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Current position

Seoul National University
Post-doctoral researcher

Seoul, Republic of Korea
2025-current

Education

Seoul National University
Ph.D. Materials Science and Engineering

Seoul, Republic of Korea
2018 –2025

Thesis entitled

"Nanoscale Near-Fields Mapping in a Chiral Plasmonic Nanoparticle via Low-loss EELS in a TEM"

Advisor: Prof. Miyoung Kim

B.S. Materials Science and Engineering
(*Summa Cum Laude*, GPA 4.18/4.3)

2014 - 2018

Research Interest

- **Monochromated low-loss electron energy loss spectroscopy (EELS) analysis**

Investigating the optical properties of materials at the nanoscale using monochromated scanning transmission electron microscopy (STEM) combined with EELS, with a particular focus on mapping plasmonic near-fields in nanoparticles to gain deeper insights into their optical behavior at the nanometer scale. Strong interest in expanding the application of low-loss EELS to achieve a nanoscale understanding of optical, electronic, and vibrational characteristics, as well as material functionalities, across a wide range of materials.

- **Multimodal electron tomography**

Understanding materials' properties in 3D through EELS tomography, which provides volumetric spectroscopic information. Realized 3D plasmonic near-field mapping in a chiral nanoparticle using monochromated low-loss EELS to gain deeper insights into its chiroptical properties. Maintains a strong interest in 1) Applying EELS tomography to investigate optical properties, electronic properties, and valence states of various material systems to uncover their relation to material functionality. 2) Exploring the



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tomography capabilities of other electron-based characterization tools, such as cathodoluminescence and diffraction, to achieve a more comprehensive 3D understanding of material structures and properties.

- **Chirality in light-matter interactions**

Exploring chirally-resolved electron spectroscopy, with a primary focus on plasmonic fields of nanoparticles exhibiting circular dichroism. Currently investigating near-fields of chiral nanoparticles under circularly polarized light using chiral-sensitive electron spectroscopy and photon-induced near-field electron microscopy (PINEM) while illuminating a light pump in ultrafast electron microscopy (UEM), by collaborating with other institutions. Additionally interested in leveraging electron beam shaping to study chirality and exploring enantioselective optoelectronic reactions in various material systems.

Selected Experimental Skills

- **Monochromated electron energy loss spectroscopy**
: Extensive experience in acquiring and interpreting both low-loss and core-loss spectra, with hands-on experience using the Themis Z (Thermo Fisher Scientific, USA).
- **Electron tomography**
: Proficient in acquiring electron tomography data, including image, EDS, and EELS tilt-series, and experienced in reconstructing and analyzing the tomograms.
- **Atomic resolution (S)TEM imaging**
: Skilled in utilizing various imaging techniques, including HAADF, ABF, and iDPC, with precise aberration correction up to higher orders.
- **Programming skills**
: Python (Basic level, able to basic scripting)
Matlab (Proficient, comfortable with scripting and data analysis)
- **4D-STEM analysis**
: Experienced in acquiring and analyzing 4D-STEM dataset.
- **Scanning electron microscopy**
: Basic experience in acquiring secondary electron and backscattered electron images, with hands-on use of the SU-70 (Hitachi, Japan).
- **TEM specimen preparation related skills**
: Hands-on experience in dispersion methods for nanoparticles, FIB lamella sampling, and mechanical polishing.

