

Nicholas Cross

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Education

- PhD in Chemical Engineering** – The Pennsylvania State University August 2023
"Characterization and Development of the All-Aqueous Copper Thermally Regenerative Ammonia Battery"
Advisors: Bruce Logan, Matthew Rau, Derek Hall
- MS in Chemical Engineering** – The Pennsylvania State University December 2020
"A Numerical Investigation into the Relationship Between Fiber Arrangement and Advective Transport in Ag-Thermally Regenerative Battery Electrodes"
Advisors: Bruce Logan, Matthew Rau
- Honors BS in Chemical Engineering** – Oregon State University March 2018
"Carbon Degradation and Kinetics in a Vanadium (4/5) Electrolyte"
Advisor: Alexander FT Yokochi
- Honors BA in International Studies**
Study abroad – Universidad Autónoma de Querétaro Summer 2015

Work Experience

- Postdoctoral Researcher** Lawrence Livermore National Laboratory May 2023 – Present
First place winner of LLNL and Bay Area (LLNL, LBNL, SLAC, and Sandia) Postdoctoral Research SLAMs
Finalist in National Lab Research SLAM competition that included all 17 National Labs
UC President's Lindau Noble Meeting Fellow – 2025 Meeting on Chemistry
- Graduate Research Assistant** Penn State University August 2018 – April 2023
- Flammables Section Engineering Intern** Linde Specialty Gases June – December 2017
- Epitaxy/Heat Treat Intern** Siltronic Corp. March – September 2016
- Research Intern** eChemion January 2015 – March 2016

Continuing Education

- Scientific Leadership and Management Skills Course** – April 2025 workshop at LBNL
- Making the Most of your Presentation** – August 2024 Workshop given by Jean-luc Dumont
- LLNL Development Resource Center** – Summer 2024 Leadership Development Courses
Leading Multiple Generations at LLNL; Moments that Matter
- Penn State Schreyer Institute for Teaching Excellence** – Fall 2022 Workshop series
Courses such as "How to Plan a Class Session" and "Teaching So All Your Students Are Included"
- Effective Teaching for New or Prospective Faculty** – Workshop at 2022 AIChE National Meeting

Service Experience

- LLNL Outreach Activities** LLNL Open House, STEM Day October 2023 – Present
- Battery Advisor** PSU AIChE ChemE Car March 2021 – May 2023
- Vice President & President** PSU ChE Graduate Student Association June 2019 – June 2022
Received ChemE Department Graduate Student Excellence Award for leadership and service
- Director of Business & Administration** OSU Solar Vehicle Team October 2014 – June 2017
Phoenix Solar Racing

Teaching Experience

Teaching Assistant

CHE 470: Design of Chemical Plants

Fall 2019

Teaching Assistant

CHE 431: Chemical Plant Design I

Winter 2018

Undergraduate Students Mentored

Ben Prisk (Queensland University of Technology – Mechanical Engineering Summer 2025)

Edrick Aponte-Torres (LLNL/University of Puerto Rico Mayagüez – Chemical Engineering May 2025 – Present)

Samuel Sarnecki (LLNL/University of California Santa Barbara – Chemistry, Summer 2023)

Alana Sweeney (Penn State University – Materials Science and Engineering, 2021 – 2022)

Journal Publications (* denotes co-first authors)

