

Dr. Bhaskarjyoti Sarma

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Executive Summary

- Post-doctoral candidate in thermal management of electronic devices with prior experience as a Research and Development Engineer in a leading automobile industry.
- Strong research background in experimental fluid mechanics and heat transfer.
- Experienced researcher in functionalized surfaces and porous media heat and mass transport phenomena, with a special focus on energy storage, thermal management of electronic devices and microfluidics.

Education

Ph.D., Mechanical Engineering, CGPA: **9.17/10** (Feb. 2021)
Indian Institute of Technology Guwahati, India
Dissertation Title: "Experimental Characterization of Field-Induced Droplet Dynamics."

Bachelor of Technology, Mechanical Engineering, CGPA: **8.87/10** (May 2013)
National Institute of Technology, Silchar, India

Research Experience

Post-Doctoral Research Associate,
Cooling Technology Research Centre, Purdue University (Aug. 2021 – current)
Advisor: Dr. Justin A Weibel

- **Direct printing of bio inspired copper microstructures on boiling surfaces**
 - Developing a novel fabrication methodology for direct printing of nature-inspired copper micro-/nano-structures atop boiling surfaces using two-photon lithography technique.
 - Design and optimize in-house electroplating technology to print complex, high-aspect ratio copper microstructures.
- **Multi-scale surface enhancement of two-phase immersion cooling**
 - Understand how fin and surface wettability effects improve boiling heat transfer so that novel heat sinks can be optimized for size or mass
- **Two-phase transport properties of sintered metal wicks in vapor chamber heat spreaders**
 - Investigation of the two-phase flow relationships between relative permeability, saturation, and capillary pressure for thin sintered metallic wicks relevant to boiling heat transfer in vapor chambers
- **Enhancing data center cooling efficiency**
 - Design and development of novel and transformative immersion cooling solutions for energy dense data centers

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Doctoral Research
Indian Institute of Technology, Guwahati (Jan. 2016 – Feb. 2021)
Advisor: Amaresh Dalal and Dipankar Narayan Basu

- **Tuning Wettability of Soft Surfaces in a Magnetic Field**
 - Investigated of the wetting dynamics of paramagnetic droplets on elastic surfaces in a magnetic field
- **Droplet Atomization via Electric Field Discharge**
 - Tuning the confinement of electric discharge inside a liquid droplet, to enhance droplet atomization
- **Low-Cost, Candle Soot-Based Superhydrophobic Surface**
 - Fabrication and characterization of the dynamic wettability of a candle soot-based superhydrophobic surface, a low-cost alternative to the existing surfaces
- **Droplet Generation from a Permeable Yarn**
 - Characterized the critical aspects of droplet generation from a yarn, relevant to drying and coating industries
- **Collaborative Research Projects**

- Experimental investigation of electrowetting dynamics on a liquid dielectric surface (EWOL)
- Exploration of electrocoalescence-mediated merging and mixing dynamics of a pair of liquid droplets
- Numerical investigation of the effect of vortex wing geometry in enhancing the mixing efficiency of two immiscible liquids in a microchannel

Junior Research Fellow

Anupravaha Lab, Indian Institute of Technology, Guwahati

Advisor: Amaresh Dalal

(Aug. 2015 – Dec. 2015)

- Development of a general purpose CFD solver over a hybrid unstructured grid --“Anupravaha”.
- Validation of test cases with the results obtained from “OpenFOAM”.

Undergraduate Honors Thesis

National Institute of Technology, Silchar, India

Advisor: Dr. P.K. Patowary

(May 2012- May 2013)

- Design and analysis of a piezoelectric-driven synthetic jet actuator for MEMS Applications

Summer Research Fellowship,

Indian Institute of Technology Guwahati

P. I. – Dr. Ganesh Natarajan and Dr. Vinayak Kulkarni

(May 2012 – July 2012)

- Development of pre-processing and postprocessing tools for CGNS (CFD general notation system) data for incompressible and compressible fluid flow simulations.

