Unhyeon Kang

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Education

Seoul National University Seoul, South Korea
Ph.D. (ongoing), Materials Science and Engineering February 2027 (Expected)
Dissertation title: Chalcogenide-based neuromorphic devices for spiking logic, hardware security, and associative memory (Supervised by Prof. Sangbum Kim)

Korea University Seoul, South Korea
Master of Science in Advanced Materials Engineering February 2023
Thesis title: Transfer-free and catalyst-free graphene thin films produced by plasma electron annealing at low temperatures (Supervised by Prof. Sang Ho Lim) [Link]

Seoul National University of Science and Technology Seoul, South Korea
Bachelor of Science in Chemical Engineering February 2021

Professional Research Experience

Doctoral Researcher, Advanced Computing Devices Lab. 2023 - present
Korea Institute of Science and Technology (KIST), Seoul, South Korea
Principal Investigator: Dr. Suyoun Lee

- Developed SbTe-doped GeSe-based OTS devices, achieving low leakage current and high endurance (> 10^8 cycles) for neuromorphic computing.
- Developed Ag-doped GeSe-based CBRAM devices for artificial synapse.
- (1st author papers) One paper has been accepted in *Nano Letters* and six papers are in prep.
- (Patents) Two domestic patents and two PCT patents have been filed.
- Skills: Device Fabrication, Wafer-level Packaging, Electrical Characterization, PCB Design, Python (PyVISA for equipment control, Pandas for data analysis), MCU (C/C++), LabView

Master's Researcher, Plasma Immersion Ion Implantation Lab. 2021 - 2023
Korea Institute of Science and Technology (KIST), Seoul, South Korea
Principal Investigator: Dr. Seunghee Han

- Low-temperature direct graphene growth on SiO_2 wafer using Plasma Electron Annealing (PEA) which is inspired by Plasma Immersion Ion Implantation and Deposition (PIIID)
- Rapid Thermal Annealing (RTA), dry/wet etching, High-Power Impulse Magnetron Sputtering (HiPIMS)
- Direct User of the KIST characterization analysis equipment (e.g. SEM, EDS, Raman, FIB, XRD, AFM, UV-Vis, Ellipsometry, etc.)

- (1st author papers) One paper has been published in *Vacuum* (2023).
- (Patents) Three domestic patents are granted and one US patent has been filed.
- Skills: Plasma Physics and Vacuum Equipment, Materials Characterization, 3D Modelling

Research Intern, Center for Advanced Biomolecular Recognition Mar - Aug 2020
Korea Institute of Science and Technology (KIST) Seoul, South Korea

- Cell Culture (Lung Cancers) and Cytotoxicity Assay.
- Chemical Analysis (HPLC, UPLC, MS, GC and Western Blot)
- Plasma Physics and Vacuum Equipment, Materials Characterization, 3D Modelling

Patents

- Ion-Based Adaptive Somatosensory Neuron Device & Circuit — PCT, Filed: 2025
- Binary Logic Operation Artificial Neuron Device — PCT, Filed: 2025
- Method and apparatus for manufacturing graphene film — US, Filed: 2022
- Ion-Based Adaptive Somatosensory Neuron Device & Circuit — KR, Filed: 2025
- Binary Logic Operation Artificial Neuron Device — KR, Filed: 2025
- Method and Apparatus for Manufacturing Graphene Film — KR, Granted: 2025.02.07.
- Manufacturing Method of Low-Resistance Film for Interconnects — KR, Granted: 2024.04.17.
- Method for Manufacturing Ferromagnetic Films — KR, Granted: 2022.08.04.
- Manufacturing Method of Refractory Metal Protective Film — KR, Filed: 2022

Awards

- Outstanding Researcher Award, Post-Silicon Semiconductor Institute (PSI), KIST — Dec 2024
- Best Poster Award, ENGE 2024 — Dec 2024
- Oral Presentation Award, KIST-Academia Conference on Research Collabo. — Nov 2024
- Poster Presentation Award, Korean Conference on Semiconductors (KCS) — Feb 2024
- Excellence Award for Start-up Commercialization Idea Incubation, KIST — Aug 2023
- Excellence Award at the Idea Bubbling Contest, KIST — Aug 2021

Publications and Presentations

Selected Manuscripts in Progress (Expected Submission: Q2 2026)

- **U. Kang**, S. Oh, S. Kim, S. Lee*, et al., "Spike-Based Ternary XOR Encryption with True Random Key Generation Using Ovonic Threshold Switches..." (Targeting *Nature Communications*)
- †H.Y. Jeong, **†U. Kang**, H.J. Lee*, S. Lee*, et al., “Multi-Modal Sensory Neurons using Ovonic Threshold Switches...” (Targeting *Advanced Materials*) (†Co-First Author)

