

**CENTER FOR FLUID MECHANICS
AND
THE FLUIDS, THERMAL AND CHEMICAL PROCESSES GROUP
OF
THE DIVISION OF ENGINEERING**

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Microstructure Evolution and Materials Synthesis in a Self-Assembled Mixed-surfactant Mesophase

Soft nanoscale materials, such as micelles, vesicles, microemulsions, liquid crystals and other complex fluids are becoming increasingly important from both a scientific as well as an applications perspective. Visualization of these materials is a challenge because of their size (2 – 100nm), their low electron density and because their aggregation state and morphology is critically dependent on solvent concentration. Several examples of artifact-free ‘visualization’ of soft nanoscale materials will be provided. These include reciprocal space imaging using Small Angle Neutron Scattering (SANS) and light scattering (LS), as well as direct imaging using cryogenic Transmission Electron Microscopy (cryo-TEM) and Freeze Fracture Direct Imaging (FFDI). Advantages and limitations of each of these techniques, as well as how they complement each other, will be discussed.

A novel transformation from a microemulsion to a gel phase has been observed by increasing the water content of a system consisting of AOT and lecithin in isooctane. Small angle neutron scattering (SANS) patterns are consistent with models that describe the microstructure as columnar hexagonal at lower water contents and temperatures, and lamellar at higher water contents and temperatures. These structures can be aligned using shear, are thermally reversible, and have been used as robust templates for a variety of reactions in the aqueous and organic nanochannels. The morphology of the nanostructured phases mimics the underlying structure of the surfactant aggregates. This feature opens up several opportunities for template-directed materials synthesis, and several examples will be shown.

**February 10, 2004
Barus & Holley, Room 190
4:00 pm**