

## EDUCATION

**Massachusetts Institute of Technology** 2011–2016

*PhD in Mechanical Engineering with a Minor in Chinese*

Thesis: Physicochemical Mechanics of Surfactant-Enhanced Boiling Heat Transfer

Core areas of interest: nanotechnology, heat and mass transfer, thermodynamics, interfacial science, physical chemistry, molecular mechanics

Broader interests: power plant efficiency, water desalination, heating & cooling technologies, global energy and environmental sustainability

**Massachusetts Institute of Technology** 2009–2011

*SM in Mechanical Engineering*

Thesis: Surface Tension and Electroporation of Lipid Bilayers

**University of Michigan** 2005–2009

*BSE in Mechanical Engineering with a Minor in Music*

Senior design project: Automotive Air Conditioning Vents Actuated by Shape Memory Alloy

## EXPERIENCE

**Graduate Researcher at MIT, Cambridge, MA** 2009–2016

Advisor: Professor Evelyn Wang

*Physicochemical Mechanics of Surfactant-Enhanced Boiling Heat Transfer*

- Identified molecular mechanism of how surfactants (detergents) can improve boiling performance, which is an energy intensive process used in domestic and industrial settings around the world
- Designed and built numerous experimental setups as well as refined existing experimental techniques and methodologies
- Developed theory to predict performance enhancement based on underlying surfactant chemistry
- Invented a novel way to actively control (turn on and off) boiling spatially and temporally using electric fields and charged surfactants

*Surface Tension and Electroporation of Lipid Bilayers*

- Investigated the use of artificial cell membranes to engineer new biomaterials for filtration technologies and lab-on-a-chip devices
- Formed lipid layers with Langmuir-Blodgett deposition and studied surface characteristics with atomic force microscope and goniometry

**Research Intern at Samsung Electronics, Suwon, South Korea** Summer 2012

- Researched heat transfer within human tissue for development of noninvasive cancer treatment devices
- Optimized heat-transfer simulation methods to increase performance by one hundredfold

Advisor: Professor Samantha Daly

- Designed and built a mini tensile-testing experimental rig
- Tested mechanical stress of polymers used for medical implants in order to understand how they fail *in vivo*

## JOURNAL PUBLICATIONS

H. K. Mutha, Y. Lu, I. Y. Stein, **H. J. Cho**, M.E. Suss, T. Laoui, B. L. Wardle, C.V. Thompson, E.N Wang. “Porosimetry and packing morphology of vertically-aligned carbon nanotube arrays via impedance spectroscopy,” *Nanotechnology*, vol. 28, no. 5, pp. 1–6, 2016.

**H. J. Cho**, D. J. Preston, Y. Zhu, E. N. Wang “Nanoengineered materials for liquid-vapour phase-change heat transfer”, *Nature Reviews Materials*, vol. 2, p. 16092, 2016.

H. Kim, **H. J. Cho**, S. Narayanan, S. Yang, H. Furukawa, S. Schiffres, X. Li, Y. Zhang, J. Jiang, O.M. Yaghi, E.N. Wang, “Characterization of Adsorption Enthalpy of Novel Water-Stable Zeolites and Metal-Organic Frameworks,” *Scientific Reports*, vol. 6, pp. 1–8, January 2016.

**H. J. Cho**, J. P. Mizerak, E. N. Wang, “Turning bubbles on and off during boiling using charged surfactants,” *Nature Communications*, vol. 6, pp. 1–7, October 2015.

N. Miljkovic, R. Enright, S. C. Maroo, **H.J. Cho**, E.N. Wang, “Liquid Evaporation on Superhydrophobic and Superhydrophilic Nanostructured Surfaces,” *Journal of Heat Transfer*, vol. 133, no. 8, p. 080903, 2011.

## MANUSCRIPTS

**H. J. Cho**, V. Sresht, D. Blankshtein, E. N. Wang, “Predicting surface tensions of surfactant solutions from statistical mechanics,” in preparation (thesis work).

**H. J. Cho**, E. N. Wang, “New models of bubble nucleation, growth, and departure for pool boiling including the effects of the thermal boundary layer,” in preparation (thesis work).

**H. J. Cho**, D. Reed, M. Ouarrak, V. Sresht, D. Blankshtein, E. N. Wang, “A framework to predict pool boiling enhancement with surfactants,” in preparation (thesis work).

