

Jordan D. Kocher

Ph.D. Candidate, Georgia Institute of Technology

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Education

Georgia Institute of Technology, Atlanta, GA (Aug 2019 - Present)

GPA: 4.00

Doctor of Philosophy in Mechanical Engineering

IBUILD Fellow

Advisors: Dr. Shannon Yee and Dr. Akanksha Menon

Thesis: "Development of a Refrigeration and Dehumidification Cycle Using Lower Critical Solution Temperature Mixtures"

Arizona State University, Tempe, AZ (Aug 2017 - May 2019)

GPA: 4.00

Master of Science in Mechanical Engineering

Advisor: Dr. Robert Wang

Thesis: "Analyzing the Opportunities for Thermoresponsive Polymers in Air Conditioning Systems"

Arizona State University, Tempe, AZ (Aug 2013 - May 2017)

GPA: 4.00

Bachelor of Science in Mechanical Engineering

Advisor: Dr. Robert Wang

Thesis: "Thermal Energy Storage Using Organic and Metallic Phase Change Materials"

Honors & Awards

- IBUILD Graduate Research Fellowship 2021– Present
 - Georgia Institute of Technology – President’s Fellowship 2019 – 2023
 - Georgia Institute of Technology – Office of the Provost Travel Grant 2023
 - Arizona State University – Moeur Award 2017
 - New American University Scholar – President’s Award 2013 – 2017
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Research & Professional Experience

Georgia Institute of Technology

Atlanta, Georgia

IBUILD Graduate Research Fellow

August 2021 – Present

- Invented a heat-driven cooling cycle that uses thermoresponsive materials (patent pending)
- Performed a thermodynamic analysis to determine the reversible limit of performance
- Derived the expressions for the maximum temperature drop and range of operating humidities as a function of the chemical potential of water in the two phases of a thermoresponsive mixture
- Characterized the chemical potential of various thermoresponsive materials from the literature and determined the performance that they could achieve
- Performed various experimental demonstrations, proving the concept of the new cycle
- Modeled a mixture with an enthalpy and entropy of mixing greater in magnitude than existing LCST mixtures and demonstrated that it would possess a greater chemical potential difference
- Performed a techno-economic analysis of an air conditioning system that would utilize this new cycle and the hypothetical "improved" thermoresponsive mixture that I modeled
- In addition to the abovementioned thermoresponsive research, I also worked on various side-projects, including the development of a broadly applicable cost scaling analysis for thermal storage, a techno-economic comparison of atmospheric water harvesting and desalination, and a numerical model of an air gap diffusion distillation (AGDD) desalination system

**NASA Johnson Space Center
CFD Analyst Internship**

**Houston, Texas
January 2018 – May 2018**

- Analyzed a modification to the ventilation system within the Orion spacecraft
- Modeled the ventilation in ANSYS Fluent and validated simulated results against a benchtop-scale experiment; found that the proposed modification significantly improved airflow

**Arizona State University
Research Assistant**

**Tempe, Arizona
August 2015 – May 2019**

- Developed a thermoresponsive hydrogel dehumidifier concept and performed a thermodynamic analysis of the proposed system (master's thesis)
- Assembled and tested a prototype thermal storage system for rooftop concentrating solar power (undergraduate honors thesis)

Journal Publications

- J6. **J. D. Kocher**, A. K. Menon, and S. K. Yee; "Equivalent Circuits for Energy and Exergy Flow in Thermodynamic Systems." (In preparation)
- J5. **J. D. Kocher**, A. K. Menon, and S. K. Yee; "A Refrigeration and Dehumidification Cycle Using Lower Critical Solution Temperature Mixtures." (In preparation)
- J4. **J. D. Kocher** and A. K. Menon; "Addressing global water stress using desalination and atmospheric water harvesting: a thermodynamic and technoeconomic perspective." *Energy & Environmental Science* 16 (November 8, 2023): 4983. <https://doi.org/10.1039/D3EE02916F>.
- J3. **J. D. Kocher**, J. Woods, A. Odukumaiya, A. Mahvi, and S. K. Yee; "Thermal Batteries Cost Scaling Analysis Minimizing the \$ per kWh." (Under review at *Energy & Environmental Science*)
- J2. W. P. Parker, **J. D. Kocher**, and A. K. Menon; "Thermal Brine Concentration Using Air Gap Membrane Distillation: Evaluating System Performance Towards Zero Liquid Discharge Desalination." (In preparation)
- J1. **J. D. Kocher**, S. K. Yee, and R. Y. Wang; "A first and second law analysis of a thermoresponsive polymer desiccant dehumidification and cooling cycle." *Energy Conversion and Management* 253 (February 1, 2022): 115158. <https://doi.org/10.1016/j.enconman.2021.115158>.

