澳門大學
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

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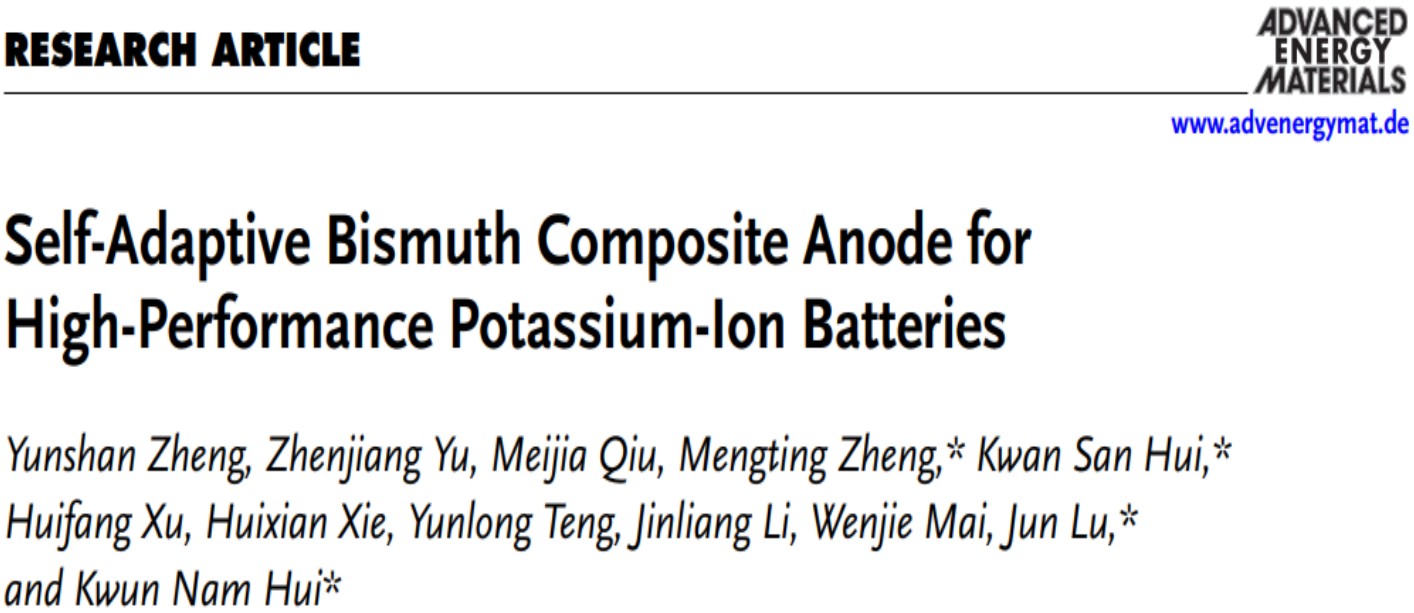
ISSUE 40

25 June 2025

✧ Content

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

1. **Yunshan Zheng**, Zhenjiang Yu, Meijia Qiu, Mengting Zheng*, Kwan San Hui*, Huifang Xu, Huixian Xie, Yunlong Teng, Jinliang Li, Wenjie Mai, Jun Lu*, **Kwun Nam Hui***. Self-Adaptive Bismuth Composite Anode for High-Performance Potassium-Ion Batteries. *Advanced Energy Materials*, 2500370 (2025). DOI: 10.1002/aenm.202500370. [2024 IF=26.0]



RESEARCH ARTICLE

ADVANCED ENERGY MATERIALS
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Self-Adaptive Bismuth Composite Anode for High-Performance Potassium-Ion Batteries

Yunshan Zheng, Zhenjiang Yu, Meijia Qiu, Mengting Zheng, Kwan San Hui,* Huifang Xu, Huixian Xie, Yunlong Teng, Jinliang Li, Wenjie Mai, Jun Lu,* and Kwun Nam Hui**

