Jai Hyun Koh, Ph.D.

Senior Research Scientist
Clean Energy Research Center
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EDUCATION

The University of Texas at Austin
Ph.D. in Chemical Engineering with C. Grant Willson and Nathaniel A. Lynd 2019
"Functional Organic Materials for Directed Self-assembly of Silicon-containing Block Copolymers"

Seoul National University
M.S. in Chemical and Biological Engineering with Kookheon Char 2013
B.S. in Chemical and Biological Engineering, *Cum Laude* 2011

APPOINTMENTS

Korea Institute of Science and Technology (KIST)
Senior Research Scientist, Clean Energy Research Center 2020–present
Research Scientist, Clean Energy Research Center 2013–2016

HONORS AND AWARDS

Kwanjeong Educational Foundation Fellowship 2016–2019
Graduate Dean's Prestigious Fellowship, UT Austin 2016–2019
Superior Academic Performance Scholarship, Seoul National University 2012
BK21 Scholarship, National Research Foundation (NRF) of Korea 2011–2012
National Undergraduate S&T Scholarship, Korea Science and Engineering Foundation 2007–2011
Gwangju Institute of Science and Technology (GIST) Scholarship 2006
Bronze Prize, Korean Chemistry Olympiad (KChO) 2005

PUBLICATIONS

[Google Scholar]

28. J. Park†, Y. Chae†, C. Lee, G. J. Kwon, W. H. Lee, H. S. Jeon, J. Cho, D. H. Won*, J. H. Koh*, "Structural engineering of ionomers stabilizes alkaline microenvironments for selective CO_2 electrolysis", In preparation.
27. W. T. Hong†, S. C. Cho†, J. Y. Kim†, G. Yuk, H. Han, Y. I. Song, T.-H. Kim, J. H. Koh*, C.-H. Chung, S. U. Lee*, J. K. Kim*, "Ultralow-overpotential direct CO_2 electrocatalytic reduction to high-efficiency 2-propanol production via steering reaction pathway", Submitted.
26. J. Wang, M. H. Han, K. M. G. Langie, D. H. Won, M.-Y. Lee, C. Oh, H. S. Jeon, J. H. Koh, H.-S. Oh, D. K. Lee, W. H. Lee*, "Understanding the dynamics governing electrocatalytic hydrodeoxygenation of lignin bio-oil to hydrocarbons", *J. Am. Chem. Soc.* **2025**, *147*, 4962–4971, [doi].
25. Y. I. Song†, B. Yoon†, C. Lee, D. Kim, M. H. Han, H. Han, W. H. Lee, D. H. Won, J. K. Kim*, H. S. Jeon*, J. H. Koh*, "Impact of side chains in 1-*n*-alkylimidazolium ionomers on Cu-catalyzed electrochemical CO_2 reduction", *Adv. Sci.* **2024**, *11*, 2406281, [doi].

