

LAISUO SU

Department of Materials Science and Engineering

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ACADEMIC EXPERIENCE:

Assistant Professor, UT Dallas Department of Materials Science and Engineering	2023-present
Research Associate, UT Austin Advisor: Prof. Arumugam Manthiram	2022-2023
Postdoctoral Fellow, UT Austin Advisor: Prof. Arumugam Manthiram	2021-2022

EDUCATION

PhD, Mechanical Engineering Carnegie Mellon University Advisor: Prof. B. Reeja-Jayan	2016-2021
MS, Automotive Engineering Tsinghua University, Beijing, China Advisor: Prof. Jianbo Zhang	2013-2016
BEng, Vehicle Engineering Hefei University of Technology, Hefei, China	2009-2013

SELECTED AWARDS AND HONORS

Presidential Fellowship, CMU, USA	2021
Phillips and Huang Family Fellowship in Energy, CMU, USA	2019
Milton Shaw Ph.D. Student Travel Award, CMU, USA	2017
Outstanding Thesis Award, Tsinghua University, China	2016
Weichai Power Scholarship, Tsinghua University, China	2015
Outstanding Graduate Award, Hefei University of Technology, China	2013
National Encouragement Scholarship, China (3%)	2012
National Scholarship (The Highest-level undergrad scholarship), China (1%)	2011
National Scholarship (The Highest-level undergrad scholarship), China (1%)	2010

PUBLICATIONS, PATENT APPLICATIONS, AND PRESENTATIONS**Journal articles**

Number of Citations: 872, **h-index:** 15, [Google Scholar](#) (accessed on 11/3/2023)

1. **Su, Laisuo**, Zhang, S., McGaughey, A., Jayan, B., Manthiram, A. Battery Charge Curve Prediction via Feature Extraction and Supervised Machine Learning, *Advanced Science*, 2023, 2301737.
2. **Su, Laisuo**, Jarvis, K., Charalambous, H., Dolocan, A., Manthiram, A., Stabilizing High-nickel Cathodes with High-voltage Electrolytes. *Advanced Functional Materials*, 2023, 2213675.
3. Lee, S. **Su, Laisuo**, Mesnier, Cui, Z. Manthiram, A., Cracking Versus Surface Reactivity in High-nickel Cathodes for Lithium-ion Batteries. *Joule*, 2023.
4. He, J., Bhargav, A., **Su, Laisuo**, et al., A Solvated Electrolyte for Stable, Dendrite-free Sodium-metal Batteries, *Nature Communication*, 2023
5. Sim, R., **Su, Laisuo**, Manthiram, A. A High Energy-Density, Cobalt-Free, Low-Nickel $\text{LiNi}_{0.7}\text{Mn}_{0.25}\text{Al}_{0.05}\text{O}_2$ Cathode with a High-Voltage Electrolyte for Lithium-Metal Batteries, *Advanced Energy Materials*, 2023, 2300096.
6. Vanaphuti, P., Su, Laisuo, Manthiram, A., Effect of Electrochemical Pre-Lithiation on Layered Oxide Cathodes for Anode-free Lithium-metal Batteries. *Small Structure*, 2023
7. Yi, M., **Su, Laisuo**, Manthiram, A. Tuning and understanding the solvent ratios of localized saturated electrolytes for lithium-metal batteries, *J. Mater. Chem. A*, 2023, 11(22), 11889-902.
8. Adamo, J., **Su, Laisuo**, Manthiram, A. Operation of Layered LiCoO_2 to Higher Voltages with a Localized Saturated Electrolyte, *ACS Applied Materials & Interfaces*, 2023, 15(12), 15458-66.
9. **Su, Laisuo**, Charalambous, H., Cui, Z., & Manthiram, A. High-efficiency, Anode-free Lithium-metal Batteries with A Close-packed Homogeneous Lithium Morphology. *Energy & Environmental Science*, 2022, 15 (2), 843-854.
10. **Su, Laisuo**, Zhao, X., Yi, M., Charalambous, H., Celio, H., Liu, Y., & Manthiram, A. Uncovering the Solvation Structure of LiPF_6 -Based Localized Saturated Electrolytes and Their Effect on LiNiO_2 -Based Lithium-Metal Batteries. *Advanced Energy Materials*, 2022, 12(36), 2201911.
11. **Su, Laisuo**, Eunmi Jo, and Arumugam Manthiram. "Protection of Cobalt-Free LiNiO_2 from Degradation with Localized Saturated Electrolytes in Lithium-Metal Batteries." *ACS Energy Letters* 2022, 7, 2165-2172.
12. **Su, Laisuo**, A., Manthiram, A., Lithium-metal Batteries via Suppressing Li Dendrite Growth and Improving Coulombic Efficiency. *Small Structure*, 2022, 3(10), 2200114.
13. **Su, Laisuo**, Kumar, S., A., Manthiram, A., B. Reeja-Jayan, A Review on Application of Poly (3, 4-ethylenedioxythiophene)(PEDOT) in Rechargeable Batteries. *Organic Materials*, 2022, 4(04), 292-300.
14. **Su, Laisuo**, Choi, P., Choi, P., Nakamura, N., Charalambous, H., Litster, S., Ilavsky, J., & Reeja-Jayan, B. Multiscale Operando X-ray Investigations Provide Insights into Electrochemo-mechanical Behavior of Lithium Intercalation Cathodes. *Applied Energy*, 2021, 299, 117315.
15. **Su, Laisuo**, Choi, P., Parimalam, B. S., Litster, S., & Reeja-Jayan, B. Designing Reliable Electrochemical Cells for Operando Lithium-ion Battery Study. *MethodsX*, 2021, 8, 101562.

