Jonathan B. Boreyko

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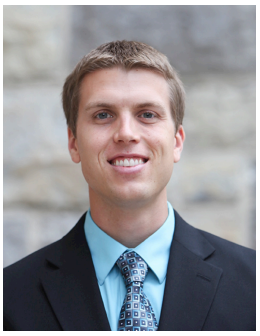
Group Website

Google Scholar Profile



Education:

Duke University, Durham, NC	Mechanical Engineering	Ph.D., 2012
Trinity College, Hartford, CT	Mechanical Engineering	B.Sc. Hons, 2007
	Physics	B.Sc. Hons, 2007

Professional Experience:

2014–present	Assistant Professor, Biomedical Engineering and Mechanics, Virginia Tech
2014	Research Scientist, Bredesen Center, University of Tennessee-Knoxville
2012–2014	Postdoctoral Research Associate, Center for Nanophase Materials Sciences, Oak Ridge National Laboratory Advisor: C. Patrick Collier
2007–2012	Graduate Research Assistant, Ph.D. Program, Duke University Advisor: Chuan-Hua Chen

Honors and Awards:

Year	Award	Agency
2016	Leader in Scholarship Award	Biomedical Engr. & Mechanics Dept. (VT)
2016	Junior Faculty Enhancement Award,	ORAU
2016	Non-Tenured Faculty Award,	3M Company
2014	Poster Award (3rd Place),	Fluid Dynamics of Living Systems Workshop
2014	Exceptional Contribution Award,	MMT-2014 Conference, Ariel University, Israel
2013	Postdoc Achievement Award,	Center for Nanophase Materials Sciences
2011	Poster Award (1st Place),	Gordon Research Conference on Microfluidics
2011	Poster Award (2nd Place),	MRS/ASM/AVS-NC Meeting
2011	Poster Award (2nd Place),	4th Annual Duke MEMS Retreat
2010	Poster Award (2nd Place),	Faraday Discussion 146 on Wetting Dynamics
2010	NSF Travel Fellowship,	Faraday Discussion Graduate Research Seminar
2009	Gallery of Fluid Motion Winner,	62nd Annual APS DFD Meeting
2009	National Finalist,	Collegiate Inventors Competition
2009	Honorable Mention,	NSF Graduate Research Fellowship Program
2009	Best Oral Presentation Award,	2nd Annual Duke MEMS Retreat
2008	Poster Award (1st Place),	1st Annual Duke MEMS Retreat
2007–11	James B. Duke Fellowship,	Duke University

Grants Awarded:

2015-17 Funding Agency: Bemis Company, Inc.
Total Amount: $200,253
Title: "Lubricant-Infused Omniphobic Polymer Films as Food-Release Agents"

2016-19 Funding Agency: 3M Company, Non-Tenured Faculty Award
Total Amount: $45,000
Title: "Passive Anti-Frosting Surfaces"

2016-17 Funding Agency: ORAU Ralph E. Power Junior Faculty Enhancement Award
Total Amount: $5,000 (plus $5,000 matching funds)
Title: "Passive Desalination via Transpiration"

2016-19 Funding Agency: NSF / CBET / Thermal Transport Processes program
Total Amount: $328,298 (Co-PI: 70% effort)
Title: Exploiting Vapor Pressure Gradients to Suppress In-Plane Frost Growth

Total Share: $480,062

Professional and Synergistic Activities:

2016

- Created and ran a "Jumping Drops and Ice Bridges!" teaching module used for two summer camp programs: C-Tech^2 and IMAGINATION. These programs are run through the Center for the Enhancement of Engineering Diversity (CEED); C-Tech^2 targets rising high-school junior and senior women while IMAGINATION targets middle school students.
- Co-organizer of NSF-sponsored Workshop on Biological Collections as a Resource for Technical Innovation, held in Smithsonian Museum of Natural History in Washington, D.C. (May 9-10).

2015

- Session chair for sessions D34 (Drops: Superhydrophobic Surfaces) and H28 (Surface Tension Effects: General) at the APS DFD 2015 Conference.
- Chairperson for 'Pool Boiling and Condensation' topic at the ASME 2015 InterPACK/ICNMM Conference .

