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Dynamics of polymeric drop breakup in microchannels PAULO ARRATIA, University of Pennsylvania, JERRY GOLLUB, Haverford College and University of Pennsylvania, DOUGLAS DURIAN, University of Pennsylvania —
The dynamics of drop formation of sheared polymeric and Newtonian fluids are investigated in a 50 μm microchannel. Inverse emulsions are obtained in a cross-like geometry by impinging a continuous oil phase (with surfactant) onto either a polymeric or a Newtonian aqueous solution. The viscosity ratio between the continuous and dispersed phases is kept close to unity, and both flow rates are varied. Solutions containing small amounts (100 ppm) of flexible polymers strongly affect the filament and drop breakup processes when compared to a Newtonian solution of similar viscosity. We find that the thinning of the filament for the Newtonian case is characterized by linear decline followed by a rapid approach to breakup. The polymeric case shows an initial Newtonian-like thinning followed by a slower, elasticity- dominated thinning. Consequently, the filament breakup time and length are considerably increased for the polymeric solutions. Also, larger primary drops and beads-on-string phenomena are found for the polymer solutions.

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