Professor LIAO, LIANG-SHENG



Macao Institute of Materials Science and Engineering (MIMSE)

Macau University of Science and Technology

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**Academic Qualification**

Ph.D. in Condensed Matter Physics, Nanjing University, 1996

M.S. in Physics of Semiconductor Devices, Nanjing University, 1988

B.S. in Semiconductor Physics, Nanchang University, 1982

**Teaching Area**

Organic Optoelectronics

Electrical Engineering

**Research Area**

Organic/Quantum-Dot Light-Emitting Materials and Devices

Organic Micro/Nano Photonics

Perovskite/Organic Photovoltaic Materials and Devices

Surface and Interface Studies on Optoelectronic Thin Films and Devices

**Professional Services**

Deputy Editor, Applied Physics Letters, since 2024 (Associate Editor, 2015-2024)

**Working Experience**

01/2021-Present Professor, Macao Institute of Materials Science and Engineering (MIMSE)

Macau University of Science and Technology, Macau, China

03/2009-Present Professor, Institute of Functional Nano & Soft Materials (FUNSOM)

Soochow University, Suzhou, China

12/2000-03/2009 Senior Research Scientist, Research Laboratories, R&D

Eastman Kodak Company, Rochester, NY 14650, USA

12/1997-12/2000 Associate Professor, Dept. of Phys.

Fudan University, Shanghai, China

(12/1998-6/2000) Research Fellow, Center Of Supper-Diamond & Advanced Films (COSDAF)

City University of Hong Kong, Hong Kong, SAR, China

(On leave from Fudan University)

07/1988-09/1993 Lecturer (since 07/1988), Associate Professor (since 06/1993), Dept. of Phys.

Nanchang University (AKA: Jiangxi Univ.), Nanchang, China

(6/1989-10/1990) Visiting Scholar, California State University, Northridge, CA 91330, USA

(On leave from Jiangxi University)

01/1982-09/1985 Teaching Assistant, Dept. of Phys.

