FROM DNA TO NANOPLASMONICS AND NANOELECTRONICS

Kosti Tapio[1], Boxuan Shen[1], Veikko Linko[2], Jenni Leppiniemi[3], Mauri Kostiainen[2], Vesa P. Hytönen[3] and J. Jussi Toppari[1]

[1]University of Jyvaskyla, Department of Physics, Nanoscience Center, P.O. Box 35, FI-40014, Finland; [2]Department of Biotechnology and Chemical Technology, Aalto University, Finland; [3]BioMediTech, University of Tampere, Biokatu 6, FI-33520 Tampere, Finland and Fimlab laboratories, Biokatu 4, FI-33520 Tampere, Finland.
email: kosti.t.o.tapio@jyu.fi

Metallic nanostructures have inspired extensive research for many decades, particularly within the fields of nanoelectronics and photonics. However, the range, where these devices have been operating, has been limited due size restrictions of the conventional top-down nanofabrication methods. Meanwhile, the bottom-up fabrication methods have become more robust and accessible. One of the promising candidate is DNA due to its versatile self-assembly and functionalization properties [1]. Today, the fabrication of DNA nanostructures has been well established and especially the discovery of DNA origami [2] has enabled fabrication of almost any arbitrary, sub-100-nanometer shape.

Here, we demonstrate two different examples to fabricate sub-100-nanometer structures for nanoelectronics and –plasmonics, via utilizing DNA. The first method involves DNA-triple-crossover tiles to fabricate of a pearl-like-assembly of three nanoparticles (see figure 1A), which can act as a single electron transistor [3]. The second method employs DNA origamis as a mask to form correspondingly shaped plasmonic nanostructures [4], e.g., silver bowties (see figure 1B) and others. In both cases, we have fully characterized the electrical or optical properties of the fabricated structures.

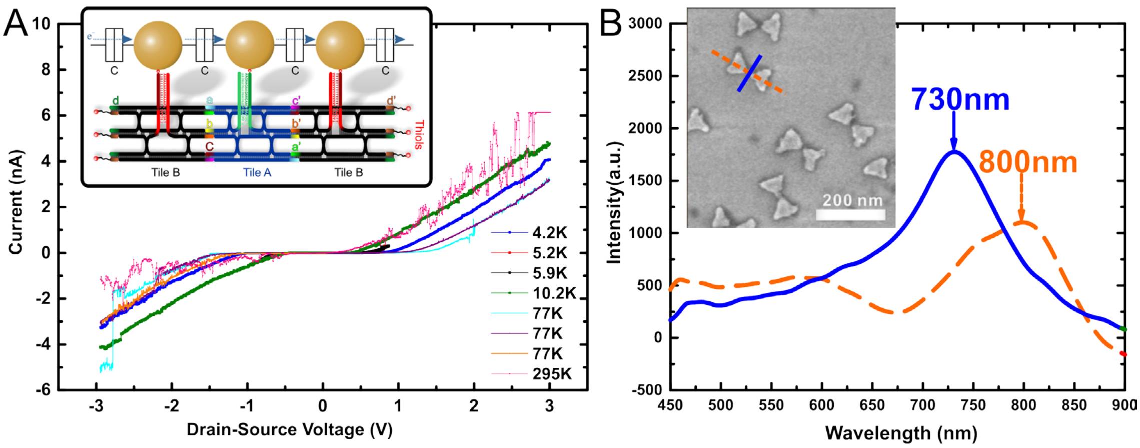

Figure 1: (A) IV characteristics of the pearl-like-three-AuNP-assembly (inset). The Coulomb blockade region is clearly visible from 4.2 K all the way to room temperature. (B) The localized surface plasmon spectra of a silver bowtie structure presented in the SEM image (inset). The blue solid and the orange dashed lines indicate the polarization angles of the excitation light as shown.

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