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Hydrodynamic Performance of Non-Newtonian Viscoelastic Fluid Flow in a Microhannel with Multiple Contractions[1] ALI ZARGARTALEBI, MOHAMMAD ZARGARTALEBI, ANNE BENNEKER, University of Calgary — The behavior of a viscoelastic fluid through small channels is relevant for applications in medicine, oil recovery and polymer processing. In this work, we numerically study a shear-thinning viscoelastic fluid through a channel with contractions. We express viscoelastic features using an Oldroyd-B model and describe the non-Newtonian behavior with the Carreau model. Parameters effecting the performance of these fluids including local stress, pressure and velocity were examined in channels with single and multiple contractions. While the influence of the non-Newtonian behavior is small, the effect of elasticity is significant. With increasing elasticity, the stresses around the contraction become more pronounced and the formation of dead zones is suppressed. When analyzing multiple consecutive contractions we observe memory-like behavior of the fluid where the local stress decreases in downstream contractions. Finally, we find that with increasing channel size, the influence of elasticity on the local stresses and fluid flow behavior in the channel becomes insignificant. These results are relevant for systems in which local stresses should be optimized and indicate that by tweaking the elasticity of the fluid the behavior of the system can be controlled.

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