Jinsoo Kim

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Research Interest

- Research and development of battery electrochemistries based on solid background of materials science
  - Materials design for rechargeable Li-ion and Na-ion batteries
  - Synthesis and fabrications of novel electrode materials and electrolytes
  - Identifying fundamental reaction mechanisms *via* designated characterizations
- Large-scale advanced energy storage devices for heavy applications such as xEVs
  - Lithium-metal batteries: membrane design to stabilize the electrolyte interface for high-energy density energy storage devices
  - Solid-state batteries: fabrication of high-capacity large electrodes for real electrified automotive applications
  - Lithium-air and sodium-air batteries: formulations, evaluations and optimizations of liquid electrolyte based on the intrinsic characteristics of components

Education

- **Seoul National University**, Seoul, Republic of Korea — Mar. 2011 – Feb. 2016
  Ph.D., Department of Materials Science and Engineering (Advisor: Prof. Kisuk Kang)
  - *Dissertations: Fundamental study on reaction mechanism in rechargeable Na-air batteries*
- **Yonsei University**, Seoul, Republic of Korea — Mar. 2008 – Feb. 2010
  M.S., Department of Materials Science and Engineering (Advisor: Prof. Myeongkyu Lee)
  - *Dissertations: Enhancement of conversion efficiency for dye-sensitized solar cell with laser welding for TiO_2 nanoparticle/FTO interface*
- **Yonsei University**, Seoul, Republic of Korea — Mar. 2004 – Feb. 2008
  B.S., Department of Metallurgical Engineering

Research Experience

- **Korea Institute of Energy Research**, Ulsan, Republic of Korea — Sep. 2019 – Present
  Senior Researcher (Ulsan Advanced Energy Technology R&D Center)
  Oxide and polymer based solid-state batteries
  - *Fundamental materials design and practical cell engineering for high-energy storage devices*
  - *Large-scale process development of electrodes and electrolytes for SSBs*
  - *Process development of dry thick electrode for LIB (NST, Chief PI, 2021~2026, ₩11.4B)*
  - *Next-generation battery prototyping center (KIAT, Chief PI,2022~2025, ₩34.9B)*
- **Lawrence Berkeley National Laboratory**, Berkeley, USA — Mar. 2019 – Aug. 2019
  Postdoctoral Scholar (Molecular Foundry Division, Dr. Brett A. Helms, Staff Scientist)
  Lithium-metal batteries
  - *Single-ion conducting and functionalized membranes with molecular design and interface engineering*
  - *Membrane design to stabilize the electrolyte interface for high-energy density energy storage*
- **Hyundai Motor Company**, Hwaseong and Uiwang, Republic of Korea — Feb. 2016 – Mar. 2019
  Senior Research Engineer (Advanced Battery Development Team)
  Senior Research Engineer, Research Engineer (Environmental and Energy Research Team)
  Sulfide based solid-state batteries
  - *Fabrication of high-capacity large electrodes for real electrified automotive applications*
  - *High-capacity nickel-rich cathodes materials and electrodes which are tuned to be utilized for solid-state batteries*
  - *Project lead for developing novel coating materials of cathode surface to stabilize the interface between cathode and solid electrolyte*

  Lithium-air batteries
  - *Formulations, evaluations and optimizations of highly advanced liquid electrolyte based on the intrinsic characteristics of components*
  - *Fabrication of high-capacity / large-area graphitized cathodes*
- **Seoul National University**, Seoul, Republic of Korea — Mar. 2011 – Feb. 2016
  Research Associate (Research Institute of Advanced Materials)
  Research and Teaching Assistant (Department of Materials Science and Engineering)
  Sodium-air batteries
  - *Charge/discharge reaction mechanism and competing electrochemical/chemical reactions in cathodes, electrolytes, and cell system*

