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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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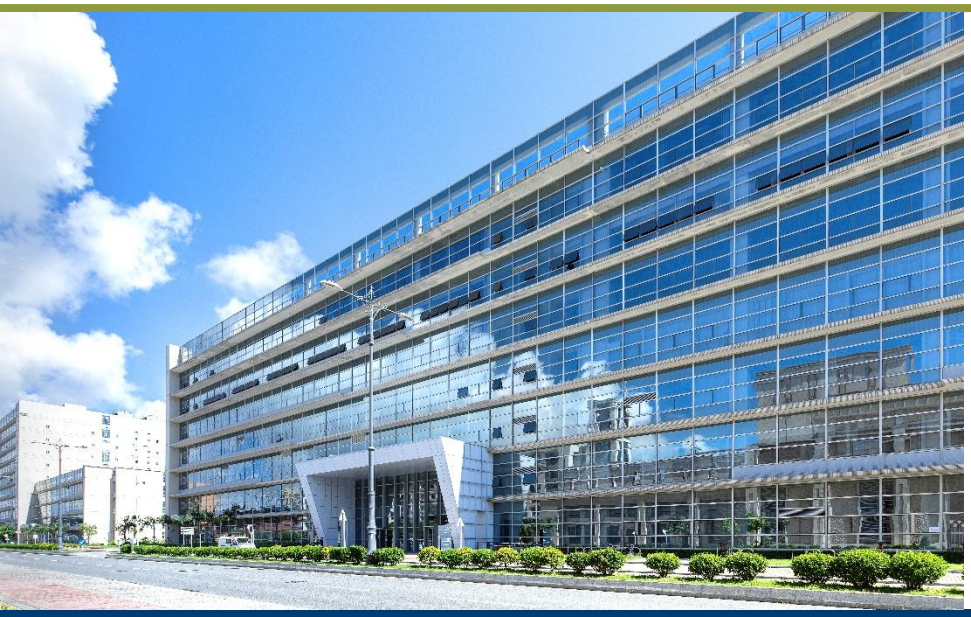

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✧ Content

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

1. **Rui Duan***, Yi Tian Thung, Yichen He, Guodan Wei, Yuan Wang, Lian Xiao, Zitong Zhang, Tianhua Ren, Lin Zhang, Van Duong Ta*, and **Handong Sun***. Multi-Wavelength and Ultra-Narrow Linewidth Emissions from Fully Integrated Colloidal Quantum Well Lasers. ***ACS Nano***, (2025). DOI: 10.1021/acsnano.5c04750. [2024 IF = 16.0]

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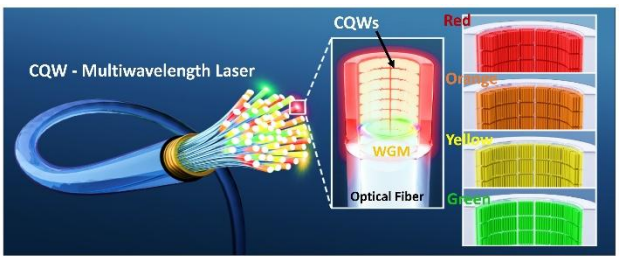
❖ Research Stories

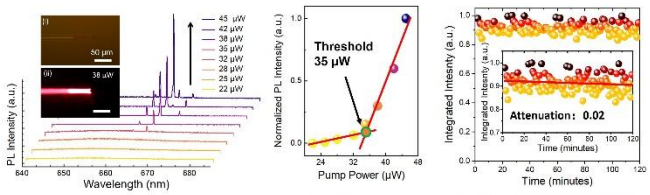
UM research team developed multiwavelength, ultranarrow-linewidth emission from fiber-capillary-integrated colloidal quantum well lasers

