



SHRAVAN PRADEEP

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EDUCATION

North Carolina State University (NC State) , Raleigh, NC	2021
Ph.D. in Chemical Engineering <i>Minor</i> : Materials Science & Engineering	
<i>Advisor</i> : Prof. Lilian C. Hsiao	
Birla Institute of Technology & Science (BITS) , Pilani, India	2015
M.S. in Chemical Engineering	
Amrita Vishwa Vidyapeetham , Coimbatore, India	2012
B.S. in Chemical Engineering First Class with Distinction	
Chinmaya Vidyalyaya , Thrissur, India	2008
CBSE Std. XII <i>Subjects</i> : Physics, Chemistry, Mathematics & Computer Science	

RESEARCH INTERESTS

Nano- and micron structured soft particles, colloidal and granular suspensions, dense suspensions rheology, microstructure and dynamics, confocal rheometry, geophysical flows, and bacterial suspensions.

AWARDS & HONORS

Future Faculty Workshop - Diverse Leaders for the Future , University of Delaware	2022
James K. Ferrell Outstanding Ph.D. Graduate Award , Chemical & Biomolecular Engineering, NC State	2022
Langmuir Graduate Student Oral Presentation - Phase I Awardee , American Chemical Society	2021
Travel Assistance Award , Graduate Student Association, NC State	2019
Conference Travel Award , College of Engineering, NC State	2019
Provost's University Graduate Fellowship , College of Engineering, NC State	2016-2017
Department 1st Rank , Chemical Engineering Department, BITS	2015
Second Best Poster Award , Indian Institute of Chemical Engineers, Pilani Chapter	2015
University 3rd Rank , Amrita Vishwa Vidyapeetham University	2012
Prime Minister's Merit Scholarship , Department of Defense, Government of India	2008-2012

PROFESSIONAL EXPERIENCE

Research Experience:

Postdoctoral Research Associate, University of Pennsylvania, Philadelphia, PA September 2021-present
Mentor(s): Prof. Douglas Jerolmack (Penn Sediment Lab) & Prof. Paulo Arratia (Penn Complex Fluids Group)
Research Focus: Flow dissipation mechanics in model earth materials

- Created a rheological framework to explain flow behavior of debris flow samples from Montecito Mudslides (California, 2018) as a function of material properties and composition.
- *Ongoing Projects*:
 - Unified dissipation framework in model earth materials.
 - Universal flow transitions in yielding suspensions.
 - Linear viscoelastic behavior of bacterial suspensions in non-Newtonian medium.

Graduate Research Assistant, North Carolina State University, Raleigh, NC January 2017-August 2021
Advisor: Prof. Lilian C Hsiao (Hsiao SMART Lab)
Dissertation: Towards designing flow mechanics in dense suspensions of smooth and rough colloids

- Synthesized and characterized polymer-based smooth and rough model colloidal systems and proposed a contact criterion for dense suspensions using arguments from jammed granular matter.
- Built a confocal rheoscope to visualize the flow microstructure of suspensions in real time.
- Proposed a universal correlation to design colloidal suspensions for desired applications from contact microstructural characterization.
- Discovered the hydrodynamic origins of higher viscoelastic moduli for suspensions comprising of rough colloidal particles.

Research Assistant, Indian Institute of Technology, New Delhi, India

July 2015-May 2016

Advisor: Prof. Shalini Gupta (Biosensors & Nanomaterials Lab)

Project: Development of immunomagnetic capture chip for optical detection of typhoid bacteria

- Optimized an immunomagnetic method to separate and fluorescently label *Salmonella typhi* in phosphate buffer and human serum.
- Studied the capture of magnetic nanoparticles (MNPS) in millifluidic PDMS chips and proposed an optimized chip design for efficient capture of MNPs.

Research Assistant, Birla Institute of Technology & Science, Pilani, India

January 2014-May 2015

Advisor: Sonal Mazumder, PhD (*Current Position*: Regulatory Scientist, US FDA, Silver Springs, MD)

Thesis: Pure-and doped- ZnS quantum dots for photocatalytic degradation of biological pollutants

- Synthesized ZnS quantum dots (pure and doped with Fe^{3+} and Mn^{2+}) using 2-mercaptoethanol as the capping agent and optimized dye degradation parameters for Malachite Green and Methyl Orange.
- Validated the dye degradation kinetics by Langmuir-Hinshelwood model and proposed an advanced oxidation route for degradation mechanism.

