Wenhao Shao

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Purdue University, West Lafayette, IN, USA
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Education

Purdue University, *West Lafayette, IN* From 2022
- Postdoctoral Associate, Davidson School of Chemical Engineering
- Advisor: Professor Letian Dou

University of Michigan, *Ann Arbor, MI* 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

Experience

Purdue University, *West Lafayette, IN* From 2022
Postdoctoral Associate, Letian Dou Group, Davidson School of Chemical Engineering
- Molecular design and synthesis of organic spacers and band-gap engineering in layered perovskites for thin-film quasi-2D and 2D/3D heterostructure-based LEDs.
- Solution-phase perovskite single crystal growth, nanocrystal fabrication, and crystallographic investigation on crystal self-assembly.
- Optical system design for chiral-optics and optically pumped lasing.

University of Michigan, *Ann Arbor, MI*
Research Assistant, Jinsang Kim Group, Materials Science & Engineering 2018-2022
- First principle design of organic triplet emitters and photophysical characterizations.
- Aromatic ring modification on small molecule and polymeric semiconductors.
- OLED fabrication, characterization, and solution-processability.

Research Assistant, Mark Banaszak Holl Group, Department of Chemistry 2017
- Molecular-to-morphological characterization of mechanically loaded Anterior Cruciate Ligament with AFM-IR and second harmonic generation confocal microscopy.

Research Assistant, Raoul Kopelman Group, Department of Chemistry 2015-2016
- Hydrogel nanoparticle design and synthesis for chemotherapeutic delivery.

Fudan University, *Shanghai, China* 2014-2017
Research Assistant, Fuyou Li & Wei Feng Group, Department of Chemistry
- Colloidal synthesis of 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 / Designing Materials to Revolutionize and Engineer our*

Future (DMREF), 2021.

Publications

Leading Projects [+]*equal contribution*

- **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. Molecular templating of layered halide perovskite nanowires. *Science* **2024**, *384(6699)*, 1000-1006.
  - News highlight: Purdue, Bioengineer.org, ScienceDaily, Phys.org.
- 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. Grain engineering for efficient near-infrared perovskite light-emitting diodes. *under revision in Nature*.
- **Shao, W.**; Yang, S.; Wang, K.; Dou, L. Light-Emitting Organic Semiconductor-Incorporated Perovskites: Fundamental Properties and Device Applications. *J. Phys. Chem. Lett.* **2023**, *14(8)*, 2034-2046.
- **Shao, W.**; Kim, J. Metal-Free Organic Phosphors toward Fast and Efficient Room-Temperature Phosphorescence. *Acc. Chem. Res.* **2022**, *55(11)*, 1573–1585.
- **Shao, W.**; Hao, J.; Jiang, H; Zimmerman, P; Kim, J. Metal-Free Organic Triplet-Emitters with On-Off Switchable Excited State Intramolecular Proton Transfer. *Adv. Funct. Mater.* **2022**, *32(29)* 2201256.
- **Shao, W.**; Jiang, H.; Ansari, R.; Zimmerman, P.; Kim, J. Heavy Atom Oriented Orbital Angular Momentum Manipulation in Metal-Free Organic Phosphors. *Chem. Sci.* **2022**, *13(3)*, 789-797.
- Song, B.[+]; **Shao, W.**[+]**;** Jung, J.; Yoon, S. -J.; Kim, J. Organic Light-Emitting Diode Employing Metal-Free Organic Phosphor. *ACS Appl. Mater. Interfaces* **2020**, *12(5)*, 6137–6143.

