August 11-14th at the Crowne Plaza Hotel in downtown Knoxville, TN

Contribution ID: **11** Type: **Contributed Talk**

Using SANS to characterize how non-adsorbing polymers affect rheology and microstructure of dense suspensions

Dense suspensions with high solid volume fractions ($\phi \geq 0.5$) are prevalent in nature and throughout industry. These highly loaded suspensions can exhibit complex rheological behaviors, including both shear thinning and subsequent thickening with increasing shear rate. Understanding the mechanisms behind these rheological behaviors can improve the design of materials systems to behave as predicted and desired under process flows, such as in direct ink writing. Here, we present a study on a dense ($\phi = 0.55$) suspension of colloidal alumina particles and show how the addition and loading of a non-adsorbing polyvinylpyrrolidone (PVP) at different molecular weights can be used to tune and control its rheological properties. PVP was added at varying concentrations spanning the dilute and semi-dilute, non-entangled regimes for each molecular weight. We performed SANS experiments on polymer solutions to obtain relevant equilibrium length scales for each polymer MW at each concentration studied. The addition of PVP at concentrations in the dilute regime was shown to increase the viscosity of the suspension and induce discontinuous shear thickening (DST). However, further increases in PVP loading particularly within the semi-dilute, non-entangled regime and at higher PVP molecular weights also increased the dynamic yield stress of the material, made the suspension more shear thinning, and delayed the onset of DST. We also performed Rheo-SANS measurements on dense polymer-particle suspensions but did not detect any structural changes with shear for either PVP or alumina, which was a surprising finding. Finally, we will present ideas for future Rheo-SANS experiments on more idealized systems which could improve our understanding of how polymeric additives can be used to control the rheological behavior and processing of dense suspensions.

Topical Area

Soft matter: polymers, and complex fluids

Author: SESHADRI, Akul (School of Materials Engineering, Purdue University)

Co-authors: KABOOLIAN, Matthew (School of Materials Engineering, Purdue University); ARDEKANI, Arezoo (School of Mechanical Engineering, Purdue University); YOUNGBLOOD, Jeffrey (School of Materials Engineering, Purdue University); WEIGANDT, Katie (Center for Neutron Research, National Institute of Standards and Technology); ERK, Kendra (School of Materials Engineering, Purdue University); CORDER, Ria (Department of Chemical and Biomolecular Engineering, University of Tennessee, Knoxville)

Presenter: CORDER, Ria (Department of Chemical and Biomolecular Engineering, University of Tennessee, Knoxville)