

JINHYUK LEE

CURRENT POSITION

-
- **Assistant Professor (William Dawson Scholar), Department of Mining and Materials Engineering, McGill University**
M.H. Wong Building, Room 2580, 3610 University Street, Montréal, QC H3A 0C5 | Tel. (514) 398-3613 | Email: jinhyuk.lee@mcgill.ca | Website: <https://www.jinfinityenergylab.com>
 - **Professional Engineer (Materials Engineering) of Ontario (PEO), Canada**

RESEARCH INTERESTS

Rechargeable battery; Renewable energy; Electrochemical materials; Inorganic materials processing; Materials theory; In-situ materials characterization; Computer-aided materials discovery

RESEARCH EXPERIENCES

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| • MCGILL UNIVERSITY | <i>Montréal, QC</i> |
| Assistant Professor, Materials Engineering (PI of the JINfinity Energy Lab) | <i>From Jan. 2020</i> |
| • MASSACHUSETTS INSTITUTE OF TECHNOLOGY | <i>Cambridge, MA</i> |
| Postdoc – Li group (PI: Prof. Ju Li) | <i>July. 2017–Dec. 2019</i> |
| • UC BERKELEY | <i>Berkeley, CA</i> |
| Postdoc – CEDER group (PI: Prof. Gerbrand Ceder) | <i>Jan. 2016–July. 2017</i> |
| • MASSACHUSETTS INSTITUTE OF TECHNOLOGY | <i>Cambridge, MA</i> |
| Postdoctoral Associate – CEDER group (PI: Prof. Gerbrand Ceder) | <i>Sep. 2015–Jan. 2016</i> |
| • MASSACHUSETTS INSTITUTE OF TECHNOLOGY | <i>Cambridge, MA</i> |
| Research Assistant – CEDER group (PI: Prof. Gerbrand Ceder) | <i>Sep. 2010–Sep. 2015</i> |

EDUCATION

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| • MASSACHUSETTS INSTITUTE OF TECHNOLOGY | <i>Cambridge, MA</i> |
| Ph.D. in Materials Science and Engineering | <i>Sep. 2010–Sep. 2015</i> |
| • SEOUL NATIONAL UNIVERSITY | <i>Seoul, Korea</i> |
| B.Sc. in Materials Science and Engineering | <i>Mar. 2004–Feb. 2010</i> |

SELECTED AWARDS & HONORS

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|---|------------------|
| • William Dawson Scholar – Distinguished Professorship at McGill | <i>2023–2028</i> |
| • Wildcat Discovery Technologies – Research Grant (CAD 1.843m for 3 years) | <i>2022–2025</i> |
| • FRQNT Establishment of new university researchers (CAD 61,328 for 2 years) | <i>2022–2024</i> |
| • Canada Foundation for Innovation – John R. Evans Leaders Fund (CFI-JELF) (CAD 879,967) | <i>2021</i> |
| • McGill Sustainability Systems Initiative (MSSI) – Ideas Fund (CAD 40,000) | <i>2021</i> |
| • NSERC Discovery Accelerator Supplement (CAD 40,000/yr for 3 years) | <i>2020–2023</i> |
| • NSERC Discovery Launch Supplement for Early Career Researcher (CAD 12,500) | <i>2020–2021</i> |
| • NSERC Discovery Grant (CAD 38,000/yr for 5 years) | <i>2020–2025</i> |
| • Science Award Electrochemistry (Volkswagen & BASF) – The finalist (5,000 Euro) | <i>2019</i> |
| • Yonsei–Institute for Basic Science (Y-IBS) Academic Symposium – Best Talk Award | <i>2017</i> |

- Materials Research Society Fall Meeting Graduate Student Award – Gold Award 2014
- Samsung Scholarship – ‘Face-of-the-year’ Award 2014
- Samsung Scholarship Open Talk (SSOT) Competition – Best Talk Award 2014
- Samsung Scholarship (USD 250,000) 2010–2015
- Seoul National University: Alumni of Metallurgical Engineering – Presidential Award 2010
- Seoul National University: College of Engineering – Summa Cum Laude 2010
- Seoul National University: Alumni Association of SNU – Presidential Award 2010

