Electronic supplementary information

Two-chip acoustofluidic particle manipulation platform with a detachable and reusable surface acoustic wave device

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S1. Fabrication and assembly process of the two-chip acoustofluidic device

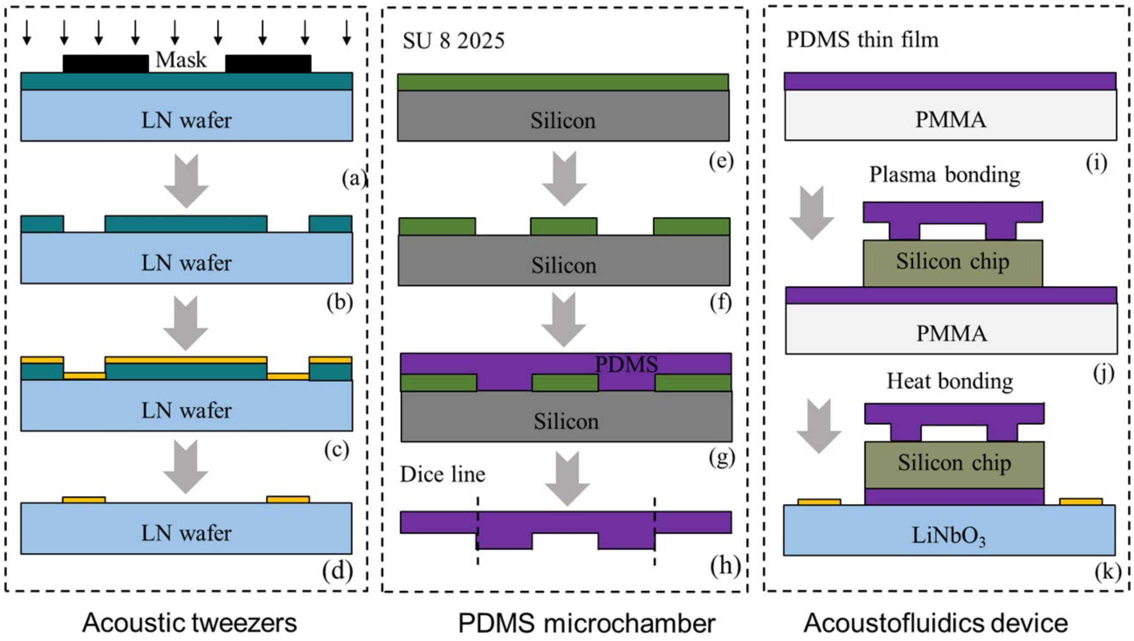

Fig. S1. Fabrication and assembling process of the integrated acoustofluidics device

S2. Design of the PCB encapsulation frame for preventing the breakage of SAW device

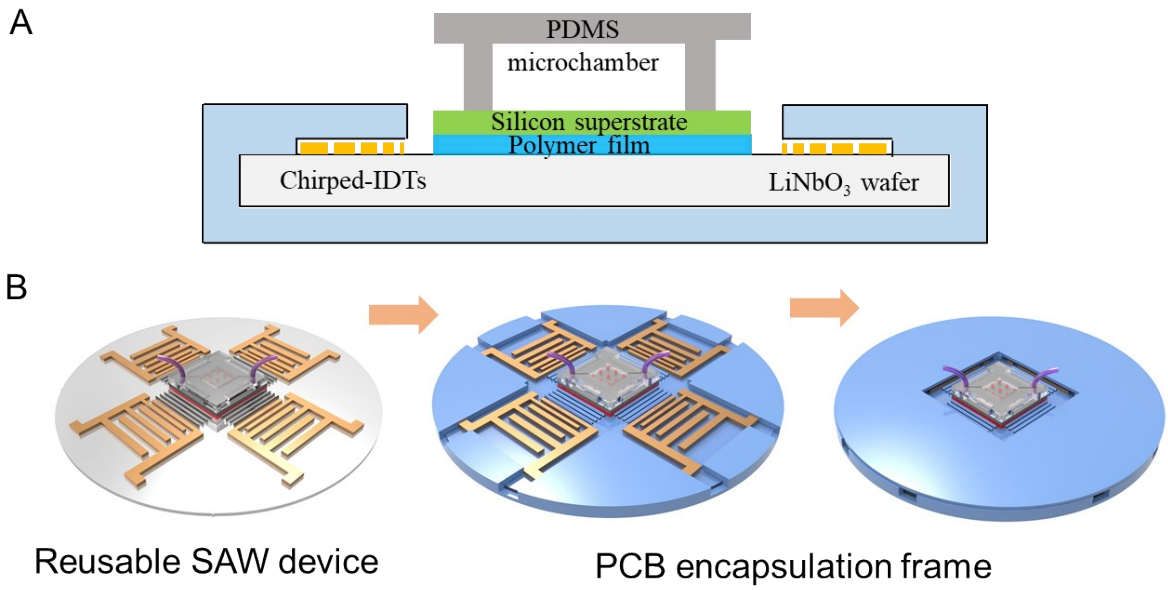

Fig. S2. (A) Cross-sectional view depicting the design of the PCB encapsulation frame for the reusable LN SAW device. (B) 3D structure showing the device encapsulation process without the covering of IDTs pattern and delay lines area for the practical application.

