The Department of Mechanical Engineering/College of Engineering and Applied Sciences
Stony Brook University

Mechanical Engineering Seminar

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Lecture Title: The Shear-Induced Jamming Transition in Dilatant Suspensions

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Abstract

Dense suspensions under sufficiently high shear stress can exhibit a dramatic transition to a solid-like state. This is known as extreme shear thickening and is sometimes accompanied by dilatancy. This behavior is contradictory; the material is solid-like but only when flowing. To probe the elasticity of the dilatant state, we measure the transient inertio-elastic oscillations that occur in response to step changes in applied stress. As the volume fraction of solids increases the apparent non-linear elasticity also increases, and the suspension flows more slowly, approaching an elastic solid, which supports stress statically. Our results confirm that shear thickening is associated with a jamming transition, and suggest that the unstable flows exhibited by dilatant materials originate from the interplay of elastic and viscous effects.

Biography

Dr. Ryan Larsen's research interests center on the phase behavior and deformation of soft materials, including suspensions, gels, and the oxide films on liquid metals. He earned Bachelors and Masters degrees in Mechanical Engineering from Brigham Young University where he developed a new stereological method for recovering the orientations of grain boundary planes in polycrystalline materials. He received a National Defense Science and Engineering Graduate Fellowship and attended the School of Engineering and Applied Sciences at Harvard University, where he worked in the group of Professor Howard A. Stone on the stability of particle-coated air bubbles. He then worked in the group of Professor David A. Weitz, where he developed advanced rheological measurements on a variety of soft materials, including dense particle suspensions, biological polymer networks, and oxidizing liquid metals for microfluidics applications. Dr. Larsen completed his Ph.D. in Applied Physics in November, 2007 and is currently employed as a Postdoctoral Research Associate in the group of Professor Charles F. Zukoski in the Department of Chemical and Biomolecular Engineering at the University of Illinois at Urbana-Champaign. His research focuses on using NMR diffusion and flow measurements to characterize the phase behavior of molecular glasses and gels.

Directions: Please call Augusta Kuhn at 631-632-8310 for more information.

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