Seung Hyun Kim

Post-Doc Research Associate | Department of Chemistry
University of North Carolina at Chapel Hill
+1 336-212-7549 | shyunkim@unc.edu

EDUCATION

Pohang University of Science and Technology (POSTECH) *Pohang, Korea*
Ph.D. in Chemical Engineering (integrated M.S./Ph.D. program) *August 2023*

- Dissertation: Studies on the Multiscale Strain Dependency of Structural Properties and Charge Transport in Organic Semiconductor Thin Films

Pohang University of Science and Technology *Pohang, Korea*
B.S. in Chemical Engineering *February 2016*

- Honors: magna cum laude
- Exchange Student, Technische Universität Berlin | Fall 2014–Spring 2015

RESEARCH EXPERIENCE

Department of Chemistry, University of North Carolina at Chapel Hill *Chapel Hill, NC*
Post-Doc Research Associate *2025–present*
Advisor: Wei You

- Develop short-wave infrared (SWIR) organic photodetectors (OPDs) by engineering donor/acceptor interfaces and charge-blocking layers to suppress reverse-bias leakage while preserving near-infrared photoresponse.
- Engineer organic electrochemical transistors (OECTs) by optimizing volumetric capacitance, doping efficiency, and mixed ionic–electronic transport in conjugated polymers.

Department of Chemical Engineering, Pohang University of Science and Technology *Pohang, Korea*
Postdoctoral Research Fellow *2023–2024*
Advisor: Kilwon Cho

- Controlled thin-film microstructure to improve charge-carrier mobility and stretchability in conjugated polymers.
- Engineered interfaces in deformable organic semiconductor devices to improve stretchability.

Department of Chemical Engineering, Pohang University of Science and Technology *Pohang, Korea*
Graduate Researcher *2016–2023*
Advisor: Kilwon Cho

- Investigated structural evolution and charge transport in conjugated polymer thin films under mechanical deformation through multiscale analyses.
- Designed deformable conjugated polymer thin films by controlling backbone rigidity and introducing nitrene-mediated crosslinking of alkyl side chains.

Selected Sponsored Research Projects

Researcher, Mid-Career Research Program, National Research Foundation of Korea *2020–2023*
PI: Kilwon Cho

- Conducted multiscale structural and charge-transport analyses to support the development of soft and deformable organic semiconductors.

Researcher, Samsung Display Research Project *Spring 2019*
PI: Kilwon Cho

- Investigated interface engineering approaches to suppress the diffusion of electrode materials into organic active layers and prevent dark spot formation in OLEDs.

Researcher, Center for Advanced Soft Electronics, Global Frontier Research Program *2016–2018*
PI: Kilwon Cho

- Investigated charge transport in aligned polymer semiconductors for stretchable electronics.

PEER-REVIEWED PUBLICATIONS

Google Scholar | ORCID: 0000-0002-1135-1477

Symbols indicate my authorship roles: † Equal contribution (co-first author); * Corresponding author.

1. Megret-Bonilla, A.; **Kim, S. H.;** Mukherjee, S.; Ade, H.; You, W. Balancing Sustainability and Performance in Ester-Incorporated Polymers for Organic Field-Effect Transistors via Physical and Chemical Blending. *Nano Research* **2026**, Just Accepted. https://doi.org/10.26599/NR.2026.94909141

2. Yu, H. S.; Hur, K.; **Kim, S. H.***; Lee, H. Water-Induced Degradation and Stabilization Strategies of PEDOT:PSS Films: A Review. *Journal of Industrial and Engineering Chemistry* **2026**, in press. https://doi.org/10.1016/j.jiec.2026.06.051

3. Hou, B.; Duong, T. T.; Chang, Y.; Lee, Y. E.; **Kim, S. H.**; Kong, H.; Kim, J.; Kim, S. H.; Kwon, H.-J. Hydroxyl-Rich Siloxane Hybrid Dielectric with Moisture-Enhanced Dipolar Polarization and Hydrophobic Surface Passivation for Stable Low-Voltage OTFTs. *Surfaces and Interfaces* **2026**, *86*, 108696. https://doi.org/10.1016/j.surfin.2026.108696

