MATERIALS DEPARTMENT / MRL
JOINT COLLOQUIUM

Friday, October 23, 2009, 4:00 PM, ESB 1001

"Highly-charged and complex interfaces: electrokinetics and rheology"

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Abstract

I will tell two stories, both of which involve fluid flows at nano-scale fluid interfaces. First, I will discuss *electrokinetic* flows, in which electric field exert forces upon ionic clouds that surround and screen charged surfaces. Such effects have been known for two centuries, and a rational theory has been around for one. Nonetheless, there exist precious few systems where the standard theory can make falsifiable, independently testible, quantitative predictions that can be measured experimentally. We discuss a system that we have developed in our laboratory to do just that, and find significant discrepancies between the standard theory and our measured results. This motivates a search for mechanisms, not generally taken into account by the standard theory, to explain this discrepancy. In particular, we describe the surprising role that even nanoscale roughness
can play, and the (not-so-surprising) role of surface chemistry.

Second, I will describe a new technique we have developed to measure the *interfacial rheology* -- the viscous and elastic properties -- of fluid-fluid interfaces, typically laden with some surface-active species (molecular surfactants, copolymers, colloids, etc.). Using microfabrication technique, we make ferromagnetic, amphiphilic microdisk probes that are ideally suited for active interfacial microrheology. By applying an oscillatory torque using electromagnets, and measuring the resulting (oscillatory) displacement, we create a small version Couette interfacial rheometer that is exceedingly sensitive to the rheology of the interface. A novel feature is our ability to directly visualize the interface during the measurement, which we use to explore history-dependent, visco-elastic and yielding behavior of a phospholipid monolayer.

Host: Professor Ram Seshadri

LIGHT REFRESHMENTS WILL BE SERVED PRIOR TO THE SEMINAR AT 3:45PM