Jovina Vaswani

CONTACT INFORMATION

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OBJECTIVE

A PhD candidate studying the dynamics of complex fluids combining experiments, simulations, and constitutive modeling. Seeking postdoctoral positions in complex fluids.

EDUCATION

University of Pittsburgh, Pittsburgh, PA — Aug 2021 - Present
PhD student in the Department of Chemical and Petroleum Engineering
Advisor: Dr. Sachin Velankar

IIT Bombay, India — July 2016 - June 2021
BTech + MTech in the Department of Chemical Engineering
Advisor: Dr. Rochish Thaokar

RESEARCH PROJECTS

Dynamics of Particle-filled Drops under Shear Flow: Partial coalescence (incomplete merging of two drops) is widely encountered during mixing processes in industries. We conducted a flow-visualization study of shear-induced partial coalescence in particle-filled emulsion drops (poly(ethylene oxide) drops in polyisobutylene, filled to >50 vol% with silica particles). We discovered that high shear creates arrested non-spherical shapes, which undergo partial coalescence at lower shear rates; however, these partially coalesced drops are short-lived under continuous shearing and gradually revert to sphericity through collision-induced yielding rather than capillarity.
Equipment/software used: Parallel-plate rheometry, Optical microscopy, ImageJ (image processing), Python (data analysis)

Relaxation of Deformed Particle-filled Drops in a Microfluidic Trap: Images from bulk shear experiments described above captured multiple drops simultaneously, limiting our ability to resolve individual drop dynamics. Using a 4-channel microfluidic Stokes trap (developed by Schroeder group), we studied the temporal evolution of individual particle-filled drops trapped in the stagnation zone of extensional flow. We subjected drops with varying particle loadings to flows of different strengths and analyzed their relaxation dynamics under quiescent conditions after elongation. While drops with low particle loading relaxed to sphericity upon cessation of flow, highly filled drops exhibited retarded relaxation dynamics until an *arrested* non-spherical shape was reached. This arrest was history-dependent and could be mitigated by applying perpendicular extensional flow.
Equipment/software used: Stokes trap, Custom LabVIEW programme developed at UIUC (flow control), ImageJ, MATLAB (PIV), Python (data analysis)

Computational Study of Relaxation and Breakup Dynamics of Non-Newtonian Drops: The arrested states observed in microfluidic experiments provided insights into how deformation depends on flow history and drop composition, but could not reveal spatial variations of viscosity and shear rate within drops. These gradients are crucial for understanding which regions arrest first. We conducted OpenFOAM simulations using the Carreau-Yasuda constitutive model to capture these spatiotemporal variations without explicitly modeling individual particles. Our simulations revealed three distinct behaviors: near-complete relaxation, intermediate arrest, and retarded dynamics from onset, depending on the characteristic relaxation time parameter. We discovered that arrest arises from spatially heterogeneous viscosity fields; low-shear-rate regions transition to high viscosity, creating "viscous anchors" that impede shape recovery.
Equipment/software used: OpenFOAM with RheoTool (rheoInterFoam solver), ParaView (visualization), Python (data analysis)

Internships

Shear and compression of complex liquid-liquid interfaces June 2019 - July 2019
Research intern, Stanford University
Advisor: Dr. Gerald Fuller
Conducted experiments and utilized the data to quantify the evolving interfacial characteristics

Industrial Learning Program Dec. 2017 - Jan. 2018
Research Intern, IIT Gandhinagar
Advisor: Dr. Nitin Padhiyar
Performed DWSIM simulations to model esterification reaction

Research Publications

Relaxation of particle-filled drop in a 4-channel microfluidic hydrodynamic trap [In Preparation]
Jovina Vaswani, Hũng Nguyêñ, Yamajala Srikar, Sachin S. Velankar

Spatiotemporal viscosity gradients shape breakup and relaxation in non-Newtonian drops [In Preparation]
Jovina Vaswani, Sachin S. Velankar, Arvind Gopinath, A Venkattraman

