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May 12, 1997

OFFICE OF NAVAL RESEARCH
800 North Quincy Street
Arlington, VA 22217-5660
Attention: Dr. Michael F. Shlesinger

Dear Dr. Shlesinger,

Enclosed please find the final report for Grant No N00014-96-0178 entitled "Complex Fluids" which supported Symposium N on of the 1995 Meeting of the Materials research Society in Boston, Massachusetts

Sincerely,

David J. Pine
Professor

cc. Donna J. Gillespie, MRS

Grant No.: N00014-96-0178

Grant Title: "Complex Fluids"

Reporting Period: 15 November 1995 to 30 September 1996

Objective: The purpose of this symposium was to bring together international scientists and engineers in complex fluids in order to report the most recent results and to stimulate new interdisciplinary activity.

Symposium Summary

The 1995 MRS Meeting Symposium N on Complex Fluids consisted of ten sessions on polymers, colloids, biopolymers, foams, emulsions, surfactant mixtures and monolayers, liquid crystals, micelles, and membranes. Compared to previous years, there were more talks on the biological aspects of complex fluids, including biomembranes, motor protein function, fractionation of biological materials, and the structure and dynamics of biopolymer gels. This reflects the growing trend in complex fluids towards biological applications. It is also the fruit of 20 years of fundamental studies on complex fluids which have lead to a strong experimental and theoretical base of knowledge which people are beginning to apply to biological materials with great success.

One of the highlights of our symposium this year was a series of excellent biophysics talks on such topics as motor protein function, fractionation of biological materials, and the structure and dynamics of biopolymer gels.

The report on the development of synthetic arrays for separations of biological objects by R. Austin (N4.6) was particularly important. By fabrication of submicron size silicon-based arrays of obstacles, Austin has demonstrated the ability to separate such

objects as cells and high molecular weight DNA. This offers the possibility of an alternative to traditional gel electrophoresis.

Paul Janmey's report (N7.1) on the properties of cytoskeletal protein networks and gels demonstrated the important opportunities of such biological systems as models for the study of basic polymer science. Both macroscopic rheological measurements and direct video imaging of the dynamics individual filaments was reported.

Steve Dierker (N2.3) presented new developments in the extension of dynamic light scattering techniques to x-ray domain. This new field of x-ray photon correlation spectroscopy (XPCS) offers an unprecedented opportunity to study the dynamics of materials down to interatomic spacings.

There were also a number of fascinating talks in other areas of complex fluids. Ludvik Leibler (N7.8) presented a new theory on tackiness which described the microscopic polymer physics associated with how adhesives such as Scotch Tape behave.

Dave Weitz (N2.4) described advances in our understanding of the glass transition using diffusion-wave spectroscopy measurements in emulsions to test recent mode-coupling theories. Surprisingly, emulsions seem to provide the ideal system for testing such theories because of the larger particle length scales which make its properties easier to probe than more conventional glasses.

One of the highlights of the Symposium was Sandy Asher's talk (N1.10), given in the very first symposium on the use of colloidal crystalline arrays as smart materials for novel nonlinear optical devices where the diffraction properties vary as a function of incident light intensity. Of particular interest was their use as optical limiting and spatial modulators.

The strength of talks in the area of colloids was unexpected. Based on the exciting developments in this field and in emulsions, we expect this, along with the more obvious biological directions, to be an important avenue of research in the future.

In this year's symposium, we attempted to bring in more people from the liquid crystal community. While this was perhaps less successful than the other areas such as biomaterials, colloids, and emulsions, we feel this is an emerging area that will become increasingly important as time goes on. We are especially excited about the possibilities of combining recent advances in liquid crystal science with those in polymer and emulsions science, as described in the talk by J. Doane on new display technologies being developed using polymer-stabilized liquid crystals.