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Droplet breakup dynamics of weakly viscoelastic fluids KRISTIN MARSHALL, TRAVIS WALKER, Oregon State Univ — The addition of macromolecules to solvent, even in dilute quantities, can alter a fluids response in an extensional flow. For low-viscosity fluids, the presence of elasticity may not be apparent when measured using a standard rotational rheometer, yet it may still alter the response of a fluid when undergoing an extensional deformation, especially at small length scales where elastic effects are enhanced. Applications such as microfluidics necessitate investigating the dynamics of fluids with elastic properties that are not pronounced at large length scales. In the present work, a microfluidic cross-slot configuration is used to study the effects of elasticity on droplet breakup. Droplet breakup and the subsequent iterated-stretching where beads form along a filament connecting two primary droplets were observed for a variety of material and flow conditions. We present a relationship on the modes of bead formation and how and when these modes will form based on key parameters such as the properties of the outer continuous-phase fluid. The results are vital not only for simulating the droplet breakup of weakly viscoelastic fluids but also for understanding how the droplet breakup event can be used for characterizing the extensional properties of weakly-viscoelastic fluids.

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