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

https://iapme.um.edu.mo/

FIRST ISSUE

25 September 2024

✧ Content

Preface for the Inaugural Issue of the IAPME Newsletter

Welcome to the inaugural issue of the Institute of Applied Physics and Materials Engineering (IAPME) Newsletter! We are excited to launch this publication as a platform to enhance internal communication and promote transparency within our community.

Our newsletter, published on weekly basis, will serve as a vital source of information, keeping you updated on the latest developments, achievements, and events at the Institute. Each issue will feature a range of content, including Research Highlights, Teaching and Students Affairs, Community News, News and Events, and Upcoming Events, etc.

We hope this newsletter will foster a sense of community and collaboration among all members of IAPME. Your feedback and contributions are invaluable as we continue to grow and improve this publication.

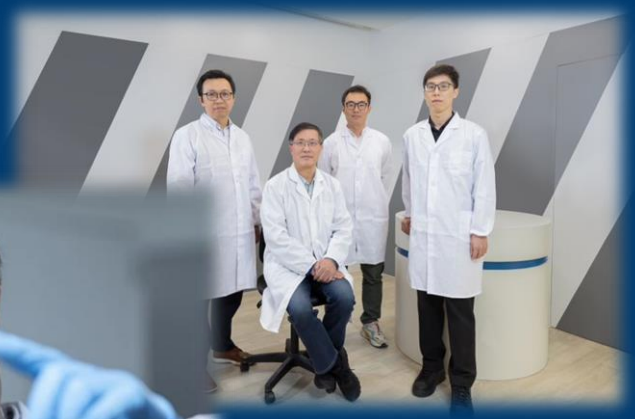
Thank you for being part of our journey, and we look forward to sharing many more updates with you in the future.

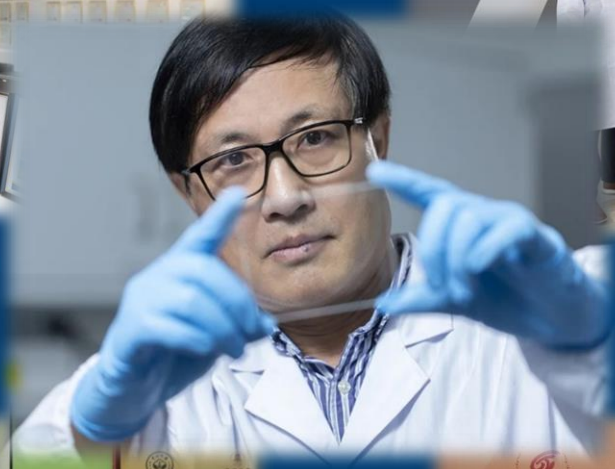
Warm regards,

Wei GE
Interim Director
Institute of Applied Physics and Materials Engineering

❖ Appreciation

We take this opportunity to give our heartfelt gratitude to Professor Zikang TANG for his selfless dedication and great contribution to the establishment and development of IAPME as the Director of IAPME. Professor Tang will continue to serve as Chair Professor of IAPME.





❖ Publications (IF≥10; *corresponding author)

1. Dong Liu*, Yaohai Cai, Xin Wang, Yuling Zhuo, Xulei Sui, **Hui Pan*** and Zhenbo Wang*, "Innovations in Electrocatalysts, Hybrid Anodic Oxidation, Eelectrolyzers for Enhanced Direct Seawater Electrolysis." *Energy & Environmental Science (2024).* DOI:10.1039/d4ee01693a [2023 IF=32.4]

2. Xuanchi Yu, Jia Guo*, Yulin Mao, Chengwei Shan, Fengshou Tian, Bingheng Meng, Zhaojin Wang, Tianqi Zhang, Aung Ko Ko Kyaw, Shuming Chen, Xiaowei Sun, Kai Wang, Rui Chen*, **Guichuan Xing***, "Enhancing the Performance of Perovskite Light-Emitting Diodes via Synergistic Effect of Defect Passivation and Dielectric Screening." *Nano-Micro Lett. 16, 205 (2024).* DOI: 10.1007/s40820-024-01405-5 [2023 IF=31.6]

3. Quansheng Cheng, Tesen Zhang, Qingcheng Wang, Xue Wu, Lingyun Li, Runxing Lin, **Yinning Zhou**, **Songnan Qu***, "Photocatalytic Carbon Dots-Triggered Pyroptosis for Whole Cancer Cell Vaccines". *Advanced Materials, 2408685.* DOI: 10.1002/adma.202408685 [2023 IF=27.4]

4. Yupeng Liu, Dengke Cheng, Bingzhe Wang, Junxiang Yang, Yiming Hao, Jing Tan, Qijun Li*, **Songnan Qu***, "Carbon Dots-Inked Paper with Single/Two-Photon Excited Dual-Mode Thermochromic Afterglow for Advanced Dynamic Information Encryption". *Adv. Mater. 2024, 36, 2403775*. DOI: 10.1002/adma.202403775. [2023 IF=27.4]

5. Lulu Qiao, Anquan Zhu, Di Liu*, Keyu An, Jinxian Feng, Chunfa Liu, **Kar Wei Ng*, Hui Pan***, "In Situ Reconstructed Cu/β-Co(OH)2 Tandem Catalyst for Enhanced Nitrate Electroreduction to Ammonia in Ampere-Level". *Adv. Energy Mater. 2024, 2402805.* DOI: 10.1002/aenm.202402805 [2023 IF=24.4]

