ROBY GAUTHIER

Pittsburgh, PA | robyg@andrew.cmu.edu | 724-825-9750 | https://robygauthier.github.io

RESEARCH EXPERIENCE

Litster Research Group, Carnegie Mellon University, Pittsburgh, PA
Research Scientist June 2024 - November 2025
Funding: ARPA-E, Hyundai, Power to Hydrogen

- Prepared polymer–based electrode inks, adjusting solids loading, solvent composition, and mixing time to improve dispersion, film uniformity, and adhesion. Analyzed film morphology with optical microscopy, SEM-EDS, and micro-CT.
- Developed ionomer-free fuel cells by collaborating with national labs.
- Studied electrolyte and ionomer degradation using multi-scale electrochemical and imaging techniques.
- Developed a computer vision pipeline trained on 3D synthetic data from the Porous Microstructure Analysis (PuMA) software and fine-tuned on real images to quantify porosity and segment porous structures.

Whitacre/Viswanathan Research Group, Carnegie Mellon University, Pittsburgh, PA
Postdoctoral Fellow October 2022 - May 2024
Funding: Toyota Research Institute, Stratus Materials

- Built qNMR and electrochemical protocols, coupled with computational modeling, to monitor and predict composition-dependent electrolyte degradation at graphite interfaces.
- Developed the FAST method to study early anode passivation, enabling rapid comparison of electrolyte formulations on SEI formation and lifetime prediction.

Obrovac Research Group, Dalhousie University, Halifax, NS, Canada
Research Scientist September 2021 - September 2022
Funding: Novonix

- Led synthesis and characterization of amorphous electrode materials, assembled coin cells, and managed lab operations, including procurement, safety, and equipment maintenance.

Dahn Research Group, Dalhousie University, Halifax, NS, Canada
Doctoral Researcher August 2016 - August 2021
Funding: Tesla

- Developed expertise about characterizing Li-ion cells, analyzing failures, automating dV/dQ analysis, and discovering new electrolyte additives.
- Applied Density Functional Theory to predict redox potentials.

Ashrit Research Group, Université de Moncton, Moncton, NB, Canada
Undergraduate Student Research Assistant May 2012 - August 2013
Funding: Natural Sciences and Engineering Research Council (NSERC)

- Executed impedance studies on tungsten trioxide thin films produced via physical vapor deposition.

EDUCATION

Dalhousie University, Halifax, NS, Canada
Ph.D. in Physics **Thesis Advisor:** Jeff Dahn August 2021
Thesis: Understanding and Preventing Lifetime Failure in Lithium-Ion Batteries.

Université de Moncton, Moncton, NB, Canada
M.Sc. in Physics **Thesis Advisors:** Normand Beaudoin, Claude Gauthier May 2018
Thesis: One-dimensional Casimir force at short and long ranges between two parallel metal plates of finite thickness using the radiation pressure method.

Université de Moncton, Moncton, NB, Canada
B.Sc. in Physics with distinction August 2013

PUBLICATIONS

PEER-REVIEWED

Formation Accelerated Side-Reactions Test: A Technique to Study Anode Passivation during Lithium-Ion Cell Formation.
Roby Gauthier, Hongyi Lin, Haotian Chen, Venkatsubramanian Viswanathan, and Jay Whitacre.
Chemistry of Materials, 2025, 37, 22, 9057–9071

Nuclear Magnetic Resonance Spectroscopy and Differential Capacity Analysis as Tools to Study Electrolyte Consumption During the Formation Cycle of Li-Ion Pouch Cells.
Roby Gauthier, Hongyi Lin, Venkatsubramanian Viswanathan, and Jay Whitacre.
Journal of Power Sources, 657, 2025, 238134.

The Complex and Spatially Heterogeneous Nature of Degradation in Heavily Cycled Li-ion Cells
Toby Bond, *Roby Gauthier*, Graham King, Reid Dressler, Jeffin James Abraham and J. R. Dahn
Journal of The Electrochemical Society, 171(11), 2024, 110514.

The Amorphization of Crystalline Silicon by Ball Milling
Roby Gauthier, B. Scott, J. Craig Bennett, Mina Salehabadi, Jun Wang, Tariq Sainuddin, and M.N. Obrovac.
Heliyon, 10(15), 2024, E34881.