Jiangxi University, Nanchang, China

**Academic Publication (selected; total: > 550)**

1. Y. K. Wang, H. Y. Wan, S. Teale, L. Grater, F. Zhao, Z. D. Zhang, H. W. Duan, M. Imran, S. D. Wang, S. Hoogland, **L. S. Liao**\*, “Long-range order enabled stability in quantum dot light-emitting diodes”, ***Nature,*** (2024). doi: 10.1038/s41586-024-07363-7.
2. J. Yan, D. Y. Zhou, **L. S. Liao**\*, M. Kuhn, X. W. Zhou\*, S. M. Yiu, Y. Chi\*, “Electroluminescence and hyperphosphorescence from stable blue Ir(III) carbene complexes with suppressed efficiency roll-off”, ***Nat. Commun.*** 14, 6419 (2023). doi: 10.1038/s41467-022-42090-z.
3. Q. Lv, X. D. Wang\*, Y. Yu, C. F. Xu, Y. J. Yu, X. Y. Xia, M. Zheng\*, **L. S. Liao**\*, “Lateral epitaxial growth of two-dimensional organic heterostructures”, ***Nat. Chem.*** (2023). doi:10.1038/s41557-023-01364-1.
4. Q. Lv, X. D. Wang\*, Y. Yu, M. P. Zhou, M. Zheng\*, **L. S. Liao**\*, “Lattice-mismatch-free growth of organic heterostructure nanowires from cocrystals to alloys”, ***Nat. Commun.*** 13, 3099 (2023). doi: 10.1038/s41467-022-30870-y.
5. S. F. Wang, B. K. Su, X. Q. Wang, Y. C. Wei, K. H. Kuo, C. H. Wang, S. H. Liu, **L. S. Liao**\*, W. Y. Hung, L. W. Fu, W. T. Chuang, M. C. Qin, X. H. Lu, C. F. You, Y. Chi\*, P. T. Chou\*, “Polyatomic molecules with emission quantum yields >20% enable efficient organic light-emitting diodes in the NIR(II) window”, ***Nat. Photonics*** 16, 843-850 (2022). doi: 10.1038/s41566-022-01079-8.
6. M. P. Zhuo, G. P. He, X. D. Wang\*, **L. S. Liao**\*, “Organic superstructure microwires with hierarchical spatial organisation”, ***Nat. Commun.*** 12, 2252 (2021). doi: 10.1038/s41467-021-22513-5.
7. Y. K. Wang, D. Ma, F. Yuan, K. Singh, J. M. Pina, A. Johnston, Y. Dong, C. Zhou, B. Chen, B. Sun, H. Ebe, J. Fan, M. J. Sun, Y. Gao, Z. H. Lu, O. Voznyy\*, **L. S. Liao**\*, E. H. Sargent\*, “Chelating-agent-assisted control of CsPbBr3 quantum well growth enables stable blue perovskite emitters”, ***Nat. Commun.*** 11, 3674 (2020). doi: 10.1038/s41467-020-17482-0.
8. Y. T. Dong, Y. K. Wang, F. L. Yuan, A. Johnston, Y. Liu, D. X. Ma, M. J. Choi, B. Chen, M. Chekini, S. W. Baek, L. K. Sagar, J. Fan, Y. Hou, M. J. Wu, S. J. Lee, B. Sun, S. Hoogland, R. Quintero-Bermudez, H. Ebe, P. Todorovic, F. Dinic, P. C. Li, H. T. Kung, M. I. Saidaminov, E. Kumacheva, E. Spiecker, **L. S. Liao**, O. Voznyy, Z. H. Lu\*, and E. H. Sargent\*, “Bipolar-shell resurfacing for blue LEDs based on strongly confined perovskite quantum dots”, ***Nat. Nanotechnology*** 15, 668-674 (2020). doi: 10.1038/s41565-020-0714-5.
9. Y. C. Wei, S. F. Wang, Y. Hu, **L. S. Liao**\*, D. G. Chen, K. H. Chang, C. W. Wang, S. H. Liu, W. H. Chan, J. L. Liao, W. Y. Hung, T. H. Wang, P. T. Chen, H. F. Hsu, Y. Chi\*, P. T. Chou\*, “Overcoming the energy gap law in near-infrared OLEDs by exciton–vibration decoupling”, ***Nat. Photonics*** 14, 570-577 (2020). doi: 10.1038/s41566-020-0653-6.
10. X. Tang, L. S. Cui\*, H. C. Li, A. J. Gillett, F. Auras, Y. K. Qu, C. Zhong, S. T. E. Jones, Z. Q. Jiang\*, R. H. Friend\*, **L. S. Liao**\*, “Highly efficient luminescence from space-confined charge-transfer emitters”, ***Nat. Mater.*** 19, 1332-1338 (2020). doi: 10.1038/s41563-020-0710-z.
11. M. P. Zhuo, J. J. Wu, X. D. Wang\*, Y. C. Tao, Y. Yuan, **L. S. Liao**\*, “Hierarchical self-assembly of organic heterostructure nanowires”, ***Nat. Commun.*** 10, 3839 (2019). doi: 10.1038/s41467-019-11731-7.
12. L. S. Cui, S. B. Ruan, F. Bencheikh, R. Nagata, L. Zhang, K. Inada, H. Nakanotani, **L.S. Liao**\*, C. Adachi\*, "Long-lived efficient delayed fluorescence organic light-emitting diodes using n-type hosts", ***Nat. Commun.*** 8, 2250 (2017). doi: 10.1038/s41467- 017-02419-x.
13. **L. S. Liao**, S.T. Lee\*, “Materials science in China”, ***Nat. Rev. Mater.*** 1, 16025 (2016). doi: 10.1038/natrevmats.2016.25.

**Research Grants**

1. “Development of key technologies and vacuum evaporation manufacturing equipment for high-performance silicon-based OLED micro-displays”, Science and Technology Development Fund of Macau (FDCT), No. 0006/2021/AKP, (07/2022-07/2025).

2. “Key materials and devices technologies for transparent OLED microdisplays manufacturing”, FDCT, No. 0034/2022/AGJ, (09/2023-09/2025).

3. “Hybrid tandem OLEDs”, Natural Science Foundation of China (NSFC), No. 62175171, (01/2022-12/2025).