Conferences

Peer Reviewed Proceedings

- R2. **J. D. Kocher**, A. K. Menon, and S. K. Yee; "An Air Conditioning Cycle Using Lower Critical Solution Temperature Mixtures." ASME 2023 Heat Transfer Summer Conference, Washington, D.C. (July 2023). <https://doi.org/10.1115/HT2023-107065>
- R1. **J. D. Kocher** and A. K. Menon; "Pathways for Atmospheric Water Harvesting to Reach Cost Parity with Distributed Desalination." ASME 2023 Energy Sustainability Conference, Washington, D.C. (July 2023). <https://doi.org/10.1115/ES2023-107067>

Presentations

- C4. **J. D. Kocher**; "A Refrigeration and Dehumidification Cycle Using Thermally-Induced Phase Separation." IBUILD Ignite Talks Competition, Virtual (November 2023); **3rd Place Winner**
- C3. **J. D. Kocher**, A. K. Menon, and S. K. Yee; "Required Properties of Lower Critical Solution Temperature (LCST) Mixtures for Use in a Dehumidification and Cooling Cycle." 2023 AIChE Annual Meeting, Orlando, FL (November 2023)
- C2. **J. D. Kocher**; "Lower Critical Solution Temperature Dehumidification and Refrigeration." BTO Peer Review 2023, Arlington, VA (April 2023)

C1. **J. D. Kocher**, A. K. Menon, and S. K. Yee; “Temperature and Humidity Control Using Lower Critical Solution Temperature (LCST) Mixtures.” MRS Spring Meeting, San Francisco, CA (April 2023)

Posters

P6. **J. D. Kocher**, A. K. Menon, and S. K. Yee; “Lower Critical Solution Temperature Dehumidification and Refrigeration.” 2023 Joint US – Japan Nanoscale Conference, San Diego, CA (July 2023)

P5. **J. D. Kocher**; “Lower Critical Solution Temperature Dehumidification and Refrigeration.” BTO Peer Review 2023, Arlington, VA (April 2023)

P4. **J. D. Kocher**, A. K. Menon, and S. K. Yee; “Lower Critical Solution Temperature (LCST) Materials Used for Solar-Powered Cooling.” Georgia Tech Career, Research, and Innovation Development Conference, Atlanta, GA (February 2023); **Top Prize Winner**

P3. **J. D. Kocher**, A. K. Menon, and S. K. Yee; “Lower Critical Solution Temperature (LCST) Materials Used for Solar-Powered Cooling.” GT² Symposium, Atlanta, GA (January 2023)

P2. **J. D. Kocher** and S. K. Yee; “Lower Critical Solution Temperature (LCST) Materials Used for Solar-Powered Cooling.” Carbice Poster Competition, Atlanta, GA (August 2022); **3rd Place Winner**

P1. **J. D. Kocher**, Y. Zhang, and R. Y. Wang; “Analyzing the Opportunities for NIPAAm Water Harvesting in Air Conditioning Systems.” MRS Spring Meeting, Phoenix, AZ (April 2019)

Patents

IP3. **J. D. Kocher**; “Refrigeration System Using Thermally Responsive Liquids” (provisional)

IP2. **J. D. Kocher**; “Air Conditioning System Using Thermally Responsive Liquid Desiccants” (pending)

IP1. **J. D. Kocher** and R. Y. Wang; “Air Conditioning System Using a Responsive Hygroscopic Material” (pending)

Courses Taught

Georgia Institute of Technology

ME 4315 – Energy Systems Analysis and Design (Teaching Practicum)

Arizona State University

MAE 241 – Thermodynamics I (Teaching Assistant)

Leadership, Clubs, and Service Activities

- SURE Program Graduate Student Mentor Summer 2023
- Georgia Tech Mechanical Engineering Recruiting Volunteer Spring 2023
- Mentor to Undergraduate Student Researchers Spring 2020, Spring 2023
- Mechanical Engineering Graduate Association (MEGA) Volunteer Fall 2020

Honor Societies and Professional Organizations

- American Society of Mechanical Engineers (ASME) Student Member
- Materials Research Society (MRS) Student Member
- American Institute of Chemical Engineers (AIChE) Student Member
- Alpha Lambda Delta Honor Society