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Dynamics of associative polymer solutions: Capillary break-up, jetting and rheology VIVEK SHARMA, Hatsopoulos Microfluids Laboratory, Dept of Mechanical Eng., MIT, Cambridge, MA 02139, JAMES G. SERDY, Laboratory of Manufacturing and Productivity, MIT, PHIL THREFALL-HOLMES, AkzoNobel, UK, GARETH H. MCKINLEY, Hatsopoulos Microfluids Laboratory, Mechanical Eng., MIT, Cambridge, MA 02139 — Associative polymer solutions are used in extensively in the formulations for water-borne paints, food, inks, cosmetics, etc to control the rheology and processing behavior of multi-component dispersions. The commercially relevant formulations use dilute solutions of associative polymers, which have low viscosity and short relaxation times, and hence their non-Newtonian response is not apparent in a conventional rheometer. In this talk, we explore several methods for systematically exploring the linear and nonlinear solution rheology of associative polymer dispersions, including: high frequency oscillatory tests at frequencies up to 10 kHz, microfluidic shear rheometry at deformation rates up to 10^6 s^{-1} and the influence of transientextensional rheology in the jet breakup. The presence of inertial, elastic and viscous effects typically leads to complex dynamics in a necking fluid thread. We show that by carefully controlling the excitation frequency, it is possible to drive the break-up in a particularly simple and symmetric mode, which can be used to extract extensional viscosity information using capillary thinning analysis.

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