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Inducing Rapid Fluid Flows In Microchannels with Surface Wave Vibrations[1] MING TAN, Monash University, JAMES FRIEND, LESLIE YEO, MICRONANOPHYSICS RESEARCH LABORATORY TEAM — The application of MHz-order traveling wave vibrations along a microchannel cut into a piezoelectric substrate results in rapid fluid flows along the channel in the direction of the vibration propagation, up to 2 cm/s in a 50×100 μm rectangular channel in our device, much faster than other methods known to the authors. The vibration energy carried along the sides and bottom of the channel is diffracted into the channel, imparting momentum to the fluid through streaming. Given the intended application of most microfluidic devices, the fluid would reasonably be expected to carry particles, and introducing micro and nanoparticles into the flow exposes transitions to chaotic behavior, particle collection, and rapid vortex formation and shedding ideal for mixing. We show experimentally and numerically what conditions are necessary for these behaviours, and explain other peculiarities of the chosen system, such as particles traveling upstream from induced forces applied via standing waves formed across the channel during mixing, and transitions between steady and chaotic flow depending on the intensity of the traveling wave vibrations.

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