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/

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✧ Content

❖ Publications (IF≥10; *corresponding author)

1. **Jinxian Feng**, Xuesen Wang, and **Hui Pan***. In-situ Reconstruction of Catalyst in Electrocatalysis. *Advanced Materials,* 2411688 (2024). DOI: 10.1002/adma.202411688. [2023 IF=27.4]

❖ Research Stories

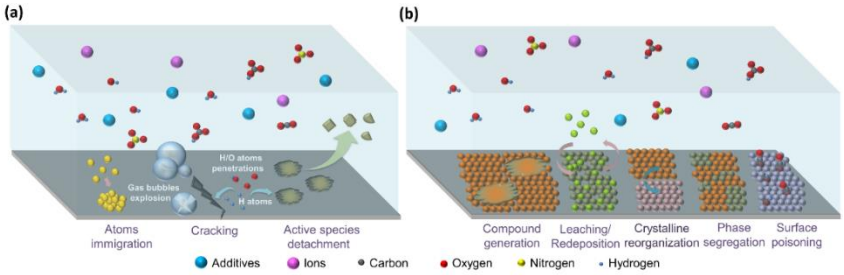
UM research team established viewpoints of in-situ reconstruction in electrocatalysis

- Reconstruction of catalyst is a common phenomenon in electrocatalysis. The reconstructed structure may promote or hamper the electrochemical performance, therefore, how to optimize the reconstructed structures by rational design of elemental composition and crystal structure for electrocatalyst, as well as the electrocatalytic condition control, have been regarded as efficient ways toward electrocatalytic performance improvement.

Dr. Jinxian Feng

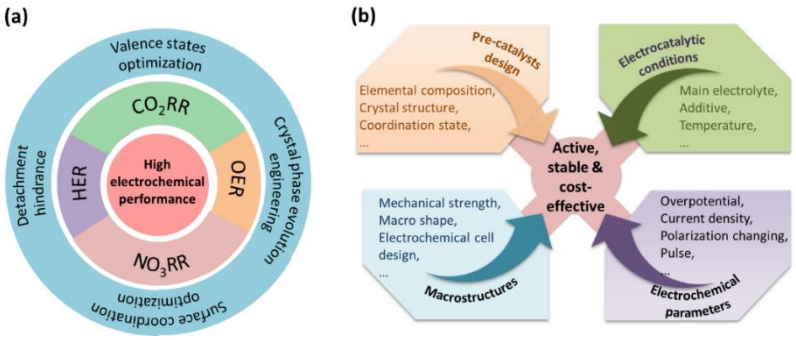
Prof. Hui Pan

- The team comprehensively discussed the genesis and affected factors of in-situ reconstruction, and the strategies for optimizing the reconstruction, such as valence states control, active phase retention, phase evolution engineering and surface poisoning prevention based on energy conversion electrocatalysts are discussed.



Schemes of reconstructions introduced by (a) physical and (b) chemical driving forces.

- The team established these following factors that need to be further studied: Advanced operando characterization techniques and the algorithm for static analysis; Reconstructions by physical factors and corrosion in electrocatalysis; Relations among the pre-catalyst, electrocatalytic conditions, reconstructed structure and electrochemical performance.



(a) Summery of the reconstruction control strategies. (b) Strategies of the reconstruction optimization.

Jinxian Feng, Xuesen Wang, and **Hui Pan***. In-situ Reconstruction of Catalyst in Electrocatalysis. *Advanced Materials,* 2411688 (2024). DOI: 10.1002/adma.202411688. [2023 IF=27.4]

The first author, Dr. Jinxian Feng, received a PhD degree from IAPME and is currently supported by the UM Postdoctoral Fellow (UMPF) scheme. Prof. Hui Pan is the corresponding author of this study. This work was supported by the Science and Technology Development Fund (FDCT) from Macau SAR (0050/2023/RIB2, 0023/2023/AFJ, 006/2022/ALC, and 0111/2022/A2) and Multi-Year Research Grants (MYRG-GRG2024-00038-IAPME, MYRG-GRG2023-00010-IAPME and MYRG2024-00026-IAPME) from the University of Macau.

