

SEUNGHOO CHOI

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RESEARCH INTERESTS

- Computational materials design using first-principles calculations and machine learning
- Multi-fidelity modeling strategies for accelerated materials discovery
- Structure–processing–property relationships in complex energy materials systems
- Descriptor development for linking atomic-scale features to functional performance
- Data-driven optimization of microstructure formation and interfacial phenomena

EDUCATION

Sungkyunkwan University

Suwon, South Korea

M.E. in Nano Science and Technology

Mar 2017 – Aug 2019

- Thesis: *Conductive Hierarchical Hairy Fibers for Highly Sensitive and Multiple Gesture-Distinguishable Multimodal Sensor*

Sungkyunkwan University

Suwon, South Korea

B.S. in Advanced Materials Science and Engineering

Mar 2010 – Feb

2017

Honors & Awards

- **Government Scholarship for Integrated B.S.–M.S. Program, Sungkyunkwan University, 2017**
Selected as a recipient of a full scholarship for outstanding academic performance; awarded opportunity for international research training.

RESEARCH EXPERIENCE

Soft Electronics & Robotics Lab (Korea National University of Transportation)

Chungju, South Korea

Visiting Researcher (Host: Prof. Da Wan Kim)

June 2025 –

present

1. Microstructured Polymer Interfaces for Molecular Transport (In Progress)

- Investigating the relationship between polymer morphology and capillary transport efficiency in microneedle-based interstitial fluid extraction systems.
- Characterizing molecular detection limits using Raman spectroscopy, generating experimental benchmarks for sensitive LFA-based screening platforms.

2. Surface Engineering & Contact Mechanics for Soft Material Interfaces (In Progress)

- Studying surface-to-surface interaction physics between microstructured polymers and biological tissues to enhance signal acquisition in soft material interfaces.
- Systematically characterizing the relationship between microstructure geometry and electrical impedance responses for analysis of skin barrier hydration and transport properties.

3. Grain Boundary Engineering in Thermoelectric Chalcogenide Alloys (In Progress)

- Exploring composition–property relationships in Cu- and Sn-doped telluride alloys for improved thermoelectric performance.
- Analyzing the influence of ion substitution and grain boundary structures on charge carrier transport and thermoelectric figure of merit (ZT)

Polymer 3D-Architecture Lab (Sungkyunkwan University)

Graduate Researcher (Advisor: Prof. Changhyun Pang)

Suwon, South Korea

Mar 2017 – Aug 2019

1. Hierarchical Percolation Networks in Conductive Polymer Composites

- Investigated structure–property relationships in stretchable conductive composites through hierarchical microstructure design.
- Analyzed microcrack-assisted percolation networks governing electrical transport behavior in polymer nanocomposites.
- Demonstrated functional materials platforms capable of real-time signal detection using dual-resistance transport mechanisms.
- Outcome: Choi et al., *Advanced Functional Materials* (2019), Back Cover Article.

2. Bio-Inspired Polymer Surface Engineering for Reversible Adhesion

- Designed bio-inspired polymer surface architectures to study conformal adhesion mechanics on wet and curved substrates.
- Characterized the influence of surface microstructures on adhesion energy and electrical signal stability in soft material interfaces.
- Award: Best Poster Award, Materials Research Society (MRS) Fall Meeting, 2018.

PROFESSIONAL EXPERIENCE

SK On Co., Ltd.

Expatriate Process Engineer, Yancheng, China

Jan 2023 – Dec 2024

- Participated in the commissioning and stabilization of industrial-scale lithium-ion battery manufacturing lines during the early-stage operation of a newly established plant.
- Investigated process–equipment interactions across electrode production systems, focusing on how operating conditions influence material flow and process stability.
- Resolved production bottlenecks during ramp-up by coordinating cross-functional engineering efforts across manufacturing and process teams.
- Supported system validation through Standard/Factory Acceptance Testing (SAT/FAT) to ensure stable operation of electrode manufacturing equipment.

Mixing Process Engineer, Korea HQ

Jul 2021 – Jan

2023

- Supervised industrial-scale slurry mixing processes for cathode and anode electrode materials across multiple production lines.
- Investigated how mixing variables (e.g., shear rate, mixing sequence, and mixing duration) influence slurry rheology, dispersion stability, and downstream coating performance.
- Supported troubleshooting during overseas plant ramp-up, resolving MES data mismatches and operational inconsistencies affecting manufacturing workflows.
- Participated in the technical validation and evaluation of electrode manufacturing systems for international battery production facilities.
- Gained practical insight into process–property relationships in complex, multi-variable materials manufacturing environments.
- Applied statistical process analysis to identify critical process parameters affecting slurry stability.