4. Yi, J.; Yang, Y.; Pei, Y.; Gadikar, A.; Mahdikhah, V.; Kotyrov, M.; **Kim, S. H.**; Gundogdu, K.; You, W.; Ade, H.; So, F. Trap-Modified Inverted Organic Photodetectors via Layer-by-Layer Processing with Poly(N-Vinylcarbazole) Additives. *Advanced Functional Materials* **2026**, *36*, e19588. https://doi.org/10.1002/adfm.202519588

5. Kim, J.; Lee, H.; **Kim, S. H.**; Kim, S. H.; Chung, S.; Ok, E.; Cho, K. Electrostatic Control of Carrier–Dopant Interactions for Efficient Free Carrier Generation in Doped Conjugated Polymers. *ACS Nano* **2025**, *19*, 38255–38266. https://doi.org/10.1021/acsnano.5c06764

6. Bai, L.; Chung, S.; Zhao, Z.; Lee, J.-H.; **Kim, S. H.**; Liu, Y.; Tan, L.; Zhong, J.; Zhang, J.; Cho, K.; Kan, Z. Stepwise Control of Molecular Packing Orientation and Order in Non-Fullerene Acceptors Using Dual Additives for High-Efficiency Organic Solar Cells. *Journal of Energy Chemistry* **2025**, *110*, 962–972. https://doi.org/10.1016/j.jechem.2025.07.021

7. Lee, Y.; **Kim, S. H.**†; Kim, D.; Lee, H. Effect of Polymer Crystallinity on the Spatial Distribution of Dopant in Sequentially Solution-Doped Conjugated Polymer Thin Films. *Macromolecular Research* **2025**, *33*, 1185–1193. https://doi.org/10.1007/s13233-025-00416-4

8. Ok, E.; Chung, S.; **Kim, S. H.**; Kim, K.; Park, S.; Kim, H.; Yi, Y.; Jang, J. D.; Lee, H.; Choi, H. H.; Kang, B.; Cho, K. Accompanying Structural Transformations in Polarity Switching of Heavily Doped Conjugated Polymers. *Advanced Materials* **2025**, *37*, 2505945. https://doi.org/10.1002/adma.202505945

9. Chung, S.; **Kim, S. H.**†; Kim, S.; Ok, E.; Kim, B. J.; Kim, J.; Shin, J.; Chung, T.; Jang, J. D.; Lee, S.; Kang, B.; Cho, K. Enhancing Mechanical Deformability of Rigid Conjugated Polymers through Functional Additive-Induced Persistence Length Modulation. *Advanced Functional Materials* **2025**, *35*, 2511256. https://doi.org/10.1002/adfm.202511256

10. **Kim, S. H.**; Park, S.; Chung, S.; Ok, E.; Kim, B. J.; Jang, J. D.; Kang, B.; Cho, K. Multiscale Analyses of Strain-Enhanced Charge Transport in Conjugated Polymers. *ACS Nano* **2024**, *18*, 31332–31348. https://doi.org/10.1021/acsnano.4c10775

11. Park, S.; **Kim, S. H.**; Lee, H.; Cho, K. Strain-Dependent Charge Trapping and Its Impact on the Operational Stability of Polymer Field-Effect Transistors. *npj Flexible Electronics* **2024**, *8*, 71. https://doi.org/10.1038/s41528-024-00359-3

12. Jang, H.; Bae, G. Y.; **Kim, S. H.**; Sung, J.; Lee, E. Crosslinking-Induced Anion Transport Control for Enhancing Linearity in Organic Synaptic Devices. *Materials Horizons* **2024**, *11*, 4638–4650. https://doi.org/10.1039/d4mh00806e

13. Chung, S.; **Kim, S. H.**†; Ok, E.; Kim, B. J.; Kang, B.; Cho, K. Structural Insights into Conjugated Polymers for Stretchable Organic Transistors. *Chemistry of Materials* **2024**, *36*, 74–98. https://doi.org/10.1021/acs.chemmater.3c02394

14. Sung, W.; **Kim, S. H.**; Kim, B.; Lee, D. C.; Kim, S.; Choi, J.; Cho, S.; Cho, K. High Luminescence Stability Enables Reduced Burn-In Voltage Loss in Organic Solar Cells. *Solar RRL* **2024**, *8*, 2400047. https://doi.org/10.1002/solr.202400047