❖ Seminars

Prof. Qibin Liu, Dean and Professor of the School of Materials & Metallurgy at Guizhou University, visited IAPME on 5 November, 2024. During his visit, Prof. Liu delivered a talk on “Preparation and Performance Study of Graphene Oxide/BCZT Composite Biopiezoelectric Ceramics” and engaged in discussions with academic staff, postdoctoral fellows, and PhD students. The visit included productive discussions on collaborations in various areas, such as joint projects, student exchange programs, and co-organized workshops. Prof. Liu also toured IAPME’s labs, including the materials characterization facilities.

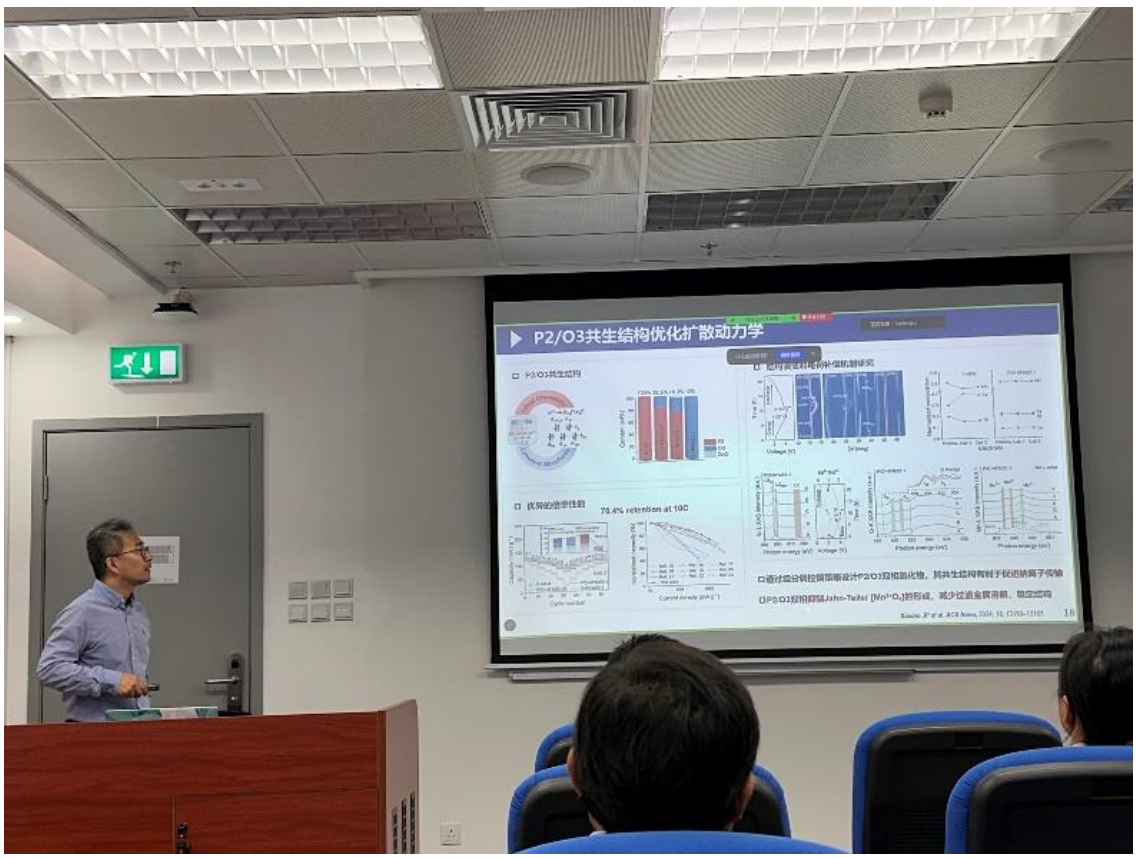
❖ Seminars

Prof. Xiaobo Ji, Associate Dean of the Department of Chemistry and Chemical Engineering at Central South University, visited IAPME and delivered an insightful presentation on "Long-Cycle and Low-Cost Cathode Materials for Sodium-Ion Batteries" as part of the IAPME Seminar Series on 6 November, 2024.

Prof. Ji is an esteemed researcher in the field of energy storage systems, holding a DPhil from the University of Oxford and having completed postdoctoral research at MIT. He has made significant contributions to the development of critical materials for energy storage. His prolific career includes over 600 peer-reviewed publications and numerous accolades, such as the National Science Fund for Distinguished Young Scholars (2023) and the IALB Research Award (2024).