PEER-REVIEWED PUBLICATIONS

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- [1] R. Fong, N. Mubarak, S.-W. Park, G. Lazaris, Y. Liu, R. Malik, D.-H. Seo, **J. Lee***, Redox-Engineering of Fe-Rich Disordered Rock-Salt Li-ion Cathode Materials, (Submitted)
 - [2] Y. Huang, Y. Dong, Y. Yang, T. Liu, M. Yoon, S. Li, B. Wang, Y. Sun, Y. Han, J. Ciston, C. Ophus, C. Song, A. Penn, **J. Lee**, Y. Liao, H. Ji, T. Shi, M. Lian, Z. Cheng, J. Xiang, Y. Peng, W.-R. Liu, R. Murugananthan, C.-C. Yang, L. Ma, X. Xiao, Y. Zhu, Q. Li, E. Zheng, A. Harutyunyan, J. Li, Integrated polyanion-rocksalt cathodes with excess lithium and stabilized cycling, (Under review in *Nature Energy*)
 - [3] J. Park, S. Kim, Y. H. Chu, D. Son, **J. Lee**, M. Choi, Y. S. Lee, Configurational entropy driven de-intercalation strategy of iodoplumbate(DMSO)_x complex enabling uniaxial-oriented halide perovskite thin-film for solar cells (Submitted)
 - [4] E. Lee, D.-H. Lee, S. Bessette, S.-W. Park, N. Brodusch, G. Lazaris, R. Malik, R. Gauvin, D.-H. Seo*, **J. Lee***, Nearly All-Active-Material Cathodes free of Nickel and Cobalt for Li-Ion Batteries, (Under review in *Nature Sustainability*) (***corresponding**)
 - [5] M. Woo, **J. Lee**, G. P Demopoulos, Surface and bulk defect formation during hydrothermal synthesis of LiCoPO₄ crystals and their electrochemical implications, *Materials Advances*, DOI: 10.1039/D3MA00455D (2023)
 - [6] E. Lee, T.-U. Wi, J. Park, S.-W. Park, D. H. Lee, M.-H. Kim, B.-C. Park, C. Jo, R. Malik, T. J. Shin, S. J. Kang, H.-W. Lee*, **J. Lee***, D.-H. Seo*, Nanocomposite engineering of a high-capacity partially ordered cathode for Li-ion batteries, *Advanced Materials* (2023) <https://doi.org/10.1002/adma.202208423> (***corresponding**)
 - [7] M. Wang, X. Chen*, H. Yao*, G. Lin, **J. Lee***, Y. Chen*, Q. Chen, Research Progress in Lithium-excess Disordered Rock-salt Oxides cathode, *Energy & Environmental Materials* 5, 1139-1154 (2022) (***corresponding**)
 - [8] T. Khudiyev, B. Grena, G. Loke, C. Hou, H. Jang, **J. Lee**, G. H. Noel, J. Alain, J. Joannopolous, K. Xu, J. Li, Y. Fink, J. T. Lee, Thermally drawn rechargeable battery fiber enables pervasive power, *Materials Today* 52, 80-89 (2022)
 - [9] H. Li, R. Fong, M. Woo, H. Ahmed, D.-H. Seo, R. Malik, **J. Lee***, Towards high-energy Mn-based disordered-rocksalt Li-ion cathodes, *Joule* 6, 53-91 (2022) (***corresponding**)
 - [10] C. Wang, A. S. Helal, Z. Wang, J. Zhou, X. Yao, Y. Ren, **J. Lee**, J.-K. Chang, B. Fugetsu, J. Li, Uranium in-situ electrolytic deposition using a reusable functional graphene-form electrode, *Advanced Materials* 33, 2102633 (2021)
 - [11] **J. Lee***, C. Wang, R. Malik, Y. Dong, Y. Huang, D.-H. Seo*, Ju Li*, Determining the criticality of Li-excess for disordered-rocksalt Li-ion battery cathodes, *Advanced Energy Materials* 11 (24), 2100204 (2021) (***corresponding**)
 - [12] M. Wang, Y. Wu, M. Qiu, X. Li, C. Li, R. Li, J. He, G. Lin, Q. Qian, Z. Wen, X. Li*, Z. Wang*, Q.