24. W. Choi, Y. Chae, E. Liu, D. Kim, W. S. Drisdell, H.-S. Oh, J. H. Koh, D. K. Lee, U. Lee, D. H. Won*, "Exploring the influence of cell configurations on Cu catalyst reconstruction during CO_2 electroreduction", *Nat. Commun.* **2024**, *15*, 8345, [doi].
23. J. Y. Kim, W. T. Hong, T. K. C. Phu, S. C. Cho, B. Kim, U. Baeck, H.-S. Oh, J. H. Koh, X. Yu, C. H. Choi, J. Park*, S. U. Lee*, C.-H. Chung, J. K. Kim*, "Proton-coupled electron transfer on $Cu_2O/Ti_3C_2T_x$ MXene for propane (C_3H_8) synthesis from electrochemical CO_2 reduction", *Adv. Sci.* **2024**, *11*, 2405154, [doi].
22. T. K. C. Phu, W. T. Hong, H. Han, Y. I. Song, J. H. Kim, S. H. Roh, M.-C. Kim, J. H. Koh, B.-K. Oh, J. Y. Kim*, C.-H. Chung, D. H. Lee, J. K. Kim*, "Conformal surface intensive doping of low-valence Bi on Cu_2O for highly efficient electrochemical nitrate reduction to ammonia production", *Mater. Today* **2024**, *76*, 52–63, [doi].
21. J. Cho, J. Oh, J. Bang, J. H. Koh, H. Y. Jeong, S. Chung, J. G. Son*, "Roll-to-plate 0.1-second shear-rolling process at elevated temperature for highly aligned nanopatterns", *Nat. Commun.* **2023**, *14*, 8412, [doi].
20. W. H. Lee, K. Kim, J. H. Koh, D. K. Lee, D. H. Won, H.-S. Oh, U. Lee, B. K. Min*, "The green-ol (green-alcohol) economy", *Nano Energy* **2023**, *110*, 108373, [doi].
19. G. S. Park, S. Lee, D.-S. Kim, S. Y. Park, J. H. Koh, D. H. Won, P. Lee, Y. R. Do*, B. K. Min*, "Amorphous TiO_2 passivating contacts for $Cu(In,Ga)(S,Se)_2$ ultrathin solar cells: Defect-state-mediated hole conduction", *Adv. Energy Mater.* **2023**, *13*, 2203183, [doi].
18. J. Park, Y.-J. Ko, C. Lim, H. Kim, B. K. Min, K.-Y. Lee, J. H. Koh, H.-S. Oh*, W. H. Lee*, "Strategies for CO_2 electroreduction in cation exchange membrane electrode assembly", *Chem. Eng. J.* **2023**, *453*, 139826, [doi].
17. K. M. G. Langie, K. Tak, C. Kim, H. W. Lee, K. Park, D. Kim, W. Jung, C. W. Lee, H.-S. Oh, D. K. Lee, J. H. Koh, B. K. Min, D. H. Won*, U. Lee*, "Toward economical application of carbon capture and utilization technology with near-zero carbon emission", *Nat. Commun.* **2022**, *13*, 7482, [doi].
16. M. H. Han, Y.-J. Ko, S. Y. Lee, C. Lim, W. H. Lee, M. W. Pin, J. H. Koh, J. Kim, W. Kim, B. K. Min, H.-S. Oh*, "Thermo-selenized stainless steel as an efficient oxygen evolution electrode for water splitting and CO_2 electrolysis in real water matrices", *J. Power Sources* **2022**, *521*, 230953, [doi].
15. M. H. Han, M. W. Pin, J. H. Koh, J. H. Park, J. Kim, B. K. Min, W. H. Lee*, H.-S. Oh*, "Improving the oxygen evolution reaction using electronic structure modulation of sulfur-retaining nickel-based electrocatalysts", *J. Mater. Chem. A* **2021**, *9*, 27034–27040, [doi].
14. J. H. Koh[†], Q. Zhu[†], Y. Asano, M. J. Maher, H. Ha, S.-S. Kim, H. L. Cater, E. U. Mapesa, J. R. Sangoro, C. J. Ellison, N. A. Lynd, C. G. Willson*, "Unusual Thermal Properties of Certain Poly(3,5-disubstituted styrene)s", *Macromolecules* **2020**, *53*, 5504–5511, [doi].
13. J. Doise, J. H. Koh, J. Y. Kim, Q. Zhu, N. Kinoshita, H. S. Suh, P. R. Delgadillo, G. Vandenberghe, C. G. Willson, C. J. Ellison*, "Strategies for Increasing the Rate of Defect Annihilation in the Directed Self-Assembly of High-χ Block Copolymers", *ACS Appl. Mater. Interfaces* **2019**, *11*, 48419–48427, [doi].
12. J. Doise*, G. Mannaert, H. S. Suh, P. Rincon, J. H. Koh, J. Y. Kim, Q. Zhu, G. Vandenberghe, C. Grant Willson, C. J. Ellison, "Defect mitigation in sub-20 nm patterning with high-chi, silicon-containing block copolymers", *Advances in Patterning Materials and Processes XXXVI* **2019**, *10960*, 93–101, [doi].

