Sensors and Materials, Vol. 23, No. 2 (2011) 111–119
MYU Tokyo

S & M 0831

Capacitance Sensor System for Oligonucleotide Hybridization Detection

Jang Zern Tsai*, Ching Jung Chen, Wen Yih Chen[1], Jen Tsai Liu[1] and Yue Ming Hsin

Department of Electrical Engineering, National Central University,
300 Jhongda Rd., Jhongli, Taoyuan County 32001, Taiwan
[1]Department of Chemical Engineering and Material Engineering, National Central University,
300 Jhongda Rd., Jhongli, Taoyuan County 32001, Taiwan

(Received January 5, 2010; accepted May 28, 2010)

Key words: capacitance, detection, interdigitated chip, oligonucleotide, biosensor

In this paper, we describe an electronic method of oligonucleotide detection implemented in silicon chips. The detection system includes an interdigitated chip and capacitance detection circuit. Interdigitated microelectrodes were microfabricated with a width of 10 μm, a gap of 3 μm, and a total length of 3,320 μm. Oligonucleotide detection was tested on an electrode surface precoated with a functional monolayer by a self-assembly technique. In this study, oligonucleotide detection used the fundamental hybridization of the complementary strand. To enhance the capacitance change in oligonucleotide detection, we used the sandwich conjugation method with the Au nanoparticles cross-linked at the end of a single DNA strand. The detection system was designed to automatically measure the individual capacitances of oligonucleotides detected from the array chip. The capacitance of a biomolecule was measured using comb-shaped electrodes and, due to DNA hybridization, the capacitance increased by 20.31%. In this work, we successfully developed a multipoint capacitance sensor that offers the potential to detect different sequences in the future.

*Corresponding author: e-mail: jztsai@ee.ncu.edu.tw