2015-present Member of Macromolecules and Interfaces Institute at Virginia Tech
2014–present Member of Bio-Inspired Science & Technology Center at Virginia Tech
2013–present Member of the American Physical Society (APS)
2010 Chairperson, 3rd Annual Retreat for Duke University's Department of Mechanical Engineering and Materials Science (MEMS)

Journal Publications (21 total, h-index = 11, over 900 citations):

1) S. Nath and J.B. Boreyko, "On Localized Vapor Pressure Gradients Governing Condensation and Frost Phenomena," *Langmuir* **32**, 8350-8365 (2016).

2) J.B. Boreyko, R.R. Hansen, K.R. Murphy, S. Nath, S.T. Retterer, and C.P. Collier, "Controlling condensation and frost growth with chemical micropatterns," *Sci. Rep.* **6**, 19131 (2016).
   [Featured in *Science News for Students*: "Beetles offer people lessons in moisture control"]
   [Featured in *Popular Science*: "Desert Beetle Teaches Scientists about how Frost Forms"]
   [Featured on *Discovery Channel Canada*: Daily Planet, Jan. 22]

3) X. Qu, J.B. Boreyko, F. Liu, R.L. Agapov, N.V. Lavrik, S.T. Retterer, J.J. Feng, C.P. Collier, and C.H. Chen, "Self-propelled sweeping removal of dropwise condensate," *Appl. Phys. Lett.* **106**, 221601 (2015).

4) P. Mruetusatorn, G. Polizos, P.G. Datskos, G. Taylor, S.A. Sarles, J.B. Boreyko, D.G. Hayes, and C.P. Collier, "Control of Membrane Permeability in Air-Stable Droplet Interface Bilayers," *Langmuir* **31**, 4224-4231 (2015).

5) S.E. Norred, P.M. Caveney, S.T. Retterer, J.B. Boreyko, J.D. Fowlkes, C.P. Collier, and M.L. Simpson, "Sealable Femtoliter Chamber Arrays for Cell-free Biology," *J. Vis. Exp.* (97), e52616, doi:10.3791/52616 (2015).

6) R.L. Agapov, J.B. Boreyko, D.P. Briggs, B.R. Srijanto, S.T. Retterer, C.P. Collier, and N.V. Lavrik, "Length Scale Selects Directionality of Droplets on Vibrating Pillar Ratchet," *Adv. Mater. Interfaces* **1**, 1400337 (2014).
   [Front Cover of Volume 1, Issue 9]

7) R.L. Agapov, J.B. Boreyko, D.P. Briggs, B.R. Srijanto, S.T. Retterer, C.P. Collier, and N.V. Lavrik, "Length scale of Leidenfrost ratchet switches droplet directionality," *Nanoscale* **6**, 9293–9299 (2014).

8) J.B. Boreyko, G. Polizos, P.G. Datskos, S.A. Sarles, and C.P. Collier, "Air-stable droplet interface bilayers on oil-infused surfaces," *Proc. Natl. Acad. Sci. USA* 111, 7588–7593 (2014).
   [Featured in *Civil Engineering*: "Technique Furthers Water-Harvesting Possibilities"]

9) P. Mruetusatorn, J.B. Boreyko, G.A. Venkatesan, S.A. Sarles, D.G. Hayes, and C.P. Collier, "Dynamics morphologies of microscale droplet interface bilayers," *Soft Matter* 10, 2530–2538 (2014).
   [Back cover of Volume 10, Issue 15]

10) R.L. Agapov, J.B. Boreyko, D.P. Briggs, B.R. Srijanto, S.T. Retterer, C.P. Collier, and N.V. Lavrik, "Asymmetric Wettability of Nanostructures Directs Leidenfrost Droplets," *ACS Nano* 8, 860–867 (2014).
   [Correction: *ACS Nano* 8, 1949–1950 (2014).]

