<Professor Shinhyun Choi's Lab.>

ENTIS (Emerging Nanoelectronic Technology and Integrated Systems) Lab.

ENTIS

■ **Contact information**

Professor : shinhyun@kaist.ac.kr TEL : +82-42-350-7450

Lab. : E3-2 Room 5215 TEL : +82-42-350-7550

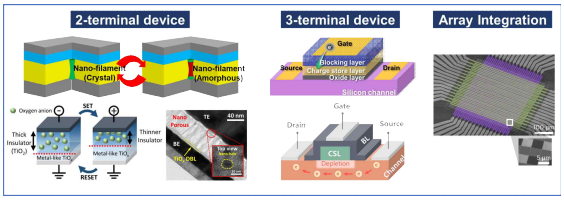
Website : www.shinhyunlab.kaist.ac.kr

■ **Current state of the Lab. (in 2025 Spring Semester)**

Postdoctoral Fellows : 0 PhD Students: 11 Master's Student: 7

■ **Research Areas**

<Developing Emerging Nanotechnology Devices>



Our research team designs, fabricates and evaluates emerging nanoelectronic devices including:

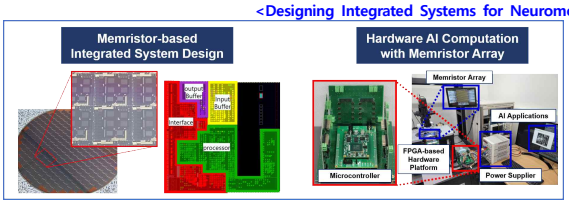
1) 2-terminal devices (RRAM, PCM, etc)

2) 3-terminal field-effect transistor (FET)

3) Array integration of emerging devices

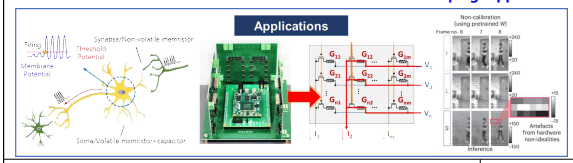
Our devices have garnered attention as possible candidates for various applications, such as neuromorphic computing, new memory technologies and logic devices.

<Designing Integrated Systems for Neuromorphic Computing>



By utilizing emerging device-based computing systems, **our team is working on demonstration of fully integrated systems from artificial neurons to artificial synapses.** Furthermore, we are also working on emerging device-based hardware such as digital/analog peripheral circuits controllers and software development for AI.

<Developing Applications>



Our team is focusing on **how to accurately implement AI inference and learning with low energy consumption using emerging devices.** Another focus of us is how to use applications that can be efficient by utilizing our devices about images, sequence data, security, medical diagnosis and etc.

■ **Recommended courses & Career after graduation**

The major pre-requisites are knowledge in semiconductor device physics, fabrication, and neural networks. However, students majoring CS or circuit are also welcome. Our goal is to help students become key members of academia and industry on a global scale.

■ **Introduction to other activities besides research**

The lab holds annual group parties and joint workshops for perspective collaboration. We also attend international conferences, including MRS, IEDM, and Memrisys. Additionally, we plan to have regular outdoor activities, such as soccer, badminton, and table tennis (participation is not mandatory).

■ **Introduction to the Lab.**

Our research group works on a wide range of multidisciplinary areas, including material sciences, device physics, circuits, and neural network algorithms. This allows students engage in various fields beyond device area. We actively collaborate with both universities and industry partners, providing opportunities for students to be involved in cutting-edge research projects.

■ **Representative recent research achievements ('22~'25)**

- S. Park*, H. Jeong, S. Seo, Y. Kwon, J. Lee†, S. Choi†, ***Nature Communications***, Accepted (2025)
- H. Jeong*, S. Han*, S. Park, T. Kim, J. Bae, T. Jang, Y. Cho, S Seo, H. Jeong, S. Park, T. Park, J. Oh, J. Park, D. Jeon, I. Kwon, Y. Yoon†, S. Choi†, Self-supervised video processing with self-calibration on an analogue computing platform based on a selector-less memristor array, ***Nature Electronics***, 1-11 (2025)
- S. Park*, S. Hong*, S. Sung, D. Kim, S. Seo, H. Jeong, T. Park, W. Cho, J. Kim, and S. Choi†, Phase-change memory via a phase-changeable self-confined nano-filament, ***Nature***, 628, 293–298 (2024)
- J. Bae*, C. Kwon*, S. Park, H. Jeong, T. Park, T. Jang, Y. Cho, S. Kim†, and S. Choi†, Tunable ion energy barrier modulation through aliovalent halide doping for reliable and dynamic memristive neuromorphic systems, ***Science Advances***, 10, 23 (2024)
- S. Seo*, B. Kim*, D. Kim*, S. Park*, T. R. Kim, J. Park, H. Jeong, S. Park, T. Park, H. Shin, M. Kim, Y. Choi, and S. Choi†, The gate injection-based field-effect synapse transistor with linear conductance update for online training, ***Nature Communications***, 13, 6431 (2022)
- S. Park*, H. Jeong*, J. Park*, J. Bae, and S. Choi†, Experimental demonstration of highly reliable dynamic memristor for artificial neuron and neuromorphic computing, ***Nature Communications***, 13, 2888 (2022)
- S. Choi*, S. Park*, S. Seo, and S. Choi†, Reliable multilevel memristive neuromorphic devices based on amorphous matrix via quasi-1D filament confinement and buffer layer, ***Science Advances***, 8, 3 (2022)