Transitional Flow Behavior of Entangled Polyisoprene Solutions

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Linear viscoelastic features of entangled monodisperse solutions and binary mixtures such as those made of polyisoprene are well known. For example, the storage modulus exhibits a plateau whose magnitude and width can be understood in terms of such concepts as reptation, tube dilation and constraint release.[1] Contradiction has recently appeared between the current theoretical understanding[2] of entangled polymers in fast shear flow and the new experimental observations based on 1,4-polybutadiene solutions.[3] Using entangled monodisperse polyisoprene solutions, we examine the universality of the new revelation that any sufficiently entangled polymeric fluids would undergo a yield like disentanglement transition in simple shear when the applied stress exceeds the level of the plateau modulus. Oscillatory shear, controlled rate and controlled stress measurements are made to delineate the flow behavior of entangled polyisoprene solutions.

[1] Wang, S.; Wang, S.Q.; Halasa, A.; Hsu, W.L.; *Macromolecules*, **36**, 5355, (2003).
[2] J. Bent *et al, Science* **301**, 1691 (2003); R. Graham, A. Likhtman, T. McLeish and S. Milner, *J. Rheol.* **47**, 1171 (2003).
[3] P. Tapadia and S.Q. Wang, *Phys. Rev. Lett.* **91**, 198301 (2003).