11) J.B. Boreyko and C.P. Collier, "Dewetting Transitions on Superhydrophobic Surfaces: When Are Wenzel Drops Reversible?" *J. Phys. Chem. C* 117, 18084–18090 (2013).

12) J.B. Boreyko, B.R. Srijanto, T.D. Nguyen, C. Vega, M. Fuentes-Cabrera, and C.P. Collier, "Dynamic Defrosting on Nanostructured Superhydrophobic Surfaces," *Langmuir* 29, 9516–9524 (2013).
    [Featured in Langmuir's 'Most Read Articles' for July 2013]

13) J.B. Boreyko, P. Mruetusatorn, S.A. Sarles, S.T. Retterer, and C.P. Collier, "Evaporation-Induced Buckling and Fission of Microscale Droplet Interface Bilayers," *J. Amer. Chem. Soc.* 135, 5545–5548 (2013).

14) J.B. Boreyko and C.H. Chen, "Vapor chambers with jumping-drop liquid return from superhydrophobic condensers," *Int. J. Heat Mass Transfer* 61, 409–418 (2013).

15) J.B. Boreyko, P. Mruetusatorn, S.T. Retterer, and C.P. Collier, "Aqueous two-phase microdroplets with reversible phase transitions," *Lab Chip* 13, 1295–1301 (2013).

16) J.B. Boreyko and C.P. Collier, "Delayed Frost Growth on Jumping-Drop Superhydrophobic Surfaces," *ACS Nano* 7, 1618–1627 (2013).
    [Highlighted article: "Giving Frost on Superhydrophobic Surfaces the Cold Shoulder," *ACS Nano* 7, 883 (2013).]

17) J.B. Boreyko, Y. Zhao, and C.H. Chen, "Planar jumping-drop thermal diodes," *Appl. Phys. Lett.* 99, 234105 (2011).
    [Featured in *Mechanical Engineering*: "Jumping Droplets Make a Heat Trap"]

18) J.B. Boreyko, C.H. Baker, C.R. Poley, and C.H. Chen, "Wetting and Dewetting Transitions on Hierarchical Superhydrophobic Surfaces," *Langmuir* 27, 7502–7509 (2011).

19) J.B. Boreyko and C.H. Chen, "Self-propelled jumping drops on superhydrophobic surfaces," *Phys. Fluids* 22, 091110 (2010).

20) J.B. Boreyko and C.H. Chen, "Self-Propelled Dropwise Condensate on Superhydrophobic Surfaces," *Phys. Rev. Lett.* 103, 184501 (2009).
    [Editor's Choice in *Science*: "Up, Up and Away" 326, 917 (2009)]
    [Featured on *Discovery Channel (Canada)*: Super Slo-Mo Tuesdays, Nov. 3]

21) J.B. Boreyko and C.H. Chen, "Restoring Superhydrophobicity of Lotus Leaves with Vibration-Induced Dewetting," *Phys. Rev. Lett.* 103, 174502 (2009).
    [Cover story of Volume 103, Issue 17]
    [Featured in Oct. 27th *NY Times*: "Vibrations Keep Water Out of Lotus Leaves"]

Conference Proceedings:

1) F. Liu, J.B. Boreyko, X. Qu, and C.H. Chen, "Self-propelled jumping condensate: fundamental mechanisms and vapor-chamber applications," *9th International Conference on Boiling and Condensation Heat Transfer*, Boulder, CO (2015).

2) Y. Zhao, J.B. Boreyko, M.H. Chiang, C.H. Baker, and C.H. Chen, "Beetle inspired electrospray vapor chamber," *ASME Micro/Nanoscale Heat & Mass Transfer International Conference*, Shanghai, China, #18498 (2009).

Theses:

1) J.B. Boreyko, "From Dynamical Superhydrophobicity to Thermal Diodes," Ph.D. Dissertation, Department of Mechanical Engineering and Materials Science, Duke University (2012).

2) J.B. Boreyko, "Harvesting Hydrogen using Renewable Wind Power," B.S. Thesis, Departments of Mechanical Engineering and Physics, Trinity College (2007).

