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/

ISSUE 11

4 December 2024

✧ Content

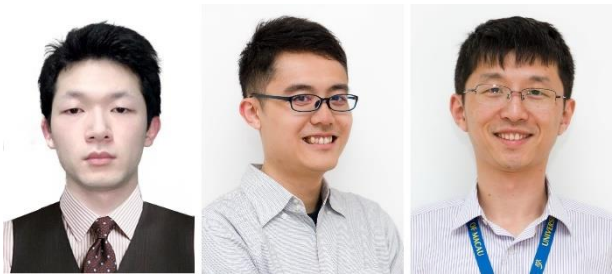
❖ Publications (IF≥8; *corresponding author)

1. **Hao Lin,** Jia-Yi Dong, Qi Wei, Gang Wang, Jie-Lei Li, Zhen-Dong Lian, Pei-Li Gao, Shi Chen, Gui-Chuan Xing, **Kar Wei Ng***, Shi-Chen Su*, **Shuangpeng Wang***. Chelating Ligand Surface Functionalization for Ultra-Stable Efficient Blue Emissive Nanoplatelets. *ACS Materials Letters.* DOI: doi.org/10.1021/acsmaterialslett.4c02269. [2023 IF=9.9]

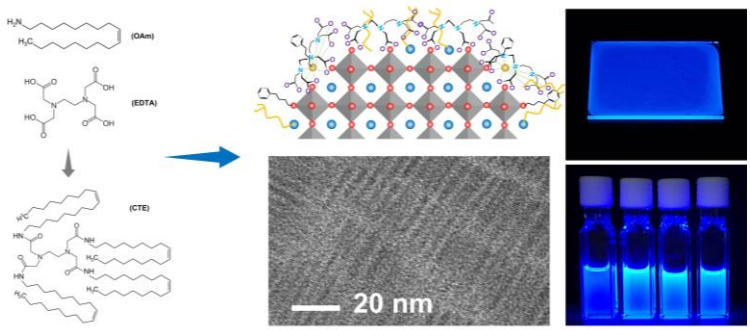
❖ Research Stories

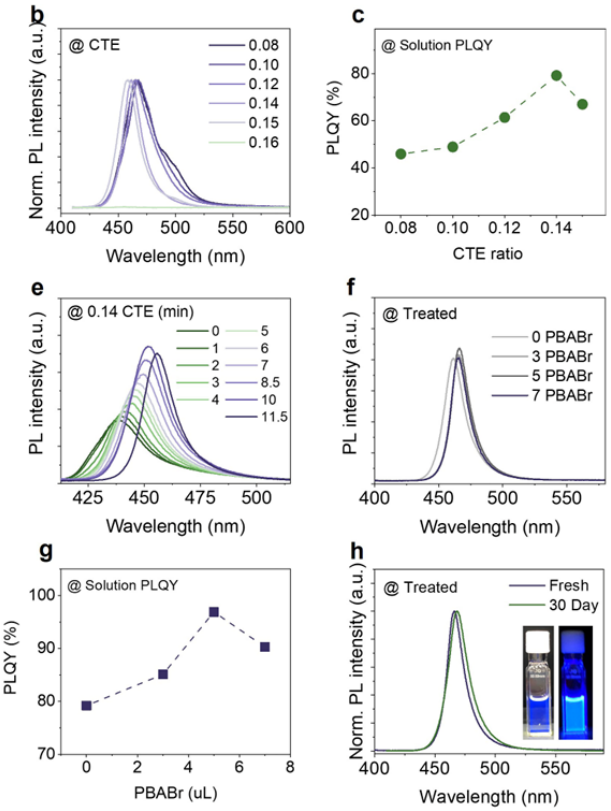
UM research team developed a sole chelating ligands strategy for synthesizing blue emissive nanoplatelets

- Surface ligand coordination chemistry plays a critical role in both directing the growth and ensuring the long-term stability of nanocrystals, particularly metal halide perovskite nanoplatelets (NPLs). Yet, the inherent proton exchange between the conventional surface capping molecules, consisting of aliphatic amines and carboxylic acids, introduces a dynamic and labile surface environment. This, in turn, consistently leads to diminished performance of the nanocrystals.
- The team designed a novel chelating ligand under atmospheric environment, showcasing excellent solubility in non-polar solvent and strong coordinating ability towards Pb^{2+}.
- By further using the chelating ligand as sole surfactant, the team solve traditional protonation/deprotonation issue; the achieved anisotropic $CsPbBr_3$ NPLs show a pure blue emission at 461 nm and PLQY of 97%, while its luminous properties remain almost unchanged after 30 days storage in air.



