Surfaces and interfaces bioengineering: functionalization, characterization and application

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During this talk we will first describe the goals and aims of the "Groupement De Recherche 3751 Bio-Ingénierie des Interfaces B2I". Thus, few examples of surfaces bioengineering will be presented.

The scientific field of the GDR B2i is centered on the material-biological interface. The bioengineering of the interfaces aims at controlling the physical and chemical properties at the interfaces of the materials in order to control their stealth and their specificities: stealth (term usually dedicated to nanoparticles but also applying here to massive materials) being defined such as the ability not to cause undesirable reactions and the specificity being defined herein as the ability to generate a desired reaction. The fields of application of surface bioengineering range from in vitro biosensors to biochips, microfluidics, biomaterials (implants) ... with major challenges in the fields of biomedical, diagnostic, food industry or the monitoring of the environment...

The control of protein immobilization through a deep characterization of each immobilization step is crucial for many biological applications, particularly for biosensors, biocompatible coatings or for antimicrobial surfaces for biofouling purposes.

On gold surfaces, the influence of thiol Self Assembled Monolayers (SAMs) properties on the protein layer is crucial and still uncontrolled. We investigate the influence of several parameters like nature, order, and length of SAMs on protein immobilization onto gold transducers, with the aim of optimizing the adsorption and accessibility of the immobilized proteins to specific targets such as proteins, antibodies or microorganisms. To this aim, we combine several characterization techniques: Modulated Polarization-Infrared Absorption Spectroscopy (PM-IRRAS), Atomic Force Microscopy (AFM), X-Ray Photoelectron Spectroscopy (XPS), Fourier Transform Surface Plasmon Resonance (FT-SPR) and Quartz Cristal Microbalance with dissipation measurement (QCM-D), to characterize SAMs formation and protein immobilization.