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Prediction of Rheological Behaviour of Unentangled Polymer Solutions in Steady Shear Flows Using a Blob-theory Based Constitutive Model PRABHAKAR RANGANATHAN, Monash University — Understanding the effects of polymer concentration and flow-induced stretching on hydrodynamic interaction between segments of polymer molecules is the key to accurately predicting the dynamical behavior of unentangled polymer solutions. Conventional wisdom avers that a polymer solution is dilute when its concentration c is less the concentration c^* at which isotropic polymer coils begin to overlap and interpenetrate. This picture is simplistic. Inter-chain interaction becomes increasingly important as chains stretch in flow. In semi-dilute unentangled solutions, on the other hand, concentration-dependence is strong at equilibrium, but inter-chain interactions weaken as chains stretch during flow. Thus, dilute solutions self-concentrate, while semi-dilute solutions self-dilute! A constitutive model based on blob concepts is used to examine the concentration dependence of shear-thinning-thickening-thinning in steady shear flows. It is shown that qualitative nonlinear rheological behaviour in strong flows is surprisingly sensitive to the friction coefficient of the Kuhn segment.

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