EMPLOYMENT PORTAL SECTION	**CONTENT** PhD Student – *fixed-term contract*
Title of post	**Project thesis :** **Electrochemical biosensor for the detection of pathogenic bacteria**
General information	***Workplace* : Laboratoire de Physique de la Matière Condensée –LPMC- Ecole polytechnique – Route de Saclay – 91128 Palaiseau cedex** ***Date of publication : 04/02/2020*** ***Scientific Responsible name : Anne Chantal Gouget*** ***anne-chantal.gouget@polytechnique.edu*** ***Co-direction : Prof Philippe Roger, Institute of Molecular Chemistry and Materials (ICMMO), University Paris Saclay*** ***Financial support****: fellowship from the doctoral school of IPP*
Description of the thesis subject	The fast and reliable detection of pathogens is of great interest in many applications related to public health such as diagnostic of diseases or food contamination. Nowadays, the standardised detection (and/or diagnostics) systems marketed are mainly based on bacteriological cultural methods using selective media which are labor, cost and time-consuming (i.e. several days). Biosensors are well-suited for this purpose because these analytical tools allow the fast detection in less than one hour of a given pathogen at low concentration thanks to specific interactions between molecules probes grafted on the biosensor surface and pathogen targets. However, this technology has limitations related to the control of probes immobilization affecting highly sensitivity and specificity. Moreover, there is a need to develop cheap and portable biosensors for the simultaneous detection of multiple pathogens. The project of this thesis is dedicated to the development of new biosensors allowing the selective and reproducible detection of bacteria at very low level. This will be achieved through surface modification with antibacterial polymers and specific probes as receptor for selected bacteria, in our case *Escherichia coli*. The proof of concept will be evaluated with two types of bioreceptors (glycan and DNA-aptamer). The surface modification will be performed by anchoring antiadhesive molecules by Surface Initiated Atom Transfer controlled Radical Polymerization (SI-ATRP). The optimization of such a bottom up chemistry will be investigated in the first step on model silicon Si(111) surface to allow the control of the surface chemistry by quantitative characterizations by FTIR spectroscopy. In the second step, all these optimized protocols will be transferred into a new architecture of biosensor based on hydrogenated amorphous silicon. Glycan/or aptamer probes will be locally introduced on the grafted polymers by electrochemical “click” patterning and their interaction with specific bacteria will be measured by electrochemical impedance spectroscopy (EIS). Such a method offers one of the highest sensitivities with limit of detection reported close to 10^2 CFU/mL with the potential of addressing multiplex detection in laboratory or handheld depending on the needed application. **Keywords:** surface initiated polymerization, electrochemical pattering, bacteria, silicon, biosensor, impedance measurements **Technics:** Plasma enhanced chemical vapor deposition (PECVD), thermal evaporation, IR spectroscopy, X-Ray photoelectron spectroscopy (XPS), Atomic Force Microscopy (AFM) and EIS
Work context	PMC is one of 22 laboratories located at the Ecole polytechnique research centre working on the frontier of knowledge on the major interdisciplinary scientific, technological and societal issues. Within the Teaching and Research Department of Ecole polytechnique, PMC (Laboratoire de Physique de la Matière Condensée) is a mixed research unit (Ecole polytechnique/CNRS) whose work is organized around two fundamental topics that are the nanosciences and the physics of Irregularity. We try to understand the solid, liquid or intermediate states (gel, pastes, foams…) of matter (structure, properties, phenomena of sets related to the interactions between the particles that compose it), the condensed matter physics is a science that is upstream of innumerable technological advances. Ecole polytechnique is attached to the IPP Institut Polytechnique de Paris created in 2019. The candidate will benefit from the top-level scientific environment and the large formation offered by the Ecole Polytechnique.
Constraints and risks	The successful candidate shall be enrolled on a PhD programme of the IPP doctoral school. The thesis will take place at PMC and at ICMMO in Orsay which is located close to Palaiseau, in collaboration with two teams of Prof. Philippe Roger and Dr. Hafsa Korri-Youssoufi.
Supplementary information	The candidate must have a degree in engineering and/or an equivalent master in materials science. The candidate must be strongly motivated by the multidisciplinary aspect of the project. Applications must include CV, at least two references (people who may be contracted); a cover letter; grades for the master 1 or 2 or the engineering degree. **Beginning date of the contract:** *October 2020* **The closing date for sending applications is 10/03/2020**