Wenhao Shao

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Education

University of Michigan, Ann Arbor, MI, USA 2017-2022
- Ph.D. in Chemistry / Graduate Certificate in Computational Discovery and Engineering
- Advisor: Professor **Jinsang Kim**
- Thesis: Purely Organic Triplet Emitters: From Fundamental Molecular Design to Performance Amplification in Modern Applications

Fudan University, Shanghai, China 2013-2017
- Bachelor of Science in Chemistry
- Advisors: Professor **Fuyou Li & Professor Wei Feng**
- Thesis: The Relationship between Shell Thickness sand FRET Efficiency in Dye-Sensitized Luminescent Core-Shell Rare-Earth Upconversion Nanoparticles

Experiences

Assistant Professor 2025-current
Department of Chemistry, University of Georgia

Postdoctoral Research Assistant 2022-2025
Davidson School of Chemical Engineering, Purdue University, West Lafayette, IN
Advisor: Professor **Letian Dou**
Keywords: Halide perovskite; Layered materials; Molecular design; Thin-film LEDs; Crystallization; Self-assembly; Optical system design; Lasing.

Graduate Research Assistant 2018-2022
Materials Science & Engineering, University of Michigan
Advisor: Professor **Jinsang Kim**
Keywords: First principles molecular design; Organic triplet emitters; Organic semiconductors; Spectroscopy; OLED.

Graduate Research Assistant 2017
Department of Chemistry, University of Michigan
Advisor: Professor **Mark M. Banaszak Holl**
Keywords: Anterior Cruciate Ligament; AFM-IR; SHG imaging.

Undergraduate Research Assistant 2015-2016
Department of Chemistry, University of Michigan
Advisor: Professor **Raoul Kopelman**
Keywords: Hydrogel nanoparticles; Chemotherapeutic delivery.

Undergraduate Research Assistant 2014-2017
Department of Chemistry, Fudan University
Advisors: Professors **Fuyou Li & Wei Feng**
Keywords: Core-shell rare-earth upconversion nanoparticles.

Leading Grant Proposals

- Development of Novel Strategies for Solution Processable Multilayer Organic Light-Emitting Diodes Based on Reversible Diels-Alder Chemistry. Funded by LG Chem, 2018-2019.
- Synergetic Manipulation of Heavy Atom Effects and Orbital Angular Momentum for the Rational Design of Novel Metal-Free Organic Semiconductors. Submitted to NSF / DMREF, 2021.

Awards

- MSED 1st Place Poster Award @AIChE, 2024
- Rackham Predoctoral Fellowship @University of Michigan, 2021-2022.
- Overall Best Poster Award @42nd Annual Macro Symposium, University of Michigan, 2018.
- Outstanding Presentation Award @Undergraduate Technology and Academy Forum, Fudan University, 2016.

Presentations (invited)

1. Topological Modifications of Layered Materials.
   @Department of Chemistry, New York University, Dec. 2024. (host: Bart Kahr)

2. Topological Modification at Organic Inorganic Interface.
   @Materials Chemistry Seminar, Purdue, Mar. 2024. (host: Department)

3. Heavy Atom Oriented Orbital Angular Momentum Manipulation in Metal-Free Organic Phosphors.
   @ACS Energy and Fuels Division Student Seminar Series (3S), Oct. 2021.

Academia and Educational Service

- OPTICA Technical Groups Leader – Quantum Applications in Biomedicine and Material Chemistry 2024-current
- Chemistry Instructional Coaching Team***, University of Michigan*** 2020-2022
- Peer Mentor at Graduate Rackham International (GRIN)***, University of Michigan*** 2020F
- President of Junior Achievement***, Fudan University*** 2014-2015

Teaching

At University of Michigan

- "General Chemistry" (Lecture, Chem 130) 2020F, 2021W
- "Advanced Functional Polymers: Molecular Design and Applications" (Lecture, MSE 517) 2019F
- "Polymer Synthesis and Characterization" (Laboratory, Chem 436) 2018W
- "Investigation in Organic Chemistry" (Laboratory, Chem 211) 2017F, 2018F

Representative Publications

† Equal contribution | * Corresponding | Mentee

1. Single-Mode Lasing of Quasi-2D Tin-Halide Perovskite Microcrystals in Ambient conditions
   Cho, S.†; Shao, W.†; Kim, J. H.; Dou, L.*; Yun, S. -H. to be submitted.