- **KAIST**, Daejeon, Republic of Korea — Feb. 2010 – Jan. 2011
  Research and Teaching Assistant (Graduate School of EEWS)
  Dye-sensitized solar cells
  - *Highly Laminated Electrospun ZnO Nanofibrous photoanode on the Transparent Conducting Oxide*
- **Yonsei University**, Seoul, Republic of Korea — Mar. 2008 – Feb. 2010
  Research and Teaching Assistant (Department of Materials Science and Engineering)
  Dye-sensitized solar cells
  - *Enhancement of photocurrent and blocking recombination of charge carriers*

Honors and Awards

- **Young Scientist Award** — May. 2021
  The Korean Society of Industrial and Engineering Chemistry
- **Poster Award** — Dec. 2020
  Korea Institute of Energy Research
- **Team Safety Management Contribution Award** — Dec. 2018
  Hyundai Motor Company
- **Best Poster Award** — May. 2016
  The Korean Society of Industrial and Engineering Chemistry
  Spring Meeting, Republic of Korea
- **Company Scholarship** — Jan. 2015 – Dec. 2015
  LG Chem, Republic of Korea
- **Government Scholarship** — Sep. 2013 – Dec. 2013
  Brain Korea 21 Project, Republic of Korea

Publications (total citation: 3495, h-index: 22 @ Google Scholar, †equal contribution, *corresponding author)

29. You Jin Kim, Ga Yoon Kim, Hyun-Soo Kim, Suji Kim, Bo Ran Kim, Yoo Jung Choi, Jaekook Kim, **Jinsoo Kim**, Won-Hee Ryu*, "Highly conductive ZrO_{2-x} spheres as Bifunctional Framework Stabilizers and Gas Evolution Relievers in Nickel-Rich Layered Cathodes for Lithium-ion batteries" ***Composites Part B: Engineering***, 2022, 109911

28. Donggun Eum, Byunghoon Kim, Jun-Hyuk Song, Hyeokjun Park, Ho-Young Jang, Sung Joo Kim, Sung-Pyo Cho, Myeong Hwan Lee, Jae Hoon Heo, Jaehyun Park, Youngmin Ko, Sung Kwan Park, **Jinsoo Kim**, Kyungbae Oh, Do-Hoon Kim, Seok Ju Kang, Kisuk Kang*, "Coupling structural evolution and oxygen-redox electrochemistry in layered transition metal oxides" ***Nature Materials***, 2022, 758-766

27. Chengyin Fu†, Victor Venturi†, **Jinsoo Kim**†, Zeeshan Ahmad, Andrew W. Ells, Venkatasubramanian Viswanathan, Brett A. Helms*, "Universal chemomechanical design rules for solid-ion conductors to prevent dendrite formation in lithium metal batteries" ***Nature Materials***, 2020, 19, 758-766

26. Myeong Hwan Lee†, Sung Joo Kim†, Donghee Chang, **Jinsoo Kim**, Sehwan Moon, Kyungbae Oh, Kyu-Young Park, Won Mo Seong, Hyeokjun Park, Giyun Kwon, Byungju Lee, Kisuk Kang*, "Toward a low-cost high-voltage sodium aqueous rechargeable battery" ***Materials Today***, 2019, 29, 26-36

25. Youngmin Ko, Hyeokjun Park, **Jinsoo Kim**, Hee-Dae Lim, Byungju Lee, Giyun Kwon, Sechan Lee, Youngjoon Bae, Sung Kwan Park, Kisuk Kang*, "Biological Redox Mediation in Electron Transport Chain of Bacteria for Oxygen Reduction Reaction Catalysts in Lithium–Oxygen Batteries" ***Advanced Functional Materials***, 2019, 29 (5), 1805623

24. Hyeokjun Park, **Jinsoo Kim**, Myeong Hwan Lee, Sung Kwan Park, Do-Hoon Kim, Youngjoon Bae, Youngmin Ko, Byungju Lee, Kisuk Kang*, "Highly Durable and Stable Sodium Superoxide in Concentrated Electrolytes for Sodium–Oxygen Batteries" ***Advanced Energy Materials***, 2018, 8 (34), 1801760

