Lateral Cavity Acoustic Transducer Based Microfluidic Switch

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BRIEF DESCRIPTION

The ability for on-chip particle/cell manipulation is important for microfluidic applications. Researchers at UC Irvine have developed a technology that exploits the phenomenon of acoustic microstreaming to manipulate fluid flow and suspended cells/particles in a microfluidic environment.

FULL DESCRIPTION

The application of microfluidic technologies to the field of cell biology have enabled the development of integrated “lab on a chip” systems that are capable of integrating multiple laboratory steps on to a single device. An important cell manipulation process that needs to be integrated into a “lab on a chip (LOC)” system is the ability to switch cells of interest to multiple downstream processes for further analysis. Existing methods for switching cells and particles within microfluidic devices include electro-osmotic flow (EOF), dielectrophoresis, microfabricated valves, external valves and optical tweezers. Drawbacks to these methods include low throughput, low cell recovery, complex off-chip optical tweezer or pneumatic valves setup and high voltages.

Researchers at UC Irvine have developed a technology using Lateral Cavity Acoustic Transducers (LCATs) that are capable of deflecting cells and particles to downstream collection channels. LCATS are dead-end side channels that are in the same plane as the microchannels in microfluidic chips. When the device is filled with liquid, LCATs trap bubbles, creating an air-liquid interface that can be excited using an external acoustic source such as a piezoelectric transducer. Actuation of the transducer effectutates symmetrical oscillation of a gas/liquid boundary at the junction. This produces micro-streaming to manipulate the fluid flow. The mechanism of an LCAT switch is shown in Figure 1.

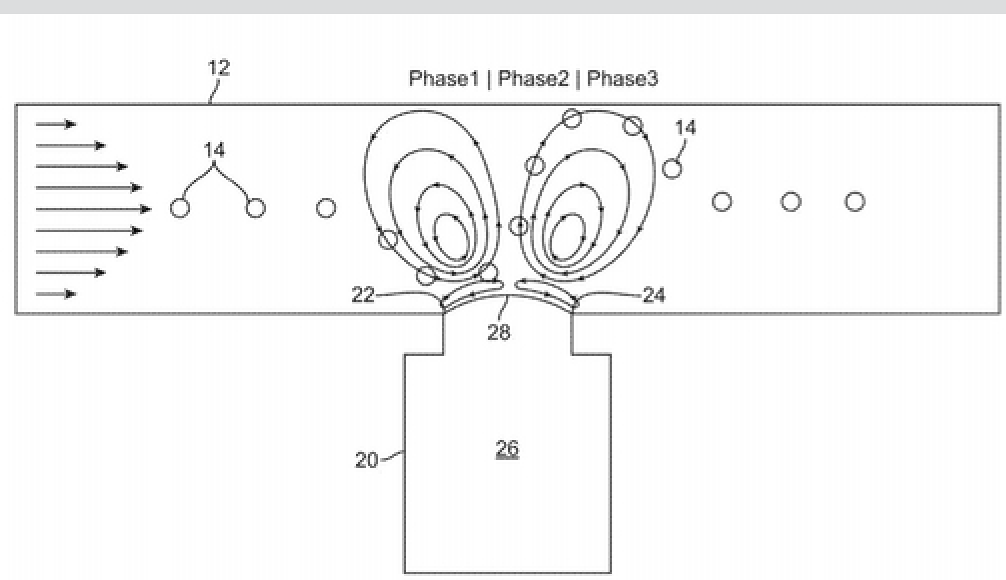

Figure 1 shows the LCAT (26) and the air-liquid interface created (28)

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OTHER INFORMATION

CATEGORIZED AS

- **Biotechnology**
  - Other
- **Medical**
  - Devices
  - Other
  - Research Tools
  - Screening
  - Stem Cell
- **Research Tools**
  - Other

RELATED CASES

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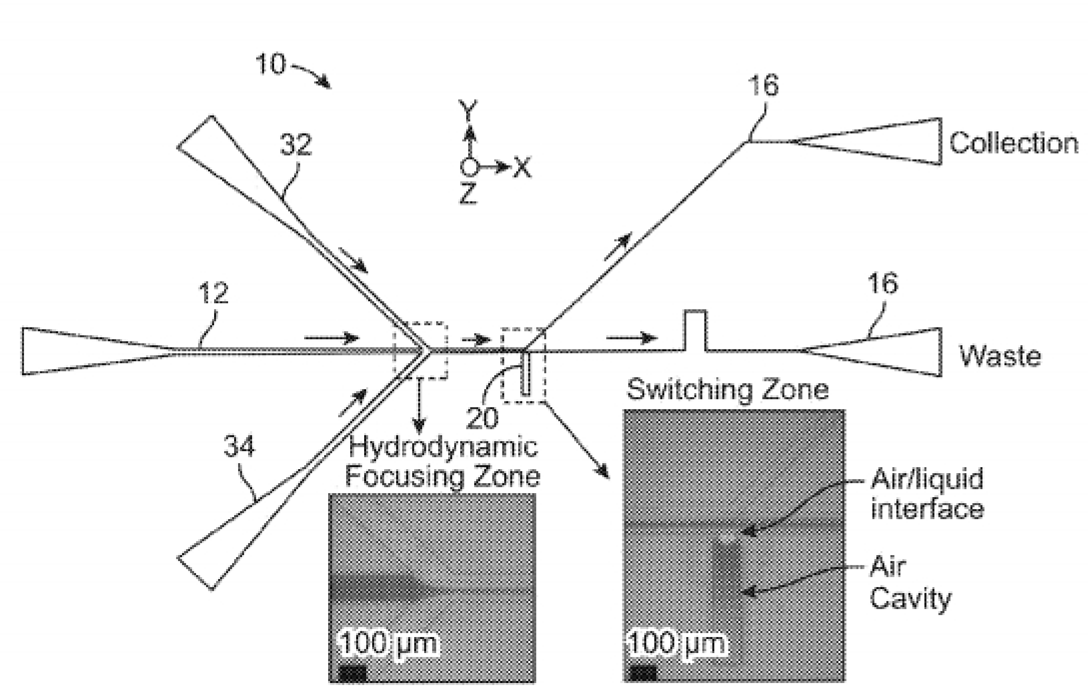

Figure 2 illustrates how acoustic microstreaming manipulates fluid flow to different parts of a microfluidic device.

Researchers have characterized the LCAT based microfluidic switch using polystyrene particles. They have also shown that the LCAT based microfluidic are able to switch cells within a microfluidic device. Cell viability of 94% of the switched cells were obtained, which is comparable to other reported values for cell viabilities for other microfluidic cell switches. This indicates that an LCAT switch does not compromise the membrane of cells and can be used as an actuator for an integrated sorting platform.

SUGGESTED USES

LCAT based microfluidic switch technology can be used for particle sorting and manipulation for subsequent downstream processing steps within microfluidic device.

ADVANTAGES

The device can be fabricated using standard soft-lithography techniques, conventional polymer fabrication techniques, hot embossing, or molding techniques, and alleviates the need to use expensive clean room facilities. Furthermore, LCAT based microfluidic switch technology allows for high throughput manipulation of particles.

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	9,517,465	12/13/2016	2012-262

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