11. J. H. Koh†, D. H. Won†, T. Eom†, N.-K. Kim, K. D. Jung, H. Kim*, Y. J. Hwang*, B. K. Min*, "Facile CO_2 Electro-Reduction to Formate via Oxygen Bidentate Intermediate Stabilized by High-Index Planes of Bi Dendrite Catalyst", *ACS Catal.* **2017**, *7*, 5071–5077, [doi].
10. Y. Sung, J. Lim, J. H. Koh, B. K. Min, J. Pyun*, K. Char*, "Arm length dependency of Pt-decorated CdSe tetrapods on the performance of photocatalytic hydrogen generation", *Korean J. Chem. Eng.* **2016**, *33*, 2287–2290, [doi].
9. E. B. Nursanto, H. S. Jeon, C. Kim, M. S. Jee, J. H. Koh, Y. J. Hwang*, B. K. Min*, "Gold catalyst reactivity for CO_2 electro-reduction: From nano particle to layer", *Catal. Today* **2016**, *260*, 107–111, [doi].
8. M. S. Jee, H. S. Jeon, C. Kim, H. Lee, J. H. Koh, J. Cho, B. K. Min*, Y. J. Hwang*, "Enhancement in carbon dioxide activity and stability on nanostructured silver electrode and the role of oxygen", *Appl. Catal. B* **2016**, *180*, 372–378, [doi].
7. Y. Sung, J. Lim, J. H. Koh, L. J. Hill, B. K. Min, J. Pyun*, K. Char*, "Uniform decoration of Pt nanoparticles on well-defined CdSe tetrapods and the effect of their Pt cluster size on photocatalytic H_2 generation", *CrystEngComm* **2015**, *17*, 8423–8427, [doi].
6. H. S. Jeon, J. H. Koh, S. J. Park, M. S. Jee, D.-H. Ko, Y. J. Hwang*, B. K. Min*, "A monolithic and standalone solar-fuel device having comparable efficiency to photosynthesis in nature", *J. Mater. Chem. A* **2015**, *3*, 5835–5842, [doi].
5. H. Yoon*, S. H. Sung, J. H. Koh, S. M. Kim, S.-J. Choi, K. Y. Suh, K. Char*, "Directional step flow across ridges on multiscale two-face prism array", *Macromol. Res.* **2015**, *23*, 145–148, [doi].
4. J. H. Koh, H. S. Jeon, M. S. Jee, E. B. Nursanto, H. Lee, Y. J. Hwang*, B. K. Min*, "Oxygen Plasma Induced Hierarchically Structured Gold Electrocatalyst for Selective Reduction of Carbon Dioxide to Carbon Monoxide", *J. Phys. Chem. C* **2015**, *119*, 883–889, [doi].
3. S. Wooh†, J. H. Koh†, S. Lee, H. Yoon*, K. Char*, "Trilevel-structured superhydrophobic pillar arrays with tunable optical functions", *Adv. Funct. Mater.* **2014**, *24*, 5550–5556, [doi].
2. S. Wooh, H. Yoon, J.-H. Jung, Y.-G. Lee, J. H. Koh, B. Lee, Y. S. Kang*, K. Char*, "Efficient light harvesting with micropatterned 3D pyramidal photoanodes in dye-sensitized solar cells", *Adv. Mater.* **2013**, *25*, 3111–3116, [doi].
1. S. M. Kim†, D. H. Kang†, J. H. Koh, H. S. Suh, H. Yoon*, K.-Y. Suh*, K. Char*, "Thermoresponsive switching of liquid flow direction on a two-face prism array", *Soft Matter* **2013**, *9*, 4145–4149, [doi].

PATENTS

17. "Mixed catalyst electrode for electrochemical production of 2.5-furandicarboxylic acid, manufacture of the same," Lee, D. K.; Woo, J.; Moon, B. C.; Lee, W. H.; Koh, J. H.; Won, D. H.; Lee, U.; Oh, H.-S.; Min, B. K. KR Patent 10-2793233.
16. "Silver chloride nanoparticle, catalyst electrode, electrochemical reactor and system for reduction of carbon dioxide," Won, D. H.; Lee, U.; Oh, H.-S.; Lee, D. K.; Koh, J. H.; Lee, W. H.; Min, B. K.; Chae, Y. KR Patent 10-2707019.