S3. Heating effect of the acoustic waves generated on LN wafer and silicon superstrate

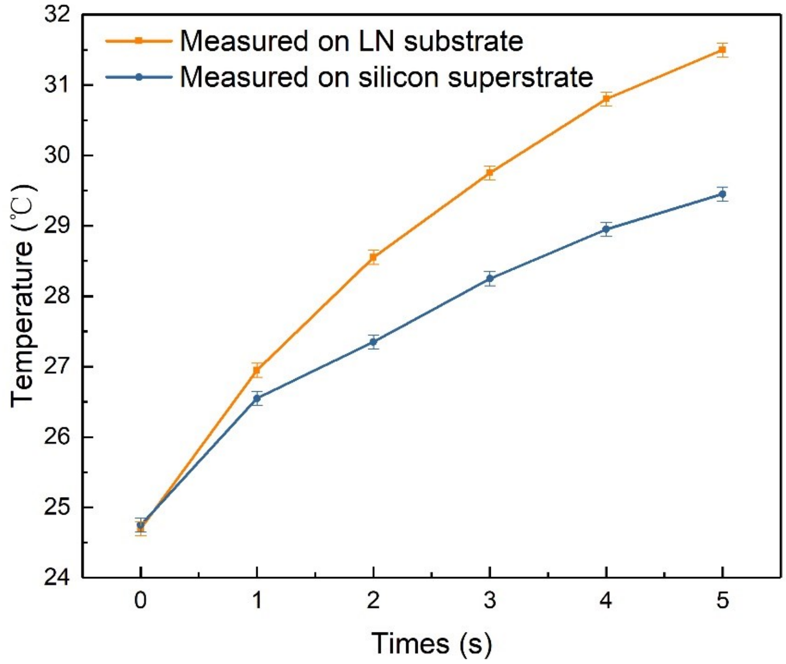

Fig. S3. Measured temperature on the SAW device alone and on the silicon superstrate over an RF signal excitation period of 5 minutes.

S4. Effect of the alignment of the microchamber relative to the SAW delay line.

Fig. S4 shows the cross-section of the acoustofluidic device with the two different alignments of the microchamber relative to the delay line. Fig. S4 (a) depicts a symmetric alignment where the center of the microchamber is coincides with the center of the delay line, which is the case in this work. We refer to the stationary pressure node in the center of the delay line as the zeroth order node, progressing to the first, second, third order and onwards moving outward from the center. While the higher order pressure nodes ($n > 0$) will change with a shift in excitation frequency, the 0^{th} order node in the center remains fixed. As such, microbeads in different areas in the microchamber could move in any direction towards any of the nearby pressure nodes. Fig. S4 (b) depicts asymmetric alignment where the microchamber of offset to lie outside the center of the delay line, i.e. the 0^{th} order node of the delay now lies outside the microchamber. Shifting the excitation frequency in this case will push the particles in the microchamber in the same direction in response to the shift in node positions.

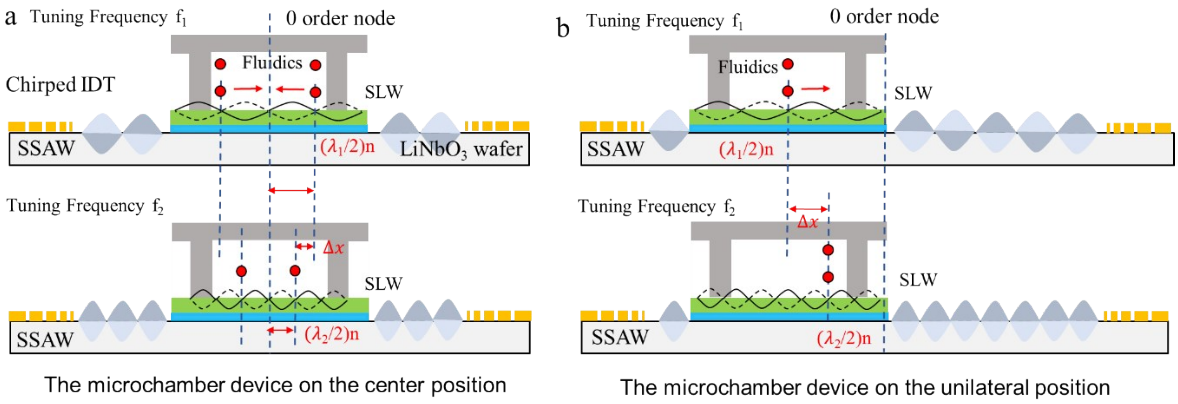

Fig. S4. Effect of microchamber alignment relative to the delay line on the behavior of particle transport in response to changing the excitation frequency. (a) Symmetrical alignment where center of the chamber coincides with the center of the delay line. (b) Asymmetrical alignment where the center of the delay line lies outside the microchamber.

Supplementary Videos:

Video S1 captures the representative movements of the microbeads under the SSAWs/SLWs;

Video S2 captures the process of 2D manipulation.