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2D Nanostructures based on DNA-Porphyrin Hybrids

G. Chatelain,^a C. Saint-Pierre,^b D. Gasparutto,^b and S. Campidelli^a

^aLICSEN, NIMBE, CEA, CNRS, Université Paris-Saclay, CEA Saclay 91191 Gif-sur-Yvette Cedex, France.

^bLCIB/UMR E3, CEA-UJF, INAC (FED no. 4177), CEA Grenoble, 38054 Grenoble, France.

The use of DNA as support of information for the fabrication of supramolecular nanostructures has been extensively reported over the last decade. Different strategies were used for this purposes either based purely on oligonucleotides or by combining oligonucleotides with organic molecules. On the first hand, the approach based on pure oligonucleotide can be achieved using double crossover DNA strands¹ or *via* DNA origami.² The second strategy relies on the use of small organic molecules to define the angle in the nanostructures.³ These organic molecules can be introduced in single stranded DNA (ssDNA) during its synthesis or functionalized afterward with functional DNA.

Recently, we reported the synthesis of porphyrin/DNA hybrids by copper-catalyzed *Huisgen* cycloaddition reaction (CuAAC). We synthesized four DNA/porphyrin derivatives (from the mono to the tetra adduct) containing a 14-mer single stranded DNA.⁴ We tested the association of the tetra-adducts with gold nanoparticles, we proved this association but we realized that the formation of double stranded DNA using 14-mer oligonucleotides was not efficient enough under our hybridization conditions. In order to improve the stability and give rise to the formation of 2D nanostructure, we increased the number of bases of our ODN from 14 to 20.

Here, we report on the synthesis of two porphyrin/oligonucleotide polyadducts *via* CuAAC containing two complementary strands (**ODN-1**: 5'-GCA TTG GTA ACT GTC AGA CCU-3' and **ODN-2**: 5'-GGT CTG ACA GTT ACC AAT GCU-3') named respectively **P_n** (n = 1-4) and **P_{nc}** (n = 1-4). The hybrids were characterized by absorption spectroscopy and gel electrophoresis. The two complementary hybrids **P₄** and **P_{4c}** were associated to form a 2D nanostructure and studied by atomic force microscopy.⁵

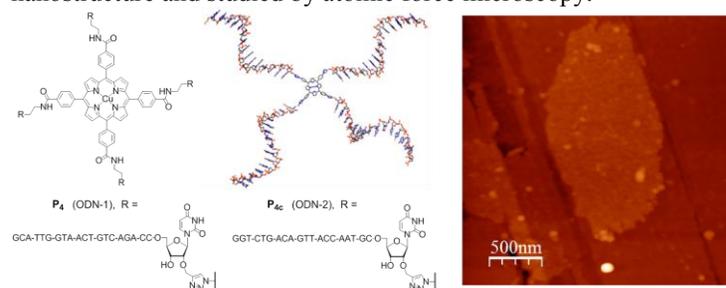


Figure. Representation of the tetra-adduct porphyrin-oligonucleotide hybrids and AFM image of a 2D nanostructure.

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