How Do Depth of Discharge, C-Rate, and Calendar Age Affect Capacity Retention, Impedance Growth, the Electrodes, and the Electrolyte in Li-Ion Cells?
Roby Gauthier, Aidan Luscombe, Toby Bond, Michael Bauer, Michel Johnson, Jessie Harlow, A. J. Louli, and J. R. Dahn.
Journal of The Electrochemical Society, 169(2), 2022, 020518.

In-Situ Computed Tomography of Particle Microcracking and Electrode Damage in Cycled NMC622/Graphite Pouch Cell Batteries.
Toby Bond, *Roby Gauthier*, Sergey Gasilov, and J. R. Dahn.
Journal of The Electrochemical Society, 169(8), 2022, 080531.

In Situ Imaging of Electrode Thickness Growth and Electrolyte Depletion in Single-Crystal vs Polycrystalline LiNixMnyCozO2/Graphite Pouch Cells using Multi-Scale Computed Tomography.
Toby Bond, *Roby Gauthier*, A. Eldesoky, Jessie Harlow and J. R. Dahn.
Journal of The Electrochemical Society, 169(2), 2022, 020501.

Lithium Difluoro (dioxalato) Phosphate as an Electrolyte Additive for NMC811/Graphite Li-ion Pouch Cells.
Wentao Song, *Roby Gauthier*, Tina Taskovic, Dongxu Ouyang, Harrison A Ingham, Ahmed Eldesoky, Saad M Azam, Eniko S Zsoldos, Zhe Deng, Dylan H Heino, and J. R. Dahn.
Journal of The Electrochemical Society, 169(11), 2022, 110513.

Ultrasonic Scanning to Observe Wetting and "Unwetting" in Li-Ion Pouch Cells.
Zhe Deng, Zhenyu Huang, Yue Shen, Yunhui Huang, Han Ding, Aidan Luscombe, Michel Johnson, Jessie E. Harlow, *Roby Gauthier*, and J. R. Dahn.
Joule, 4(9), 2020, 2017-2029.

Effect of Duty Cycle on the Lifetime of Single Crystal LiNi0.5Mn0.3Co0.2O2/Graphite Lithium-Ion Cells.
JH Cheng, JE Harlow, MB Johnson, *Roby Gauthier*, and J. R. Dahn.
Journal of The Electrochemical Society, 167(13), 2020, 130529.

Impact of Functionalization and Co-Additives on Dioxazolone Electrolyte Additives.
Roby Gauthier, David S Hall, Katherine Lin, Jazmin Baltazar, Toren Hynes, and J. R. Dahn.
Journal of The Electrochemical Society, 167(8), 2020, 080540.

New Chemical Insights into the Beneficial Role of Al2O3 Cathode Coatings in Lithium-Ion Cells.
David S Hall, *Roby Gauthier*, Ahmed Eldesoky, Vivian S Murray, and J. R. Dahn.
ACS Applied Materials & Interfaces, 11(15), 2019, 14095–14100.

A Joint DFT and Experimental Study of an Imidazolidinone Additive in Lithium-ion Cells.
Roby Gauthier, David S Hall, T Taskovic, and J. R. Dahn.
Journal of The Electrochemical Society, 166(15), 2019, A3707.

WORKING PAPERS

One-Dimensional Casimir Force at Short and Long Ranges Between Two Parallel Plates of Finite Thickness.
Roby Gauthier, Ahcène Brahmi, Claude Gauthier, and Normand Beaudoin.
Physical Review A (In Review), 2025

Reproducible determination of 3D model and porosity of fuel cell cathode layers from pFIB-SEM data.
Roby Gauthier, Nicole Wang, Enora Petry, and Aryan Mehta.
In Preparation, 2025

A Guide to Predict Redox Potentials of New Electrolyte Components for Li-ion Batteries and Beyond.
Roby Gauthier, Shang Zhu, Venkatsubramanian Viswanathan, and Jay Whitacre.
In Preparation, 2025

TEACHING EXPERIENCE

Carnegie Mellon University, Pittsburgh, PA
Guest Instructor for 24-642 / 06-644: Electrochemical Decarbonization Technologies
(with Shawn Litster) January 2025 - May 2025

Carnegie Mellon University, Pittsburgh, PA
Guest Instructor for 24-643 / 27-700: Energy Storage Materials and Systems
(with Jay Whitacre) August 2024 - December 2024