2. Hydrogen-bonded Organic Framework Enables Phase-pure Layered Tin Perovskite Nanowires for Room Temperature Nanolasing.
   Kim, J. H.†; Simon, J.†; Shao, W.*; Nian, Z.; Yang, H.; Chen, P.; Triplett, B.; Li, Z.; Wu, P.; Chen, Y.; Farheen, H.; Pagadala. K;

Fruhling, C. B.; Boltasseva, A.; Savoie, B. M.; Shalaev, V. M.*; Dou, L.* to be submitted.

3. Ionic liquids improve perovskite solar cells long-term stability.
   Xu, W.†; Shao, W.†; Tang, Y.; Lin, C.; Yang, H.; Yang, Y. -T.; Kim, J. H.; Lee, G.; Kumar, P.; Pedersen, K. R.; Coffey, A. H.; Harvey, S. P.; Graham, K. R.; Zhu, C.; Zhu, K.; Dou, L.* Under review in Nat. Energy.

4. Molecular templating of layered halide perovskite nanowires.
   Shao, W.†; Kim, J. H.†; Simon, J.; Nian, Z.; Baek, S. -B.; Lu, Y.; Fruling, C. B.; Yang, H.; Wang, K.; Park, J. Y.; Huang, L.; Yu, Y.; Boltasseva, A.; Savoie, B. M.; Shalaev, V. M.; Dou, L.* Science 2024, 384, 1000-1006.
   - News highlight: Purdue, Bioengineer.org, ScienceDaily, Phys.org.

5. Grain engineering for efficient near-infrared perovskite light-emitting diodes.
   Baek, S. -B.†; Shao, W.†; Feng, W. -J.; Tang, Y.; Lee, Y. H.; Loy, J.; Gunnarsson, W. B.; Yang, H.; Zhang, Y.; Faheem, M. B.; Kaswekar, P. I.; Atapattu, H. R.; Coffey, A.; Park, J. Y.; Yang, S. J.; Yang, Y. -T.; Zhu, C.; Wang, K.; Graham, K.; Gao, F.; Qiao, Q.; Guo, L. J.; Rand, B.; Dou, L.* Nat. Commun. 2024, 15, 10760.

6. Light-Emitting Organic Semiconductor-Incorporated Perovskites: Fundamental Properties and Device Applications.
   Shao, W.; Yang, S.; Wang, K.; Dou, L.* J. Phys. Chem. Lett. 2023, 14(8), 2034-2046.

7. Metal-Free Organic Phosphors toward Fast and Efficient Room-Temperature Phosphorescence.
   Shao, W.; Kim, J.* Acc. Chem. Res. 2022, 55(11), 1573–1585.

8. Metal-Free Organic Triplet-Emitters with On-Off Switchable Excited State Intramolecular Proton Transfer.
   Shao, W.; Hao, J.; Jiang, H; Zimmerman, P; Kim, J.* Adv. Funct. Mater. 2022, 32(29), 2201256.

9. Heavy Atom Oriented Orbital Angular Momentum Manipulation in Metal-Free Organic Phosphors.
   Shao, W.; Jiang, H.; Ansari, R.; Zimmerman, P.; Kim, J.* Chem. Sci. 2022, 13(3), 789-797.

10. Organic Light-Emitting Diode Employing Metal-Free Organic Phosphor.
    Song, B.†; Shao, W.†; Jung, J.; Yoon, S. -J.; Kim, J.* ACS Appl. Mater. Interfaces 2020, 12(5), 6137–6143.

Other Publications

1. Microsecond Triplet Emitters by Hybridizing Organic with 2-D Transition Metal Dichalcogenides.
   Choi, J.†; Im, H.†; Kim, D. W.; Jiang, H.; Stark, A.; Shao, W.; Zimmerman, P. M.; Jeon G. W.; Jang, J. W.; Hwang, E. H.; Kim, S.*; Park, D. H.*; Kim, J.* Nat. Commun. 2024, 15, 10282.
   - News highlight: Michigan Engineering.

