Euichul Shin

Ph.D.

Department of Materials Science & Engineering

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ACADEMIC TRAINING

Korea Advanced Institute of Science and Technology (CoE PhD Dissertation Award, Top 25) **Korea**
2022-2026 **Ph.D. in Materials Science and Engineering**
Advisor: Prof. Il-Doo Kim

Korea Advanced Institute of Science and Technology **Korea**
2020-2022 **M.S. in Materials Science and Engineering**
Advisor: Prof. Il-Doo Kim

Hanyang University (Summa Cum Laude) **Korea**
2016-2020 **B.S. Materials Science and Engineering**

RESEARCH EXPERIENCE

Korea Advanced Institute of Science and Technology (KAIST)
Postdoctoral Researcher, Department of Materials Science and Engineering | Mar. 2026–Present
Advisor: Prof. Il-Doo Kim

Massachusetts Institute of Technology (MIT)
Visiting Researcher, Department of Materials Science and Engineering | Dec. 2025–Feb. 2026
Advisor: Prof. Harry L. Tuller

RESEARCH INTERESTS

Topic: Developing Nanomaterials for gas-solid reaction chemistry

- Millisecond flash thermal synthesis : Activity enhancements of transition metal dichalcogenide (Core-shell, SACs, few-layered nanoflake).
- Metal catalyst design (Top-down atomization and robust exsolution) on metal oxides.

PROFESSIONAL EXPERTISE

- Chemical synthesis : Sacrificial template-assisted synthesis (Metal oxides nanofiber and nanosheets), flash-thermal synthesis (TMD nanoflakes, TMC nanoparticles) & Organic synthesis (electrospun polymer nanofibers(or yarn), metal-organic frameworks)
- Catalyst design strategies: Exsolution, Top-down Atomization (SACs, HEO, HEA, etc), Redispersion
- Various synthetic techniques : Light-driven Ultrafast Treatments, Electrospinning, Yarn-spinning, Sputtering, Graphene oxide-templated synthesis.
- Material characterization : XRD, XPS, SEM, Raman, TEM, ICP, XAS, IR-temperature detectors
- Applications : Chemiresistive gas sensors, Colorimetric sensors (drug, hydride gases), Breath analysis (alcohol

consumer), Hydrogen evolution reaction

- Custom-built platform : Chemiresistor (gas sensors), Robotic intense pulsed light-photothermal processing platform

PROFESSIONAL SERVICE AND LEADERSHIP

2027	Program Committee : Gordon Research Conferences Gas Sensing & Artificial Olfaction
2025	Program Assistant: Nature Conferences 2025
2024	Program Assistant: KAIST-MIT Future Energy Initiative Symposium
2024	Program Committee: NANOKOREA : ACS Nano Summit 2024
2024	Program Committee: ACS Nano Summit 2024
2023	Program Committee: 4th KAIST Emerging Materials e-Symposium 2023
2022	Program Assistant: Israel Technion-KAIST Joint Workshop
2022	Program Committee: 3rd KAIST Emerging Materials e-Symposium 2022
2021	Program Assistant: 2nd KAIST Emerging Materials e-Symposium 2021
2020	Program Assistant: 1st KAIST Emerging Materials e-Symposium 2020

AWARDS & HONOR

2026	Jonghuen Lee Award at Korea Sensor Society Spring Conference
2026	CoE PhD Dissertation Award at KAIST
2024	Best Presentation Award at Korea Ceramic Society 2024 Fall
2024	Best Poster Award in NANO KOREA 2024 Symposium
2023	KAIST Ethical Leadership Scholarship

JOURNAL ARTICLES

1. **Euichul Shin,** Dong-Ha Kim, Jun-Hwe Cha, Seolwon Yun, Hamin Shin, Jaewan Ahn, Ji-Soo Jang, Jong Won Baek, Chungseong Park, Jaehyun Ko, Seyeon Park, Sung-Yool Choi*, Il-Doo Kim*. Ultrafast ambient-air exsolution on metal oxide via momentary photothermal effect. ***ACS Nano***, **16**, 11, 18133–18142 (2022) **(Supplementary Cover-Featured)**.

2. Jong Won Baek†, **Euichul Shin**†, Jinho Lee†, Dong-Ha Kim, Seon-Jin Choi*, Il-Doo Kim*. Present and Future of Emerging Catalysts in Gas Sensors for Breath Analysis. ***ACS Sensors***, **10**, 1, 33–53 (2025) **(Supplementary Cover-Featured)**.

