

MAR05-2004-001291

Abstract for an Invited Paper
for the MAR05 Meeting of
the American Physical Society

Convective constraint release, chain stretch and hopping tubes: details matter.

DANIEL READ, The University of Leeds

This talk will discuss constitutive equations, for entangled polymer melts and solutions, which incorporate the effects of convective constraint release (CCR) and chain stretch. The model for CCR is based on the conjecture that constraint release events produce local hops of the tube, giving rise to a dynamical equation similar to the Rouse model. Two recent articles [R.S. Graham et al, J. Rheol. 47, 1171-1200 (2003) and D.J. Read, J. Rheol. 48, 349-377 (2004)] have used this idea to derive, and solve, a PDE for the tube motion. The first article presents the more detailed model, including all known relaxation processes; it has been used to predict neutron scattering from melts in non-linear flow as well as melt and solution rheology. The second article uses an “infinite tube” limit of the equations to examine in detail the CCR process and the coupling to chain stretch. It shows that “details matter” the equations appear to be highly sensitive to the nature of the tube on deformation, and in particular to the lower lengthscale cutoff to the CCR process. This talk will highlight these issues, and present a computer simulation scheme that can be used to further investigate the problem.