- Chen*, Q. Chen*, **J. Lee***, Y.-W. Mai*, Y. Chen*, Research progress in electrospinning engineering for all-solid-state electrolytes of lithium metal batteries, *Journal of Energy Chemistry* **61**, 253-268 (2021) (***corresponding**)
- [13] D. Kwon†, **J. Lee†**, N. Artrith, L. Wu, H. Kim, Z. Lun, Y. Tian, Y. Zhu, G. Ceder, The impact of surface structure transformation on the performance of Li-excess cathodes, *Cell Reports Physical Science* **1**, 100187 (2020) (**†equal contributions**)
- [14] Z. Zhu, R. Gao, I Waluyo, Y. Dong, A. Hunt, **J. Lee**, J. Li, Stabilized Co-free Li-rich oxide cathode particles with an artificial surface prereconstruction, *Advanced Energy Materials* **10** (35), 2001120 (2020).
- [15] **J. Lee**, D. Yu, Z. Zhu, X. Yao, C. Wang, Y. Dong, R. Malik, J. Li, Kinetic rejuvenation of Li-rich Li-ion battery cathodes upon oxygen redox, *ACS Applied Energy Materials* **3** (8), 7931-7943 (2020).
- [16] Y. Huang, Y. Dong, S. Li, **J. Lee**, C. Wang, Z. Zhu, W. Xue, Y. Li, J. Li, Lithium manganese spinel cathodes for lithium-ion batteries: Past understanding and future implications, *Advanced Energy Materials* **11**, 202000997 (2020).
- [17] Z. Zhu, D. Yu, Y. Yang, C. Su, Y. Huang, Y. Dong, I. Waluyo. B. Wang, A. Hunt, X. Yao, **J. Lee**, W. Xue, J. Li, Gradient Li-rich oxide cathode particles immunized against oxygen release by a molten salt treatment, *Nature Energy* **4** (12), 1049-1058 (2019)
- [18] Z. Lun, B. Ouyang, D. A. Kitchaev, R. J. Clément, J. K. Papp, M. Balasubramanian, Y. Tian, T. Lei, T. Shi, B. D. McCloskey, **J. Lee***, G. Ceder*, Improved cycling performance of Li-excess cation-disordered cathode materials upon fluorine substitution, *Advanced Energy Materials* **9**, 1802959 (2019) (***corresponding**)
- [19] R. J. Clément, D.A. Kitchaev, **J. Lee**, G. Ceder, Short-range order and unusual modes of nickel redox in a fluorine-substituted disordered rocksalt oxide lithium-ion cathode, *Chemistry of Materials* **30** (19), 6945–6956 (2018)
- [20] H. Kim, D.-H. Seo, A. Urban, **J. Lee**, D.-H. Kwon, S.-H. Bo, T. Shi, J. K. Papp, B. D. McCloskey, G. Ceder, Stoichiometric layered potassium transition metal oxide for rechargeable potassium batteries, *Chemistry of Materials* **30** (19), 6352–6539 (2018).
- [21] D.A. Kitchaev, Z. Lun, W. D. Richards, H. Ji, R. J. Clément, M. Balasubramanian, D.-H. Kwon, K. Dai, J. K. Papp, T. Lei, B. D. McCloskey, W. Yang, **J. Lee**, G. Ceder, Design principles for high transition metal capacity in disordered rocksalt Li-ion cathodes. *Energy & Environmental Science* **11**, 2159–2171 (2018).
- [22] **J. Lee***, D. A. Kitchaev, D.-H. Kwon, C.-W. Lee, J. K. Papp, Y.-S. Liu, Z. Lun, R. J. Clément, T. Shi, B. D. McCloskey, J. Guo, M. Balasubramanian, G. Ceder*, Reversible $\text{Mn}^{2+}/\text{Mn}^{4+}$ double redox in lithium-excess cathode materials. *Nature* **556**, 185–190 (2018). (***corresponding**)
- [23] **J. Lee**, J. K. Papp, R. J. Clément, S. Sallis, D.-H. Kwon, T. Shi, W. Yang, B. D. McCloskey, G. Ceder, Mitigating oxygen loss to improve the cycling performance of high capacity cation-disordered cathode materials. *Nature Communications* **8**, 981 (2017).
- [24] D.-H. Seo†, **J. Lee†**, A. Urban, R. Malik, SY. Kang, G. Ceder, The structural and chemical origin of the oxygen redox activity in layered and cation-disordered Li-excess cathode materials. *Nature Chemistry* **8**, 692–697 (2016). (**†equal contributions**)
- [25] **J. Lee**, D.-H. Seo, M. Balasubramanian, N. Twu, X. Li, G. Ceder, A new class of high capacity cation-disordered oxides for rechargeable lithium batteries: Li–Ni–Ti–Mo oxides. *Energy & Environmental Science* **8**, 3255–3265 (2015).