3. **Euichul Shin**, Dong-Ha Kim, Mingyu Sagong, Jacob Choe, Seo Hak Park, Jaewan Ahn, Jong Won Baek, Minhyun Kim, Sungyoon Woo, Yujang Cho, Seon-Jin Choi, Sang-Joon Kim, Jong Min Yuk, Ju Li, Sung-Yool Choi, Il-Doo Kim*. Flash Thermal Shock Synthesis of Heterostructured Transition Metal Dichalcogenides and Carbides in Milliseconds. ***Advanced Materials***, **37**, 2419790 **(**2025) **(Back Cover-Featured)**.

4. **Euichul Shin**, Jacob Choe, Wonjun Choi, Sanghyeon Park, Chungseong Park, Jong Won Baek, Sungyoon Woo, Mingyu Sagong, Minsu Kim, Chan-Woo Lee, Jong Min Yuk, Sung-Yool Choi, Dong-Ha Kim,* and Il-Doo Kim*. In Situ Single-Atom Decoration of Transition Metal Dichalcogenides by Millisecond Flash Thermal Synthesis toward High Performance Room Temperature Chemiresistors. ***Advanced Materials***, e75106 (2026).

5. **Euichul Shin**†, Dogyeong Jeon†, Hamin Shin, Jun-Hwe Cha, Il-Doo Kim*. Intense Pulsed Light-Driven Flash Thermal-Shock Synthesis: A Frontier Strategy for Ultrafast Nanomaterial Design. ***Accounts of Materials Research*****, 7,** 6, 624–635 (2026).

6. **Euichul Shin**[†], Kichul Lee[†], Ynnsung Lim[†], Inkyu Park[*], Il-Doo Kim[*]. Micro-LED-Activated Formaldehyde Sensing via Au Loading-Regulated Interfacial Engineering in Anatase TiO_2 Nanofibers. ***ACS Nano*** **(In revision)**.
7. **Euichul Shin**[†], Minsu Kim[†], Sanghyeon Park[†], Jong Min Yuk[*], Il-Doo Kim[*]. Millisecond Photothermal Alloying of Transition Metal Dichalcogenides in Ambient Air. ***Advanced Materials*** (**Under review)**
8. **Euichul Shin**, Minsu Kim, Sungyoon Woo, Il-Doo Kim[*], Furnace Reconstruction of Nanoparticles into Single Atoms through Kinetic Trapping and Transient Carbonaceous Stabilization. ***ACS Nano*** **(Under review)**.
9. **Euichul Shin**[†], Jong Won Baek[†], Jacob Choe[†], Jong Min Yuk[*], Il-Doo Kim[*]. Flash Thermal Shock-driven Atomization for Robust Single Atom Catalysts Synthesis on Metal Oxides. **(Manuscript preparation)**
10. **Euichul Shin**, H. L. Tuller[*], Il-Doo Kim[*]. Acidic Oxide-Mediated Pathway Engineering for Selective Gas Sensing. (**Manuscript preparation)**

[CONTRIBUTING AUTHOR]

