

Byeongmoon Lee

Curriculum Vitae

Stanford University
Shriram Center Chemical Engineering
443 Via Ortega
Stanford, CA 94305-4125
E-mail: bmoon@stanford.edu

RESEARCH INTERESTS

- Self-sustainable, fully tailored human-integrated electronics
- Multifunctional soft nanocomposites
- Additive manufacturing and bottom-up micro-fabrication
- Intelligent electronic skins

EDUCATION

Seoul National University	Seoul, Korea
Ph.D. in Electrical and Computer Engineering	Aug 2020
Adviser: Prof. Yongtaek Hong	
Thesis: <i>“Enhancement of Mechanical Conformability via Nanocomposites for Augmented Spatial Signal/Heat Transfer in Wearable Sensors and Energy Devices”</i>	
Seoul National University	Seoul, Korea
B.S. in Electrical and Computer Engineering	Feb 2014

PROFESSIONAL EXPERIENCE

Stanford University	Stanford, USA
Postdoctoral Scholar in Department of Chemical Engineering	Jan 2024 – <u>Current</u>
Visiting Postdoctoral Scholar in Department of Chemical Engineering	Jan 2023 – Jan 2024
Adviser: Prof. Zhenan Bao	
Korea Institute of Science and Technology	Seoul, Korea
Postdoctoral Scholar in Soft Hybrid Materials Research Center	Sep 2020 – Jan 2024
Adviser: Dr. Seungjun Chung	
ALL-M Inc.	Seoul, Korea
Senior Program Engineer	Sep 2010 – Aug 2013

HONORS & AWARDS

Best Onsite Early Career Oral Presentation Award	Jan 2023
2022 MRS Fall Meeting & Exhibit, National Science Foundation (NSF)	
The 25th Doyeon Academic Paper Award	Oct 2021
Inter-university Semiconductor Research Center, Seoul National University	
Sejong Science Fellowship Grant	Sep 2021 – Feb 2026
Young Scientist Grants from the Ministry of Science and ICT (Korea)	
Distinguished Ph.D. Dissertation Award	Aug 2020
Dep. of Electrical and Computer Engineering, Seoul National University	
The 26th Humantech Paper Award	Feb 2020

PEER-REVIEWED PUBLICATIONS

†First authorship with equal contribution; *Corresponding authorship

1. **“Universal, site-selective, and anisotropically conductive integration of microdevices into highly conformable, miniaturized electronics”**
H. Yoon, S. Jeong, **B. Lee***, and Y. Hong*
Nature Electronics, Accepted (2024).
2. **“Milliwatt-scale body-heat harvesting using stretchable thermoelectric generators for fully untethered, self-sustainable wearables”**
H. Cho, D. Jang, J. Yoon, Y.-S. Ryu, B. Lee, **B. Lee***, S. Chung*, and Y. Hong*
ACS Energy Letters **8**, 2585-2594 (2023).
3. **“Omnidirectional printing of elastic conductors for 3D stretchable electronics”**
B. Lee†*, H. Cho†, Y. Ko, Y.-S. Ryu, H. Kim, J. Jeong, and S. Chung*
Nature Electronics **6**, 307-318 (2023).
4. **“Selective Purity Modulation of Semiconducting Single-Walled Carbon Nanotube Networks for High-Performance Thin-Film Transistors”**
H. Kim†, H. Oh†, H. Yoo, K. Cho, T. Lee, S. Chung, **B. Lee***, and Y. Hong*
ACS Applied Electronic Materials **5**, 2055-2064 (2023)
5. **“Recent progress in strain-engineered elastic platforms for stretchable thin-film devices”**
H. Cho†, **B. Lee**†, D. Jang, J. Yoon, S. Chung*, and Y. Hong*
Materials Horizons **9**, 2053-2075 (2022).
6. **“Stretchable hybrid electronics: Combining rigid electronic devices with stretchable interconnects into high-performance on-skin electronics”**
B. Lee, H. Cho, S. Jeong, J. Yoon, D. Jang, D. K. Lee, D. Kim, S. Chung, and Y. Hong*
Journal of Information Display **23**, 163-184 (2022).
7. **“Inkjet-Printing-Based Density Profile Engineering of Single-Walled Carbon Nanotube Networks for Conformable High-On/Off-Performance Thin-Film Transistors”**
H. Oh†, H. Kim†, H. Yoo, B. Park, S. Chung, **B. Lee***, and Y. Hong*
ACS Applied Materials & Interfaces **13**, 43163 (2021).
8. **“High-performance compliant thermoelectric generators with magnetically self-assembled soft heat conductors for self-powered wearable electronics”**
B. Lee†, H. Cho†, K. T. Park, J.-S. Kim, M. Park, H. Kim*, Y. Hong*, and S. Chung*
Nature Communications **11**, 5948 (2020).
9. **“Ultraflexible and transparent electroluminescent skin for real-time and super-resolution imaging of pressure distribution”**
B. Lee†, J.-Y. Oh†*, H. Cho, C. W. Joo, H. Yoon, S. Jeong, E. Oh, J. Byun, H. Kim, S. Lee, J. Seo, C. W. Park, S. Choi, N.-M. Park, S.-Y. Kang, C.-S. Hwang, S.-D. Ahn, J.-I. Lee, and Y. Hong*
Nature Communications **11**, 663 (2020).
10. **“Fully printable, strain-engineered electronic wrap for customizable soft electronics”**
J. Byun†, **B. Lee**†, E. Oh, H. Kim, S. Kim, S. Lee, and Y. Hong*