6. Wei Li, Junjie Lin, Wanyi Huang, Qingrou Wang, Haoran Zhang, Xuejie Zhang, Jianle Zhuang, Yingliang Liu, **Songnan Qu*** and Bingfu Lei, "Delivery of luminescent particles to plants for information encoding and storage." *Light - Science & Applications 13.1 (2024), 217.* DOI: 10.1038/s41377-024-01518-x [2023 IF=20.6]

7. Shuangyin Wang, Yujie Wang, Xiaorong Zhu, Qizheng An, Xiaoran Zhang, Xiaoxiao Wei, Chen Chen, Han Li, Dawei Chen, Yangyang Zhou, Qinghua Liu, **Huaiyu Shao***, "Electron Deficiency is More Important than Conductivity in C– N Coupling for Electrocatalytic Urea Synthesis." *Angewandte Chemie – International Edition (2024), e202410938.* DOI: 10.1002/ange.202410938 [2023 IF=16.1]

8. Guodong Zhang, Yanjie Cheng, Tingting Niu, Ziwei Zheng, Zongwei Li, Junwei Xiang, Qiaojiao Gao, Minghao Xia, Lijuan Guo, Yiming Liu, Mengru Zhang, Yiran Tao, Xueqin Ran, Mingjie Li, **Guichuan Xing***, Yingdong Xia, Lingfeng Chao, Anyi Mei, Hongwei Han and Yonghua Chen, "Homogeneous permeation and oriented crystallization in nanostructured mesopores for efficient and stable printable mesoscopic perovskite solar cells." *Science China - Chemistry (2024), 1-9.* DOI: 10.1007/s11426-024-2283-9 [2023 IF=10.4]

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IAPME Newsletter
FIRST ISSUE 25 September 2024

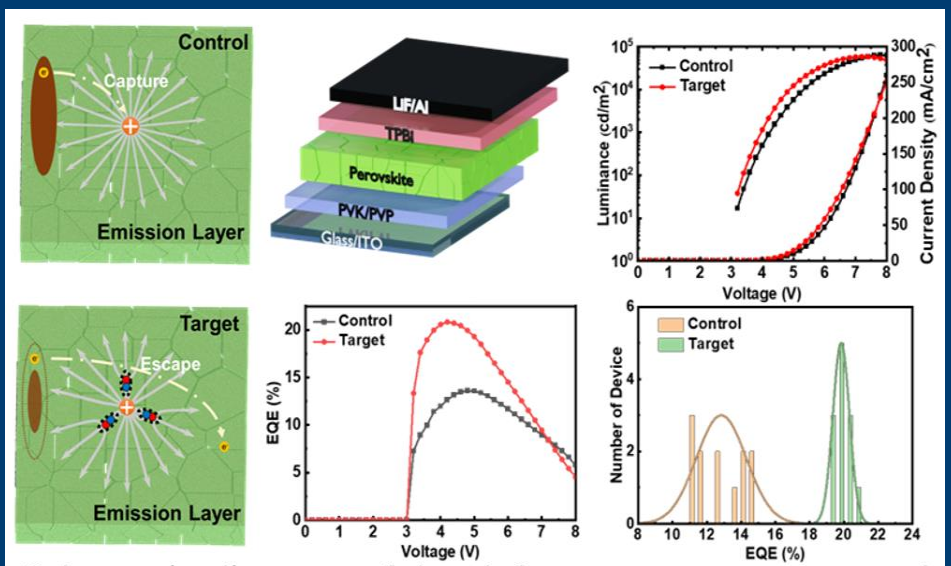
❖ Research Stories

UM research team successfully Improving the performance of perovskite light-emitting diodes through the synergistic effect

- The synergistic passivation mechanism of perovskite films by using the bifunctional compound potassium bromide was revealed.
- Metal halide perovskites, especially the quasi-two-dimensional perovskite, show considerable potential in next-generation electroluminescent materials for lighting and display. However, the presence of internal defects in these perovskites has a substantial impact on the emission efficiency and durability of the device.

(from left) Dr. Xuanchi YU, Dr. Jia GUO and Prof. Guichuan XING

- This method effectively reduces the probability of carrier quenching caused by charge defect trapping, thus improving the radiation recombination efficiency of perovskite films. At the same time, potassium bromide treatment promotes the uniform and smooth growth of the film, which is conducive to the charge carrier injection in the device. The passivation mechanism of solution ionic compound additive in perovskite was further understood in this work.