16. T. Y. Lin, H. Li, N. W. Brady, **N. Cross**, V. M. Ehlinger, T. R. Roy, M. Worsley, T. Lin, G. Bucci, "Topology Optimization of Curved Electrodes with Suggested Simplified Corrugated Designs", *ACS Electrochemistry*, 2025, [[doi](#)]
15. S. T. W. Sarnecki, S. P. Mish, N. Brady, **N. Cross**, V. Ehlinger, H. Li, T. Roy, C. A. Orme, M. Worsley, T. Lin, G. Bucci, "Modeling Electrodeposition in 3D Porous Architectures for Solid-State Li-Metal Batteries", *Journal of the Electrochemical Society*, 2025, [[doi](#)] [Open Access](#)
14. M. Goldman*, A. Prajapati*, **N. Cross***, A. Clemens, A. T. Chu, L. Gutierrez, M. Marufu, E. Krall, V. Ehlinger, T. Moore, E. B. Duoss, S. E. Baker, C. Hahn, "Designing ionomers to control water content for low-voltage ethylene production from CO₂ electrolysis", *Chem Catalysis*, 2025, [[doi](#)]
13. J. Rochin, **N. Cross**, R. Bachman, D. Hall, "200 h of discharge cycling with an all-aqueous copper thermally regenerative ammonia battery", *Journal of Power Sources*, 2025, [[doi](#)]
12. **N. Cross***, H. Li*, T. Roy*, V. Ehlinger, T. Lin, N. Brady, M. Worsley, G. Bucci, "Viability of Additively Manufactured Electrodes for Lithium-ion Batteries", *ACS Applied Engineering Materials*, 2024, [[doi](#)] [Invited contribution to special issue on additive manufacturing for energy and the environment](#)
11. T. Moore*, A. Wong*, B. Giera, D. Giera, D. Oyarzun, A. Gongora, T. Lin, W. Li, T. Owens, D. Nguyen, V. Ehlinger, A. Prajapati, S. Chung, P. Roy, J. DeOtte, **N. Cross**, A. Aui, Y. Choi, M. Goldman, H. Jeong, C. Ye, A. Sarkar, E. Duoss, C. Hahn, S. Baker, "The Science of Scale-up: Accelerating the Development of Climate Technologies", *Nature Chemical Engineering*, 2024 [[doi](#)]
10. H. Li, G. Bucci, N. Brady, **N. Cross**, V. Ehlinger, T. Lin, M. de Troya, D. Tortorelli, M. Worsley, T. Roy, "Topology Optimization for the Full-Cell Design of Porous Electrodes in Electrochemical Energy Storage Device", *Structural and Multidisciplinary Optimization*, 2024, [[doi](#)]
9. T. Lin, H. Li, N. Brady, **N. Cross**, V. Ehlinger, T. Roy, D. Tortorelli, C. Orme, M. Worsley, G. Bucci, "Shape matters: Understanding the effect of electrode geometry on cell resistance and chemo-mechanical stress", *Journal of the Electrochemical Society*, 2024, [[doi](#)]
8. **N. Cross**, M. Rau, C. Gorski, B. Logan, D. Hall, "Simulating Discharge Curves of an All-Aqueous TRAB to Identify Pathways for Improving System Performance", *Journal of the Electrochemical Society*, 2024, [[doi](#)] [Open Access](#)

7. **N. Cross**, H. Vazquez-Sanchez, M. Rau, S. Lvov, M. Hickner, C. Gorski, S. Nagaraja, S. Sarathy, B. Logan, D. Hall, "Hydrocarbon-based membranes cost-effectively manage species transport and increase performance in thermally regenerative batteries", *Electrochimica Acta*, 2023, [\[doi\]](#)
6. H. Vazquez-Sanchez, S. S. Nagaraja, **N. Cross**, D. Hall, S. Sarathy, "A techno-economic analysis of a thermally regenerative ammonia-based battery", *Applied Energy*, 2023, [\[doi\]](#)
5. **N. Cross**, M. Rau, S. Lvov, C. Gorski, B. Logan, D. Hall, "System efficiency and power assessment of the all-aqueous copper thermally regenerative ammonia battery", *Applied Energy*, 2023, [\[doi\]](#)
4. **N. Cross**, M. Rau, S. Lvov, C. Gorski, B. Logan, D. Hall, "Power and energy capacity tradeoffs in an all-aqueous copper thermally regenerative ammonia battery", *Journal of Power Sources*, 2022, [\[doi\]](#)
Paper featured in PSU news article
3. R. Rossi, D. Hall, L. Shi, **N. Cross**, C. Gorski, M. Hickner, B. Logan, "Using a vapor-fed anode and saline catholyte to manage ion transport in a proton exchange membrane electrolyzer", *Energy and Environmental Science*, 2021, [\[doi\]](#)
2. R. Springer, **N. Cross**, S. Lvov, B. Logan, C. Gorski, D. Hall, "An All-Aqueous Thermally Regenerative Ammonia Battery Chemistry Using Cu(I,II) Redox Reactions", *Journal of The Electrochemical Society*, 2021, [\[doi\]](#) *Free Article*
1. **N. Cross**, D. Hall, S. Lvov, B. Logan, M. Rau, "The Impact of Fiber Arrangement and Advective Transport in Porous Electrodes for Silver-Based Thermally Regenerated Batteries", *Electrochimica Acta*, 2021, [\[doi\]](#)

Oral and Poster Presentations Given

LLNL SAGE Summer Workshop, June 2025

Oral: "How did I end up here? My journey to the center of the simulation" *STEM Outreach*

The 247th Meeting of the Electrochemical Society, May 2025

Oral: "Modeling Additively Manufactured Electrodes to Assess Device-Level Performance in Lithium-Ion Batteries"

Oral: "Inclusion of a Growing SEI Improves the Ability to Predict Dendrite Formation in Lithium Metal Batteries"

National Lab Research SLAM!, March 2025

Oral: "Predicting critical failure in next-generation batteries"

