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Surface Acoustic Wave (SAW) based Microfluidics for Particle and Droplet Manipulation YE AI, BABETTA L. MARRONE, Advanced Measurement Science, Los Alamos National Laboratory, Los Alamos, New Mexico 87545, USA — Acoustics has emerged as one of the most promising non-invasive techniques for particle and droplet manipulation in microfluidics. Surface acoustic wave (SAW) based microfluidic devices are developed to manipulate micron-sized particles and discrete droplets. When solid particles are immersed in a standing SAW, the resulting acoustic radiation force acting on the particles can drive the particles into the pressure node, resulting in particle focusing phenomenon. The amplitude of the acoustic radiation force highly depends on the particle properties, leading to different acoustic responses for different types of particles. Separation of two types of fluorescent particles is demonstrated using the developed SAW-based microfluidic device. Numerical simulations are performed to study the generation of the standing SAW and the particle separation which is in good agreement with the experimental results. When a SAW propagates through a droplet in contact with the piezoelectric substrate, the SAW partially leaks into the droplet and exerts an acoustic streaming force in the droplet, which can move the droplet in the direction of SAW propagation. It is further found that a curved SAW transducer is able to focus SAW into a very narrow beam and in turn focus randomly distributed droplets into a specific target. It is demonstrated that focused SAWs can be more efficient than uniform SAWs for droplet actuation in microfluidics.

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