

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

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**Studying Microstructural Dynamics of Complex Fluids
with Microrheology**

Over the last decade, particle tracking microrheology has matured as a new tool for complex fluids research. The main advantages of microrheology over traditional macroscopic rheometry are: the required sample size is extremely small (< 1 microliter), local viscoelastic properties can be probed with high spatial resolution (~ 1 - 10 micrometer), and the sample is not disturbed by moving rheometer parts. I will present a few examples of recent work in my group that highlight how the technique can be exploited to acquire unique information about the dynamics of complex fluids.

First, I will discuss the development of a dialysis cell for studying microstructural rearrangements due to changes in solvent composition. With macroscopic rheometry, it is virtually impossible to change the solvent composition in a sample in a controlled manner during an experiment. By integrating microfluidics and microrheology, we have created a device that enables us to achieve rapid and reversible changes in solvent composition via diffusive mass transport. The microdialysis cell can be used for well-defined experiments with solvent-sensitive materials and I will present results for two such complex fluids: 1) alginate hydrogels, 2) biomimetic self-assembled block-copolyptide hydrogels.

In another project, we have employed microrheology to monitor the progress of photopolymerization of UV curable acrylate resins and hydrogels. In this case, microrheology enables a detailed study of three-dimensional gelation profiles with a spatial and temporal resolution that is inaccessible to a rheometer. The results of our experiments clearly show the shortcomings of the models that are currently used to predict the outcome of photopolymerization reactions and provide a solid basis for the development and validation of more detailed microscopic photopolymerization models.

Dr. Victor Breedveld is an assistant professor in Chemical & Biomolecular Engineering at the Georgia Institute of Technology. His research focuses on the structure and rheology of complex fluids, with a particular interest in the development and use of novel experimental techniques to elucidate the microstructural dynamics of these materials. In 2006, he received the NSF-CAREER award.

**Tuesday, April 24, 2007
Barus & Holley - Room 190 – 3:00pm**