(From left) Dr. Hao Lin, Prof. Kar Wei Ng, and Prof. Shuangpeng Wang





Hao Lin, Jia-Yi Dong, Qi Wei, Gang Wang, Jie-Lei Li, Zhen-Dong Lian, Pei-Li Gao, Shi Chen, Gui-Chuan Xing, **Kar Wei Ng***, Shi-Chen Su*, **Shuangpeng Wang***. Chelating Ligand Surface Functionalization for Ultra-Stable Efficient Blue Emissive Nanoplatelets. *ACS Materials Letters.* DOI: doi.org/10.1021/acsmaterialslett.4c02269. [2023 IF=9.9]

Prof. Shuangpeng Wang and Prof. Kar Wei Ng are the corresponding authors of this study. The first author is Dr. Hao Lin, who obtained his PhD from IAPME in 2024. This work was financially supported by the Science and Technology Development Fund, Macao SAR (file nos. 0071/2019/AMJ, 0027/2023/AMJ, and 0038/2019/A1), the National Key Research and Development Plan of China (Grant 2019YFE0111900), the Multi-year Research Grants (MYRG2020-00207-IAPME, MYRG2020-00082-IAPME, MYRG-GRG2023-00230-IAPME-UMDF) from the University of Macau, and the Scientific and Technological Plan of Guangdong Province (2022A0505050067).

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

ISSUE 11

4 December 2024

❖ IAPME Graduates Attended Ceremony for the Conferment of Higher Degrees

On 23 November 2024, the University of Macau (UM) held the Ceremony for the Conferment of Higher Degrees 2024.

This year, 28 postgraduate students graduated from the Institute of Applied Physics and Materials Engineering (IAPME) with doctoral degrees, and 7 of them attended the ceremony.

(From left) Prof. Wei Ge, Dr. Yupeng Liu, Dr. Zhu Xu, Dr. Hongfei Chen, Dr. Peixian Huo, Dr. Zhaoyang Sun, Dr. Xuanchi Yu, Dr. Qian Zhao, Prof. Yonghua Song

❖ Seminars

Prof. Quan Li is a Distinguished Chair Professor and Director of Institute of Advanced Materials at Southeast University, China. 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 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.

Prof. Li held appointments in USA, Germany, and France 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.

In the presentation, Prof. Li first introduced what liquid crystals are and their properties. Based on the results of their research group, they introduced the multifunctional applications of liquid crystals and their optoelectronic stimuli-responsive materials, including optical switches, displays, tunable photonics, and photo-deformable soft systems. Finally, Prof. Li introduced the vision and development goals of the journal "Responsive Materials" he founded to the audience and encouraged researchers to submit their latest scientific research results.

Prof. Handong Sun also introduced the development strategies and scientific research status of UM and IAPME to Prof. Li and his entourage. Prof. Li expressed his appreciation for the rapid development of IAPME.

❖ Visits

Prof. Quan Li, Distinguished Chair Professor and Director of Institute of Advanced Materials at Southeast University, China, visited IAPME from 19 to 22 November 2024. A fruitful discussion between IAPME members and Prof. Li is conducted, it covers exchange scientific insights, innovative ideas, and further substantive research collaboration. Prof. Li also visited IAPME's labs, such as the materials characterization facilities.

❖ Upcoming Events

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 Seminar

Noncovalent π-stacked Organic Framework (πOF)

6 December 2024

Prof. Dong MENG
Shanghai Jiao Tong University
Venue: N23-1004b
Time: 10:30 – 11:30
Hosted by: Prof. Pengzhan SUN

Abstract

Unlike metal-organic frameworks (MOFs) and covalent organic frameworks (COFs) assembled through strong coordination or covalent bonds, novel porous organic molecular materials based on non-covalent interactions have garnered significant attention due to their simple structural units and the flexibility of their supramolecular assemblies. Noncovalent π-stacked organic frameworks (πOFs) are a subclass of porous materials that consist of crystalline networks formed by self-assembly of organic building blocks through π-π interactions. The flexible, reversible, and conductive nature of π-π interactions and π-delocalized supramolecular frameworks impart advantageous attributes to πOFs, including solution processability, self-healing capability, notable carrier mobility and excellent stability. These features make πOFs ideal candidates for applications like gas separation, molecular structure determination, and electrocatalysis. Since the concept was introduced in 2020, significant advancements have been made in both the chemistry and applications of πOFs. Future research should focus on expanding their structural diversity and exploring new applications, particularly in areas where traditional porous materials encounter limitations. [1, 2].

References

[1] Meng, D.; Yang, J. L.; Xiao, C.; Wang, R.; et al. Proc. Natl. Acad. Sci. U S A (PNAS) 2020, 117, 20397.
[2] Zheng, R.; Meng, D.; Yang, Y. Materials Today 2024, 75, 244.

Biography

Prof. Dong MENG joined the School of Chemistry and Chemical Engineering at Shanghai Jiao Tong University in July 2023 as associate professor, and doctoral supervisor. He received PhD degree in the Institute of Chemistry at Chinese Academy of Sciences in 2017. From 2017 to 2023, he worked as a postdoctoral research fellow at University of California, Los Angeles (UCLA). He was awarded with National Young Overseas High-Level Talents, Shanghai Young Overseas High-Level Talents, Fellow of International Association of Advanced Materials, IAAM Young Scientist Award, Vebleo Fellow Jr. and Chinese Dean of Science Institute Award. He serves as an Early Career Board Member of journals including Precision Chemistry, Applied Chemistry etc. To date, he has published over 50 papers in high-impact journals including Sci Adv, J. Am. Chem. Soc., PNAS., Adv. Mater. etc., with over 6000 citations and an h-index of 34.

