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Perforated MOS Structure for Single Biomolecule Detection

This method utilizes a metal-oxide semiconductor sensor with embedded nanochannels to detect and sequence single biomolecules by measuring a high frequency current generated as the molecule passes through, overcoming limitations of current nanochannel technologies.

Characterizing and sequencing single biomolecules, such as DNA, RNA, proteins, carbohydrates, etc., offers significant impact to science, medicine, and biotechnology. Single biomolecule detection has many benefits and could allow for early disease detection and screening, have pharmacological relevance, and help in understanding genetic information encoded in DNA. There are many proposed methods of studying single biomolecules, but they have several limitations. Many techniques require the isolation of the molecule prior to study, and most techniques are also limited by sample preparation, sensitivity, and specificity to specific categories of biomolecules.

Researchers at Purdue University have developed a method for single biomolecule detection that allows for characterization and sequencing of biomolecules without the limitations of current nanochannel technologies. This method uses a metal-oxide semiconductor (MOS) sensor with embedded, fluidic nanochannels. As a biomolecule moves through the nanochannel, a high frequency current is generated that contains information about the biomolecule, such as the type of nucleotides in the case of DNA/RNA, which can be used to sequence the molecule. This method does not have the problems associated with other nanopore techniques because it does not require the difficult drilling of extremely small nanopores, can detect four nucleotides at a time, and is not significantly affected by the rotation or position of the biomolecule in the nanochannel.

Advantages:

-Detection of single molecule or low concentration biomolecules, bio-polymers, RNAs, DNAs, carbohydrates, proteins, viruses, and virions

-Lowers the cost of sequencing single molecule DNAs, RNAs, and carbohydrates

Technology ID

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Category

Semiconductors/Devices & Components
Materials Science & Nanotechnology/Nanomaterials & Nanostructures
Biotechnology & Life Sciences/Analytical & Diagnostic Instrumentation

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-Addresses shortcomings of current nanochannel technology

Potential Applications:

-Development of tools for early detection of a number of diseases and environmental hazards

-Biomedical applications in diagnosis and therapy

-Early detection of viruses

-Study of carbohydrates

-Genetics

TRL: 3

Intellectual Property:

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