

Exponent®
Engineering & Scientific Consulting

Christian Machado, Ph.D., CFEI

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Professional Profile

Dr. Machado specializes in applied mechanics to investigate failure analyses involving large-scale industrial processes, fires, explosions, and consumer products. His expertise lies in experimental and computational heat and mass transfer, thermodynamics, and fluid mechanics of and around interfaces.

Dr. Machado received his Ph.D. in Mechanical Engineering from Northwestern University. His research focused on interfacial design, from microscale to mesoscale, as it relates to phase-change heat transfer, optimizing substrates to possess unique freezing, condensing, and boiling characteristics. Further, he worked with the Innovation and New Ventures Office to establish and apply for numerous patents, and with the Kellogg School of Management to better understand the commercial viability of various technologies. At Exponent, Dr. Machado has investigated residential and industrial fires/explosions, chemical and mechanical process designs, and performed experimental testing of household consumer products in both arbitration and litigation matters.

Prior to joining Northwestern, Dr. Machado received his BS in Chemical Engineering from Northeastern University, where he worked on a range of different subject matters, including the synthesis of metal organic frameworks for carbon sequestration and the formulation of small molecule compounds in the biotechnology sector.

Academic Credentials & Professional Honors

Ph.D., Mechanical Engineering, Northwestern University, 2023

B.Ch.E., Chemical Engineering, Northeastern University, 2018

Licenses and Certifications

40-Hour Hazardous Waste Operation and Emergency Response Certification (HAZWOPER)

Certified Fire and Explosion Investigator (CFEI)

Prior Experience

Graduate Research Assistant, Northwestern University, 2018-2023.

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Professional Affiliations

Member, American Society of Mechanical Engineers

Member, National Association of Fire Investigators

Publications

Machado, C., Stern, B., Huang, H., Meem, A.U.H., Huang, J., Park, K-C. Robust hybrid diffusion control for long-term scalable frost prevention. Science Advances 2024, 10 (44), eadq8525.

Feng, L., Jiang, Y., Machado, C., Choi, W., Patankar, N.A., Park, K-C. Short-time asymmetric droplet coalescence dynamics on a pre-wetted fiber. Applied Physics Letters 2024, 125 (6)

Jiang, Y., Machado, C., Park, K-C. From capture to transport: a review of engineered surfaces for fog collection. Droplet 2 (2), e55.

Jiang, Y., Feng, L., O'Donnel, A., Machado, C., Choi, W., Patankar, N.A., Park, K-C. Coalescence-induced propulsion of droplets on a superhydrophilic wire. Applied Physics Letters 2022; 121 (23), 231602.

Yao, Y., Zhao, T.Y., Machado, C., Feldman, E, Patankar, N.A., Park, K-C. Frost-free zone on macrotextured surfaces. Proceedings of the National Academy of Sciences 2020; 117 (12), 6323-6329.

Jiang, Y., Machado, C., Savarirayan, S., Patankar, N.A., Park, K-C. Onset time of fog collection. Soft Matter 2019; 15 (34), 6779-6783.

Presentations

Machado, C., Yao, Y., Feldman, E., Aizenberg, J. Park, K-C. Liquid transport on curved surfaces. 75th Annual Meeting of the Division of Fluid Dynamics, Indianapolis, IN, 2022.

Machado, C., Huang, H., Huang, J, Park, K-C. Multi-scale textured surface designs with passive frost-resistant capabilities. 74th Annual Meeting of the Division of Fluid Dynamics, Phoenix, AZ, 2021.

Machado, C., Park, K-C. Enhanced anti-frosting strategies for macrotextured surfaces. 73rd Annual Meeting of the Division of Fluid Dynamics, Virtual Meeting, 2020.

Machado, C., Jiang, Y., Park, K-C. Jet atomization of brine to achieve zero liquid discharge. 72nd Annual Meeting of the Division of Fluid Mechanics, Seattle, WA, 2019.

Project Experience

Including but not limited to:

Process Engineering

- Oil refining
- Paper milling
- Glass manufacturing

Consumer Products

- Electric Kettles

- Battery-powered flashlights
- Pressure cookers
- Centrifugal pumps
- Refrigerators

Fire and Explosion Investigations

- Self-heating reactions
- Combustible dust process/area hazard classifications
- Hot work incidents
- Residential fire investigation

Additional Education & Training

Management for Scientists and Engineers, Kellogg School of Management, Northwestern University