Mason Zadan

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EDUCATION

Carnegie Mellon University *August 2024*
Doctor of Philosophy in Mechanical Engineering *Pittsburgh, PA*
Advisor: Carmel Majidi
Thesis: Stretchable Thermoelectric Devices for Wearable Electronics and Soft Robotics

University of Richmond *May 2020*
Bachelor of Science in Physics with a Minor in Mathematics *Richmond, VA*
Honors: Magna Cum Laude

APPOINTMENTS

David H. Koch Institute for Integrative Cancer Research at *November 2024-Present*
The Massachusetts Institute of Technology *Cambridge, MA*
Postdoctoral Research Associate
Advisors: Robert Langer and Ana Jaklenec

RESEARCH EXPERIENCE

Postdoctoral Researcher *November 2024-Present*
Koch Institute for Integrative Cancer Research, Massachusetts Institute of Technology, Cambridge, MA

- Developing a polymeric drug delivery depot platform, administration route, and in vivo rat model of femoral bone metastasis for the local sustained release of bisphosphonates, targeting bone regeneration and tumor eradication in late-stage metastatic cancers.
- Demonstrated 665 nm interstitial light therapy within the bone for localized light-based cancer ablation.
- Collaborating with Harvard Medical School and Roswell Park Comprehensive Cancer Center on dosing regimens and clinical translatability.
- Building modular liquid crystal elastomer-based drug pumps for implantable pulsatile drug delivery.

PhD Researcher *September 2020-August 2024*
Soft Machines Lab, Department of Mechanical Engineering, Carnegie Mellon University, Pittsburgh, PA

- Led research efforts on Air Force funded projects and worked closely with Series A startup Arieca Inc. on developing stretchable thermoelectric energy harvesters for next-generation wearable health monitoring
- Published 16 papers during a PhD completed in under four years with additional manuscripts in preparation and under review, including research articles in Nature Materials, Nature Communications, and Advanced Materials
- Worked at the intersection of soft robotics, liquid metals (LM), and shape memory materials to develop technologies for robotic actuation
- Developed first of its kind photoplethysmography (PPG) health monitoring wearable powered solely by body heat

Visiting Researcher, Air Force Research Lab *February 2024-July 2024*
Materials and Manufacturing Directorate, Air Force Research Lab, Dayton, OH

- Led development of liquid metal-2D MXene nanocomposites as thermal interface materials for the semiconductor industry
- Developed synthesis method and microCT characterization of soft composites for improved thermal pastes
- Collaborated on-site and remotely with AFRL, publishing work on emergent properties of assembled MXene coated LM particles into aggregates

Research Scientist Intern *May 2023-August 2023*
Meta Reality Labs, Redmond, WA

- Produced patent and first author manuscript during 4-month internship
- Developed stretchable vapor chambers enabled by thin film liquid metal-based gas barrier films
- Collaborated with research scientists on addressing thermal management issues within next-generation wearables

PATENTS

- Awartani, O.; Boromand, A.; Wallin, T. J. F.; **Zadan, M.** "Stretchable vapor chamber and methods of using the same." U.S. Patent Application No. 19/057,832, filed January 2025. Publication No. US20250280512A1, published August 22, 2025. (Pending)

- **Zadan, M.**; Patel, D. K.; Sabelhaus, A.; Liao, J.; Wertz, A.; Majidi, C. "Liquid crystal elastomer with integrated soft thermoelectrics for shape memory actuation and energy harvesting." U.S. Patent Application No. 18/838,315, filed February 2023. Publication No. US20250151621A1, published May 8, 2025. (Pending)

PUBLICATIONS (*Google Scholar*: citations =907, h-index = 10, i10-index = 10)

