

# Kunmo Koo, Ph.D.

Senior Research Associate

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## Research Interests and Contributions

- Development, implementation, and application of novel devices and instrumentation for *in situ* electron microscopy to achieve high spatial, temporal, and spectral clarity.
- Nanoscale investigations of liquid-solid, gas-solid, and plasma-solid interfaces.
- Exploring electron beam-mediated reaction chemistry of soft and hard materials.

## Education

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### 2013. 3. - 2020. 8. **Ph.D. in Department of Materials Science and Engineering**

Korea Advanced Institute of Science and Technology (KAIST), Daejeon, Republic of Korea  
Thesis title: "Development of Operando Electron Microscopy Platform for High-Resolution Imaging" (Supervisor: Jong Min Yuk)

### 2009. 2. - 2013. 2. **B.S. in Department of Materials Science and Engineering**

Korea Advanced Institute of Science and Technology (KAIST), Daejeon, Republic of Korea

## Professional Appointments

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2024. 9. - current **Senior Research Associate**, Northwestern University Atomic and Nanoscale Characterization Experimental (NUANCE) Center, Evanston, IL

2021. 7. - 2024. 8. **Postdoctoral Research Associate**, Northwestern University Atomic and Nanoscale Characterization Experimental (NUANCE) Center, Evanston, IL

2020. 8. - 2021. 6. **Post-Doc Researcher**, Interdisciplinary Materials Measurement Institute, Korea Research Institute of Standards and Science (KRISS), Daejeon, Republic of Korea

## Grants and Awards

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2023. 11. **International Institute of Nanotechnology (IIN) Outstanding Researchers Award-Leader Level**, Evanston, IL

2023. 9. **International Microscopy Congress Best Oral Presentation Award**, Busan, Republic of Korea

2023. 4. **Microscopy and Microanalysis Postdoctoral Scholar Award**, Minneapolis, MN

2022. 9. - 2023. 8. **Fostering Next Generation Researcher**, National Research Foundation of Korea (NRF), Republic of Korea

2020. 8. - 2021. 7. **Postdoctoral Fellowship Program for Young Scientists**, National Research Council of Science & Technology (NST), Republic of Korea

## Journal Publications

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1. Y. Liu, **K. Koo**, Z. Mao, X. Fu, X. Hu, and V. P. Dravid, "Unraveling the Adsorption-limited Hydrogen Oxidation Reaction at Palladium Surface via *in situ* Electron Microscopy", *Proceedings of the National Academy of Sciences USA (PNAS)*, 121, 40, e2408277121, 2024 (*Direct Submission*)
  2. **K. Koo**, Y. Liu, Y. Cheng, Z. Cai, X. Hu, and V. P. Dravid, "Advances and Opportunities in the Closed-cell Gas Transmission Electron Microscopy", *Chemistry of Materials*, 36, 9, 4078-4091, 2024 (*Invited Review*)

3. **K. Koo**, N. S. Chellam, S. Shim, C. A. Mirkin, G. C. Schatz, X. Hu, and V. P. Dravid, "Electron-Induced Radiolysis Chemistry in Fluid Cell Electron Microscopy: Application on the Reactivity of Aluminum Nanocubes", *arXiv Preprint*, 2402.17928, 2024
4. **K. Koo**, J. H. Chang, S. Ji, H. Choi, S. H. Cho, S. J. Yoo, J. Choe, H. S. Lee, S. W. Bae, J. M. Oh, H. S. Woo, S. Shin, K. Lee, T. -H. Kim, Y. S. Jung, J. -H Kwon, J. H. Lee, Y. Huh, S. Kang, H. Y. Kim, and J. M. Yuk, "Abnormal Silicon Etching Behaviors in Nanometer-Sized Channels", *Nano Letters*, 24, 16, 4900-4907, 2024 (*Supplementary cover*)
5. **K. Koo**, Z. Li, Y. Liu, S. M. Ribet, X. Fu, Y. Jia, X. Chen, G. Shekhawat, P. J. M. Smeets, R. d. Reis, J. Park, J. M. Yuk, X. Hu, and V. P. Dravid, "Ultrathin Silicon Nitride Microchip for *in-situ/operando* Microscopy with High Spatial Resolution and Spectral Visibility", *Science Advances*, 10, eadj6417, 2024
6. **K. Koo**, B. Shen, S. -I. Baik, Z. Mao, P. J. M. Smeets, I. Cheuk, K. He, R. d. Reis, L. Huang, Z. Ye, C. Mirkin, X. Hu, and V. P. Dravid, "Formation Mechanism of High-index Faceted Pt-Bi Alloy Nanoparticles by Evaporation-induced Growth from Metal Salts", *Nature Communications*, 14, 3790, 2023 (*Selected as Editor's Highlights*)
7. **K. Koo**, S. M. Ribet, C. Zhang, P. J. M. Smeets, R. d. Reis, X. Hu, and V. P. Dravid, "Effect of the Encapsulation Membrane in Operando Scanning Transmission Electron Microscopy", *Nano Letters*, 22, 10, 4137-4144, 2022
8. **K. Koo**, J. Park, S. Ji, S. Toleukhanova, and J. M. Yuk, "Liquid-Flowing Graphene Chip-Based High-Resolution Electron Microscopy", *Advanced Materials*, 33, 2, 2005468, 2021 (*Inside back cover*)
9. **K. Koo**, K. S. Dae, Y. K. Hahn, and J. M. Yuk, "Live Cell Electron Microscopy Using Graphene Veils", *Nano Letters*, 20, 6, 4708-4713, 2020 (*Supplementary cover*)
10. X. San, J. Hu, M. Chen, H. Niu, P. J. M. Smeets, C. D. Malliakas, J. Deng, **K. Koo**, R. d. Reis, V. P. Dravid, and X. Hu, "Unlocking the Mysterious Polytypic Features within Vaterite CaCO<sub>3</sub>", *Nature Communications*, 14, 7858, 2023
11. B. I. Koo, I. Kim, M. Y. Yang, S. D. Jo, **K. Koo**, S. Y. Shin, K. M. Park, J. M. Yuk, E. Lee, and Y. S. Nam, "Protein-induced Metamorphosis of Unilamellar Lipid Vesicles to Multilamellar Hybrid Vesicles", *Journal of Controlled Release*, 331, 187-197, 2021
12. J. Park, **K. Koo**, N. Noh, J. H. Chang, J. Y. Cheong, K. S. Dae, J. S. Park, S. Ji, I. -D. Kim, and J. M. Yuk, "Graphene Liquid Cell Electron Microscopy: Progress, Applications, and Perspectives", *ACS Nano*, 15, 1, 288-308, 2021 (*Invited Review*)
13. N. Noh, J. Park, J. S. Park, **K. Koo**, J. Y. Park, and J. M. Yuk, "Lithographically Patterned Well-Type Graphene Liquid Cells with Rational Designs", *Lab on a Chip*, 20, 15, 2796-2803, 2020
14. K. S. Dae, J. H. Chang, **K. Koo**, J. Park, J. S. Kim, and J. M. Yuk, "Real-time Observation of CaCO<sub>3</sub> Mineralization in Highly Supersaturated Graphene Liquid Cells", *ACS Omega*, 5, 24, 14619-14624, 2020 (*Supplementary cover*)
15. S. Y. Kim, K. S. Dae, **K. Koo**, D. Kim, J. Park, and J. M. Yuk, "Sequential Growth and Etching of Gold Nanocrystals Revealed by High-Resolution Liquid Electron Microscopy", *Physica Status Solidi (a)*, 216, 7, 1970026, 2019 (*Cover picture*)
16. D. J. Lee, H. S. Park, **K. Koo**, J. Y. Lee, Y. S. Nam, W. Lee, and M. Y. Yang, "Gold Binding Peptide Identified from Microfluidic Biopanning: An Experimental and Molecular Dynamics Study", *Langmuir*, 35, 2, 522-528, 2019