Research Assistant, Amrita School of Engineering, Coimbatore, India

January 2012 - May 2012

Advisor: Prof. Kanakasabai Panchanathan

Project: Effect of TiO_2 nanoparticles on properties of Sulfothalic acid crosslinked-PVA membranes

- Fabricated Sulfothalic acid cross-linked PVA based membranes with and without TiO_2 nanoparticles. Studied the transport properties, thermal and mechanical properties of the membranes.
- Analyzed the effect of nanofillers on hydrophilicity of membranes, performed surface energy calculations and fitted water uptake values for GAB and MBET isotherms.

Summer Research Intern, Research & Development Establishment (Eng.), Pune, India

May 2011-July 2011

Advisor: Anoop Anand, PhD (Composite Research Center)

Project: Graphene in advanced structural composites

- Functionalized graphene to study the wettability of graphene-grafted glass fibers with resin.
- Proposed a mechanism to fabricate the graphene based nano-hybrid composite with epoxy resin.

Industry Experience:

Management Trainee, Mangalore Chemicals & Fertilizers Ltd., Mangalore, India

July 2012-June 2013

- Studied process parameters, mechanical and instrumentation aspects of NH_3 production plant.
- Involved in day-to-day operations in plant (shift basis) and participated in safety training programs.

Summer Inplant Trainee (Co-Op), Exide Industries, Hosur, India

June 2010-July 2010

- Equipped with the basic knowledge of lead-acid based battery manufacturing process.
- Trained in the departments of industrial and automotive battery divisions.

JOURNAL PUBLICATIONS

[†]indicates equal contributions | First-Author Publications: 7

1. Ranjiangshang Ran, **Shravan Pradeep**, Sebastien Kosgodagan Acharige, Brendan C Blackwell, Christoph Kammer, Douglas J. Jerolmack, and Paulo E. Arratia, "Understanding the rheology of kaolinite clay suspensions using Bayesian inference". (*In Review*) [[Preprint](#)]

2. Bryan O. Torres Maldonado, Ranjiangshang Ran, K. L. Galloway, Quentin Brosseau, **Shravan Pradeep**, and Paulo E. Arratia, "Phase-separation during sedimentation of dilute bacterial suspensions" (2022). (*In Review*) [\[Preprint\]](#)
3. **Shravan Pradeep**, Alan Wessel, and Lilian C Hsiao, "Hydrodynamic origin for the suspension viscoelasticity in rough colloids", *Journal of Rheology*, 66: 895 (2022). [\[Paper\]](#)
 - Designated as the **Editor's Featured Article**
4. Robert Kostynick[†], Hadis Matinpour[†], **Shravan Pradeep**[†], Thomas Dunne, Sarah Haber, Alban Sauret, Eckart Meiburg, Paulo E Arratia, and Douglas J Jerolmack, "Rheology of debris flows controlled by the distance from jamming" (2022). (*In Review*) [\[Preprint\]](#)
5. **Shravan Pradeep**, Paulo E. Arratia, "To biofilm or not to biofilm", *eLife*, 80891 (2022). [\[Paper\]](#)
6. Zijian Dai, **Shravan Pradeep**, Jie Zhu, Wenyi Xie, Heather F Barton, Yang Si, Bin Ding, Jianyoung Yu, and Gregory Parsons, "Freestanding metal organic framework-based microfiltration membranes fabricated *via* pseudomorphic replication toward liquid- and gas hazards abatement", *Advanced Materials Interfaces*, 2101178 (2021). [\[Paper\]](#)
7. **Shravan Pradeep**, Mohammad Nabizadeh, Alan R Jacob, Safa Jamali, and Lilian C Hsiao, "Jamming distance dictates colloidal shear thickening", *Physical Review Letters*, 127: 158002 (2021). [\[Paper\]](#)
 - *Research Highlights*: New images lead to better prediction in shear thickening. [Phys.org](#)
 - Highlighted in [NC State University News Releases](#)
8. Jie Zhu, Weiwang Qiu, Hua Han, Chengjian Yao, Chun Wang, Dequn Wu, Shravan Pradeep, and Zijian Dai, "Water stable UiO-66-NH₂ metal organic frameworks armed poly(vinyl) alcohol nanofibrous wound dressing with anti-infective therapy", *Journal of Colloid and Interface Science*, 603: 243-251 (2021). [\[Paper\]](#)
9. **Shravan Pradeep**, Lilian C Hsiao, "Contact criterion in suspensions of smooth and rough colloids", *Soft Matter*, 16:4980-4989 (2020). [\[Paper\]](#)
10. Lilian C Hsiao, **Shravan Pradeep**, "Experimental synthesis and characterization of frictional particles for colloidal and granular rheology", *Current Opinion in Colloid & Interfacial Science*, 43:94-112 (2019). [\[Paper\]](#)
11. **Shravan Pradeep**, Sai Raghuram, and Sonal Mazumder, "Rapid synthesis of pure and doped ZnS quantum dots for photocatalytic degradation of biological dye pollutants", *Materials Focus*, 6:657-667 (2017). [\[Paper\]](#)
12. **Shravan Pradeep**[†], Sai Raghuram[†], Mahua Ghosh Chaudhury, and Sonal Mazumder, "Synthesis and characterization of Fe³⁺ and Mn²⁺ doped ZnS quantum dots for photocatalytic application: Effect of mercaptoethanol and chitosan as capping agent", *Journal of Nanoscience & Nanotechnology*, 17:1125-1132 (2017). [\[Paper\]](#)
13. Sai Raghuram, **Shravan Pradeep**, Subhra Dash, Rajdeep Chowdhury, and Sonal Mazumder, "Chitosan encapsulated ZnS:M (M: Fe³⁺ and Mn²⁺) quantum dots for fluorescent labelling of sulphate reducing bacteria", *Bulletin of Materials Science*, 39:405-413 (2016). [\[Paper\]](#)