23. Hee-Dae Lim†, Byungju Lee†, Youngjoon Bae, Hyeokjun Park, Youngmin Ko, Haegyeom Kim, **Jinsoo Kim**, Kisuk Kang*, "Reaction Chemistry in Rechargeable Li-O_2 batteries" ***Chemical Society Reviews***, 2017, 46 (10), 2873-2888

22. Youngjoon Bae†, Young Soo Yun†, Hee-Dae Lim, Hongkyung Lee, Yun-Jung Kim, **Jinsoo Kim**, Hyeokjun Park, Youngmin Ko, Sungho Lee, Hyuk Jae Kwon, Hyunjin Kim, Hee-Tak Kim, Dongmin Im, Kisuk Kang*, "Tuning the Carbon Crystallinity for Highly Stable Li–O_2 Batteries" ***Chemistry of Materials***, 2016, 28 (22), 8160-8169

21. Haegyeom Kim, Hyunchul Kim, Hyungsub Kim, **Jinsoo Kim**, Gabin Yoon, Kyungmi Lim, Won-Sub Yoon, Kisuk Kang*, "Understanding Origin of Voltage Hysteresis in Conversion Reaction for Na Rechargeable Batteries: The Case of Cobalt Oxides" ***Advanced Functional Materials***, 2016, 26 (28), 5042-5050

20. Hee-Dae Lim†, Byungju Lee†, Yongping Zheng, Jihyun Hong, **Jinsoo Kim**, Hyeokjo Gwon, Youngmin Ko, Minah Lee, Kyeongjae Cho*, Kisuk Kang*, "Rational design of redox mediators for advanced Li–O_2 batteries" ***Nature Energy***, 2016, 1, 16066

19. **Jinsoo Kim**†, Hyeokjun Park†, Byungju Lee, Won Mo Seong, Hee-Dae Lim, Youngjoon Bae, Haegyeom Kim, Won Keun Kim, Kyoung Han Ryu, Kisuk Kang*, "Dissolution and ionization of sodium superoxide in sodium-oxygen batteries" ***Nature Communications***, 2016, 7, 10760, * *The article was introduced as a title of "Batteries: Discharging the right product" in Nature Energy and several magazines.*

18. Byungju Lee, **Jinsoo Kim**, Gabin Yoon, Hee-Dae Lim, In-Suk Choi, Kisuk Kang*, "Theoretical evidence for low charging overpotentials of superoxide discharge products in metal–oxygen batteries" ***Chemistry of Materials***, 2015, 27 (24), 8406-8413

17. Hee-Dae Lim, Hyeokjun Park, Hyungsub Kim, **Jinsoo Kim**, Byungju Lee, Youngjoon Bae, Hyeokjo Gwon, Kisuk Kang*, "A New Perspective on Li–SO_2 Batteries for Rechargeable Systems" ***Angewandte Chemie International Edition***, 2015, 127 (33), 9799-9803

16. Hee-Dae Lim†, Won Mo Seong†, **Jinsoo Kim**, Byungju Lee, Dong Hoe Kim, Kisuk Kang*, "Nb-doped TiO_2 air-electrode for advanced Li-air batteries" ***Journal of Asian Ceramic Societies***, 2015, 3, 77-81

15. Haegyeom Kim, Jihyun Hong, Young-Uk Park, **Jinsoo Kim**, Insang Hwang, Kisuk Kang*, "Sodium Storage Behavior in Natural Graphite using Ether-based Electrolyte Systems" ***Advanced Functional Materials***, 2016, 25 (4), 534-541

14. Hee-Dae Lim, Hyelynn Song, **Jinsoo Kim**, Hyeokjo Gwon, Youngjoon Bae, Kyu-Young Park, Jihyun Hong, Haegyeom Kim, Taewoo Kim, Yong Hyup Kim, Xavier Lepro, Raquel Ovalle-Robles, Ray H. Baughman, Kisuk Kang*, "Superior rechargeability and efficiency of lithium–oxygen batteries: hierarchical air electrode architecture combined with a soluble catalyst" ***Angewandte Chemie International Edition***, 2014, 53 (15), 3926-3931

