UNIVERSITI TEKNOLOGI MARA

# THE DOCTORAL RESEARCH ABSTRACT

Volume:1,Issue:1 May2012

2012


UiTM

## FIRST ISSUE

INSTITUTE of GRADUATE STUDIES

*Leading You To Greater Heights, Degree by Degree*

IPSis Biannual Publication

Name : Nina Korlina Binti Madzhi, *PhD*
Title : Development And Fabrication Of Piezoresistive Microcantilever-Based Glucose Biosensor
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This thesis is focused on the Development and Fabrication of the Piezoresistive Microcantilever-based Glucose Biosensor. The objective of this work is to design via simulation a piezoresistive microcantilever sensor suitable for glucose sensing. Then, the piezoresistive microcantilever is fabricated with CMOS micromachining technique. The fabricated piezoresistive microcantilever performed the fabrication process characterization to prove the viability of the design. Finally, the objective in this work is to identify suitable Glucose immobilization technique onto microcantilever surface. The methodology of this work starts with the designing of piezoresistive microcantilever. The microcantilever beam length is selected at 195µm and width, 70µm. On this microcantilever beam there are four different piezoresistor with the length of 80µm, 110µm, 140µm and 170µm. The sacrificial layer of BPSG material in the piezoresistive microcantilever have two different thickness of 0.9µm and 1.8µm.The proposed biosensor also includes the fabrication process design and the process characteristic study such as the resistivity testing and wet etching characteristic study with wet etchant of Hydrofluoric (HF) acid, Pad Etchant and Buffered Oxide Etch (BOE) to observe the etching rate of the BPSG sacrificial layer. This investigation is important to observe the performance of the MEMS biosensor. Then, the signal conditioning circuit is developed to convert the physical behavior of the piezoresistive microcantilever to electrical signal. The signal conditioning circuit includes the wheatstone bridge, amplification, filtering and linearization circuitry. The next step is the investigation of several Glucose Oxidase (GOx) immobilization techniques on the fabricated microcantilever biosensor surface to find out the optimal enzyme immobilization. In this work there are two controlled conditions which is the glucose testing on the blank piezoresistive microcantilever and other is glucose testing on piezoresistive microcantilever immobilized without Glucose Oxidase (GOx). The proposed glucose-based MEMS biosensor has been developed and tested. The measurement obtained shows that at the testing of the glucose with blank microcantilever no resistance changes are observed indicates that no immobilization of receptor occurs with this technique. In the second method, the immobilization technique used normally is for the Au coated silicon microcantilever investigated previously by Jianhong et al. With this technique, GOx immobilized PZR microcantilever sensor found there is a resistance change caused by a change in surface stress in response to the microcantilever deflection. The measurement obtained shows the possibility use of piezoresistive microcantilever for glucose testing.