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Flows of elastic liquids through planar hyperbolic micro contractions CHRISTOPHER PIPE, NAHN JU KIM, GARETH MCKINLEY, Hatsopoulos Microfluids Laboratory - MIT, Cambridge, MA 02139 — Understanding and characterizing fluid elasticity in elongational flows remains a challenging area of complex liquid behaviour, and especially so for low viscosity solutions. In this experimental investigation, microfluidic devices featuring hyperbolic contractions are used to generate planar elongational flows. The extensional strain rate and total material strain are controlled by the dimensions of the microfluidic device. As a result of the small length scales ($10 - 50$ μm) very high deformation rates can be achieved. An approximately homogeneous streamwise velocity gradient is achieved by confining viscous shearing effects to boundary layers near the converging channel walls. The fluids studied include concentrated surfactant solutions ($\eta_0 \sim 10$ Pa·s) and dilute aqueous solutions of polyethylene oxide ($\eta \sim 0.01$ Pa·s). The velocity and pressure fields in the hyperbolic converging flow regions are quantified using micro-PIV and a MEMS-based pressure sensor. The resulting information can then be used to evaluate the apparent extensional viscosity of these complex fluids.

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