Wenhao Shao

Davidson School of Chemical Engineering
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Education

Purdue University, *West Lafayette, IN* 2022 – Present
- 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* 2022 – Present
Postdoctoral Associate, Letian Dou Group, Davidson School of Chemical Engineering
- Designing, synthesizing, and band-gap engineering of organic cations in layered 2D 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 atomic force microscope-infrared spectroscopy 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.

Publications

[+]*Equal contribution*

Submitted and/or under revision

- **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. *revision under review in Science*.
- Baek, S. -B.[+]; **Shao, W.**[+]; Tang, Y.; Lee, Y. H.; Loy, J.; Gunnarsson, W.; Feng, W. -J.; Zhang, Y.; Poojan Kaswekar, M. F.; Atapattu, H.; Yang, H.; Qin, J.; Coffey, A.; Park, J. Y.; Yang, S. J.; Zhu, C.; Wang, K.; Graham, K.; Gao, F.; Qiao, Q.; Guo, L. J.; Rand, B.; Dou, L. Near-infrared perovskite light-emitting diodes with external quantum efficiency approaching 30%. *under revision in Nature*.
- 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. *under revision in Nature*.
- Yang, H.; **Shao, W.**; Sun, J.; Kim, J. H.; Lee, Y. H.; Huang, L; Dou, L. Ligand-variant two-dimensional halide perovskite lateral heterostructure. *Submitted to MRS Bulletin*.
- 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. *under revision in Nat. Commun*.

Published

- 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.
- **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.
- 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.
- **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.

- 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(24)*, 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.
- 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.
- 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.

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
  - Conceived for NSF / Designing Materials to Revolutionize and Engineer our Future (DMREF)

Presentations (selected)

- "Efficient Coupling of Heavy Atom Effects and Orbital Angular Momentum Towards Fast and Efficient Metal-Free Organic Phosphors", MRS Spring Meeting, 5/2022.
- "Heavy Atom Oriented Orbital Angular Momentum Manipulation in Metal-Free Organic Phosphors"
  - ACS Energy and Fuels Division Student Seminar Series (3S), 10/2021. *(invited)*
  - ACS National Conference, 8/2021.
- "Crosslinking Chemistry for Solution Processable Multilayer Organic Light-Emitting Diodes", ACS National Conference / Celebration of the 40th Anniversary of CACS, 8/2021.
- Shao, W.; Song, B.; Lee, D.; Jung, J.; Yoon, S-J.; Lee, J. Y.; Kim, J. "Organic Light-Emitting Diode (OLED) Employing Metal-Free Organic Phosphor", ACS National Conference, 8/2021.
- 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

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