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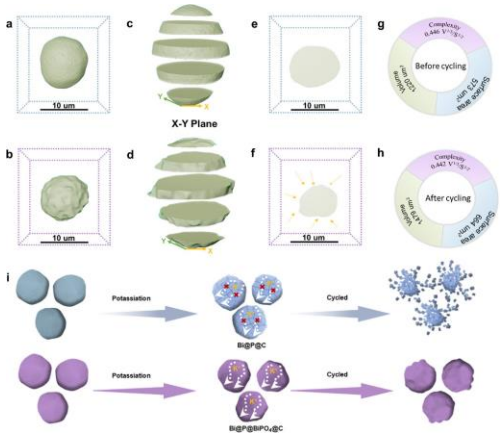
❖ Research Stories

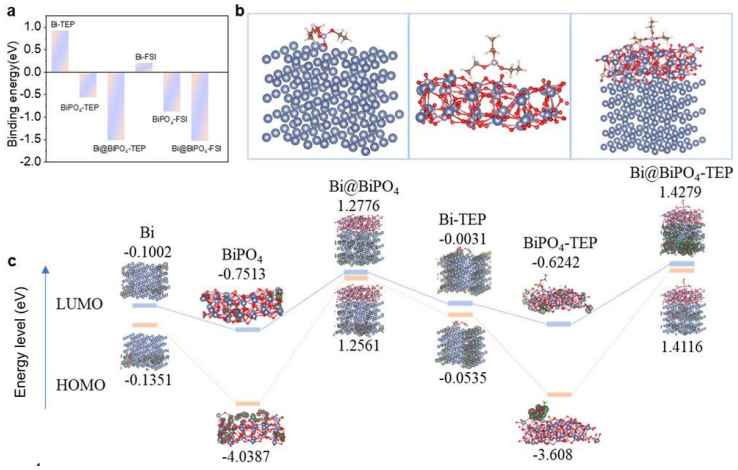
The UM Research Team Has Successfully Developed A Self-Adaptive Bismuth Composite Anode For High-Performance Potassium-Ion Batteries

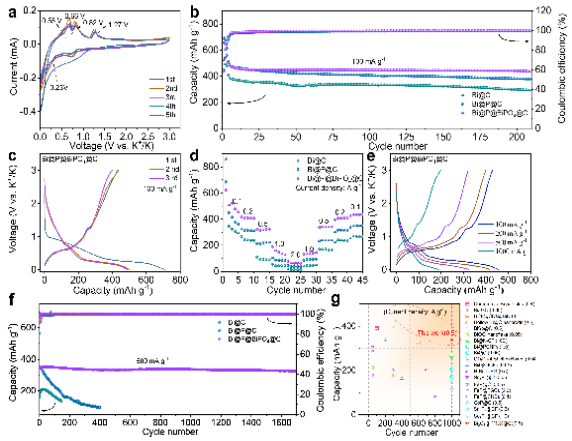
- Bismuth (Bi)-based anode materials have gained significant attention in potassium-ion batteries (PIBs) due to their promising theoretical gravimetric and volumetric capacity. However, Bi-based anode suffers from significant volumetric expansion during potassiation/depotassiation, bringing stress/strain accumulation and the resultant pulverization.
- In this work, the team developed a "self-adaptive expansion and contraction" behavior, triggered by amorphous $BiPO_4$, which enables Bi@P@$BiPO_4$@C particles to form a twisted structure rather than developing cracks during cycling. This structural adaptability enhances performance and provides a solid foundation for future research in the field of PIBs.
- Molecular dynamics calculations reveal that the introduction of $BiPO_4$ enhances the electron affinity of Bi@P@$BiPO_4$@C toward the electrolyte, thereby regulating solid electrolyte interphase formation.

