**Xiaoli Liu**

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**EDUCATION**

***Purdue University* *01/2019-05/2022***

* Ph.D. in Civil Engineering, Lyles School of Civil Engineering
* ***Dissertation:*** “*Thermoelectric Building Envelope: Material Characterization, Modeling, and Experimental Performance Evaluation*.”
* Committee: Prof. Ming Qu (Chair), Prof. Qingyan Chen, Prof. Brandon Boor, Prof. Kazuaki Yazawa.

***Purdue University* *08/2017-12/2018***

* M.Sc., Architectural Engineering, Lyles School of Civil Engineering
* ***Thesis:*** “*Performance Analysis for A Membrane-Based Liquid Desiccant Air Dehumidifier: Experiment and Modeling*.”
* Committee: Prof. Ming Qu (Chair), Prof. Eckhard A. Groll, Prof. W. Travis Horton, Dr. Xiaobing Liu.

***Chongqing University, China* *09/2013-05/2017***

* B.S., Built Environment and Energy Application Engineering
* Minor B.S., International Economy and Trade, College of Public Affairs

**PROFICIENT SKILL**

***Background:*** Dehumidification, heat and mass exchanger, thermoelectric cooling and power generation, membrane, desiccant, adsorption, energy conversion and storage, vapor compression systems.

***Fundamental Skills:*** Transient heat and mass transfer analysis, thermodynamic analysis, first-principle modeling, scientific computing, numerical simulation.

***Experimental Skills:*** Experiment design, sensor & instrumentation, thermo-physical property measurement.

***Computing and 3D Modeling:*** Python, Arduino, MATLAB, COMSOL, Modelica, LabVIEW, EES, Fusion 360.

**PROFESSIONAL EXPERIENCE**

***Postdoctoral Research Associate, Oak Ridge National Laboratory 07/2022-present***

* Leading numerical modeling, facility development, and experimental validation for multiple projects:
  + Combined washer and dryer with thermal energy storage (TES)
    - *Conducted market research on heat pump dryers.*
    - *Developed an advanced heat pump model for a comprehensive dryer simulation, encompassed phase change material (PCM) selection, PCM-to-refrigerant heat exchanger design, and systematic deployment.*
    - *Collaborating with industry partners for prototype development, testing, and validation.*
    - *Presented the project progress in the 2023 DOE BTO Project Peer Review.*
  + Multi-functional equipment for direct decarbonization with improved indoor air quality (IAQ)
    - *Developed transient heat and mass transfer model to simulate the dynamic performance of a rotary desiccant wheel for air dehumidification with active regeneration.*
    - *Developed an experimental setup, including sensor selection and facility construction, for dehumidifier evaluation.*
  + Reduced Cost Heat Pump Space- And Water-Heating in Cold Climates
    - *Focusing on advanced heat exchanger design and manufacturing for TES purposes.*
  + Cost compression for multifamily heat pump water heaters
  + Dual Source Heat Pump Integrated with Thermal Energy Storage
  + Impact Analysis of Heating Electrification in US Buildings with Geothermal Heat Pumps
  + A CVT-guided design framework for borehole planning of ground source heat pump system
* Assisting in project management and proposal writing, including:
  + *DOE DE-LC-0000020: Advanced Desiccant Clothes Dryers with a Heat Recovery System*

***Research assistant, Purdue University 2019-05/2022***

* Studied thermoelectric (*TE*) cement for space heating and cooling and power generation as advanced building envelopes, a multi-lab/center collaboration project funded by NSF:
  + *Contributed to the design, assembly, and evaluation of TE building envelopes at Ray W. Herrick Laboratories.*
  + *Supported with characterizing properties of TE cement composite materials at Birck Nanotechnology Center.*
  + *Collaborated with Pankow Materials Laboratory for the development of TE cement composites.*

***Visiting researcher, Dublin Institute of Technology 11/2019***

* Characterized *TE* properties of varied *TE* cement.
* Led and published a high-impact review paper on *TE* cement composite.

