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Unstable flow of worm-like micelles in rectangular microfluidic channels PAUL SALIPANTE, STEVEN HUDSON, NIST - Natl Inst of Stds Tech — We investigate a jetting instability of shear banding worm-like micelle (WLM) solutions in microfluidic channels with rectangular cross-sections. The flow is tracked using both 3-D and 2-D particle tracking methods in channels of different aspect ratio, size, and wall materials. We observe that the instability forms in high aspect ratio channels within an intermediate range of volumetric flows. The location of the high velocity jet in the channel appears to be sensitive to stress localizations induced by channel defects and wall roughness. A lower concentration WLM solution, with a monotonic stress curve, does not show the banding instability but displays non-negligible velocity gradients across the channel width. The transient development of the instability at the entrance of the microfluidic channel is observed in various geometries. The experimental measurements are compared to finite volume simulations using the Johnson-Segalman viscoelastic model. The simulations show a qualitatively similar behavior to our experimental observations and indicate that normal stresses in the cross stream directions lead to the development of the jetting flow.

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