澳門大學
UNIVERSIDADE DE MACAU
UNIVERSITY OF MACAU

應用物理及材料工程研究院
INSTITUTO DE FÍSICA APLICADA E ENGENHARIA DE MATERIAIS
INSTITUTE OF APPLIED PHYSICS AND MATERIALS ENGINEERING

IAPME Newsletter

https://iapme.um.edu.mo/

ISSUE 4

16 October 2024

✧ Content

❖ Publications (IF≥10; *corresponding author)

1. **Dan Fang, Sen Ding**, Qian Zhou, Dazhe Zhao, Junwen Zhong, and **Bingpu Zhou***. Crosstalk-Free Position Mapping for One-Step Reconstruction of Surface Topological Information via Eigenfrequency-Registered Wearable Interface. *ACS Nano* **18**(1), 1157-1171 (2024). DOI: 10.1021/acsnano.3c11080. [2023 IF=15.8]

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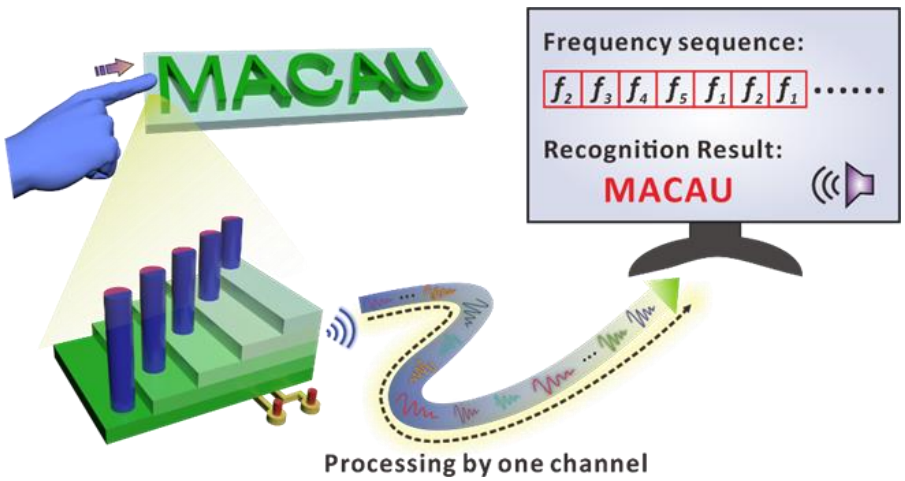
❖ Research Stories

UM research team successfully develops wearable haptic sensing interface for recognizing surface topological information efficiently

- Inspired by tactile perception mechanism of the fingertip, an eigenfrequency-based haptic sensing interface for recognizing surface pattern information is reported.
- It is still a challenge for current tactile sensors to efficiently recognize the surface pattern information while maintaining the simplicity of the overall system. Therefore, magnetized micropillars (MMPs) with height gradients are assembled as a position-registered array for rapid recognition of surface pattern information.
- With a customized LabVIEW program, the surface information (e.g., letters, numbers, and Braille) can be accurately reconstructed in the form of text and voice by the frequency sequence produced in a single scanning procedure. Because all micropillars share the same conductive coil, the sensing interface not only improves the detection efficiency, but also simplifies the system configuration for a better wearing experience.

(from left) Ms. Dan FANG, Dr. Sen DING and Prof. Bingpu ZHOU



A schematic diagram of wearable haptic sensing interface for surface information perception

Dan Fang, Sen Ding, Qian Zhou, Dazhe Zhao, Junwen Zhong, and **Bingpu Zhou***. Crosstalk-Free Position Mapping for One-Step Reconstruction of Surface Topological Information via Eigenfrequency-Registered Wearable Interface. *ACS Nano* **18**(1), 1157-1171 (2024). DOI: 10.1021/acsnano.3c11080. [2023 IF=15.8]

Prof. Bingpu ZHOU is the corresponding authors of this study. The first author are Ms. Dan FANG and Dr. Sen DING, they are Ph.D. student and postdoctoral researcher in IAPME respectively. This work was supported by the Science and Technology Development Fund, Macao SAR (File no. 006/2022/ALC, 0057/2023/RIB2), UM's research fund (File no. MYRG2022-00006-IAPME), and Guangdong Science and Technology Department (File no. 2022A0505030024).

