<Professor Sung-Yool Choi's Lab.>

QMDL
QUANTUM MATERIALS & DEVICES LAB

■ Contact information

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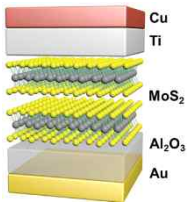
■ Current state of the Lab. (in 2025 Spring Semester)

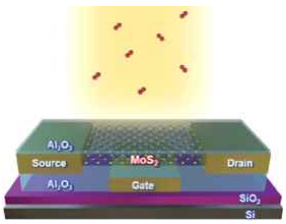
Research Professor: 1 Postdoctoral Fellows : 1 PhD Students: 8 Master's Student: 11

■ Research Areas



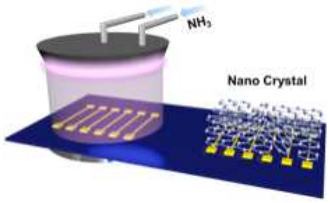
▸ Neuromorphic and Memristor Devices

- Our research focuses on studying and advancing innovative devices for memory, logic, and neuromorphic computing applications, including the next generation of in-memory computing and memristor-based neural network-mimicking devices.
- By employing advanced materials and structural engineering, we aim to enhance the performance of memristors as artificial synapses ans neurons, complemented by comprehensive device-to-system simulations for artificial neural networks.



▸ Electronics based on 2D Materials

- By conducting core technologies compatible with 2D semiconductors—such as precise doping, defect passivation, and material transfer—we are able to meticulously fine-tune transistor performance.
- Furthermore, we also utilize intensive pulsed light (IPL) technology to improve the performance of transistors and synthesize different materials.
- By developing low-power integrated circuits based on two-dimensional semiconductors, we aspire to implement TFT arrays within flexible display backplanes.
- We are also focused on creating advanced optical devices for sensor applications, utilizing two-dimensional materials with diverse bandgaps.



▸Synthesis & Process for 2D or Novel nanomaterials

- Our laboratory employs a diverse array of advanced technologies for the synthesis of semiconductor transition metal dichalcogenides (TMDs) including metallic graphene, molybdenum disulfide (MoS_2), and insulating hexagonal boron nitride (h-BN).
- In addition to traditional chemical vapor deposition (CVD) methods, we are exploring innovative synthesis techniques such as organometallic chemical vapor deposition (MOCVD) and atomic layer deposition (ALD) to transcend the limitations associated with conventional processes.

■ Recommended courses & Career after graduation

We encourage you to take following courses.

- Introduction to Physical Electronics (EE211)
- Semiconductor Devices (EE362)
- Semiconductor IC Technology (EE463)

As of 2024, 7 QMDL alumni hold university professorships, 2 are conducting research at ETRI and KIMM, and 29 are employed by companies such as Samsung Electronics and SK hynix.

■ Introduction to other activities besides research

We develop our research through lively discussions between seniors and juniors in a casual atmosphere. We also invite alumni to present their research and conduct workshops once a semester. In addition, there are many opportunities to attend national and international conferences. Annual events include a strawberry party in April and a year-end party in December.

■ Introduction of the Lab.

Quantum Materials and Devices Lab (QMDL) is focusing on the molecular-scale materials and devices for the next-generation IT-ET-BT convergence technology, spanning the electronics and photonics applications. Our vision of research is "**creative researches to change the world**". All research members can choose creative research topics based on the above-mentioned topics considering students' opinions. **QMDL is mainly supervising GRC (Graphene/2D Materials Research Center), CAMD^3 (Center for Advanced Materials Discovery towards 3D Display), and KAIST-Hansol Center for Advanced Materials and Devices**. Individual member can have opportunities to perform in-depth study by cooperating with other members to achieve outstanding performance.

KAIST GRC 그래핀/2D소재 연구센터
GRC (Since 2012)

KAIST CAMD^3 디스플레이 미래소재 연구센터
CAMD^3 (Since 2016)

KAIST-Hansol Center (Since 2022)

■ Recent research achievements ('22~'25)

Neuromorphic and Memristor Devices

1. Adv. Mater. 37(4), 2413640 (2025)
2. Adv. Funct. Mater. 35(10), 2416811 (2024)
3. ACS Nano, 19(1), 638-648 (2025)
4. Adv. Sci. 11(23), 2308847 (2024)
5. Adv. Funct. Mater. 34, 2305136 (2024)
6. Small. 19, 2300223 (2023)
7. Mater. Horiz. 10, 2035-2046 (2023)
8. Adv. Mater. 35, 2300023 (2023) [Inside Front Cover]

Electronics based on 2D Materials

1. Nano Letter, 25(14), 5731-5740 (2025)
2. Nanoscale, 17(18), 11305-11315 (2025)
3. ACS Appl. Mater. Interfaces. 16(43), 59434 (2024)
4. ACS Appl. Mater. Interfaces. 16(33), 43849 (2024)
5. Nanoscale, 16, 16602 (2024)
6. Small. 20, 2305143 (2024)
7. ACS Photonics. 10, 3027 (2023)
8. ACS Nano. 17, 9262 (2023)

Synthesis & Process for 2D or Novel nanomaterials

1. Adv. Mater. 35, 2305222 (2023) [Supplementary Cover]
2. Adv. Mater. Interfaces. 10, 2300135 (2023)
3. ACS Appl. Nano. Mater. 6, 8981 (2023)
4. ACS Appl. Mater. Interfaces. 14, 43907 (2022)
5. Chem 8, 1014 (2022) [Front Cover]