Project 1:
Micro fluidic system for water depolution

Authors: Philippe, Sébastien, Panagiotis, Loïc, Thomas, Maneesha, Sofiane, Umberto

Abstract: A device to sense the amount of common pollutants in water like nitrites, phosphates has been realized using a microfluidic self-powered chip. It contains a generation unit and an optical detection mechanism as read-out. The central ideas behind implementing this miniaturized device were to **facilitate easier lab-on chip** measurements, **reduce use of reagents** to detect pollutants, **less waste** generation, **low power** consumption and overall, to **reduce the cost** of the device. The proposed designs for the microfluidic section of a mixing channel and micro-pump were simulated to validate their functioning. Additionally, a micro-turbine using the water flow and dedicated to the power generation for the device has been proposed.

Keywords: microfluidic, sewage plant, pollutant sensing, Griess detection, absorbance, micro-pump

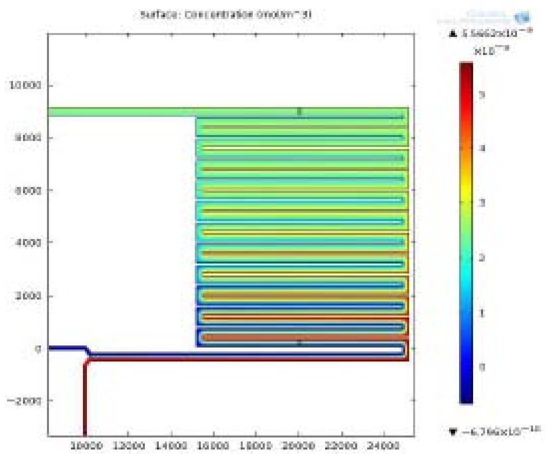

Figure 10: Simulating the mixing path

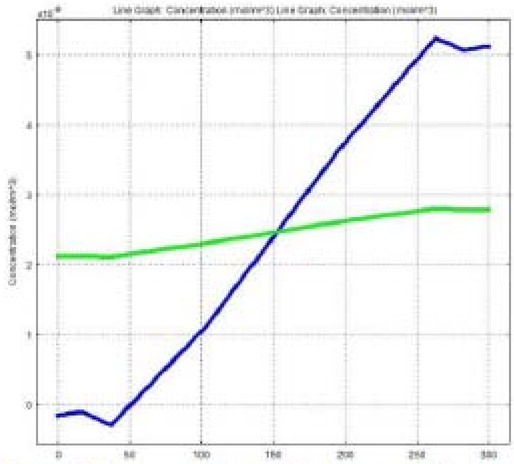

Figure 11: Concentration profile, entrance (blue) and output (green)

Project 2:
HIV Detection by a Silicon Nanowire Field Effect Transistor

Authors: Dimitry, Fatmah, Marie, Vincent, Nadia, Ashwyn

Introduction:

Currently, the detection systems only allows the HIV virus to be detected at an advanced stage (the virus has to start infecting the cells so that the body produces antigens), whereas technologies such as Field Effect Transistors (FET) are starting to be developed as biosensors and show new interesting possibilities such as better sensitivity. Thus, maybe a detection at an earlier stage could be implemented, detecting the virus itself before it could enter the human cells.
This will be the object of our study: detecting HIV with a Silicon Nanowire Field Effect Transistor (Si-NW FET). Is it possible? How the device should be designed for such an application

In this report, we will present and summarize our work and our results concerning the Si-NW FET for HIV detection. In a first part, through analysis of the current market and overview of possibilities, we will explain why we chose a Si-NW FET to detect the virus and present our device architecture. In a second part, we will present everything that concerns the biology and chemistry related to the device. Eventually, we will show the physical model chosen, the different achieved simulations and the related conclusions concerning our work.

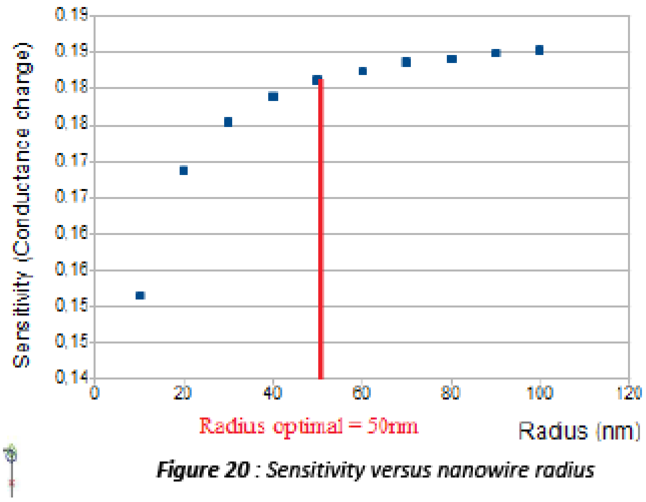

Figure 20 : Sensitivity versus nanowire radius

Project3:
SAWtilever: A wireless sensor node for explosives detection

Authors: Giuseppe, Eva, Luciana, Jorge, Alexis, Valeria

Abstract:

The present document reports on the feasibility study of a new type of passive wireless sensor for the detection of explosives. The sensor is based on a novel configuration, henceforth referred to as "SAWtilever", that combines two well-known transduction structures, namely: the surface acoustic wave (SAW) resonator and the microcantilever. By integrating these structures in a single substrate along with suitable readout electronics, a passive device that can be used as a sensor node in a wireless sensor network (WSN) scheme can be realized. The main advantage of this approach would be possibility of monitoring large building areas by deploying many of these nodes, with the benefit of very low-power consumption per node due to the passive nature of the sensors, along with several other advantages that derive from the small size of the sensor node and its low-cost, when taking a mass-production scenario into consideration.

