Acoustic radiation forces, micro-particle trapping in a capillary

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Excitation of resonances in a fluid filled micro-channel with ultrasound will create stationary pressure and velocity gradients in the fluid. These gradients can be used for features such as micro-particle manipulation or for fluidic mixing by using acoustic streaming.

Using a miniaturized ultrasonic transducer (1x1 mm) to actuate a resonating rectangular cross-section capillary (0.2x2 mm) produces an acoustic field localized to vicinity of the transducer, figure 1. This localized field can be used to retain/trap particles and cells in a non-contact mode [1], figure 2. This new technique has several applications in biological sample preparation when cells need to be collected and analyzed.

Physical understanding of the complex phenomena in the field of acoustic particle manipulation has recently been advanced greatly by the use of particle image velocimetry (PIV) methods in a paper by Barnkob et. al. [2]. This was done in a device utilizing the axial components of the acoustic force for particle focusing. A similar approach will be applied for a study of the lateral components of the localized wave used for trapping in the trapping capillary.

1. Hammarstrom, B., et al., *Non-contact acoustic cell trapping in disposable glass capillaries.* Lab on a Chip, 2010. **10**(17).
2. Barnkob, R., et al., *Measuring the local pressure amplitude in microchannel acoustophoresis.* Lab on a Chip, 2010. **10**(5): p. 563-570.

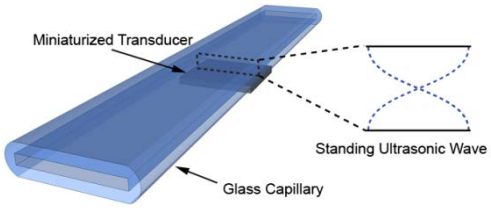

Figure 2. Actuation of a glass capillary using a miniaturized ultrasonic transducer produces a localized resonance.

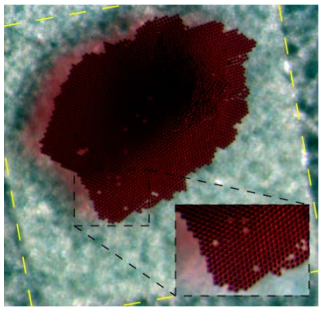

Figure 1. Acoustic trapping of 10 um beads above a small transducer using a potential minimum created by the standing ultrasonic wave.