Tunable-angle wedge transducer for improved acoustophoretic control in a microfluidic chip - DTU Orbit (09/11/2017)

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We present a tunable-angle wedge ultrasound transducer for improved control of microparticle acoustophoresis in a microfluidic chip. The transducer is investigated by analyzing the pattern of aligned particles and induced acoustic energy density while varying the transducer geometry, transducer coupling angle, and transducer actuation method (single-frequency actuation or frequency-modulation actuation). The energy-density analysis is based on measuring the transmitted light intensity through a microfluidic channel filled with a suspension of 5 μm diameter beads and the results with the tunable-angle transducer are compared with the results from actuation by a standard planar transducer in order to decouple the influence from change in coupling angle and change in transducer geometry. We find in this work that the transducer coupling angle is the more important parameter compared to the concomitant change in geometry and that the coupling angle may be used as an additional tuning parameter for improved acoustophoretic control with single-frequency actuation. Further, we find that frequency-modulation actuation is suitable for diminishing such tuning effects and that it is a robust method to produce uniform particle patterns with average acoustic energy densities comparable to those obtained using single-frequency actuation.

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