Towards DNA-Coated Anisotropic Building-Blocks: A Robust Surface Modification Strategy to Functionalize Gold Nanorods with DNA Oligonucleotides

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Abstract

Anisotropic nanoparticles like gold nanorods (Au NRs) are appealing building-blocks for the development of higher-order assemblies with strong plasmon-plasmon interactions and thus, sensing potential. DNA-directed assembly is one of the most powerful and versatile strategies to controllably direct either the self-organization of colloidal nanoparticles [1] or the formation of biocompatible organic-inorganic nanoscale hybrids of complex geometries.[2] In this context, the effective functionalization of Au NRs with DNA is a necessary key step, where the challenge remains in avoiding NR aggregation throughout the DNA-modification process.

In this work we have developed a strategy to functionalize CTAB-stabilized gold nanorods with DNA oligonucleotides while maintaining their colloidal stability.[3] Our approach consists of a ligand exchange process that leads to the careful displacement of CTAB from the Au surface by “thiolated” helper molecules first and by thiolated DNA strands in the last instance. We will present our results on the optimization of the different surface functionalization steps and on the quantification of DNA grafting on the Au NRs’ surface. We will also show that the as-functionalized nanorods are highly stable overtime in high ionic strength media. Taken altogether, our results indicate that our DNA-functionalized Au NRs may be used as building-blocks for DNA-directed (self)-organization.

References

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