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 41

02 July 2025

✧ Content

1. Research Highlights
   a. Publications
   b. Research Stories
2. Teaching and Student Affairs
   a. Ph.D. Student Thesis Oral Defenses
3. News and Events
   a. Seminars
4. Upcoming Events

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

1. **Qingbin Jiang, Huifang Xu**, Kwan San Hui,* Yijie Wei, Lingwen Liu, Zhengqing Ye, Chenyang Zha, Mengting Zheng,* Jun Lu,* and **Kwun Nam Hui***. Inner-Layer Indium Doping Achieved Highly Active and Stable Sulfur Vacancies in MoS_2 for Superior Sulfur Redox Kinetics. *Advanced Materials*, 2415986 (2025). DOI: 10.1002/adma.202415986. [2024 IF=26.8]


RESEARCH ARTICLE

ADVANCED MATERIALS
www.advmat.de

Inner-Layer Indium Doping Achieved Highly Active and Stable Sulfur Vacancies in MoS_2 for Superior Sulfur Redox Kinetics

Qingbin Jiang, Huifang Xu, Kwan San Hui, Yijie Wei, Lingwen Liu, Zhengqing Ye, Chenyang Zha, Mengting Zheng,* Jun Lu,* and Kwun Nam Hui**

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

ISSUE 41

02 July 2025

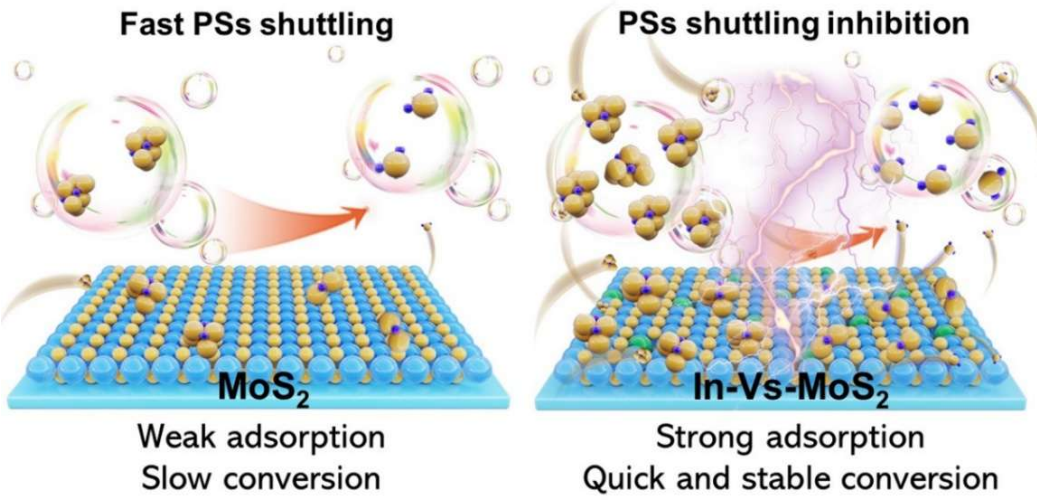
❖ Research Stories

UM Team Unlocks Superior Sulfur Redox with Novel Indium Doping in MoS_2 Catalysts

- The development of highly active and stable catalysts for highly efficient adsorption and conversion of polysulfides during the charging and discharging process lays the foundation for the realization of high-performance and long cycling lithium sulfur batteries (LSBs).
- This work introduces a novel and impactful strategy by incorporating inner-layer indium dopants into sulfur-deficient MoS_2 (In-Vs-MoS_2), marking a significant advance in sulfur-redox electrocatalysis for LSBs. The key novelty lies in the synergistic use of defect engineering (sulfur vacancies) and indium doping, which reduces surface energy and creates unpaired electrons near the Fermi level. This optimizes charge distribution and strengthens polysulfide adsorption, effectively enhancing redox kinetics. The result is a highly stable, high-rate, and high-capacity Li–S system. This breakthrough paves the way for scalable, durable Li–S batteries, bringing the technology significantly closer to practical, real-world energy applications.

(from left) Mr. Qingbin Jiang (江慶斌), Dr. Huifang Xu (徐惠芳), Prof. Kwun Nam Hui (許冠南)

- The system delivers a reversible capacity of 1042 mAh g^{-1} after 100 cycles at 0.5 C and retains 865 mAh g^{-1} at 5 C. It also shows long-term stability under high current densities and achieves 10 mAh cm^{-2} areal capacity at a sulfur loading of 8.7 mg cm^{-2}, highlighting its promise for practical applications.



Qingbin Jiang, Huifang Xu, Kwan San Hui,* Yijie Wei, Lingwen Liu, Zhengqing Ye, Chenyang Zha, Mengting Zheng,* Jun Lu,* and **Kwun Nam Hui***. Inner-Layer Indium Doping Achieved Highly Active and Stable Sulfur Vacancies in MoS_2 for Superior Sulfur Redox Kinetics. *Advanced Materials*, 2415986 (2025). DOI: 10.1002/adma.202415986. [2024 IF=26.8]

Prof. Kwun Nam Hui is the corresponding author of this study. The first authors are Qingbin Jiang and Huifang Xu, Ph.D. students in the IAPME. This work was supported by the Science and Technology Development Fund (FDCT) of Macao S.A.R (0033/2023/ITP1, and 0022/2023/RIB1, 046/2019/AFJ, 0007/2021/AGJ, 0070/2023/AFJ), the Macau Young Scholars Program (AM2020005), Guangdong Basic and Applied Basic Research Foundation (2022A1515110994, 2024A1515030228, and 2022A0505030028), the Multi-Year Research Grants (MYRG2022-00223-IAPME and MYRG-GRG2024-00166-IAPME) from the Research Services and Knowledge Transfer Office at the University of Macau.