Enquiry: iampe.enquiry@um.edu.mo

❖ Upcoming Events

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 Seminar

Room-Temperature Waveguide Integrated Quantum Register in a Semiconductor Photonic Platform

6 December 2024

Prof. Yu ZHOU
Harbin Institute of Technology, Shenzhen
Venue: N23-4018
Time: 14:00 - 15:00
Hosted by: Prof. Shen LAI

Abstract

Quantum photonic integrated circuits are reshaping quantum networks and sensing by providing compact, efficient platforms for practical quantum applications. Despite continuous breakthroughs, integrating entangled registers into photonic devices on a CMOS-compatible platform presents significant challenges. Herein, we present single electron-nuclear spin entanglement and its integration into a silicon-carbide-on-insulator (SiCOI) waveguide. We demonstrate the successful generation of single divacancy electron spins and near-unity spin initialization of single ^{13}C nuclear spins. Both single nuclear and electron spin can be coherently controlled and a maximally entangled state with a fidelity of 0.89 has been prepared under ambient conditions. Based on the nanoscale positioning techniques, the entangled quantum register has been further integrated into SiC photonic waveguides for the first time. We find that the intrinsic optical and spin characteristics of the register are well preserved and the fidelity of the entangled state remains as high as 0.88. Our findings highlight the promising prospects of the SiCOI platform as a compelling candidate for future scalable quantum photonic applications and Nature Communications recently accepted this work.

Biography

Dr. Yu ZHOU is an outstanding young professor and doctoral supervisor at the Harbin Institute of Technology, Shenzhen. He earned his Bachelor's degree from Xi'an Jiaotong University in 2014 and his Ph.D. from Nanyang Technological University, Singapore, under the mentorship of Prof. Gao Weibo in 2019. Dr. Zhou also served as a senior researcher at Tencent's Quantum Lab.

Dr. Zhou's research expertise lies in quantum defects and nano-optics, where he has made significant contributions with high-impact SCI publications. Notably, he has published ten first/corresponding author high-impact SCI papers, including 4 Nature Communications, 1 Science Advances, and a featured cover article in Photonics Research in 2024.

Dr. Zhou has been instrumental in securing and leading key research projects, such as the Youth Fund of the National Natural Science Foundation of and the Guangdong Province Quantum Strategy Special Project (2 million RMB). He has also been honored as the 9th recipient of the China Association for Science and Technology Young Talent Support. He has been recognized in Forbes' 30 Under 30 list for his work in technology.

Enquiry: iapme.enquiry@um.edu.mo

❖ Upcoming Events

澳門大學
UNIVERSIDADE DE MACAU
UNIVERSITY OF MACAU

應用物理及材料工程研究院

IAPME Seminar

AC-driven excitonic devices based on two-dimensional semiconductors

11 December 2024
Prof. Wei DU
Soochow University
Venue: N23-4018
Time: 14:00 - 15:00
Hosted by: Prof. Shen LAI

Abstract

Layered two-dimensional semiconductor materials, e.g. transition metal dichalcogenides (TMDs), are widely studied for room-temperature excitonic devices due to their large exciton binding energy. Using excitons as the bridge to communicate the optical and electrical properties of two-dimensional semiconductors, electrically-driven excitonic light emission or transport devices have potential applications in future opto-electronic circuits. However, most of the current studies still focus on the low frequency operation. Exploring the interactions of electrons, excitons and photons in two-dimensional semiconductors under the alternating current (AC) electric field will provide new information for the design of high-frequency excitonic devices. In this talk, progresses in Prof. Du's group will be discussed regarding the AC-driven excitonic devices based on two-dimensional semiconductors.

Biography

Prof. Wei DU is currently a full professor at the Institute of Functional Nano & Soft Materials of Soochow University. She received her bachelor degree from Fudan University in 2012 and Ph.D. from National University of Singapore in 2017. From 2018 to 2021, she was engaged in postdoctoral research at Nanyang Technological University (NTU) in Singapore. In May 2021, she joined the Institute of Functional Nano and Soft Materials of Soochow University, and won the National Overseas High-level Talent Youth Program in the same year. Over the past years, she has been engaged in the research of electrically-driven plasmonic and excitonic devices towards applications in optoelectronic circuits. So far, she has published 19 papers as the first or corresponding author, including Nature Photonics (2), Nature Communications (1), Journal of the American Chemical Society (1), Nano Letters (3), Advanced Materials (1), Small (2) etc., and has been granted 5 patents.

Enquiry: iampe.enquiry@um.edu.mo

Contact Us

Email
iapme.enquiry@um.edu.mo