

The viscoelastic effects of polymer entanglement in complex fluids: a topological analysis of a fluctuating hydrodynamic simulation

E. Panagiotou, K. C. Millett, and P. J. Atzberger

In this study, we consider the topological consequences in low molecular weight systems of aligned short chains and of infinite woven chains in a solvent through a rheological analysis by imposing a fluctuating shearing force across a broad range of frequencies. Using the periodic boundary condition model and a stochastic Euler-Lagrange method, we identify and quantify the hydrodynamic effect of thermal fluctuations on the macroscopic properties of the materials. The periodic linking number and writhe allow us to quantify the entanglement and the consequences for the viscoelastic properties due to the complex microscopic interactions. Such considerations arise in the study of the microtubules, such as actin filaments, in the cytoskeleton of cells.