<Professor Sanghyeon Kim's Lab.>

3D integrated opto-electronic device Laboratory	■ Contact information		
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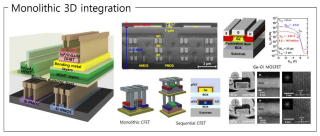
■ **Current state of the Lab. (in 2025 Spring Semester)**

Postdoctoral Fellows : 2 PhD Students: 14 Master's Student: 10

■ **Research Areas** : 3D integrated opto-electronic semiconductor devices (mainly using III-V compound semiconductor and Ge.), which is one of the most promising device research areas toward future 3D integrated systems

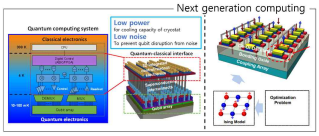
▶ **Monolithic 3D integration**

Monolithic 3D (M3D) integration provides increased bandwidth, smaller power consumption, smaller footprint, and increased functionality. We are exploring layer stacking and device technology to realize stackable 3D devices.



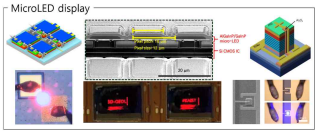
▶ **Next generation computing**

To reduce computing power, we are developing next-generation CMOS devices using III-V, Ge. Not only beyond conventional CMOS under Von-Neumann architecture, we initiated the research on semiconductor devices for artificial neural network / neuromorphic computing. To realize the ultra-low computing, we are developing 3D stackable neuronal and synaptic devices, which would be ultimate device structure minimizing the power consumption in the interconnect as well as the power consumption for computing.



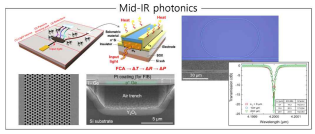
▶ **MicroLED display**

For ultra-small, but ultra-high resolution display, we are developing 3D stacked inorganic MicroLED display using wafer bonding and sequential device fabrication process.



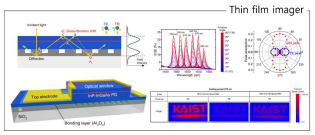
▶ **Mid-IR photonics**

For very compact on-chip gas sensor, we are developing Mid-IR integrated photonics platform using Ge-on-insulator structure.



▶ **Thin film imager**

Ultimate goal of the semiconductor-based hardware system would be a full imitation of the human's function such as feeling emotions, learning, and thinking, etc. To do that with semiconductor-based hardware, sensing the information will be an inevitable functionality. Sensing the visual information is one of the most important features to enable lots of tasks such as pattern recognition, real-time image processing, self-adaptive detecting, etc. Therefore, we are exploring the thin film imager using M3D integration technology.



■ **Recommended courses & Career after graduation**

Any courses about semiconductor devices and solid-state physics, semiconductor integration, photonics are recommended. Career path will include academia, major industries in semiconductor and display, etc. (Four Ph.D. alumni until now: Three academias (Postdoc at KAIST, Harvard, Yale), one industry (Staff engineer at Samsung Electronics))

■ **Introduction to other activities besides research**

We are encouraging students to participate in international and domestic conferences and also internship programs for their experiences. We are also planning to have enjoyable dinner and outer activities regularly.

■ **Introduction to the Lab.**

Prof. Kim opened the lab in KAIST on Feb. 2019. We are doing multi-disciplinary researches on various semiconductor electron and photonic devices with an emphasis on monolithic 3D integration (M3D). To contribute to future M3D semiconductor devices, we are fully supporting students' research and helping to broaden their research scope with world-class infrastructure.

■ **Recent research achievements**

Since the lab opened in 2019, 19 papers and 12 papers have been presented in IEDM and VLSI symposium on Technology and Circuits, respectively. (IEDM, VLSI are the most prestigious conferences in the semiconductor device society)