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Pinched flow fractionation of microbubbles for ultrasound contrast agent enrichment[1] MICHEL VERSLUIS, MAARTEN KOK, TIM SEGERS, Physics of Fluids group, University of Twente — An ultrasound contrast agent (UCA) suspension contains a wide size distribution of encapsulated microbubbles (typically 1-10 μm in diameter) that resonate to the driving ultrasound field by the intrinsic relationship between bubble size and ultrasound frequency. Medical transducers, however, operate in a narrow frequency range, which severely limits the number of bubbles that contribute to the echo signal. Thus, the sensitivity can be improved by narrowing down the size distribution of the bubble suspension. Here, we present a novel, low-cost, lab-on-a-chip method for the sorting of contrast microbubbles by size, based on a microfluidic separation technique known as pinched flow fractionation (PFF). We show by experimental and numerical investigation that the inclusion of particle rotation is essential for an accurate physical description of the sorting behavior of the larger bubbles. Successful sorting of a bubble suspension with a narrow size distribution (3.0$\pm$ 0.6 μm) has been achieved with a PFF microdevice. This sorting technique can be easily parallelized, and may lead to a significant improvement in the sensitivity of contrast-enhanced medical ultrasound.

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