

# Nanomaterials and Neutrons

## Research Forum

Friday, April 4, 2014 • 11:00 am

Iran Thomas Auditorium



### How do colloidal gels form and flow?

Microstructure and rheology of a thermoreversible gel under steady and large amplitude oscillatory shear (LAOS) using time-resolved oscillatory rheo-small-angle neutron scattering

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Large amplitude oscillatory shear (LAOS) rheology is an effective way of studying the nonlinear dynamics of complex fluids. We study the formation, microstructure and rheology of model thermoreversible nanoparticle gels under steady and time-dependent shear flow. From the rheological results an interpretation is made about the underlying microstructure of the sample and how it is affected by the imposed deformation. However, this approach remains largely qualitative and indirect due to both the lack of structural information and numerical tools to quantify the structure. Here, we present a new method for a direct, quantitative study of the microstructure under LAOS deformation in the framework of the alignment factor,  $A_f$ . We use a model thermoreversible adhesive hard-sphere system composed of octadecyl-coated silica particles suspended in n-tetradecane. Thixotropic models are fit to the measurements and a comparison of the “structure” parameter appearing in these models and the microstructure obtained by scattering provides new insights into the physical meaning of these models. This new analysis demonstrates a novel method for simultaneously measuring the rheology and microstructure during a time-dependent deformation (LAOS) and routes forward for predicting the dynamic behavior of thixotropic gels.



Norman J. Wagner is the Alvin B. and Julia O. Stiles Professor in the Department of Chemical & Biomolecular Engineering at the University of Delaware. He served as Chair of the Department from 2007-2012, and is the director of the Center for Neutron Science ([www.cns.che.udel.edu](http://www.cns.che.udel.edu)). He leads an active research group in the fields of rheology, complex fluids, polymers, applied statistical mechanics, nanotechnology and particle technology. He earned his Bachelor's degree from Carnegie Mellon and Doctorate from Princeton University, was an NSF/NATO Postdoctoral Fellow in Germany, and a Director's Postdoctoral Fellow at Los Alamos National Lab prior to joining the University of Delaware in 1991. He was named a Senior Fulbright Scholar (Konstanz, Germany) and served as a guest Professor at the ETH, Zurich (1997) and the University of Rome (2004). Prof. Wagner has authored or coauthored over 200 scientific publications and patents and has served on the editorial boards of six international journals.

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