Journal Publications

- Song, Y.; Bharambe, A.; Patel, D. K.; Zhuo, B.; **Zadan, M.**; Majidi, C.; Kumar, S. Actuatable Wide Bandwidth Liquid Metal Based Software Tunable Antenna. Advanced Science, 13, no. 5 (2026): e12996.
- Song, Y.*; Li, Z.*; **Zadan, M.**; Wang, J.; Majidi, C.; Kumar, S. Low-Power Radio-Frequency Actuation for Soft Robots. Nature Communications, 16, 7292 (2025).
- **Zadan, M.;** Hu, Y.; Lipp, J.; Lewis, N.; Shah, D.; Islam, M. F.; Nepal, D.; Grasinger, M.; Dayal, K.; Tabor, C.; Majidi, C. MXene-Coated Liquid Metal Nanodroplet Aggregates, Langmuir, 2025, 41, 13, 8834-8841.
- Reese, C. J.; Musgrave, G. M.; Wong, J.; Pan, W.; Uehlin, J.; **Zadan, M.**; Awartani, O. M.; Wallin, T. J.; Wang, C. Photopatternable, Degradable, and Performant Polyimide Network Substrates for e-Waste Mitigation. RSC Applied Polymers, 2024, *2* (5), 805–815.
- **Zadan, M.**; Wertz, A.; Shah, D.; Patel, D. K.; Zu, W.; Han, Y.; Gelorme, J.; Mea, H. J.; Yao, L.; Malakooti, M. H.; Ko, S. H.; Kazem, N.; Majidi, C. Stretchable Thermoelectric Generators for Self-Powered Wearable Health Monitoring. Advanced Functional Materials, 2024, 2404861.
- Abdelrahman, M. K.; Wagner, R. J.; Kalairaj, M. S.; **Zadan, M.**; Kim, M. H.; Jang, L. K.; Wang, S.; Javed, M.; Dana, A.; Singh, K. A.; Hargett, S. E.; Gaharwar, A. K.; Majidi, C.; Vernerey, F. J.; Ware, T. H. Material Assembly from Collective Action of Shape-Changing Polymers. Nature Materials 2024, 1–9.
- **Zadan, M.**; Patel, D. K.; Sabelhaus, A. P.; Liao, J.; Wertz, A.; Yao, L.; Majidi, C. Liquid Crystal Elastomer with Integrated Soft Thermoelectrics for Shape Memory Actuation and Energy Harvesting. Advanced Materials 2022, 34 (23), 2200857.
- Won, P.; Valentine, C. S.; **Zadan, M.**; Pan, C.; Vinciguerra, M.; Patel, D. K.; Ko, S. H.; Walker, L. M.; Majidi, C. 3D Printing of Liquid Metal Embedded Elastomers for Soft Thermal and Electrical Materials. ACS Appl. Mater. Interfaces 2022, 14 (49), 55028–55038.
- Roberts, P.; **Zadan, M.**; Majidi, C. Soft Tactile Sensing Skins for Robotics. Curr Robot Rep 2021, 2 (3), 343–354.
- **Zadan, M.**; Chiew, C.; Majidi, C.; Malakooti, M. H. Liquid Metal Architectures for Soft and Wearable Energy Harvesting Devices. Multifunctional Mater. 2021, *4* (1), 012001.
- **Zadan, M.***; Malakooti, M. H.*; Majidi, C. Soft and Stretchable Thermoelectric Generators Enabled by Liquid Metal Elastomer Composites. ACS Appl. Mater. Interfaces 2020, 12 (15), 17921–17928.

Peer-reviewed Conference Publications

- Han, V. Y.; Chen, A.; **Zadan, M.**; Gonzalez, J.; Patel, D. K.; Yu, F.; Majidi, C.; Ion, A. Transforming Everyday Objects into Dynamic Interfaces using Smart Flat-Foldable Structures. In Proceedings of the 38th Annual ACM Symposium on User Interface Software and Technology (UIST) September 2025; pp. 1-15.
- Song, Y.; **Zadan, M.**; Misra, K.; Li, Z.; Wang, J.; Majidi, C.; Kumar, S. Navigating Soft Robots through Wireless Heating. In 2023 IEEE International Conference on Robotics and Automation (ICRA); IEEE: London England, 2023; pp 2598–2605.
- Wang, J.; Song, Y.; **Zadan, M.**; Shen, Y.; Chen, V.; Majidi, C.; Kumar, S. Wireless Actuation for Soft Electronics-Free Robots. In Proceedings of the 29th Annual International Conference on Mobile Computing and Networking; ACM: Madrid Spain, 2023; pp 1–16.
- **Zadan, M.**; Patel, D. K.; Malakooti, M. H.; Yao, L.; Majidi, C. Fabrication of 3D Printed Thermoelectric Devices for Integration into Liquid Crystal Elastomer Actuators. In Proceedings of the ASME 2022 Conference on Smart Materials, Adaptive Structures and Intelligent Systems; ASME: Dearborn, Michigan, USA, 2022; Vol. 86274.
- Malakooti, M. H.; **Zadan, M.**; Kazem, N.; Majidi, C. Liquid Metal Composites for Flexible Thermoelectric Energy Harvesting. In Behavior and Mechanics of Multifunctional Materials XV; SPIE: Online, 2021; Vol. 11589, pp 57–64.

