Richa Ghosh, Materials Characterization | Optical Instrumentation | Experimental Mechanics
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EXPERIENCE

UNIVERSITY AT BUFFALO | BUFFALO, NY

March 2026 - Present

Postdoctoral researcher
PI: *Priya Banerjee*

- Collaborated with multidisciplinary scientists to characterize the material properties of biomolecular condensates using fast and slow **video particle tracking (VPT)** for high throughput microrheology.
- Performed three-dimensional imaging of biomolecular condensates across multiple z-planes using Dragonfly **spinning-disk confocal microscopy** to investigate condensate architecture.
- Applied **optical tweezers (OT) microrheology – both passive and active** to probe localized viscoelastic properties and mechanical heterogeneity within biomolecular condensates.
- Studying the effect of **small molecule interaction of condensate aging**.

LAWRENCE LIVERMORE NATIONAL LABORATORY | LIVERMORE, CA

May 2025 - Aug 2025

Graduate Research Intern
PI: *Nathan Ray* & Mentor: *Todd Noste*

- Collaborated with scientists to study **subsurface damage (SSD)** of Potassium Dihydrogen Phosphate (**KDP)** & Dideuterium Phosphate **(DKDP)** crystals using emulsion etching **at the National Ignition Facility (NIF)**.
- Built **a Physics-Informed Neural Network (PINN)** to optimize a parametric study of subsurface damage opening.
- Collaborated with scientists at on-site **laser and nuclear research facilities** to support research in **hydrodynamics**, **materials science**, and **optics**.
- Acquired **data** using a high-speed camera **and analyzed** it with an advanced microscope and spectrometer.
- Performed quantitative characterization of **subsurface damage in KDP/DKDP frequency-conversion crystals** using **high-speed imaging**, **microscopy**, and interferometric measurements, supporting analysis of **material damage and failure mechanisms.**

IOWA STATE UNIVERSITY | AMES, IA

Aug 2024 - Dec 2025

Graduate Research Assistant, Project 4
PI: Prof. *Jaime Juárez* & Prof. *Sarah A Bentil*

- Designed and executed machine learning models predicting the rheological performance of polymer composites for **contact lenses**.
- Correlated viscoelastic and optical properties using **rheometers and various spectroscopy tools: Optical Tweezer, Dynamic Light Scattering, and Laser Speckle Rheology**.
- Performed material formulation and photocuring using UV light and photomasks; assessed optical clarity and drug-polymer interactions via spectroscopic tools and UV-Vis spectroscopy.
- **Publication: Ghosh, Richa**, Sarah A. Bentil, and Jaime J. Juárez. 2024. "Rheological Characterization of Contact Lens using various Spectroscopic methods." (*in process*)

Aug 2023 - Dec 2025

Graduate Research Assistant, Project 3
PI: Prof. *Jaime Juárez* & Prof. *Sarah A Bentil*

- **Formulated** and optimized **tunable polymer composites optically** for ocular and tissue scaffolds**.**
- **Built a custom Laser Speckle Rheology system** and **Python-based data analysis pipeline**.
- **Characterized** drug-excipient interactions and polymer microstructure with advanced spectroscopic tools to guide formulation refinement

Aug 2023 - Present

Graduate Research Assistant, Project 2
PI: Prof. *Jaime Juárez* & Prof. *Sarah A Bentil*

- Formulated biopolymer scaffolds **focusing on transparency** using **Poly(vinyl) alcohol** and **Phytagel polymer composites.**

- Used **Dynamic Light Scattering and microscopy** to correlate phase separation behavior with rheological evolution.
- **Publication: Ghosh, Richa**, Sarah A. Bentil, and Jaime J. Juárez. 2024. "Dynamic Light Scattering Microrheology of Phase-Separated Poly (Vinyl) Alcohol–Phytagel Blends." *Polymers* 16 (20): 2875. https://doi.org/10.3390/polym16202875