- [26] R. Wang, X. Li, L. Liu, **J. Lee**, D.-H. Seo, S.-H. Bo, A. Urban, G. Ceder, A disordered rock-salt Li-excess cathode material with high capacity and substantial oxygen redox activity: $\text{Li}_{1.25}\text{Nb}_{0.25}\text{Mn}_{0.5}\text{O}_2$. *Electrochemistry Communications* **60**, 70–73 (2015).
- [27] N. Twu, X. Li, A. Urban, M. Balasubramanian, **J. Lee**, L. Liu, G. Ceder, Designing new lithium-excess cathode materials from percolation theory: Nanohighways in $\text{Li}_x\text{Ni}_{2-4x/3}\text{Sb}_{x/3}\text{O}_2$. *Nano Letters* **15** (1), 596–602 (2015).
- [28] A. Urban, **J. Lee**, G. Ceder, The configurational space of rocksalt-type oxides for high-capacity lithium battery electrodes. *Advanced Energy Materials* **4**, 1400478 (2014).
- [29] **J. Lee**, A. Urban, X. Li, D. Su, G. Hautier, G. Ceder, Unlocking the potential of cation-disordered oxides for rechargeable lithium batteries. *Science* **343**, 519–522 (2014).
- [30] A. Jain, G. Hautier, C. Moore, B. Kang, **J. Lee**, H. Chen, N. Twu, G. Ceder, A computational investigation of $\text{Li}_9\text{M}_3(\text{P}_2\text{O}_7)_3(\text{PO}_4)_2$ (M=V, Mo) as cathodes for Li ion batteries. *Journal of the Electrochemical Society* **159**, A622–A633 (2012).

PATENTS

- [1] D.-H. Seo, E. Lee, S.-W. Park, D.-H. Lee, **J. Lee**, Manufacturing method for disordered rocksalt-cathode active material and manufacturing method for cathode material use, UTP23124KR-00 (South Korea), 10-2023-0089965 (2023)
- [2] D.-H. Seo, E. Lee, S.-W. Park, D.-H. Lee, **J. Lee**, Cathode material based on disordered rock salt structure and secondary battery comprising the same, UTP23128KR-00 (South Korea), 10-2023-0089961(2023)
- [3] G. Ceder, **J. Lee**, High-capacity lithium metal oxyfluorides with combined metal and oxygen redox for Li-ion battery cathodes, U.S. Patent Application No. 16/613,731 (2020)
- [4] G. Ceder, **J. Lee**, Fluorine substitute cation-disordered lithium metal oxides and methods of making same, U.S. Patent Application No. 16/500666 (2020)
- [5] G. Ceder, **J. Lee**, D.-H. Seo, Cation-disordered oxides for rechargeable lithium batteries and other applications, U.S. Patent Application No. 15/748,704 (2021)
- [6] G. Ceder, **J. Lee**, D.-H. Seo, Cation-disordered oxides for rechargeable lithium batteries and other applications, European Patent Application No, EP3136478A1 (2017)
- [7] G. Ceder, **J. Lee**, A. Urban, X. Li, S. Kim, G. Hautier, High-capacity positive electrode active material, U.S. Patent No. US 9,780,363 B2 (2017)
- [8] G. Ceder, **J. Lee**, S. Kim, X. Li, G. Hautier, Molybdenum oxides and uses thereof, U.S. Patent No. US 9,960,417 B2 (2018)

