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Irreversible Gelation in Wormlike Micellar Solutions via Microfluidics JOSHUA CARDIEL, YA ZHAO, PERRY CHEUNG, AMY SHEN, University of Washington — Surfactant molecules can self-assemble into various morphologies under proper combinations of ionic strength, temperature, and flow conditions. At equilibrium, the wormlike micelles can transition from entangled to branched and multi-connected structures with increasing salt concentration. Under specific flow conditions, micellar structure transition can follow different trajectories. In this work we consider the flow of two semi-dilute wormlike micellar solutions through microposts, focusing on their microstructural and rheological evolution. Both solutions contain cetyltrimethylammonium bromide (CTAB) and sodium salicylate (NaSal). One is weakly viscoelastic and shear thickening while the other is strongly viscoelastic and shear thinning. When subject to strain rates $\sim 10^3$ s^{-1} and strain $\sim 10^3$, we observe irreversible gelation, with entangled, branched, and multi-connected micellar bundles, evidenced by electron microscopy. We also show that the rheological properties of the shear-thickening precursor are smaller than those of the gel, while the rheological properties of the shear-thinning precursor are several times larger than those of the ge. This rheological property variation is associated with their respective structural evolution.

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