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Simulation study of suspension plugs in unsteady microchannel flows AMANDA HOWARD, MARTIN MAXEY, FRANCIS CUI, ANUBHAV TRIPATHI, Brown University — The analysis or processing of particles in suspension may often involve a sample of finite length that is moving in a microchannel flow. Using numerical simulations, we examine the development of such a suspension plug of non-Brownian particles in unsteady, low Reynolds number shear flows in a microchannel. We focus on the early development in an oscillating Poiseuille flow, the distortion of the plug and the degree to which the motion is reversible relating this to prior work on oscillating suspension flows. For an initial particle volume fraction of 30% in the plug, the forward and then reversed flow leads to minimal net forward motion of the plug front at the centerline even after several oscillations. However a forward migration is seen near the walls. This net flux of particles is balanced by a flux of particles towards the wall within the plug. The exact response depends on the strain amplitude of the oscillation, the particle volume faction and other parameters of the flow. We are also able to examine the shear-driven particle fluxes at the tail of the plug. Both regions illustrate the effect of strong inhomogeneities in particle concentration on transport. We will relate the results to our recent experimental observations.

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