



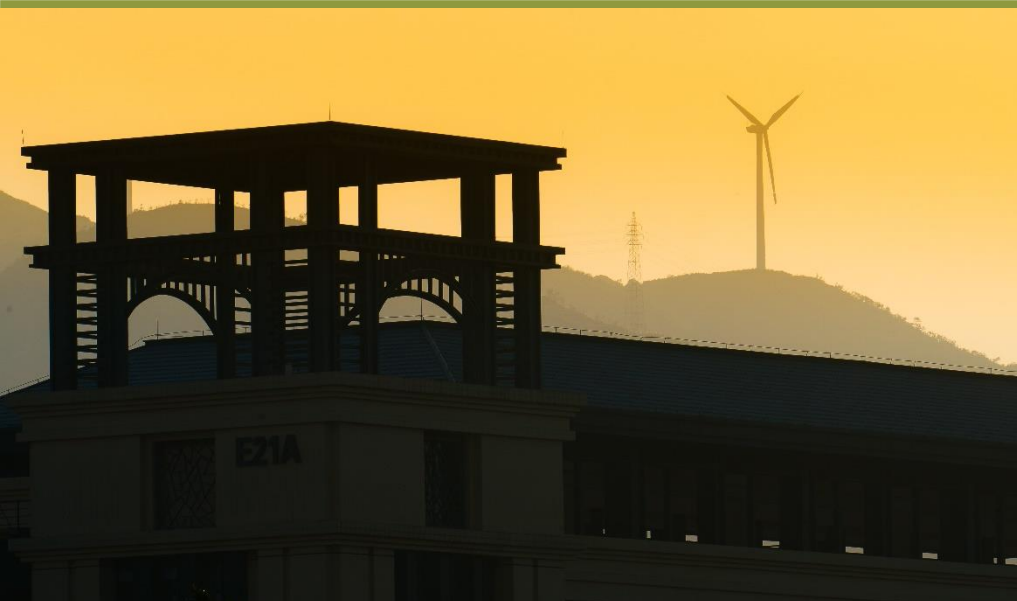
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應用物理及材料工程研究院
INSTITUTO DE FÍSICA APLICADA E ENGENHARIA DE MATERIAIS
INSTITUTE OF APPLIED PHYSICS AND MATERIALS ENGINEERING

IAPME Newsletter

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

1. **Tianyu Chen, Zhiwen Min**, Zhenjiang Yu, Mengting Zheng, Qingbin Jiang, Huifang Xu, Yuanmiao Sun, Kwan San Hui*, Chenyang Zha*, Jun Lu*, **Kwun Nam Hui***. Molecular Clip Strategy of Modified Sulfur Cathodes for High-Performance Potassium Sulfur Batteries. *Advanced Science*. 11, 202405457 (2024). DOI: 10.1002/advs.202405457. [2023 IF=14.3]

RESEARCH ARTICLE

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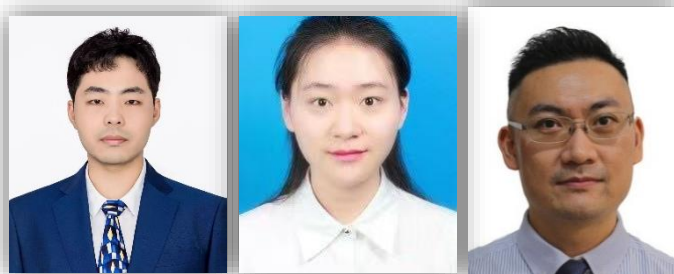
Molecular Clip Strategy of Modified Sulfur Cathodes for High-Performance Potassium Sulfur Batteries

Tianyu Chen, Zhiwen Min, Zhenjiang Yu, Mengting Zheng, Qingbin Jiang, Huifang Xu, Yuanmiao Sun, Kwan San Hui,* Chenyang Zha,* Jun Lu,* and Kwun Nam Hui*