- †M.S. Oh, **†U. Kang**, H.J. Lee*, S. Lee*, et al., “Robotics with Artificial Sensory Neurons...” (Targeting *Science Robotics*) (†Co-First Author)
- **U. Kang**, S. Oh, S. Kim, S. Lee*, et al., "In-Materia Hopfield Network..." (Targeting *Nature Electronics*)

Journal Publications (First Author)

2. **[Featured on Cover] U. Kang**, H. Song, S. Kim, S. Yi, S. Kumar*, S. Lee*, et al., "Ovonic switches enable energy-efficient dendrite-like computing", *Nano Letters* 26 (2), 699-706 (2026) [Cover] [DOI]

1. **U. Kang**, S. H. Lim, S. Han*, et al., “Transfer-free and catalyst-free graphene thin films produced by plasma electron annealing at low temperatures”, *Vacuum* 218, 112665 (2023) [DOI]

Journal Publications (Co-Author)

4. S. Oh, **U. Kang**, C. Kim, S. Lee*, et al., "Optimizing reservoir connectivity: A path to high-performance liquid state machines", *Neurocomputing*, 663, 132037 (2026) [DOI]

3. S. Kim, **U. Kang**, T. Seong, S. Lee*, et al., “Artificial Multimodal Neuron with Associative Learning Capabilities: Acquisition, Extinction, and Spontaneous Recovery”, *ACS Applied Materials & Interfaces* 16, 36519–36526 (2024) [DOI]

2. M. Cho, **U. Kang**, S. H. Lim, S. Han*, et al., “α-phase tantalum film deposition using bipolar high-power impulse magnetron sputtering technique”, *Thin Solid Films* 767, 139668 (2023) [DOI]

1. S. Min, **U. Kang**, S. H. Lim, S. Han*, et al., “Low-Resistivity Cobalt and Ruthenium Ultra-Thin Film Deposition Using Bipolar HiPIMS Technique”, *ECS Journal of Solid State Science and Technology* 11, 033006 (2022) [DOI]

Invited Presentations

- **U. Kang**, "Brain-Inspired Electronics and Their Applications", *Korean Physical Society (KPS) Fall Meeting*, Gwangju, Korea (Oct 2025) - Focus Session

Oral Presentations

- **U. Kang**, S. Lee, "Artificial Neural Logic Operators for Energy-Efficient Dendritic Computing", *Korean Conference on Semiconductors (KCS)*, Jeongseon, Korea (Jan. 2026)
- **U. Kang**, S. Kim, S. Yi, S. Kumar, S. Lee, "Neuromorphic Boolean Logic Implementation Using Ovonic Threshold Switch Devices", *Materials Research Society (MRS) Spring*, Seattle, WA, USA (Feb 2025)

- **U. Kang**, S. Lee, "An Artificial Multimodal Neuron with Associative Learning Capabilities: Acquisition, Extinction, and Spontaneous Recovery", *KIST-Academia Conference on Research Collaboration*, Seoul, Korea (Jul 2024)
- **U. Kang**, E. Jung, S. An, J. Yoon, S.H. Lim, S. Han, "Transfer-Free and Catalyst-Free Graphene Thin Film Produced by Plasma Electron Annealing at Low Temperatures", *Korean Vacuum Society (KVS)*, Hoengseong, Korea (Feb 2023)
- **U. Kang**, E. Jung, S. An, S. Han, "Revolutionary Simple Production Method of Transfer-free, Low Temperature, Conductive Graphene Film", *Korean Vacuum Society (KVS)*, Jeju, Korea (Aug 2022)
- **U. Kang**, M. Cho, S. Jeon, S. Han, "Transfer-Free and Low-Temperature Graphene Production", *Korean Vacuum Society (KVS)*, Hoengseong, Korea (Feb 2022)

Posters

- **U. Kang**, S. Lee, "Artificial Neural Logic Operators for Energy-Efficient Dendritic Computing", *KIST-Academia Conference on Research Collaboration*, Seoul, Korea (Jul 2025)
- **U. Kang**, S. Oh, J. Kim, J. Hwang, J. Bang, Y. Lee, S. Lee, "An Artificial Multimodal Neuron with Associative Learning Capabilities: Acquisition, Extinction, and Spontaneous Recovery", *International Conference on Electronic Materials and Nanotechnology for Green Environment (ENGE),* Jeju, Korea (Nov 2024)
- **U. Kang**, S. Kim, Y.W. Lee, S. Oh, J. Kim, J. Hwang, S. Lee, "An Artificial Multimodal Neuron with Associative Learning Capabilities: Acquisition, Extinction, and Spontaneous Recovery", *Korean Conference on Semiconductors (KCS),* Gyeongju, Korea

Professional Memberships

- The Korean Physical Society (KPS, KR)
- The Korean Vacuum Society (KVS, KR)
- Materials Research Society (MRS, US)

Languages

- English (Fluent)
- Korean (Native)
- Chinese (Intermediate)

References

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