16. **Su, Laisuo**, Wu, M., M., Li, Z., & Zhang, J. Cycle life Prediction of Lithium-ion Batteries Based on Data-driven Methods. *eTransportation*, 2021, 10, 100137.
17. **Su, Laisuo**, Weaver, J. L., Groenenboom, M., Nakamura, N., Rus, E., Anand, P., ... & Reeja-Jayan, B. Tailoring Electrode–Electrolyte Interfaces in Lithium-Ion Batteries Using Molecularly Engineered Functional Polymers. *ACS Applied Materials & Interfaces*, 2021, 13(8), 9919-9931.
18. Nakamura, N., **Su, Laisuo**, Wang, H., Bernstein, N., Jha, S. K., Culbertson, E., ... & Reeja-Jayan, B. Linking Far-from-equilibrium Defect Structures in Ceramics to Electromagnetic Driving Forces. *Journal of Materials Chemistry A*, 2021, 9(13), 8425-8434.
19. Choi, P., Parimalam, B. **Su, Laisuo**, et al. Operando Particle-Scale Characterization of Silicon Anode Degradation during Cycling by Ultra High-Resolution X-ray Microscopy and Computed Tomography. *ACS Applied Energy Materials*, 2021, 4(2), 1657-1665.
20. **Su, Laisuo**, Jha, S.K., Phuah, X.L. et al. Engineering lithium-ion battery cathodes for high-voltage applications using electromagnetic excitation. *J Mater Sci*, 2020. 55, 12177-12190.
21. Nakamura, N., **Su, Laisuo**, Bai, J., et al. Monitoring Electromagnetic Field-Assisted SnO₂ Synthetic Pathways via In-Situ Pair Distribution Function Analysis. *Journal of Materials Chemistry A*, 2020, 8(31), 15909-15918.
22. Liu, D., **Su, Laisuo**, Liao, J., et al.. Rechargeable Soft-Matter EGaIn-MnO₂ Battery for Stretchable Electronics. *Advanced Energy Materials*, 2020, 9(46), 1902798.
23. Jha, S. K., Nakamura, N., Zhang, **Su, Laisuo**, L., et al.. Defect-Mediated Anisotropic Lattice Expansion in Ceramics as Evidence for Nonthermal Coupling between Electromagnetic Fields and Matter. *Advanced Engineering Materials*, 2019, 1900762
24. Liu, Z., Li, Z., Zhang, J., **Su, Laisuo**, et al. Accurate and Efficient Estimation of Lithium-Ion Battery State of Charge with Alternate Adaptive Extended Kalman Filter and Ampere-Hour Counting Methods. *Energies*, 12(4), 2019, 757
25. Jimenez, E. M., Ding, D., **Su, Laisuo**, et al. Parametric Analysis to Quantify Process Input Influence on the Printed Densities of Binder Jetted Alumina Ceramics. *Additive Manufacturing*, 2019, 30, 100864
26. **Su, Laisuo**, Smith, P. M., Anand, P., et al. Surface Engineering of a LiMn₂O₄ Electrode Using Nanoscale Polymer Thin Films via Chemical Vapor Deposition Polymerization. *ACS Applied Materials & Interfaces*, 2018, 10(32), 27063-27073
27. Smith, P. M., **Su, Laisuo**, Gong, W., et al. Thermal Conductivity of Poly (3, 4-ethylenedioxythiophene) Films Engineered by Oxidative Chemical Vapor Deposition (oCVD). *RSC Advances*, 2018, 8(35), 19348-19352
28. Zhang, Y., Li, X., **Su, Laisuo**, et al. Lithium Plating Detection and Quantification in Li-ion Cells from Degradation Behaviors. *ECS Transactions*, 2017, 75(23), pp.37-50
29. **Su, Laisuo**, Zhang, J., Wang, C., et al. Identifying Main Factors of Capacity Fading in Lithium-ion Cells Using Orthogonal Design of Experiments. *Applied Energy*, 2016, 163, pp.201-210
30. **Su, Laisuo**, Zhang, J., Huang, J., et al. Path Dependence of Lithium-ion Cells Aging Under Storage Conditions. *Journal of Power Sources*, 2016, 315, pp.35-46
31. Zhang, J., **Su, Laisuo**, Li, Z., et al. The Evolution of Lithium-ion Cell Thermal Safety with Aging Examined in A Battery Testing Calorimeter. *Batteries*, 2016, 2(2), p.12

