DNA coated metal nanoparticles with tailored optical properties

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The unique way metal nanoparticles interact with molecules close to their surface has captured many scientists' interest, especially the ability to enhance otherwise very small optical signals difficult to observe. In this work, gold nanoparticles and nanorods are used as metal substrate for dye-functionalized DNA to study optical signals generated at different metal-dye distances using Raman and fluorescence spectroscopy.

Gold nanoparticles decorated with dye-functionalized DNA were prepared to study for the distance dependence of Raman and fluorescence signals. Rigid double stranded DNA of varying length is used as spacers to control the distance between the dye and the surface. At large enough metal-dye distances, metal-enhanced fluorescence of the dye is expected to occur [1] yielding improved fluorescence quantum yields and shortened fluorescence lifetimes where as at very small metal-dye distances, complete quenching of the dye emission is expected as well as surface enhanced Raman scattering [2]. Such systems can be used as labels for lifetime multiplexing applications and as nanosensors in the case of stimuli-responsive dyes.

A preliminary study has been conducted on 20 nm sized gold nanoparticles and the fluorescence intensity as well as lifetime measurements for 2 different metal-dye distances. Gold nanorods were synthesized to have desired optical properties, according to previously reported methods [3] for metal-dye distance studies. The freshly synthesized nanorods were then coated with DNA and hybridized with dye-labeled DNA for further optical studies. A preliminary study has been conducted on 20 nm sized gold nanoparticles and the fluorescence intensity as well as lifetime measurements for 2 different metal-dye distances.

Funding by DFG (SALSA, part of the Excellence Initiative) and a Marie Curie FP7 Integration Grant (7th European Union Framework Programme) is gratefully acknowledged.

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