Scientific Reports 7, 45328 (2017).

11. **“Drug Delivery Systems for Personal Healthcare by Smart Wearable Patch System”**
B. Khadka, **B. Lee**, and K.-T. Kim*
Biomolecules 13, 929 (2023)
12. **“All Direct Ink Writing of 3D Compliant Carbon Thermoelectric Generators for High-Energy Conversion Efficiency”**
S. Hwang†, D. Jang†, **B. Lee**, Y.-S. Ryu, J. Kwak*, H. Kim*, and S. Chung*
Advanced Energy Materials 13, 2204171 (2023)
13. **“High-performance, printable quasi-solid-state electrolytes toward all 3D direct ink writing of shape-versatile Li-ion batteries”**
J. Bae, S. Oh, **B. Lee**, C. H. Lee, J. Chung, J. Kim, S. Jo, S. Seo, J. Lim*, and S. Chung*
Energy Storage Materials 57, 277-288 (2023).
14. **“Crack-inducing Strain Sensor Array using Inkjet-Printed Silver Thin Film for Underplate and Off-centered Force Sensing Applications”**
S. Choi, S. Lee, **B. Lee**, J. Yoon, C. Lee, T. Kim*, and Y. Hong*
ACS Applied Materials & Interfaces 15, 4487-4494 (2023).
15. **“Lamination of inkjet-printed Ag electrodes for highly patternable and customizable polymer light-emitting diodes”**
H. Yoon, S. Jeong, **B. Lee**, D. Kim, J. Park, and Y. Hong*
Flexible and Printed Electronics 8, 015005 (2023).
16. **“Optimization of conductive elastomeric composites for directly printed intrinsically stretchable conductors”**
T. K. Kim, S. Moon, **B. Lee**, and S. Chung*
Japanese Journal of Applied Physics 62, SE1002 (2023).
17. **“Nonpatterned Soft Piezoresistive Films with Filamentous Conduction Paths for Mimicking Multiple-Resolution Receptors of Human Skin”**
H. Kim, S. Choi, **B. Lee**, J. Seo, S. Lee, J. Yoon, and Y. Hong*
ACS Applied Materials & Interfaces 14, 55088-55097 (2022).
18. **“Electronic Skin Based on a Cellulose/Carbon Nanotube Fiber Network for Large-Area 3D Touch and Real-Time 3D Surface Scanning”**
D. Kim, D. K. Lee, J. Yoon, D. Hahm, **B. Lee**, E. Oh, G. Kim, J. Seo, H. Kim, and Y. Hong*
ACS Applied Materials & Interfaces 13, 53111 (2021).
19. **“Underwater maneuvering of robotic sheets through buoyancy-mediated active flutter”**
J. Byun, M. Park, S.-M. Baek, J. Yoon, W. Kim, **B. Lee**, Y. Hong, and K.-J. Cho*
Science Robotics 6, eabe0637 (2021).
20. **“2-D Strain Sensors Implemented on Asymmetrically Bi-axially Pre-strained PDMS for Selectively Switching Stretchable Light-emitting Device Arrays”**
S. Choi, S. Kim, H. Kim, **B. Lee**, T. Kim*, and Y. Hong*
IEEE Sensors Journal 20, 14544-14661 (2020).
21. **“Selective Crack Formation on Stretchable Silver Nano-particle Based Thin Films for Customized and Integrated Strain-sensing System”**
S. Choi, S. Lee, **B. Lee**, T. Kim*, and Y. Hong*
Thin Solid Films 707, 138068 (2020).

