance, etc.)[1-2]. Since the display has very strict standards for transmittance, general optical measurement method are difficult to obtain focal length for multi-layer structured transparent materials. In this research, with the aid of Chromatic confocal microscopy [3], a measurement system has been built to obtain the three-dimensional surface topography of a multi-layer structure by taking advantage of its optical slicing capability. The result shows that the system can overcome the cross-sectional error encounter when the adhesive is not dispensed uniformly, and the result is compared with the reflection moiré method. In addition, with the proposed system, shrinkage rate of optical clear adhesive is analyzed for finding the best curing condition for display bonding. For the manufacture process of panel display, optical clear adhesive is not only play the role of lamination, but also be able to increase the sensitivity of touch by optimizing the surface topography.

Keyword: Optical clear adhesive, Surface topography, Non-contact measurement systems

REFERENCES

[1] Rosen, S. L.; Fundamental principles of polymeric material, 2nd ed.; Wiley Interscience, New York, 1993.
[2] Satas, D.; Handbook of Pressure Sensitive Adhesive Technology, 2nd ed.; Springer, New York, 1989.
[3] Weng, C.J., Lu, B.R., Cheng, P.Y., Hwang, C.H., and Chen, C.Y., Measuring the thickness of transparent objects using a confocal 28 displacement sensor, 2017 IEEE International Instrumentation and Measurement Technology Conference (I2MTC), Italy, 2017, 29 pp. 1-5.

No. P-20

TITLE: An Immunobiosensor Based on Titanium Oxide Nano-Tubes for Liver Cancer Screening

Thien Luan Phan[1,2], Nguyen Van Hieu[2], Hou-Wei Tsai[3] and Congo Tak-Shing Ching[1,3,*,†]

[1]Graduate Institute of Biomedical Engineering, National Chung Hsing University, Taiwan
[2]Department of Physics and Electronic Engineering, Vietnam National University, Vietnam
[3]Department of Electrical Engineering, National Chi Nan University, Taiwan

[†]Presenter
[*]Corresponding author's e-mail: *tsching@nchu.edu.tw*

ABSTRACT

According to the C.D.C statistics, liver cancer has been the second position of the top leading causes of cancer death for years, and according to WHO statistics, liver cancer is also on the sec-ond position of the top causes of cancer death among the world. Moreover, liver cancer is com-monly unobservable in its early stage. The purpose of this study is to design and develop an immunobiosensor which can immediately detect the impedance of Des-γ-carboxy prothrombin (DCP), a biomarker of liver cancer, to achieve the goal of early detection and early medical treatment in its early stage.

Applying anodization, the immunobiosensor is composed of the titanium oxide nanotubes as the substrate, and the DCP antibody fixed on the sensor. Results shows that the immunobiosen-sor performs good linearity in both high frequency at 942.74Hz ~ 1.99kHz and low frequency at 3.162Hz ~ 0.79Hz, with the best linearity 0.9186 at 1.55KHz in high frequency part and 0.9759 at 1.59Hz in low frequency part. Connecting with the readout circuit, the immunobiosensor will become a portable, fast and timely detection device providing the purposes of monitoring liver cancer, home care and early detection.

Keyword: liver cancer; impedance; titanium oxide nanotubes; biosensor; DCP

No. P-21

TITLE: Acousto-optic Modulated LD Sources Designed for Multi-color Photo-acoustic Imaging

Bor-Wen Yang[*,†]

Department of Electro-Optical Engineering, Minghsin University of Science and Technology, No.1, Xinxing Rd., Xinfeng Hsinchu, Hsin-Chu, Taiwan

[†]Presenter
[*]Corresponding author's e-mail: *bwyang@must.edu.tw*

ABSTRACT

To extend non-invasive full-color imaging to diffusion regime as deep as 2~5 mm, we chose to implement photo-acoustic imaging system. As the ultrasound signal for imaging is induced by optical absorption, negative film development system is used to reproduce the original tissue color. Using Acousto-optic method to modulate LD, the traditional big high-frequency modulated source of photo-acoustic system can be replaced and meanwhile minimized. The photo-acoustic system can therefore be extended to hand –held, personal-use medical product.