Schematic diagram of the defect capture process and performance of perovskite light-emitting diodes

Yu, X., Guo, J.*, Mao, Y., … Chen, R.* & Xing, G.* (2024). Enhancing the Performance of Perovskite Light-Emitting Diodes via Synergistic Effect of Defect Passivation and Dielectric Screening. **Nano-Micro Lett.**, 16, 205. DOI: 10.1007/s40820-024-01405-5. **[2023 IF=31.6]**

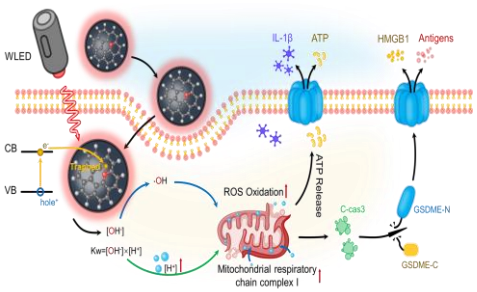
Dr. Jia GUO, Prof Rui CHEN and Prof. Guichuan XING are the corresponding authors of this study. The first author is Ms. Xuanchi YU, a Ph.D. student in the IAPME. This work was supported by the Science and Technology Development Fund, Macao SAR (File no. FDCT-0082/2021/A2, 0010/2022/AMJ, 006/2022/ALC), UM's research fund (File no. MYRG2022-00241-IAPME, MYRG-CRG2022-00009-FHS), the research fund from Wuyi University (EF38/IAPME-XGC/2022/WYU), and the Natural Science Foundation of China (61935017, 62175268) and Science, Technology and Innovation Commission of Shenzhen Municipality (Project Nos. JCYJ20220530113015035, JCYJ20210324120204011, and KQTD2015071710313656).

❖ Research Stories

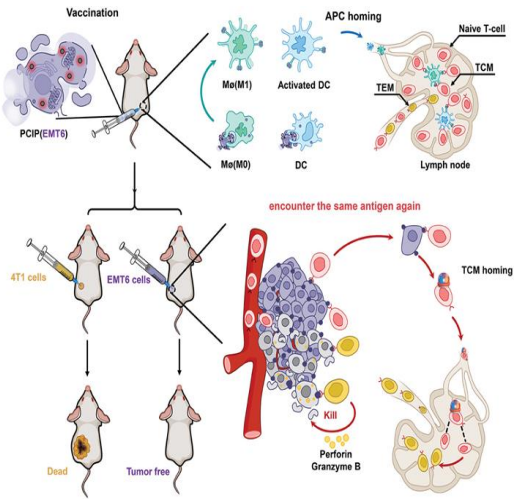
UM research team successfully develops photocatalytic carbon nanodot-triggered pyroptotic cancer cells for tumor immunoprevention

- A facile strategy that utilized photocatalytic carbon dots (CDs) to induce pyroptosis of cancer cells for fabricating whole cancer cell vaccines (WCCV) is reported.
- Photocatalytic CDs are capable of generating substantial amounts of hydroxyl radicals and can effectively decrease cytoplasmic pH values under white light irradiation. This process efficiently triggers cancer cell pyroptosis through the reactive oxygen species (ROS)-mitochondria-caspase 3-gasdermin E pathway and the proton motive force-driven mitochondrial ATP synthesis pathway.
- Photocatalytic CDs-induced pyroptotic cancer cells (PCIP) induced specific immune-preventive effects in melanoma and breast cancer mouse models through anticancer immune memory, demonstrating effective WCCV.

(from left) Mr. Quansheng CHENG, Mr. Tesen ZHANG, Mr. Qingcheng WANG and Prof. Songnan QU



Schematic illustration of photocatalytic CDs inducing pyroptosis of cancer cells under WLED irradiation



The proposed mechanism schematic of PCIP-induced specific tumor prevention

Cheng, Q., Zhang, T., Wang, Q., Wu, X., Li, L., Lin, R., ... & Qu, S. (2024). Photocatalytic Carbon Dots-Triggered Pyroptosis for Whole Cancer Cell Vaccines. **Advanced Materials**, 2408685. DOI: 10.1002/adma.202408685. **[2023 IF=27.4]**

Prof. Songnan QU is the corresponding author of this study. The first authors are Mr. Quansheng CHENG, Mr. Tesen ZHANG and Mr. Qingcheng WANG, three Ph.D. students in the IAPME. This project was funded by the Science and Technology Development Fund of Macao SAR (File no: 0139/2022/A3, 0128/2020/A3, 0131/2020/A3, 0007/2021/AKP, and 006/2022/ALC), Shenzhen-Hong Kong-Macao Science and Technology Programme (Category C) (File no: SGDX20210823103803021), UM (MYRG2020-00164-IAPME), and the University of Macau-Huafa Group Joint Laboratory (HF-001-2021).

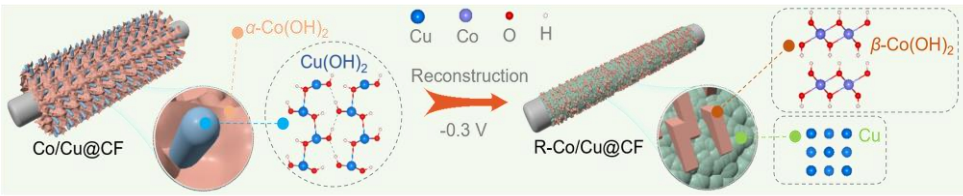
❖ Research Stories

UM research team successfully developed electrochemical tandem catalyst for efficient nitrate reduction to ammonia in ampere-Level

