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Rheology of discontinuously shear thickening suspensions beyond simple shear PAWEL ZIMOCH, GARETH MCKINLEY, ANETTE HOSOI, Massachusetts Institute of Technology — The behavior of discontinuously shear thickening suspensions in flows other than simple shear is not well understood, in part due to unresolved experimental challenges. For example, such suspensions thicken most easily close to rigid boundaries due to the no-slip condition. This makes experiments highly dependent on the shape and size of the container used. We show that by placing a lubricating layer of oil between the suspension and the container we can generate flows where thickening is nearly independent of rigid boundaries. This method is particularly useful in creating quasi one- and two-dimensional flows, which can be easily visualized. We use this method to conduct capillary breakup experiments with thickening suspensions of silica and cornstarch particles, in which we observe the formation of beads-on-a-string morphologies with multiple satellite and sub-satellite bead generations, similar to the morphologies observed in breakup of viscoelastic fluids. Using a one-dimensional continuum model, we show how nonlinear rheology of thickening suspensions results in the creation of these complex morphologies.

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