## CONFERENCE PUBLICATIONS

**H. J. Cho**, V. Sresht, D. Blankshtein, E. N. Wang, “Understanding Enhanced Boiling with Triton X Surfactants,” *Proceedings of the ASME 2013 Summer Heat Transfer Conference*, Minneapolis, MN, July 14–19, 2013.

**H. J. Cho**, S. C. Maroo, E. N. Wang, “Characterization of Lipid Membrane Properties for Tunable Electroporation,” *Proceedings of the ASME 2012 3<sup>rd</sup> Micro/Nanoscale Heat & Mass Transfer International Conference*, Atlanta, Georgia, March 3–6, 2012.

S. C. Maroo, **H. J. Cho**, E. N. Wang, “Wetting Characteristics of a Phospholipid Membrane using Molecular Dynamics Simulation,” *Proceedings of the ASME International Mechanical Engineering Congress & Exposition*, Vancouver, Canada, November 12–18, 2010.

## CONFERENCE PRESENTATIONS, SEMINARS, POSTERS

**H. J. Cho**, V. Sresht, D. Blankschtein, E.N. Wang, “Predicting Nucleate Pool Boiling Enhancement with Surfactants” *Gordon Research Conference: Micro & Nanoscale Phase Change Heat Transfer*, Galveston, TX, January 8–13, 2017.

**H. J. Cho**, J. P. Mizerak, E. N. Wang, “On Demand and Tunable Pool Boiling,” *Gordon Research Conference: Micro & Nanoscale Phase Change Heat Transfer*, Galveston, TX, January 11–16, 2015.

**H. J. Cho**, E. N. Wang, “Dynamically Tuning Pool Boiling with Charged Surfactants,” *MTL Annual Research Conference*, Bretton Woods, NH, January 29–30, 2014.

**H. J. Cho**, E. N. Wang, “Tunable Nucleate Boiling Using Electric Fields and Charged Surfactants,” *Proceedings of the ASME 2013 4<sup>th</sup> Micro/Nanoscale Heat & Mass Transfer International Conference*, Hong Kong, December 11–14, 2013.

**H. J. Cho**, E. N. Wang, “Wetting and Phase Behavior of Phospholipids,” *Materials Day 2012*, Cambridge, MA, October 16, 2012.

**H. J. Cho**, S. C. Maroo, E.N. Wang, “Wetting Phenomena of Phospholipid Films for Electroporating Membranes,” *MRS Fall Meeting*, Boston, MA, November 28–December 2, 2011.

**H. J. Cho**, S. C. Maroo, E. N. Wang, “Surface Morphology, Interfacial Energy, and Wetting of DPPC Monolayers,” *Materials Day 2011*, Cambridge, MA, October 18, 2011.

**H. J. Cho**, S. C. Maroo, E. N. Wang, “Wetting and Electroporation Behavior of Phospholipid Layers for Desalination Membranes,” *ASME International Mechanical Engineering Congress & Exposition*, Vancouver, Canada, November 12–18, 2010.

**H. J. Cho**, S. C. Maroo, E. N. Wang, “Wetting and Electroporation of Phospholipid Layers,” *Micro Nano Seminar*, Cambridge, MA, November 11, 2010.

## PATENTS

**H. J. Cho**, E. N. Wang, Massachusetts Institute of Technology, “Tunable nucleate boiling using electric fields and ionic surfactants,” Patent Appl. No. 14/568,927. Filed December 12, 2014.

## MENTORING

Mohamed Ouarrak, undergraduate researcher, 2015.

Darci Reed, undergraduate thesis student, “Investigation of the effects of surfactant concentration on the boiling curve of water,” 2015.

Jordan Mizerak, undergraduate thesis student, “Experimental analysis of boiling enhancement from surfactant addition with electric fields,” 2014.

Diane Kayitesi, undergraduate researcher, 2011.

Jenny Qiu, undergraduate researcher, 2010-2011.

## **AWARDS/HONORS**

First place in the de Florez Competition for Graduate Science, MIT	<i>2015</i>
Summer Undergraduate Research Award, University of Michigan	<i>2008</i>
Pi Tau Sigma Mechanical Engineering Honor Society	<i>2007</i>

## **OTHER ACTIVITIES**

Participant in the 2011 Northeast Asia Economic Forum Young Leaders Program	<i>2011</i>
Senior Photo Editor and Photojournalist at The Michigan Daily	<i>2005–2009</i>