Self-assembly and optical properties of single molecule polymers on DNA origami

Kurt V. Gothelf, Mikael Madsen, Mette Riis Bakke

Department of Chemistry and iNANO, Aarhus University, Denmark.
Email: kvg@chem.au.dk

We are using DNA as a programmable tool for directing the self-assembly of molecules and materials. The unique specificity of DNA interactions and our ability to synthesize artificial functionalized DNA sequences makes it the ideal material for controlling self-assembly and chemical reactions of components attached to DNA sequences [1]. In particular we are using DNA origami, large self-assembled DNA structures as a template for positioning of materials such as organic molecules, polymers and biomolecules.
In recent years we have developed methods for functionalizing conjugated polymers with multiple DNA strands in a graft type fashion [2-4]. We have prepared long phenylene-vinylene and fluorene polymers and synthesized DNA strands extending from most of the repeat units of the polymers. The polymers self-assemble on tracks of complementary DNA strands extending from DNA origami structures and in this way the routing of the individual polymers can be controlled. By immobilizing fluorescent dyes along the polymer we have investigated the properties of the polymers as single molecule optical wires (Figure 1).

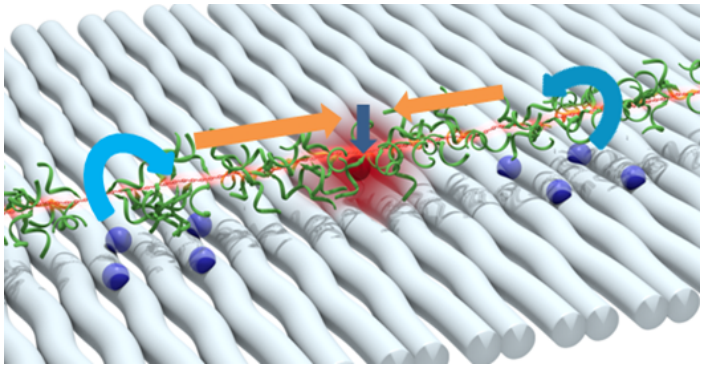

Figure 1: Transfer of excitation energy from a donor dye to an acceptor dye via a conjugated polymer immobilized on DNA origami.

References

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