Publications

1. Han, J. H., Ha, I. H., Cha, J.H., Jo, J., Lv, J., Im, S.W., Cho, S. H., Lim, D., Kim, M., & Nam, K. T. Isotropic Size Control of Chiral Gold Helicoids. *The Journal of Physical Chemistry* (submitted)



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2. Koo, J. W., Yeo, J. B., Jang, J. H., **Jo, J.**, Heo, J., Yoon, J., Jo, Y. I., Ko, C., Lee, M. Y., Hong, J. S., Kim, M. & Nam, K. T. CO₂ Storing Lignin-Clay Brick Strengthened with Minimum Base. *ACS Central Science* (submitted)
3. Kim, I., Lee, G.-B., Kim, S., Jung, H. D., Kim, J.-Y., Lee, T., Choi, H., **Jo, J.**, Kang, G., Oh, S.-H., Kwon, W., Hong, D., Kim, H. G., Lee, Y., Kim, U., Kim, H., Kim, M., Back, S., Park, J., & Joo, Y.-C. Unveiling the reconstruction of copper bimetallic catalysts during electrochemical CO₂ reduction. *Nature Catalysis* (submitted)
4. **Jo, J.**, Ryu, J., Huh, J.-H., Kim, H., Seo, D. H., Lee, J., Kwon, M., Lee, S., Nam, K. T., & Kim, M. (2024). Direct three-dimensional observation of the plasmonic near-fields of a nanoparticle with circular dichroism. *ACS Nano*.
5. Choi, W. I., **Jo, J.**, Choi, S., Hong, J. S., Yoo, I., Randriamahazaka, H., Kim, M., Park, S., & Nam, K. T. (2024). Thin Titanium Nitride Layer-Inserted Porous Ru_{0.3}Sn_{0.35}Ti_{0.35}O_{2-x} Anode for Stable Chlorine Evolution Reaction. *ACS Applied Energy Materials*.
6. Ha, I. H., Kim, R. M., Han, J. H., Im, S. W., **Jo, J.**, Lee, Y. H., Lv, J., Lee, U. C., Ahn, H.-Y., Lee, H.-E., Kim, M. & Nam, K. T. (2024). Synthesis of Chiral Ag, Pd, and Pt Helicoids inside Chiral Silica Mold. *Journal of the American Chemical Society*, 146(45), 30741-30747.
7. Choi, S., Liu, C., Seo, D. H., Im, S. W., Kim, R. M., **Jo, J.**, Kim, J. W., Park, G.-S., Kim, M., Brinck, T. & Nam, K. T. (2024). Kink-Controlled Gold Nanoparticles for Electrochemical Glucose Oxidation. *Nano Letters*, 24(15), 4528-4536.
8. Kim, J.-Y., Ahn, H. S., Kim, I., Hong, D., Lee, T., **Jo, J.**, Kim, H., Kwak, M. K., Kim, H. G., Kang, G., Go, S., Ryu, W. H., Lee, G.-D., Kim, M., Nam, D.-H., Park, E. S. & Joo, Y.-C. (2024). Selective hydrocarbon or oxygenate production in CO₂ electroreduction over metallurgical alloy catalysts. *Nature Synthesis*, 3(4), 452-465.
9. Kim, J., Ko, E., **Jo, J.**, Kim, M., Yoo, H., Son, Y. W., & Cheong, H. (2022). Anomalous optical excitations from arrays of whirlpooled lattice distortions in moiré superlattices. *Nature Materials*, 21(8), 890-895.
10. Ryu, J., Kim, H., Kim, R. M., Kim, S., **Jo, J.**, Lee, S., Nam, K. T., Joo, Y.-C., Yi, G.-C., Lee, J. & Kim, M. (2021). Dimensionality reduction and unsupervised clustering for EELS-SI. *Ultramicroscopy*, 231, 113314.
11. Park, G. S., Min, K. S., Kwon, H., Yoon, S., Park, S., Kwon, J. H., Lee, S., **Jo, J.**, Kim, M. & Kim, S. K. (2021). Strain-Induced Modulation of Localized Surface Plasmon Resonance in Ultrathin Hexagonal Gold Nanoplates. *Advanced Materials*, 33(38), 2100653.

