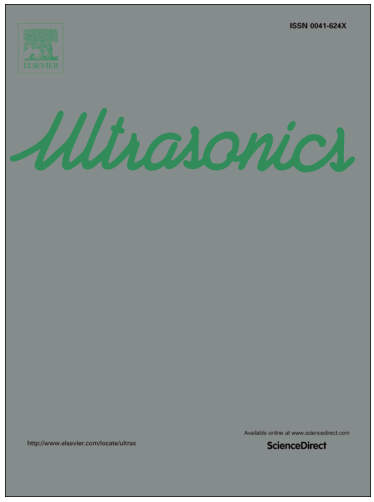

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Improving acoustic streaming effects in fluidic systems by matching SU-8 and polydimethylsiloxane layers

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Abstract: This paper reports the use of acoustic waves for promoting and improving streaming in tridimensional polymethylmethacrylate (PMMA) cuvettes of 15 mm width × 14 mm height × 2.5 mm thickness. The acoustic waves are generated by a 28 µm thick poly(vinylidene fluoride) – PVDF – piezoelectric transducer in its β phase, actuated at its resonance frequency: 40 MHz. The acoustic transmission properties of two materials – SU-8 and polydimethylsiloxane (PDMS) – were numerically compared. It was concluded that PDMS inhibits, while SU-8 allows, the transmission of the acoustic waves to the propagation medium. Therefore, by simulating the acoustic transmission properties of different materials, it is possible to preview the acoustic behavior in the fluidic system, which allows the optimization of the best layout design, saving costs and time. This work also presents a comparison between numerical and experimental results of acoustic streaming obtained with that β-PVDF transducer in the movement and in the formation of fluid recirculation in tridimensional closed domains. Differences between the numerical and experimental results are credited to the high sensitivity of acoustic streaming to the experimental conditions and to limitations of the numerical method. The reported study contributes for the improvement of simulation models that can be extremely useful for predicting the acoustic effects of new materials in fluidic devices, as well as for optimizing the transducers and matching layers positioning in a fluidic structure.

Keywords: Piezoelectricity; Transducer; PVDF; Acoustics; SU-8; PDMS.