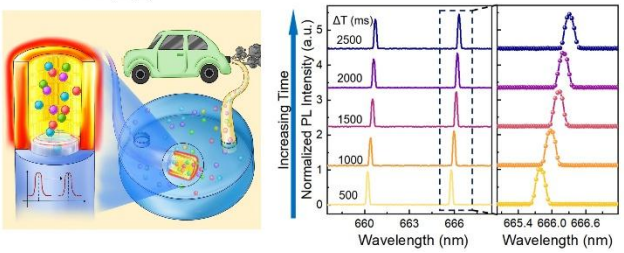
- Conventional multiwavelength lasers, vital for quantum tech, lighting, and displays, are often costly, bulky, and complex, limiting their practical use. A more integrated, simpler solution was needed.
- The research team developed a fully integrated, multiwavelength laser source using solution-processed colloidal quantum wells (CQWs). By precisely controlling size, elemental doping, and heterostructure design, the team engineered four distinct CQWs emitting red, orange, yellow, and green light with ultralow lasing thresholds. Crucially, these CQWs spontaneously deposit onto optical fibers via capillary action, creating the first fully integrated CQW-optical fiber laser (OFL) system without complex micro-manipulation. This source delivers single-mode lasing with remarkably narrow linewidths below 50 pm.
- This CQW-OFL platform demonstrates excellent stability and high performance. The team showcased its potential in a practical application: highly sensitive automobile exhaust sensing. This breakthrough paves the way for compact, versatile, next-generation visible lasers, promising significant advances in optical sensing, modern communication, and laser display technologies

Dr. Rui Duan
(段瑞)

Prof. Handong Sun
(孫漢東)







Rui Duan*, Yi Tian Thung, Yichen He, Guodan Wei, Yuan Wang, Lian Xiao, Zitong Zhang, Tianhua Ren, Lin Zhang, Van Duong Ta*, and **Handong Sun***. Multi-Wavelength and Ultra-Narrow Linewidth Emissions from Fully Integrated Colloidal Quantum Well Lasers. ***ACS Nano***, (2025). DOI: 10.1021/acsnano.5c04750. [2024 IF = 16.0]

Prof. Handong Sun and Dr. Rui Duan are the corresponding authors of this study. The first author is Dr. Rui Duan, who is a postdoctoral researcher at IAPME. This work was supported by CPG2024-00006, SRG2023-00025, CPG2025-00034-IAPME, and the Science and Technology Development Fund (FDCT), Macao SAR (File no. 0122/2023/RIA2). V.D.T. acknowledges the support from the Vietnam National Foundation for Science and Technology Development (NAFOSTED) under grant no. 103.03-2021.62. Z.Z. gratefully acknowledges the strong support provided by the Guangdong Academy of Sciences' Project of Science and Technology Development at Guangdong Academy of Sciences, award no.: 2022GDASZH-2022010107. We sincerely thank Dr. Junzi Li and Prof. Tingchao He for assistance in measuring the Auger lifetime of CQWs and for the helpful discussions.

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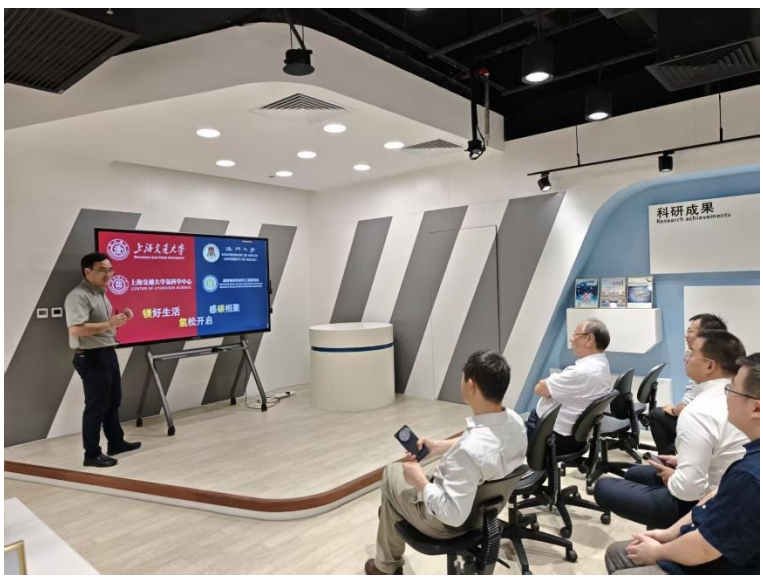
❖ Delegation from the School of Materials Science and Engineering, Hydrogen Science Center of Shanghai Jiao Tong University, visited IAPME and signed the Cooperative Framework Agreement

On 7 August 2025, Academician Wenjiang Ding (丁文江) and Dean Qing Dai (戴慶), led a delegation from the School of Materials Science and Engineering and the Hydrogen Science Center of Shanghai Jiao Tong University to visit the Institute of Applied Physics and Materials Engineering (IAPME) at the University of Macau.

