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Experimental Study of the Hydrodynamic Resistance of Liquid Droplets in Polycarbonate Microchannels[1] ZEYAD ALMUTAIRI, University of Waterloo/King Saud University, CAROLYN REN, DAVID JOHNSON, University of Waterloo — The presence of liquid droplets in a microchannel adds excess hydrodynamic resistance to the flow compared to single phase flow. The hydrodynamic resistance of liquid droplets is a function of fluid properties (viscosity ratios $\frac{\mu_d}{\mu_c}$, interfacial tension γ), geometrical properties of the droplet and the confining channel (droplet length L_d, microchannel width and height), and flow condition (Ca, Re). This work presents the results of an experimental examination of the transport properties of liquid droplets in a microchannel. Focus was given to the hydrodynamic resistance of droplets with lengths comparable or greater than the channel width ($L_d \gtrsim W_{ch}$. Experiments were performed in surface modified polycarbonate microchannels since they will reduce measurement uncertainties associated with channel swelling in soft materials such as PDMS. For the droplets sizes that were examined results confirm the relation between the hydrodynamic resistance of liquid droplets and the Capillary number (Ca). It was also observed that droplet slip ($\beta = \frac{u_d}{u_{c,avg}}$) is less than 1 in all the experiments performed.

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