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Breakup dynamics of Non-Newtonian droplets in microfluidic devices: From necking to Rupture POUYAN BOUKANY, SHAURYA SACHDEV, Delft University of Technology — It has been shown that addition of small amounts of polymers to a Newtonian fluid can exhibit non-Newtonian behavior in extensional flows. For instance, polymeric fluids produce strong filament thinning called necking when subjected to extensional flows. Coiled polymeric chains are expected to be stretched in this exponential necking regime. These stretched long chains induce elastic stress that resist the capillary forces trying to break the filament apart. Still, the molecular picture behind filament thinning and rupture of polymeric threads in extensional flow conditions is unknown. In this work, we study breakup and filament thinning of micro-droplets containing polymeric suspensions by using micro-fluidic devices. To reveal the underlying mechanism of thinning and rupture of polymeric filament, conformation of DNA suspensions were visualized in different flow conditions. Experiments have been done on both dilute and concentrated polymeric solutions. These new results allow us to pinpoint the molecular mechanism behind filament thinning and flow instabilities in strong extensional flows of polymeric fluids.

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