Dr. Yunshan Zheng (鄭雲珊)

Prof. Kwun Nam Hui (許冠南)







Yunshan Zheng, Zhenjiang Yu, Meijia Qiu, Mengting Zheng*, Kwan San Hui*, Huifang Xu, Huixian Xie, Yunlong Teng, Jinliang Li, Wenjie Mai, Jun Lu*, **Kwun Nam Hui***. Self-Adaptive Bismuth Composite Anode for High-Performance Potassium-Ion Batteries. *Advanced Energy Materials*, 2500370 (2025). DOI: 10.1002/aenm.202500370. [2024 IF=26.0]

Prof. Kwun Nam Hui is the corresponding author of this study. The first author is Dr. Yunshan Zheng in the IAPME. This work was supported by the Science and Technology Development Fund, Macau SAR (File no., 0033/2023/ITP1, 0022/2023/RIB1, 0070/2023/AFJ), University of Macau (File no. MYRG2022-00223-IAPME and MYRG2024-00166-IAPME).

❖ Ph.D. Student Thesis Oral Defenses

Yulin Mao of Prof. Guichuan Xing's group presented "Probing and Tailoring the Carrier Dynamics in Metal-Halide Perovskite for Light Emission Applications" in her oral defense on June 11, 2025.

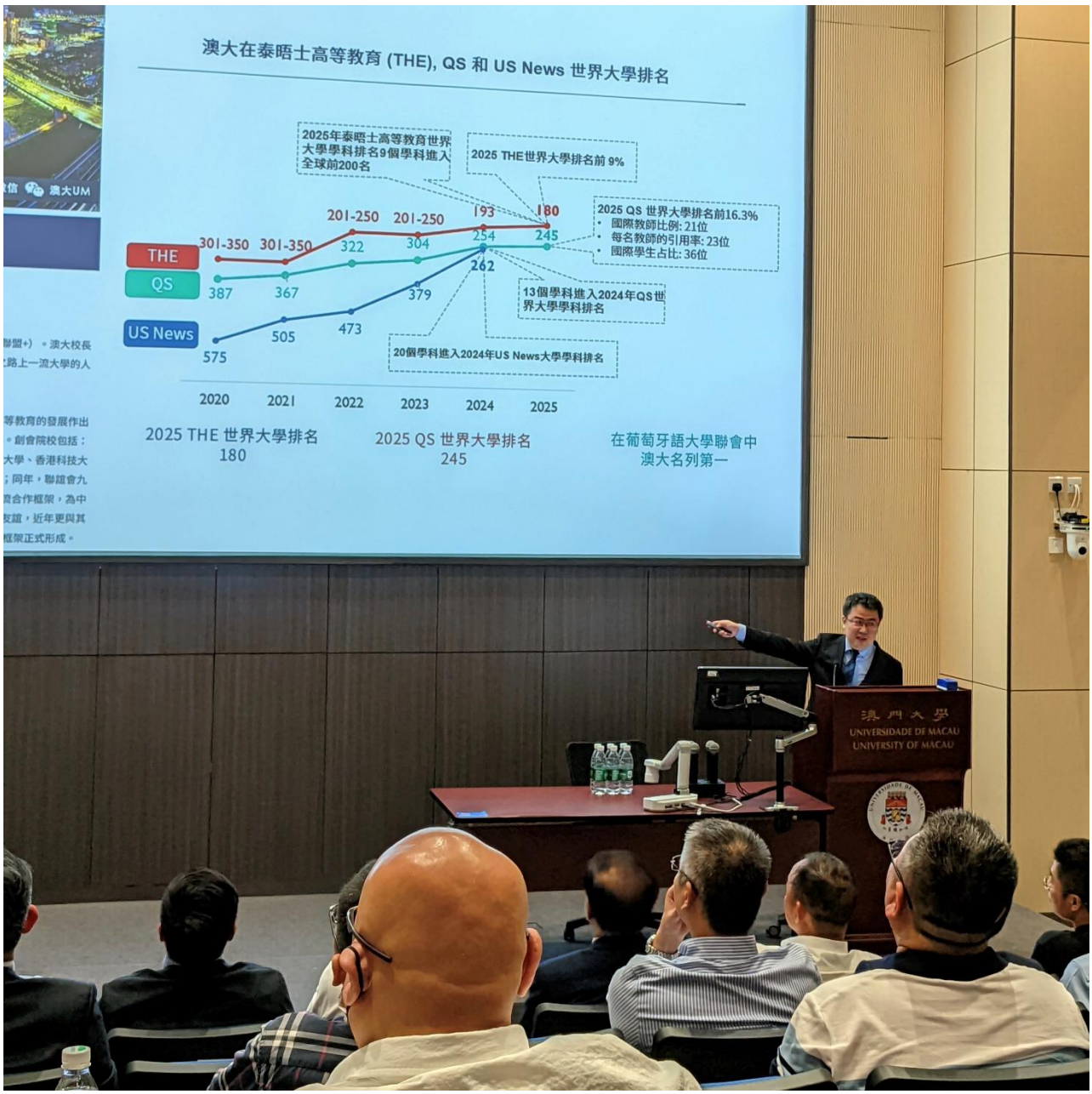
Congratulations to Dr. Yunlin Mao!