15. “Catalyst-electrode structure and electrochemical reactor using the same and system of utilizing carbon dioxide using the same,” Lee, U.; Won, D. H.; Koh, J. H.; Lee, D. K.; Oh, H.-S.; Lee, H. J.; Min, B. K.; Ko, Y. J.; Kim, C. KR Patent 10-2638399.
14. “Metal-phosphorized catalyst for producing 2,5-furandicarboxylic acid and producing method of 2,5-furandicarboxylic acid using thereof,” Lee, D. K.; Moon, B. C.; Woo, J.; Koh, J. H.; Won, D. H.; Lee, U.; Oh, H.-S.; Min, B. K. KR Patent 10-2543047.
13. “Flow plate for electrochemical carbon dioxide reduction device forming unidirectional flow,” Lee, U.; Kim, C.; Won, D. H.; Koh, J. H.; Oh, H.-S.; Lee, D. K.; Min, B. K. KR Patent 10-2524209.
12. “Silver incorporated chalcopyrite thin film and manufacturing method thereof,” Min, B. K.; Kim, B. W.; Hwang, Y. J.; Oh, H.-S.; Lee, U.; Lee, D. K.; Won, D. H.; Koh, J. H. KR Patent 10-2512512.
11. “Iridium alloy catalyst having reversible catalytic activity and preparation method thereof,” Oh, H.-S.; Lee, W. H.; Min, B. K.; Hwang, Y. J.; Lee, U.; Lee, D. K.; Won, D. H.; Koh, J. H. KR Patent 10-2491462.
10. “A hydrogen production and storage system using solar energy independently operated without external power,” Lee, U.; Min, B. K.; Lee, H. J.; Hwang, Y. J.; Oh, H.-S.; Lee, D. K.; Won, D. H.; Koh, J. H.; Han, D. G. KR Patent 10-2434620.
9. “Carbon dioxide CO_2 recycling electrochemical device,” Lee, U.; Lee, H. W.; Kim, K. S.; Koh, J. H.; Won, D. H.; Lee, D. K.; Oh, H.-S.; Hwang, Y. J.; Min, B. K. KR Patent 10-2418964.
8. “Catalyst electrode, method for manufacturing the catalyst electrode, electrochemical reactor comprising the same and system for reduction of carbon dioxide,” Won, D. H.; Lee, U.; Oh, H.-S.; Lee, D. K.; Koh, J. H.; Min, B. K. KR Patent 10-2409746.
7. “System for reduction of carbon dioxide,” Lee, U.; Won, D. H.; Lee, D. K.; Oh, H.-S.; Koh, J. H.; Min, B. K. KR Patent 10-2399070.
6. “Self-driving electrochemical cell,” Lee, U.; Min, B. K.; Lee, H. J.; Hwang, Y. J.; Oh, H.-S.; Lee, D. K.; Won, D. H.; Koh, J. H.; Kim, K. S. KR Patent 10-2386012.
5. “Electrocatalyst for CO_2 reduction and method for manufacturing the same,” Oh, H.-S.; Lee, W. H.; Lim, C.; Hwang, Y. J.; Lee, U.; Lee, D. K.; Won, D. H.; Koh, J. H. KR Patent 10-2372659.
4. “Photoelectrode for hydrogen generation in solar water splitting and manufacturing method thereof,” Lee, D. K.; Min, B. K.; Kim, B. W.; Hwang, Y. J.; Oh, H.-S.; Lee, U.; Koh, J. H. KR Patent 10-2311750.
3. “Photoelectrochemical artificial photosynthesis device,” Min, B. K.; Hwang, Y. J.; Koh, J. H.; Jeon, H. S. KR Patent 10-2155231.
2. “Carbon dioxide reduction electrode and the preparation method thereof,” Min, B. K.; Koh, J. H.; Hwang, Y. J. KR Patent 10-1636024.
1. “Selective reducing method of carbon dioxide using silicon nanowire and pyridine,” Hwang, Y. J.; Min, B. K.; Joo, O. S.; Koh, J. H.; Sim, S. J.; Jeon, H. S.; Jee, M. S. KR Patent 10-1566471.

