

**February Section Meeting:
Engineering Injectable Complex
Fluids Using Single-Drop Extensional
Rheology**

Injectability, sprayability, and printability in soft materials are dictated by the flow properties under extensional “stretching” flows. Until recently, the extensional rheology of dilute protein and polymer solutions has been sparsely studied due to experimental limitations. Most extensional rheology devices yield mixed shear and extensional flows, cover limited extension rates, require multiple loadings, and are not commercially available. However, capillary-driven thinning of a liquid bridge – in which filament thinning can be mathematically described by distinct behavioral regimes accounting for inertial, viscous, elastic, and capillary forces – can be used to accurately measure rheological parameters. To measure scarce materials and low viscosity fluids in truly small volumes, we have developed instrumentation for simultaneous droplet-based extensional rheology and surface tension measurements in $<10 \mu\text{L}$ /trial over a range of temperatures, humidities, and organic solvents. We demonstrate the utility of capillary-driven thinning to determine injectability and coatability in protein therapeutics and polymer solutions. For example, common excipients added to

February Section Meeting

Topic: Engineering Injectable Complex Fluids Using Single-Drop Extensional Rheology

Speaker: Michelle A Calabrese,
Assistant Professor,
Dept of Chemical Engineering
and Materials Science,
University of Minnesota

Date: **THURSDAY**, February 17th
** Please note the day change **

Time: 6:00 – Introduction
6:05 - Career Discussion
6:15 - Technical Presentation
7:15 – Q & A

Cost: Free, Registration Required

Location: Online Zoom meeting

REGISTRATION REQUIRED. More information can be found on our [website](#).

[Register](#)

stabilize proteins in shear flows produce adverse behavior in extension that can cause protein denaturing. For polymer solutions in organic solvents, we employ a new environmental control system to confirm scaling relationships for the first time, and also show that evaporation effects during measurement can depend more on polymer mobility than solvent vapor pressure. These case studies illustrate the utility of solution extensional rheology for predicting injectability and coatability, enabling rapid formulation screening using a single drop.



Speaker Biography: Michelle A Calabrese is an assistant professor in the Department of Chemical Engineering and Materials Science at the University of Minnesota. She received her BS in Chemical Engineering from the University of Pennsylvania in 2012. She completed her PhD in Chemical Engineering at the University of Delaware in 2017, where she focused on developing new techniques in rheology and neutron scattering to understand the flow properties of complex fluids.

Following her postdoc in chemical engineering at MIT, she joined the faculty at UMN in mid-2019. Her research group employs rheology, soft matter physics, and polymer and nanoparticle synthesis to address a range of fundamental and applied problems in polymer and soft materials engineering. Her recent recognitions include the 3M Non-tenured Faculty Award, NSF CAREER Award, and NIH NIDCD Early Career Research Award (R21).

Education Corner:

What Are Homographs?

- 1) *The bandage was wound around the wound.*
- 2) *The farm was used to produce produce.*
- 3) *The dump was so full that it had to refuse more refuse.*
- 4) *We must polish the Polish furniture.*
- 5) *He could lead if he would get the lead out.*
- 6) *The soldier decided to desert his dessert in the desert.*
- 7) *Since there is no time like the present, he thought it was time to present the present.*
- 8) *A bass was painted on the head of the bass drum.*
- 9) *When shot at, the dove dove into the bushes.*
- 10) *I did not object to the object.*
- 11) *The insurance was invalid for the invalid.*
- 12) *There was a row among the oarsmen about how to row.*
- 13) *They were too close to the door to close it.*
- 14) *The buck does funny things when the does are present.*
- 15) *A seamstress and a sewer fell down into a sewer line.*
- 16) *To help with planting, the farmer taught his sow to sow.*
- 17) *The wind was too strong to wind the sail.*
- 18) *Upon seeing the tear in the painting I shed a tear.*
- 19) *I had to subject the subject to a series of tests.*
- 20) *How can I intimate this to my most intimate friend?*

Did you get the answer? Homographs are words that are spelled the same but differ in meaning or pronunciation.

AIChE Meetings

2022

- Apr 10-14 [2022 Spring Meeting and 18th Global Conference on Process Safety](#)
San Antonio, TX
- May 2-5 [2022 Synthetic Biology; Evolution, Engineer and Design \(SEED\)](#)
Arlington, VA
- June 1-3 [Advanced Manufacturing and Processing Conference](#)
Bethesda, MD
- June 7-9 [Process Development Symposium](#)
Philadelphia, PA
- June 26-28 [NDEW-ChE: National Diversity Equity Workshop for Chemical Engineering Academic Leaders](#)
Baltimore, MD

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The objectives of AIChE are to advance chemical engineering in theory and practice, to maintain a high professional standard among its members, and to serve society, particularly where chemical, engineering can contribute to the public interest.
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VOLUNTEER AS A YOUNG PROFESSIONAL LIAISON (YPL)

We are looking for Young Professional Liaisons for each state – CO, NM, WY, SD & MT. Please send nominations to any section officer listed above.

MEETING SCHEDULE

The Rocky Mountain Local Section (RMLS) of AIChE generally meets the second or third Tuesday of every month, September through May.