22. **“Distortion-free Stretchable Light-Emitting Diodes via Imperceptible Microwrinkles”**
S. Jeong, H. Yoon, **B. Lee**, S. Lee, and Y. Hong*
Advanced Materials Technologies **5**, 2000231 (2020).
23. **“Fluoroelastomer encapsulation for enhanced reliability of solution-processed carbon nanotube thin-film transistors”**
J. Seo, J. Ha, **B. Lee**, H. Kim, and Y. Hong*
Thin Solid Films **704**, 138021 (2020).
24. **“Highly Customizable Transparent Silver Nanowire Patterning via Inkjet-printed Conductive Polymer Templates Formed on Various Surfaces”**
J. Park†, G. Kim†, **B. Lee**, S. Lee, P. Won, H. Yoon, H. Cho, S. Ko, Y. Hong*
Advanced Materials Technologies **5**, 2000042 (2020).
25. **“Network Structure Modification-Enabled Hybrid Polymer Dielectric Film with Zirconia for the Stretchable Transistor Applications”**
J. O. Kim, J. S. Hur, D. Kim, **B. Lee**, J. M. Jung, H. A. Kim, U. J. Chung, S. H. Nam, Y. Hong, K.-S. Park, and J. K. Jeong*
Advanced Functional Materials **30**, 1906647 (2020).
26. **“Stretchable strain tolerant soft printed circuit board: A systematic approach for design rules of stretchable interconnects”**
H. Cho, Y. Lee, **B. Lee**, J. Byun, S. Chung*, and Y. Hong*
Journal of Information Display **21**, 41-47 (2019).
27. **“Highly Customizable All Solution-Processed Polymer Light Emitting Diodes with Inkjet Printed Ag and Transfer Printed Conductive Polymer Electrodes”**
J. Park, H. Yoon, G. Kim, **B. Lee**, S. Lee, S. Jeong, T. Kim, J. Seo, S. Chung, Y. Hong*
Advanced Functional Materials **29**, 1902412 (2019).
28. **“Soft Modular Electronic Blocks (SMEBs): A Strategy for Tailored Wearable Health-Monitoring Systems”**
J. Yoon†, Y. Joo†, E. Oh, **B. Lee**, D. Kim, S. Lee, T. Kim, J. Byun*, and Y. Hong*
Advanced Science **6**, 1801682 (2019) (Front Cover Paper).
29. **“Highly Reliable Liquid Metal-Solid Metal Contacts with a Corrugated Single-Walled Carbon Nanotube Diffusion Barrier for Stretchable Electronics”**
E. Oh, T. Kim, J. Yoon, S. Lee, D. Kim, **B. Lee**, J. Byun, H. Cho, J. Ha, and Y. Hong*
Advanced Functional Materials **28**, 1806014 (2018) (Inside Front Cover Paper).
30. **“Electronic skins for soft, compact, reversible assembly of wirelessly activated fully soft robots”**
J. Byun†, Y. Lee†, J. Yoon, **B. Lee**, E. Oh, S. Chung, T. Lee, K.-J. Cho*, J. Kim*, and Y. Hong*
Science Robotics **3**, eaas9020 (2018).
31. **“Printed cylindrical lens pair for application to the seam concealment in tiled displays”**
S. Lee, S. Lee, H. Yoon, C.-K. Lee, C. Yoo, J. Park, J. Byun, G. Kim, **B. Lee**, B. Lee, and Y. Hong*
Optics Express **26**, 824 (2018).
32. **“A Single Droplet-Printed Double-Side Universal Soft Electronic Platform for Highly Integrated Stretchable Hybrid Electronics”**
J. Byun†, E. Oh†, **B. Lee**, S. Kim, S. Lee, and Y. Hong*
Advanced Functional Materials **27**, 1701912 (2017).
33. **“Highly sensitive and bendable capacitive pressure sensor and its application to 1V operation**

