The Australian Society Of Rheology, Inc.

2020-21 Rheology Lecture Series

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The Australian Society of Rheology is presenting a national series of lectures, which is open to anyone interested in the flow and deformation of matter. The next event in the series will be held online.

Calendar details

Date:	**21 July 2021**
Time:	9:00 to 10:30 AM (Melbourne, Australia)

Event Registration Link: https://www.eventbrite.com.au/e/australian-society-of-rheology-seminar-21-july-2021-registration-161195079823

Invited lecture

A/Prof. Roseanna Zia

(Department of Chemical Engineering, Stanford University)

Presentation Title: Physics-based modelling of whole-cell function: colloidal fundamentals to life-essential processes

Summary: My research group aims to unlock the fundamental connections between colloidal-scale physics and life-essential processes in biological cells using theoretical colloid physics, biological modelling, and high-fidelity computational models. Part of our ultimate vision is to create a platform for uncovering physics-based disease mechanisms and pathways for physics-based therapeutics. To achieve this, we have systematically worked toward four goals that serve as building blocks for this vision: developing analytical theory to model dense macromolecular suspensions; explaining how colloidal gels and glasses form and age; modelling a spatially resolved, simple biological cell; and applying what we have learned in the physics of non-living systems to discover how transport and reactions cooperate to power translation elongation in *E. coli*. Today I will present the highlights of this arc of inquiry, with in-depth discussion of our discoveries of how colloidal gels age-coarsen, how previously undiscovered colloidal physics may be essential to mRNA translation in *E. coli*, and how we can use what we have learned to inform current understanding of the role of maturation of amyloid aggregates in neurodegenerative disease processes.

Speaker's biography

Roseanna N. Zia is an Assistant Professor of Chemical Engineering at Stanford University. She received her Ph.D. from the California Institute of Technology in Mechanical Engineering in 2011 with Professor John F. Brady, for development of theory in colloidal hydrodynamics and microrheology. Zia subsequently conducted post-doctoral study of colloidal gels at Princeton University, in collaboration with Professor William B. Russel. Zia began her faculty career at Cornell in January 2013, then subsequently moved her research group to Stanford University in 2017.

Dr. Zia's research includes developing micro-continuum theory for structure-property relationships of flowing suspensions, elucidating the mechanistic origins of the colloidal glass transition, and microscopic modeling of reversibly bonded colloidal gels, which resulted in discovery that gel aging is actually ongoing but very slow phase separation and the finding that mechanical yield of colloidal gels is actually a non-equilibrium phase transition, triggered by changes in osmotic pressure. Her research group aims to unlock the fundamental connections between colloidal-scale physics and life-essential processes in biological cells using theoretical colloid physics, biological modeling, and high-fidelity computational models. Our ultimate vision is to create a generalized platform for uncovering disease mechanisms and pathways for physics-based therapeutics.

Dr. Zia's work has been recognized by several awards, including the PECASE Award, the ONR Director of Research Early Career Award, the Office of Naval Research (ONR) Young Investigator award, the NSF CAREER Award, the NSF BRIGE Award, the Publication Award from the Society of Rheology, and the Engineering Sonny Yau ('72) Teaching Award.

Dr. Zia serves as an Associate Editor for the *Journal of Rheology*, and on the Advisory Boards of the journal *Physics of Fluids* and *AIChE Journal.*

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