15. **Kim, S. H.**†; Chung, S.; Kim, M.; Yoo, D.; Ok, E.; Kim, S.; Song, K. C.; Song, Y. J.; Kang, B.; Cho, K. Designing a Length-Modulated Azide Photocrosslinker to Improve the Stretchability of Semiconducting Polymers. *Advanced Functional Materials* **2023**, *33*, 2212127. https://doi.org/10.1002/adfm.202212127

16. Min, J.; Im, J.; **Kim, S. H.**; Choi, H. H.; Cho, K. Morphology Associated Positive Correlation between Carrier Mobility and Carrier Density in Highly Doped Donor–Acceptor Conjugated Polymers. *Advanced Functional Materials* **2023**, *33*, 2212825. https://doi.org/10.1002/adfm.202212825

17. Park, S.; Choi, W.; **Kim, S. H.**; Lee, H.; Cho, K. Protonated Organic Semiconductors: Origin of Water-Induced Charge-Trap Generation. *Advanced Materials* **2023**, *35*, 2303707. https://doi.org/10.1002/adma.202303707

18. Sung, W.; Lee, H.; Choi, W.; Han, S. G.; Kim, J.; Cho, K.; **Kim, S. H.**; Lee, D.; Kim, H. D.; Ohkita, H.; Cho, K. Nanomorphology Dependence of the Environmental Stability of Organic Solar Cells. *NPG Asia Materials* **2022**, *14*, 56. https://doi.org/10.1038/s41427-022-00400-9

19. Hong, J.-H.; **Kim, S. H.**†; Jo, S. B.; Cho, K.; Kang, B. Organic Small-Molecule Heterointerface for Use in Transistor-Type Non-Volatile Memory. *Organic Electronics* **2021**, *93*, 106107. https://doi.org/10.1016/j.orgel.2021.106107

20. Lee, S. B.; Lee, S.; Kim, D. G.; **Kim, S. H.**; Kang, B.; Cho, K. Solutal-Marangoni-Flow-Mediated Growth of Patterned Highly Crystalline Organic Semiconductor Thin Film via Gap-Controlled Bar Coating. *Advanced Functional Materials* **2021**, *31*, 2100196. https://doi.org/10.1002/adfm.202100196

21. Park, S.; **Kim, S. H.**†; Choi, H. H.; Kang, B.; Cho, K. Recent Advances in the Bias Stress Stability of Organic Transistors. *Advanced Functional Materials* **2020**, *30*, 1904590. https://doi.org/10.1002/adfm.201904590

HONORS AND AWARDS

Outstanding Poster Award, Polymer Society of Korea *2022*

Samsung Electronics Scholarship, Samsung Electronics *2021–2023*
- Approximately $20,000 per year

Graduation with Honors: magna cum laude, POSTECH *2016*

Best Student Poster Award, Department of Chemical Engineering, POSTECH *2015*

Presidential Science Scholarship, Korea Student Aid Foundation (KOSAF) *2012–2016*
- Approximately $15,000 per year

Samsung Junior Frontier Leader (JFL) Scholarship, Samsung SDS *2011*

Grand Prize in National BioLab Competition, Ministry of Health and Welfare *2010*

TEACHING AND MENTORING

Teaching Assistantships

Teaching Assistant, Organic Chemistry Laboratory (CHEB211), POSTECH *Fall 2018*

- Prepared reagents, checked equipment, and supported laboratory instruction in organic synthesis, separation, and characterization.

Teaching Assistant, Physical Chemistry Laboratory (CHEB212), POSTECH *Fall 2017*

- Assisted with laboratory instruction in thermodynamics, electrochemistry, spectroscopy, and chemical kinetics.

Laboratory Instruction and Training

Training Program Coordinator and Instructor *2023–2024*

- Planned and coordinated laboratory training for new lab members and research participants.
- Delivered lectures on semiconductor fundamentals and crystal structure (2023).
- Delivered lectures on brittleness in conjugated polymers and mechanical characterization methods (2024).

Research Mentoring

Peer Research Mentor, OFET Team *2018–2023*

Prof. Kilwon Cho's Research Group, POSTECH

- Mentored six junior lab members working on organic field-effect transistors.