The rest of this report is organized as follows: Section 2 introduces the proposed device along with its main features, Section 3 provides the details on the theoretical principles behind the operation of the sensor node; the results of the quantitative modeling of the device performance are reported in Section 4, while the conclusions arising from these results are finally discussed in Section 5.

Figure 4.4.1 Cantilever with Aluminum IDTs on the top layer and gold layer on the bottom one

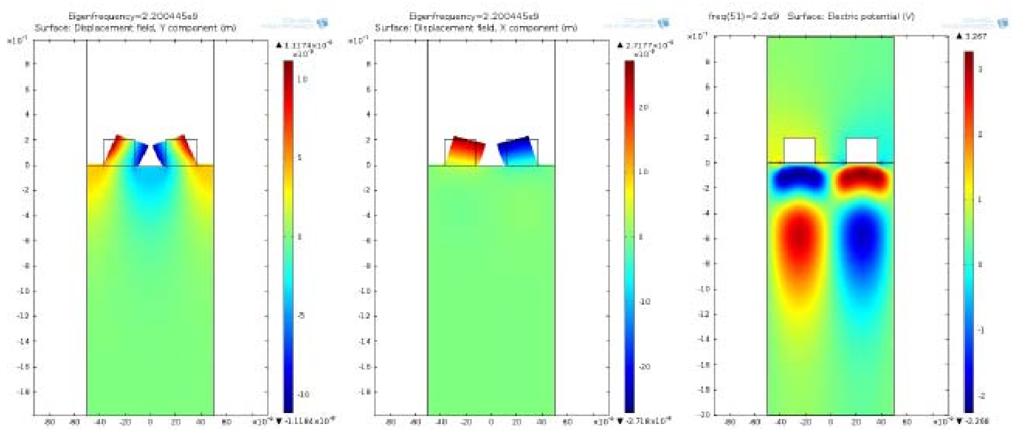

Figure 4.3.2-2: Results of the SAWtilever piezoelectric effects simulations: (leftmost inset) transverse and (center inset) axial displacement due to SAW wave, and (rightmost inset) associated potential.

Project 4:
Perseus Project (with CNES)

Authors: Catalin, Davide, Félix, Cédric, Giovanni, Alexia, Giuseppe, Odysseas

Introduction:

Launched in 2006 PERSEUS (Projet Etudiant de Recherche Spatiale Européen Universitaire et Scientifique -European Scientific and University Space Research Student Project) has, since 3 years, reached a stable number of 250 involved students, 100 professors working on 90 different projects and 8 PhD thesis. Divided in Macro-project, the PERSEUS project is led by the Centre National d'Etude Spatiale (CNES) and targets the building of a space launcher which should be able to launch a Nanosatellites up to 10kg. PERSEUS also develops a set of ground or flight demonstrators in order to build the whole chain of command.

As a first collaboration between Phelma engineering school (PHysic, ELectronic and MAterial school) and PERSEUS, CNES chose to assign to the Students of the International Nanotech master the realization of Pressure, Temperature and Vibration sensors to be integrated in an experimental rocket under development.
Thus three teams were formed inside the group to allow a parallel development of each sensor (pressure, temperature and vibration)

This report, done to summarize the work carried out in the 4 month of our semester in Grenoble, is structured in order to keep trace of the four phases, or milestones, scheduled by Phelma. Thus for each sensor we have a bibliographic research and state of the art for phase 1, and product specification and market analysis for phase 2. The work of the other two phases, instead, is divided by argument (electronic, process, etc) regardless of the milestone in which was done, in order to have a more complete and clear view of our results.

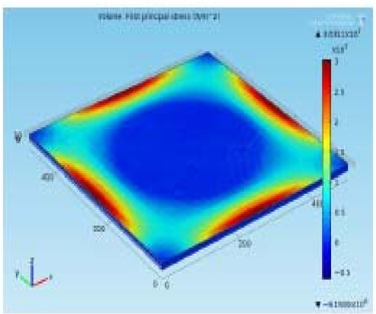

Fig. 2.6 Stress repartition along the membrane

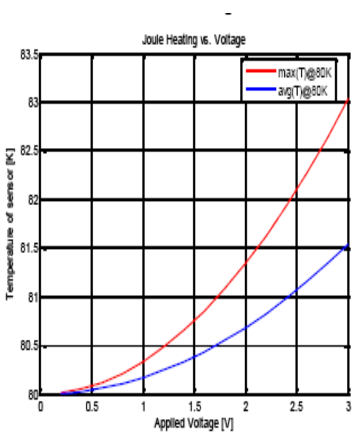

Fig. 3.5 Joule Heating vs. Applied Voltage

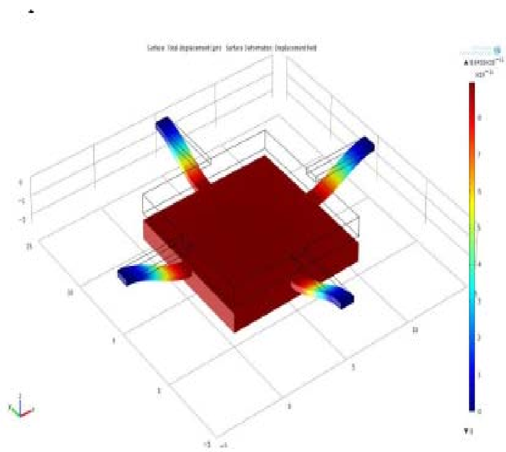

Fig. 4.6 Deformation induced to sensor