Manuscripts in progress

1. **Su, Laisuo**, Cui, Z., Manthiram, A., Impact of High-Ni Cathodes on Li Coulombic Efficiency of Advanced Electrolytes, *ACS Materials Letter (In revision)*

2. He, J., Bhargava, A., **Su, Laisuo**, Lamb, J., et al., An Intercalation-conversion Hybrid Catalytic Cathode for Sustainable Sodium-sulfur Batteries, *Nature Energy (In revision)*
3. Sim, R., **Su, Laisuo**, Dolocan, A., Manthiram, A., Correlating Cross Overed Transition Metals with Electrolyte Decomposition on the Li Metal Anode via 3D TOF-SIMS Mapping, *Advanced Materials (Under review)*

Patent applications

1. **Su, Laisuo**, Shuyan Zhang, B. Reeja-Jayan, Alan McGaughey, Arumugam Manthiram. Lithium Battery Cycling Curve Prediction via Machine Learning. (The disclosure form was submitted on 11/16/2022)
2. **Su, Laisuo**, Arumugam Manthiram. Localized Saturated Electrolytes and Rechargeable Batteries Containing the Same. (Filed on December 14, 2021, **TexPower Co. showed interest to license this patent**)
3. **Su, Laisuo**, Jayan, B. Reeja. Electrode Surface Engineering in Lithium-ion Batteries. "Electrode Surface Engineering in Lithium-ion Batteries." U.S. Patent Application No. 16/886,948. (**We are starting a start-up company based on this patent, and I will be a co-founder and adviser**)
4. Jiang, Jianping, **Su, Laisuo**, and Jianbo Zhang. "Apparatus and method for detecting battery state of health." U.S. Patent 10,989,762, issued April 27, 2021.
5. J Jiang, G Zhang, X Zeng, **Su, Laisuo**, J Zhang, Z Li "Apparatus and method for detecting battery state of health" U.S. Patent 10,712,395, issued July 14, 2020.

Conference presentations

Invited talks

1. **Laisuo Su**, et al. "Battery Charge Curve Prediction via Feature Extraction and Supervised Machine" 2023 MRS Fall Meeting & Exhibiting. Boston, Massachusetts, USA, Nov. 26 – Dec. 1, 2023.
2. **Laisuo Su**. "High Voltage Electrolytes Development for High-Ni Cathodes " 2023 MRS Fall Meeting & Exhibiting. Boston, Massachusetts, USA, Nov. 26 – Dec. 1, 2023.
3. **Laisuo Su**. "Materials Compatibility Engineering for Advanced Renewable Energy Devices" The University of North Texas, March 7, 2023
4. **Laisuo Su**. "Materials Compatibility Engineering for Advanced Renewable Energy Devices" The University of Texas at Dallas, Feb 27, 2023
5. **Laisuo Su**, Arumugam Manthiram. "Advanced Electrolyte Development for Next-generation Lithium Batteries". The University of Texas at Dallas, MSE Colloquium Series, Sep 23, 2022.
6. **Laisuo Su**, Arumugam Manthiram. "*In-situ* Surface and Interface Engineering for Battery Electrodes". UT Dallas-LEAP Manufacturing Next-Gen Battery Workshop, Sep 22, 2022.
7. **Laisuo Su**, B. Reeja-Jayan. "Tailoring Electrode-electrolyte Interfaces in Lithium-ion Batteries using Molecularly Engineered Functional Polymers". *International Webinar on Functional Energy Materials*. Nov 18-19, 2020.
8. **Laisuo Su**, B. Reeja-Jayan. "Tailoring Electrode-electrolyte Interfaces in Lithium-ion Batteries using Molecularly Engineered Functional Polymers". *AVS 66th International Symposium & Exhibition*, Columbus, Ohio, USA. Oct 20-25, 2019.

