Integrated CMOS On-Chip Fluorescence Bio-Sensor and Microscopy System

Published date: Oct. 30, 2014

Technology description

Integrated CMOS-based Single–chip Fluorescence Bio-Sensor System
Integrated, low-cost and portable point-of-care diagnostic technology has the potential to bring transformative changes in healthcare by enabling early detection of diseases in a remote field setting, allowing timely and rapid treatment to the patient and facilitating a potential shift from curative medicine, to predictive, personalized, and preemptive medicine. Affinity-based bio-sensor technology based on selective interaction of different analytes for detection of proteins, DNA, toxins, bacteria, etc. is one of the most important analytical tools in biotechnology, among which fluorescence-based methods remains the most sensitive, specific and robust biosensing methodology. However, current technology, which mostly relies on fluorescent molecular tags, requires complex, bulky and very expensive optical components, including multi-wavelength fluorescent microscopes and spectrofluorometers, which are limited in their use beyond laboratory settings. On the other hand, Integrated Circuits technology, especially Complementary Metal-Oxide Semiconductor (CMOS) technology provides an unparalleled platform for integration of complex systems, with high yield in an extremely cost-efficient manner.
By leveraging the integration capability of CMOS technology, high precision analog and mixed-signal circuits, and marrying integrated circuits with techniques from nanophotonics and electromagnetics, researchers in the Department of Electrical Engineering at Princeton University aim to develop fully integrated, battery-operated, high density arrays of single-chip fluorescence-based biosensors capable of rapid, low-cost screening and infield medical diagnostics, epidemic disease control, and biohazard detection. Combined with fully integrated electronics, such CMOS chips can function as fluorescence bio-sensing systems for both antigen and nucleic acid detection with attomole sensitivity, while being disposable (extremely low-cost), robust and compact. This can lead to the monitoring and diagnosing of one’ s personal health and allow connectivity to personal electronic devices to rapidly obtain diagnostic information and communicate with healthcare institutions.

Application area

· Point-of-care diagnostics in remote field settings

· Immunoassays/DNA microarrays: Sensor, scanner, bio surface all rolled into one single chip
· Based on selective interaction of different analytes for detection of Proteins,DNA,Toxins,Bacteria
· DNA sequencing/genotyping

Advantages

· Single chip solution: Low-cost, fully integrated, portable, robust, battery operated multiplexed arrays
· No complex microfluidics requirement.
· Integrable with existing assay protocols.
· Disposable cartridge format : Same chip architecture for different assays: Chip surface capable of functionalization for both antigen and nucleic acid detection.
· Very small liquid volume required : Attomole sensitivity

Institution

Princeton University

Inventors

Lingyu Hong
Electrical Engineering
Kaushik Sengupta
Assistant Professor
Electrical Engineering

联系我们

叶先生

电 话：021-65679356

手 机：13414935137

邮 箱：yeyingsheng@zf-ym.com