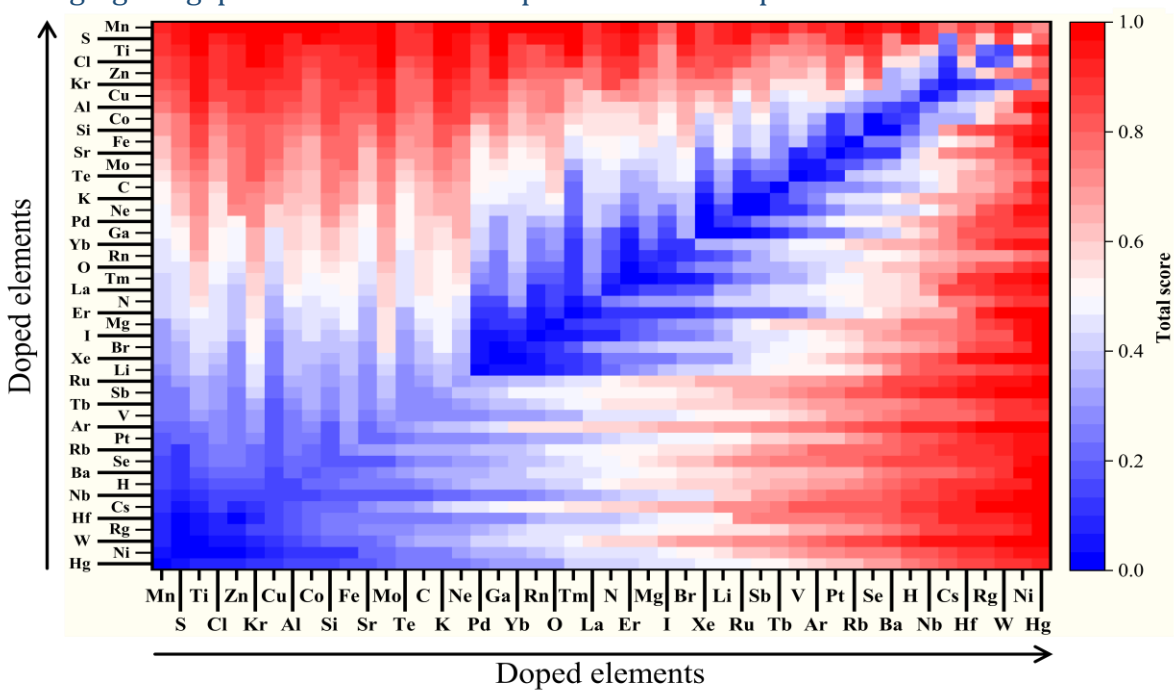
❖ Research Stories

UM research team successfully improving the performance of Ion-doped NASICON Materials for Enhanced Solid-state Battery by Deep Learning Method

- This study provides us with a strongly robust deep learning model designed to efficiently evaluate ion-doped NASICON materials, leading to highly accurate predictions of their electrochemical properties. Utilizing an extensive dataset, it has achieved unprecedented accuracy in predicting the behavior of NASICON-type materials.

(from left) Mr. Zirui Zhao and Prof. Hai-Feng Li

- As a result, three high-performance NASICON materials were successfully synthesised and experimentally validated in this study, and the CNN model accurately predicted the performance of these materials, while also contributing to the field of solid-state electrolytes by bridging the gap between theoretical prediction and experimental validation.



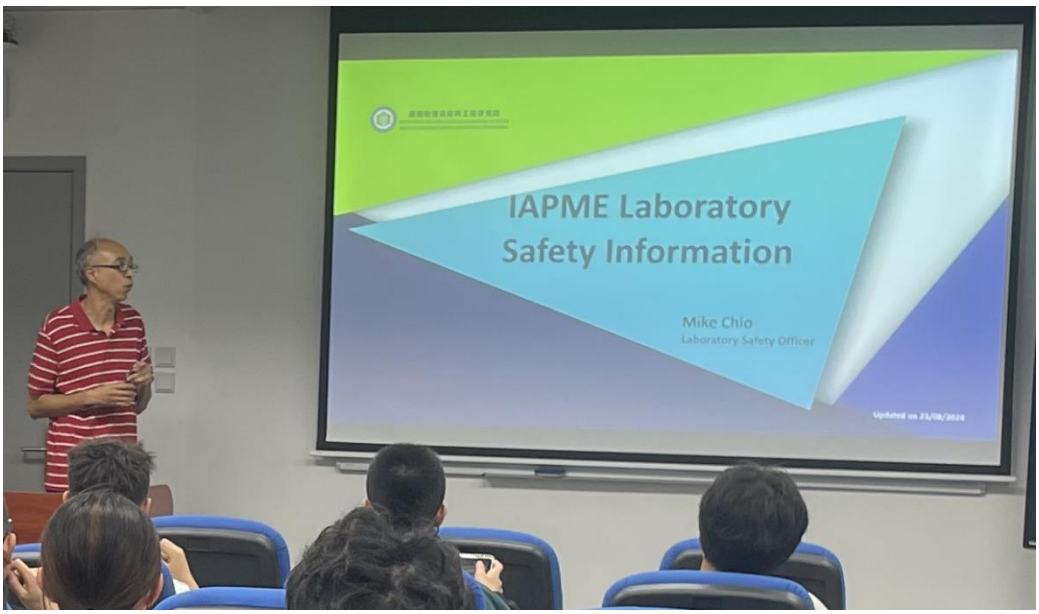
Zirui Zhao, Xiaoke Wang, Si Wu, Pengfei Zhou, Qian Zhao, Guanping Xu, Kaitong Sun, Hai-Feng Li*. Deep learning-driven evaluation and prediction of ion-doped NASICON materials for enhanced solid-state battery performance. *AAPPS Bulletin* **34**, 26 (2024). DOI: 10.1007/s43673-024-00131-9.

