MONTANA STATE UNIVERSITY
College of ENGINEERING

Chemical and Biological Engineering

Special Materials Science Seminar
Physics Colloquium

Extreme transitions of flow properties in mixtures: discontinuous shear thickening and hydrate jamming

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Friday, April 24, 2015
4:10 – 5:00 pm, 103 EPS

Biography

Dr. Jeff Morris is Department Chair and Professor of Chemical Engineering at City College of New York. His education includes a BS from Georgia Institute of Technology, and an MS and PhD from California Institute of Technology. He is also the Acting Director of the Benjamin Levich Institute for Physico-Chemical Hydrodynamics, an interdisciplinary research center for the study of fundamental problems of flow and transport in complex fluids, fluid-like media, and interfaces. His specific research interests are in the properties and dynamics of flowing mixtures, with the goal of developing a dynamic materials science. A major focus has been to carry scientific understanding of nonequilibrium microstructure and rheology in sheared suspensions to engineering applications through flow modeling.

Abstract

This talk will discuss two quite different but equally extreme transitions in flow properties observed in dispersed multiphase mixtures. The first discussion will describe a simulation study of abrupt or "discontinuous" shear thickening (DST), which occurs as *shear rate is increased* in near-hard sphere suspensions at large solid fraction. For many years, DST has been known, and popular videos of running on "oobleck" (cornstarch suspended in water) are found on-line. Yet the fundamental basis has been mysterious and controversial. In the second discussion, the property variations of hydrate-forming water-in-oil emulsions will be described based on experimental observations. This is a critical problem in petroleum pipeline transport where a transition occurs due to a *reaction as time progresses*. The developed porosity of the solid hydrate is critical: even modest internal phase (water) emulsions can "jam": the low-viscosity emulsion develops a large viscosity and eventually a large yield stress as hydrate formation progresses—much like the undesirable plugging of pipelines.

Host: Ryan Anderson, ChBE
Refreshments: 3:45 p.m. EPS 2nd Floor Atrium

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