Master internship

Internship/job title	Light-Addressable Nano-junction Device (LAND)
Location :	Laboratoire PMC – Ecole Polytechnique – Route de Saclay – 91128 Palaiseau
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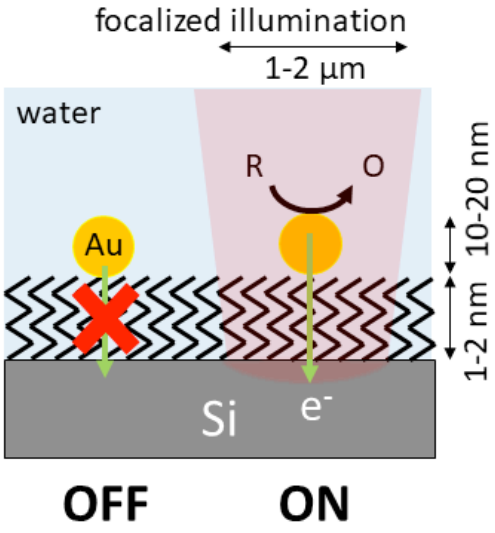
Observations	Starting date : Feb. – Jul. 2020

TOPIC:

Scientific description: The context of the project LAND is multiplexed electrochemical sensing. We will explore a strategy to study individual Metal-Insulator-Semiconductor nano-junctions within a large ensemble obtained by adsorbing metal nanoparticles (metal contact) on a Si wafer (semiconductor) onto which a molecular layer of carboxydecyl chains (insulating layer) has been grafted. A schematic representation of the proposed system is shown in **Figure 1**.



This system will be immersed in a redox electrolyte to measure electrochemically the photo-current of the junctions. The functioning of the MIS nano-junctions is such only the illuminated ones are "on" (i.e. they transfer photo carriers from Si to the redox species in solution) while those in the dark are "off" (no exchange of charge carriers). Using a focused laser beam potentially allows investigating an individual (or a small number) of nano-junction which paves the way to the design of highly-multiplexed (bio-)sensors.

The intern will be in charge of fabricating the Si – organic monolayer – NP device and study the properties of the nano-junctions in the dark and under illumination. These characterizations will be performed by recording I-V curves in electrochemical environment (oxidation/reduction of a redox molecule R/O dissolved in solution) with a specifically designed opto-electrochemical microscope. The energy diagram deduced from these measurements will serve as a basis for the optimization of individual photo-responsive nano-junctions.

Keywords: nano-electrochemistry, semiconductor, photo-electrochemistry, Metal-Insulator-Semiconductor tunnelling junction, surface functionalization, nanoparticle

Techniques/methods in use: electrochemistry (cyclic voltammetry, chronoamperometry, electrochemical impedance spectroscopy), optical microscopy, wet surface modification,

Applicant skills: semiconductor physics, experimental rigor, strong motivation

Possibility for a Doctoral thesis: Yes (we support applications to obtain funding from the doctorate school)