Particle-filled emulsion drops show flow-induced partial coalescence, but only transiently [Published]
IECR, Volume 64, 2025, 22185–22195
Jovina Vaswani, Sachin S. Velankar

Low viscosity liquid bridges: Stretching of liquid bridges immersed in a higher viscosity liquid [Published]
JCIS Open, Volume 9, 2023, 100079, ISSN 2666-934X
Ramon Lopez, **Jovina Vaswani**, Dylan T. Butler, Joseph McCarthy, Sachin S. Velankar

Conferences

Particle-filled emulsion drops show flow-induced partial coalescence, but only transiently
Poster, Society of Rheology, 2024
Jovina Vaswani, Charles M Schroeder, Sachin S. Velankar

Particle-filled emulsion drops show flow-induced partial coalescence, but only transiently
Oral talk, APS March meeting, 2024
Jovina Vaswani, Charles M Schroeder, Sachin S. Velankar

Mentorship

Graduate mentor Jan 2024 - July 2024
University of Pittsburgh
Mentored an undergraduate student, **Srikar**, on conducting experiments to study the **deformation of particle-filled drops** in a 4-channel microfluidic trap

Institute Student mentor Apr 2019 - Apr 2020
Student Mentor Program, IIT Bombay
1 among **108** out of **300+** applicants, selected through a rigorous procedure comprising of SOP, peer review and interviews. Mentored and guided **6** freshmen from diverse backgrounds academically,

vocationally,and providing motivational counsel

DUEL tutor May 2017 - Jul 2017
Department Undergraduate English Learning
Volunteered as **teaching assistant** for Department English Learning Program to aid students with **non-English speaking background** cope with difficulties in academics

Teaching

ChE 300: Transport Phenomena Aug 2023 - Dec 2023
University of Pittsburgh, Teaching Assistant

ChE 2101: Fundamentals of Thermodynamics Jan 2023 - May 2023
University of Pittsburgh, Teaching Assistant

CL 249: Computational Methods Lab Jul 2020 - Dec 2020
IIT Bombay, Teaching Assistant

CL 433: Chemical Engineering Lab Jan 2021 - Jun 2021
Indian Institute of Technology, Bombay, Teaching Assistant

Poetry Publications

Author of a published poetry book *It's Dawn* which is a collection of poems on healing, growth and persistence. Details at jovinavaswani.com/books

Service

Student Member, Community development committee Jan 2026- Jan 2028
Society of Rheology
Currently serving as a student member of the committee that helps organize Society of Rheology events and Future of Rheology seminars

Student judge, Research day Apr 2025 and Aug 2024
Department of Chemical and Petroleum Engineering, University of Pittsburgh
Served as a judge for graduate student oral presentations during two consecutive research days organized by the department

Volunteer, Science outreach event for 6th graders Mar 2025
Roy Hunt Elementary School
Served as a volunteer in a hands-on science outreach event for 6th graders

Events Manager, AZeotropy 2019 Mar 2018 - Mar 2019
Annual Chemical Engineering Symposium, IIT Bombay
Part of a 2-tier team of **14 core members** to conceptualize and execute over **20+**events
Organized and executed events spanning across various genres including **Lectures**, **Panel Discussion**, **Exhibitions, Workshops and Fireside Chats**

Activity Associate, Vikas, NSS Apr 2017 - Apr 2018
National Service Scheme, IIT Bombay
Ideated and **organized** several events with the volunteers, to promote **sustainable practices**
Mentored 60+ volunteers in their two semester long NSS courses, **NOCS01** and **NOCS02**

Editor, The Monthly Prophet Aug 2017 - Sep 2017
Monthly newsletter published by Mood Indigo, IIT Bombay
Authored articles on topics integrated to **youth culture**, escalating readership to over **30k**
Ideated on the **overall layout** of the newsletter and **brainstormed** upon the relevant articles