

Dr. Daniel A. Moreno

Assistant Professor, Mechanical Engineering
Cooperative Engineering Program at Missouri State University
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Adjunct Assistant Professor, Mechanical & Aerospace Engineering (Courtesy Appointment)
Missouri University of Science and Technology
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I. EDUCATION/PROFESSIONAL DEVELOPMENT

Education:

Georgia Institute of Technology, Atlanta, GA
Ph.D., Mechanical Engineering 5/2019
Thesis Title: Thermodynamics of Electrosorption-Based Separation Processes and Cycles
Advisor: Dr. Marta Hatzell
M.S., Mechanical Engineering 12/2015
The Cooper Union for the Advancement of Science and Art, New York, NY
B.Eng., Mechanical Engineering 5/2014

Previous Positions Held:

Postdoctoral Scholar, University of Kentucky Center for Applied Energy Research 5/2019 – 7/2021
Graduate Research Assistant, Georgia Institute of Technology 3/2016 – 5/2019
Graduate Teaching Assistant, Georgia Institute of Technology 1/2015 – 12/2016
Undergraduate Research Assistant, Olin College of Engineering 6/2013 – 8/2013

II. RESEARCH

Ongoing Research:

- Director of research in engineering and related sciences pertaining to electrochemical technologies.
- Current primary focus topics are on electrochemical energy storage and CO₂ conversion.

Student Advising:

Graduate:

- Niklas Landgraf (Materials Science) (Co-advised with Dr. David Cornelison) 6/2022 – 5/2024
- David Iyodo (Materials Science) 3/2023 - 5/2024
- Olumide Akindoru (Materials Science) (Co-advised with Dr. Robert Mayanovic) 8/2024 - Present

Undergraduate:

- Joshua Cox (Mechanical Engineering) 1/2022 – 5/2023
- Ana Torres (Mechanical Engineering) (Co-advised with Dr. Tayo Obafemi-Ajayi) 1/2022 – 5/2023
- Pablo Skaggs (Mechanical Engineering) 2/2022 – 5/2024
- Devon Parker (Mechanical Engineering) 5/2022 – 5/2023
- Joe Cota (Mechanical Engineering/Physics Dual Degree) 5/2023 – 8/2023
- Gavin Reese (Mechanical Engineering/Physics Dual Degree) 5/2023 – 5/2024
- Grant Cary (Mechanical Engineering) 5/2023 – 8/2023
- Hunter Nelson (Physics) 5/2023 – 5/2024
- Emily Rapp (Physics) 8/2023 – Present
- Ryan Ellis (Mechanical Engineering) 5/2024 – 8/2024
- Stone Simpson (Mechanical Engineering) 5/2024 – Present
- Mick Drecker (Mechanical Engineering/Physics Dual Degree) 8/2024 – Present

Publications:

