>>> ANNOUNCEMENT

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Characterization and modification of potential bioelectronic interfaces

ABSTRACT

In this work, planar biocompatible dielectric and metal surfaces, modified with self-assembling organic monolayers and functionalized gold nanoparticles are studied. In the field of bioelectronics, adhesion and guiding of cells (especially neurons) on a substrate is of great importance, and withal a hard challenge. Optimization and engineering of properties of a carrier (biocompatible inorganic substrates) can potentially improve the contact between cells and substrates, increase the survival rate of cells and improve the signal transfer. Nowadays it is clear, that the cell interacts with outer world via proteins, which, following the physical approach, interact with the surface via electrostatic interaction. Unfortunately, in aqueous environment, proteins responsible for the cell adhesion as well as most inorganic substrates bear a net negative surface charge that leads to an electrostatic repulsion and, consequently, impairs adhesion. The use of functionalized organic molecules or inorganic nanoparticles allows engineering the surface properties of various materials in order to facilitate the cell adhesion. Therefore, in this work, planar biocompatible dielectric and metal surfaces modified subsequently with organic molecules, and functionalized gold nanoparticles are characterized via an optimized surface potential analysis in combination with other supporting techniques (e.g. ellipsometry, wetting angle and SEM). Additionally, a setup for the deposition of molecular monolayers, including in-situ cleaning and activation, accompanied by in-situ electronic analysis via capacitive and microwave measurements is developed and tested. During this work, the deposition and functionalization of AuNPs as well as a streaming potential/streaming current experiment for the analysis of the surface potential of the substrates and layers were improved and optimized. Using especially the time- and pH-dependent analysis of the ζ potential, we can analyze the various types of 'simple' (e.g. various biocompatible substrates, metallic layers, graphene) and complex (e.g. molecular monolayers, functionalized gold nanoparticles) interfaces and identify possible candidates for the modification of a given surface with respect to their surface potential (e.g. organic molecules with different functionalization). Finally, our extended analysis allows us to determine the stability of a given surface and monitor the change of the surface potential due to the engineering of a surface (e.g. via deposition of gold nanoparticles).

BIO

Since 2011 PhD studies in Experimental Physics, Thesis Title: Modification and characterization of potential bioelectronics interfaces, Forschungszentrum Jülich GmbH, Institute of Complex Systems/Peter Grünberg Institute: Bioelectronics, Jülich, Germany

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