UNIVERSITY OF GENOA
DEPARTMENT OF INFORMATICS, BIOENGINEERING, ROBOTICS AND SYSTEMS ENGINEERING
MASTER'S PROGRAM IN BIOENGINEERING

Dibris

Thesis Project Form

Title (tentative): Anodic porous alumina modified microcantilevers for biosensing

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Description

Motivation and application domain

A relatively recent and interesting class of transducers that can be used to develop chemical or bio-sensors is based on microcantilevers (MCLs). In order to expand the capabilities of MCL sensors we want to investigate the effects of coating MCLs with anodic porous alumina (APA) of different pore sizes on immunobiosensing, by covalent immobilization of antibody molecules and detection of their antigens. By using different anodization voltages it is possible to control the pore size in the 50-200 nm range.

General objectives and main activities

The aim is to verify improvements in performance of the APA-modified MCL sensors as compared to standard MCLs, with respect to sensitivity and limit of detection. In addition to modification of MCLs with Aluminium coating and anodization, the project will focus on one or more of the following activities: high-resolution imaging (by AFM and/or SEM) of the APA coating, with advanced image analysis aiming to possibly associate the morphological figures to the mechanical functionality; finite element modelling of APA-coated MCLs; characterization of APA-coated MCLs by measurements of both bending and resonance frequency response; development of the functionalization protocol of interest appropriate for APA, after review and modification of similar protocols in the literature; execution of the actual sensing experiments; independent assessment of antigen binding by fluorescence microscopy, based on antigens labelled with fluorochromes (eg FITC). Controls of non-porous alumina and bare Si MCLs will also be assessed.

Training Objectives (technical/analytical tools, experimental methodologies)

The candidate will gain practical lab experience and learn: the basic working principles of AFM and microcantilever sensors; how to fabricate and characterize stand-alone APA and APA coating on MCLs; how to model the static and dynamic mechanical behaviour of MCLs; how to develop and perform surface functionalization/treatment protocols.

Place(s) where the thesis work will be carried out: DIBRIS and IIT@Morego

Additional information

Pre-requisite abilities/skills: Attitude towards experimental work and problem solving.

Maximum number of students: 1