2. Exciton Dynamics in Layered Halide Perovskite Light-Emitting Diodes.
   Baek, S. -D.; Yang, S. J.; Yang, H.; Shao, W.; Yang, Y. -T., Dou, L.* Adv. Mater. 2024, 2411998.

3. A Pyrrole Modified 3,4-Propylenedioxythiophene Conjugated Polymer as Hole Transport Layer for Efficient and Stable Perovskite Solar Cells.
   Tang, Y.; Ma, K.; Shao, W.; Lee, Y. H.; Abtahi, A.; Sun, J.; Yang, J.; Coffey, A. H.; Atapattu, H.; Ahmed, M.; Hu, Q.; Xu, W.; Dani, R.; Wang, L..; Zhu, C.; Graham, K. R.; Mei, J.*; Dou, L.* Small 2024, 2408440.

4. Two-Dimensional Lattice Confined Single-Molecule-Like Aggregates.

Wang, K.; Lin, Z. -Y.; De, A.; Kocoj, C.; Shao, W.; Yang, H.; Coffey, A.; Fruhling, C. B.; Tang, Y.; Varadharajan, D.; Zhu, C.; Boltasseva, A.; Shalaev, V. M.; Guo, P.; Savoie, B. M.*; Dou, L.* Nature 2024, 633, 567-574.

5. Triplet Management at Ligand-Perovskite Interface to Enhanced Photovoltaics Performance.
   Tang, Y.; Yang, H.; Sun, J.; Wu, Z.; Shao, W.; Joy, S.; Kim, J. H.; Xu, W.; Coffey, A. H.; Lee, Y. H.; Lin, C.; Wang, L.; Ma, K.; Zhu, C.; Graham, K. R.; Tao, S.; Huang, L.; Dou, L.* ACS Eng. Lett. 2024, 9, 4323-4330.

6. Ligand-variant two-dimensional halide perovskite lateral heterostructure.
   Yang, H.; Shao, W.; Sun, J.; Kim, J. H.; Lee, Y. H.; Huang, L.; Dou, L.* MRS Bulletin 2024, 49, 1-7.

7. Balancing the Phosphorescence and Fluorescence of a Double-Ring Porphyrin Using Different Lanthanides for Ratiometric Oxygen Sensing.
   Zhao, H.†*; Wang, Q.†; Wang, S.; Yin, J.; Wang, H.; Shao, W.; Yao, Z.; Yao, J.; Zang, L.* Inorg. Chem. Front. 2023, 10, 5161-5166.

8. Polarity-Induced Dual Room-Temperature Phosphorescence Involving the T2 States of Pure Organic Phosphors.
   Zang, L.; Shao, W.; Bolton, O.; Ansari, R.; Yoon, S. -J.; Heo, J. -M.; Kieffer, J.; Matzger, A. J.; Kim, J.* J. Mater. Chem. C 2022, 10, 14746-14753.

9. Charge Transfer as the Key Parameter Affecting the Color Purity of Thermally Activated Delayed Fluorescence Emitters.
   Ansari, R.; Shao, W.; Yoon, S. -J.; Kim, J*; Kieffer, J.* ACS Appl. Mater. Interfaces. 2021, 13, 28529-28537.

10. Photoresponsive Luminescence Switching of Metal-Free Organic Phosphors Doped Polymer Matrices.
    Zang, L.; Shao, W.; Kwon, M. S.*; Zhang, Z.; Kim, J.* Adv. Opt. Mater. 2020, 8(23), 2000654.

11. Heavy Atom Effect of Selenium for Metal-Free Phosphorescent Light-Emitting Diodes.
    Lee, D. R.; Lee, K. H.; Shao, W.; Kim, C. L.; Kim, J.*; Lee, J. Y.* Chem. Mater. 2020, 32(6), 2583–2592.

12. An Anterior Cruciate Ligament Failure Mechanism.
    Chen, J.; Kim, J. -H; Shao, W.; Schlecht, S. H.; Baek, S. Y.; Jones, A. K.; Ahn, T.; Ashton-Miller, J. A.; Banaszak Holl, M. M.; Wojtys E. M.* Am. J. Sports Med. 2019, 47, 2067-2076.