Conference talks and posters

1. **Laisuo Su**, Arumugam Manthiram. *Battery500 Quaternary Meeting*. Austin, Texas, USA, Dec. 13 – Dec. 14, 2022. (**Best Poster Award**)
2. **Laisuo Su**, Arumugam Manthiram. *2022 MRS Fall Meeting & Exhibiting*. Boston, Massachusetts, USA, Nov. 27 – Dec. 2, 2022. (Poster)
3. **Laisuo Su**, Jamie Weaver, Mitchell Groenenboom, et al. *2020 MRS Fall Meeting & Exhibiting*, Online. Nov. 27 – Dec. 4, 2020 (**Talk**)
4. **Laisuo Su**, B. Reeja-Jayan. *International Webinar on Functional Energy Materials*. Nov 18-19, 2020. (**Talk and Poster, Best Poster Award**)
5. **Laisuo Su**, Paul Choi, Nathan Nakamura, et al. *2020 MRS Fall Meeting & Exhibiting*, Online. Nov. 27 – Dec. 4, 2020 (**Talk**)
6. **Laisuo Su**, Mengche Wu, B. Reeja-Jayan, et al. *MS&T 20*, Online. Nov. 2-6, 2020. (**Talk**)
7. **Laisuo Su**, B. Reeja-Jayan. *MIT A+B*, Online. Aug. 13 – 14, 2020 (**Talk**)
8. **Laisuo Su**, Jamie Weaver, Mitchell Groenenboom, et al. *2019 MRS Fall Meeting & Exhibiting*, Boston, Massachusetts, USA. Dec. 1-6, 2019 (**Talk**)
9. **Laisuo Su**, Jamie Weaver, Mitchell Groenenboom, et al. *2018 MRS Fall Meeting & Exhibiting*. Boston, Massachusetts, USA, Nov. 24-30, 2018. (Poster)
10. **Laisuo Su**, Jamie Weaver, Mitchell Groenenboom, et al. *CMU Electrochemical Energy Symposium*. Pittsburgh, PA, USA. Nov. 15 - 16, 2018. (Poster, **Best Poster Award**)
11. **Laisuo Su**, Phil Smith, B. Reeja Jayan. *MS&T 2018*, Columbus, Ohio, USA. Oct 14 - 18, 2018. (**Talk**)
12. **Laisuo Su**, B. Reeja Jayan. *GRC Batteries*, Ventura, CA United States. February 25 - March 02, 2018. (Poster)
13. **Laisuo Su**, Phil Smith, B. Reeja Jayan. *The AVS Western Pennsylvania Chapter*, Pittsburgh, PA, February 23, 2018. (Poster, **Best Poster Award**)
14. Erin Balke, Vasudevan Nambeesan, **Laisuo Su**. *Electrifying the Future: Challenges and Opportunities*. Pittsburgh, PA, December 1, 2017 (Poster, **Best Poster Award, Team Leader**).
15. **Laisuo Su**, B. Reeja-Jayan. *MS&T 2017*, Pittsburgh, PA, USA, OCTOBER 8 –12, 2017. (**Talk**)
16. **Laisuo Su**, B. Reeja-Jayan, *2017 Graduate Research Symposium*, Pittsburgh, PA. March 31, 2017. (Poster, **Best Poster award**)
17. **Laisuo Su**, Jianbo Zhang. *First Asian Symposium on Impedance Spectroscopy for Electrochemical Energy Devices*, Beijing, China, April 16-April 17, 2015; pp. 72. (Poster)

TEACHING EXPERIENCE

Research Mentor, Tsinghua University, CMU, and UT Austin 2015-present

- Served as the research mentor for 3 Ph.D. graduate students, 2 Master's students, and 2 undergraduate students. Two of them (Richard Sim and Joseph Adamo at UT Austin) are *first-generation students from low-income families*.
- Co-authored 5 journal articles with 3 of these students. Projects include developing advanced electrolytes, understanding the degradation of different high-Ni cathodes, stabilizing Li metal anodes, investigating the aging of lithium-ion batteries, and electrochemical impedance spectroscopy analysis techniques for battery internal temperature monitoring.

