Effect of geometry and elasticity on the vortex development of dilute polymer solutions in the 4:1 microcontraction channel

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There have been studies on the flow of viscoelastic fluids in microcontraction channel because it is possible to get highly elastic flow environment by reducing length scale. In this work, the effect of channel geometry and fluid elasticity on the flow of viscoelastic fluids in 4:1 planar contraction microchannels was investigated. Fluorescent particles and mercury lamp were used to generate streak images. Channels were fabricated with poly(dimethyl siloxane) and have difference upstream width and uniform channel height. In this work the characteristics of the channel geometry were represented by the aspect ratio, which is the ratio of upstream width to channel height. In this work, it was found that there exists a critical aspect ratio which determines two sequences in this system. At high aspect ratio, the sequence in vortex development did not change regardless of elasticity number. On the other hand, various sequences in vortex development were observed by changing the fluid elasticity at low aspect ratio. This result implies that the combination of aspect ratio and fluid elasticity can determine the sequence in vortex development.