LABORATOIRE DE PHYSIQUE
DE LA MATIÈRE CONDENSÉE
CNRS-ECOLE POLYTECHNIQUE

PhD position

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Location:	LPMC – Ecole Polytechnique – Palaiseau – France
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"Functionnalized Silicon surfaces as plateforms for *in situ* AFM characterizations of DNA/ligands interactions."

Context : AFM is an established powerful tool to investigate biomolecules at molecular scale. This requires however controlling the immobilization of biological entities on a surface, which may greatly influence the biomolecules reactivity towards its environment. To be relevant, AFM studies of bio recognition events, require the preservation of the probe properties/reactivity. Up to now, mica has been mostly used as substrate since it is easy to adsorb the biomolecules by electrostatic interactions on its surface. In addition, the surface is flat on the atomic scale and inert in physiological environment.

Objective of the PhD: The PhD project is to use ideally functionalized silicon surfaces, as new and more versatile platform, to anchor covalently biological probes in controlled density. The project will focus on DNA/Ligands interactions and a particular emphasis will be given to the development of in-situ AFM characterizations and measurements in order to elucidate the factors affecting the bio-recognition events on a surface in physiological conditions. Complementary characterizations (infra red spectroscopy etc.) will be also conducted, in particular for the design of surfaces with defined physicochemical properties.

Expertise of host group: Our group has a long lasting experience with the organic functionalization of silicon surfaces and their application to the development of new DNA biochips[1]. It has also a strong expertise with *in-situ* scanning probe Microscopy (STM, AFM). As shown in Fig. 1, we master the preparation of functionalized Si(111) surfaces atomically flat[2] suitable for high resolution AFM characterizations of biomolecules and other nano-objects. In addition, the strategy we use enables to vary at will the density of anchoring sites as well as tuning the physicochemical properties of the surface (hydrophilic/phobic properties etc.). Different routes to immobilize biological probes (electrostatic interactions, covalent anchoring) can also be compared. Mastering all these factors is a critical advantage to elucidate bio-interactions taking place on a surface.

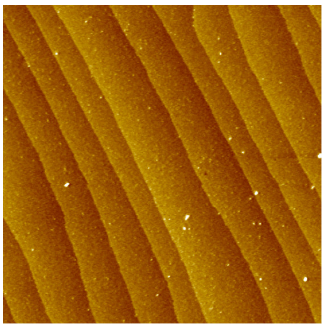

Figure 1 : Stair-like structure of a functionnalized Si(111) surface. The terraces (separated by steps 3.1Å high) are smooth at atomic scale and fully covered by a close-packed layer of decyl chains bearing COOH end-groups (3 10^{14} COOH / cm^2) covalently bond on Si. Image area 1µm x 1µm.

[1] L. Touahir and al. Biosensors and Bioelectronics, 25, 4, (2009).
[2] A. Faucheux and al. Langmuir (2006) 22, 153;