Patents and Applications:

1) C.P. Collier, S.T. Retterer, J.B. Boreyko, and P. Mruetusatorn, "Reversible, On-Demand Generation of Aqueous Two-Phase Microdroplets," *US Application No.* 13/970,724 (filed 2013).

2) C.H. Chen, J.B. Boreyko, and Y. Zhao, "Thermal Diode Device and Methods," *US Patent No. 8716689.*
[National Finalist in the 2009 Collegiate Inventors Competition]

Invited Presentations:

1) "Materials with Periodic Humidity Sinks for Passive Anti-Fogging and Anti-Frosting Surfaces,"
3M Company, St. Paul, MN (2016).

2) "Suppressing Frost Growth with Micropatterned Surfaces,"
Center for Nanophase Materials Sciences (CNMS) Triennial Review, Oak Ridge, TN (2016).

3) "A Tale of Two Droplets,"
Virginia Tech, Department of Materials Science and Engineering Seminar Series, Blacksburg, VA (2016)

4) "Phase-Change Systems with Dynamics Interfaces: From Jumping Droplets to Ice Bridges,"
Macromolecules and Interfaces Institute (MII), Blacksburg, VA (2015)

5) "Anti-Moisture and Anti-Frosting Surfaces,"
Bemis Company, Inc., Neenah, WI (2014).

6) "Dynamics of Frosting and Defrosting on Superhydrophobic Surfaces," *8th International Conference on Materials Technologies and Modeling (MMT-2014)*, Ariel University, Israel (2014).

7) "Wetting and Dewetting Transitions on Superhydrophobic Surfaces," *8th International Conference on Materials Technologies and Modeling (MMT-2014)*, Ariel University, Israel (2014).

Conference Presentations (* denotes speaking author):

1) J.B. Boreyko*, "Passive Anti-Frosting Surfaces via the Exploitation of Vapor Pressure Gradients," *39th Annual Meeting of the Adhesion Society Annual Meeting*, San Antonio, TX (2016).

2) M. Habibi*, C.P. Collier, and J.B. Boreyko, "Reducing Sliding Friction with Liquid-Impregnated Surfaces," 68th *American Physical Society Division of Fluid Dynamics (APS DFD) Meeting*, Boston, MA (2015).

3) C. Bisbano*, S. Nath, and J.B. Boreyko, "Dry Zones Around Frozen Droplets," 68th *APS DFD Meeting*, Boston, MA (2015).

4) S. Nath*, R.R. Hansen, K.R. Murphy, C.P. Collier, and J.B. Boreyko, "Can Ice Prevent Frost Growth?" 68th *APS DFD Meeting*, Boston, MA (2015).

5) K.R. Murphy*, R.R. Hansen, S. Nath, S.T. Retterer, C.P. Collier, and J.B. Boreyko, "Spatial Control of Condensation using Chemical Micropatterns," 68th *APS DFD Meeting*, Boston, MA (2015).

6) F. Ahmadi*, J.B. Boreyko, "Layers of Porous Superhydrophobic Surfaces for Robust Water Repellency," *68th APS DFD Meeting*, Boston, MA (2015).

7) A. Berrier*, J.B. Boreyko, "Orientation Dependence of Jumping Droplet Condensation," 68th *APS DFD Meeting*, Boston, MA (2015).

8) J.B. Boreyko*, X. Qu, F. Liu, R.L. Agapov, N.V. Lavrik, S.T. Retterer, J.J. Feng, C.P. Collier, and C.H. Chen, "Self-Propelled Sweeping Removal of Dropwise Condensate on Two-Tier Superhydrophobic Surfaces," 68th *APS DFD Meeting*, Boston, MA (2015).

9) X. Qu, J.B. Boreyko*, F. Liu, R.L. Agapov, N.V. Lavrik, S.T. Retterer, J.J. Feng, C.P. Collier, and C.H. Chen, "Self-Propelled Sweeping Removal of Dropwise Condensate on Hierarchical Superhydrophobic Surfaces," *ASME InterPACK/ICNMM*, San Francisco, CA (2015).