PUBLICATIONS

1. **Choi, Seunghoon**, Kukro Yoon, Sanggeun Lee, Heon Joon Lee, Jaehong Lee, Da Wan Kim, Min-Seok Kim, Taeyoon Lee, and Changhyun Pang. "Conductive hierarchical hairy fibers for highly sensitive, stretchable, and water-resistant multimodal gesture-distinguishable sensor, VR applications." **Advanced Functional Materials** 29, no. 50 (2019): 1905808.
 - Designed hierarchical conductive microstructures on fiber surfaces to enable stable electrical responses under large mechanical deformation.
 - Quantitatively characterized the relationship between microstructure geometry and electrical transport behavior in stretchable polymer nanocomposites.
 - Selected as **Back Cover Article**; cited **140+ times** on Google Scholar
2. **Choi, Seunghoon**, Junwon Jang, Junho Lee, and Da Wan Kim. "Design and Sensing Frameworks of Soft Octopus-Inspired Grippers Toward Artificial Intelligence." *Biomimetics* **2025**, 10(12), 813. DOI: 10.3390/biomimetics10120813 (Co-first author).
 - Reviewed structural design strategies of bio-inspired soft grippers and their associated sensing architectures.
 - Analyzed how geometric parameters and material selection influence adhesion behavior and sensing performance in soft robotic systems.
 - Discussed integration of soft material systems with feedback-enabled adaptive robotic interfaces.
3. **Choi, Seunghoon**, Hyung-ki Park, Jaehwan Ahn, Keun Ho Lee, and Da Wan Kim. "Pilot clinical study of a biomimetic suction patch for improving wrinkles, elasticity, hydration, and pigmentation via enhanced topical delivery." *Journal of Cosmetic Dermatology* (Accepted), 2026.
 - Engineered biomimetic suction microstructures to enhance conformal skin contact for topical drug delivery.
 - Evaluated the effect of interface mechanics on transdermal delivery efficiency through pilot clinical studies.
 - Quantitatively assessed dermatological indicators including skin elasticity, hydration, and pigmentation.
4. Jeon, Subi, **Seunghoon Choi**, Junwon Jang, Jun Young Shim, and Da Wan Kim. "Octopus-Inspired Adhesive Electrode for Robust EMG-Based Robotic Control under Dry and Wet Conditions." *International Journal of Internet, Broadcasting and Communication*, Vol. 18, No. 1 (2026): 274–284. DOI: 10.7236/IJIBC.2026.18.1.274. (Co-first author)
 - Developed a microstructured adhesive electrode based on suction-cup architectures for stable bio-signal acquisition.
 - Demonstrated improved signal reliability under both dry and wet interface conditions.
5. Jeon, Subi, **Seunghoon Choi**, and Da Wan Kim. "Bio-Inspired Hydrogel Adhesive Electrode Enabling Stimulus-Responsive Electrical Signal Recording in Plant Leaves." *International Journal of Advanced Smart Convergence*, Vol. 15, No. 1 (2026): 241–253. DOI: 10.7236/IJASC.2026.15.1.241. (Co-first author)
 - Developed hydrogel-based adhesive electrodes enabling electrical signal monitoring on biological surfaces.
 - Demonstrated stimulus-responsive electrical signal recording from plant leaves.

PATENTS

1. Fiber-Type Sensor and Its Manufacturing Method

- Patent Number: KR 10-2026011
- Registration Date: September 20th, 2019
- Description
 - Developed a twisted conductive fiber architecture enabling multimodal mechanical sensing.
 - Demonstrated simultaneous detection of stretching, bending, and pressure through dual electrical resistance measurements.
 - Investigated structural factors influencing electrical response behavior in conductive fiber systems.

2. Functional Surgical Suture with Micro-structured Surface and Its Manufacturing Method

- Application No.: KR 10-2019-0061944
- Filing Date: June 5th, 2019
- Description
 - Developed microstructured biodegradable polymer coatings on surgical sutures using thermomechanical patterning.
 - Investigated the influence of surface geometry on mechanical knot retention and polymer degradation behavior.
 - Demonstrated potential applications in enhanced wound healing and drug delivery.

PRESENTATIONS

1. Octopus-Inspired Adhesive Patch for Bio-Signal Monitoring

MRS Fall Meeting, Boston, MA, November 2018

- Designed a microstructured adhesive patch inspired by octopus suction mechanisms for stable attachment to wet and curved surfaces.
- Quantitatively characterized the role of wrinkle microstructures in maintaining adhesion stability under dynamic motion.
- Demonstrated a stretchable conductive interface enabling stable bio-signal monitoring.

2. A Fiber-Based Multimodal Sensor Using Hybrid Nanocomposites for Human Motion Monitoring

The Polymer Society of Korea Fall Meeting, Busan, Korea, November 2017

- Developed stretchable conductive fibers using polyurethane matrices with silver nanowire and carbon black composites.
- Designed a dual electrical resistance sensing mechanism enabling discrimination of multiple mechanical stimuli.
- Demonstrated motion recognition through characteristic electrical signal responses under deformation.

SKILLS

1. Materials Characterization & Structural Analysis

- SEM (EDS), AFM, Optical Microscopy, XRD, FT-IR, UV-Vis Spectroscopy, Surface Morphology Analysis, Contact Angle Measurement

2. Materials Processing & Microstructure Fabrication

- Microstructure Imprinting, Polymer Surface Patterning, Stretchable Polymer Composite Fabrication, Surface Coating Techniques

3. Slurry & Colloidal Systems

- Slurry Rheology, Colloidal Dispersion Stability, Particle Suspension Systems, Industrial Mixing Processes

4. Modeling & Data Analysis

- COMSOL Multiphysics (Finite Element Simulation), MATLAB (Numerical Analysis), Minitab (Statistical Process Control), OriginPro, Excel VBA

5. Programming/Manufacturing System

- Python (PyTorch – basic ML implementation), C++, MATLAB, Manufacturing Execution Systems (MES), Real-Time Database (RTDB), Statistical Process Control (SPC), FAT/SAT