11. Jong Won Baek, Yoon Hwa Kim, Jaewan Ahn, Dong-Ha Kim, Hamin Shin, Jaehyun Ko, Seyeon Park, Chungseong Park, **Euichul Shin**, Ji-Soo Jang, Il-Doo Kim. Galvanic replacement reaction in perovskite oxide for superior chemiresistors. ***Journal of Materials Chemistry A***, **10**, 43, 23282–23293 (2022).
12. Minki Kim, Min Young Ha, Woo-Bin Jung, Jeesoo Yoon, **Euichul Shin**, Il-doo Kim, Won Bo Lee, YongJoo Kim, Hee-tae Jung. Searching for an optimal multi-metallic alloy catalyst by active learning combined with experiments. ***Advanced Materials***, **34**, 19, 2108900 (2022) **(Back Cover-Featured)**.
13. Hyeonjung Park, Dong-Ha Kim, Boo Soo Ma, **Euichul Shin**, Youngkwon Kim, Taek-Soo Kim, Felix Sunjoo Kim, Il-Doo Kim, Bumjoon Kim. High-Performance, Flexible NO_2 Chemiresistors Achieved by Design of Imine-Incorporated n-Type Conjugated Polymers. ***Advanced Science***, **9**, 14, 2200270 (2022).
14. Lu Song, Jaewan Ahn, Liangliang Xu, Jong Won Baek, **Euichul Shin**, Il-Doo Kim. Facile Synthesis of Co_3O_4/$CoMoO_4$ Heterostructure Nanosheets for Enhanced Acetone Detection. ***ACS Sensors***, **7**, 11, 3540–3550 (2022).
15. Minki Kim, Yesol Kim, Min Young Ha, **Euichul Shin**, Seung Jae Kwak, Minhee Park, Il-Doo Kim, Woo-Bin Jung, Won Bo Lee, YongJoo Kim, Hee-Tae Jung. Exploring optimal water splitting bifunctional alloy catalyst by pareto active learning. ***Advanced Materials***, **35**, 17, 2211497 (2023).
16. Chungseong Park, Jong Won Baek, **Euichul Shin**, Il-Doo Kim. Two-Dimensional Electrically Conductive Metal–Organic Frameworks as Chemiresistive Sensors. ***ACS Nanoscience Au***, **3**, 5, 353–374 (2023) **(Supplementary Cover-Featured)**.
17. Jong Won Baek, Seunghee Han, Sang Eun Lee, Jaewan Ahn, Chungseong Park, Jong Seok Nam, Yoon Hwa Kim, **Euichul Shin**, Minhyun Kim, Ji-Soo Jang, Jihan Kim, Hee Jung Park, Il-Doo Kim. Cobalt-doped ceria sensitizer effects on metal oxide nanofibers: heightened surface reactivity for high-performing chemiresistive sensors. ***ACS Nano***, **18**, 30, 19568–19580 (2024).
18. Donghyun Kim, Jinho Lee, Seongcheol Ahn, Chungseong Park, **Euichul Shin**, Il-Doo Kim. Selective colorimetric sensors and diagnostic microfiber yarn for carbonyl groups via ion-pairing dyes with plural chromatic behaviors. ***Chemical Engineering Journal***, **498**, 155296 (2024).
19. Won-Tae Koo, Sungyoon Woo, **Euichul Shin**, Juyoung Lee, Hyunji Lee, Kang Hee Ku, Sang-Joon

Kim, Il-Doo Kim. Nanoscopic catalyst-loaded porous metal oxide hollow frameworks using porous block copolymer templates for high performance formaldehyde sensors. ***Sensors and Actuators B: Chemical***, **418**, 136282 (2024).

