144m Particle Motion in Microfluidic Contraction and Expansion Flows

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Many analytical operations at the microfluidic scale, such as cell sorting, involve flows containing particles. However, only a limited amount of work to date covers the fundamentals of particle behavior during flow in microchannels, especially those with complex geometries. A microfluidic system is attractive as a tool for fundamental studies of particulate flows for two main reasons, specifically, the ease of fabricating and testing multiple flow geometries and the accessibility of certain flow conditions (e.g. high shear rates and low Reynolds numbers) that are difficult to achieve in macroscopic systems. This experimental study focuses on microfluidic flows of monomodal suspensions of rigid spheres in abrupt, symmetric contractions and expansions. Flow cells were fabricated by standard soft lithography methods. 10 um and 32 um diameter PMMA particles were suspended at low concentrations in a density-matched solution of glycerin and water containing a fluorescent dye. Particle motion was visualized by fluorescence microscopy and image analysis allowed the tracking of individual particles' trajectories. Particle trajectory results will be presented for microchannel geometries with several contraction/expansion ratios.