

Oral Qualifying Exam - Dynamics of Macromolecular Fluids

This exam focuses on basic physical understanding of the fundamental dynamical behavior and properties of both colloidal suspensions and polymer liquids mainly in the linear response regime. The student is also responsible for the limit amount of relevant equilibrium knowledge required to describe and understand polymer and colloid dynamics.

NON-EXHAUSTIVE TOPICAL AREAS

- Brownian motion, time correlation functions, direct forces, fluctuating forces, hydrodynamic forces, friction, and colloidal dynamics in dilute suspensions
- Principles of dynamic light scattering; single particle versus collective diffusion; shear viscosity, stress relaxation in the time and frequency domains
- Slow dynamics in concentrated colloidal suspensions; behavior of "hard sphere" colloids, the "cage effect", and colloidal glass transition; role of attractive van der Waals and Coulomb forces
- Gelation of colloidal suspensions; elastic modulus, mechanical properties
- Qualitative structure of polymer chains and dense melts
- Dynamics of dilute polymer solutions; hydrodynamic interactions; monomer friction constant
- Diffusion, viscoelasticity, and chain relaxation of unentangled and entangled polymer liquids; role of polymer architecture

LEVEL (BASED ON UIUC COURSES)

MSE583: Dynamics of Complex Liquids

STANDARD TEXTS

- COLLOIDS: Russel, Saville and Schowalter, "Colloidal Dispersions"
Larson, "Structure and Rheology of Complex Fluids"
- POLYMERS: Rubinstein and Colby: "Polymer Physics"