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Break-up dynamics of a confined droplet in a microchannel containing obstacle MEHDI NEKOUEI, SIVA VANAPALLI, Department of Chemical Engineering, Texas Tech University — Understanding the break-up of confined drops passing through obstacle-laden microchannels is important for a variety of applications ranging from oil recovery to blood flows to microfluidics. A confined droplet impacting an obstacle can either break-up or bypass the obstacle. Although there have been a number of studies on the dynamics of droplet break-up at microfluidic T-junctions, investigations of dynamics of droplet break-up against an obstacle in a microchannel is limited. Using volume-of-fluid three-dimensional simulations, we investigated the influence of different system parameters on the break-up of a droplet. We observed that by increasing the viscosity of the droplet, break-up occurs at smaller imposed flow rate, i.e. highly viscous droplets break-up more easily. This observation is in contrast to unconfined droplets in shear flows, where both low (λ <0.1) and high viscosity (λ >10) droplets are more difficult to fragment. We found that the hydrodynamic resistance of the droplets plays an important role in dictating the break-up. In addition, we performed stop-flow simulations, to investigate the role of curved interface and internal flow in autonomous pinch-off of the droplet.

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