(from left) Prof. Hongchao Liu (劉宏超), Prof. Guichuan Xing (邢貴川), Dr. Yulin Mao (毛玉麟), Prof. Hui Pan (潘暉), Prof. Yongqing Cai (蔡永青) and Prof. Bo Wu (吳波, SCNU)

❖ Seminars

The "Zhuhai-Macau Collaboration: Co-Creating the Future – Innovation and Practice in Engineering Project Management" seminar concluded at the University of Macau on May 30, 2025. The event, organized by Zhuhai Communication Group and co-hosted by the University of Macau, over 100 industry professionals attending in person to explore innovative paths in engineering management. The seminar was chaired by Mr. Xiaoxiong Men(門小雄), the general manager from Zhuhai Communication Group and Prof. Guoxing Sun (孫國星) from the University of Macau. The organizers emphasized that the seminar aimed to respond to the development needs of the Greater Bay Area and to serve as a platform for exchange.

Prof. Guoxing Sun and Prof. Binmeng Chen (陳斌猛) presented on the topics "Application of Nano-Foam Concrete in Building Products and Cast-in-Situ Projects" and "Rheology Control of 3D Concrete Printing via In-Situ Polymerization," sparking discussions on smart construction and the application of green materials. After the seminar, Prof. Guoxing Sun led the participants on a laboratory tour, showcasing the technical features and practical applications of nano-foam concrete technology.



The successful hosting of this seminar has established an efficient platform for resource integration and academic exchange in the field of engineering management between Zhuhai and Macao. It not only showcased the innovative achievements of both regions in smart engineering, green construction, and other fields but also helped build consensus for the integrated development of engineering management within the Guangdong-Hong Kong-Macao Greater Bay Area. Moving forward, both Zhuhai and Macao will be beneficial from this conference, to continue deepening industry academia-research cooperation, promote innovations in engineering management theory, and push for breakthroughs in practical applications, jointly writing a new chapter in regional collaborative development.

❖ Delegation from Sun Yat-sen University Visited IAPME

On May 27, 2025, a 33-member delegation from the School of Physics and Astronomy at Sun Yat-sen University (SYSU) visited the Institute of Applied Physics and Materials Engineering (IAPME). The delegation included professors, student mentors, and Bachelor's and Master's students. Prof. Hui Pan and Prof. Yongqing Cai from IAPME participated in the meeting.

During the visit, Prof. Hui Pan provided a detailed overview of IAPME, highlighting the research capabilities, key focus areas, ongoing projects in advanced materials and related applications, and the Master and PhD programmes. The students expressed interests in pursuing graduate studies at IAPME. Both parties engaged in in-depth discussions about recruiting undergraduate students from SYSU to participate in IAPME's Master and PhD programmes.

During the visit, IAPME lab technicians Mike and Ringo conducted a lab tour for the delegation, including the room 1009 (PPMS), G015 (dilution refrigerator), G003 (FIB/TEM), G004 (AFM/EBL/XPS), etc.

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