Capillary thinning of polymeric filaments

The capillary thinning of filaments of a Newtonian polybutene fluid and a viscoelastic polyisobutylene solution are analyzed experimentally and by means of numerical simulation. The experimental procedure is as follows. Initially, a liquid sample is placed between two cylindrical plates. Then, the bottom plate is lowered under gravity to produce a specified strain. The sample is thereby stretched into a filament. Provided the filament is sufficiently long, surface tension will induce a thinning of the filament until breakup in finite time. The numerical simulations are performed with a Lagrangian finite element method and show good agreement with the experiments. A comparison of the results with existing theory in the literature reveals differences between the theoretical predictions and the real behavior, both for Newtonian and viscoelastic fluids. The origin to the divergence is analyzed and quantified. (C) 1999 The Society of Rheology. [S0148-6055(99)00103-0].

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