Aug 2021 - Present

Graduate Research Assistant, Project 1

PI: Prof. *Jaime Juárez* & Prof. *Sarah A Bentil*

- **Built** and calibrated a custom Optical Tweezer system to study viscometry measurements near solid boundaries.
- Validated experimental results using **Molecular Dynamics simulation**, improving understanding of microscale material interactions.
- Identified the significance of **near-wall hydrodynamic effects of the glass slide** on Optical Trapping Viscometry measurements.
- **Publication: Ghosh, R.**, S. A. Bentil, and J. J. Juarez. 2024. "Particle-Wall Hydrodynamic Effects on Optical Trapping Viscometry." *Colloids and Surfaces. A, Vol 682, Physicochemical and Engineering Aspects*. https://doi.org/10.1016/j.colsurfa.2023.132942

EDUCATION

2021 - 2025	**PhD in Mechanical Engineering -** Iowa State University, US	**(3.86/4)**
2018 - 2020	**M.Tech in Laser Science and Engineering**, Jadavpur University, India	**(9.17/10)**
2014 - 2018	**B.Tech in Mechanical Engineering**, WBUT, India	**(8.8/10)**

SUMMARY

PhD-trained materials scientist with expertise in experimental characterization, optical instrumentation, materials mechanics, and quantitative data analysis. Experienced in investigating material behavior using high-speed imaging, confocal microscopy, white-light interferometry, optical tweezers, laser-based spectroscopy, dynamic light scattering, and rheological techniques. Conducted subsurface damage characterization of KDP/DKDP frequency-conversion crystals at Lawrence Livermore National Laboratory, including high-speed imaging and quantitative analysis. Experienced in experimental design, scientific computing, machine learning, and numerical modeling for materials research.

SKILLS

• **Setup built**	Optical Tweezers, Laser Speckle Rheology & Optical microscopy
• Materials & Characterization skills	Polymer science, formulation and characterization using Rheometer, Optical Tweezer, Dynamic Light Scattering, Laser Speckle Rheology, etching characterization using confocal microscopy, white-light interferometer, bright- and dark field microscopy
• Techniques	Microscopy - bright and dark field microscopy, Fluorescence Microscopy, UV-Vis Spectroscopy, pH Meter, Refractometer, Particle Sizing
• Programming	Python, MATLAB
• Machine Learning	Frameworks: Scikit-learn, PyTorch, and TensorFlow
• Simulation	COMSOL, ANSYS, LAMMPS, Molecular Dynamics, and Monte Carlo simulation
• Designing & Visualization	AutoCAD, Blender, SolidWorks, Adobe Illustrator, Photoshop, LaTeX

AWARDS

- 2025 **Carl Storm Opportunity Fellow** – Gordon Research Conferences, Colloidal, Macromolecular and Polyelectrolyte Solutions.
- 2025 **Research Excellence and Teaching Excellence Award** – Iowa State University - IA, US
- 2024, 2025 **Binger Symposium Award** for competitive poster session – Iowa State University - IA, US
- 2020 **University Gold Medalist** – Jadavpur University – Calcutta, India

REFERENCES

- Prof. Jaime Juárez, Mechanical Engineering Department, Iowa State University (jjuarez@iastate.edu)
- Prof. Sarah A. Bentil, Mechanical Engineering Department, Iowa State University (sbentil@iastate.edu)
- Prof. Davit Potoyan, Chemistry Department, Iowa State University (potoyan@iastate.edu)
- Nathan Ray, Lawrence Livermore National Laboratory (ray36@llnl.gov)

PUBLICATIONS

- **R. Ghosh**, S. A. Bentil, and J. J. Juárez. (2024). "Particle-wall hydrodynamic effects on optical trapping viscometry," *Colloids and Surfaces A*, Vol 682, Physicochemical and Engineering Aspects. https://doi.org/10.1016/j.colsurfa.2023.132942
- **R. Ghosh**, S. A. Bentil, and J. J. Juárez. (2024). "Dynamic Light Scattering Microrheology of Phase-Separated Poly (Vinyl) Alcohol–Phytagel Blends," *Polymers 16 (20)*: 2875. https://doi.org/10.3390/polym16202875
- Miah, Md, **R. Ghosh**, Chandra Tangudu, M. G. Olsen, and J J. Juárez. 2026. "Acoustic Streaming Micromixer with Embedded Obstacle Arrays for Dispersion Enhancement." *Heat and Mass Transfer, Vol* 62 (9). https://doi.org/10.1007/s00231-026-03759-5.
- **R. Ghosh**, S. A. Bentil, and J. J. Juárez. (**Manuscript stage**). Correlating drug release profile of contact lens with micro-rheology using various spectroscopy tools.
- Nathan Ray, **R. Ghosh,** Jake Yoo Hyuck, Todd Noste, Jungmin Ha, Eyal Feigenbaum, Raluca Negres, Paul R. Ehrmann, Gary Tham, and Rusty Steele. (**Manuscript stage**). In-situ imaging and quantifying sub-surface damage (SSD) as a function of the diamond turning process variable of frequency conversion crystals.
- **R. Ghosh**, S. A. Bentil, and J. J. Juárez. (**Manuscript stage**). A comprehensive review on multi-speckle rheology and its application.