2024 AIChE National Meeting, October 2024

Oral: "Techno-Economic Analysis of Liquid Absorbent-Based Carbon Capture for Achieving Net-Zero Natural Gas Power Generation"

Pacific Rim International Meeting of Electrochemists (PRiME), October 2024

Oral: "Full Cell Modeling of Flooding Effects on Ionomer-Based CO₂ Electrolyzers"

Science Café with the Cal ACS Chapter, September 2024

Oral: "Electrochemical Systems for Large Scale Energy Storage" *Invited Presentation*

Bay Area Postdoctoral Research SLAM!, October 2024

LLNL Postdoctoral Research SLAM!, September 2024

Oral: "Looking Inside Batteries to Predict Failure" *First Place Winner at both competitions*

California Battery Manufacturing Summit, September 2024

Poster: "Inclusion of a Growing SEI Improves the Ability to Predict Dendrite Formation in Lithium Metal Batteries"

The 245th Meeting of the Electrochemical Society, May 2024

Poster: "Simulating the Effects of Ammonia Crossover and Alternative Ligands in Thermally Regenerative Flow Batteries"

Poster: "Numerical Modeling of 3D Printed Structures for Lithium Metal Batteries"

Oral: "Design Principles for Architected Battery Electrodes (Presented in place of Giovanna Bucci)"

Battery Modeling Webinar Series, December 2022

Oral: "Development of Thermally Regenerative Ammonia Batteries Through Numerical Modelling"

Invited Presentation

2022 AIChE National Meeting, November 2022

Poster: "Interdisciplinary Research to Advance Flow-Based Electrochemical Power Systems"

Oral: "Elevated Temperature Performance of the All-Aqueous Copper Thermally Regenerative Battery"

The 242nd Meeting of the Electrochemical Society, October 2022

Oral: "Membrane Transport and Performance in the All-Aqueous Copper Thermally Regenerative Battery"

Oral: "Improving the Performance of Bimetallic Thermally Regenerative Ammonia Batteries"

The 241st Meeting of the Electrochemical Society, May/June 2022

*Oral: "The impacts of electrolyte composition on key performance metrics of the all-aqueous copper thermally regenerative ammonia battery" *Awarded ECS and PSU UPAC Travel Grants**

Penn State Chemical Engineering Graduate Research Symposium, September 2022

PSU Institute for Energy and the Environment Energy Days Conference, May 2022

Poster: "Increasing Power and Energy Output in an All-Aqueous Thermally Regenerative Flow Battery"

DOE/NETL Energy Storage Program Spring R&D Project Review Meeting, May 2022

Oral: "Characterization and Modeling of an All-Aqueous Thermally Regenerative Redox Flow Battery"

PSU EnvironMentors Spring Webinar Series, April 2022

*Oral: "Research and Careers in Environmental Engineering" (Co-presenter with Bruce Logan) *STEM Outreach**

Penn State University College of Engineering Research Symposium, April 2022

Oral: "Pushing the Limits of the All-Aqueous Copper Thermally Regenerative Ammonia Battery Through Electrolyte Manipulation"

PSU Civil and Water Resources Engineering Seminar Series, Fall 2021

Oral: "Experiments and Modeling of Power and Energy Density Thermally Regenerative Ammonia Batteries"

The 240th Meeting of the Electrochemical Society, October 2021

*Oral: "A Numerical Investigation of the All-Aqueous Copper Thermally Regenerative Ammonia Battery" *Awarded ECS Travel Grant**

Penn State Chemical Engineering Graduate Research Symposium, September 2021

Oral: "Energy Storage Density in the All-Aqueous Copper Thermally-Regenerative Ammonia Battery"

The 239th Meeting of the Electrochemical Society, May/June 2021

Oral: "The Impact of Fiber Arrangement on Power Density and Electrodeposition in Porous Ag-TRAB Electrodes"

Penn State University College of Engineering Research Symposium, April 2021

Oral: "A Numerical Investigation into the Relationship Between Fiber Arrangement and Advective Transport in Ag-Thermally Regenerative Ammonia Battery Electrodes"

AIChE PNW Regional Conference, April 2017

Oral: "Carbon Degradation and Kinetics in a Vanadium (IV/V) Electrolyte"

Oregon BESTFEST Cleantech Conference, September 2015

Poster: "Achieving Exceptionally Long Battery Life: A Cost Effective Solution to Intermittency"

External Service

Reviewer for the following journals: *Electrochimica Acta*, *Ionics*, *Journal of Applied Electrochemistry*, *Discover Electrochemistry*

Session Chair for "A09 - Multivalence Metal Based Battery 1" at PRiME 2024

Session Chair for "A04 - Flow Battery Power Cells" at the 247th ECS Meeting