***Research assistant, Purdue University 01/2018-12/2018***

* IoT smart building control from data acquisition of CO2, PM2.5, temperature & humidity on cloud and mobile platform to control strategies implementation for heater on/off to realize lighting control.
* Studied the membrane-based ionic liquid desiccant air dehumidification, a project funded by DOE.

***Summer research assistant, Oak Ridge National Laboratory 07/2018***

* Designed and conducted experiments to characterize membrane materials for air dehumidification.
* Measured the mass transfer coefficient of different membranes under various conditions.
* Led and published a review paper on membrane-based liquid desiccant air dehumidifiers.

**AWARD**

* Lyles Graduate Teaching Fellowship ***2022***
* Crooks Graduate Scholarship from Civil Engineering, Purdue University ***2020***
* Excellent Student Comprehensive Scholarship, Top15% of 180  ***2014***

**TEACHING & MENTORING EXPERIENCE**

***Lyles teaching fellow for spring 2022 in CE 21100 (thermodynamics)***

* Delivering lectures and conducting active learning sessions.
* Helping the Faculty Mentor prepare homework, quizzes, and exams.

***Graduate student mentor in SURF programs at Purdue***

* Guided undergraduate students with paper writing and research skills.
* Collaborated with undergraduate students on the design and manufacturing of experimental molds.
* Familiarizing undergraduate students with advanced physical property measurement systems.
* Published a journal paper and a conference paper with undergraduate students.

**PROFESSIONAL ASSOCIATION & LEADERSHIP**

* Vice-chair of Herrick Conferences 2022 ***07/2022***
* Member of American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)

***2017-present***

* Social Media Officer of ASHRAE Purdue Chapter ***2021-2022***

**PUBLICATION**

**First-authored Peer-Reviewed Journal Papers**

**[1] *Liu, X.,*** Yazawa, K., Qu, M., Kurtulus, O., Norton, B., Holmes, N., ... & Yin, H. (2022). Experimental performance evaluation of a convective thermoelectric building envelope for building heating and cooling. Energy and Buildings, 273, 112376.

**[2]** ***Liu, X.,*** Nguyen, A., Qu, M., Dilley, N., & Yazawa, K. (2021) Characteristics of new cement-based thermoelectric composites for low-temperature applications, Construction and Building Materials.

**[3]** ***Liu, X.,*** Jani, R., Orisakwe, E., Johnston, C., Chudzinski, P., Qu, M., ... & Yin, H. (2020). State of the art in composition, fabrication, characterization, and modeling methods of cement-based thermoelectric materials for low-temperature applications. Renewable and Sustainable Energy Reviews, 110361.

**[4]** ***Liu, X.,*** Qu, M., Liu, X., Wang, L., & Warner, J. (2020). Numerical modeling and performance analysis of a membrane-based air dehumidifier using ionic liquid desiccant. Applied Thermal Engineering, 115395.

**[5]** ***Liu, X.,*** Qu, M., Liu, X., & Wang, L. (2019). Membrane-based liquid desiccant air dehumidification: A comprehensive review on materials, components, systems and performances. Renewable and Sustainable Energy Reviews, 110, 444-466.

**Other Peer-Reviewed Journal Papers**

**[6]** Rendall, J., Brechtl, J., Nawaz, K., Elatar, A., Sun, J., An, K., ... & Asher, W. (2023). Experimental results of embedded phase change material capsules for increasing the performance of a wrapped heat pump water heater. International Communications in Heat and Mass Transfer, 145, 106806.

**[7]** Jani, R., Holmes, N., West, R., Gaughan, K., ***Liu, X.,*** Qu, M., ... & Wojciechowski, B. (2022). Characterization and Performance Enhancement of Cement-Based Thermoelectric Materials. Polymers, 14(12), 2311.

