

Silicon nanowire based (bio) sensing

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Since silicon nanowire (SiNW) based field effect transistors (FETs) were first introduced for pH and bio sensing, [1] diverse configurations of nanowires based sensor devices have been demonstrated to allow the label-free detection of proteins [2], DNA [3], viruses [4], ions [5] and gases [6]. Therefore, using such systems a specific detection of - among others - medically relevant data is possible. Compared to enzyme-linked immunosorbent assay (ELISA) [7], the commonly applied technique for biodetection purposes, results may be obtained much quicker and with lower detection limits.

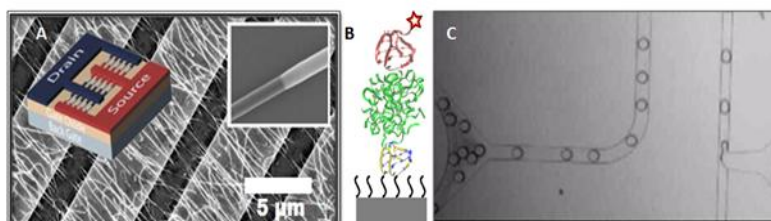
Here, we present an approach towards the assembly of SiNW based sensory devices made from bottom-up grown SiNWs (see Fig. 1 A). Introducing well-defined Schottky barrier contacts between electrodes and SiNWs allows on/off current ratios of up to 10^6 and using parallel arrays of SiNWs enables on-currents of over 500 μA at a source drain voltage of 0.5 V. [8]

Furthermore, we implement the SiNW FETs into a biocompatible microfluidic setup for measuring pH changes and determining the optimum working regime of our devices. We also demonstrate the immobilization of aptamer bio receptor molecules on the sensor surface to obtain a bio sensor specific for the blood coagulation protein thrombin with a detection limit in the picomolar range (see Fig. 1 B). And we show how digital droplet logic can be fruitfully combined with our sensor platform to obtain a setup which can provide information

about many separate droplets, i. e. experiments, within a very short time (see Fig. 1 C).

References

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Figure 1. Parallel SiNW arrays in-between interdigitated finger electrodes. B: Schematic drawing of the applied silane based immobilization of aptamers specifically binding thrombin. A second (fluorescence labeled) aptamer is used to realize a sandwich assay. C: Digital droplet logic assembly for multi droplet sensing experiments.