Prof. Handong Sun provided an overview of IAPME's research activities, followed by research reports from Prof. Guoxing Sun and Prof. Songnan Qu. Academician Ding outlined the strategic directions of SJTU's Hydrogen Science Center and expressed a strong interest in deepening collaboration with IAPME in the fields of hydrogen energy, hydrogen medicine, and hydrogen health.

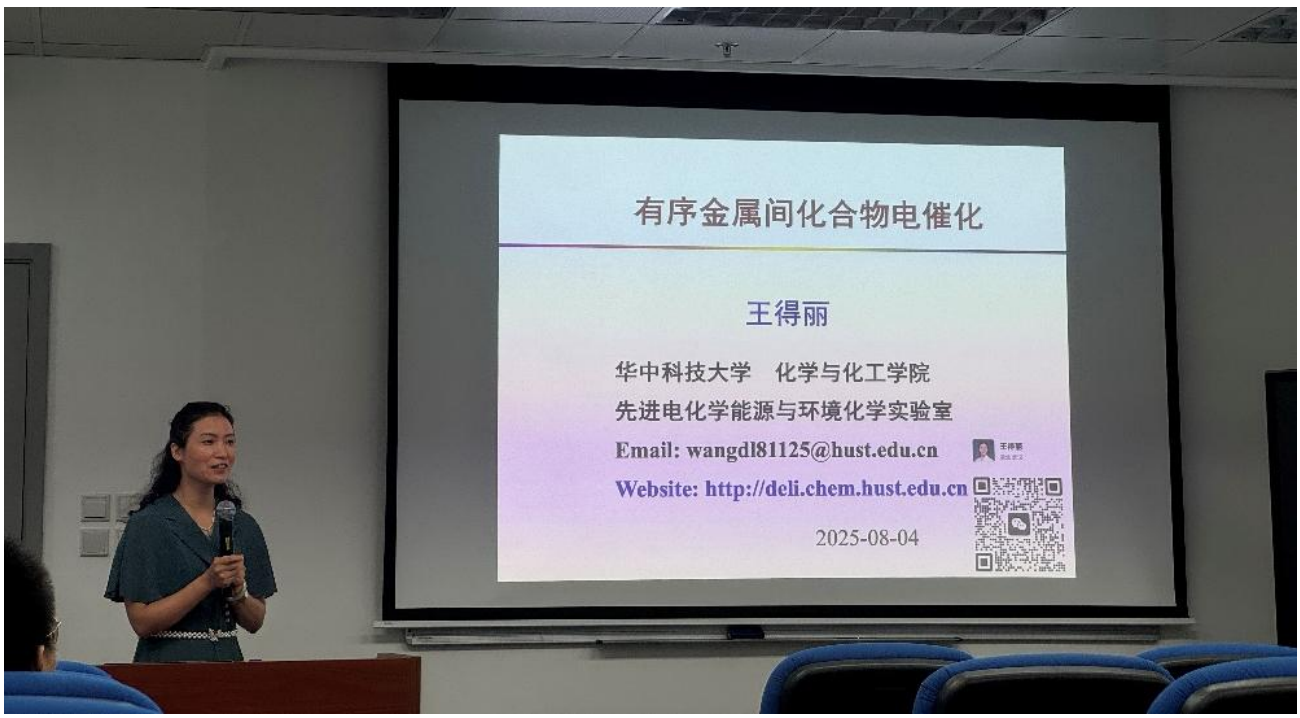


Later that day, Prof. Wei Ge, Interim Director of IAPME; Academician Wenjiang Ding, Director of SJTU's Hydrogen Science Center, and Mr. Binli LIU (劉斌立), General Manager of Macau Hydrogen Health Technology Co., Ltd., signed a tripartite framework agreement during the "2025 Pujiang Innovation Forum – Shanghai-Macau Science and Technology Innovation Dialogue." The agreement commits the parties to develop joint research and technology transfer related to hydrogen-storage materials and their applications in the health sector.