10) J.B. Boreyko, R.R. Hansen, K.R. Murphy*, S.T. Retterer, and C.P. Collier, "Controlling the Growth of Condensation and Frost with Chemical Micropatterns," *ASME InterPACK/ICNMM*, San Francisco, CA (2015).

11) S. Nath*, A. Mukherjee, S. Chatterjee, R. Ganguly, S. Sen, A. Mukhopadhyay, and J.B. Boreyko, "Inverse Floatation," *67th APS DFD Meeting*, San Francisco, CA (2014).

12) J.B. Boreyko* and C.P. Collier, "Non-coalescence of water droplets on oil-infused surfaces," *247th ACS National Meeting and Exposition*, Dallas, TX (2014).

13) C.P. Collier* and J.B. Boreyko, "Evaporation-induced shape changes in femtoliter-volume microscale droplet interface bilayers," *247th ACS National Meeting and Exposition*, Dallas, TX (2014).

14) J.B. Boreyko*, "Dynamic Defrosting on Nanostructured Superhydrophobic Surfaces," *1st Annual ORNL Postdoc Symposium*, Oak Ridge, TN (2013).

15) B.R. Srijanto, T.D. Nguyen, M. Fuentes-Cabrera, C.P. Collier, and J. B. Boreyko*, "Dynamic Defrosting via Spontaneous Dewetting on Nanostructured Superhydrophobic Surfaces," *87th ACS Colloid and Surface Science Symposium,* Riverside, CA (2013).

16) J.B. Boreyko* and C.P. Collier, "On-Demand Generation of Aqueous Two-Phase Microdroplets with Reversible Phase Transitions," *APS March Meeting*, Baltimore, MD (2013).

17) J.B. Boreyko* and C.H. Chen, "Planar Jumping-Drop Thermal Diodes: Experiments and Modeling," *86th ACS Colloid and Surface Science Symposium*, Baltimore, MD (2012).

18) J.B. Boreyko*, Y. Zhao, and C.H. Chen, "Planar Jumping-Drop Thermal Diodes," *64th APS DFD Meeting*, Baltimore, MD (2011).

19) J.B. Boreyko*, C.H. Baker, C.R. Poley, and C.H. Chen, "Wetting and Dewetting on Superhydrophobic Surfaces with Two-Tier Roughness," 63rd *APS DFD Meeting*, Long Beach, CA (2010).

20) J.B. Boreyko*, "Bioinspired Antidew Superhydrophobicity," *Faraday Discussion Graduate Research Seminar*, Richmond, VA (2010).

21) J.B. Boreyko and C.H. Chen*, "Spontaneous Jumping of Coalescing Drops on a Superhydrophobic Surface," 62nd *APS DFD Meeting*, Minneapolis, MN (2009).

22) J.B. Boreyko*, "Spontaneous Jumping of Coalescing Drops on a Superhydrophobic Surface," *2nd Annual Duke University MEMS Science Retreat*, Durham, NC (2009).

23) J.B. Boreyko*, "Towards Antidew Superhydrophobicity," *Duke University CBIMMS Retreat,* Beaufort, *NC* (2009).

24) J.B. Boreyko* and C.H. Chen, "Vibration-induced Wenzel to Cassie Transition on a Superhydrophobic Surface," 61st *APS DFD Meeting*, San Antonio, TX (2008).

25) X. Zhang, J.B. Boreyko*, and C.H. Chen, "Rapid Drop Dynamics during Superhydrophobic Condensation," 61st *APS DFD Meeting*, San Antonio, TX (2008).

Conference Posters (* denotes speaking author):

1) S.F. Ahmadi* and J.B. Boreyko, "Latent Heat of Cars Moving from Rest," *Women in Transportation Seminar*, Blacksburg, VA (2016).

2) S. Nath*, B.R. Srijanto, S.T. Retterer, C.P. Collier, and J.B. Boreyko, "Anti-Frosting Surfaces using Ice as Humidity Sinks," *Oak Ridge National Laboratory CNMS User Meeting*, Oak Ridge, TN (2016).