**[8]** Wang, L., Liu, X., Qu, M., ***Liu, X.,*** & Bahar, B. (2021). An experimental study on dehumidification and regeneration performance of a new nonporous membrane-based heat and mass exchanger using an ionic liquid desiccant. Energy and Buildings, 111592. [[Doi](https://doi.org/10.1016/j.enbuild.2021.111592)]

**[9]** Qu, M., ***Liu, X.,*** Yang, Z., Wu, F., Shi, L., Liu, X., ... & Yin, H. (2018). Energy-saving technologies for building heating, ventilation, and air conditioning systems. Annual Review of Heat Transfer, 21. [[Doi](https://www.dl.begellhouse.com/references/5756967540dd1b03,6d280f305cda5f5e,4b2916c52a290a95.html)]

**Conference Proceedings & Presentations**

**[1]** **Liu, X.,** Li, K., & Nawaz, K. Numerical Modeling of a Rotary Desiccant Wheel using Super Absorbent Polymer for Air Dehumidification. 2023 ASHRAE Annual Conference. Tampa, FL, United States.

**[2]** Wang, L., Liu, X., Shen, B., **Liu, X.,** Gehl, A., Shi, L., & Qu, M. (2022). Experimental performance analysis of a dual source heat pump integrated with thermal energy storage. IGSHPA 2022.

**[3] *Liu, X.,*** *Qu, M., Yazawa, K., Kohanoff, J., Chudzinski, P., Stella, L., … & Johnston C. (2022). Performance Modeling and Analysis of a Thermoelectric Building Envelope for Space Heating. 2022 High performance buildings Conference, West Lafayette, Indiana, United States.*

**[4] *Liu, X.,*** Qu, M., & Yazawa, K. (2022). Performance Assessment of Integrated Building Envelopes Using Thermoelectric Modules for Temperature Regulation. 2022 ASHRAE Winter Conference. Las Vegas, NV, United States.

**[5]** ***Liu, X.,*** & Qu, M. (2021). Thermoelectric Characteristics of Graphene and Aluminum Doped Zinc Oxide Nanopowder Enhanced Cement Composite for Low-Temperature Applications. 2021 ASHRAE Annual Conference. Atlanta, Georgia, United States.

**[6]** ***Liu, X.,***Qu, M., & Yazawa, K. (2021). A Three-Dimensional Transient Model for Evaluating the Performance of Cement-Based Thermoelectric Module. 2020 High performance buildings Conference, West Lafayette, Indiana, United States.

**[7]** Jawadwala, H., Tian, R., Yin, H., Qu, M., ***Liu, X.,*** Holmes, N., ... & Jani, R. (2021, March). Thermal Comfort: Radiant Systems-A Review of Experimental-based Thermal Comfort Research in Radiation Systems. In 108th ACSA Annual Meeting Proceeding.

**[8] *Liu, X.,*** Qu, M., & Nguyen, A. (2021). Characteristics of New Cement-Based Thermoelectric Composite for Low-Temperature Applications by A Novel Method. 2020 High performance buildings Conference, West Lafayette, Indiana, United States.

**[9]** Jani, R., Holmes, N., West, R. P., Gaughan, K., ***Liu, X.,*** Orisakwe, E., Johnston, C., Qu, M., Kohanoff, J., Stella, L., & Yin, H. (2020). Characterization and Performance of Cement-based Thermoelectric Materials. In Civil Engineering Research in Ireland (CERI) 2020.

**[10]** ***Liu, X.,*** Qu, M., Warner, J., & Liu, X. (2019). A Novel Heat and Mass Transfer Model for Membrane-based Ionic Liquid Desiccant Air Dehumidifier. 2019 ASHRAE Winter Conference. Atlanta, Georgia, United States.

**[11]** Liu, X., Warner, J., Qu, M., ***Liu, X.,*** Opadrishta, H., & William, P. (2018). A preliminary experimental study on the performance of a membrane-based air dehumidifier using ionic liquid. 17th International Refrigeration and Air Conditioning Conference, West Lafayette, Indiana, United States.