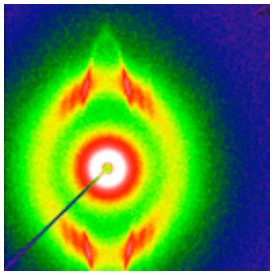

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Keynote 11 - Development of µRheoSANS and Investigating the Structure and Rheology of Complex Fluids at High Shear Rate

Wednesday 12 December 2018 10:30 (40 minutes)

We are developing slit rheometers compatible with simultaneous small angle neutron scattering (SANS) measurements to directly correlate structure and rheology over a broad range of conditions. Eventually we hope to probe sample structure in Poiseuille flow at high shear rates, under high pressure head, and relatively high temperatures. This builds upon an existing suite of Couette rheoSANS and flowSANS devices at the NIST Center for Neutron Research that are accessible to the scientific community through a peer reviewed proposal system. Industrial applications, such as lubrication, mixing, spraying and injection, involve the flow of complex fluids at high deformation rates. Clogging, fluid degradation, and other processing challenges can arise in these extreme contexts and are often driven by structural changes in the fluid. To date, we have developed a prototype slit rheometer capable of simultaneously measuring structure and rheology of relatively low viscosity or shear thinning fluids (η_∞ < 5 mPa·s) at shear rates up to 100,000 s-1 and a capillary rheoSANS instrument capable of simultaneously measuring structure and rheology at rates up to 106 s-1. Our initial investigations have focused on measuring wormlike micelle solutions at low to moderate shear rates and comparing the results with Couette rheoSANS measurements. In this talk we will discuss the ongoing development of µRheoSANS measurements including our existing low-pressure apparatus, the capillary device and our newly built high pressure µRheoSANS device, designed to withstand pressure drops or pressure heads up to 350 bar. This device will enable us to measure SANS at shear rates up to 106 in samples with η_∞ ~ 100 mPa·s. Furthermore, we will discuss the results of a series of experiments aimed at understanding the rheological response of wormlike micelle solutions at relatively high shear rates.

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Session Classification: Late morning session - Associated systems