Docket #: S09-141

Sensor for Measuring Properties of Liquids and Gases

Stanford researchers in the Khuri-Yakub Ultrasonics Group have developed a powerful new bio-sensor platform technology for a highly sensitive non-invasive detection of molecules and particles, suitable for various types of point of care diagnostic tests. The sensor is low-cost and based on simple and established silicon micromachining techniques. It is developed to measure the properties of liquids and gases to determine the presence and characteristics of a target molecule or particle in the liquid or gas. Key features of the sensor include high vibration quality resulting in low phase noise, and high frequency and low mass of the vibrating structure resulting in good mass resolution.

The sensor can directly be used as resonator in an oscillator circuit, without the need of any expensive optical detection equipment - the main reason why this bio-sensor platform technology is perfectly suitable for low cost mass production. Further, the sensor is compatible with existing microchannel, microtiter plates, and lab-on-a-chip based solutions and it features the ability to mix gases or liquids directly inside the sensing elements, which significantly increases value and the number of experiments that can be performed on such a platform technology. Finally, the monolithic integrating electronic circuitry (ASICs) is easily available for complete system implementation.

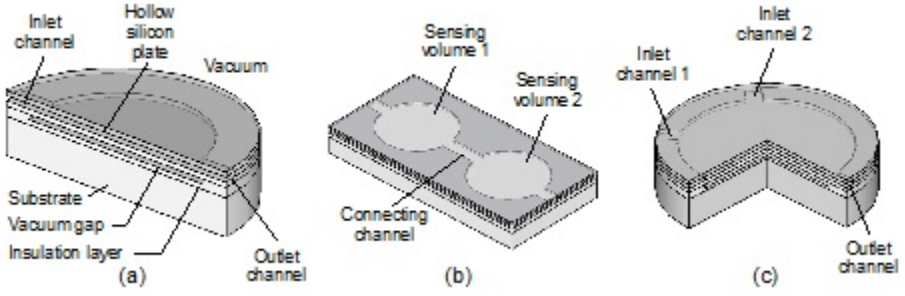

Figure 1: Schematic drawings to illustrate the main idea of the new technology. (a) Cross-section of a half circular sensing element with hollow silicon plate in which the

sample will flow. The size of this structure will be in the range of tenths of microns. An electrical voltage (not shown) will be applied between the hollow silicon plate and the substrate to actuate the structure. (b) Many sensing elements (only two are shown in this drawing) can be easily connected in parallel for increased active sensing area and better signal to noise ratio. (c) In addition, the technology supports mixing two samples just inside the hollow silicon plate (sensing volume), which is advantageous for e.g. measuring the affinity and energetics of chemical bindings.

Stage of Research:
The fabrication technology for this new sensor is readily available and first experiments are planned in the near future.

Applications

- Lab-on-a-chip
- Medical devices for blood and pathogen testing
- Environmental monitoring equipment
- Homeland defense security sensors (particularly biological sensors)
- Medical and biological lab equipment (including drug evaluation and biological research)
- Analysis of food products for quality and health control
- Protein research and engineering

Advantages

- Wide variety of target molecule or particle measurements from one sensor design
- Simple sensing system capable of precise measurements in many conditions
- Can make measurements in both liquids and gases
- Measures many of the most important factors for biological sensing and research
- High performance
- Flexible over different applications and environments
- Ideally suited for many lab on chip measurements and sensing requirements

Patents

- Published Application: 20110023582

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