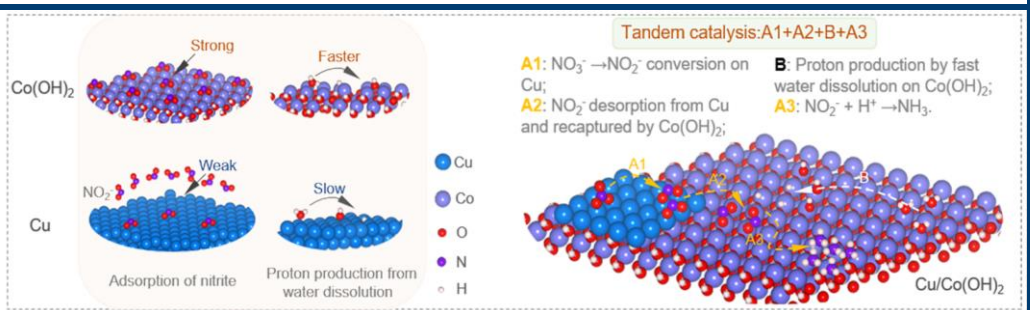
- The potential- and time-dependent reconstruction mechanisms of $Cu(OH)_2$ and α-$Co(OH)_2$ into metallic Cu and β-$Co(OH)_2$ in e-NO_3RR are in-depth investigated.
- Based on the understanding of reconstruction mechanism of pre-catalysts, the hybrid catalyst (R-Co/Cu@CF) is obtained by in-situ reconstruction of the α-$Co(OH)_2$/$Cu(OH)_2$ pre-catalyst (Co/Cu@CF) under working condition. The R-Co/Cu@CF exhibits an optimal FE for ammonia of 97.7% with a yield of 3.9 mmol h^{-1} cm^{-2} at -0.5 V vs. RHE.

(from left) Dr. Lulu QIAO, Dr. Di LIU, Prof. Gar Wei NG, and Prof. Hui PAN

- The tandem catalytic mechanism is revealed in R-CoCu@CF, where Cu contributes to the generation and release of NO_2^- by initially reducing NO_3^-, and β-$Co(OH)_2$ provides protons and acts as an active site for converting NO_2^--to-NH_3, which accounts for the superior e-NO_3RR performance for the NH_3 synthesis.



The reconstruction mechanism of Co/Cu@CF



The tandem catalytic mechanism in R-Co/Cu@CF

L. Qiao, A. Zhu, D. Liu*, K. An, J. Feng, C. Liu, K. W. Ng*, and H. Pan*, In Situ Reconstructed Cu/β-Co(OH)2 Tandem Catalyst for Enhanced Nitrate Electroreduction to Ammonia in Ampere-Level. Adv. Energy Mater. 2024, 2402805. DOI: 10.1002/aenm.202402805 **[2023 IF=24.4]**

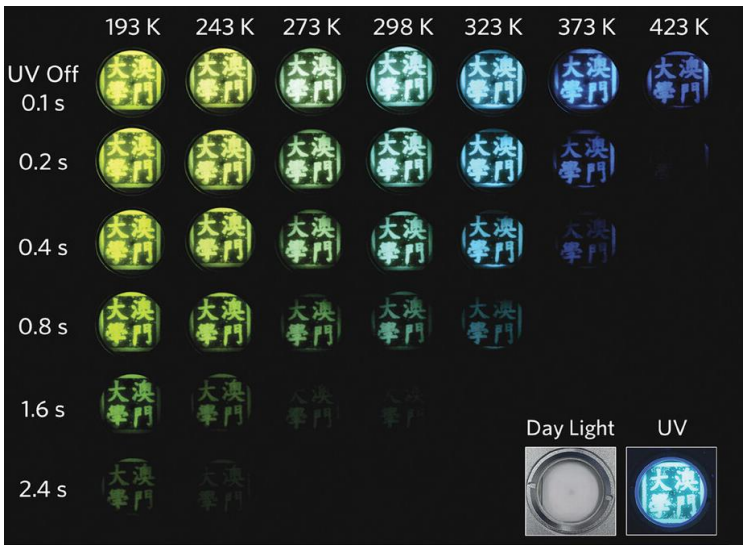
Dr. Di LIU, Prof. Gar Wei NG and Prof. Hui PAN are the corresponding authors of this study. The first author is Ms. Lulu QIAO, a Ph.D. student in the IAPME. This work was supported by the Science and Technology Development Fund (FDCT) from Macau SAR (0050/2023/RIB2, 0023/2023/AFJ, 006/2022/ALC, 0111/2022/A2 and 0052/2021/AGJ), Multi-Year Research Grants (MYRG-GRG2023-00010-IAPME and MYRG2022-00026-IAPME) from the University of Macau, and Shenzhen-Hong Kong-Macao Science and Technology Research Programme (Type C) (SGDX20210823103803017) from Shenzhen.