3) S. Nath and J.B. Boreyko*, "Passive Anti-Frosting Surfaces," *3M Company, Faculty Day*, St. Paul, MN (2016).

4) J.B. Boreyko*, "Dynamics of Droplet Interface Bilayers: Shape-Change, Buckling, Fission, and Air-Stability," *Fluid Dynamics of Living Systems Workshop*, Arlington, VA (2014)

5) J.B. Boreyko*, G. Polizos, P.G. Datskos, S.A. Sarles, and C.P. Collier, "Non-Coalescence of Water Droplets on Oil-Infused Surfaces," *247th ACS National Meeting and Exposition*, Dallas, TX (2014).

6) J.B. Boreyko*, B.R. Srijanto, T.D. Nguyen, C. Vega, M. Fuentes-Cabrera, and C.P. Collier, "Dynamic Defrosting on Nanostructured Superhydrophobic Surfaces," *International Workshop on Micro and Nano Structures for Phase Change Heat Transfer*, Dedham, MA (2013).

7) J.B. Boreyko*, P. Mruetusatorn, S.A. Sarles, S.T. Retterer, and C.P. Collier, "Evaporation-Induced Dynamics in Microdroplets," *Center for Nanophase Materials Sciences Nanobio Workshop*, Oak Ridge, TN (2013).

8) J.B. Boreyko*, Y. Zhao, and C.H. Chen, "Planar Jumping-Drop Thermal Diodes," *DARPA Thermal Management Technologies (TMT)Meeting*, Orlando, FL (2011).

9) J.B. Boreyko*, Y. Zhao, and C.H. Chen, "A Planar Jumping-Drop Thermal Diode," *MRS/ASM/AVS-NC Meeting*, Raleigh, NC (2011).

10) J.B. Boreyko*, Y. Zhao, and C.H. Chen, "A Planar Phase-Change Thermal Diode," *Triangle Soft Matter Workshop*, Chapel Hill, NC (2011).

11) J.B. Boreyko*, Y. Zhao, and C.H. Chen, "A Planar Phase-Change Thermal Diode," *Gordon Research Conference on the Physics and Chemistry of Microfluidics*, Waterville Valley, NH (2011).

12) J.B. Boreyko*, Y. Zhao, C.H. Chen, "A Planar Phase-Change Thermal Diode," *DARPA Young Faculty Award Kickoff Meeting*, Arlington, VA (2010).

13) J.B. Boreyko*, C.H. Chen, "Self-propelled Dropwise Condensate on Superhydrophobic Surfaces," *Triangle Soft Matter Workshop*, Durham, NC (2010).

14) J.B. Boreyko, C.H. Chen*, "Restoring Superhydrophobicity of Lotus Leaves with Vibration-induced Dewetting," *Triangle Soft Matter Workshop*, Durham, NC (2010).

15) J.B. Boreyko*, C.H. Chen, "Self-propelled Dropwise Condensate on Superhydrophobic Surfaces," *Faraday Discussion 146*, Richmond, VA (2010).

16) J.B. Boreyko*, C.H. Chen, "Restoring Superhydrophobicity of Lotus Leaves with Vibration-induced Dewetting," *Faraday Discussion 146*, Richmond, VA (2010).

17) J.B. Boreyko*, C.H. Chen, "Towards Antidew Superhydrophobicity," *Gordon Research Conference on Soft Condensed Matter Physics*, New London, NH (2009).

18) J.B. Boreyko*, C.H. Chen, "Towards Antidew Superhydrophobicity," *Triangle Soft Matter Workshop*, Raleigh, NC (2009).

19) Y. Zhao, J.B. Boreyko*, C. Baker, C.H. Chen, "Beetle Inspired Electrospray Vapor Chamber," *Duke University Center for Biologically Inspired Materials & Material Systems Research (CBIMMS) Retreat*, Beaufort, NC (2009).

20) J.B. Boreyko*, C.H. Chen, "Restoring Superhydrophobicity with Vibration," *Duke University MEMS Graduate Retreat*, Durham, NC (2008).