Selected presentations

- **3D imaging of Circular Dichroic Plasmonic Near-Fields Using Polarization-Controlled Photo-Induced Near-Field Electron Microscopy (PINEM)**, Asia-Pacific Microscopy Congress (APMC13) 2025, Brisbane, Australia (Oral presentation)
- **Non-Monochromatic Plasmonic Behavior of Metal Nanoparticle/Dielectric Nanorod Composite Material**, Materials Research Society Fall Meeting 2024, Boston, USA (Poster presentation)



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- **Unraveling surface plasmon peak splitting in silver nanoparticles decorated on ZnO nanorods via monochromated STEM EELS tomography**, International Microscopy Conference 20 2023, Busan, Republic of Korea (Poster presentation)
- **Three-dimensional tomographic imaging simulation of surface plasmon modes of a chiral gold nanoparticle using STEM-EELS**, Materials Research Society Spring Meeting 2022, Honolulu, USA (Oral presentation)
- **Three-dimensional tomographic imaging simulation of surface plasmon modes on a chiral nanoparticle**, Korean Society of Microscopy Fall Meeting 2021, Pyeongchang, Republic of Korea (Oral presentation)
- **Three-dimensional characterization of nanoparticles with simultaneously acquired bright-field, dark-field and secondary electron signals in STEM**, PICO 2021, Virtual (Poster Presentation)
- **Understanding the Physics of Interaction Between Surface Plasmons and Dielectric Matters in Ag/ZnO Nanorod System Using STEM-EELS**, Virtual Materials Research Society Spring/Fall Meeting 2020, Virtual (Oral Presentation)
- **Interpretation of Plasmon Peak Splitting in Silver/ZnO Nanorod Heterostructure via Low-loss EELS Simulation**, Korean Ceramic Conference Spring 2020, Virtual (Oral Presentation)
- **Simulation of geometric effect on plasmons in silver/ZnO system**, European Microscopy Research Society Spring Meeting 2019, Nice, France (Poster Presentation)

Visiting Experience

Ernst-Ruska Center (ER-C) of Forschungszentrum Juelich Institute, Germany

Oct. 2020 – Mar. 2021

- Involved in Q-SORT, the project for orbital-angular-momentum resolving EELS working with Dr. Amir. H. Tavabi, Dr. Enzo Rotunno, Prof. Vincenzo Grillo, Dr. Peter Tiemeijer, and Prof. Rafal D. Borkowski
- STEM-tomography experiment for comparing the tomographic reconstruction of HAADF images and photogrammetric reconstruction of secondary electron images acquired by STEM probe for a chiral nanoparticle

Teaching Experience

Special Lecture in User Training Workshop of Research Institute of Advanced Materials (RIAM, Seoul National University)

Jul. 2021 & Jan. 2022

- 1.5-hour-lecture about introduction to monochromated low-loss electron energy loss spectroscopy including its application and practical issues

Teaching Assistance (TA) for undergraduate 'Mathematics in Engineering' course

Fall 2018

Tutor for undergraduate students in 'Basic Physics' course

2016-2017

- Tutored 12 students in total during their course in "Basic Physics" as a high-achieving student in general physics



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Additional Experience

Gatan EELS & EFTEM analysis virtual training school **Oct. 2020**

**2022 ThermoFisher Scientific Themis Z (3.1) Application Training @Netherland Eindhoven
Nanoport Center** **Oct. 2022**

Scholarships

- **Funded by Scholarship for next generation in fundamental disciplines**
Seoul National University (2022 – current)
- **Fully funded by Gwanjung Scholarship**
Gwanjung Educational Foundation (2018 – 2020)
- **Fully funded by Cheonghap scholarship**
Cheonghap Educational Foundation (2014 – 2017)

Awards

- **Best Presentation Award for graduate students**, 2021 Korean Society of Microscopy Fall Meeting (2021)
- **Best Presentation Award**, Virtual Materials Research Society (MRS) Spring/Fall Meeting 2020 : "Advanced Linear/Nonlinear, Tunable and Quantum Materials for Metasurfaces, Metamaterials and Plasmonics" Symposium (2020)
- **Commendation for the academic achievements**, President of alumni associate of the department (2018)