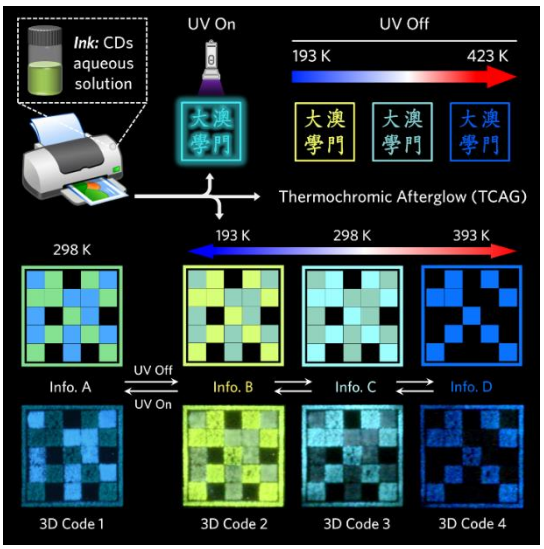
❖ Research Stories

UM research team successfully develops thermochromic afterglow from carbon dots- inked paper for advanced dynamic information encryption

- **Thermochromic afterglow (TCAG) in carbon dots-inked paper (CDs@Paper) is achieved by tuning the temperature-dependent dual-mode afterglow of room temperature phosphorescence and thermally activated delayed fluorescence.**
- **Two-photon afterglow in CDs-based afterglow materials and time-dependent two-photon afterglow colors are achieved for the first time.**
- **CDs@Paper-based 3D codes containing color and temperature information is successfully developed for advanced dynamic information encryption.**

(from left) Dr. Yupeng LIU and Prof. Songnan QU





Y. Liu, D. Cheng, B. Wang, J. Yang, Y. Hao, J. Tan, Q. Li*, S. Qu*, Carbon Dots-Inked Paper with Single/Two-Photon Excited Dual-Mode Thermochromic Afterglow for Advanced Dynamic Information Encryption. **Adv. Mater.** 2024, 36, 2403775. DOI: 10.1002/adma.202403775. [2023 IF=27.4]

Prof. Songnan QU (UM) and Prof. Qijun LI (YZU) are the corresponding authors of this study. The first author is Mr. Yupeng LIU, a Ph.D. student in the IAPME. This work was financially supported by the Science and Technology Development Fund of Macau SAR (0128/2020/A3, 006/2022/ALC, and 0139/2022/A3), the Shenzhen-Hong Kong-Macao Science and Technology Innovation Project (Category C) (SGDX20210823103803021, EF029/IAPME-QSN/2022/SZSTIC), the National Natural Science Foundation of China (62205384), the Natural Science Foundation of Jiangsu (BK20231537), and the China Postdoctoral Science Foundation (2023M732973).

❖ Orientation for New Students

On 15 August 2024, the Institute of Applied Physics and Materials Engineering (IAPME) held an Orientation for New Students to welcome the master and Ph.D. students of the 2024/2025 cohort. Prof. Handong SUN, Associate Director of IAPME, kicked off the orientation by introducing the situation of UM and IAPME. He also advised students to focus on the details of their research work which would distinct them from peers in their research career, leading to the road of success. In addition, he encouraged students to explore more interesting ideas and their supervisors will assist them to achieve breakthroughs in their work.

Prof. Handong SUN

On this occasion, IAPME academic awards 2023/2024 were presented as well. Prof. Hui PAN is the recipient of Excellence in Service; Prof. Yinning ZHOU is the recipient of Excellence in Teaching; and Prof. Guichuan XING is the recipient of Excellence in Research. A round of applause was given to the awardees and it is hoped that the faculty would excel in the new academic year in various aspects.

Prof. Hui PAN, Excellence in Service

Prof. Yinning ZHOU, Excellence in Teaching

Prof. Guichuan XING , Excellence in Research

In addition, the IAPME PhD Student Seminar Competition Award was also presented. Dr. Haoyun BAI won the First Prize, and Dr. Yupeng LIU and Dr. Jiahao XIONG won the Second Prize. A round of applause was also given to the awardees and it is hoped that the Ph.D. students will achieve more in the research area.

Dr. Haoyun BAI, the First Prize

Dr. Yupeng LIU, the Second Prize

Dr. Jiahao XIONG, the Second Prize

The second session of the orientation was to highlight some academic information, administrative procedures, laboratory operations, and safety codes for the students. Lastly, Mr. Biao QI, a 2nd-year Ph.D. student, and Ms. Yuwei LI, a 2nd-year master's student, also shared some useful tips with their juniors respectively so they could adopt to the new environment easier.

IAPME promises to provide the utmost support to the students and wishes to witness their success in the foreseeable future.

