CHEMICAL, BIOLOGICAL & MATERIALS ENGINEERING

100 E. Boyd, Sarkeys Energy Center, T-301
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The University of Oklahoma
Norman, Oklahoma

2012 – 2013 Seminar Series

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Will present a seminar on

"INTERFACIAL DYNAMICS AND MECHANICS AT THE MICROSCALE"

Surfactants and adsorbed particles impact the formation, rheology, and stability of emulsions and foams by imparting unique interfacial mechanical properties that are a function of their transport and adsorption behaviors. The nonlinear coupling of advection, diffusion, kinetics, interfacial stresses, and interfacial deformation often hinders analysis of the relevant processes. The goal of this talk is to demonstrate the utility of microfluidic length scales in separating and analyzing these processes.

At microfluidic length scales, surfactants diffuse more rapidly to an interface, which can lead to kinetically limited adsorption. Reduced transport timescales can thus be employed to deduce kinetic rate constants for adsorption at oil-water interfaces. We accomplish this by measuring the dynamic surface tension at microscale bubbles in a microtensiometer apparatus that we developed. We then use the measured rate constants to model a fluid dynamical phenomenon called tipstreaming, in which micron scale droplets are formed in a microfluidic flow focusing geometry. Tipstreaming occurs as a result of strong interfacial tension gradients that are established in an elongational flow past an oil-water interface. At relevant flow speeds, adsorption is kinetically limited. The model we have developed provides a relatively simple set of criteria for obtaining and controlling the process.

Finally, we apply the concepts of transport and mechanics at interfaces to examine more complex interfaces. For example, we show that microfluidic geometries can be used to control particle adsorption rates in Pickering foams. The microtensiometer device can be used to determine the interfacial dilatational modulus of particle-laden interfaces, which is a property implicated in emulsion and foam stability.

These examples demonstrate the utility of microfluidic length scales in separating timescales and elucidating interfacial transport and mechanical behaviors.

THURSDAY, APRIL 25, 2013

COOKIES AND COFFEE -- 2:45 P.M.

SEMINAR -- 3:00 P.M.

SARKEYS ENERGY CENTER, ROOM M-204

THIS IS A REQUIRED SEMINAR FOR CHE 5971

Accommodations on the basis of disability are available by contacting the office before the event.