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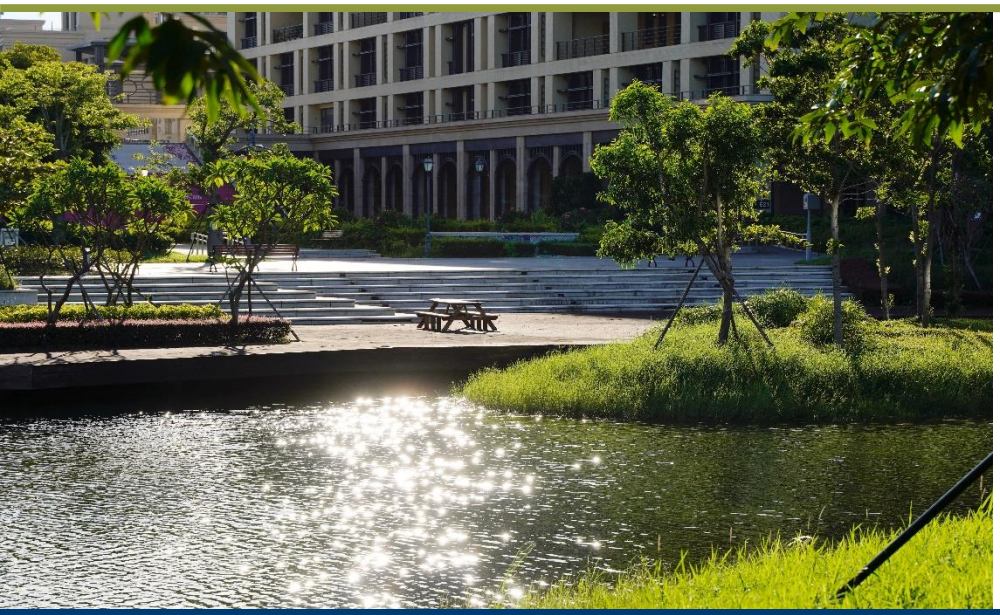
應用物理及材料工程研究院
INSTITUTO DE FÍSICA APLICADA E ENGENHARIA DE MATERIAIS
INSTITUTE OF APPLIED PHYSICS AND MATERIALS ENGINEERING

IAPME Newsletter

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



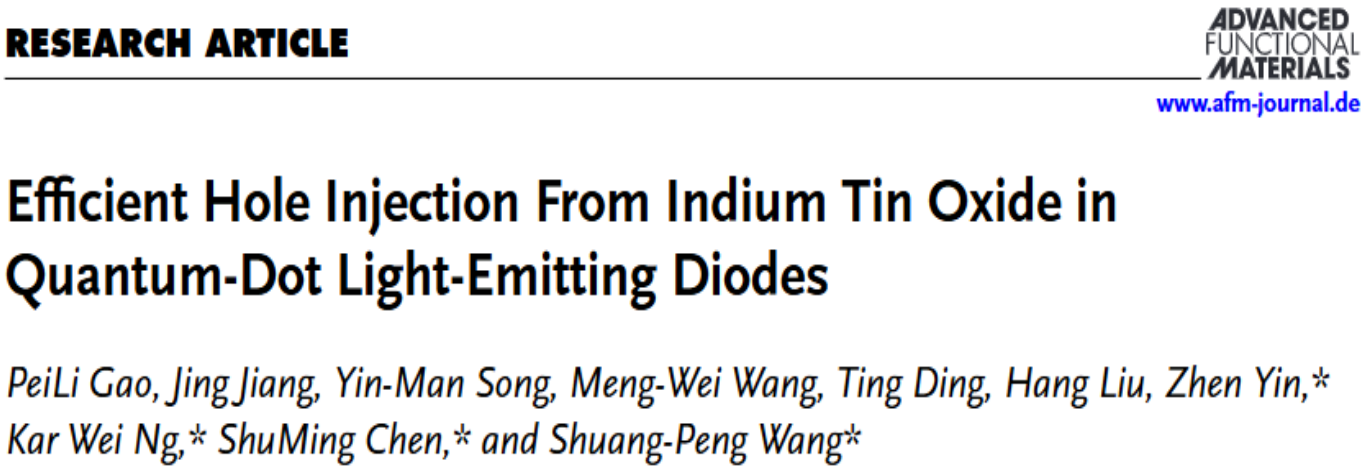
ISSUE 30

16 April 2025

✧ Content

❖ Publications (IF≥8, and/or Nature Index; *corresponding author)

