PENNSTATE

Technology Available for Licensing
Office of Technology Management-The Pennsylvania State Univ.
113 Technology Center, University Park, PA 16802
814.865.6277 phone; 814.865.3591 fax

Non-Confidential Description - PSU No. 3370
"Microfluidics Three-Dimensional Hydrodynamic Focusing Device"

Keywords:

Microfluidics, lab-on-a-chip, three-dimensional hydrodynamic focusing, flow cytometry

Inventors:

X. Mao, T. Huang

Links:

Inventor website
Lab On Chip Article
US Patent 8,120,770
US Patent 8,941,826

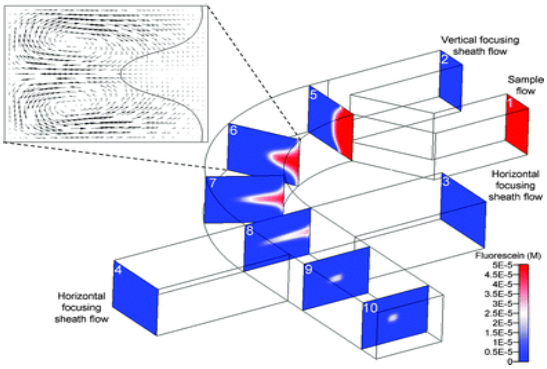

Figure 1: CFD Schematic of "Microfluidic Drifting"

Background

Hydrodynamic focusing is one of the most utilized techniques in microfluidics. Its applications have been employed in a wide variety of chemical/biological analyses including on-chip flow cytometry, single molecule detection, and laminar mixers. However, the planar nature of standard microfluidic manufacturing processes only facilitates two dimensional focusing. In many cases a lack of vertical focusing is problematic and there has been great interest in developing micro fabrication procedures for 3D hydrodynamic focusing devices. Although a few micro-fabricated 3D hydrodynamic focusing devices have been developed, the methods require either tedious assembly of the individual components or multiple alignments and exposures during mold fabrication. These limitations increase the cost and complexity of the device and ultimately hinder their application.

Invention Description

This disclosed invention introduces a novel fluid manipulation technique named "microfluidic drifting" to allow three-dimensional ("3D") hydrodynamic focusing with a simple single layer planar microfluidic device. The method is effective, robust, and requires only standard soft lithography fabrication methods. The 3D hydrodynamic focusing is accomplished in a two-step sequence. The first step focuses the sample flow in the vertical direction by using what we call the "microfluidic drifting" technique. Focusing in the horizontal direction is conducted with two horizontal focusing sheath flows. Switching between static flow and 3D focusing takes less than three seconds and is highly repeatable. This invention may permit many applications which would otherwise not be possible due to the current limitations of impractical and specialized 3D micro fabrication techniques required for 3D hydrodynamic focusing. The mechanism of 3D focusing is illustrated in Figure 1 using a computational fluid dynamics (CFD) simulation. See Lab on a Chip article for more.

Advantages/Applications

- Allows 3D focusing with a single layer planar device fabricated using soft lithography
- Vertical and horizontal compression ratios can be easily altered by changing flow rates
- Featured on the cover of *Lab on a Chip*, 7 (10) Oct. 2007

Contact: **Bradley A. Swope**
Sr. Technology Licensing Officer
The Pennsylvania State University

Phone: (814) 863-5987
Fax: (814) 865-3591
E-mail: bradswope@psu.edu

June-15