PROFESSIONAL SERVICES

Climate, Diversity, Equity & Inclusion Committee Member , Penn Arts & Sciences, UPenn	2022-present
Student Affairs Committee Member , Division of Soft Matter, American Physical Society	2019-present
Conference Chair , <i>Session: Rheology, Flow & Instabilities of Soft Materials</i> , APS March Meeting	2022
Mentor - Alumni Mentoring Program , Chemical & Biomolecular Engineering, NC State	2021-2022
Captain - Graduate Recruitment Event , Chemical & Biomolecular Engineering, NC State	2019
Student Organizer , Future Leaders in Chemical Engineering, NC State	2018 & 2019
Vice-President , Chemical & Biomolecular Engineering Graduate Student Association, NC State	2017-2018
Department Ambassador (Chemical & Biomolecular), Office of International Services, NC State	2016-2018
Department Representative (Master's Student Body), Chemical Engineering, BITS	2014-2015
Student Senate Member , Academic Counselling Cell, BITS	2014-2015

Reviewer: *Physical Review Letters*

Professional Member: American Institute of Chemical Engineers (AIChE), Society of Rheology (SOR), American Chemical Society (ACS), American Physical Society (APS)

TEACHING EXPERIENCE

Guest Lecturer & Lab Assistant, Department of Mechanical Engineering & Applied Mechanics, UPenn

- MEAM 2020 Introduction to Thermo-Fluids Engineering Fall 2022
- MEAM 225 Engineering in the Environment Spring 2022

Teaching and Communication Certificate, The Graduate School, NC State Spring 2021

Teaching Assistant, Department of Chemical & Biomolecular Engineering Department, NC State.

- CHE 713 Chemical Engineering Thermodynamics Fall 2019
- CHE 205 Chemical Process Calculations Fall 2017
- CHE 312 Transport Processes II Spring 2017

Teaching Assistant, Chemical Engineering Department, BITS.

- CHE F312 Chemical Engineering Lab I Fall 2013, Fall 2014
- CHE F322 Chemical Engineering Lab II Spring 2014, Spring 2015

SUPERVISING & MENTORING EXPERIENCE

Graduate Students: John Ruck (*Earth & Environmental Science, UPenn*)

Undergraduate Students: Eric Sigg (*Mechanical Engineering & Applied Mechanics, UPenn*), Philip Choi (*Earth & Environmental Science, UPenn*), Alan Wessel (*Chemical Engineering, NC State*), Sara Wozniak (*Chemical Engineering, NC State*), Christine Dang (*Chemical Engineering, NC State*), Colin Donaldson (*Chemical Engineering, NC State*), Alexander Kramer (*Chemical Engineering, NC State*)

SCIENTIFIC PRESENTATIONS

Invited Presentations

1. "Distance to jamming dictate colloidal shear thickening", *The Plot Thickens: Shear Thickening Seminar Series*, Virtual (2021).
2. "Probing contact microstructure in shear thickening colloidal suspensions", *ACS Colloids and Surface Science Symposium*, Virtual (2021). **Langmuir Student Oral Award Presentation**