During his talk, Prof. Ji highlighted the potential of sodium-ion batteries (SIBs) for renewable energy integration and grid-level storage. He focused on the challenges faced by cathode materials, which are crucial for battery performance, and introduced innovative solutions to address capacity deterioration and sluggish dynamics. Prof. Ji's research explores advanced P2/O3 biphasic cathodes, high-entropy layered oxide cathodes, and Prussian blue analogue cathodes, offering new insights into their structural stability and ion kinetics.

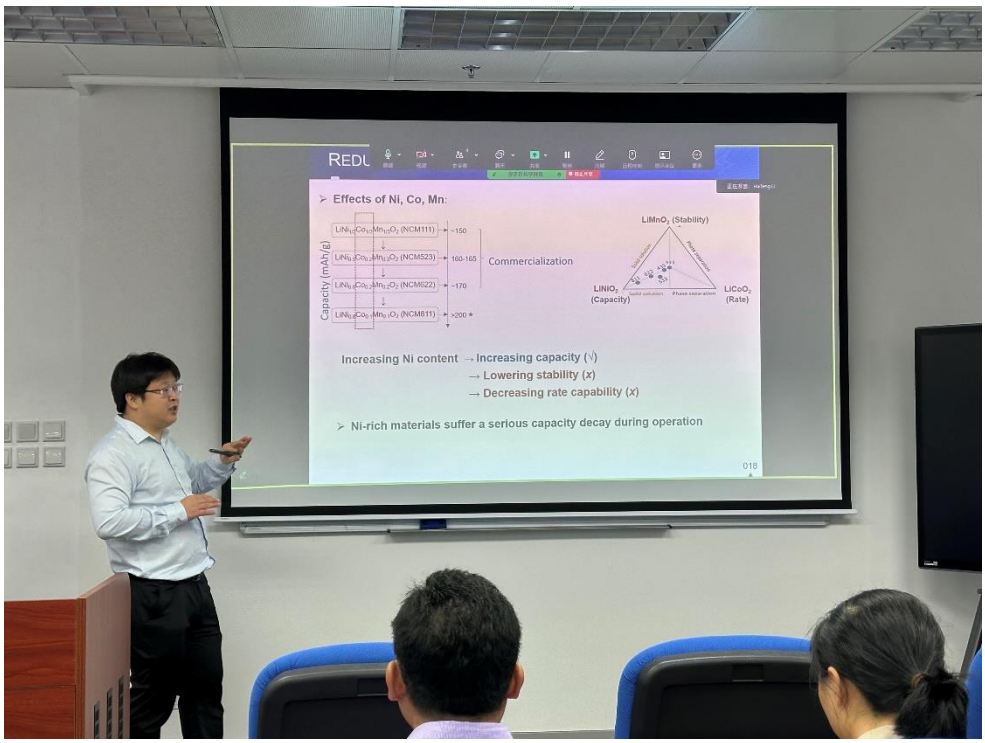
The seminar provided attendees with a comprehensive understanding of the latest advancements in sodium-ion battery technology, emphasizing the importance of low-cost and long-cycle cathode materials. Prof. Ji's work continues to pave the way for sustainable energy solutions, with his patents already contributing to industrial applications worth over 10 million RMB.