Keyword: non-invasiveness, photo-acoustic imaging, ultrasound, acousto-optic modulation

No. P-22

TITLE: Skin Absorption and Restoring Effects of Collagen and L-ascorbic Acid Explored by Fluorescence and Reflection Spectroscopy

Bor-Wen Yang[*,†] and Yen-Chun Chen

Department of Electro-Optical Engineering, Minghsin University of Science and Technology, No.1, Xinxing Rd., Xinfeng Hsinchu, Hsin-Chu, Taiwan

[†]Presenter
[*]Corresponding author's e-mail: *bwyang@must.edu.tw*

ABSTRACT

By fluorescence and reflection spectroscopy, the absorption efficiency and restoration effects of collagen and L-ascorbic acid are explored, respectively. It is found that skincare materials of appropriate concentration are best for absorption, skin-whitening or spots-removal.

Keyword: fluorescence spectrum, reflection spectrum, collagen, L-ascorbic acid

No. P-23
TITLE: Non-invasive Tissue Recognition Imaging for Cosmetology and Industry

Bor-Wen Yang[*,†] and Guan-Yu Chen

Department of Electro-Optical Engineering, Minghsin University of Science and Technology, No.1, Xinxing Rd., Xinfeng Hsinchu, Hsin-Chu, Taiwan

[†]Presenter
[*]Corresponding author's e-mail: *bwyang@must.edu.tw*

ABSTRACT

By readout of reflection spectrum, the medical imaging technique of "Tissue Recognition Imaging" is proposed. By recognizing the kind of tissue of every focused element, the non-invasive 2- or 3-dimensional skin imaging can be achieved.

Keyword: reflection spectrum; medical imaging; tissue; cross-correlation

No. P-24
TITLE: Inspection of Micro-Structure by Tissue Recognition Imaging

Bor-Wen Yang[*,†] and Yi-Yan Su

Dept. of Electro-Optical Engineering, Minghsin University of Science and Technology, No.1, Xinxing Rd., Xinfeng Hsinchu, Hsin-Chu, Taiwan

[†]Presenter
[*]Corresponding author's e-mail: *bwyang@must.edu.tw*

ABSTRACT

To reduce invasiveness of laser source on tissues, tissue recognition imaging is proposed. The reflection spectra of main skin tissue, such as melanin, collagen and hemoglobin, are established as reference database. Reflection spectra are derived from all scanned sample points; the type of the scanned tissue is identified by cross-correlation with the database. All scanned points are filled with their corresponding tissue colors in the imaging program, e.g. black for melanin, white for collagen, or red for hemoglobin. Tissue recognition imaging has merits of easy configuration, low cost, color imaging, high resolution and real non-invasiveness. Employing RGB LED module and micro-spectrometer, tissue recognition imaging can be miniaturized as portable skincare devices, which have great potential in cosmetic markets.

Keyword: reflection spectrum; cross-correlation; RGB LED; micro-spectrometer

No. P-25

TITLE: Non-invasive Multi-color Skin Imaging Using Multi-color LED Source Module and Floating Lens

Bor-Wen Yang[*,†]

Dept. of Electro-Optical Engineering, Minghsin University of Science and Technology, No.1, Xinxing Rd., Xinfeng Hsinchu, Hsin-Chu, Taiwan

[†]Presenter
[*]Corresponding author's e-mail: *bwyang@must.edu.tw*

ABSTRACT

New hand-held model is proposed for non-invasive 3D skin imaging. Employing RGB LED and floating lens in fiber-based optical coherence tomography, full-color image can be derived for inspection of dermal capillary structure.

Keyword: non-invasiveness; skin imaging; RGB LED; optical coherence tomography

No. P-26

TITLE: Multi-color Optical Coherence Tomography Apparatus Powered by LED Source

Bor-Wen Yang[*,†]

Dept. of Electro-Optical Engineering, Minghsin University of Science and Technology, No.1, Xinxing Rd., Xinfeng Hsinchu, Hsin-Chu, Taiwan

[†]Presenter
[*]Corresponding author's e-mail: *bwyang@must.edu.tw*

ABSTRACT

In present cosmetic market, the skin image obtained from hand-held camera is 2-dimensional. With high resolution and adequate penetration, optical coherence tomography (OCT) becomes one popular medical imaging technique. To take place of a conventional 2D camera, new hand-held system by OCT is proposed for 3D skin imaging. With red, green and blue LEDs applied in OCT, full-colored image could be derived. Colorful and non-invasive perspectives of deep skin structure help to advance skin science, dermatology and cosmetology.

Keyword: optical coherence tomography, medical imaging, dermatology, cosmetology

ISPE 2021

THE 2nd INTERNATIONAL SYMPOSIUM ON PRECISION ENGINEERING

NOV. 12-14, 2021

ISPE 2021 Website

Organizers

Co-Organizers