13. Byungju Lee, Dong-Hwa Seo, Hee-Dae Lim, Inchul Park, Kyu-Young Park, **Jinsoo Kim**, Kisuk Kang*, "First-principles study of the reaction mechanism in sodium–oxygen batteries" ***Chemistry of Materials***, 2014, 26 (2), 1048-1055

12. Haegyeom Kim†, Hee-Dae Lim†, **Jinsoo Kim**, Kisuk Kang*, "Graphene for advanced Li/S and Li/air batteries" ***Journal of Materials Chemistry A***, 2014, 2 (1), 33-47

11. Hee-Dae Lim, Kyu-Young Park, Hyelynn Song, Eui Yun Jang, Hyeokjo Gwon, **Jinsoo Kim**, Yong Hyup Kim, Marcio D. Lima, Raquel Ovalle Robles, Xavier Lepro, Ray H. Baughman, Kisuk Kang*, "Enhanced Power and Rechargeability of a Li−O_2 Battery Based on a Hierarchical-Fibril CNT Electrode" ***Advanced Materials***, 2013, 25 (9), 1348-1352

10. Hee-Dae Lim, Hyelynn Song, Hyeokjo Gwon, Kyu-Young Park, **Jinsoo Kim**, Youngjoon Bae, Hyungsub Kim, Sung-Kyun Jung, Taewoo Kim, Yong Hyup Kim, Xavier Lepro, Raquel Ovalle-Robles, Ray H. Baughman, Kisuk Kang*, "A new catalyst-embedded hierarchical air electrode for high-performance Li–O_2 batteries" ***Energy & Environmental Science***, 2013, 6 (12), 3570-3575

9. **Jinsoo Kim**, Hee-Dae Lim, Hyeokjo Gwon, Kisuk Kang*, "Sodium–oxygen batteries with alkyl-carbonate and ether based electrolytes" ***Physical Chemistry Chemical Physics***, 2013, 15 (10), 3623-3629

8. Haegyeom Kim, Hyungsub Kim, Sung-Wook Kim, Kyu-Young Park, **Jinsoo Kim**, Seokwoo Jeon, Kisuk Kang*, "Nano-graphite platelet loaded with $LiFePO_4$ nanoparticles used as the cathode in a high performance Li-ion battery" ***Carbon***, 2012, 50 (5), 1966-1971

7. **Jinsoo Kim**, Sanghoon Yoon, Jung-Keun Yoo, Jongsoon Kim, Haegyeom Kim, Kisuk Kang*, "Highly Laminated Electrospun ZnO Nanofibrous Film on the Transparent Conducting Oxide for Photovoltaic Device" ***Journal of Electrochemical Science and Technology***, 2012, 3 (2), 68-71

6. Sanghoon Yoon, Sehyun Tak, **Jinsoo Kim**, Yongseok Jun, Kisuk Kang*, and Jiyoung Park*, "Application of transparent dye-sensitized solar cells to building integrated photovoltaic systems" ***Building and Environment***, 2011, 46 (10), 1899-1904

5. Sung-Wook Kim, Vadam Ganesh Kumar, Dong-Hwa Seo, Young-Uk Park, **Jinsoo Kim**, Haegyeom Kim, Jongsoon Kim, Jihyun Hong, Kisuk Kang*, "Preparation and electrochemical characterization of doped spinel $LiMn_{1.88}Ge_{0.1}Li_{0.02}O_4$ cathode material" ***Electronic Materials Letters***, 2011, 7 (2), 105-108

4. Jongsoon Kim, Young-Uk Park, Dong-Hwa Seo, **Jinsoo Kim**, Sung-Wook Kim, Kisuk Kang*, "Mg and Fe Co-doped Mn based olivine cathode material for high power capability" ***Journal of The Electrochemical Society***, 2011, 158 (3), A250-A254