Carnegie Mellon University, Pittsburgh, PA
Guest Lecturer for 24-653: Special Topics: Materials and Their Processing for Mechanical Engineers
(with B. Reeja Jayan) January 2024 - May 2024

Dalhousie University, Halifax, Canada
Graduate Student Instructor for PHYC1190 & PHYC1290 -
Introduction to Physics September 2016 - December 2020

Université de Moncton, Moncton, Canada
Teaching Assistant for PHYS2523 - Introduction à la physique
moderne et à l'optique January 2014 - April 2015

SKILLS

- **Characterization:** X-ray CT (lab scale acquisition, synchrotron data processing), pFIB-SEM image processing and segmentation, SEM-EDS, XRD, NMR (1D, 2D, quantitative), EIS, CV/LSV, gas-evolution, dQ/dV analysis.
- **Electrochemistry:** Aging and interphase studies, cell performance optimization, thickness growth and swelling measurements, correlation with impedance growth and capacity fade.
- **Computational:** DFT (Gaussian, GPAW, Psi4, ABINIT), molecular dynamics (GROMACS), Advanced Electrolyte Model (AEM), MATLAB.
  Software & Infrastructure: Python, Matlab, Bash, Azure, Spark, PyTorch, TensorFlow, Scikit-learn, Pandas, NumPy, Matplotlib, Git.
- **Collaborations & Mentorship:** Synchrotron CT data processing, operando ultrasonic transmission, and pouch-cell pressure measurements. Collaborating with LANL, Hyundai, ARPA-E, Tesla, and TRI on cell optimization and characterization. Mentored PhD students in best practices for successful lab work and data processing
- **Languages:** French (native), English (professional).

SPECIAL TRAINING AND COURSES

10-601: Introduction to Machine Learning (CMU)	2025
24-789: Deep Learning for Engineers (CMU)	2025
11-637: Foundations of Computational Data Science (CMU)	2023
CHEM 2401: Introductory Organic Chemistry	2019
CHEM 6363: Electronic Structure Theory of Solids (Abinit)	2018
CHEM 6353: Density-Functional Theory	2018
CHEM 5301: Theory of Chemical Bonding (Gaussian)	2017

TALKS AND POSTERS

Low Salt Concentration and Temperature during Formation as a Tool to Characterize the Passivation of the Anode Solid Electrolyte Interface.
Roby Gauthier, Hongyi Lin, Haotian Chen, Venkatasubramanian Viswanathan, and Jay Whitacre.
Electrochemical Society Meeting Abstracts 247, 2025.

Development of Characterization Techniques to Study Chemical and Ionomer Degradation in Proton-Exchange Membrane Fuel Cells.
Roby Gauthier, Eugene Jeong, Chanho Jeong, and Shawn Litster.
Electrochemical Society Meeting Abstracts 247, 2025.

A Coupled NMR and Differential Capacity Study of the Consumption of Electrolyte and Additive Components during the Formation Cycle of Li-Ion Pouch Cells.
Roby Gauthier, Hongyi Lin, Venkatasubramanian Viswanathan, and Jay Whitacre.
Electrochemical Society Meeting Abstracts 224, 2024.

A Study on the Kinetics and Structural Changes of Silicon during Ball Milling.
Roby Gauthier, J. Craig Bennett, Benjamin Scott, and M.N. Obrovac.
Electrochemical Society Meeting Abstracts 408, 2024.

Understanding Lifetime Failure in Lithium-ion Batteries
UC Berkeley Invited Lecture (February 2021).

New Chemical Insights into the Beneficial Role of Al2O3 Cathode Coatings in Lithium-ion Cells.
Roby Gauthier, David S Hall, Ahmed Eldesoky, Vivian S. Murray, and Jeff R Dahn.
Batteries Gordon Research Conference (2020).

Probing the Effect of the Depth of Discharge Range and C-Rate on the Lifetime of Li-Ion Cells at Different Temperature.
Roby Gauthier, Alexander J Louli, and Jeff R Dahn.
Electrochemical Society Meeting Abstracts 446, 2019.

The Effect of Functional Groups and Co-Additives on the Performance of an Electrolyte Additive for Li-Ion Cells.
Roby Gauthier, David S Hall, Toren Hynes, and Jeff R Dahn.
Electrochemical Society Meeting Abstracts 313, 2019.

