ONE-STEP PACKAGED MULTI-MODE CMOS BIO-ANALYZER FOR POINT-OF-CARE

Tech ID: 33776 / UC Case 2025-042-0

PATENT STATUS

Patent Pending

BRIEF DESCRIPTION

Current clinical practice for detecting low-concentration molecular biomarkers requires sending samples to centralized labs, leading to high costs and delays. Successful point-of-care (POC) diagnostic technology exist, such as the paper-based lateral-flow assay (LFA) used for pregnancy tests and SARS-CoV-2 rapid antigen tests, or miniaturized instruments such as the Abbot i-Stat Alinity. However, the former provides binary results or limited quantitative accuracy, and the latter is too expensive for in-home deployment. A promising approach for POC diagnostics, offering tailored circuit optimization, multiplexed detection, and significant cost and size reductions, is millimeter-sized CMOS integrated circuits coupled with microfluidics. Recent demonstrations include protein, DNA/RNA, and cell detection. The current complexity of system packaging (e.g., wire/flip-chip bonding) makes integrating microfluidics with more sophisticated functions challenging, and often-required syringe pumps and tubing are operationally unfriendly, limiting current approaches.

UC Berkeley researchers have developed a fully integrated, multi-mode POC device that requires single-step assembly and operates autonomously. Drawing inspiration from RFID technology and implantables, they have introduced inductively-coupled wireless powering and communication functionality into a CMOS bio-analyzer. With the chip being fully wireless, the die can be easily integrated into a substrate carrier, achieving a completely flat surface that allows for seamless bonding with the microfluidic module. In the final product, the device will be sealed in a pouch inside a vacuum desiccator. The user tears the pouch, adds a drop of sample, and the system automatically begins operation. The operation window can last up to 40 minutes, making the process insensitive to time delays. The present CMOS bio-analyzer integrates pH-sensing and amperometric readout circuits for both proton-based and redox-based immunoassays.

SUGGESTED USES

» Point-of-care (POC) diagnostics; detection of low-concentration molecular biomarkers at or near a patient's location

ADVANTAGES

» Seamless integration of CMOS IC and microfluidic components for high-performance, multi-functional point-of-care (POC) diagnostic device

» Single-step assembly, without wire/flip-chip bonding

» Autonomous operation

RELATED MATERIALS

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OTHER INFORMATION

CATEGORIZED AS

» **Optics and Photonics**
» All Optics and Photonics
» **Agriculture & Animal Science**
» Animal Science
» Devices
» Other
» **Biotechnology**
» Health
» Other
» **Engineering**
» Engineering
» Other
» **Materials & Chemicals**
» Biological
» **Medical**
» Diagnostics
» Disease: Autoimmune and Inflammation
» Disease: Blood and Lymphatic System

- » Disease: Digestive System
- » Disease: Infectious Diseases
- » Other
- » Research Tools
- » Screening

» **Research Tools**

- » Other

» **Semiconductors**

- » Assembly and Packaging
- » Other

» **Sensors & Instrumentation**

- » Biosensors
- » Medical
- » Other
- » Scientific/Research

» **Veterinary**

- » Diagnostics

RELATED CASES

2025-042-0

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- ▶ Subtractive Microfluidics in CMOS
- ▶ Real-Time Antibody Therapeutics Monitoring On An Implantable Living Pharmacy

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