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Stable Stretched Suspended DNA Molecules

Manola Moretti[1], Tania Limongi[1*], Monica Marini[1], Francesco Gentile[2], Andrea Giugni[1], Bruno Torre[1], Marco Allione[1], Luca Tirinato[1], Gobind Das[1], Gerardo Perozziello[2], Patrizio Candeloro[2] and Enzo di Fabrizio[1]

[1]SMILEs Lab, PSE and BESE Divisions, King Abdullah University of Science and Technology, Thuwal, Saudi Arabia

[2]University of Magna Graecia, Viale Europa, Germaneto, Italy

[*]**Corresponding author:** Tania Limongi, SMILEs Lab, PSE and BESE Divisions, King Abdullah University of Science and Technology, Thuwal, 23955-6900, Kingdom of Saudi Arabia, Tel: 00393283366593; E-mail: tania.limongi@kaust.edu.sa

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Introduction

The elastic properties of nucleic acids (DNA and RNA) are strictly related to their biological function, especially in the case of DNA.

The elastic properties control their bending and twisting by ensuring that long molecules can fit into the nucleus of a cell and that, proteins and drugs, can regulate all the cellular processes by means of effective bindings.

Accurate elasticity response measurement of DNA molecules to chemo/ mechanical stress, is usually determined in pulling experiments by investigating secondary structure formation and conformational transitions. Many techniques are available for DNA/RNA manipulation such as optical and magnetic tweezers.

These experimental methods, combined with worm-like chain model are useful to determine interesting mechanical phenomena such as a massive forced overstretching of DNA [1] and mechanically-induced strand separation [2]. DNA flexibility experiment first requires to anchor the molecule extremities to appropriately treated surfaces; different methods have been developed to achieve specific DNA binding to surfaces [3]. The extremity of the molecule can, for example, be functionalized with biotin that can interact specifically with

Streptavidin previously bound to a surface [4]. Here we briefly present a new application of the devices presented in [5-11] where no DNA modification is required. The method relies on the self-aggregation of DNA on teflonated super hydrophobic Silicon textured surface. DNA was observed to firstly adhere strongly to the silicon surface, by one of its end, and pulled toward a second Silicon surface, by drop receding during the evaporation. At the end of the evaporation process, DNA is suspended, stretched and anchored on both ends (Figure 1) [12]. This method doesn't need any fixation of DNA on the substrates or on the tips [7] during the stretching such as in by atomic force microscopy (AFM) or other DNA manipulation. The presented device could be also used as a tool for others DNA nanotechnology application such as novel single molecule enzyme assay.

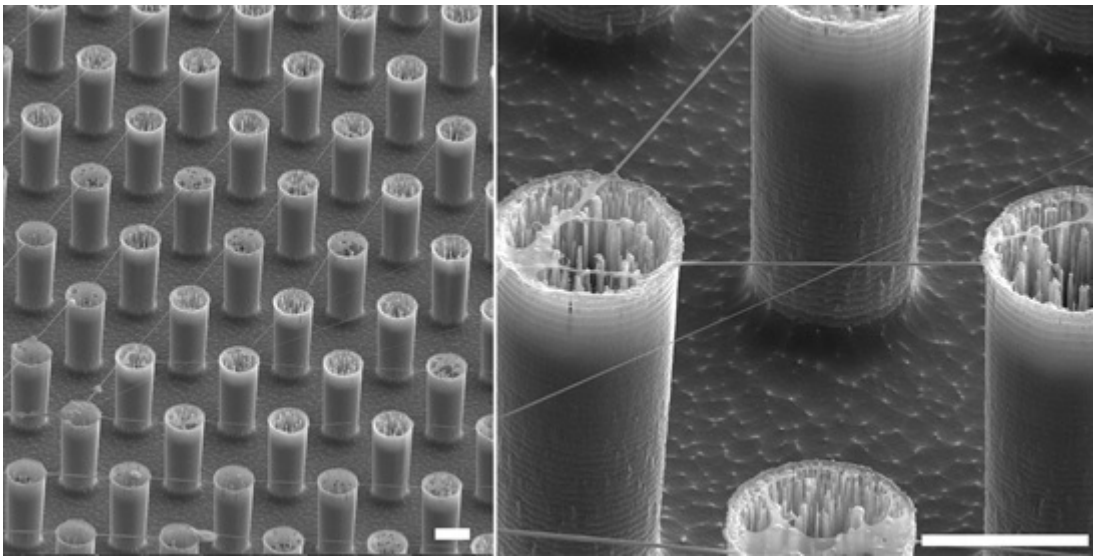

Figure 1: Low magnification (left) and high magnification (right) scanning electron microscopy images of DNA suspended on the device surface (scale bar, 10 μm).

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