❖ Ph.D. Student Thesis Oral Defenses

Wei Wang of Prof. Hou Ian's group presented "Harnessing Classical Techniques for Quantum Advantage: Deep Learning and Optical Simulations in Quantum Computing" in his oral defense on June 18, 2025.

Congratulations to Dr. Wei Wang!

(from left) Prof. Shuangpeng Wang (王雙鵬), Prof. Kar Wei Ng (吳嘉偉), Prof. Hou Ian (殷灝), Dr. Wei Wang (王偉), Prof. Zhirui Gong (龔志瑞, SZU) and Prof. Hui Pan (潘暉),

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

ISSUE 41

02 July 2025

❖ SIAT Professor Wei Tang Unveils Nanoplatforms for Barrier-Penetrating Tissue Regeneration at IAPME Seminar

On June 12, 2025, Prof. Wei Tang (唐爲) from Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences (SIAT, CAS) was invited to give a pioneering seminar titled "Nanoplatforms Overcoming Physiological Barriers for Tissue Regeneration and Precision Imaging". Prof. Tang presented breakthrough strategies to overcome the critical challenge of biological barriers in hard-to-penetrate tissues (bone, cartilage, brain). Her team developed three revolutionary approaches: i) In Situ H_2-Generating Nanomaterials – Remodeling senescent/inflammatory microenvironments for aged bone repair, arthritis therapy, and stroke treatment; ii) Pathology-Targeted Self-Assembled Lubrication Layers – Preventing arthritis progression through cartilage-specific retention; iii) Glycosylated AIE Nanoparticles – Enabling ultrasensitive bacterial imaging in complex biological environments. These platforms achieve what traditional nanomedicine cannot: deep-tissue penetration with sustained therapeutic modulation, highlighted by Prof. Tang, showcasing hydrogen's unique role in reprogramming pathological microenvironments.

The seminar sparked vibrant discussions among IAPME faculty members and students, particularly inspiring young researchers in biomaterials design. "Prof. Tang's work exemplifies how smart material engineering can transcend physiological frontiers," remarked by the host Prof. Guichuan Xing. Attendees left with renewed enthusiasm for translating nanotechnologies into clinical solutions.

Prof. Tang leads cutting-edge research on hydrogen biomaterials at SIAT's Neural Engineering Center, with 17 first/corresponding-author publications in Nature Communications, Science Advances et al. Her honors include Guangdong Top Young Talents and global top 2% scientist recognition.

❖ Upcoming Events

澳門大學
UNIVERSIDADE DE MACAU
UNIVERSITY OF MACAU

應用物理及材料工程研究院

IAPME Seminar

Regulating Carrier Transport toward Highly Efficient Perovskite-based Tandem Solar Cells

4 July 2025
Prof. Mingzhen LIU
University of Electronic Science and Technology of China (UESTC)
Venue: N23-4018
Time: 10:00 - 11:00
Hosted by: Prof. Guichuan XING

Abstract

In recent years, the integration of emerging perovskite solar cells with traditional c-silicon solar cells to construct tandem devices has become to a promising photovoltaic technology. However, the integration of commercial silicon cells with perovskite solar cells, particularly on textured silicon substrates featured with large pyramids, presents a significant challenge in achieving effective charge transfer, which is critical for highly efficient tandem solar cells. This report focuses on our recent works on developing molecular-level nanotechnology that involves the design of charge transport layers, alongside optimizing the crystallization of conformal perovskite layers on the textured silicon sub-cells, leading to highly efficient perovskite/silicon tandem solar cells with certified power conversion efficiencies over 34%. This series of work aims to further enhance the performance of perovskite/silicon tandem photovoltaic technology and push its industrial application.

Biography

Prof. Mingzhen LIU earned her Ph.D. in Condensed Matter Physics from the University of Oxford and currently serves as Vice Dean of the School of Materials and Energy at the University of Electronic Science and Technology of China (UESTC). Prof. Liu has been working on perovskite solar cells for more than a decade. Her current research primarily focuses on perovskite-based tandem solar cells technology. Her group has achieved a series of breakthrough on perovskite/silicon tandems, perovskite-based triple junction tandems and flexible tandems. Prof. Liu has published more than 40 papers in journals such as Nature, Nat. Commun., Energy Environ. Sci., Adv. Mater. and Angew. Chem. Her articles have been cited over 14,000 times by scholars worldwide (Google Scholar). She is a Fellow of the Royal Society of Chemistry (RSC) and has been named a "Highly Cited Chinese Researcher" in Materials Science and Engineering by Elsevier every year since 2022.

Enquiry: iampe.enquiry@um.edu.mo

Contact Us

Email
iapme.enquiry@um.edu.mo