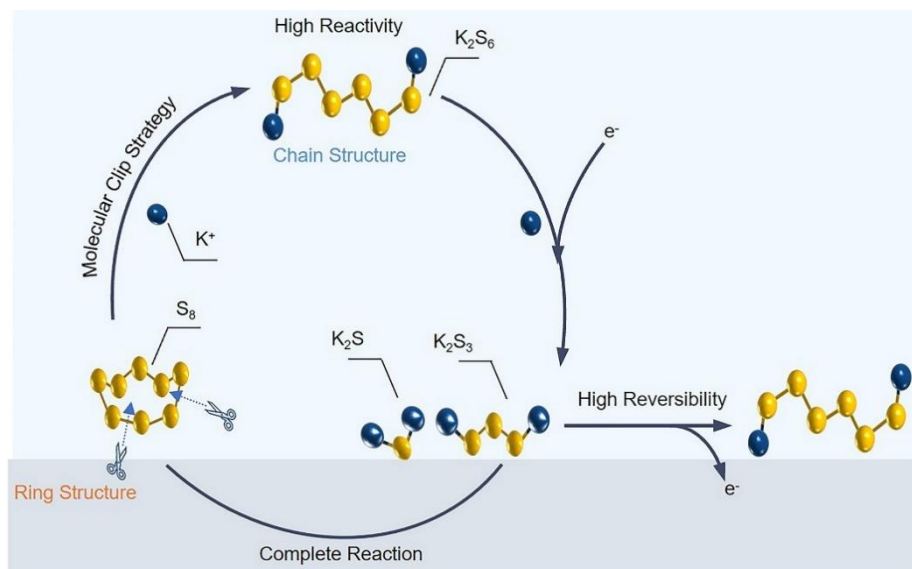
❖ Research Stories

UM research team successfully developed molecular clip strategy of modified sulfur cathodes for high-performance potassium sulfur batteries

- A fundamental investigation into the molecular clip strategy on S_8 through wet chemistry method and subsequently elucidate their profound impact on the catalytic activity of K-S systems.
- A molecular clip strategy is employed to design a novel electrode for potassium-sulfur batteries, replacing the traditional ring structure S_8 with the chain-like S_6^{2-} . This approach significantly reduces the reaction barrier and enhances the conductivity compared to conventional S_8 cathode. The elongation of S-S bonds in S_6^{2-} weakens interactions of sulfur atoms, thereby promoting the efficient conversion of potassium polysulfides.
- The molecular clip strategy effectively lowers the reaction barrier in potassium-sulfur systems, and the stretching of S-S bonds weakens the binding between sulfur atoms, facilitating the transformation of potassium polysulfides (KPSs). The as-prepared cathode exhibits a reversible capacity of 894.8 mAh g^{-1} at a current rate of 0.5 C.



(From left)
Mr. Tianyu Chen (陳天宇), Ms. Zhiwen Min (閔志雯), and Prof. Kwun Nam Hui (許冠南)



Tianyu Chen, Zhiwen Min, Zhenjiang Yu, Mengting Zheng, Qingbin Jiang, Huifang Xu, Yuanmiao Sun, Kwan San Hui*, Chenyang Zha*, Jun Lu*, **Kwun Nam Hui***. Molecular Clip Strategy of Modified Sulfur Cathodes for High-Performance Potassium Sulfur Batteries. *Advanced Science*. 11, 202405457 (2024). DOI: 10.1002/advs.202405457. [2023 IF=14.3]

Prof. Kwun Nam Hui is the corresponding author of this study. The first authors are Mr. Tianyu Chen and Ms. Zhiwen Min, the Ph.D. students in the IAPME. This work was supported by the Science and Technology Development Fund, Macau SAR (File no. 0046/2019/AFJ, 0007/2021/AGJ, 0070/2023/AFJ, 0022/2023/RIB1, 0033/2023/ITP1, 0032/2021/ITP, and 006/2022/ALC), University of Macau (File no. MYRG2020-00187-IAPME and MYRG2022-00223-IAPME), the UEA funding, and the Science and Technology Program of Guangdong Province of China (Grant No. 2022A0505030028), and the Guangdong Basic and Applied Basic Research Foundation (Grant No. 2022A1515110994 and 2024A1515030228).

❖ IAPME professor participated in the development of a novel two-dimensional proton-conducting material, angstrom-porous titania monolayer

According to a recent report by the Macao Daily News, Prof. Pengzhan Sun's research team recently participated in developing a new type of ultra-thin porous proton exchange membrane material. This new proton exchange membrane will provide high-temperature resistance, high proton conductivity, and perfect selectivity in hydrogen-based technologies such as fuel cells, addressing the issue of existing proton exchange membranes failing due to dehydration at high temperatures. The related research has been published in the internationally renowned journal *Nature Communications*.