3. Jonghyun Kim, **Jinsoo Kim**, Myeongkyu Lee*, "Laser-induced enhancement of the surface hardness of nanoparticulate TiO_2 self-cleaning layer" ***Surface and Coatings Technology***, 2010, 205 (2), 372-376

2. **Jinsoo Kim**, Jonghyun Kim, Myeongkyu Lee*, "Laser welding of nanoparticulate TiO_2 and transparent conducting oxide electrodes for highly efficient dye-sensitized solar cell" ***Nanotechnology***, 2010, 21 (34), 345203

1. Hyunkwon Shin, Hyunjun Kim, Hyeongjae Lee, Hyeonggeun Yoo, **Jinsoo Kim**, Hyoungsub Kim, Myeongkyu Lee*, "Photoresist-Free Lithographic Patterning of Solution-Processed Nanostructured Metal Thin Films" ***Advanced Materials***, 2008, 20 (18), 3457-3461

Conferences

25. **Materials Research Society of Korea Fall Meeting**, “Universal Chemomechanical Design Rules for Solid-Ion Conductors to Prevent Dendrite Formation in Lithium Metal Batteries” Gyeongju, Republic of Korea, Nov 11, 2021 (Invited, Poster)
24. **Korea Society of LEDs and Optoelectronics**, “Universal Chemomechanical Design Rules for Solid-Ion Conductors to Prevent Dendrite Formation in Lithium Metal Batteries” Online, Republic of Korea, Aug 8, 2021 (Invited, Oral)
23. **KIER Conference 2020**, “Structure Design and Process Development for Solid-State Battery Pouch Cell” Online, Republic of Korea, Dec 15-18, 2020 (Invited, Poster)
22. **The Korean Society for Composite Materials Fall Meeting**, “Universal Chemomechanical Design Rules for Solid-Ion Conductors to Prevent Dendrite Formation in Lithium Metal Batteries” Gwangju, Republic of Korea, Nov 5-6, 2020 (Invited, Oral)
21. **The Korean Society of Industrial and Engineering Chemistry Fall Meeting**, “Universal Chemomechanical Design Rules for Solid-Ion Conductors to Prevent Dendrite Formation in Lithium Metal Batteries” Gwangju, Republic of Korea, Oct 28-30, 2020 (Invited, Oral)
20. **Korean Electrochemical Society Spring Meeting**, “Universal Chemomechanical Design Rules for Solid-Ion Conductors to Prevent Dendrite Formation in Lithium Metal Batteries” Jeju, Republic of Korea, July 16-18, 2020 (Invited, Oral)
19. **The Korean Ceramic Society Spring Meeting**, “Universal Chemomechanical Design Rules for Solid-Ion Conductors to Prevent Dendrite Formation in Lithium Metal Batteries” Online, Republic of Korea, July 6-9, 2020 (Invited, Oral)
18. **Americas International Meeting on Electrochemistry and Solid State Science (AiMES 2018)**, “Highly Durable and Stable Sodium Superoxide in Concentrated Electrolytes for Sodium–Oxygen Batteries” Cancun, Mexico, September 20-October 4, 2018 (Oral)
17. **Americas International Meeting on Electrochemistry and Solid State Science (AiMES 2018)**, “Biological Redox Mediation for Oxygen Reduction Reaction Catalysts in Lithium–Oxygen Batteries” Cancun, Mexico, September 20-October 4, 2018 (Oral)
16. **International Conference on Electronic Materials and Nanotechnology for Green Environment (ENGE)**, “Tuning the Carbon Crystallinity for Highly Stable Li-O_2 Batteries” Jeju, Republic of Korea, November 6-9, 2016 (Oral)
15. **International Conference on Electronic Materials and Nanotechnology for Green Environment (ENGE)**, “Dissolution and ionization of sodium superoxide (NaO_2) in sodium-oxygen batteries” Jeju, Republic of Korea, November 6-9, 2016 (Oral)
14. **Pacific Rim Meeting on Electrochemical and Solid-state Science 2016 (PRiME 2016)**, “Understanding the Mechanism of Two-Step Discharge Behavior in Lithium Air Batteries with Extremely High Capacity” Honolulu, Hawaii, USA, October 2-7 (Poster)
13. **The Korean Society of Industrial and Engineering Chemistry Spring Meeting**, “Dissolution and ionization of sodium superoxide (NaO_2) in sodium-oxygen batteries” Yeosu, Republic of Korea, May 2-4, 2016 (Poster)
12. **Korean Electrochemical Society Spring Meeting**, “Dissolution and ionization of sodium superoxide (NaO_2) in sodium-oxygen batteries” Gwangju, Republic of Korea, April 7, 2016 (Oral)
11. **International Conference on Electronic Materials and Nanotechnology for Green Environment (ENGE)**, “Redox Mediator & Soluble Catalyst for Rechargeable Li-O_2 Battery” Jeju, Republic of Korea, November 16-19, 2014 (Oral)
10. **International Lithium-Air Battery Symposium (ILABS)**, “Sodium-Oxygen Batteries with Alkyl-carbonate and Ether based Electrolytes” Seoul, Republic of Korea, September xx-xx, 2013 (Poster)
9. **Korean Electrochemical Society Spring Meeting**, “Enhanced power and rechargeability of a Li-O2 battery based on a hierarchical-fibril CNT electrode” Changwon, Republic of Korea, April 12, 2013 (Oral)
8. **Korean Electrochemical Society Spring Meeting**, “Sodium-Oxygen Batteries with Alkyl-carbonate and Ether based Electrolytes” Changwon, Republic of Korea, April 12, 2013 (Oral)
7. **International Lithium-Air Battery Symposium (ILABS)**, “Sodium-Oxygen Batteries with Alkyl-carbonate and Ether based Electrolytes” Seoul, Republic of Korea, September 21, 2012 (Poster)
6. **Korean Battery Society Fall Meeting**, “Highly laminated electrospun ZnO nanofibrous film on the transparent conducting oxide for photovoltaic device” Jeju, Republic of Korea, December 1-3, 2011 (Poster)