Summer Research Fellowship,

Indian Institute of Technology Guwahati

P. I. – Dr. Uday Shankar Dixit

(May 2011 – July 2011)

- Feasibility study of friction stir welding (FSW) of thin aluminum sheets using a vertical milling machine

Work Experience

Research and Development Engineer (Assistant Manager),

Maruti Suzuki India Limited (MSIL)

Common Rail Fuel System Group

(July 2013 – July 2015)

- **Design and Development**
 - Parts: Common rail fuel system components (800 CC diesel engine), fasteners, sheet metal components
 - FEMA, and NVH (Noise, Vibration, and Harshness) analysis
- **Testing**
 - Design-of-Experiments (DOE) for bench testing of the fuel components
 - Vehicle level testing and post-test analysis of fuel components (*driveability testing*)
- **Additional Responsibilities**
 - Kaizen and VA/VE analysis
 - Vehicle teardown and benchmarking
 - Vendor Development for engine parts and sheet metal components
 - Liaising with Japanese technical experts

Project Engineer,

IIT Guwahati Technology Innovation and Development (IITGTIDF)

Project title: TIH on Technology for Underwater Exploration

Advisor: Santosha Kumar Dwivedy

(Feb. 2021 – July. 2021)

Professor, Mechanical Engineering, IIT Guwahati

- Liaising with 9 COEs in the Centre for Intelligent Cyber-Physical Systems (ICPS), laboratory set-up, and technical knowledge transfer
- Development of thermal model of melt pool dynamics in selective laser sintering.
- Course development (M. Tech: Robotics and Artificial Intelligence): Introduction to Python

Teaching Experience

Graduate Teaching Assistant, Indian Institute of Technology Guwahati

(Spring 2016-Fall 2019)

Courses:

- Fluid Mechanics (*Instructor: Dr. D. N. Basu*) Course strength: 45, undergrad
- Basic Thermodynamics (*Instructor: Dr. D. N. Basu*) Course strength: 45, undergrad
- Heat and Mass Transfer (*Instructor: Dr. D. N. Basu*) Course strength: 45, undergrad
- Conduction and Radiation (*Instructor: Dr. D. N. Basu*) Course strength: 60, gradschool
- CNC milling and CNC lathe machine (Non-conventional Machining Workshop, IIT Guwahati, Superintendent: Dr. P. S. Robi) Course strength: 30, Undergrad

Online Teaching Assistant, MOOC online course by IIT Madras

(Spring 2018 - Spring 2021)

Courses:

- **Viscous Fluid Flow**
Course Instructor: Dr. Amaresh Dalal, IIT Guwahati Spring 2021
Student strength: - 1800
- **Introduction to CFD**
Course Instructor: Dr. Amaresh Dalal, IIT Guwahati Spring 2020
Student strength: - 1750
- **Fundamentals of Conduction and Radiation**
Course Instructor: Dr. Amaresh Dalal and Dr. D. N. Basu, IIT Guwahati Fall 2019, Fall 2020
Student strength: - 2100
- **Principles of Mechanical Measurement**
Course Instructor: Dr. D. N. Basu, IIT Guwahati Spring 2019
Student strength: - 1600
- **Fundamentals of Nuclear Power Generation.**
Course Instructor: Dr. D. N. Basu, IIT Guwahati Spring 2018
Student strength: - 1700

