

## **Progress and Prospects in Understanding Single Molecule Polymer Dynamics**

*Eric S.G. Shaqfeh*

Departments of Chemical and Mechanical Engineering  
Stanford University, Stanford CA 94305

Within the last decade, the use of video fluorescence microscopy to visualize DNA chains in flow as pioneered by Chu and co-workers is revolutionizing the field of polymer solution rheology. Rather than simply postulating coarse-grained models for a chain in various "strong" or "fast" flow fields (and then examine the resulting stresses in comparison to measured values), researchers can now directly examine the configurational statistics of a molecule in flow far from equilibrium. Combining these experimental studies with Brownian dynamics where an assortment of molecular models can be examined, provides an extremely powerful tool to probe the physics in the molecular dynamics.

In this presentation, I will review the state of research in single DNA dynamics studies in bulk flows including extensional, shear, and mixed flows and I will discuss outstanding questions that have developed in this research. I will then introduce and discuss a few relatively new applications of single molecule microscopy involving DNA dynamics in micro-post arrays and in non-dilute solution. All of these examples indicate that the applications of examining polymer dynamics "one molecule at a time" (a quote from Ron Larson) are burgeoning and will play an increasing role in the study of polymeric liquids in the foreseeable future.