SUBTRACTIVE MICROFLUIDICS IN CMOS

Tech ID: 33775 / UC Case 2025-041-0

PATENT STATUS

Patent Pending

BRIEF DESCRIPTION

Integrating microelectronics with microfluidics, especially those implemented in silicon-based CMOS technology, has driven the next generation of in vitro diagnostics. CMOS/microfluidics platforms offer (1) close interfaces between electronics and biological samples, and (2) tight integration of readout circuits with multi-channel microfluidics, both of which are crucial factors in achieving enhanced sensitivity and detection throughput. Conventionally bulky benchtop instruments are now being transformed into millimeter-sized form factors at low cost, making the deployment for Point-of-Care (PoC) applications feasible. However, conventional CMOS/microfluidics integration suffers from significant misalignment between the microfluidics and the sensing transducers on the chip, especially when the transducer sizes are reduced or the microfluidic channel width shrinks, due to limitations of current fabrication methods.

UC Berkeley researchers have developed a novel methodology for fabricating microfluidics platforms closely embedded within a silicon chip implemented in CMOS technology. The process utilizes a one-step approach to create fluidic channels directly within the CMOS technology and avoids the previously cited misalignment. Three types of structures are presented in a TSMC 180-nm CMOS chip: (1) passive microfluidics in the form of a micro-mixer and a 1:64 splitter, (2) fluidic channels with embedded ion-sensitive field-effect transistors (ISFETs) and Hall sensors, and (3) integrated on-chip impedance-sensing readout circuits including voltage drivers and a fully differential transimpedance amplifier (TIA). Sensors and transistors are functional pre- and post-etching with minimal changes in performance. Tight integration of fluidics and electronics is achieved, paving the way for future small-size, high-throughput lab-on-chip (LOC) devices.

SUGGESTED USES

- Lab-on-chip (LOC) devices
- Microelectronic/microfluidic integration in CMOS technology

ADVANTAGES

- Tight integration and alignment of fluidics with electronics

RELATED MATERIALS

CONTACT

Sabrina N. David
sabrina.david@berkeley.edu
tel: .

INVENTORS

- Chien, Jun-Chau

OTHER INFORMATION

CATEGORIZED AS

- **Optics and Photonics**
  - All Optics and Photonics
- **Agriculture & Animal Science**
  - Animal Science
  - Devices
  - Other
- **Biotechnology**
  - Bioinformatics
  - Health
  - Other
- **Engineering**
  - Engineering
  - Other
- **Materials & Chemicals**
  - Biological
  - Other
- **Medical**
  - Devices
  - Diagnostics
- **Nanotechnology**

- NanoBio
- Other

Research Tools

- Other

Semiconductors

- Assembly and Packaging
- Design and Fabrication
- Materials
- Other

Sensors & Instrumentation

- Biosensors
- Medical
- Other
- Scientific/Research

Veterinary

- Diagnostics

RELATED CASES

2025-041-0

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Real-Time Antibody Therapeutics Monitoring On An Implantable Living Pharmacy
- One-step Packaged Multi-mode CMOS Bio-analyzer for Point-of-Care

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University of California, Berkeley Office of Technology Licensing
2150 Shattuck Avenue, Suite 510, Berkeley,CA 94704
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