MOSFET DNA sensor using nano SAM

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Abstract

In recent years, the rapid progress of the Human Genome Project has stimulated the development of so-called genosensors and DNA chip technology, which draw upon the building blocks of genetics.[2]

Self assembled monolayer(SAM) based biosensors can be classified into different types depending on the mechanism of analyte recognition. Optical, thermal and mass spectroscopy sensors can be easily identified depending on the type of signal used for gathering information about the analyte. However, these methods involve some disadvantages, such as, time-consuming, multi-stage processes which are expensive and unsuitable for on-line monitoring. [1]

Electrochemical method offer a new approach for fast, simple and inexpensive. Electrochemical sensors can be further classified into: (a)potentiometric (voltammetric), (b)amperometric, and (c)conductimetric (impedometric), as shown in Fig 1 [1,3]

Here we will try to measure the taken DNA through Potentiometic method using a MOSFET as DNA sensor.

A MOSFET DNA chip for the easy detection of DNA will fabricate and its characteristics will investigate. The DNA with negative charge varies gate potential of the MOSFET. Therefore, these voltage variations can be used as the response of the MOSFET DNA chip.

Most of the DNA detection techniques are based on a DNA hybridization process. In DNA hybridization, the target (unknown single-stranded DNA (ssDNA)) is identified by a probe molecule with which it forms a double-stranded (dsDNA) helix structure with its complementary nucleic acid with high efficiency and specificity in the presence of a mixture of many different non-complementary nucleic acids, as shown in Fig 2 [2]

We will form the SAM using 3-Mercaptopropionic acid on the gate (Au) surface of a MOSFET to immobilize ssDNA that is able to hybridize with dsDNA. Consequently, we will immobilize ssDNA on top of SAM, and then the ssDNA becomes dsDNA by hybridization and this means taking DNA selectively.

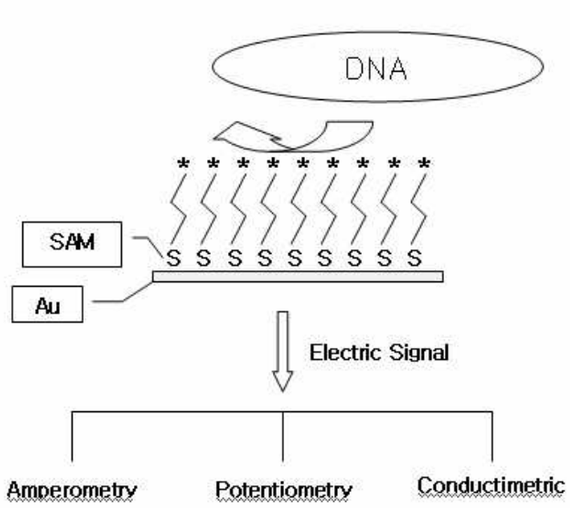

Fig. 1. Schematic representation for the mechanism of electrochemical transduction.

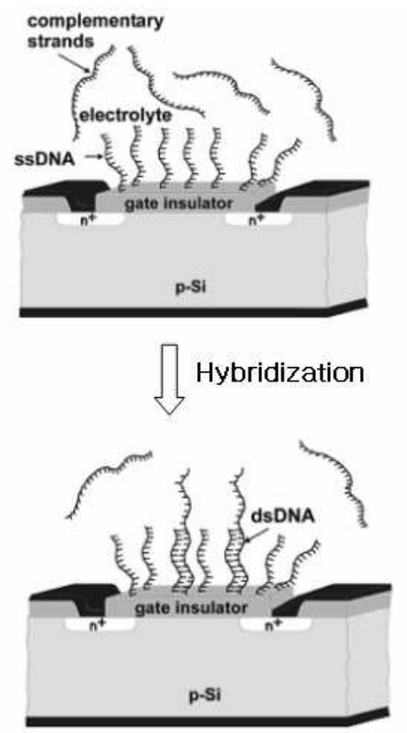

Fig. 2. Schematic structure of MOSFET DNA sensor and the principle of DNA-hybridization.

References

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