Oral Presentations

1. **Shravan Pradeep**, Paulo Arratia, Douglas Jerolmack, "Rheological flow curves for model earth suspension mixtures", *Society of Rheology Annual Meeting*, Chicago, IL (2022).
2. **Shravan Pradeep**, Robert Kostynick, Thomas Dunne, Paulo Arratia, Douglas Jerolmack, "Constraint-based approach towards debris flow rheology", *APS March Meeting*, Chicago, IL (2022).
3. **Shravan Pradeep**, Alan Wessel, Lilian Hsiao, "Elucidating the effect of surface roughness-induced geometric frustration on linear viscoelasticity in colloids suspensions", *APS March Meeting*, Chicago, IL (2022).
4. **Shravan Pradeep**, Alan Wessel, Lilian Hsiao, "Effect of geometric frustration on the linear viscoelasticity in dense colloidal suspensions", *Society of Rheology Annual Meeting*, Bangor, ME (2021).
5. **Shravan Pradeep**, Alan Wessel, Lilian Hsiao, "Elasticity in dense suspensions of geometrically frustrated colloids", *APS March Meeting*, Virtual (2021).
6. **Shravan Pradeep**, Alan Jacob, Lilian C Hsiao, "Distance to jamming dictates onset stress and strength of shear thickening", *International Congress on Rheology*, Virtual (2020). **Keynote Speaker - Colloids, Suspensions, and Granular Media Session**

7. **Shravan Pradeep**, Alan R Jacob, Lilian C Hsiao, “Universal correlation between jamming distance and shear-thickening strength in dense colloidal suspensions”, *Annual Meeting of the APS Division of Fluid Dynamics*, Virtual (2020).
8. **Shravan Pradeep**, Alan R Jacob, Lilian C Hsiao, “Distance to jamming defines shear thickening strength in colloids”, *AIChE Annual Meeting*, Virtual (2020).
9. **Shravan Pradeep**, Lilian C Hsiao, “Dynamics and contact microstructure of rough colloids”, *APS March Meeting*, March 2-8, Denver, CO (2020).
10. **Shravan Pradeep**, Lilian C Hsiao, “Contact numbers and radial distributions in suspensions of smooth and rough colloids”, *APS March Meeting*, Boston, MA (2019).
11. **Shravan Pradeep**, H Sai Raghuram, Sonal Mazumder, “Synthesis and characterisation of Fe³⁺ doped ZnS based colloidal quantum dots in aqueous media, *2nd International Conference on Nanotechnology*, Haldia, India (2015).

Poster Presentations

1. **Shravan Pradeep**, “Towards rational design of structured soft earth materials”, *AIChE Annual Meeting*, Phoenix, AZ (2022).
2. **Shravan Pradeep**, Lilian C Hsiao, “Engineering flow mechanics in dense suspensions of surface-anisotropic colloids”, *Society of Rheology Annual Meeting*, Chicago, IL (2022).
3. **Shravan Pradeep**, Robert Kostynick, Hadis Matinpour, Alban Sauret, Eckart Meiburg, Thomas Dunne, Paulo Arratia, Douglas Jerolmack, “Yield, jam, and flow: Unpacking physics of debris flows”, *Gordon Research Seminar: Granular Matter*, Boston, MA (2022).
4. **Shravan Pradeep**, Lilian Hsiao, “Towards designing flow mechanics in dense suspensions”, *Triangle Soft Matter Workshop*, Virtual (2021).
5. **Shravan Pradeep**, Lilian C Hsiao, “Geometric frustration-induced phase behavior in spherically symmetric colloids”, *AIChE Annual Meeting*, Virtual (2020).
6. **Shravan Pradeep**, Yunhu Peng, Lilian C Hsiao, “Connecting frictional dissipation to rheology of confined suspensions”, *Society of Rheology Annual Meeting*, Raleigh, NC (2020).
7. **Shravan Pradeep**, Alex Kramer, Lilian C Hsiao, “Programmable self-assembly and suspension rheology in light-responsive colloidal systems”, *ACS Colloids & Surface Science Symposium*, State College, PA (2018).
8. **Shravan Pradeep**, Alex Kramer, Lilian C Hsiao, “Programmable self-assembly in photoresponsive colloids”, *Schoenborn Graduate Research Symposium*, Raleigh, NC (2018).
9. **Shravan Pradeep**, H Sai Raghuram, Sonal Mazumder, “Synthesis and characterization of Fe³⁺ and Mn²⁺ doped ZnS nanocrystals”, *Workshop on Analytical Instruments for Chemical & Environmental Engineers*, Pilani, India (2015). **Second Best Poster Award**
10. **Shravan Pradeep**, A K Ashwath, Smita Raghuvanshi, “Synthesis and characterisation of Graphene oxide nanoparticles using Modified Hummers Method, *National Conference on Nano-and Functional Materials*, Pilani, India (2014).
11. **Shravan Pradeep**, Banasri Roy, “Chitosan as a nano-biopolymer for drug delivery systems, *International Conference on Polymeric Biomaterials, Bioengineering & Biodiagnostics*, New Delhi, India (2014).

REFERENCES

Prof. Lilian C. Hsiao, Assistant Professor
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Prof. Douglas J. Jerolmack, Professor
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University of Pennsylvania, Philadelphia, PA
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Prof. Paulo E. Arratia, Professor
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