5. **Seoul National University-Tohoku University Joint Symposium**, Highly Laminated Electrospun ZnO Nanofibrous Film on Transparent Conducting Oxide for Photovoltaic Device" Sendai, Japan, November 11, 2011 (Oral)

4. **18th International Conference on Photochemical Conversion and Storage of Solar Energy (IPS-18)**, "Morphology Control of Electrospun ZnO Nanowire for Dye Sensitized Solar Cell" Seoul, Republic of Korea, July 25-30, 2010 (Poster)

3. **Materials Research Society Spring Meeting (MRS)**, "Laser Welding of Nanocrystalline Titania and Transparent Conducting Oxide Electrodes for High-Efficiency Solar Cells" San Francisco, USA, April 5-9, 2010 (Poster)

2. **19th International Photovoltaic Science and Engineering Conference and Exhibition (PVSEC-19)**, "Enhancement of Conversion Efficiency for Dye-Sensitized Solar Cell with Laser Welding for TiO_2 nanoparticle/FTO Interface" Jeju, Republic of Korea, November 9-13, 2009 (Poster)

1. **European Materials Research Society Spring Meeting (E-MRS)**, "Enhancement of Conversion Efficiency for Dye-Sensitized Solar Cell with Laser Welding for TiO_2 nanoparticle / FTO interface" Strasbourg, France, June 10, 2009 (Poster)

Patents

8. "Graphite-free composite anode for all-solid state battery and process for preparing thereof" Sang Heon Lee, Sang-Mo Kim, Jaemin Lim, **Jinsoo Kim**, Ju Young Sung, Yongsub Yoon, 1020200056039 (Pending, Korea)

7. "Cathode active material with coating layer formed and manufacturing method thereof" **Jinsoo Kim**, Yongsub Yoon, Jaemin Lim, Sang-Mo Kim, Sang Heon Lee, Hyomyung Lee, Jaephil Cho, 1020180095653 (Pending, Korea)

