

CMET Seminar

366 Colburn Lab

Wednesday, February 27, 2019

10:30 a.m.

"Using Rheology to Determine the Phase Behavior: A Case Study of Colloidal Suspension of Charged Discotic Particles"

In this work, we discuss the use of rheological tools to study the phase behavior of an aqueous suspension of Laponite that is composed of charged discotic nanoparticles, a highly contested system in the literature. The scattering studies on Laponite suspension suggest that below 2 weight % it is in an attractive gel state while beyond 2 weight %, it is in a repulsive 'Wigner' glass state. In this work, we perform time-resolved rheometry on Laponite suspensions over a concentration range of 1 to 4 weight %. Very interestingly the linear viscoelastic response shows all the characteristic signatures of the sol-gel transition observed for polymeric materials undergoing crosslinking reaction sampling the critical gel state with a percolated space spanning network. Significantly, the cryo-TEM images of the post-gel state also clearly show the presence of a percolated network formed by interparticle bonds. Therefore, contrary to scattering studies, the present work clearly suggests Laponite suspensions to be in attractive gel state over the studied concentration range. We also discuss rheological distinguishing features of a glass and a gel state and possible origin of discrepancy between scattering studies and the microstructure shown by TEM.

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Dr. Joshi completed his Bachelor of Engineering in Polymer Engineering from Pune University in 1996 and PhD in Chemical Engineering from Indian Institute of Technology Bombay in 2001. Subsequently, he joined Benjamin Levich Institute, New York for post-doctoral studies. Dr Joshi joined Department of Chemical Engineerin, Indian Institute of Technology Kanpur in 2004, where presently he is C. V. Seshadri Chair Professor. His research interests include the rheology of complex fluids, colloidal glasses and gels, clay dispersions, and polymer science and engineering. He is also on the editorial advisory board of Langmuir. Dr Joshi is an elected fellow of the Indian National Academy of Engineering and the National Academy of Sciences, India. He is also closely associated with many industries pertaining to improving the flow behavior and stability of soft materials.