For more detailed information, please visit

http://www.macaodaily.com/html/2025-01/23/content_1809041.htm



(From left)

Dr. Yu Ji (冀宇) and

Prof. Pengzhan Sun (孫鵬展)

nature communications



Article

<https://doi.org/10.1038/s41467-024-54544-z>

High proton conductivity through angstrom-porous titania

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Wenzhe Zhou¹, Dai-Ming Tang⁷, Renzhi Ma⁷, Shengjun Yuan⁶,
Takayoshi Sasaki⁷, Marcelo Lozada-Hidalgo^{3,4}✉, Andre K. Geim^{3,4}✉ &
Pengzhan Sun¹✉

❖ Fellows of European Academy of Sciences, Prof. Rodrigo Martins and Prof. Elvira Fortunato, visited IAPME

Guided by UM Vice Rector Prof. Rui Paulo da Silva Martins, two Fellows of European Academy of Sciences, Prof. Rodrigo Martins and Prof. Elvira Fortunato, both from NOVA University Lisbon, visited Institute of Applied Physics and Materials Engineering (IAPME) on January 16, 2025. Prof. Hui Pan, Associated Director of IAPME, briefed them on the institute's rapid progress and demonstrated its cutting-edge research and commercial achievements. Both guests were highly impressed by the development of IAPME. They also shared the materials of NOVA University Lisbon and i3N/CENIMAT with Prof. Pan, and conveyed their interests in collaborating with IAPME in the future. Prof. Guichuan Xing, Prof. Songnan Qu, Prof. Bingpu Zhou, Prof. Kar Wei Ng, and Prof. Hongchao Liu participated the visit. A short lab visit was also conducted and a brief sharing was given by Prof. Ng.



Prof. Rodrigo Martins is a Full Professor at the NOVA School of Science and Technology, NOVA University Lisbon, a Fellow of the Portuguese Engineering Academy since 2009 and a member of the European Academy of science since 2016. He was decorated with the gold medal of merit and distinction by the Almada Municipality for his R&D achievements. Prof. Rodrigo Martins has been involved in the pioneer European research on amorphous silicon semiconductors and pioneer with his group worldwide activity related to passive and active oxides, the so-called transparent electronics and it is one of the inventors of the so-called paper electronics, where paper is exploited not only as a substrate but also as a functional component in active devices.



Prof. Elvira Fortunato is a Portuguese Scientist and Minister of Science and Technology. She is a Full Professor in the Department of Materials Science at the NOVA School of Science and Technology and Vice Rector of the NOVA University Lisbon. Prof. Elvira Fortunato pioneered European research on transparent electronics, namely thin-film transistors based on oxide semiconductors, demonstrating that oxide materials may be used as true semiconductors. Her research team is exploring novel active properties in advanced and sustainable multifunctional materials, including oxides as well as novel electronic-active materials including alternative deposition methods, with the main objective of developing eco-friendly technologies and devices to be used and exploited in electronic circuits made of stable amorphous semiconductors able to serve large area smart flexible and conformable surface electronics.



❖ Visits

Professor Andrey ROGACH, a Yeung Kin Man Chair Professor in Photonics Materials at the Department of Materials science and Engineering, and the Founding Director of the Centre for Functional Photonics (CFP) at City University of Hong Kong, visited IAPME on January 17, 2025, upon the invitation by Prof. Qu Songnan.

Professor Rogach gave a lively speech to the teachers and students of IAPME and DPC, entitled "Anchoring Cobalt and Nickel Atoms on Mxene Substrates for Oxygen and Hydrogen Evolution Reactions". During this presentation, Prof. Rogach introduced the basic mechanism of oxygen evolution reaction (OER) and hydrogen evolution reaction (HER). And then he showed his two typical works on the metal atom anchored Mxene for the catalytic water splitting. Prof. Rogach's group has many insights into this research direction.





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On the afternoon of January 17, Professor Songnan Qu introduced the members of the research team and the recent research progress to Professor Rogach, and Dr. Yupeng Liu introduced the progress of the afterglow luminescence application of carbon dots. The research results of the research team were praised by Professor Rogach. Finally, the research team and Professor Rogach had some in-depth discussions on the development direction of luminescent carbon nanomaterials.



❖ Visits

Prof. Yonghong Deng (鄧永紅), from Southern University of Science and Technology, visited IAPME and gave a speech on “Electrolyte/electrode interface in lithium-ion batteries” in January 2025.

Prof. Yonghong Deng is a professor at the Department of Materials Science and Engineering, Southern University of Science and Technology, Vice Dean of the School of Innovation and Entrepreneurship, and a Peacock B Talent in Shenzhen. She has published more than 200 papers in Nature Communications, Energy & Environmental Science, Advanced Materials, Advanced Energy Materials, Nano Letters and other journals, and more than 100 patents (45 granted). She is also the director of China Solid State Ion Society, the editorial board member of the Journal of Energy Storage Science and Technology, the expert committee member of China Energy Society, and the member of China Energy Storage and Power Battery and its materials professional committee.



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