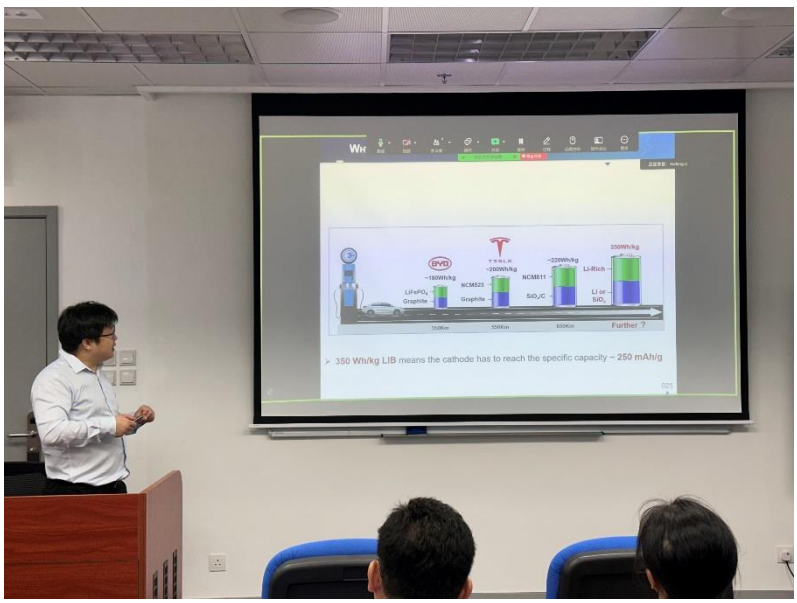
❖ Seminars

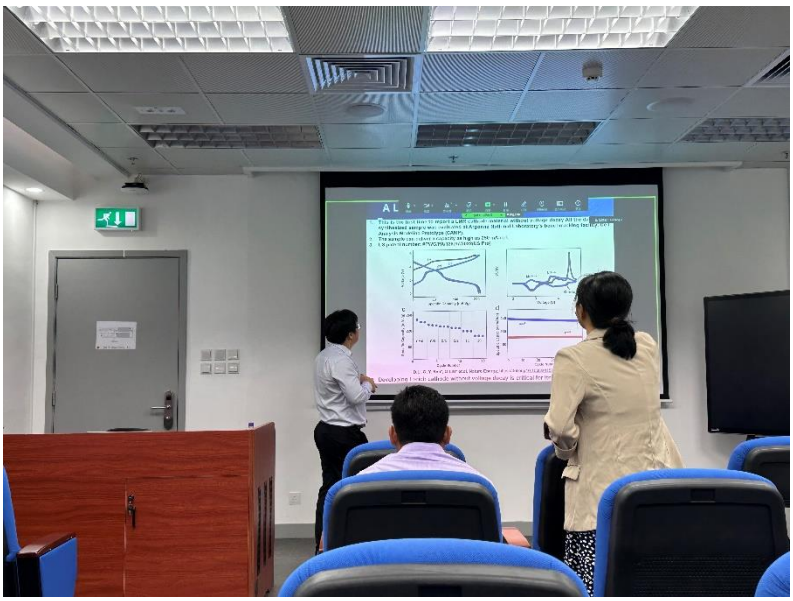
Prof. Qi Liu, Associate Professor of the Department of Physics at the City University of Hong Kong, delivered an engaging talk on the "Study of Phase Transition Behaviour in Materials via Advanced Synchrotron Techniques" on 6 November 2024. Prof. Liu shared his extensive research on the structure-property relationships of functional materials, utilizing cutting-edge synchrotron-based techniques.

With a prolific publication record, Prof. Liu has authored 128 peer-reviewed journal papers, including 14 in prestigious journals like Nature Energy and Nature Materials. He holds 12 patents filed in the US and China and has been invited to deliver over 50 talks at international conferences and workshops. His accolades include the CityU President's Award 2021 and the Rising Star Lecturer (Physics) by the Hong Kong Institute of Advanced Study. In 2019, he was elected as a committee member of the Chinese Ceramic Society, representing Hong Kong.



In his presentation, Prof. Liu provided a comprehensive overview of advanced X-ray techniques for studying secondary rechargeable batteries, such as lithium-ion and sodium-ion batteries. He discussed the theoretical principles underlying these techniques. Prof. Liu illustrated the applicability of these techniques through practical examples, emphasizing their structural sensitivities across various temporal, elemental, and length scales. His broader research interests also include the design and synthesis of novel energy storage materials and phase transition mechanisms.





❖ Upcoming Events

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IAPME Seminar

Stimuli-Directing Liquid Crystalline Materials: From Tunable Photonics to Deformable Soft Systems and Beyond

20 November 2024

Prof. Quan LI
Southeast University
Venue: N23-1004b
Time: 10:00 – 11:00
Hosted by: Prof. Songnan QU

Abstract

Liquid crystals (LCs) represent a fascinating state of matter that combines order and mobility on a molecular and supramolecular level. The unique combination of order and mobility results in that LC is typically "soft" and responds easily to external stimuli. The responsive nature and diversity of LCs provide tremendous opportunities as well as challenges for insights in fundamental science, and open the door to various applications. Conventional nematic LCs have become the quintessential materials of LC displays. With the LC displays ubiquitous in our daily life, the research and development of LCs are moving rapidly beyond display applications and evolving into entirely new and fascinating scientific frontiers. In my talk, I will present our recent research and development on stimuli-directing liquid crystalline materials with focus on light and electric field as two stimuli: from tunable photonics to photodeformable soft systems.