20. Minhyun Kim, Seyeon Park, Jaewan Ahn, Jong Won Baek, Dong-Ha Kim, Hamin Shin, Jaehyun Ko, Lu Song, Chungseong Park, **Euichul Shin**, Il-Doo Kim. Vitalizing Perovskite Oxide-Based Acetone Sensors with Metal–Organic Framework-Derived Heterogeneous Oxide Catalysts. ***ACS Sensors***, **9**, 12, 6492–6501 (2024) **(Supplementary Cover-Featured)**.
21. Chungseong Park, Junhee Woo, Mingyu Jeon, Jong Won Baek, **Euichul Shin**, Jihan Kim, Steve Park, Il-Doo Kim. Dual-MOF Layered Films via Solution Shearing Approach: A Versatile Platform for Tunable Chemiresistive Sensors. ***ACS Nano***, **19,** 9, 8411-8432 (2025).
22. Dogyeong Jeon, Hamin Shin, Jun-Hwe Cha, HongHui Kim, Seohak Park, Jaewan Ahn, Su-Ho Cho, Chungseong Park, Dong-Ha Kim, **Euichul Shin**, Hionsuck Baik, Jihan Kim, Sung-Yool Choi, Il-Doo Kim. Light-Activated Direct-Contact Annealing for Millisecond-Scale Carbon Nanoonion Synthesis. ***ACS Nano***, **19**, 38, 34235-34247 (2025) **(Supplementary Cover-Featured)**.
23. Jianhang Guo, Jong Won Baek, Yeonghun Kang, Dongyoung Kim, Chungseong Park, Junhee Woo, Taoyu Zou, **Euichul Shin**, Qijing Wang, Yong-Young Noh, Steve Park, Jihan Kim, Yun Li, Il-Doo Kim, Kibum Kang. Molecular Sensitizer-loaded Monolayer Organic Semiconductor for High-Performance H_2S Sensors. ***ACS Nano***, **19,** 16, 16175–16187 (2025).
24. Jihwan Chae, Yujang Cho, Jiyeon Yu, Sungyoon Woo, Seongcheol Ahn, Changhoon Ahn, Mingyu Sagong, **Euichul Shin**, Jinyoung Choi, Seung Su Lee, Il-Doo Kim. Self-pumped Hygroscopic Nanofiber Emitter for Ozone-Free Water Electrospray-based Air Purification. ***Advanced Functional Materials*** **36**, 25, e23456 (2026)
25. Wenliang Song, Yuheng Wen, Yujang Cho, Xinzeyu Zhang, Dandan Kang, **Euichul Shin**, Deng-Guang Yu, Guisheng Li, Yaozu Liao, Il-Doo Kim. Advances and Prospects in Multifunctional Composite Fibrous Materials Utilizing Porous Organic Polymers. ***Advanced Materials*** **38,** 4, e13138 (2026) **(Frontispiece-Featured)**.
26. Chungseong Park, Sungyoon Woo, Jong Won Baek, **Euichul Shin**, Minhyun Kim and Il-Doo Kim. Integrating Multidimensional Charge-Transport Pathways in Bimetallic Conductive Metal–Organic Frameworks. ***Advanced Materials (Under review).***
27. Sungyoon Woo, Chungseong Park, Younghun Kim, Mingyu Sagong, Hamin Shin, **Euichul Shin**, Jong Won Baek, Minhyun Kim, Dong Hyuk Kwak, Hyein Park, Jaewan Ahn, Jaehyun Ko, Seyeon Park, Hyunji Lee, Sang-Joon Kim, Jihan Kim, and Il-Doo Kim. Versatile Dual-Ligand Coordination for Stabilizing Platinum Single Atoms on Metal Oxides with Tunable Lewis Acidity. ***Advanced Materials (Under review).***

PRESENTATION

KAIST-MIT Future Energy Initiative Symposium (2024) Boston, USA
International Conference on Electrospinning (2024) Krakow, Poland
International Conference on Electrospinning (2022) Kuala Lumpur, Malaysia
International Nanotech Symposium (2022, 2024) Goyang, Korea
International Conference on Electronic Materials and Nanotechnology for Green Environment(2022) Jeju, Korea
International Conference on Advanced Electromaterials (2021) Jeju, Korea

TECHNICAL SKILLS

Experimental Skills

- Photothermal treatments (metal foils (*e.g.*, Zn, Cu, Al), metal oxides (*e.g.*, TiO_2, Co_3O_4, WO_3, SnO_2, In_2O_3, etc), carbon materials (*e.g.*, graphene oxide, graphene quantum dots, carbon nanotubes, carbon nanofibers, etc)
- Synthesis of polymeric and inorganic nanofibers using electrospinning
- Synthesis of polymeric nanofiber yarn using electrospinning
- Synthesis of metal oxide nanosheets using sacrificial template methods
- Fabrication of thin films using sputtering
- Sensing measurements, including chemiresistive gas sensing, colorimetric sensing, acidic HER.
- Fabrication of a robotics system with photothermal treatments (automated drop coating, drying, and heat treatments)
- Fabrication of a gas sensing system (16 multi-channel)

Analysis Skills
- X-ray Diffraction (XRD)
- X-ray Photoelectron Spectroscopy (XPS)
- X-ray Absorption Fine Structure (XAFS)
- Scanning Electron Microscopy (SEM)
- Transmission Electron Microscopy (TEM)
- Raman analysis
- Fourier Transform Infrared Spectroscopy (FT-IR)
- Ultraviolet-Visible Spectroscopy (UV-Vis)
- Thermogravimetric Analysis (TGA)
- Electron Paramagnetic Resonance (EPR)
- Inductively Coupled Plasma Optical Emission Spectroscopy or Mass Spectrometry (ICP-OES or MS)
- Temperature Programmed Desorption (TPD)
- Temperature profile using IR camera

Other Skills
- Conference Organizing:
- Visualization tools: 3ds Max, VESTA, Blender, Keyshot
- AI-driven tools: Claude-, ChatGPT-based 3D figure modeling, AI-driven EXAFS fitting