INVITED TALKS

- **R. Ghosh**, S. A. Bentil, and J. J. Juárez. (2025). "Correlating drug release profile of contact lens with microrheology using various spectroscopy tools", Gordon Research Seminar, Colloidal, Macromolecular and Polyelectrolyte Solutions.

CONFERENCE PRESENTATIONS

- **R. Ghosh**, S. A. Bentil, and J. J. Juárez. (2024) Hydrodynamic effects for Optical Trapping," 98th *ACS Colloid & Surface Science Symposium, University of Washington, WA, USA.*
- **R. Ghosh**, S. A. Bentil, and J. J. Juárez. (2023) "Hydrodynamic effects for Optical Trapping," 2023 Joint Midwest and Great Lakes Regional Meeting, MO, USA.

POSTER PRESENTATIONS

- P. Khanal, **R. Ghosh**, A. Singh, S. Manasvi, P. R. Banerjee. (2026) "Programmable bio-molecular condensates with sticker-spacer zipper polypeptides", Function without Form – 2026, Northeast regional disordered proteins workshop, Syracuse, NY.
- **R. Ghosh**, S. A. Bentil, and J. J. Juárez. (2025). "Correlating drug release profile of contact lens with microrheology using various spectroscopy tools", ASME, Memphis, TN, USA.
- **R. Ghosh**, S. A. Bentil, and J. J. Juárez. (2024). "Dynamic Light Scattering Microrheology of Phase-Separated Poly (Vinyl) Alcohol–Phytagel Blends," CoMFRE, Iowa State University, IA, USA.
- **R. Ghosh**, S. A. Bentil, and J. J. Juárez. (2024). "Dynamic Light Scattering Microrheology of Phase-Separated Poly (Vinyl) Alcohol–Phytagel Blends," 2024 Virginia and William Binger Graduate Research symposium, Department of Mechanical Engineering, Iowa State University, IA, USA.
- **R. Ghosh**, S. A. Bentil, and J. J. Juárez. (2025). "Correlating drug release profile of contact lens with micro rheology using various spectroscopy tools", 2025 Virginia and William Binger Graduate Research symposium, Department of Mechanical Engineering, Iowa State University, IA, USA.
- Nathan Ray, **R. Ghosh,** Jake Yoo Hyuck, Todd Noste, Jungmin Ha, Eyal Feigenbaum, Raluca Negres, Paul R. Ehrmann, Gary Tham, and Rusty Steele. (2025). "In-situ imaging and quantifying sub-surface damage (SSD) as a function of diamond turning process variable of frequency conversion crystals". Summer Poster Competition, Lawrence Livermore National Laboratory, CA, USA.
- **R. Ghosh**, S. A. Bentil, and J. J. Juárez. (2025). "Correlating drug release profile of contact lens with micro rheology using various spectroscopy tools", CoMFRE, Iowa State University, IA, USA.
- **R. Ghosh**, S. A. Bentil, and J. J. Juárez. (2025). "Correlating drug release profile of contact lens with micro rheology using various spectroscopy tools", ASME 2025 International Mechanical Engineering Congress & Exposition Renasant Convocation Center, Memphis, TN, USA.

Lecturer

- ME 1600 - Mechanical *engineering problem solving with computer applications.*

I designed the course structure with objective – at the end of Fall semester 2025, students will be able to independently solve simple Engineering Dynamics, Thermal and Mechanical system problems and translate the solutions using codes developed in Python via collaborative projects. This approach blends fundamentals with computational problem solving, preparing students for modern engineering practice.