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A Study of Flow Separation in Microfluidic Channels MRUDHULA BASKARAN, Princeton University, JESSE AULT, Oak Ridge National Laboratory, CLARENCE ROWLEY, HOWARD STONE, Princeton University — Flow separation is detrimental in aerodynamics and the paradigm for studying this concept is the flow over a cylinder. Prior works have studied this problem extensively in macroscale setups. However, no work has studied it in microscale systems. This work aims to study the flow over a cylinder and laminar flow separation in microfluidic devices. Such channels were fabricated using lithography and the flow was imaged and analyzed using particle image velocimetry. The experimental results were verified through numerical simulations. Data show the onset of similar flow regimes in microchannels as those observed in macroscale experiments, such as detached flow, separation bubble/recirculation zone formation and growth, and van Karman vortex street formation. However, these occur at larger Reynolds numbers in the confined microchannels because the free shear layer formed during flow separation is slowed down by the presence of walls. The effect of the walls is also studied in numerical simulations of the system, which are done for confined geometries mimicking microchannels, as well as the 2D flow over a cylinder case in the absence of walls. Overall, this work contributes to the understanding of laminar flow separation and has important applications in topics such as physiology.

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