PRESENTATIONS

- [1] **J. Lee**, Composition engineering for Ni- and Co-free cation-disordered cathode materials for Li-ion batteries, Invited talk for the ECS student chapter of **Virginia Institute of Technology**, USA (2023)
- [2] **J. Lee**, Multiscale materials engineering for sustainable Li-ion batteries, Invited talk at the **University of Michigan Ann Arbor**, USA (2023)
- [3] **J. Lee**, Materials and electrode engineering for high-energy cobalt- and nickel-free Li-ion batteries, Invited talk at the **SMEQ workshop**, Cancun, Mexico (2023)
- [4] **J. Lee**, Opportunities and challenges of practical high-energy disordered rock-salt Li-ion cathodes, Invited talk at the **Seoul National University**, South Korea (2023)

- [5] **J. Lee**, The Chemical Space of High-Energy Ni/Co-Free Li-ion Battery Cathode Materials, Invited talk at the **Nano Korea 2023**, South Korea (2023)
- [6] **J. Lee**, D.-H. Seo, E. Lee, Nanocomposite Engineering of High-Capacity Partially Ordered Cathode Materials for Li-Ion Batteries, Oral presentation at the **243rd ECS meeting**, Atlanta, USA (2023)
- [7] **J. Lee**, Towards Co- and Ni-free Li-ion cathode materials, Invited talk at the **Center of Excellence – Symposium 2022, Hydro Quebec**, Canada (2022)
- [8] **J. Lee**, Particle Size and Transition-Metal Chemistry Determine the Impact of Li-Excess on Disordered Rock-Salt Li-Ion Cathode Materials, Digital presentation at the **242nd ECS meeting**, Atlanta, USA (2022)
- [9] **J. Lee**, Designing sustainable Li-ion battery materials and their outlook, Invited talk at the **Research Institute of Industrial Science and Technology**, South Korea (2022)
- [10] **J. Lee**, The opportunities of disordered rock-salt cathodes for sustainable Li-ion batteries, Invited talk at the 2022 **Canada-Korea Conference (CKC)** on Science and Technology (2022)
- [11] **J. Lee**, Opportunities of Co-free Li-ion cathodes, Invited talk at the **Sungkyunkwan University** (2022)
- [12] **J. Lee**, Towards Co-free Li-ion batteries, Invited talk at the **Pukyung National University** (2022)
- [13] **J. Lee**, Towards sustainable Li-ion batteries, Invited talk at the **Korea Advanced Institute of Science & Technology (KAIST)**, South Korea (2022)
- [14] **J. Lee**, The opportunities and challenges of disordered-rocksalt cathodes for sustainable Li-ion batteries, Invited talk at the **Dalhousie University** (2021)
- [15] **J. Lee**, The strategies towards high-capacity Co-free Li-ion cathode materials, Invited talk at the **Seoul National University** (2021)
- [16] **J. Lee**, Dual roles of Li-excess for disordered-rocksalt Li-ion battery cathodes, Oral presentation at the **240th ECS meeting** (2021)
- [17] **J. Lee**, Reevaluating the criticality of Li-excess for disordered-rocksalt Li-battery cathodes, Oral presentation at the **239th ECS meeting** (2021)
- [18] **J. Lee**, Kinetic rejuvenation of Li-rich layered and disordered-rocksalt Li-ion battery cathodes upon oxygen redox, Oral presentation at the **239th ECS meeting** (2021)
- [19] **J. Lee**, Reinventing cathode chemistries for Co-free Li-ion batteries, Invited talk at the **Ulsan National Institute of Science and Technology** (2020)
- [20] **J. Lee**, Toward Co-free Li-ion batteries, Invited talk at the **Stevens Institute of Technology** (2020)
- [21] **J. Lee**, Disordered-rocksalt cathode materials for sustainable and high performing Li-ion batteries, Science Award Electrochemistry, held by Volkswagen and BASF (2019)
- [22] **J. Lee**, Designing resource-friendly battery materials based on experiments and modeling, Invited talk at the Stanford University (2019)
- [23] **J. Lee**, Expanding the chemical space of high capacity Li-ion cathodes: Rise of the cation-disordered cathode materials, Invited talk at the Columbia University (2018)

