

## 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*
- 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

<b>Teaching Assistant</b>	CHE 470: Design of Chemical Plants	Fall 2019
<b>Teaching Assistant</b>	CHE 431: Chemical Plant Design I	Winter 2018

## Undergraduate Students Mentored

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)

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

##### **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 CO<sub>2</sub> 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 245<sup>th</sup> 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 242<sup>nd</sup> 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 241<sup>st</sup> 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)

**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 240<sup>th</sup> 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 239<sup>th</sup> 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