Journal Publications

1. D. J. Lohan, **B. Sarma**, S. N. Joshi, E. M. Dede, A. Soto, S. Sudhakar, and J. A. Weibel, "A pump-assisted capillary loop evaporator design for high heat-flux dissipation." (*Under Review*)
2. **B. Sarma**, S. Sudhakar, D. T. Nasilowski, and J. A. Weibel, "Measurement of capillary pressure and relative permeability relations for two-phase air-water cross flow in thin sintered metal wicks." (*In prep.*)
3. Y. Huang, **B. Sarma**, and J. A. Weibel, "Multi-scale surface enhancement of two-phase immersion cooling." (*In prep.*)
4. R. Deb, **B. Sarma**, and A. Dalal, "Magnetic-field mediated active propulsion of ferrobots on a wire." (<https://doi.org/10.1021/acs.langmuir.3c00717>)
5. **B. Sarma**, A. Dalal, and D. N. Basu, "Interfacial dynamics of viscous droplets impacting a superhydrophobic candle soot surface: overview and comparison." *Physics of Fluids* (2022), **34**, 012121.
6. R. Deb*, **B. Sarma***, and A. Dalal, "Magnetowetting dynamics of sessile ferrofluid droplets: A review." *Soft Matter* (2022), **18**, 2287-2324. (*- equal contribution).
7. **B. Sarma**, S. Kumar, A. Dalal, D. N. Basu, and D. Bandyopadhyay, "Electric-discharge-mediated jetting, crowning, bursting, and atomization of a droplet." *Physical Review Applied* (2021) **15**, 014005.
8. **B. Sarma**, V. Shahapure, A. Dalal, and D. N. Basu, "Magnetowetting dynamics of sessile ferrofluid droplets on soft surface." *Soft Matter* (2020) **16**, 970-982.
9. **B. Sarma**, V. Shahapure, A. Dalal, and D. N. Basu, "Experimental characterization of the growth dynamics during capillarity-driven droplet generation." *Physical Review E* (2019) **100**, 013106.
10. S. Kumar, **B. Sarma**, A. Dalal, D. N. Basu, A. K. Dasmahapatra, and D. Bandyopadhyay, "Field induced anomalous spreading, oscillation, ejection, spinning, and breaking of oil droplets on a strongly slipping water surface." *Faraday Discussions*, (2017) **199**, 115-128.
11. **B. Sarma**, "Friction stir welding of thin aluminum alloy plates using milling machine: a basic compatibility study." *IOP Conference Series: Materials Science and Engineering*, (2018) **377**, 012012.

12. **B. Sarma**, A. Dalal, and D. N. Basu, "Dynamics of viscous jets during droplet impact on a fractal superhydrophobic surface. (*Under review*)

Selected Conference Presentations (Total number: 25+)

1. **B. Sarma**, A. Dalal and D. N. Basu, "Candle Soot is a Low-cost Alternative for Water Repelling Surfaces?" **APS DFD 2022**, 20 November – 22 November, Indianapolis, USA.
2. **B. Sarma**, S. Sudhakar, D. T. Nasilowski, and J. A. Weibel, "Measurement of capillary pressure and relative permeability relations for two-phase air-water cross flow in thin sintered metal wicks." **InterPore 2022**, 29 May – 2 June, Khalifa University, Abu Dhabi, UAE.
3. **B. Sarma**, A. Dalal, and D. N. Basu, "Effect of substrate wettability on magnetowetting dynamics." **25th International Congress of Theoretical and Applied Mechanics (ICTAM 2020+1) 2021**, 22 – 27 August 2021, Virtual.
4. **B. Sarma**, A. Dalal, and D. N. Basu, "Capillary flow mediated dynamics of liquid droplet generation from a yarn." **APS March Meeting 2021**, 15 - 19 March, 2021, Virtual; Time Zone: CDT, USA.
5. **B. Sarma**, A. Dalal, and D. N. Basu, "Stick-slip" or "Stick-break?": Stiffness-mediated magnetowetting dynamics of sessile droplets.", **73rd Annual Meeting of the APS Division of Fluid Dynamics**, 22 – 24 November, 2020 (Virtual).
6. **B. Sarma**, "Capillary flow mediated drop formation in a yarn-based microfluidic system." **InterPore 2020**, 31 August - 3 September, 2020 (Virtual).
7. **B. Sarma**, "Soft magnetowetting." **UK Colloids 2020**, 21 July, 2020 (Virtual).
8. **B. Sarma**, S. Kumar, A. Dalal, D. N. Basu, and D. Bandyopadhyay, "Electric discharge mediated transient interfacial dynamics of a sessile liquid droplet: Plethora of hydrodynamic features.", **APS March Meeting 2020**, 2 - 6 March, 2020, Denver, Colorado. (Cancelled due to COVID 19)
9. **B. Sarma**, A. Dalal, and D. N. Basu, "Impact dynamics of viscous droplets on superhydrophobic surfaces." **Fluids and Health 2019: Fluid Dynamics of Disease Transmission** 23 July- 3 August 2019, The Cargese Institute of Scientific Studies, France. (**Oral Presentation**)
10. **B. Sarma**, A. Dalal, and D. N. Basu, "Universal scaling laws in drop-on-demand generation from a yarn." Paper no: 467, **7th International and 45th National Conference on Fluid Mechanics & Fluid Power (FMFP 2018)**, 10-12 December 2018, IIT Bombay, India. (**BEST PAPER AWARD, M. G. DESHPANDE MEMORIAL PRIZE**)