1. **PeiLi Gao**, Jing Jiang, Yin-Man Song, Meng-Wei Wang, Ting Ding, Hang Liu, Zhen Yin*, **Kar Wei Ng***, ShuMing Chen*, **Shuang-Peng Wang***. Efficient Hole Injection from Indium Tin Oxide in Quantum-Dot Light-Emitting Diodes. *Advanced Functional Materials.* 2503467 (2025). DOI:10.1002/adfm.202503467 [2023 IF=18.5]



RESEARCH ARTICLE

ADVANCED FUNCTIONAL MATERIALS
www.afm-journal.de

Efficient Hole Injection From Indium Tin Oxide in Quantum-Dot Light-Emitting Diodes

PeiLi Gao, Jing Jiang, Yin-Man Song, Meng-Wei Wang, Ting Ding, Hang Liu, Zhen Yin, Kar Wei Ng,* ShuMing Chen,* and Shuang-Peng Wang**

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❖ Research Stories

Significant improvement in QLED Technology: Stable, High-Efficiency QLEDs Achieved with Novel SAM Layer

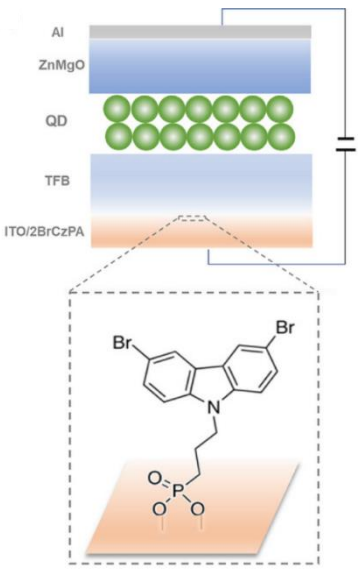
- Traditional PEDOT:PSS layers, while efficient, suffer from drawbacks such as acidity, moisture sensitivity, and metal diffusion, which degrade QLED performance over time. By replacing the problematic PEDOT:PSS hole injection layer (HIL) with a novel self-assembled molecule (SAM), [4-(3,6-dibromo-9H-carbazol-9-yl)butyl]phosphonic acid (2BrCzPA), the research team eliminate these issues by forming a robust dipole layer on the ITO electrode, improving hole injection and preventing exciton quenching caused by metal ion diffusion.

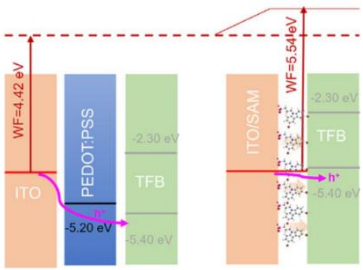
- The results are impressive: green, blue, and red QLEDs achieved record external quantum efficiencies (EQEs) of 15.28%, 12.63%, and 14.83% at high brightness levels. Additionally, the devices demonstrated exceptional operational stability, functioning reliably for over a month under high bias.

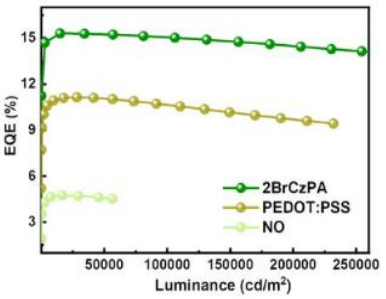
Dr. Pei-li Gao
(高佩麗)

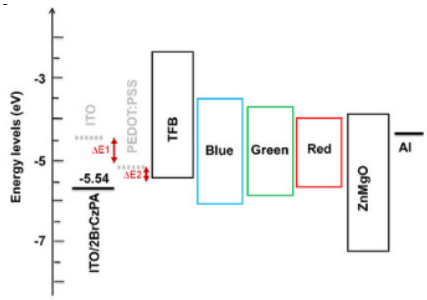
Prof. Shuang-peng Wang
(王雙鵬)

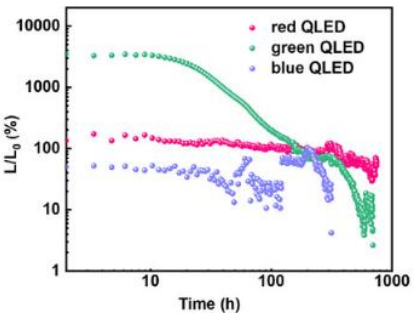
Prof. Kar Wei Ng
(吳嘉偉)











