

**“The Professor Meyer H. Birnboim Endowed Lecture Series”
Inaugural Seminar – Fall 2022****Dr. Norman J. Wagner**Alison Professor & Unidel Robert L. Pigford Chair
Chemical & Biomolecular Engineering | University of Delaware**Seminar: Wednesday, September 21, 2022
9:30 a.m. (CBIS Auditorium)**Live stream link: <https://mediasite.mms.rpi.edu/mediasite/Play/6e54e6f956214835993fa0dc9f880db01d>**“The Micromechanics of Shear Thickening Fluids and Their Application as Protective Materials for Medical Professionals, First Responders, Athletes, and Astronauts.”****Abstract:**

Shear thickening colloidal and/or nanoparticle suspensions are commonly encountered in chemical and materials processing and are also the basis of a technology platform for advanced, field responsive nanocomposites. In this presentation, I will review some of the experimental methods and key results concerning the micromechanics of colloidal suspension rheology. Micromechanics is the ability to predict the rheological properties of complex systems from a colloidal or microscopic level description of the structure and forces. A fundamental understanding of colloidal suspension rheology and in particular, shear thickening, has been achieved through a combination of model system synthesis, rheological, rheo-optical and rheo-small angle neutron scattering (SANS) measurements, as well as simulation and theory. In particular, the role of particle contact friction versus enhanced lubrication friction will be elucidated along with implications for formulation.

Shear thickening fluids (STFs) are novel field-responsive materials that can be engineered to be useful nanocomposites for enhanced ballistic and impact protection, puncture resistant medical gloves, energy absorbing materials for mitigating impacts and concussions, as well as in systems for mitigating puncture, micrometeoroid, and orbital debris threats in space applications. The development of commercial applications of STFs will be discussed. The rheological investigations and micromechanical modeling serve as a framework for the rational design of STF-based materials to meet specific performance requirements not easily achieved with more conventional materials. I will illustrate some technological applications of STFs under commercial development, including use in astronaut protection with application in the Artemis Mission as well as the Mission to Mars, with the associated flight experiments on the International Space Station.

Biography:

Norman J. Wagner is an Alison Professor of the University of Delaware and holds the distinguished Unidel Robert L. Pigford Chair in Chemical Engineering, with affiliated faculty appointments in Physics and Astronomy, Biomechanics and Movement Science, and Biomedical Engineering. He leads an interdisciplinary research team at the University of Delaware. He was President of the Society of Rheology (American Institute of Physics Member Society), is the co-founder and director of the Center for Neutron Science www.cns.che.udel.edu, and served as Chair of the CBE Department from 2007-2012. He was elected to the National Academy of Inventors in 2016 and the National Academy of Engineering in 2015, and is a fellow of both the AAAS and NSSA. In 2018 he was awarded the Sustained Research Award of the Neutron Scattering Society of America. He leads an active research group with focus on the rheology of complex fluids, neutron scattering, colloid and polymer science, applied statistical mechanics, nanotechnology and particle technology. He is also the PI on a mid-range infrastructure project funded by the National Science Foundation to build a world-class neutron spin echo instrument at the NIST

Center for Neutron Research. Prof. Wagner co-founded STF Technologies LLC in 2003 to commercialize his inventions for applications in personal protective equipment and astronaut protection for NASA, as well as new scientific instruments. More about Professor Wagner, including his three textbooks, many patents and research publications can be found at www.cbe.udel.edu/wagner.

Refreshments will be available at 9:00 a.m. in the Auditorium Gallery.***Masks are required to attend this seminar.**For more information, please contact Lisa Martin (swishl@rpi.edu)