4. “Bis-tridentate Ir(III) phosphors for high-efficiency and long-lifetime organic light-emitting diodes”, NSFC, No. 61961160731, (01/2020-12/2023).

5. “Investigation on the key technologies of silicon-based OLED microdisplay for virtual augmented reality applications”, Provincial Key R&D Program of Jiangsu, No. BE2018006, (06/2018-09/2021).

6. “Studies of key scientific issues on highly stable and printable perovskite solar cells”, NSFC, No. 91733301, (01/2018-12/2020).

7. “High-efficiency NIR materials and devices with thermally activated delayed fluorescence mechanism”, NSFC, No. 51773141, (01/2018-12/2021).

8. “The key technology and manufacturing demonstration of high-efficiency and large area OLED lighting sources”, The National Key R&D Program of China, No. 2016YFB0400700, (07/2016-12/2020).

9. “Tandem OLEDs with both visible and NIR emissions”, NSFC, No. 61575136, (01/2016-12/2019).

10. “Organic solid-state sources for 3D displays”, NSFC, No. 61177016, (01/2012-12/2015).

11. “Surface plasmon polariton enhancement at the interface of metal/organic in light-emitting devices”, Key project of NSFC, No. 61036009, (01/2011-12/2014).

12. “Studies on low-k materials for high speed integrated circuits”, a sub project of “02 Project”, by National Science and Technology Major Project (02 Project), No. 2011ZX02703-05, (01/2011-12/2014).

13. “Studies on high-efficiency tandem OLEDs and their interfaces” a Taiwan-strait collaboration funded by NSFC, No. 21161160446, (2012-2014).

14. “Development of large area, high efficiency, and long lifetime white OLEDs and the solid-state lighting luminaires”, the National High Technology Research and Development Program ("863"Program) of China, No. 2011AA03A110, (01/2011-12/2013).

15. “Novel OLED structures for display and solid-state applications”, Natural Science Foundation of Jiangsu Province, No. BK2010003, (07/2010-06/2013).

**Patents (selected; total: 281 granted, including 42 US patents)**

1. L. S. Liao, M. W. Culver, and C. W. Tang, “Fluorocarbon electrode modification layer”, US7,799,439 B2.

2. L. S. Liao, W. Slusarek, M. Ricks, R. H. Young, and D. L. Comfort, “OLED electron-injecting layer”, US7,629,741 B2.

3. **L. S. Liao**, T. K. Hatwar, K. P. Klubek, D. L. Comfort, and C. W. Tang, “White OLEDs having a color compensated electroluminescent unit”, US7,560,862 B2.

4. **L. S. Liao**, K. P. Klubek, and C. W. Tang, “Color organic OLED device”, US7,528,545 B2.

5. **L. S. Liao**, W. Slusarek, T. K. Hatwar, M. L. Ricks, and D. L. Comfort, “Tandem OLED having an organic intermediate connector”, US7,494,722 B2.

6. **L. S. Liao**, T. K. Hatwar, K. P. Klubek, and C. W. Tang, “White OLED having multiple white electroluminescence units”, US7,273,663 B2.

7. **L. S. Liao** and K. P. Klubek, “Using a crystallization-inhibitor in organic electroluminescent devices”, US7,211,948 B2.

8. **L. S. Liao** and K. P. Klubek, “Organic electroluminescent devices having a stability-enhancing layer”, US7,138,763 B2.

9. **L. S. Liao** and C. W. Tang, “Tandem OLED having stable intermediate connectors”, US7,126,267 B2.

10. **L. S. Liao**, T. K. Hatwar, K. P. Klubek, J. R. Vargas, and D. L. Comfort, “Tandem OLED having low drive voltage”, US7,075,231 B1.

11. **L. S. Liao**, K. P. Klubek, and C. W. Tang, “A full-color organic display having improved blue emission”, US7,030,554 B2.

12. **L. S. Liao**, K. P. Klubek, D. L. Comfort, and C. W. Tang, “Cascaded organic electroluminescent device having connecting units with n-type and p-type organic layers”, US6,936,961 B2.

