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Flow of polymer solutions in planar 90 degree micro-bends DORIAN LIEPMANN, SHELLY GULATI, CARI DUTCHER, SUSAN MULLER, University of California, Berkeley — The characterization of flows containing macromolecules is critical for the optimal design of microfluidic systems for biochemical analyses. The effects on transport in microscale flows are significant because the flow behavior may be influenced by molecular interactions, both viscous and elastic forces dominate inertial forces at this length scale, and the macromolecular length scale L approaches the device length scale D. Our previous studies explored flows of semi-dilute DNA solutions in planar 90 degree micro-bends (L/D $\sim$ 0.09), a canonical microfluidic structure; macromolecular flows in this geometry on a macro or microscale had been essentially unexplored. A recirculation region present in the interior corner of the bend is enhanced with increasing Re ($7 \times 10^{-7} <$ Re $< 8 \times 10^{-4}$) and Wi ($1 <$ Wi < 190). Flows of poly(ethylene) oxide (PEO) solutions are explored across a similar parameter range to determine the influence of polymer extensibility and flexibility on the instability. Comparison of flows of DNA and PEO solutions offers insight into physical mechanism for the formation of elastic instabilities in micro-geometries.

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