Under Review and In Preparation

- **Zadan, M.***; Kapsalis, L.*; Bardhan, N. M.; Rastogi, V.; Gawrys, E.; Brown, P.; Shafirstein, G.; Belcher, A. M.; Langer, R.; Jaklenec, A. Intraosseous Localized Zoledronic Acid Depots for Breast Cancer Bone Metastases. 2026, In Preparation.
- Chibh, S.; Liu, S.; Tian, J.; **Zadan, M.**; Langer, R.; Jaklenec, A. Development of Dissolving Microneedle Patches for Polio-VLP Delivery Using AI-Guided Excipient Screening. 2026, In Preparation.

- Vinciguerra, M.; **Zadan, M.**; Hu, Y.; Desatnik, R.; Reinhard, G.; Nepal, D.; Grasinger, M.; Dayal, K.; Majidi, C.; Varshney, V. Microstructure reconstruction of liquid metal MXene composites via denoising diffusion probabilistic models. Engineering Applications of Artificial Intelligence, 2026, *In preparation.*
- Kim, H.; Patel, D. K.; Hu, J.; Sue, A.; Hu, Y.; Seok, J.; Bai, Z.; **Zadan, M.**; Vinciguerra, M.; Lee, G. H.; Webster-Wood, V.; Cohen-Karni, T.; Shah, D.; Majidi, C. Printable Thermoelectric Ink for Self-Healing, Thermally Responsive Soft Devices. ACS Nano 2026, *Under Review*.
- Yang, X.; Zhang, L.; Song, H.; Gao, W.; Huang, Y.; Zheng, Z.; Wang, E. Y.; Liu, Y.; Durand, F.; Liu, Y.; Gao, W.; Chen, Y.; Chen, B.; Chen, Y.; Eshaghi, B.; Han, J.; Shi, Y.; **Zadan, M.**; Yu, C.; Langer, R.; Jaklenec, A. SMART: Smart Microneedle Array for Responsive Therapy – An AI Assisted Microneedle Patch Based Programmable Drug Release Platform. Nature Communications 2026, *Under Review.*
- **Zadan, M.**; Andrade, M.; Uehlin, J.; Ohm, Y.; Jacobs, J.; Awartani, O. Ultrathin Liquid Metal Films for Moisture Barriers and RF Shielding in Stretchable Electronics. Matter 2026*, Under Review*.

INVITED TALKS

- **Zadan, M.** Soft Matter and Liquid Metals for Human Interfacing Technologies. *Princeton University Department of Mechanical and Aerospace Engineering Seminar Talk.* September, 2026. Invited Talk.
- **Zadan, M.** Soft Matter and Liquid Metals for Human Interfacing Health Technologies. *Texas A&M University Department of Engineering Technology & Industrial Distribution Seminar Talk.* February, 2026. Invited Talk.
- **Zadan, M.** Liquid Metals and Soft Active Matter for Stretchable Thermoelectrics and Soft Robotics. *The Born and The Made - Morphing Matter Lab Guest Lecture, Berkeley Mechanical Engineering Department Seminar Talk.* September, 2025. Invited Talk.