Teaching Certificate Program, CMU

2018-2019

Attended workshops taught by the Eberly Center Teaching Excellence & Educational Innovation

aimed at developing teaching skills for a career in academia. Topics included course and syllabus design, constructing effective problem sets, planning a class session, interactive teaching and active teaching, and educational technologies.

Graduate Teaching Assistant, CMU

Spring 2018 and 2020

Course: **Mechanical System Experimental**

- This is an undergraduate-level class consisting of ~ 160 students. We have a total of 10 TAs and graders for the course. I served as the head TA in Spring 2020 in our TA team. Besides doing the general TA tasks, I also arranged TA meetings, assigned different tasks to TAs, led conversations between teachers and other TAs, and contacted guest lecturers.
- Students were introduced to the fundamental theories in dynamic systems, asked to design experiments to obtain the dynamic parameters, write MATLAB code to calculate these parameters, and identify different types of systems.
- Held multiple office hours and discussion sessions every week.
- Designed, graded, and provided feedback on the lab reports. Evaluated the final team projects.

Community service and outreach, Tsinghua University and CMU

2014-2018

- **Summer School** (Tsinghua University, 2014 and 2015): This event was designed for graduate students to learn the front knowledge in a few specific topics, such as Intelligent Vehicle Technology (2015) and Hybrid Electric Vehicle and Connected Vehicle Technology (2014). There were ~ 150 students from all over the country. I was one of the three TAs to help contact the lecturers, design activities, collect homework, and host presentation competitions.
- **Energy from Everyday Things** (CMU Gelfand Center, 2016 and 2017): Prepared classroom lectures and hosted activities using everyday objects to generate energy offered as part of Gelfand Center's Saturday series classes for K-9 students from local schools.
- **STEM Demo Day** (Jeron X. Grayson Center, Pittsburgh, PA, 2018): Designed two funny and popular experiments, including a drinking bird and quicksand, and demonstrated them to the kids from the nearby middle schools, prepared posters to demonstrate the scientific reasons behind these interesting phenomena.

OTHER EXPERIENCE

Experimental Expertise: Extensive experience working with solution and solid-state synthesis, CVD and ALD synthesis, glovebox usage, various types of electrochemical testing, and window coin cell design for operando experiments. Specific experimental characterization techniques include X-ray diffraction (powder and film), microscopy (SEM, TEM, AFM) and spectroscopy (Raman, FTIR, XPS, ICP-MS, TOF-SIMS), variable angle spectroscopic ellipsometry, and various synchrotron characterization techniques (ED-XRD, PDF, SAXS, USAXS, Nano-CT). Working experience with statistics and advanced algorithms, including orthogonal design of experiment (DOE), supervised machine learning algorithms (SVM, NN, CNN), and unsupervised machine learning algorithms (PCA, NMF, autoencoder).

Programming Languages: MATLAB, C++, Python

Others: Lab equipment setup, electrical and mechanical troubleshooting, management of lab

personnel and equipment, and preparation of Research grant proposals for DOE and NSF.

PROFESSIONAL ACTIVITIES

- Guest Editor – *Sustainability* special issue on the topic of “Lithium Batteries and Fuel Cells for a Sustainable Future”
- Guest Editor – *Frontiers in Energy Research* special issue on the topic of “Electrolyte Design for Advanced Batteries”
- Reviewer for the following Journals: *Nature Communications*, *Science Advances*, *ACS Applied Materials & Interface*, *Materials Today Chemistry*, *Journal of The Electrochemical Society*, *Metals*, *Energies*, *Materials*, *Batteries*, *Frontiers in Energy Research*.
- Won CMU Scott Proposal Seed Grant (\$45,900.00) in 2020 with the proposal titled “Computed Tomography Imaging and Synchrotron Studies of Mechanical Fatigue in Lithium-Ion Batteries”