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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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✧ Content

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

1. **Xin Xu**, **Yan Guo**, Hua-Jun Zhao, Yi-Ke Huang, Jun-Po Guo, **Huai-Yu Shao***. "Modification strategies of molybdenum sulfide towards practical high-performance lithium-sulfur batteries: a review". *Rare Metals*, 1-21 (2024). DOI: 10.1007/s12598-024-03033-9. [2023 IF=9.6]

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RARE METALS

MINI REVIEW

Modification strategies of molybdenum sulfide towards practical high-performance lithium-sulfur batteries: a review

Xin Xu, Yan Guo, Hua-Jun Zhao, Yi-Ke Huang, Jun-Po Guo, Huai-Yu Shao*

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❖ Research Stories

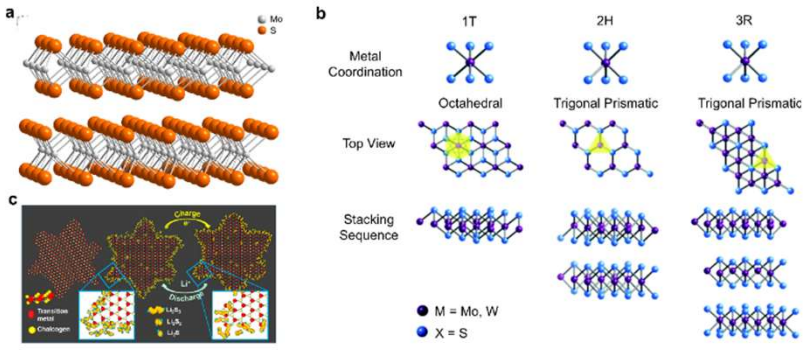
UM research team analyzed the modification strategies of molybdenum sulfide towards practical high-performance lithium-sulfur batteries.

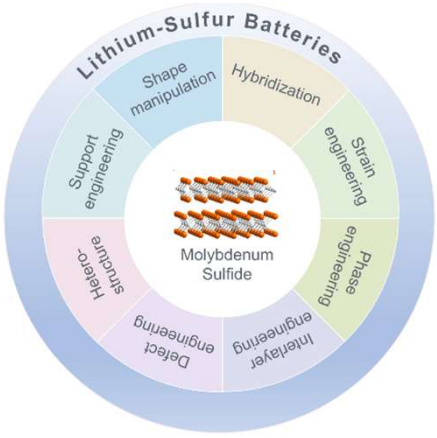
- Molybdenum sulfide (MoS_2) has attracted widespread attention due to its strong adsorption of polysulfides, fast electron transfer, and catalysis, which can accelerate the redox reaction kinetics during charge and discharge processes. However, the inert basal planes on MoS_2 greatly limit polysulfide adsorption and catalytic conversion. In response to the issue of insufficient catalytic sites and catalytic activity of MoS_2, remarkable advances have been made in developing high-performance MoS_2 in the past decade via shape manipulation, support engineering, heterostructure, doping, defect engineering, interlayer engineering, phase engineering, strain engineering, and hybridization.

(From left)
Ms. Xin Xu (徐 鑫) ,
Dr. Yan Guo (郭燕)
and Prof. Huaiyu Shao (邵懷宇)

- The team conducted a comprehensive analysis of various modification strategies of MoS_2 materials in LSBs and their impact on electrochemical and catalytic performance.

- The team discussed the challenges faced in the application of MoS_2 in LSBs and proposed potential pathways for future development, aiming to provide researchers with a relatively comprehensive research framework.





Xin Xu, **Yan Guo**, Hua-Jun Zhao, Yi-Ke Huang, Jun-Po Guo, **Huai-Yu Shao***. "Modification strategies of molybdenum sulfide towards practical high-performance lithium-sulfur batteries: a review". *Rare Metals*, 1-21 (2024). DOI: 10.1007/s12598-024-03033-9. [2023 IF=9.6]

Prof. Huaiyu Shao is the corresponding author of this study. The first authors are Ms. Xin Xu and Dr. Yan Guo, who contributed equally to this work. Ms. Xin Xu, an MSc student in the IAPME, and Dr. Yan Guo, who obtained her PhD from the IAPME in 2024, are both affiliated with the IAPME.

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❖ Outstanding Achievements of PhD Graduate from the Institute of Applied Physics and Materials Engineering (IAPME)

Under the supervision of Associate Professor Haifeng Li (李海峰), 2022 PhD graduate Yinghao Zhu (朱英浩) from the Institute of Applied Physics and Materials Engineering (IAPME) at the University of Macau has achieved remarkable results. During his Ph.D. studies, his primary research areas included the single crystal growth, structural and physical property analysis of rare earth-transition metal oxides, as well as the investigation of their magnetic ground states and excitation behaviours using neutron scattering techniques. After obtaining his Ph.D., he pursued postdoctoral research at the Department of Physics, Fudan University.

(1) In 2023, Dr. Yinghao Zhu applied for and received funding from the National Natural Science Foundation of China (NSFC) under the Young Scientists Fund.