13. **L. S. Liao** and K. P. Klubek, “Blue organic electroluminescent devices having a non-hole-blocking buffer layer”, US6,881,502 B2.

14. **L. S. Liao** and C. W. Tang, “Providing an organic electroluminescent device having stacked electroluminescent units”, US6,872,472 B2.

15. **L. S. Liao**, K. P. Klubek, and D. L. Comfort, “Providing an emission-protecting layer in an OLED device”, US6,853,133 B2.

16. **L. S. Liao** and J. K. Madathil, “Organic electroluminescent devices having a metal sub-layer within a hole-transporting region”, US6,818,329 B1.

17. **L. S. Liao**, J. K. Madathil, P. K. Raychaudhuri, and C. W. Tang, “Organic electroluminescent device having an adhesion-promoting layer for use with a magnesium cathode”, US6,794,061 B2.

18. **L. S. Liao**, J. K. Madathil, K. P. Klubek, D. L. Comfort, and C. W. Tang, “OLED device with a performance-enhancing layer”, US6,781,149 B1.

19. **L. S. Liao**, K. P. Klubek, D. L. Comfort, and C. W. Tang, “Cascaded organic electroluminescent devices with improved voltage stability”, US6,717,358 B1.

20. **L. S. Liao**, J. K. Madathil, K. P. Klubek, and C. W. Tang, “Organic light-emitting diode having an interface layer between the hole-transporting layer and the light-emitting layer”, US6,603,150 B2.

**Professional Certification and Awards**

1. “Second Prize of Science and Technology Award”, by the Provincial Government of Jiangsu, China in 2022.

2. “Second Prize of Technological Invention of the Science and Technology Award of the Chinese Institute of Electronics”, by the Chinese Institute of Electronics in 2021.

3. “Second Prize of China Industry-University-Research Cooperation Innovation Achievement Award”, by China Industry-University-Research Cooperation Promotion Association in 2021.

4. “Second Prize of National Teaching Achievement Award in Higher Education”, by the Chinese Government in 2018.

5. “Excellent Mentor Award of the First Jiangsu Postdoctoral Innovation and Entrepreneurship Competition”, by Jiangsu Provincial Administration in 2018.

6. “Second Prize of National Teaching Achievement Award in Higher Education”, by the Chinese Government in 2018.

7. “The Second Prize of Technology Invention Award for Outstanding Achievement in Scientific Research of Higher Education”, by the Ministry of Education of China in 2017.

8. “Grand Prize of Jiangsu Teaching Achievement Award (Higher Education)”, by Jiangsu Provincial Government in 2017.

9. “Model Worker”, conferred by Suzhou City Government in 2015.

10. “Outstanding Educator”, awarded by Suzhou City Government in September 2012.

11. “Distinguished Inventor”, awarded by Eastman Kodak Company in March 2007.

12. “First Rate Award in Progress of Science and Technology”, by the Provincial Government of Jiangsu, China in 1998.

**Student Awards (selected)**

Xun Tang, “Second Prize of the National Challenge Cup for College Students Extracurricular Academic Science and Technology Competition”, China, in 2015

Zhi-Zhou Li, Yi-Chen Tao, Guo-Qing Wei, Jun-Jie Wu, Yue Yu, “Third Prize of the National Challenge Cup for College Students Extracurricular Academic Science and Technology Competition”, China, in 2019.

Meng Li, “Award of Outstanding PhD Dissertation”, Jiangsu Province, 2019.

Ya-Kun Wang, “Award of Outstanding Master Degree Thesis”, Jiangsu Province, 2018.

Zhi-Zhou Li, “Award of Outstanding Master Degree Thesis”, Jiangsu Province, 2020.

Yuan-Lan Zhang, “Award of Outstanding Master Degree Thesis”, Jiangsu Province, 2021.

**Professional Society Membership**

Member, Russian Academy of Engineering.

Member, OLED Subcommittee, Society for Information Display (SID), USA.

Member, Wide Bandgap Semiconductor Subcommittee, The Nonferrous Metals Society of China (NFsoc).

Member, The Chinese Chemical Society.