Development and evaluation of chemical interfaces for a nanophotonic silicon-on-insulator biosensor platform

A. Goes*, S. Werquin, E. Vanderleyden, P. Bienstman, P. Dubruel
Ghent University, Belgium

Biosensors are widely used in a variety of applications with the aim to detect biomolecules. Within the wide variety of existing detection platforms, nanophotonic silicon-on-insulator (SOI) platform allows for a high degree of multiplexing enabling simultaneous detection of various pathogens[1]. This makes it a very promising platform for the development of rapid point-of-care tests. However, to link the required capture biomolecules to the sensor surface, a high quality chemical interface (homogeneous, reproducible,..) is of paramount importance.

After cleaning and activation of the silicon surface, the functional groups generated were reacted consecutively with the silanization product, polyethylene glycol (PEG) and a DNA capture sequence. In this study, two different silanization products were used. One was deposited via molecular vapor deposition (MVD), the other via conventional wet chemistry[2].

Each of the steps of the surface modification was verified by SCA-, XPS- and AFM-measurements. The AFM-images showed the formation of a quasi-monolayer, while the XPS results revealed an atomic surface compositions which are in good correlation with the applied surface modification steps.

Subsequent biosensing experiments showed the requirement of an intermediate PEG-layer. We could show that the applied PEG-layer reduces the non-specific adsorption of BSA with more than 90% (figure 1).

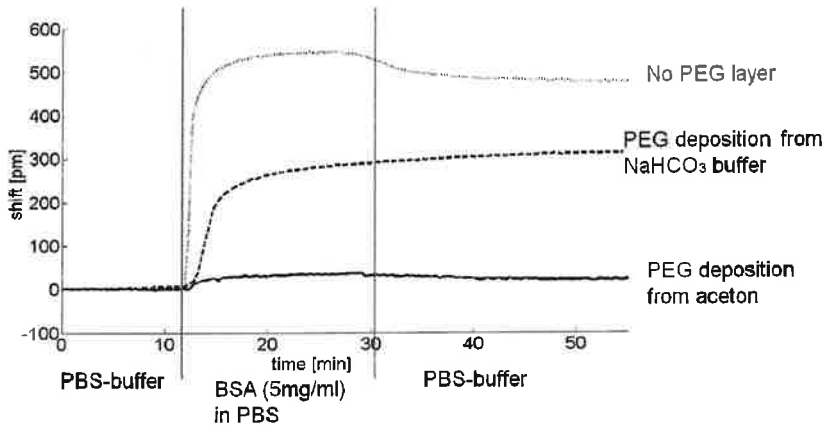

Figure 1: Biosensing experiment depicting the influence of PEG as an intermediate layer

Future work will focus on the coupling of different nucleotides to the surface while eliminating non-specific adsorption in this way increasing sensitivity.

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