pressure sensitive transistor”

Y. Joo, J. Yoon, J. Ha, T. Kim, S. Lee, **B. Lee**, C. Pang, and Y. Hong*
Advanced Electronic Materials **3**, 1600455 (2017).

34. **“Modulus-gradient Conductive Core-shell Structures Formed by Magnetic Self-assembling and Printing Processes for Highly Stretchable Via Applications”**
E. Oh, J. Byun, **B. Lee**, S. Kim, D. Kim, J. Yoon, and Y. Hong*
Advanced Electronic Materials **3**, 1600517 (2017).
35. **“Revisit to three-dimensional percolation theory: Accurate analysis for highly stretchable conductive composite materials”**
S. Kim, S. Choi, E. Oh, J. Byun, H. Kim, **B. Lee**, S. Lee, and Y. Hong*
Scientific Reports **6**, 34632 (2016).
36. **“F-number matching method in light field microscopy using an elastic micro lens array”**
J. Kim, Y. Jeong, H. Kim, C.-K. Lee, **B. Lee**, J. Hong, Y. Kim, Y. Hong, S.-D. Lee, and B. Lee*
Optics Letters **41**, 2751 (2016).

OTHER PUBLICATIONS

1. **“Printed carbon electronics get recycled”**
B. Lee and S. Chung*
Nature Electronics **4**, 241 (2021).
2. **“Invited Paper: Strain-engineered Platform Technology for Stretchable Hybrid Electronics”**
Y. Hong*, **B. Lee**, J. Byun, E. Oh, J. Yoon, H. Kim, S. Choi, and H. Cho
SID Symposium Digest of Technical Papers **49**, 483-485 (2018)
3. **“Late-News Poster: Stretchable Active-Matrix Light-Emitting Diode Array Using Printed Electric Components on Plastic and Elastomer Hybrid Substrate”**
J. Yoon, Y. Joo, **B. Lee**, E. Oh, H. Cho, and Y. Hong*
SID Symposium Digest of Technical Papers **49**, 1925-1927 (2018)
4. **“Invited Paper: Key Enabling Technology for Stretchable LED Display and Electronic System”**
Y. Hong*, **B. Lee**, J. Byun, E. Oh, H. Kim, S. Kim, S. Lee, D. Kim, and J. Yoon
SID Symposium Digest of Technical Papers **48**, 253-256 (2017)
5. **“Stretchable Displays: From Concept Toward Reality”**
Y. Hong*, **B. Lee**, E. Oh, J. Byun
Information Display **33**, 6-38 (2017)
6. **“Late-News Paper: All-Ink-Jet-Printed Wearable Information Display Directly Fabricated onto an Elastomeric Substrate”**
B. Lee, J. Byun, E. Oh, H. Kim, S. Kim, Y. Hong*
SID Symposium Digest of Technical Papers **47**, 672-675 (2016)

CONFERENCE PRESENTATIONS

1. **“Direct Writing Freestanding, Three-Dimensional Soft Electronics”**
B. Lee, and S. Chung
ICAE 2023, Jeju, Korea, November 2023 (Oral presentation).
2. **“Magnetically Self-Assembled Stretchable Thermoelectric Devices for Energy Conversion on Skin”**
B. Lee, H. Cho, H. Kim, Y. Hong, and S. Chung

IEEE NEMS 2023, Jeju, Korea, May 2023 (Poster presentation).