### Domestic and International Conference

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1. **K. Koo**, X. Hu, and V. P. Dravid, "Toward Probing Molecular Radiolysis Behavior in Gas Cell Electron Microscopy", Microscopy and Microanalysis 2024, Huntington Convention Center of Cleveland, Cleveland, OH (Jul 28-Aug 1, 2024)
  2. **K. Koo**, X. Hu, and V. P. Dravid, "Ultra-thin (UT) Silicon Nitride Microchip for *in-situ/operando* Microscopy with High Spatial Resolution and Spectral Visibility", Liquid Phase Electron Microscopy Gordon Research Conference, Renaissance Tuscany Il Ciocco, Barga, Italy (Jan 28-Feb 2, 2024)

3. **K. Koo**, X. Hu, and V. P. Dravid, "Palladium-Hydrogen Interactions at the Atmospheric Pressure Enabled by the Ultrathin (UT) Window SiN<sub>x</sub> Gas Cell", the 20<sup>th</sup> International Microscopy Conference, BEXCO, Busan, Republic of Korea (Sep 10-15, 2023)
4. **K. Koo**, P. J. M. Smeets, X. Hu, and V. P. Dravid, "Analytical *in situ* Gas Transmission Electron Microscopy Enabled with Ultrathin Silicon Nitride Membranes", Microscopy and Microanalysis 2023, Minneapolis Convention Center, Minneapolis, MN, USA (Jul 23-27, 2023)
5. **K. Koo**, S. M. Ribet, R. d. Reis, X. Hu, and V. P. Dravid, "Controlled Growth of High-Index Faceted Nanoparticles Using the Gas Phase Environmental Cell TEM", Microscopy and Microanalysis 2022, Oregon Convention Center, Portland, OR, USA (Jul 31- Aug 4, 2022)
6. **K. Koo**, J. H. Chang, S. Ji, J. Choe, S. Shin, G. -T. Lee, T. -H. Kim, and J. M. Yuk, "Etching Dynamics of Geometrically Confined Silicon Nanostructure", Microscopy and Microanalysis 2022, Oregon Convention Center, Portland, OR, USA (Jul 31- Aug 4, 2022)
7. **K. Koo**, and J. -H. Kwon, "Abnormal Melting Behavior of Colloidal Nanoparticles in Liquid Cell Electron Microscope", 2020 Korean Society of Microscopy Fall meeting, Phoenix Pyeongchang, Pyeongchang, South Korea (November 12-13, 2020)
8. **K. Koo**, S.-W. Nam, S. H. Ko, B. Koo, and J. Y. Lee, "Advanced Silicon Nitride Membrane Liquid Chip Design for Observation of Various Nanomaterials in Transmission Electron Microscope", 2017 European Materials Research Society Fall Meeting, Warsaw University of Technology, Warsaw, Poland (September 18-21, 2017)
9. **K. Koo**, K. S. Dae, S. Y. Song, B. Koo, and J. Y. Lee, "A Scanning Electron Microscopic Observation of Living Bacteria in Graphene Liquid Cell", 2016 European Materials Research Society Spring Meeting, Lille Grand Palais, Lille, France (May 2-6, 2016)
10. **K. Koo**, and J. Y. Lee, "A Scanning Electron Microscopic Observation of Living *Escherichia Coli*. in Graphene Liquid Cell", 2015 Materials Research Society Fall Meeting & Exhibit, Hynes Convention Center, Boston, MA, USA (November 30-December 4, 2015)