❖ Seminars

Prof. Deli Wang (王得麗), from Huazhong University of Science & Technology visited IAPME and gave a talk on 4 August 2025. Prof. Wang delivered an insightful presentation titled "Electrocatalysis on Structure Ordered Intermetallics". The seminar was hosted by Prof. Huaiyu Shao, who extended the invitation to Prof. Wang.

Prof. Wang received her Ph.D. from Wuhan University in 2008. After postdoctoral work at Nanyang Technological University and Cornell University from 2009 to 2012, she earned several prestigious recognitions, including selection to the Overseas High-Level Talents Program and the MOE New Century Excellent Talent. Her research focuses on nanomaterial structure design and electrochemical tuning for energy conversion/storage. She has published over 100 papers in top journals (Nat. Mater., Nat. Commun., JACS, etc.) and holds 12 Chinese patents and 2 US patents. She serves as Associate Editor for J. Chem. Phys. and sits on several editorial boards.



During her talk, Prof. Wang highlighted the scarcity and high cost pf Platinum (Pt) catalysts hinder fuel cell commercialization. Her research addresses this challenge by enhancing Pt utilization and developing alternatives. Specifically, her team designs novel Pt-based ordered intermetallic compounds. By varying the types, proportions, and post-treatment temperatures of Pt and transition metals, they optimize surface structure, alloy degree, and electronic structure to regulate electrocatalytic performance. Concurrently, they are tackling the significant challenge of morphology regulation in these compounds and have made preliminary advances. This dual approach aims to reduce costs while maintaining high catalyst performance for fuel cells.

During the visit, Prof. Wang joined an IAPME lab tour, had close discussion with some professors and PhD students, and expressed deep impression on IAPME's research facilities and achievements.

❖ Seminars

Invited by Prof. Huaiyu Shao, Prof. Hong Guo (郭洪) from Yunnan University, visited IAPME and delivered a talk on 4 August 2025.

Prof. Guo received his Ph.D. degree from the University of Science and Technology Beijing in 2008, and obtained the nomination of national outstanding doctorate dissertation. He was a visiting scholar in State Key Laboratory of Fire Science in Japan from 2002 to 2004. Prof. Guo has been appointed as a Professor in the School of Chemistry Science and Engineering at Yunnan University through the Talents Introduce Project in 2010. He was also a visiting scholar at Western University in Canada from 2016 to 2017. Prof. Guo is a Vebleo Fellow; a council member of the Solid Ionics Branch of the Chinese Ceramic Society; a member of the International Society of Electrochemistry (ISE), a member of a council of the International Academy of Electrochemical Energy Science (IAOEES), and a recipient of the Science and Technology Award of Yunnan Province.

Prof. Guo delivered a seminar titled "Design Strategies for In Situ Polymerized Gel Composite Electrolytes". His talk focused on DOL-based gel polymer electrolytes (GPEs) for solid-state batteries via multidimensional optimization. In-situ polymerized PDOL with an interfacial inducer formed a stable CEI/SEI bilayer, enabling long-cycle Li and NCM811 cells. Incorporating titanium-based MOFs as scaffolds boosted mechanical strength and Li^+ transport (ionic conductivity 1.36×10^{-3} S cm^{-1}; Li^+ transference number: 0.71). Further, integrating Co-Ti bimetallic MOFs via combined processes created a redox potential gradient, achieving 97% Li utilization and high capacities in NCM90/LFP cells (e.g., 198.8 mAh g^{-1} at 1C). In-situ studies confirmed suppressed inactive Li^0 and enhanced kinetics, providing a design pathway for high-energy-density SSBs. In the Q&A session, Prof. Guo engaged actively with the audience.

During the visit, Prof. Guo joined an IAPME lab tour, had close discussion with some professors and PhD students, and expressed deep impression on IAPME's research facilities and achievements.