Biography

Prof. Quan LI is a Distinguished Chair Professor and Director of Institute of Advanced Materials at Southeast University, China. He is the honorary Editor-in-Chief of "Chinese Journal of Liquid Crystals and Displays", the founding Editor-in-Chief of Wiley "Responsive Materials", an editor of Springer Nature "Light: Science & Applications" etc. Li held appointments in USA, Germany, and France. In the past decade, Prof. Li has been a Principal Investigator and Project Director in awarded federal grants from US Air Force Office of Scientific Research, US Air Force Research Laboratory, US Army Research Office, US Department of Energy, US Department of Defense Multidisciplinary University Research Initiative (MURI), US National Aeronautics and Space Administration, and US National Science Foundation, and has advised over 20 postdoctoral fellows and many Ph.D. students. He has edited eight books (2 Wiley-VCH, 2 Wiley, and 4 Springer books), and has co-authored 40 chapters including the invited author of the entry entitled "Liquid Crystals" in the prestigious Kirk-Othmer Encyclopedia. Prof. Li was Alexander von Humboldt Fellow in Germany. He has won the Kent State University Outstanding Research and Scholarship award. He is a Fellow of the Royal Society of Chemistry (FRSC). He has been elected as a member of European Academy of Sciences and a member of European Academy of Sciences and Arts. He has also been honored as Professor and Chair Professor at several universities. Prof. Li's current research interest spans from stimuli-responsive smart soft matter, advanced photonics, and optoelectronic materials for energy harvesting and energy saving to functional biomedical materials and nanoparticles to nanoengineering and device fabrication. More info about Prof. Li: http://www.quanlilab.com

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❖ Upcoming Events

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IAPME Seminar

Superconductivity in Thin-film Infinite-layer Nickelates

21 November 2024

Prof. Danfeng LI
City University of Hong Kong
Venue: N23-4018
Time: 15:00 - 16:00
Hosted by: Prof. Haifeng LI

Abstract

The recent discovery of superconductivity in infinite-layer nickelates has engendered reviving interest in the study of a cuprate-analog system. Notably, superconducting nickelates display signatures of intriguing similarities and distinctions to the cuprates in their phase diagrams, proximity to strongly correlated electronic phases, antiferromagnetic interactions, superconducting anisotropy, etc. Partially owing to the non-trivial challenges in materials synthesis and their thin-film nature, experimental demonstration of the intrinsic properties of this materials family has still been limited. In this talk, I will introduce this new family of superconductors synthesized by a soft-chemistry approach and highlight the critical aspects of their electronic and magnetic structure. I will also present our latest work on novel synthetic approaches to the materials system and probing of their distinct features, in a broader context of the unusual role that rare-earth elements and chemical environment play. Finally, I will suggest how new applications of kinetic-based synthetic approaches in oxide heterostructures provide a broad opportunity to create novel nickelate systems in previously inaccessible ways.

Biography

Prof. Danfeng LI is an Associated Professor in the Department of Physics and currently serves as Associate Dean for Research and Postgraduate Education in the College of Science at City University of Hong Kong (CityUHK). Prof. Li has received several prestigious awards and recognitions, including the AAPPS-APCTP Chen-Ning Yang Award in 2023, The Oxide Electronics Prize for Excellence in Research in 2024, the MIT Technology Review 35 Innovators Under 35 (China) in 2021, and the Stanford's List of World's Top 2% Scientists in 2023 and 2024. Prof. Li obtained his B.Eng. from Zhejiang University and M.Phil. from The Hong Kong Polytechnic University (advisor: Prof. Ji-yan Dai). Shortly after earning his Ph.D. (2016) in the Department of Quantum Matter Physics at University of Geneva (advisor: Prof. Jean-Marc Triscone), he joined Stanford University as a Swiss National Science Foundation postdoctoral fellow, working with Prof. Harold Hwang. He joined CityUHK as an Assistant Professor in November 2020.

Prof. Li's main research interests span across condensed-matter physics and materials science, focusing on atomic-scale fabrication of oxide heterostructures and nanomembranes, kinetic based synthesis of unconventional quantum materials, low-dimensional superconductivity, oxide interfaces for emergent states, etc. In 2019, a team led by Prof. Li and Prof. Hwang discovered the first nickelate superconductor, which had been a target of continuous materials search for over three decades. This discovery has opened a new research area, which now marks nickelates as the new family of high-temperature.

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