RESEARCH GROUP

Current Graduate Students (total = 5):
Jihyun Park, Young In Song, Hyung Rae Kim, Jisoo Park, Won So

Former Graduate Students (total = 1):
Chanwoo Lee (MS, Aug 2023)

Former Undergraduate Students (total = 8):
Insu Jeong (Incheon Nat'l Univ., Feb 2024), Hyeon Ji Kim (Yonsei Univ., Jun 2023), Su Min Choi (Konkuk Univ., Dec 2022), Hyesu Song (Sogang Univ., Dec 2022), Da Young Shim (Hanyang Univ., Aug 2022), Gyeongjin Kwon (Yonsei Univ., Aug 2022), Minju Kang (Ewha Womans Univ., Feb 2022), Kwanwoo Chun (Hanyang Univ., Feb 2022)

SERVICE AND MEMBERSHIP

- Industrial Liaison Officer, KIChE, Polymer Division 2024–present
- Member of Korean Institute of Chemical Engineers (KIChE), Polymer Society of Korea (PSK), American Chemical Society (ACS), American Institute of Chemical Engineers (AIChE)

RESEARCH TALKS AND SEMINARS

16. 2025 ACS Spring National Meeting, "Engineering of side chains in 1-*n*-alkylimidazolium ionomers for CO_2 electrolysis," San Diego, CA, March 27th, 2025.
15. (*Invited*) Seminar, School of Chemical Engineering, Sungkyunkwan University, "Functional ion-containing polymers for selective CO_2 electrolysis," Suwon, Korea, January 7th, 2025.
14. (*Invited*) Seminar, Department of Petrochemical Materials Engineering, Chonnam National University, "Functional ion-exchange polymers for CO_2 electrolysis," Yeosu, Korea, November 25th, 2024.
13. (*Invited*) Departmental Seminar, Department of Chemical and Biological Engineering, Korea University, "Functional polymeric materials for CO_2 electrolysis," Seoul, Korea, November 20th, 2024.
12. (*Invited*) Seminar, Department of Chemical Engineering and Materials Science, Chung-Ang University, "Carbon Capture and Utilization via Electrochemistry," Seoul, Korea, May 13th, 2024.
11. (*Invited*) 16th Korea-China Bilateral Symposium on Polymer Materials, KIChE, "Systematic design and synthesis of 1-alkylimidazolium-containing ionomers for Cu-catalyzed electrochemical CO_2 reduction," Yeosu, Korea, November 14th, 2023.
10. (*Invited*) Seminar, Department of Petrochemical Materials Engineering, Chonnam National University, "Tailoring styrene-based ionomers for enhanced electrochemical CO_2 reduction," Yeosu, Korea, October 5th, 2023.
9. (*Invited*) Seminar, Department of Chemical and Biological Engineering, Sookmyung Women's University, "Functional Materials for Electrochemical CO_2 Reduction," Seoul, Korea, September 27th, 2023.
8. 2023 ACS Fall National Meeting, "Design and synthesis of styrene-based ionomers as binders for electrochemical CO_2 reduction," San Francisco, CA, August 17th, 2023.
7. (*Invited*) Departmental Seminar, Department of Chemical Engineering, Hongik University, "Functional Materials for Electrochemical CO_2 Reduction," Seoul, Korea, November 29th, 2022.
6. (*Invited*) 2022 KIChE Spring Meeting, "Design and synthesis of silicon-containing block copolymers for nanolithography," Jeju, Korea, April 21th, 2022.

5. (*Invited*) 2022 Polymer Society of Korea Spring Meeting, "Functional Organic Materials for Directed Self-assembly of Block Copolymers," Daejeon, Korea, April 8th, 2022.
4. (*Invited*) 2019 ACS Fall National Meeting, "Selective grafting of polymer brushes enables directed self-assembly of high-χ block copolymers," San Diego, CA, August 26th, 2019.
3. 2019 SPIE Advanced Lithography Conference, "Selective grafting of polymer brushes for directed self-assembly of high-χ block copolymers," San Jose, CA, February 27th, 2019.
2. 2015 ACS Fall National Meeting, "Electrochemical CO_2 conversion catalysts for integrated monolithic solar-fuel generators," Boston, MA, August 16th, 2015.
1. 2014 MRS Spring Meeting & Exhibit, "Photoelectrochemical CO_2 Conversion for Fuel Production Powered by Monolithic Thin-Film Photovoltaic Devices," San Francisco, CA, April 24th, 2014.