OFFICE OF TECHNOLOGY TRANSFER

McGill

TECHNOLOGY OPPORTUNITY

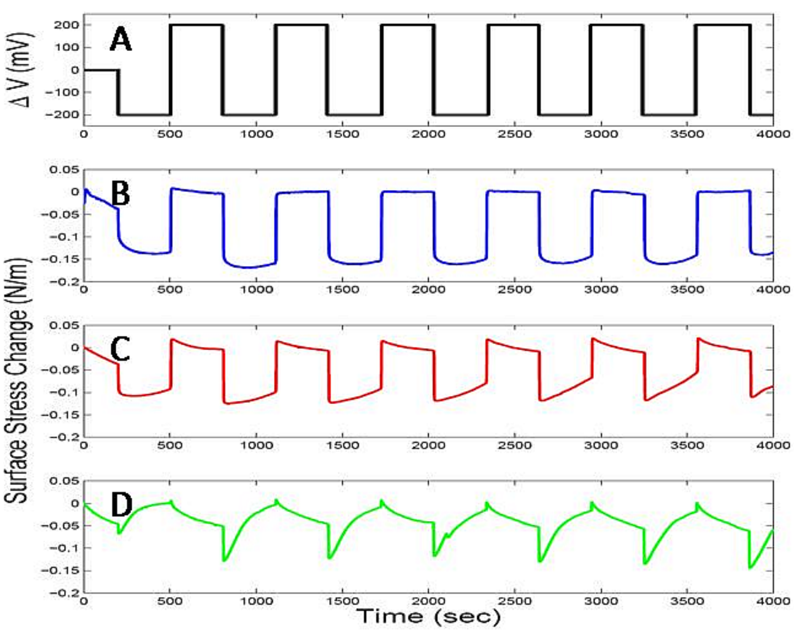
Electrochemically Controlled Microcantilever Biosensor

Description

McGill University is seeking to outlicense technology relating to microcantilever biosensors systems enabling detection of a surface binding event electrochemically. Changes in the surface stress of a microcantilever can indicate interaction between its chemically functionalized surface and biomolecules or other analytes. For the first time we demonstrate that different surface potentials of a gold coated cantilever create significantly different surface stress changes and stress direction and that when combined with in-situ functionalization of a probe molecule in a liquid environment, achieves reproducible large and stable signals. The change in the surface stress induces a measurable deflection of the microcantilever which correlates with formation of a high affinity complex.

Validation

The microcantilever system provides for the first time a label free system to detect DNA hybridization electrochemically. **Figure 1** below shows the applied periodic square wave DV ***(Fig 1A)*** and resulting stress changes from the bare gold cantilevers ***(Fig 1B),*** 25mer probe ssDNA on gold cantilevers ***(Fig 1C),*** and 25mer probe dsDNA on the gold surface ***(Fig 1D)***.



The stress changes arising from the bare gold are the largest, followed by the ssDNA. In both cases, the pattern of surface stress changes is in phase with the periodic square wave; however, examination of the surface stress changes from the dsDNA reveals distinct patterns. In addition, dsDNA has larger changes in surface stress -200 mV than at +200 mV. These surface stress changes in bare gold, ssDNA, and dsDNA can be explained in terms of comparative adsorption between chloride ions in the buffer and DNA phosphate.

.

Market need & Opportunity

Micromechanical cantilevers (microcantilevers) as biological sensors is a rapidly evolving field. There is increasing interest in the field of biosensor research on miniaturized platforms. Cantilever sensors can be configured to detect mass, heat, magnetic moments, electric fields, or stress and to provide quantitative measurement analytes. Molecular-based biosensors can be constructed to provide specific and high affinity recognition of components of the analyte such as base pairing in oligonucleotides or other complexation events such as biotin and avidin. Changes in the surface stress of a microcantilever can indicate interaction between its chemically functionalized surface and biomolecules. This change in the surface stress induces a measurable deflection of the microcantilever and has been used to detect molecules such as double stranded DNA (dsDNA). Detection methods that provide readouts for a binding event are critical to a functional cantilever based system. Presently there is no reliable label free electrochemical method that provides high sensitivity for detecting a binding event on a cantilever system such as that characterized by DNA:DNA pairing.

Inventors: Grutter Peter; Lennox R.B.; Nagai Yoshihiko; Sladek Robert; White John

Contact:
Dr. R. B. Lennox Tomlinson Professor of Chemistry and Chair of the Department of Chemistry; McGill University.

B.Sc. (University of Toronto, 1979); M.Sc. (University of Toronto, 1981)
Ph.D. (University of Toronto, 1985) ; NSERC Postdoctoral Fellow (Imperial College, 1985-87)

Member, McGill Center of Physics of Materials Research; FQRNT Centre for Self Assembled Chemical Structures

Ongoing research includes:
Synthesis of stabilized gold and platinum nanoparticles
Application of these nanoparticles in drug delivery, biorecognition schemes, and as tracers in materials diffusion problems
Synthesis and assessment (using electron microscopy and 2H NMR) of novel two-headed lipids
Relationships between complex lipid dynamics (flip-flop), lipid reactivity, and enzyme (phospholipase A2) activity
Preparation and application of novel lipids and polymers as two-dimensional lithography masks
Development of ion channel-based electrochemical biosensors
Development of cantilever-based sensors
Exploration of surfaces, and surface features, as templates for chemical reactions
Development of an in vivo sensor for ascorbate and dopamine

CONTACT:

John DiMaio, Ph.D.
Office of Technology Transfer
McGill University
514-398-8949
John.dimaio@mcgill.ca
Reference code: ROI 09123
Opportunity: Exclusive or non-exclusive license; R&D partnership

McGill