Ms. Yuwei LI

Mr. Biao QI

❖ Ph.D. Student Thesis Oral Defences

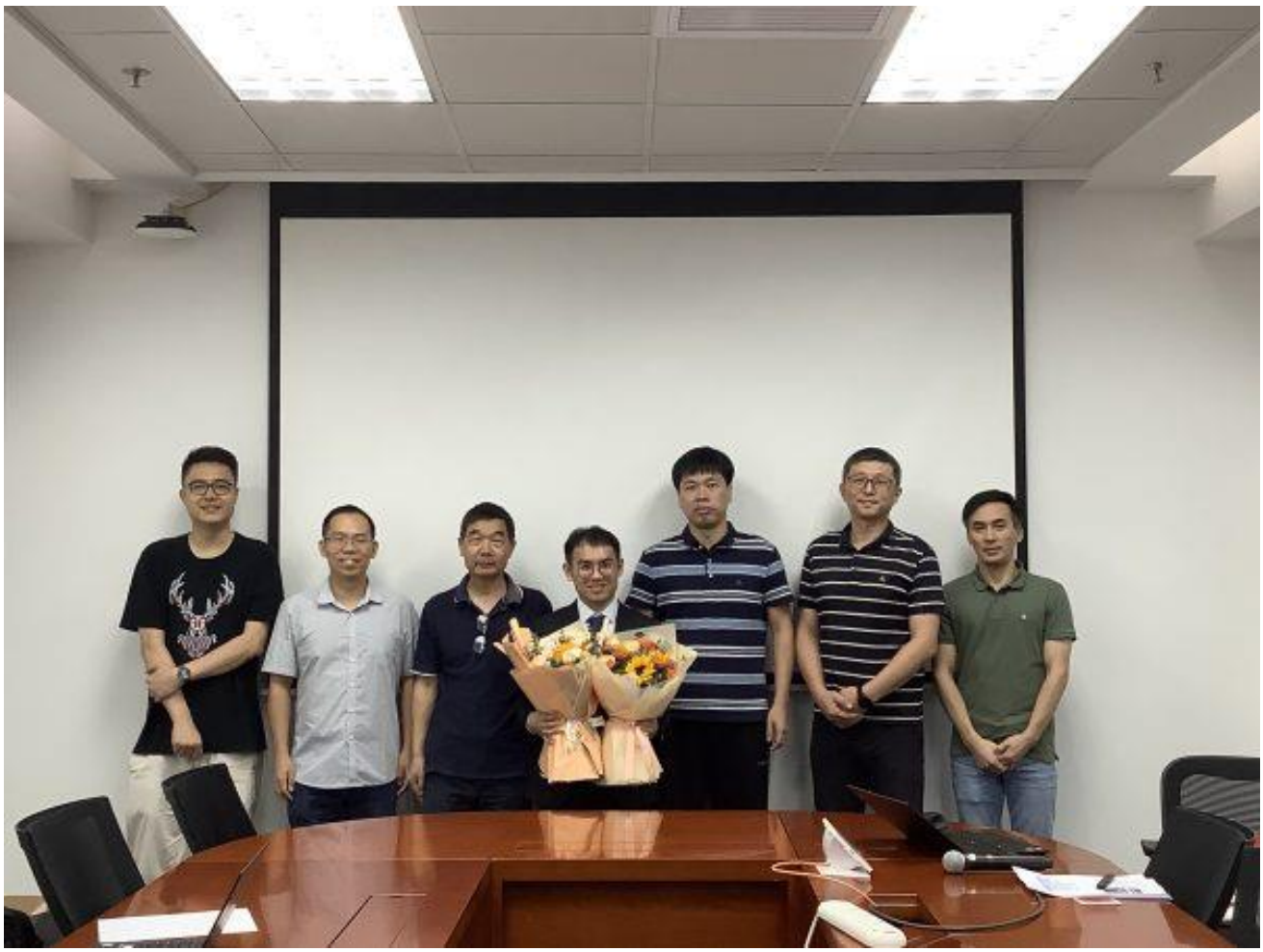
Zhendong LIAN of Prof. Kar Wei NG's group presented "Stable Halide Perovskite Nanostructures Encapsulated in Inert Matrix" in his oral defence on 10 September 2024.

Congratulations to Dr. Zhendong LIAN!

❖ Ph.D. Student Thesis Oral Defences

Keyu AN of Prof. Shuangpeng WANG & Prof. Hui PAN's group presented "Experimental and Theoretical Studies of Ferroelectric Materials for Water Splitting" in his oral defence on 4 September 2024.

Congratulations to Dr. Keyu AN!



❖ Ph.D. Student Thesis Oral Defences

Zhu XU of Prof. Shi CHEN's group presented "Highly reversible Zn Metal Anode for Aqueous Zn Ion Batteries" in his oral defence on 29 August 2024.

Congratulations to Dr. Zhu XU!

❖ Ph.D. Student Thesis Oral Defences

Peixian HUO of Prof. Guoxing SUN's group presented "Fabrication and Application of Silk Fibroin Composites in Flexible Electronics and Energy Storage" in his oral defence on 5 August 2024.

Congratulations to Dr. Peixian HUO!

❖ Ph.D. Student Thesis Oral Defences

Xuanchi YU of Prof. Guichuan XING's group presented "Boosting Efficiency of Perovskite Light-emitting Diodes Through Compositional Engineering" in her oral defence on 5 August 2024.

Congratulations to Dr. Xuanchi YU!

❖ Introduction of New Staff

It is our great pleasure to introduce our new faculty member, Professor Wei GE, who takes up the role as Interim Director of Institute of Applied Physics and Materials Engineering (IAPME) recently.

Prof. Wei GE is the Vice Rector (Research) at the University of Macau (UM) and a Chair Professor at the Faculty of Health Sciences (FHS). He also directs the Centre of Reproduction, Development, and Aging (CRDA). His previous administrative roles include but not limited to Interim Dean of FHS (2013-2014), Associate Dean of FHS (2013-2018), Interim Dean of the Graduate School (2018-2019), and Interim Dean of the Faculty of Business Administration (FBA) (2022-2023).

