Dr. Seongmin Jin

Senior Research Scientist
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Professional Summary

- 2024 – Present: Senior research scientist, Korea Institute of Science & Technology (KIST)
- 2021 – 2024: Postdoctoral researcher at EPFL, École Polytechnique Fédérale de Lausanne (EPFL), Switzerland, Supervisor: Prof. Jeremy Luterbacher
- 2015 – 2020 Ph. D. in Chemical and Biomolecular Engineering Yonsei University, Seoul, South Korea, Supervisor: Prof. Chang-Ha Lee

Core Competencies

- Liquid-phase Atomic Layer Deposition (ALD): Precise "atom-by-atom" design of single-atom and atomic cluster catalysts using liquid-phase ALD
- CCU & H_2: Advanced development of CO_2 hydrogenation catalysts (Methanol/Higher alcohols) and Sorption-Enhanced Water-Gas Shift (SE-WGS) processes for high-purity H_2 production.
- Biomass valorization: Upgrading of biomass-derived organic acids and furanic compounds into fuel and commodity chemicals.

Research Highlights: From Atomic Precision to Integrated Processes

Dr. Jin's research bridges fundamental catalyst design and practical process engineering. In the field of CO_2 capture and utilization, he developed adsorbents and catalysts by controlling their structures at atomic as well as macroscopic scales [1-4]. In particular, he has pioneered the design of atomic cluster catalysts via liquid-phase Atomic Layer Deposition (ALD), enabling atomically precise control over catalytic properties and being recognized in high impact journals [3-4]. Expanding into hydrogen energy, he innovated an integrated Sorption-Enhanced Water-Gas Shift (SE-WGS) process, which overcomes thermodynamic constraints via simultaneous in-situ carbon capture to produce ultra-high purity hydrogen [5]. Currently, he is expanding his research scope into biomass valorization, to address the challenges of biomass valorization, focusing on catalyst design for the selective conversion of complex biomass-derived molecules.

Selected Publications

[1] Seongmin Jin, et al., "Direct formation of hierarchically porous MgO-based sorbent bead for enhanced CO_2 capture," *Chemical Engineering Journal*, 2019, 371, 64-77.
[2] Seongmin Jin, et al., "Revisiting magnesium oxide to boost hydrogen production via water-gas shift reaction: Mechanistic study to economic evaluation," *Applied Catalysis B: Environmental*, 2021, 284, 119701.
[3] Seongmin Jin, et al., "Atom-by-atom design of Cu/ZrO_x clusters on MgO for CO_2 hydrogenation using liquid-phase atomic layer deposition," *Nature Catalysis*, 2025, 7, 1199-1212.
[4] Seongmin Jin*, et al., "Controlling Acid Sites in Atomically Precise Cu/Al_2O_3 Clusters for Selective Methanol Production from CO_2 Hydrogenation," *ACS Catalysis*, 2025, 15, 16026–16038.
[5] Seongmin Jin, et al., "Ensemble process for producing high-purity H_2 via simultaneous in situ H_2 extraction and CO_2 capture," *Cell Reports Physical Science*, 2022, 3, 101003.