Multi-scale polymeric flows

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Abstract

We will concentrate on a class of mathematical models for polymeric fluids, which involves the coupling of the Navier–Stokes equations for a viscous, incompressible, constant-density fluid with a parabolic-hyperbolic integro-differential equation describing the evolution of the polymer distribution function in the solvent, and a parabolic integro-differential equation for the evolution of the monomer density function in the solvent. The viscosity coefficient, appearing in the balance of linear momentum equation in the Navier–Stokes system, includes dependence on the shear-rate as well as on the weight-averaged polymer chain length. The system of partial differential equations under consideration captures the impact of polymerization and depolymerization effects on the viscosity of the fluid. We discuss the existence of global-in-time, large-data weak solutions under fairly general hypotheses.

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