The Effect of 1,3-Dimethyl-2-Imidazolidinone (DMI) as an Additive in Lithium-ion Cells.
Roby Gauthier, David S. Hall, and Jeff R. Dahn.
CAP Congress, 2018.

Propriétés Électriques de Couches Minces de WO3 Amorphes et Polycristallins Lithiés.
Roby Gauthier.
2013 Atlantic Universities Physics & Astronomy Conference, 2013.

MENTORSHIP

Abigail Hempy, CMU PhD student — Janurary 2025 - Present
Advising on the fabrication, assembly, and testing of new fuel cell technologies.

Eugene Jeong, CMU PhD student — June 2024 - Present
Advising on best practices for using NMR and leading through the experimental study of ionomer degradation in fuel cells.

Hongyi Lin, CMU PhD student — November 2022 - Present
Advising on best practices for using NMR and directing the choice of electrolyte and charging-discharging protocol for lithium-ion battery studies.

Shang Zhu, CMU PhD student — November 2022 - Present
Instructing on performing density functional theory (DFT) calculations with experimental accuracy by teaching the inclusion of polarizable continuum models. Also guided on how to compare theoretical results to published experimental research.

Matéo Croussette, Polyvalente Alexandre J. Savoie June 2022 - Present
Guiding on potential career paths, answering science-related questions, and encouraging passion for the sciences.

Adriana Reitano, Dalhousie University B.Sc. Student September 2018 - December 2018
Mentored through the introduction to physics class by building confidence and fostering a passion for the subject.

SERVICE & OUTREACH

Organized and hosted a laboratory visit for our Hyundai research sponsors for a week. The visit consisted of demonstrating our laboratory method and discussing its potential impact on the ongoing research partnership.
Carnegie Mellon University, Pittsburgh, PA 2024

Supported OurCS 2024, a 3-day research-focused workshop aimed at improving gender balance in computing research. The event encourages undergraduate students from the USA and across the globe to explore research opportunities and develop skills in computing disciplines.
Carnegie Mellon University, Pittsburgh, PA 2024

Offered expertise in chemistry to a research team focused on using generative AI for the advancement of learning materials and educational resources.
Carnegie Mellon University, School of Computer Science, Pittsburgh, PA 2023

Provided technology and emotional support for stroke recovery patients.
March of Dimes Canada 2021

Planetary Shows: Hosted high school students to explore educational opportunities in astronomy.
Physics Department, Dalhousie University, Halifax, Canada 2019

Physics Fun and Discovery Days: Hosted high school students to explore educational opportunities about physics.
Physics Department, Dalhousie University, Halifax, Canada 2019

REFERENCES

Shawn Litster, Ph.D.
Professor of Mechanical Engineering
Department of Mechanical Engineering
Carnegie Mellon University
Email: litster@andrew.cmu.edu
Phone: 412-268-3050
Website: https://www.meche.engineering.cmu.edu/directory/bios/litster-shawn.html

Jay F. Whitacre, Ph.D.
Trustee Professor in Energy
Department of Materials Science and Engineering
Carnegie Mellon University
Email: whitacre@andrew.cmu.edu
Phone: 412-268-1765
Website:
https://www.andrew.cmu.edu/user/whitacre/index.html

Venkat Viswanathan, Ph.D.
Associate Professor of Aerospace Engineering
University of Michigan
College of Engineering
Email: venkvis@umich.edu
Phone: 734-764-3310
Website: https://aero.engin.umich.edu/people/viswanathan-venkat/

David Scott Hall, Ph.D.
Associate Professor in Battery Technology
Faculty of Science and Technology
Department of Energy and Petroleum Engineering
University of Stavanger
Email: david.s.hall@uis.no
Website: https://www.uis.no/en/profile/david-scott-hall

B. Reeja Jayan, Ph.D.
Professor of Mechanical Engineering
CMU Engineering Dean's Early Career Fellow
Carnegie Mellon University
Email: bjayan@andrew.cmu.edu
Phone: 412-268-4343
Website: https://www.meche.engineering.cmu.edu/directory/bios/jayan-reeja.html

Jeff Dahn, Ph.D., FRSC, O.C.
Professor Emeritus
Principal Investigator - NSERC/Tesla Canada Industrial Research Chair/Dalhousie Alliance Grant
Dalhousie University
Email: jeff.dahn@dal.ca
Phone: 902-494-2991
Website: https://www.dal.ca/diff/dahn.html