6. "A binder solution for all solid state battery, electrode slurry comprising the same and a method of preparing all solid state battery using the same" Sang-Mo Kim, Yongsub Yoon, Jaemin Lim, **Jinsoo Kim**, Sang Heon Lee, Yoon Seok Jung, Young Jin Nam, Sung Hoo Jung, Dae Yang Oh, 1020180095653 (Pending, Korea), 16/291,847 (Pending, USA), 102019107269 (Pending, Germany), 201910217286.1 (Pending, China)

5. "Metal air battery" **Jinsoo Kim**, Jongchan Song, 1020170176672 (Pending, Korea), 16/161,767 (Pending, USA)

4. "The metal air battery" **Jinsoo Kim**, 1020170140229 (Pending, Korea)

3. "A sodium air battery comprising high-concentration electrolyte" Kisuk Kang, Hyeonkjun Park, Youngjoon Bae, Won Keun Kim, **Jinsoo Kim**, Kyoung Han Ryu, Ho-Taek Lee, 1020170063848 (Pending, Korea), 15/845,807 (Pending, USA), 201711402729.1 (Pending, China)

2. "A lithium air battery comprising quinone-based soluble catalyst inducing discharge in solution" Kisuk Kang, Youngmin Ko, Won Keun Kim, **Jinsoo Kim**, Kyoung Han Ryu, Ho-Taek Lee, 1020160177581 (Pending, Korea), 15/845,908 (Registered, USA), 201711383198.6 (Pending, China)

1. "Dye-sensitized solar cell of high efficiency and method of manufacturing the same" Myeongkyu Lee, **Jinsoo Kim**, 1010717200000 (Registered, Korea)

Skills

- Materials synthesis
  Solid-state reaction (layered oxides, NCM cathodes) / liquid electrolyte formulation (salt and solvent combinations) / polymer synthesis (polymer of intrinsic microporosity: PIMs), membrane casting (solid electrolyte and polymer),
- Materials characterization
  X-ray diffraction (XRD) / X-ray photoelectron spectroscopy (XPS) / Fourier-transform infrared spectroscopy (FTIR) / Raman spectroscopy / Nuclear magnetic resonance (NMR) / Electron spin resonance (ESR) / Scanning electron microscopy (SEM) / Transmission electron microscopy (TEM) / Atomic force microscopy (AFM) / Differential electrochemical mass spectroscopy (DEMS) / Karl-Fischer titration
- Electrochemical experiment
  Charge-discharge protocol design / Cyclic voltammetry (CV) / Linear sweep voltammetry (LSV) / Electrochemical impedance spectroscopy (EIS) / Galvanostatic intermittent titration technique (GITT) / Potentiostatic intermittent titration technique (PITT) / Rotating disk electrode (RDE) / Rotating ring disk electrode (RRDE) / Three-electrode cell
- Software
  MDI Jade / PANalytical X'Pert HighScore / PerkinElmer Chemoffice / ChemAxon MarvinSketch / OriginLab OriginPro / VESTA / xpspeak / Microsoft Powerpoint / Microsoft Excel / Microsoft Word

References

- **Prof. Kisuk Kang (Professor, Doctoral thesis advisor)**
  - Department of Materials Science and Engineering, Seoul National University, Republic of Korea
  - Ph.D. Department of Materials Science and Engineering, Massachusetts Institute of Technology, USA, 2006
  - Contact information: matlgen1@snu.ac.kr

- **Dr. Brett A. Helms (Staff Scientist, Postdoctoral advisor)**
  - Molecular Foundry Division, Lawrence Berkeley National Laboratory, USA
  - Ph.D. College of Chemistry, University of California Berkeley, USA, 2006
  - Contact information: bahelms@lbl.gov
- **Prof. Myeongkyu Lee (Professor, Master thesis advisor)**
  - Department of Materials Science and Engineering, Yonsei University, Republic of Korea
  - Ph.D. Department of Materials Science and Engineering, Stanford University, USA, 1997
  - Contact information: myeong@yonsei.ac.kr