Microfluidic Flow Transducer Based on the Measurement of Electrical Admittance

Tech ID: 18852 / UC Case 2004-146-2

BACKGROUND

The development of multifunctional, high throughput lab-on-a-chip depends heavily on the ability to measure flow rate and perform quantitative analysis of fluids in minute volumes. Traditionally, there have been many microelectromechanical system (MEMS) based flow sensors for gaseous flows. In recent times, there is some advancement in measuring micro flows of liquids. Examples of sensing principles explored in the measurement of microfluidic flow are heat transfer detection molecular sensing, atomic emission detection, streaming potential measurements, electrical impedance tomography, ion-selective field-effect transitor and periodic flapping motion detection. Flow sensors based on sensing the temperature difference require a complicated design and the integration of the heater, temperature sensors and membrane shielding is difficult to implement. Most other methods are not capable of measuring very low flow rates.

TECHNOLOGY DESCRIPTION

A new flow transducer for measuring the flow rate of a conducting fluid in a microchannel is reported by University of California Researchers. In this paper, the measure of flow of such fluid under laminar flow conditions based on the change of electrical admittance is established with the aid of a pair of electrodes. Some of the advantages of the flow sensor include simplicity in design, integration to most microfluidic platforms, high signal-to-noise ratio, and measurements of a wide range of liquids. The effect of flow rate of the electrolyte, the frequency of the applied ac voltage, the voltage applied across the detector electrodes, and the conductivity of the electrolyte are varied to optimize for high sensitivity. The optimized values are then used to demonstrate the measurements of very low flow rates (<1 nL s-1). This flow sensor can be extended towards the measurement of chemical and biochemical buffers and reagents. Further, this flow sensor has the potential to measure a broad range of liquid properties, including the characterization of biomolecules and microbes in microfluidic channels.

APPLICATIONS

The flow sensor operating with optimized electric parameters can be efficient and accurate for precise values of flows. This method is relatively simple and suitable for most of the chemical and biochemical microfluidic applications since most of the reagents used are electrolytes. The method of measuring electrical admittance can also be used to decipher parameters other than flow. There have been several reports on the detection of biomolecules and cells in lab-on-chip devices based on impedance spectroscopy of the solution. In these methods, the measurements are done with static fluids. By measuring impedance change due to different conditions of flow it is possible to investigate the constituents of the solution. In the future, impedance spectroscopy based on differential flow can thus be used to characterize electrolytes including biomolecules, cells or microbes under laminar flow.

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	7,250,775	07/31/2007	2004-146

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OTHER INFORMATION

CATEGORIZED AS

- **Medical**
  - Devices
  - Screening
- **Nanotechnology**
  - Electronics
  - Other
  - Tools and Devices
- **Research Tools**
  - Other
  - Screening Assays

RELATED CASES

2004-146-2

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- New Microwell Plate Configurations to Increase Microwell Density
- Multi Layered Microfluidic Devices For In Vitro Large Scale Perfused Capillary Networks
- Controlled 'One-Cell-One-Bead' Encapsulation in Droplets
- Microfluidic device for multiplex diagnostics / Microfluidic devices and methods
- Microfluidic Device for Cell Separation Using Dielectrophoresis and/or Magnetohydrodynamics
- On-Demand Cell Encapsulation Using On-Demand Droplet Generation and Impedance-based Detection
- High throughput and precision cell sorting
- High-throughput Microfluidic Research Platform for Performing Versatile Single-Cell Molecular Timed-Release Assays within Droplets

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