- 15. Moreno, D.**, Landgraf, N., Cornelison, D. “Evaluation and Mitigation of H₂ and O₂ Evolution in Ni-Zn Battery”. *In Preparation*.
- 14. Moreno, D.**, Nelson, H., Cary, G., Parker, D., Skaggs, P. “Thermodynamic Evaluation of Electrode Storage for Capacitive Deionization.” ACS Omega. *Under Review*.
- 13. Moreno D.**, Omosebi A, Jeon BW, Abad K, Kim YH, Thompson J, Liu K. Decoupling Charge Carrier Electroreduction and Enzymatic CO₂ Conversion to Formate Using a Dual-Cell Flow Reactor System. ACS Omega. 2024 Sep 9.
- 12. Moreno, D.** “Theoretical performance optimization of enzymatic electrochemical CO₂ reduction to formate: Voltage, concentration, temperature, pressure, and flow rate.” Journal of CO₂ Utilization. 2024 May 1;83:102805.
- 11. Moreno, D.**, Omosebi A, Jeon BW, Abad K, Kim YH, Thompson J, Liu K. Electrochemical CO₂ conversion to formic acid using engineered enzymatic catalysts in a batch reactor. *Journal of CO₂ Utilization*. 2023 Apr 1;70:102441.
- 10.** Naser, M., Thompson, J., **Moreno, D.**, Abad, K., Omosebi, A., Wook Jeon, B., Kim, Y.H., Liu, K. “Electrochemical Reduction of Carbon Dioxide to Formic Acid: The Life Cycle Assessment Study.” *Under Review*.
- 9. Moreno, D.**, Thompson J, Omosebi A, Landon J, Liu K. Electrochemical analysis of charge mediator product composition through transient model and experimental validation. *Journal of Applied Electrochemistry*. 2022 Nov;52(11):1573-84.7.
- 8.** Thompson, J., Omosebi, A., **Moreno, D.**, Matin, N., Abad, K., Liu, K. An Intensified Electro-Catalytic Process for Production of Formic Acid from Power Plant CO₂ Emissions: Final Technical Report. *University of Kentucky Research Foundation*; 2022 Apr 1.
- 7. Moreno, D.**, Hatzell, M. C. (2019). Constant chemical potential cycles for capacitive deionization. *Physical Chemistry Chemical Physics*, 21(44), 24512-24517.
- 6. Moreno, D.**, Hatzell, M. C. (2019). Efficiency of Thermally Assisted Capacitive Mixing and Deionization Systems. *ACS Sustainable Chemistry & Engineering*, 7(13), 11334-11340.
- 5.** Dixit, M. B., **Moreno, D.**, Xiao, X., Hatzell, M. C., Hatzell, K. B. (2019). “Mapping charge percolation in flowable electrodes used in capacitive deionization.” *ACS Materials Letters*, 1(1), 71-76.
- 4. Moreno, D.**, Bootwala, Y., Tsai, W. Y., Gao, Q., Shen, F., Balke, N., Hatzell, K. B., Hatzell, M. C. (2018). “In situ electrochemical dilatometry of phosphate anion electroadsorption.” *Environmental Science & Technology Letters*, 5(12), 745-749.
- 3.** Gunawan, A., Simmons, R. A., Haynes, M. W., **Moreno, D.**, Menon, A. K., Hatzell, M. C., Yee, S. K. (2019). “Techno-economics of cogeneration approaches for combined power and desalination from concentrated solar power.” *Journal of Solar Energy Engineering*, 141(2).
- 2. Moreno, D.**, Hatzell, M. C. (2018). “Efficiency of Carnot and conventional capacitive deionization cycles.” *The Journal of Physical Chemistry C*, 122(39), 22480-22486.
- 1. Moreno, D.**, Hatzell, M. C. (2018). “Influence of feed-electrode concentration differences in flow-electrode systems for capacitive deionization.” *Industrial & Engineering Chemistry Research*, 57(26), 8802-8809.

Grants, Contracts, and Related Sponsored Research:

- 10. Moreno, D.** Flow-Electrode Capacitive Deionization: Optimizing Performance, Energy Use, and Ion Selectivity for Treating Total Dissolved Solids in Fracking Wastewater (\$70,000.00). American Chemical Society Petroleum Research Fund. *Submitted 6 Sep 2024*.
- 9. Moreno, D.** Evaluating Long-Term Effects of Li-ion Battery Subject to Different Temperature & Charging Conditions for Extraterrestrial Applications. NASA Missouri Space Grant Consortium Affiliates. *Awarded May 2024*.
- 8. Ghosh, K., Santra, S., Moreno, D, Besara, T.** MRI: Acquisition of a Physical Properties Measurement System for Research and Education (\$643,620). *Submitted Nov. 2023, Under Review*.

7. **Moreno, D.** Evaluating Effectiveness of Acidic Solution in Anode for Electrochemical Chemical Conversion of CO₂ from Petroleum-Derived Processes (\$70,000.00). American Chemical Society Petroleum Research Fund. *Rejected May 2024.*
6. **Moreno, D.** ERI: Towards Net-Zero Emissions: Engineering Photoelectrochemical CO₂ Reduction Using Available Temperature and Pressure Variations (\$199,937.57). National Science Foundation Grant aimed at initiating research programs for engineering faculty in non-R1 institutions. *Rejected Feb. 2024.*
5. **Moreno, D.** Large Temperature-Range Computational Modeling to Predict Lithium Ion Battery Performance. NASA Missouri Space Grant Consortium Affiliates. *Awarded Sep. 2023.*
4. **Moreno, D.** ERI: Exploring the Physical and Theoretical Limits of Electrosorption-Based Electrodes for Capacitive Deionization and Capacitive Mixing (\$198,886). National Science Foundation Grant aimed at initiating research programs for engineering faculty in non-R1 institutions. *Rejected Mar. 2023.*
3. Cornelison, D., **Moreno, D.** Ni/Zn Battery gas evolution under operational conditions (\$10,646). Private Contract, Sponsored by Aesir Technologies. Applied May 2022, *Received Jun. 2022.*
2. MSU 2023 Summer Faculty Fellowship (\$6,000 stipend). Applied Oct. 2022, *Awarded Dec. 2022.*
1. MSU International Travel Grant Award (\$1,000). Submitted March 2022, *Awarded May 2022.*