PeiLi Gao, Jing Jiang, Yin-Man Song, Meng-Wei Wang, Ting Ding, Hang Liu, Zhen Yin*, **Kar Wei Ng***, ShuMing Chen*, **Shuang-Peng Wang***. Efficient Hole Injection from Indium Tin Oxide in Quantum-Dot Light-Emitting Diodes. *Advanced Functional Materials.* 2503467 (2025). DOI:10.1002/adfm.202503467 [2023 IF=18.5]

Prof. Shuang-peng Wang and Prof. Kar Wei Ng are the corresponding authors of this study. The first author is Dr. Pei-li Gao, who works in IAPME as a postdoc. This work was financially supported by the Science and Technology Development Fund, Macao SAR (file nos. 0107/2023/AFJ, 0027/2023/AMJ, and0083/2023/ITP2), Research Projects of Department of Education of Guangdong Province-024CJPT002, Special Project of Guangdong Provincial Department of Education in Key Areas (No. 6021210075K), Shenzhen Polytechnic University Research Fund. (No. 6024310006K)

❖ Ph.D. Student Thesis Oral Defenses

Chunfa Liu of Prof. Hui Pan's group presented "Fabrication of Transition Metal Compound Electrodes for Industrial Electrolysis of Water" in his oral defence on 9 April 2025.

Congratulations to Dr. Chunfa Liu!

(from left) Prof. Shi Chen (陳石), Prof. Yongqing Cai (蔡永青),
Prof. Hui Pan (潘暉), Dr. Chunfa Liu (劉春發), Prof. Hongchao Liu(劉宏超),
Prof. Shengyuan Yang (楊聲遠) and Prof. Peng Yang (楊鵬, YNU)

❖ Delegation from Xi'an Jiaotong University visited IAPME

A delegation from Xi’an Jiaotong University (XJTU), led by Prof. Zhiwei Shan (單智偉), the Vice President of XJTU, visited the Institute of Applied Physics and Materials Engineering (IAPME) on March 27, 2025.

The visit started with a general introduction of the key research areas and representative outputs of the institute by Prof. Bingpu Zhou and Prof. Kar Wei Ng, followed by an inspiring discussion on the possible collaboration opportunities between the two Universities. Prof. Shan mentioned that the School of Materials Engineering at XJTU has already grown into a size of over 200 academic staff members, and is looking into forming collaborations with fast-growing research institutes like IAPME. Prof. Shan showed great interest in establishing a joint programme with IAPME to enable the synergy of the research strengths from both sides. He was also impressed with the research outputs of IAPME, particularly the foam concrete which is now being used in many locations all over the country.

❖ Upcoming Events

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IAPME Seminar

Synchrotron Radiation Study on 2D MXene-based Energy Materials

22 April 2025

Prof. Dr. Li SONG
National Synchrotron Radiation Laboratory,
University of Science and Technology of China

Venue: N23-3022
Time: 16:00 – 17:00
Hosted by: Prof. Hai-Feng LI

Abstract

The high brightness, tunability, and penetrating power of synchrotron radiation light sources with multiple techniques enable to explore numerous intricate properties of functional materials and devices at the nanoscale. Among various objects, two-dimensional layered transition metal carbides/nitrides (MXenes) with ultrathin layered structure and rich elemental variety are emerging as promising energy materials for energy generation and storage. In principle, MXenes can be produced by selective etching of the A-layers from their MAX phases, exhibiting a hexagonal crystal structure with transition metal carbide/nitride layers. Due to the involvement of both anions and cations in the etching reactions, it is still high challenge to obtain detailed information, such as phase evolution, lattice change, etching time scale, and so on. Therefore, it is highly desired to develop in-situ and operando techniques to further study realize the real-time monitoring of the complicated and fast etching process, as well as to better understand the real working mechanism of MXenes in energy storage and conversion applications. Here, we will present our recent results on MXene-based energy materials by means of various synchrotron radiation X-ray techniques and methods.

Biography

Prof. Li SONG received Ph.D. from Institute of Physics Chinese Academy of Science in 2006, then worked at University of Munich Germany, Rice University USA and Shinshu University Japan. In 2012, he was promoted to professor at University of Science and Technology of China, leading a multi-technique research team in Hefei Light Source. His research focuses on the development and application of synchrotron radiation-based new technologies and in-situ methods for various nanomaterials and nanodevices. So far, he has published about 400 scientific papers with over 50,000 citations (H-index 118), continuously nominated as the global highly cited scientist by Clarivate in 2019-2024.

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