Prof. Ge earned his BSc from Nanjing University (1982), MSc from the Institute of Hydrobiology, Chinese Academy of Sciences (CAS) (1985), and PhD from the University of Alberta, Canada (1993). After his PhD, he received a Natural Sciences and Engineering Research Council of Canada (NSERC) scholarship for postdoctoral research at the National Institute for Basic Biology (NIBB) in Japan. He joined The Chinese University of Hong Kong (CUHK) in 1995 and UM in 2013.

Prof. Ge's main research area is molecular endocrinology of reproduction, and his current work focuses on reproductive development and aging. He has published about 200 papers and presented over 100 times at academic conferences. In 1994, he received the First-Class Prize for Natural Science from the Chinese Academy of Sciences as a major contributor, followed by the Second-Class Prize for National Natural Science in 1995.

For more information of Prof. Wei GE, please visit:
https://fhs.um.edu.mo/en/staff/wei-ge/

❖ Introduction of New Staff

It's our great pleasure to introduce our new faculty member, Prof. Qing LI (李清), Assistant Professor, who joins IAPME recently.

Before joining UM, Prof. Li was an RGC postdoctoral fellow at the City University of Hong Kong. She earned her PhD from the City University of Hong Kong (recipient of the Hong Kong PhD Fellowship) in 2023, a dual master's degree from Tsinghua University/The Hong Kong University of Science and Technology in 2017, and a bachelor's degree from Central South University in 2014. Prof. Li's research endeavors have focused on developing high-performance aqueous zinc-ion batteries. She has made significant contributions in the areas of anode stability evaluation, electrolyte modification, and flexible zinc-ion batteries. She is the first author/co-first author of 16 papers in journals, including *Nature Communications, Joule, Angewandte Chemie International Edition, Advanced Materials, Advanced Energy Materials, Science Bulletin, and ACS Nano*, among others. Additionally, as a co-author of more than 50 papers, Prof. Li's works have received over 5500 citations, earning her an H-index of 34 (google scholar). With two years of industry experience (2017-2019) in developing commercial batteries, Prof. Li brings both academic and practical expertise.

Let's welcome Prof. Qing LI and we highly appreciate your support to Prof. Li.

For more information of Prof. Li, please visit:
https://iapme.um.edu.mo/people/academic-staff/li-qing/

❖ Academic Promotion

We are happy to announce that our Assistant Professor Shi CHEN is successfully promoted to the rank of Associate Professor due to his excellent contribution in past six years.

Prof. Chen's research focus is materials surface and interface for energy materials application. Since he joined UM in 2018, he has published more than 80 papers in journals like Advanced Energy Materials, Carbon Energy, Advanced Science, Chemical Engineering Journal etc. He also secured 4 FDCT projects with more than 8 million MOP research funding in perovskite solar cell and rechargeable batteries.

His research expertise and commitment will be greatly valued by our institute.

Prof. Chen is also hiring new Ph.D. students with support from UM Ph.D. scholarship or assistantship program.

For more information of Prof. Chen, please visit:
https://iapme.um.edu.mo/people/academic-staff/chen-shi/

❖ Seminars

Invited by Prof. Hui PAN, Prof. Tao ZHU from Tiangong University gave a talk on first-principles method to study radiative heat transfer and a unified theory for photon transport in the nonequilibrium regime. In his talk, methods for calculating near-field radiative heat flux between objects at different temperatures based on first-principles methods of density functional theory were discussed in detail.

❖ Seminars

Invited by Prof. Hui PAN, Prof. Qingchun ZHANG from Southwest University of Science and Technology gave a talk on "Atomically dispersed transition metal sites as heterogeneous or homogeneous catalysts for high-performance lithium-sulfur batteries". In his talk, he presented that atomically dispersed transition sites anchored on suitable substrates or dissolved in electrolytes as heterogeneous or homogeneous catalysts enabled maximum atomic utilization and robust catalytic activity, which have high potential to propel the real implementation of efficient and durable LSBs.

❖ Visits

On 20 August 2024, a delegation led by Prof. Jin ZHANG, vice president of Peking University (PKU) and academician of the Chinese Academy of Sciences, visited Institute of Applied Physics and Materials Engineering (IAPME) and was warmly received by Prof. Hui PAN and Prof. Zikang TANG.

During the visit, the delegation from PKU shared the key research achievement and innovative education of School of Materials Science and Engineering in PKU. Prof. Tang introduced the main research directions and achievements of IAPME in the past years, including the photoelectric materials, new energy materials, and environment and functional materials. The two parties had in-depth discussions about the research opportunity in related fields in future, and explored potential interdisciplinary collaborations in frontier science and technology.

