Nanowires based biosensorics

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Abstract

Efficient diagnostics of diseases at early stages requires synergy of knowledge and advances not only in medicine and biology but also in material science and nanotechnology. This implies the need for the development of novel approaches capable of sensing down to femto-molar concentrations of biomolecules. Here, we present a novel biosensing platform based on semiconductor Si nanowire-based electronic devices, which proved to be an efficient solution for a label-free and real-time detection of various bio-chemical species [1]. When assembled as field effect transistors (FETs), Si nanowires experience variations of their conductance that is caused by the change of the electrical potential at their surface [1, 2]. We demonstrate that electrically sensitive Si nanowire FETs can be fabricated even without doping via creating one dimensional Schottky barriers within the wire [3]. One of the methods to achieve substantial modification of the surface states and electrical properties is chemical functionalization of a surface of the nanowires.

In our investigations we combine different aspects of the biosensor design, including nano-device fabrication and characterisation, building the measurement platform capable of liquid cell measurements and development of the bioreceptors (i.e. oligopeptides). Finally we demonstrate that apart from biosensor applications, chemical functionalization of the nanowires opens new ways for novel hybrid electronics [4], where electrical characteristics of the traditional semiconductor devices are controlled by molecules that are bound to the wire surface.

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