Role of enabled surface diffusion in ordering DNA Origamis on surfaces

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Programmed molecular self-assembly of DNA has become an established method for the nanofabrication of DNA nanostructures [1]. A huge milestone in self-assembly has been applying DNA Origami [2] to arrange substances like enzymes, nanoparticles, and fluorophores with nanometer resolution [3]. However, the use of scaffold DNA poses a limitation in size for the DNA origami structures as well as some applications that depend on larger DNA nanostructures in micron-scale. For example, surface modifications such as *single molecule contact printing* which applies DNA origami structures as stamps to print patterns of single molecules on pre-activated surfaces, depends on a higher degree of order. A smart approach to achieve large structures with high order for surface modifications is to align those finite Origami structures directly on surfaces, but this requires enabled surface-diffusion after immobilization. It was demonstrated by anchoring origami structures on lipid-bilayers [4] or cations exchange on mica surfaces after immobilization [5]. The latter approach is followed in this project, but will be modified to create densely packed alignments. In an initial experiment, rectangular DNA origamis (Fig. 1), with no preprogrammed interactions for ordering was immobilized in a high density. Due to its geometry, it builds up a compact alignment with a small cluster size of 5 (Fig. 2). Preliminary results will show that a specialized DNA origami design increases density and cluster size and additionally rotational freedom could reduce error rate. Furthermore the method will be generalized to a variety of substrates in order to show surface diffusion assisted assembly of DNA origami on conductive electroactive surfaces, e.g. gold for biosensor applications.

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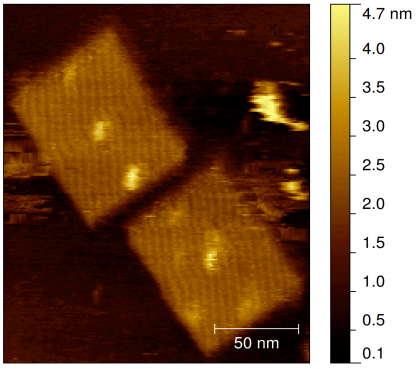

Fig. 1: Rectangular DNA origamis carrying 3 spots in a preprogrammed pattern.

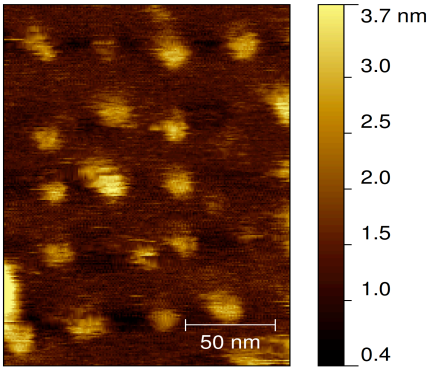

Fig. 2: Rectangular DNA origami structures with 3 spots aligned in a cluster of 5.

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[4] S.*Yuki et al., Nature Communications 6, 805208 (2015).*
[5] *Woo et al., Nature Communications 5, 488910 (2014).*