3. **“Magnetically Self-Assembled Stretchable Thermoelectric Devices for Energy Conversion on Skin”**
B. Lee, H. Cho, H. Kim, Y. Hong, and S. Chung
2022 MRS Fall Meeting & Exhibit, Boston, USA, November 2022 (Oral presentation).
4. **“Magnetic self-assembly for scalable fabrication of conformable thermoelectric devices”**
B. Lee, H. Cho, H. Kim, Y. Hong, and S. Chung
ICFPE 2022, Jeju, Korea, October 2022 (Poster presentation).
5. **“Direct Writing of Elastic Conductors for Stretchable Displays”**
B. Lee, H. Cho, Y. Ko, H. Kim, and S. Chung*
IMID 2022, Busan, Korea, August 2022 (Poster presentation).
6. **“High-Performance Wearable Thermoelectric Devices with Magnetically Self-Assembled Soft Heat Conductors”**
B. Lee, H. Cho, H. Kim, Y. Hong*, and S. Chung*
ICAE 2021, Jeju, Korea, November 2021 (Oral presentation).
7. **“Ultraflexible and Transparent Pressure-Imaging Skin Using Cellulose/Nanowire Nanohybrid Networks for High-Information-Density Human-Machine Interfaces”**
B. Lee, J.-Y. Oh, H. Cho, H. Yoon, S. Jeong, N.-M. Park, C.-S. Hwang, S.-D. Ahn, J.-I. Lee, Y. Hong
2019 MRS Fall Meeting & Exhibit, Boston, USA, December 2019 (Poster presentation).
8. **“Printed Integration of High-Performance Intrinsically Stretchable TFTs with Soft Sensors for Mass Customization of Wearable Electronics”**
B. Lee, J. Seo, H. Cho, T. Kim, and Y. Hong
2018 MRS Fall Meeting & Exhibit, Boston, USA, November 2018 (Poster presentation).
9. **“Fabrication and Characterization of Nanocomposite Dielectrics for Applications in Intrinsically Stretchable Thin Film Transistors”**
B. Lee, J. Seo, T. Kim, and Y. Hong
ICANS 27, Seoul, Korea, August 2017 (Poster presentation).
10. **“All-Ink-Jet-Printed Wearable Information Display Directly Fabricated onto an Elastomeric Substrate”**
B. Lee, J. Byun, E. Oh, H. Kim, S. Kim, and Y. Hong
SID Display Week 2016, San Francisco, USA, May 2016 (Oral presentation).
11. **“Rationally Designed Topographic Configuration of Elastomeric System for Inkjet Printed Stretchable Electronics”**
B. Lee, J. Byun, and Y. Hong
ENGE 2014, Jeju, Korea, November 2014 (Oral presentation).

PATENTS*

*Registered in USA

1. **“METHOD FOR FORMING FLEXIBLE SUBSTRATE INCLUDING VIA, AND FLEXIBLE SUBSTRATE HAVING VIA”**
Y. Hong, E. Oh, J. Byun, **B. Lee** (SNU R&DB Foundation)
USA, US11284509B2 (Registration, 2022).
2. **“APPARATUS FOR FABRICATING STRETCHABLE ELECTRICAL CIRCUIT”**
Y. Hong, **B. Lee**, J. Byun (SNU R&DB Foundation)

USA, US11134566B2 (Registration, 2021).

3. “METHOD FOR FORMING FLEXIBLE SUBSTRATE INCLUDING VIA, AND FLEXIBLE SUBSTRATE HAVING VIA”

Y. Hong, E. Oh, J. Byun, **B. Lee** (SNU R&DB Foundation)

USA, US10905002B2 (Registration, 2021).

4. “METHOD OF FABRICATING STRETCHABLE ELECTRICAL CIRCUIT”

Y. Hong, **B. Lee**, J. Byun (SNU R&DB Foundation)

USA, US10757803B2 (Registration, 2020).

REFERENCES

Available upon request.