Awards and Achievements

- **Purdue Post-Doctoral Association** travel grant for attending international conference. 2022
- Recipient of **Best Ph.D Thesis in Mechanical Engineering** Award from IIT Guwahati 2021
- Recipient of **International Union of Theoretical and Applied Mechanics'** Conference Grant for the (**ICTAM 2020+1**) 2021 Meeting. 2021
- Recipient of **American Physical Society Forum for Early Career Scientists (FECS)** Mini Grant for the 2021 March Meeting. 2021
- Recipient of **International Society for Porous Media** Conference grant for InterPore 2020. 2020
- Recipient of **MIT Department of Civil and Environmental Engineering's Travel Grant** (Full Grant) for attending the **Fluids and Health 2019: Fluid Dynamics of Disease Transmission** conference held at The Cargese Institute of Scientific Studies, France. 2019
- Recipient of "**Tse Cheuk Ng Tai Innovations in Fluids and Health 2019 Award**" in the **Fluids and Health 2019: Fluid Dynamics of Disease Transmission** conference held at The Cargese Institute of Scientific Studies, France. 2019
- Awarded M. G. Deshpande Memorial Prize in the "**Best Paper Award**" category in the **7th International and 45th National Conference on Fluid Mechanics & Fluid Power (FMFP 2018)** held at IIT Bombay. 2018
- **Best Poster Award** in **Research Conclave 2018** organized by IIT Guwahati. 2018

- **Award of Appreciation** from **Royal Society of Chemistry** for conducting a pre-conference workshop in the **Complex Dynamical Systems and Applications conference (CDSA-2017)** held at IIT Guwahati. 2017
- Recipient of **North-East Scholarship** for showing Excellent Performance in Academics. 2010 - 2013

Skills

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| ○ <i>Cleanroom experience</i> | ○ 3D printing based on two-photon polymerization | |
| | ○ Metal electrodeposition/electroplating | |
| | ○ Thin-film fabrication | |
| | ○ Photonic Professional GT2 (Nanoscribe) | ○ Interferometer |
| | ○ Iko Jr. Electroplater | ○ Contact Angle Goniometer |
| ○ <i>Instruments</i> | ○ Spin Coater | ○ Optical microscope |
| | ○ High-Speed camera | ○ Data acquisition units |
| | ○ ANSYS Fluent | ○ SOLIDWORKS |
| | ○ COMSOL Multiphysics | ○ Fusion 360 |
| ○ <i>Software</i> | ○ MATLAB | ○ Linux tools |
| | ○ NI LabVIEW | ○ EES |
| | ○ ImageJ | ○ OriginPro |
| ○ <i>Coding languages</i> | ○ C/C++ | ○ Python |

Leadership, professional involvement, and community outreach:

- Volunteer of the *8th International and 47th National Conference on Fluid Mechanics and Fluid Power (FMFP 2020)* (organized in virtual mode) during December 9-11, 2020 in the Department of Mechanical Engineering, IIT Guwahati, India.
- Volunteer of the TEQIP sponsored short-term course on *Computational Fluid Dynamics for Incompressible Flows* during June 17 - 21, 2019 in the Department of Mechanical Engineering, IIT Guwahati, India.
- Reviewer of Physics of Fluids, Langmuir, Physical Review E.

Membership of Professional Bodies

- **International Society for Porous Media** (Student Membership)
- **American Physical Society** (Student)

Courses

Thermal Hydraulics in Power Generation Technology, Computational Fluid Dynamics, Convective Heat and Mass Transfer, Refrigeration and Air Conditioning, Heat Transfer in Electronic Systems