Patents:

1. Thompson, J., Liu, K., Widger, L., **Moreno, D.**, Omosebi, A, Landon, J. “Method and apparatus of a dual cell electrochemical reactor.” *Mar. 2023.*

Invited Talks:

4. **Moreno, D.** “Evaluating Thermodynamics and Physical Principles to Predict Limitations to Optimized Performance for Capacitive Mixing and Deionization Processes”. *Civil Engineering and Environmental Science & Engineering Graduate Seminar Series, University of Texas – San Antonio.* 2 Apr. 2024.
3. **Moreno, D.** “Thermodynamic Analogies for Salt Water Mixing and Desalination Processes.” *Presented to Department of Mechanical Engineering, Missouri University of Science & Technology.* Apr. 2023.
2. **Moreno, D.** “Exploring the Limits of Electrosorption-Based Electrodes for Capacitive Deionization Using Thermodynamic Principles.” *Presented to Department of Chemical and Biomedical Engineering, University of Missouri - Columbia.* Oct. 2022. *Presented to Department of Physics, Astronomy, Materials Science, Missouri State University.* Nov. 2022.
1. **Moreno, D.** “Employing Thermodynamics Principles to Optimize Electrochemical Capacitor Performance: Capacitive Mixing & Deionization”. *Presented to Department of Chemistry, Missouri State University.* Sep. 2021.

Recent Conference Poster/Oral Presentations:

32. **Moreno, D.**, Rapp, E., Shortt, J. “Connecting Physical and Circuit-Based Li-Ion Battery Models Under a Large Range of Temperature Conditions”. *ASME Power 2024.* 17 Sep. 2024.
31. Simpson, S., **Moreno, D.** “Development of an Enhanced Heat Transfer Model of Laminar Pipe Flow for Pedagogical and Research Purposes”. *ASME Regional Midwest Section Conference.* 9 Sep. 2024. *Awarded Third Place at Student Poster Competition.*
30. **Moreno, D.**, Cota, J., Reese, G. “Optimizing Electrochemical CO₂ Reduction to Formate Using Temperature Variations in Batch and Flow Reactors.” *2024 ASME Energy Sustainability.* Jul 2024.
29. Reese, G, **Moreno, D.** “Effect of Temperature and Pressure on Electrochemical Production of Formic Acid” *Presented at Spring 2024 MSU Undergraduate Research Symposium.* May 2024.
28. Rapp, E., **Moreno, D.** “Large Temperature-Range Physical Model to Predict Li-Ion Battery Performance”. *33rd Annual Spring Meeting of the NASA-Missouri Space Grant Consortium, Missouri University of Science & Technology.* 19 Apr 2024.

- 27.** Nelson, H., Cary, G., **Moreno, D.** “Experimentally Investigating the Thermodynamic Adsorption Limits of Carbon-Based Electrodes for Capacitive Deionization (CDI)”. *March Meeting of the American Physical Society (APS)*. Poster Presentation. 9 Mar 2024.
- 26.** Landgraf, N., **Moreno, D.**, Cornelison, D. “Experimentally Investigating the Thermodynamic Adsorption Limits of Carbon-Based Electrodes for Capacitive Deionization (CDI)”. *2024 MOCAP Research Symposium*, Mar. 2024.
- 25.** Skaggs, P., **Moreno, D.** “Experimentally Investigating the Thermodynamic Adsorption Limits of Carbon-Based Electrodes for Capacitive Deionization (CDI)”. *2024 MOCAP Research Symposium*, Mar. 2024.
- 24.** **Moreno, D.**, Skaggs, P., Parker, D. “Evaluating the Limits of Electrosorption-Based Electrodes for Capacitive Deionization Using Thermodynamic Principles.” *ASME International Mechanical Engineering Congress & Exhibition (IMECE)*. Nov. 2023.
- 23.** **Moreno, D.** “Employing Variable Current/Voltage Control Schemes to Develop Carnot-Analogous Mixing Engines for Salinity Gradient Energy Extraction.” *Proceedings of the ASME 2023 Power Conference*. Aug. 2023.
- 22.** Landgraf, N., Mandava, P., Cox, J., Skaggs, P., Cornelison, D., **Moreno, D.** “Gas Evolution Characterization of NiZn Batteries with Residual Gas Analysis.” Poster Presentation. *Proceedings of the 241st Electrochemical Society Meeting*, May 2023.
- 21.** **Moreno, D.**, Omosebi, A., Landon, J., Thompson, J., Liu, K. “A Computational Model to Optimize the Electrochemical Reduction of CO₂ to Formic Acid Using an Enzymatic Catalyst”. *Proceedings of the 241st Electrochemical Society Meeting*, May 2023.
- 20.** Torres, A., **Moreno, D.**, Obafemi-Ajayi, T. “The Effect of Different Types of Charging Cycles and Composition on the Aging of Li-Ion Batteries for Electric Vehicles.” *Presented at Spring 2023 MSU Undergraduate Research Symposium*. Apr. 2023.
- 19.** Cox, J, Moreno, D.. “Electrochemical Carbon Dioxide Reduction and Formic Acid Production.” *Presented at Spring 2023 MSU Undergraduate Research Symposium*. Apr. 2023. **Awarded First Place with Engineering Division.**

