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Surface acoustic wave induced flow in micro channels: peculiar flow instability observed in experiment and advances in theory OFER MANOR, JAMES FRIEND, LESLIE YEO, Micro/Nanophysics Research Laboratory, Monash University, Clayton, VIC, MICRO/NANOPHYSICS RESEARCH LABORATORY, MONASH UNIVERSITY TEAM — Challenges in microfluidics have initiated a renewed interest in surface acoustic waves (SAW) and in particular Rayleigh SAW for generating high fluid velocities and mixing in microchannels. SAW are generated by piezoelectric actuators that transfer electric to kinetic energy and give rise to different types of flow regimes – Eckart, Rayleigh and Schlichting streaming. Here we extend the theory for the Schlichting boundary layer. We show that due to the complex nature of the Rayleigh SAW, the leading order result for the steady flow in the Schlichting layer is of greater magnitude than previously considered in studies on stationary planar acoustic waves. We confirm this result by measuring the behavior of a dilute suspension of particles in 80 micron thick PDMS channels. In the presence of only a stationary planar acoustic wave in the liquid we observe the weak accumulation of particles in the vicinity of acoustic nodal lines. These structures are easily interrupted by bulk flow. In the presence of Rayleigh SAW, however, particle structures are found to maintain much better integrity and to occupy much larger area under dispersive flow effects.

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