Prof. Hai-Feng Li is the corresponding author of this study. The first author is Mr. Zirui Zhao, a Ph.D. student in the IAPME. This work was supported by the Science and Technology Development Fund, Macao SAR (File No. 0090/2021/A2), University of Macau (MYRG-GRG2024-00158- IAPME), and the Guangdong-Hong Kong-Macao Joint Laboratory for Neutron Scattering Science and Technology (Grant No. 2019B121205003).

❖ Laboratory Safety Training for Students

On 9 October, the Laboratory Safety Training was conducted for MSc students in IAPME, which included a 1.5-hour lecture and a 0.5-hour exam.

The IAPME laboratory safety officer, Dr. Mike Chio, presented personal protection, hazardous chemicals, compressed gases, and laser safety during the training.



❖ Ph.D. Student Thesis Oral Defenses

Lin Hao of Prof. Wang Shuangpeng's group presented "Surface Functionalization of Blue-Emitting CsPbBr3 Perovskite Nanoplatelets for Enhanced Stability and Photoluminescence" in his oral defense on 10 October 2024.

Congratulations to Dr. Lin Hao!

(from left) Prof. Ng Kar Wei, Prof. Liu Hongchao, Prof. Xing Guichuan, Dr. Lin Hao, Prof. Wang Shuangpeng and Prof. Zhang Dingke

❖ UM showcases research achievements at the Macau Industrial Products Show

The University of Macau (UM) showcased its research projects and products at the 10th Macau Industrial Products Show, held from October 3-6, 2024. The trade show provided the public with an opportunity to learn about the University's achievements in industrial research and technology transfer.

The Wearable Interactive System, a research project led by Prof. Zhou Bingpu, Associate Professor of IAPME, was featured at the trade show.

Dr. Lam Kam Seng, UC Chair of UM (fourth from right), Prof. Zhou Bingpu (third from right) and other UM staff members at the 10th Macau Industrial Products Show

❖ Visits

Invited by Prof. Sun Guoxing, Manager Sun Long and the representative of CCCC Third Harbour Consultants Macau Co., Ltd., visited IAPME recently.

A fruitful discussion between IAPME members and Manager Sun was conducted during the visit.

Manager Sun Long (second from left) and Prof. Sun Guoxing (second from right)

❖ Upcoming Events

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IAPME Seminar

Emerging Semiconductor Optoelectronics of Colloidal Quantum Wells

18 October 2024

Prof. Hilmi Volkan Demir
Nanyang Technological University - NTU Singapore
Venue: N23-4018
Time: 10:30 - 11:30
Hosted by: Prof. Handong SUN

Abstract

Lighting and displays are integral parts of human activities and economic development. Semiconductor nanocrystals, now offering a market volume exceeding 5B Euros annually, have attracted great interest in quality lighting and displays in the last decade. Such colloidal semiconductors enable enriched color conversion essential to superior lighting and displays. These colloids span different types and heterostructures of semiconductors from colloidal quantum dots to wells. In this talk, we will focus on atomically-flat, tightly-confined, quasi-2-dimensional wells, also popularly nick-named 'nanoplatelets', particularly for use in lighting and displays. Also, we will present a powerful, large-area, orientation-controlled self-assembly technique for orienting these quantum wells either all face down or all edge up. We will demonstrate three-dimensional constructs of their oriented self-assemblies with monolayer precision. Among their extraordinary features important to applications in lighting and displays, we will show record high efficiency from their colloidal LEDs and record high gain coefficients and record low lasing thresholds from their colloidal laser media using their heterostructures and/or oriented assemblies. Given their current accelerating progress, these solution-processed nanocrystals hold great promise to challenge their epitaxial thin-film counterparts in semiconductor optoelectronics.

Biography

Hilmi Volkan Demir (IEEE Fellow'21; OPTICA Fellow'20) is a professor at the School of Electrical and Electronic Engineering, together with the Schools of Physical and Mathematical Sciences and of Materials Science and Engineering (by courtesy) at NTU. As an NRF Fellow of Singapore, he joined NTU with the appointment of Nanyang Associate Professorship and established the Centre of Excellence for Semiconductor Lighting and Displays, LUMINOUS!, at NTU in 2009, which has been awarded large-scale programs including NRF CRPs and NRF Fellowship as well as A*STAR programs. Demir earned his PhD (2004) and MSc (2000) degrees from Stanford University, USA, and his BSc (1998) from Bilkent University, Ankara, one of the top engineering schools in Türkiye. Concurrently, Dr. Demir is a professor of electrical engineering and physics at Bilkent University UNAM (his alma mater). His current research interests include the science and technology of semiconductor lighting and displays, nanocrystal optoelectronics, and smart metastructured implants. As a PI, Demir has contributed to commercialization and licensing of over 10 new enabling technologies, generating over 100 patent applications (granted and pending) as a principle inventor. His scientific and entrepreneurship activities resulted in several important awards including Nanyang Award for Research Excellence, NRF Investigatorship Award of Singapore, TÜBİTAK Science Award of Turkey, and EURYI Award of European Science Foundation.

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