CONFERENCE PRESENTATIONS

- **Zadan, M.** Local Delivery of Sustained Zoledronic Acid for Metastatic Cancers to the Bone. 17th US-Japan Symposium on Drug Delivery Systems. December 2026. Poster (Accepted).
- **Zadan, M.** SEAL Vaccine Microparticle Manufacturing Through Precise Control of Temperature, Pressure, and Alignment. 17th US-Japan Symposium on Drug Delivery Systems. December 2026. Poster (Accepted).
- **Zadan, M.**; Hu, Y.; Lipp, J.; Majidi, C. MXene-Liquid Metal Embedded Elastomer Aggregate Composites. *41st Annual Semiconductor Thermal Measurement, Modeling and Management Symposium*. March, 2025.
- **Zadan, M.;** Patel, D. K.; Wertz, A.; Majidi, C. Advances in Soft and Wearable Energy Harvesters Using Stretchable Thermoelectrics. *Materials Research Society Spring Meeting.* April, 2024.
- **Zadan, M.**; Wang, J.; Song, Y.; Patel, D. K.; Li, Z.; Yao, L.; Kumar, S.; Majidi, C. Wireless and Thermoelectric Actuation Methods for Liquid Crystal Elastomer Based Soft Robots. *International Liquid Crystal Elastomer Conference.* October, 2023.
- **Zadan, M.**; Patel, D. K.; Wertz, A.; Shah, D.; Kazem, N.; Majidi, C. Stretchable Thermoelectric Generators and Peltier Coolers for Wearable Applications. *SEMICON West.* July, 2023.
- **Zadan, M.**; Patel, D. K.; Majidi, C. Soft and Stretchable Composite Materials for Wearable Thermoelectric Body Thermoregulation and Energy Harvesting. *39th Annual Semiconductor Thermal Measurement, Modeling and Management Symposium.* March, 2023.
- **Zadan, M.**; Patel, D. K.; Majidi, C. Stretchable 3D Printed Thermoelectric Generators for Liquid Crystal Elastomer Actuation, Control and Energy Recovery. *Materials Research Society Fall Meeting.* December, 2022.
- **Zadan, M**.; Majidi, C. Characterization of Liquid Crystal Elastomer with Integrated Soft Thermoelectrics Enabling Actuation and Energy Harvesting. Workshop on *Determining Appropriate Metrics and Test Methods for Soft Actuators in Robotic Systems, International Conference on Robotics and Automation (ICRA).* May, 2022.

REVIEWER FOR JOURNALS

- ACS Applied Materials and Interfaces, Advanced Functional Materials, ACS Energy Letters, RSC Soft Matter Book Series, IOP Engineering Research Express, IOP Journal of Physics: Energy

AWARDS AND SCHOLARSHIPS

Awards and Honors

- 2026 Koch Institute Joseph C. Jefferds, Jr. Research Travel Award

- Milton Shaw PhD Research Award, 2024 CMU Mechanical Engineering PhD Graduate Research Symposium
- Finalist, 2024 CMU Three Minute Thesis Competition
- 3rd Place American Society of Mechanical Engineers SMASIS 2022 Conference Best Student Paper Competition
- University of Richmond School of Arts and Sciences Best Paper in the Natural Sciences Award 2020
- The Jackson J. Taylor Best Senior Seminar in Physics Award 2020

Scholarships and Grants

- Richmond Science Scholar *August 2016-May 2020*
    - Awarded $200,000 merit-based full tuition scholarship for four years
    - 45 scholars selected from 5,500 applicants

TEACHING AND LEADERSHIP

Laboratory Manager *September 2021-March 2024*

Soft Machines Lab, Department of Mechanical Engineering, Carnegie Mellon University

- Conducted training for over 20 master's and PhD students, and postdocs on proper lab protocols and safety practices
- Managed hazardous waste protocols and removal, implemented and devised lab safety and cleaning procedures, and managed chemical inventories

Teaching Assistant *Spring 2022, 2023*

Soft Robots: Mechanics, Design and Modeling
Instructor: Carmel Majidi

- Mentored students on a host of soft robotics projects giving design and characterization feedback
- Directed student projects through evaluation and feedback for literature reviews, mid-semester, and final reports

OUTREACH

Senior Reviewer *January 2024-April 2025*
Associate Reviewer *March 2023-January 2024*
Reviewer *August 2022-March 2023*

Journal of Emerging Investigators (JEI)

- Volunteered at JEI, a non-profit graduate student run open-access journal publishing middle and high school students' research
- Reviewed scientific manuscripts submitted by middle and high school students to mentor, guide, and introduce students to the scientific review process

RECOMMENDERS

Robert Langer and Ana Jaklenec *Institute Professor and Principal Research Scientist*
Contact: langeroffice@mit.edu *Koch Institute for Integrative Cancer Research, MIT*

Carmel Majidi *Clarence H. Adamson Professor*
Contact: cmajidi@andrew.cmu.edu *Department of Mechanical Engineering, CMU*

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Mohammad Malakooti *Assistant Professor*
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Swarun Kumar *Sathaye Family Foundation Professor*
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