❖ Upcoming Events

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IAPME Seminar

Design of High-Energy Density Lithium-Sulfur Batteries

27 September 2024

Prof. Guangmin ZHOU
Tsinghua Shenzhen International Graduate School
Venue: E11-G012
Time: 10:30 - 11:30
Hosted by: Prof. Kwun Nam HUI

Abstract

Lithium-sulfur (Li-S) batteries are among the most promising next-generation high-energy density secondary batteries. However, their practical application is hindered by issues such as the shuttle effect, slow reaction kinetics, and lithium dendrite growth on the anode during cycling. This report focuses on the key materials and device designs necessary for high-energy density Li-S batteries. It proposes a rational design for cathode catalysts by examining the electronic structure at the catalyst surface. Specifically, it introduces the concept of hybridization between the d-orbitals of transition metal catalysts and the p-orbitals of lithium polysulfides, which can serve as a descriptor for screening single-atom catalysts in Li-S batteries. Machine learning is employed to develop a binary descriptor that can efficiently screen transition metal compound catalysts, elucidating the electronic and structural effects in Li-S catalysis. A universal strategy is proposed for tuning the spin and orbital topology of the catalysts. The report also explores the transition between different orbital hybridizations over time in Li-S battery catalysts. To address the uncontrolled growth of lithium dendrites and the associated safety risks, the coupling mechanism between the Li-S cathode and anode under co-regulated mass and charge transport is unveiled, guiding the rational design of electrode structures. An artificial solid electrolyte interphase (SEI) layer based on a layered structure is proposed to stabilize the lithium metal anode and prevent dendrite formation. Additionally, by adjusting the solvation structure of the electrolyte, molecular-level control of the SEI layer is achieved, resulting in stable cycling of the lithium metal anode. Building on this foundation, a systematic strategy for preparing high-sulfur-loading electrodes has been developed. The report investigates the construction of Li-S full cells, analyzing how key technologies and process parameters affect the charge-discharge and cycling performance of Li-S pouch cells. After optimizing these parameters, the pouch cells achieved an energy density exceeding 400 Wh kg^{-1}.

Biography

Prof. Guangmin ZHOU is an Associate Professor in Tsinghua Shenzhen International Graduate School, Tsinghua University. He received his Ph.D. degree from Institute of Metal Research, Chinese Academy of Sciences in 2014, and then worked as a postdoc in UT Austin during 2014-2015. After that, he was a postdoc fellow at Stanford University from 2015 to 2019. His research mainly focuses on the development of advanced energy-storage materials and devices, and battery recycling. He has published more than 290 articles in peer-reviewed scientific journals, and first/corresponding-authored papers published in Nature Catalysis, Nature Nanotechnology, Nature Energy, Nature Sustainability, Nature Communications, PNAS, Advanced Materials, National Science Review, etc. These publications have been cited more than 44300 times with an H-index of 92. Prof. Zhou was honored "Highly Cited Researcher" in Materials Science field by Clarivate Analytics for consecutive 6 years (2018-2023), EcoMat Young Researcher Award (2023), Young Scientist Award of Hou Debang Chemical Science and Technology (2021), Young Scientist Award of Guangdong Materials Research Association (2020), etc. Prof. Zhou served as Associate Editor/Scientific Managing Editor of Energy Storage Materials.

Enquiry: iapme.enquiry@um.edu.mo

All academic staff, students and interested parties are welcome to join!

❖ Upcoming Events

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UNIVERSITY OF MACAU

應用物理及材料工程研究院

IAPME Seminar

Beyond Perovskite Solar Cells: Can Perovskite LEDs Lead the Way in Lighting and Communication Applications?

27 September 2024

Prof. Hin-Lap YIP
City University of Hong Kong
Venue: N23-4018
Time: 14:00 - 15:00
Hosted by: Prof. Guichuan XING

Abstract

Organic-inorganic hybrid perovskites have rapidly advanced as versatile semiconductors for solar cells and LEDs, with their properties tunable through composition and crystal structure modifications. This talk will outline our strategies to control perovskite dimensions and nanostructures using small molecules with tailored functional groups, leading to developing highly stable and efficient quasi-2D perovskite solar cells. We also leverage interface engineering techniques from organic solar cells to enhance charge collection and defect passivation in perovskite solar cells and organic/perovskite tandem solar cells.

Extending beyond solar cells, our research focuses on perovskite light-emitting diodes (PeLEDs) for lighting, display technologies, and visible light communication (VLC). For green PeLEDs, we employ interfacial chemistry-assisted in-situ growth of high-quality perovskite films with ultra-low trap densities, significantly improving brightness, operational lifetimes, and efficiency. In blue and white PeLEDs, we use self-assembled monolayers (SAMs) to enhance stability, efficiency, and color purity, as well as a downconversion approach for high-quality white light. These advancements highlight the potential of perovskite materials in various optoelectronic applications, including VLC and possibility lasing.

Biography

Prof. Angus Hin-Lap Yip joined the Department of Materials Science and Engineering and the School of Energy and Environment at the City University of Hong Kong as a Professor in 2021. He has also served as the Associate Director for the Hong Kong Institute for Clean Energy since 2022. He is an elected member of the Hong Kong Young Academy of Sciences. From 2013-2020, he was a Professor at the State Key Laboratory of Luminescent Materials and Devices (SKLLMD) and the School of Materials Science and Engineering (MSE) at the South China University of Technology (SCUT). He got his BSc (2001) and MPhil (2003) degrees in Materials Science from the Chinese University of Hong Kong (CUHK), and completed his PhD degree in MSE in 2008 at the University of Washington (UW), Seattle. His research uses an integrated approach combining materials, interface, and device engineering to improve polymer and perovskite optoelectronic devices. He has published over 300 scientific papers with citations of ~45000 and an H-index of 107. He was also honored as ESI "Highly Cited Researcher" for 10 consecutive times from 2014-2023.

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All academic staff, students and interested parties are welcome to join!

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