AKB 85 Biosensors and Biohybrid Systems

Zeit: Mittwoch 12:30–13:30 Raum: TU H2013

AKB 85.1 Mi 12:30 TU H2013

Characterization of cell adhesion and cell properties on suspended nanoporous membranes — •Bernhard Wolfrum, Youlia Mourzina, Matthias Höller, and Andreas Offenhäusser — ISG2:Bioelectronic Signal Processing, Research Centre Jülich, 52425 Jülich, Germany

Suspended membranes of nanoporous materials like porous alumina and porous silicon facilitate the development of interesting biohybrid systems, particularly with regard to their good biocompatibility. For example, these materials can be used as carriers for artificial or natural cell membranes to study cell signalling in a bioelectronic hybrid system.

A close contact between porous structure and cell membrane is a precondition for the functionality of such a device. We therefore investigated the adhesion and morphology of cortical rat neurons and cells from cell lines on porous silicon and porous alumina membranes using scanning electron microscopy. The results were compared with the adhesion of cells to other substrates like silicon nitride and silicon oxide. Further, we characterized electrophysiological properties of adherent cells on porous structures using patch-clamp techniques. The adherent cells can thereby be chemically stimulated through the nanopores in the substrate.

AKB 85.2 Mi 12:45 TU H2013

Adsorption of Self-Assembled Polyelectrolyte Multilayers on a Silicon-on-Insulator based Sensor Device — •Petra A. Neff, Michael G. Nikolaides, Simon Q. Lud, and Andreas R. Bausch — Lehrstuhl für Biophysik - E22, Technische Universität München, 85747 Garching

Recently, a new Silicon-on-Insulator (SOI) based thin film resistor device for chemical and biological sensor applications was introduced. Its response against pH changes and variations of the salt concentration of an electrolyte on the native oxide surface was measured and compared to the theoretical predictions. It has been shown that the charge of different small peptides or proteins can be determined.

We study the adsorption of polyelectrolyte multilayers onto the SOI sensor devices. During the layer-by-layer deposition of the polycation poly(allylamine hydrochloride) (PAH) and the polyanion poly(styrene sulfonate) (PSS) by alternating buffer exchange, the response of a SOI sensor with a native oxide surface was observed as a change in its sheet resistance. The change in surface potential can be calculated from the sheet resistance applying calibration measurements. It corresponds to the surface charge density expected as a result of the multilayer build-up. The sensor signal amplitude was observed to be decreasing linearly with an increasing number of monolayers enabling the detection of more than 20 monolayers. To understand the sensor signal a theoretical model of the properties of the polyelectrolyte layers was compared to the measured data.

AKB 85.3 Mi 13:00 TU H2013

Time Resolved Dynamics of Electrically Switched Oligonucleotides on Au Surfaces — •Ulrich Rant[1], Kenji Arinaga[1,2], Yong Woon Kim[1], Shozo Fujita[2], Naoki Yokoyama[2], Roland Netz[1], Gerhard Abstreiter[1], and Marc Tornow[1] — [1]Technische Universitaet Muenchen, 85748 Garching, Germany — [2]Fujitsu Laboratories Ltd., 10-1 Morinosato-Wakamiya, Atsugi 243-0197, Japan

Macromolecules grafted to surfaces have been receiving considerable attention lately due to their interesting and complex behaviour at interfaces, but also in terms of applications (e.g., DNA sensors). In particular, the use of electrically addressable substrates permits many possibilities for manipulating charged molecules, which is accompanied by novel insights into interactions between the surface and the tethered polyelectrolytes. Recently, we reported on the dynamic manipulation of DNA on Au surfaces by electrically switching the strands while observing their orientations by optical means. Here we present time resolved experiments in which we study surface-tethered oligonucleotides of different lengths (24 and 48mer) in their single as well as double stranded conformation. We elucidate the dynamics of the molecules as they are repelled from, or attracted to the biased surface when reversing the charge on the metal substrate. By comparing the experimental data to hydrodynamic simulations, we are able to identify a distinctly different behaviour for single and double stranded DNA, respectively. Possibly, the identified mechanisms are of fundamental nature for the electrical manipulation of charged polymers with markedly dissimilar mechanical flexibilities.

AKB 85.4 Mi 13:15 TU H2013

Characterization of a chemically passivated GaAs based sensor device in electrolytes — •Sebastian M. Luber[1], Daniel Gassull[2], Dieter Schuh[1], Motomu Tanaka[2], Marc Tornow[1], and Gerhard Abstreiter[1] — [1]Walter Schottky Institut, TU München, 85748 Garching, Germany — [2]Lehrstuhl für Biophysik, E22, TU München, 85748 Garching, Germany

Functionalized field effect devices are promising candidates to act as smart substrates for sensor applications. For a use in biological systems an intermediate layer has to provide stabilization against electrochemical decomposition, and allow effective electrostatic coupling of the surface potential to the conductive channel.

We present a resistor device passivated with a 4'-substituted 4-mercaptobiphenyl self-assembled monolayer (SAM) for sensing applications. Starting material was a GaAs-AlGaAs heterostructure containing a quasi 2D electron gas 60nm beneath the surface. In the first part of our study we tested the stability of the device against aqueous solutions. Whereas a bare GaAs device degraded rapidly the coated samples showed a remarkable increase in stability. In the second part samples coated with monolayers with CH_3 (MBP-CH_3) and OH (MBP-OH) substituents in various buffered electrolyte solutions were characterized. For the MBP-OH coated sample, a change in pH induced a change in the resistance of the device. This behaviour can be expected due to non-specific adsorption at the hydrophilic surface of the −OH terminated SAM. However unexpectedly, the sample grafted with a MBP-CH_3 SAM with a hydrophobic surface also showed a clear response on pH.