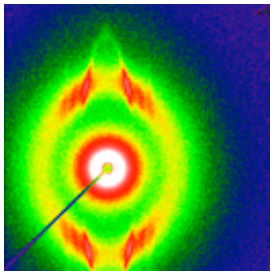

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Keynote 6 - Nonlinear rheology of polydisperse blends of entangled linear polymers: Rolie-Double-Poly models

Tuesday, 11 December 2018 10:50 (40)

Whilst there has been much success in modeling the linear and nonlinear rheology of monodisperse entangled linear polymers, progress in the constitutive modeling of polymeric materials continues to lag behind the needs of industry. Industrially sourced polymers are typically polydisperse (comprising a broad distribution of molecular weights), making their rheology more suitable for processing but also more difficult to predict. To date, there are no molecular-based constitutive models that are practically suitable for describing industrially relevant polymers in industrially relevant flows. We extend but strongly simplify the Read et al. model [Read et al., J.Rheol. 56, 823-873 (2012)], which is able to predict the linear and nonlinear rheology of bidisperse blends but is prohibitively complex for industrial use. We propose a pair of simplified tube models for polydisperse melts of entangled linear polymers that combine the success of the double reptation approximation [des Cloizeaux, Europhys. Lett. 5, 437-442 (1988)] in the linear regime with the success of the Rolie-Poly constitutive equation [Likhtman et al., J. Non-Newton. Fluid Mech.114, 1-12 (2003)] in the nonlinear regime. For binary blends, We show that these models naturally identify the effects from couplings between constraint release and chain retraction (i.e. the so-called “enhanced stretch relaxation time”). We generalize to a multi-component (polydisperse) model, based on the same underlying principles. Both of our models are in qualitative, and largely quantitative, agreement with experimental data for bidisperse and polydisperse melts of entangled linear polymers.

Presenter(s) : Prof. READ, Daniel (Department of Applied Mathematics, University of Leeds, UK)

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