Undergraduate Research Mentor *Fall 2018*

Prof. Kilwon Cho's Research Group, POSTECH

- Mentored one undergraduate student on the project "Molecular Orientation-Dependent Bias Stress Stability in *n*-Type Organic Transistors."

PRESENTATIONS

1. **S. H. Kim**, "Balancing Dark Current and Photoresponse in Organic Photodetectors via Cleavable Side Chain Engineering", *U.S.–Korea Conference on Science, Technology, and Entrepreneurship*, Orlando, FL, USA, August **2026**, Oral presentation.

2. **S. H. Kim**, "Spectroscopic Insights into the Bias-Stress-induced Charge Trapping in Stretchable Organic Transistors", *Annual Spring Meeting of the Polymer Society of Korea*, Jeju, Korea, April **2024**, Oral presentation.

3. **S. H. Kim** and K. Cho, "Strain Dependency of Charge Transport of Stretchable Conjugated Polymers", *MRS Fall Meeting & Exhibit*, Boston, MA, USA, November **2023**, Poster presentation.

4. **S. H. Kim** and K. Cho, "Strain Dependent Charge Transport of Stretchable Organic Semiconductors: Insights from Molecular Deformation Behaviors", *Annual Fall Meeting of the Polymer Society of Korea*, Jeju, Korea, October **2023**, Oral presentation.

5. **S. H. Kim** and K. Cho, "Multiscale Study of Strain-Dependent Charge Transport in Deformable Conjugated Polymers", *Annual Spring Meeting of the Polymer Society of Korea*, Daejeon, Korea, April **2023**, Poster presentation.

6. **S. H. Kim**, S. Park, and K. Cho, "Multiscale Study of Strain-Dependent Charge Transport in Deformable Conjugated Polymers", *Annual Spring Meeting of the Polymer Society of Korea*, Daejeon, Korea, April **2022**, Poster presentation.

ACADEMIC SERVICE

Ad Hoc Peer Reviewer | 2025–present
Journals: *Macromolecular Rapid Communications; Journal of Adhesion and Interface*.

Peer-Review Contributions under Faculty Supervision | 2018–present
Contributed to 14 peer-review reports across nine journals under faculty supervision.
Journals: *ACS Applied Materials & Interfaces; Advanced Functional Materials; Advanced Materials; Chemistry of Materials; Journal of the American Chemical Society; Journal of Materials Chemistry C; Macromolecules; Nature Communications; Science Advances.*

TECHNICAL SKILLS

Thin-Film Fabrication and Patterning:
Spin coating, bar coating, dip coating, thermal evaporation, photolithography, reactive ion etching

Structural, Surface, and Optical Characterization:
GIWAXS, SAXS, SANS, AFM, SEM, TEM, XPS, Raman spectroscopy, UV–vis spectroscopy, ellipsometry

Thermal and Mechanical Characterization:
DMA, DSC, tensile testing of submicrometer organic thin films using film-on-elastomer and film-on-water methods

Electrical and Optoelectronic Characterization:
- **OFETs**: Charge-carrier mobility, threshold voltage, trap density, bias-stress stability, and memory characteristics
- **OPDs**: Dark current density–voltage (*J–V*) characteristics, spectral responsivity, external quantum efficiency (EQE), and noise measurements
- **OECTs**: Transfer and output characteristics, transconductance, and volumetric capacitance
- **Charge transport and trapping**: Electrical conductivity and photoexcited charge-collection spectroscopy (PECCS)

Computation and Data Analysis:
Gaussian 16, GaussSum, Python

Scientific Visualization:
Adobe Illustrator, Adobe Photoshop, Autodesk 3ds Max

LANGUAGES

Korean: Native; **English:** Professional working proficiency

ACADEMIC REFERENCES

Wei You (Postdoctoral Advisor)
Cary C. Boshamer Distinguished Professor of Chemistry and Applied Physical Sciences
University of North Carolina at Chapel Hill, Chapel Hill, NC, USA
Email: wyou@unc.edu

Kilwon Cho (Ph.D. Advisor)
Professor, Department of Chemical Engineering
Pohang University of Science and Technology (POSTECH), Pohang, Korea
Email: kwcho@postech.ac.kr

Boseok Kang (Research Collaborator)
Associate Professor, Department of Nano Engineering
Sungkyunkwan University (SKKU), Suwon, Korea
Email: bskang88@skku.edu