PROFESSIONAL ACTIVITIES

- [1] **Early Career Researcher (ECR) Editorial Board** (2023-2025) of *Materials Today Energy*
- [2] **Symposium organizer** of the 2023 PACRIM Young Scholars Forum (S28)
- [3] **Symposium organizer** of the Materials Research Society (MRS) 2023 Spring meeting
- [4] **Early Career Researcher Advisory Board member** of *Materials Today Energy*
- [5] **Symposium chair** (Energy and Environmental Materials) of COM 2022 (Montreal)

- [6] **Invited Guest Editor**, *Processes* of MDPI (2022)
- [7] **Scientific Advisor** of *Neo Battery Materials*, a Canadian Battery Material Company at Vancouver (From June 2021)
- [8] **The Engineering Representative on the Council of Graduate and Postdoctoral Studies (CGPS)**, McGill University (From May 2020)
- [9] Journals reviewer – *Nature Materials*; *Nature Communications*; *Joule*; *Chemistry of Materials*; *ACS Applied Materials & Interfaces*; *Nano-Micro Letters*; *Electrochimica Acta*; *Advanced Materials*, *Advanced Energy Materials*
- [10] Member of The Materials Research Society (MRS) and The Electrochemical Society (ECS)
- [11] One of 30 official mentors of the Samsung Presidential Scholars (from 2020)

TEACHING

- (MIME 212) Engineering Thermodynamics
- (MIME 260) Materials Science and Engineering
- (MIME 317) Analytical and Characterization Techniques
- (MIME 610/710) Electrochemistry for Energy Applications
- (MIME 670/771) Research Seminar

STUDENTS & POSTDOCS SUPERVISION

Current graduate students

- Hoda Ahmed (from Sep. 2020, Ph.D. program, FRQNT Doctoral Research Scholarship awardee)
- Richie Fong (from Sep. 2021, Ph.D. program)
- Gregory Lazaris (from Sep. 2021, Ph.D. program)
- Pablo Treviño Lara (from Sep. 2023, Ph.D. program)
- Wenqi Jia (from Sep. 2023, Ph.D. program)
- Vlad Vasylyev (from Dec. 2023, Ph.D. program)
- Yixuan Zhang (from Sep. 2023, M.Sc. program)

Current postdocs

- Nauman Mubarak (from Feb. 2023)
- Hailemariam Kassa Bezabh (from April 2023)

Current undergraduate students

- Vivienne Liu (COOP from Sep. 2023)

Alumni

- Eunryeol Lee (Ph.D. 2023, a co-supervising student with Prof. Dong-Hwa Seo in UNIST, South Korea, Currently at UC Berkeley as a Postdoc of Prof. Gerbrand Ceder)
- Hao Li (Postdoc from Jan. 2021 to July 2023)
- Misha Donais (MIME 410 student from Jan. 2023)
- Yuanhui Zhu (COOP from Sep. 2022)
- Yueying Yang (from Jan. 2020 to May 2020, Undergraduate researcher)
- Wei Cao (from Sep. 2021 to Dec. 2021, Undergraduate researcher)

Jan. 25, 2024

- Sangwook Park (from Jan. 2020 to July 2022, Visiting Ph.D. student from UNIST, South Korea)
- Bill Huang (from May. 2022 to Dec. 2022)