DFG-Graduiertenkolleg 2767 "Suprakolloidale Strukturen: Von Materialien zu optischen und elektronischen Bauteilen"

Abstract – Project B2 ‘Electronic circuits by self-organization based on DNA origami molds’

Self-organization based on DNA origami nanostructures can serve as a fabrication technique for nanoscale electronics with feature sizes below 5 nm. For the creation of electronic circuits based on these single building blocks, interconnects on larger areas need to be defined. Possible candidates are one and two-dimensional (1D and 2D) nanostructures, which can be contacted using top-down strategies like electron beam lithography (EBL).

Based on the DNA origami technique, we were able to generate metallic and semiconducting structures at the nanoscale. We have already demonstrated that we can produce fully metallic nanowires using this technique, which could be characterized using multiple electronic contacts fabricated by EBL. We have demonstrated that 2D materials with tailored optoelectronic properties can be contacted and integrated with EBL fabricated electrodes and specially designed via-techniques.

Main aim of this project is to establish 2D materials as a convenient substrate to interconnect individual self-assembled nanoelectronic structures and devices into larger circuit structures. To this end, the DNA origami nanostructures shall be adhered onto 2D semiconductors using functional groups. The main advantages of using 2D semiconductors as interconnects are their scalability and their broad range of electronic properties, which can be tuned *in-situ* by applied gate voltages. Possible examples are materials, which can exhibit ambipolar behavior such as black phosphorus or WSe2, which interconnect the self-assembled devices reprogrammably. Using such combinations, circuits with ultra-low energy consumption may be achieved, because the layout can be adapted according to external signals. We will investigate how the interaction between the 2D materials and the DNA origami nanostructures affects the order of deposited nanostructures and whether large scale order can be induced by such interactions.