III. TEACHING

Teaching Experience:

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| Primary Instructor, Thermodynamics | <i>Missouri State University</i> |
| Primary Instructor, Applied Thermodynamics | <i>Missouri State University</i> |
| Primary Instructor, Heat Transfer | <i>Missouri State University</i> |
| – Developed classes for MSU’s Co-op Mechanical Engineering Program. Curriculum adapted and corresponding degree awarded from Missouri University of Science & Technology (MS&T). | |

Training in Teaching:

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| Annual Teaching & Learning Showcase | <i>Missouri State University</i> |
| – Attended talks, workshops, and networked with other faculty on teaching methods at MSU’s annual showcase hosted by the Faculty Center for Teaching & Learning. | |
| Innovation in Teaching & Learning Conference | <i>Missouri University of Science & Technology</i> |
| – Attended virtual talks to integrate course content developed with the student curriculum at MS&T. | |

Guest Lectures:

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| “Strategies for Student Success”, Study and Careers in Engineering | <i>10/2022</i> |
| - Lecture for freshmen engineering students on useful tips for time management and motivation. | |

Awards:

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| CNAS Excellence in Teaching Award | <i>4/2024</i> |
| - Awarded to select faculty for strong teaching evaluations and departmental recommendations. | |

IV. SERVICE

Committees:

- CNAS Awards Committee** 8/2024 - Present
– Evaluation and selection of faculty for awards in CNAS (College of Natural and Applied Sciences).
- CNAS Student Research Committee** 8/2023 - Present
– Development of research programs for undergraduate and graduate students within CNAS.
- ASME Renewable Energy System Committee** 7/2022 - Present
– Planning and development of future conferences with the ASME POWER division.
– Served as session chair for various presentation topics at 2023-2024 conferences.
- PAMS Graduate Student Committee** 5/2022 - Present
– Contributing to the recruitment and review of graduate students in the Materials Science program.
- CNAS Scholastic Appeals Committee** 1/2022 - Present
– College-wide committee evaluating students on academic probation.

Peer Review:

- Reviewed proceedings papers for the ASME POWER Conference in 2023.
- Submitted two paper reviews for the American Chemical Society (ACS) during 2021.
- Submitted five paper reviews for ASEE Midwest Regional Conference from 2023-2024.
- Served on NSF Pre-proposal review panel in 2023.
- Submitted paper reviews for Journal of Colloid and Interface Science and Electrochemical Society in 2023.

Community Activities:

- Chapter Advisor, American Society of Mechanical Engineers (ASME)** *Missouri State University*
– Advising student-led chapter of ASME within the MSU/MS&T Cooperative Engineering Program.
- Volunteer Judge, Ozarks Science and Engineering Fair** *Missouri State University*
– Scored and evaluated physics and engineering related projects for high school students.
- Project Leader, Regional Science Olympiad** *Missouri State University*
– Project leader for student teams at the middle school level on the fundamentals of waves.
– Developed a questionnaire along with three lab-based modules.

Leadership Positions:

- Faculty Advisor, American Society of Mechanical Engineers (ASME), MSU/MS&T Co-op Program Chapter** *Missouri State*
- President, American Society for Engineering Education (ASEE)** *Georgia Tech*
- Vice President, Mechanical Engineering Graduate Association (MEGA)** *Georgia Tech*
- Co-Head Teaching Assistant, Creative Decisions and Design** *Georgia Tech*
- Outreach Coordinator, Pi Tau Sigma** *Cooper Union*

Professional Organizations:

- APS, American Physical Society** 10/2023
- ACS, American Chemical Society** 9/2023
- ECS, The Electrochemical Society** 9/2017
- ASEE, American Society for Engineering Education** 10/2016
- Order of the Engineer** 4/2014
- Pi Tau Sigma, Mechanical Engineering Honor Society** 4/2013
- ASME, American Society of Mechanical Engineers** 4/2012