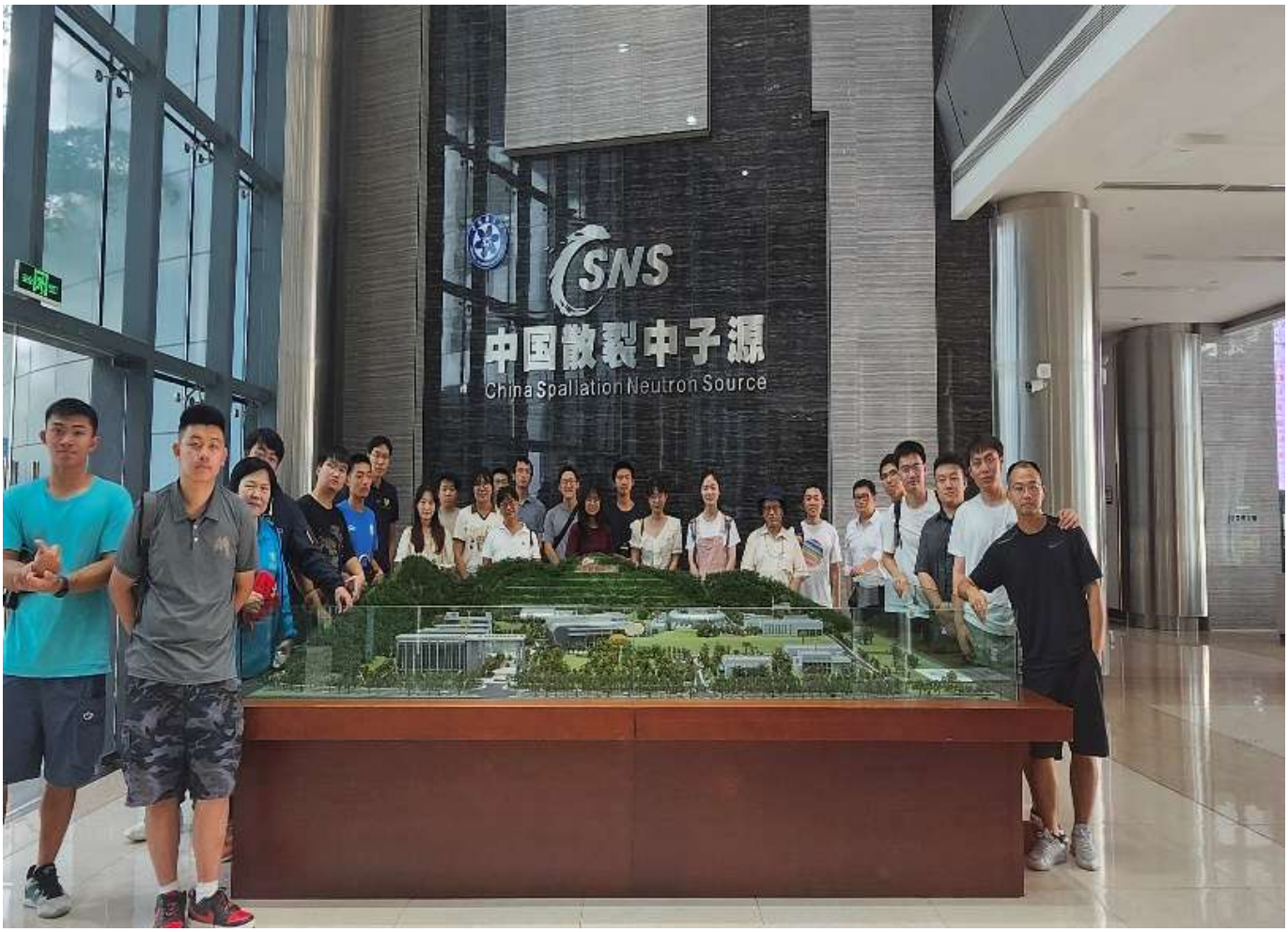
(2) In the global application process of 2024, Dr. Zhu applied for and was awarded the prestigious Maria Skłodowska Curie Postdoctoral Fellowship that is established by the European Union and supported by the Horizon 2020 Project, making it one of the most competitive and prestigious talent programs in Europe.

(3) Recently, under the guidance of his postdoctoral advisor, Professor Jun Zhao (趙俊) from the Department of Physics at Fudan University, Dr. Zhu and his team published a research paper titled "Superconductivity in pressurized trilayer $La_4Ni_3O_{10}$ single crystals" in Nature. In this study, he and his team successfully grew high-quality single crystal samples of $La_4Ni_3O_{10}$, used neutron scattering techniques to analyse the oxygen occupancy, and for the first time reported pressure-induced superconductivity in $La_4Ni_3O_{10}$.

IAPME's Ph.D. programme integrates various disciplines of science and engineering, consistently focusing on cutting-edge scientific research issues. It aims to equip students with the necessary interdisciplinary knowledge to achieve potential breakthroughs in new materials and manufacturing technologies in the future.

❖ From Classroom to Cutting Edge: A Scientific Excursion to the China Spallation Neutron Source

A group of staff members from IAPME, DPC, and FBA, along with students from bachelor, master, and Ph.D. programs, led by Prof. Hai-Feng Li and Dr. Matthew Feng, participated in a one-day educational trip to the China Spallation Neutron Source (CSNS). This national, large-scale scientific facility, located in Dongguan, provides an immersive learning experience in neutron science. CSNS is the fourth pulsed neutron source facility in the world, alongside those in the USA, UK, and Japan. Its significance and pioneering status made it an ideal destination for this educational visit, offering participants firsthand exposure to cutting-edge scientific research.



The group visited the exhibition hall, target station, and beamline stations. Scientific experiments are conducted for various purposes and applications. Participants observed the onsite equipment and engaged in face-to-face discussions with scientists at CSNS. They gained hands-on experience and an understanding of the principles and applications of neutron scattering technology. This direct interaction with advanced technology and experts significantly enhanced their scientific understanding and appreciation, particularly of the marvelous properties of neutrons.