Nano-electronic components built from DNA templates

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On the nanoscale, fundamental properties and potential applications are greatly influenced by the size and shape of the material. “DNA Origami” takes advantage of base complementarity of individual short oligonucleotides, to fold a long “scaffold strand” into almost any continuous 2D or 3D shape. [1] We recently introduced a new concept of DNA mold-based particle synthesis that allows the synthesis of inorganic nanoparticles with programmable shape. We demonstrated the concept by fabricating a 40 nm long rod-like gold nanostructure with a quadratic cross-section. [2] We expanded the capabilities of the mold-based particle synthesis to demonstrate the synthesis of uniform conductive gold nanowires with 20-30 nm diameters. [3] With conductance characterization, metallic conducting wires were demonstrated. Here the concept is further expanded by designing mold monomers with different geometries and interfaces[4], and we can fabricate more complex ‘mold-superstructure’ in a unique and flexible way based on this modular DNA platform (see figure 1). We can also incorporate semi-conducting nano-rods into this mold-based system to fabricate single molecular transistor. [5] Furthermore, we investigate different conditions for the metal deposition inside the long mold chain structure to achieve a high aspect ratio of gold rod shape formation.

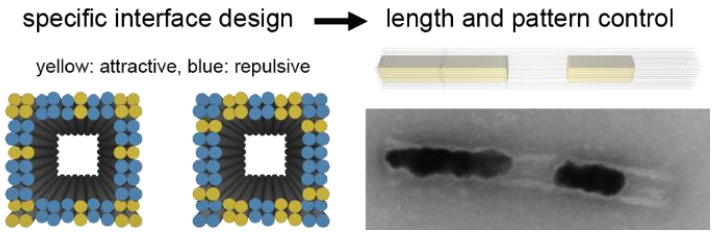

Figure 1. Sketch and tSEM images showing the modular DNA platform. With specific interface design by choosing different helix positions for attractive and repulsive reaction, the length and pattern of the metal structures can be controlled.

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