IMMOBILIZATION AND METALLIZATION OF DNA FRAMEWORK MOLECULES AND DNA-SUPERSTRUCTURES FOR NANOELECTRONICS

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DNA molecules are optimal tools for nanotechnology [1, 2]. These mechanical stable, flexible molecules can build a template for nanoscale structures while also being appropriate for the biological functionalization of different surfaces. This biological matrix has a highly defined structure and its sequence ensures a direct addressability for manipulation on the nanoscale level.
For the construction of nanodevices, we compared immobilization techniques enable a technological implementation in a parallel way. Basic criteria for the immobilization are the addressability, specificity and the defined geometry of the immobilized molecules. The addressability enables the site-directed and assembly of framework molecules in parallel. The specificity ensures their selective binding onto surfaces whereas a defined geometry, i.e. a geometrically convenient arrangement, is required for the following manipulation steps in the nanoconstruction. We therefore tested combined stretching and immobilization methods for framework DNA molecules [3] and DNA superstructures like G-wires [4]. The one or two step binding of these molecules was arranged on microelectrodes, structured by conventional photolithographic techniques. The surfaces were either biologically or chemically modified or only activated prior to binding. Subsequently, the contacting of the molecules to the surfaces was achieved by guided immobilization based on self organization processes. The applied techniques, like immobilization and stretching by hydrodynamic and electrical forces, were presented and tested for their effectivity and ability for the construction of future nanoelectronic devices [5].

A specific metallization of DNA molecules was used for the generation of small nanowires enabling the electrical contacting with the macroscopic periphery (electrodes). On the one hand, we realized this metallization by binding of gold nanoparticles as seeds for a subsequent silver deposition [3]. On the other hand, we arranged this by direct metallization along the DNA backbone [6]. Additionally, a comparison between different metallization methods was implemented.

References:

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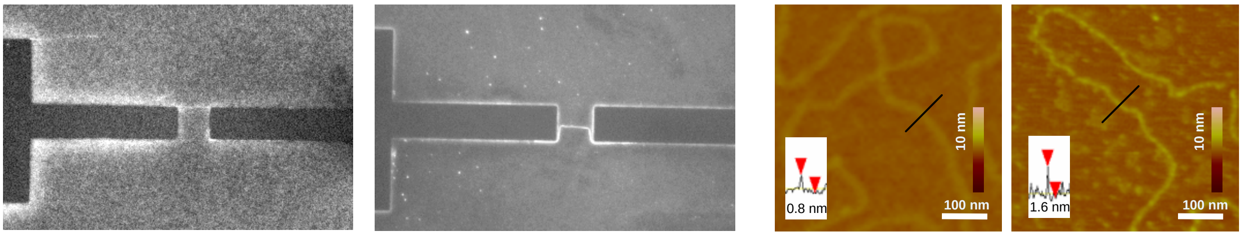
Figures:



Immobilized single DNA molecule (left) and G-wire (middle) between microelectrodes (fluorescence images). Right: Metallization of DNA-molecules (AFM images).