Contributing

- Baek, S. -D.; Yang, S. J.; Yang, H.; **Shao, W.**; Yang, Y. -T., Dou, L. Exciton Dynamics in Layered Halide Perovskites for Light-Emitting Diodes. *Adv. Mater. Under Revision.*
- 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. Two-Dimensional Lattice Confined Single-Molecule-Like Aggregates. *Nature* **2024**, s41586-024-07925-9.
- 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. Microsecond Triplet Emitters by Hybridizing Organic with 2-D Transition Metal Dichalcogenides. *Nat. Commun. in press.*
- 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. Triplet Management at Ligand-Perovskite Interface to Enhanced Photovoltaics Performance. *ACS Eng. Lett.* **2024**, *9*, 4323-4330.
- Yang, H.; **Shao, W.**; Sun, J.; Kim, J. H.; Lee, Y. H.; Huang, L.; Dou, L. Ligand-variant two-dimensional halide perovskite lateral heterostructure. *MRS Bulletin* **2024**, *49*, 1-7.
- Zhao, H.; Wang, Q.; Wang, S.; Yin, J.; Wang, H.; **Shao, W.**; Yao, Z.; Yao, J.; Zang, L. Balancing the Phosphorescence and Fluorescence of a Double-Ring Porphyrin Using Different Lanthanides for Ratiometric Oxygen Sensing. *Inorg. Chem. Front.* **2023**, *10*, 5161-5166.
- Zang, L.; **Shao, W.;** Bolton, O.; Ansari, R.; Yoon, S. -J.; Heo, J. -M.; Kieffer, J.; Matzger, A. J.; Kim, J. Polarity-Induced Dual Room-Temperature Phosphorescence Involving the T2 States of Pure Organic Phosphors. *J. Mater. Chem. C* **2022**, *10*, 14746-14753.
- Ansari, R.; **Shao, W.;** Yoon, S. -J.; Kim, J; Kieffer, J. Charge Transfer as the Key Parameter Affecting the Color Purity of Thermally Activated Delayed Fluorescence Emitters. *ACS Appl. Mater. Interfaces*. **2021**, *13*, 28529-28537.
- Zang, L.; **Shao, W.;** Kwon, M. S.; Zhang, Z.; Kim, J. Photoresponsive Luminescence Switching of Metal-Free Organic Phosphors Doped Polymer Matrices. *Adv. Opt. Mater.* **2020**, *8(23)*, 2000654.
- Lee, D. R.; Lee, K. H.; **Shao, W.;** Kim, C. L.; Kim, J.; Lee, J. Y. Heavy Atom Effect of Selenium for Metal-Free

Phosphorescent Light-Emitting Diodes. *Chem. Mater.* **2020**, *32(6)*, 2583–2592.

- 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. An Anterior Cruciate Ligament Failure Mechanism. *Am. J. Sports Med.* **2019**, *47*, 2067-2076.

Awards

- Rackham Predoctoral Fellowship, University of Michigan, 2021-2022
- Overall Best Poster Award, 42nd Annual Macro Symposium, University of Michigan, 10/2018.

Presentations (selected)

- *Topological Modification at Organic Inorganic Interface*, Materials Chemistry Seminar @Purdue, 3/2024.
  - Related topic at MRS Spring, 245th ECS meeting, 2024.
- *Heavy Atom Oriented Orbital Angular Momentum Manipulation in Metal-Free Organic Phosphors*
  - ACS Energy and Fuels Division Student Seminar Series (3S), 10/2021. *(invited)*
- Shao, W.; Konar, A.; Ogilvie, J.; Kim, J. *Polymerization Enhanced Thermally Activated Delayed Fluorescence (TADF) based on a Homopolymer Series*, 42nd Annual Macro Symposium, University of Michigan, 10/2018. **"Overall Best Poster Award"**
- *Redox Responsive Hydrogel Nanoparticles for Delivery of Chemotherapeutic Drugs*. Undergraduate Technology and Academy Forum, Fudan University, 10/2016. **"Outstanding Presentation Award"**

Teaching, Mentoring, Coaching, Service

At Fudan University

- President of Junior Achievement, campus chapter: *design and coordinate career coaching courses at the University level.* 2014-2015

At University of Michigan

- "Investigation in Organic Chemistry" (Laboratory, Chem 211) Fall 2017/2018
- "Polymer Synthesis and Characterization" (Laboratory, Chem 436) Winter 2018
- "Advanced Functional Polymers: Molecular Design and Applications" (Lecture, MSE 517) 2019F
- "General Chemistry" (Lecture, Chem 130) 2020F, 2021W
- Peer Mentor at Graduate Rackham International (GRIN) 2020F
- Chemistry Instructional Coaching Team: *supporting new graduate student investigators navigate their teaching role.* 2020-2022

After Ph.D.

- OPTICA Technical Groups – Quantum Applications in Biomedicine and Material Chemistry (QA) 2024-