

DNA origami based plasmonic nanostructures for surface-enhanced Raman scattering (SERS)

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DNA origami allows for the arrangement of nanoparticles, fluorescent dyes, specific DNA structures (such as aptamers) and proteins into well-defined arrays with nanometer precision [1-3]. Consequently, DNA origami nanostructures have been used to fabricate a variety of plasmonic nanostructures by the controlled arrangement of metallic nanoparticles. Surface-enhanced Raman scattering (SERS) is one of the most promising bioanalytical techniques, capable of single-molecule detection and true multiplexing. DNA origami nanostructures can be used to fabricate intense Raman scattering hot spots between two Au nanoparticles and to place a specific number of target molecules precisely into these hot spots to enable highly sensitive detection of analyte molecules down to the few-molecule level. The basic concept is shown in Fig. 1. By correlating atomic force microscopy (AFM) images with confocal Raman microscopy the number of molecules contributing to the SERS spectra can be precisely determined and controlled. Furthermore, the DNA origami substrates can be used to create more complex plasmonic nanostructures consisting e.g. of three differently sized AuNPs.

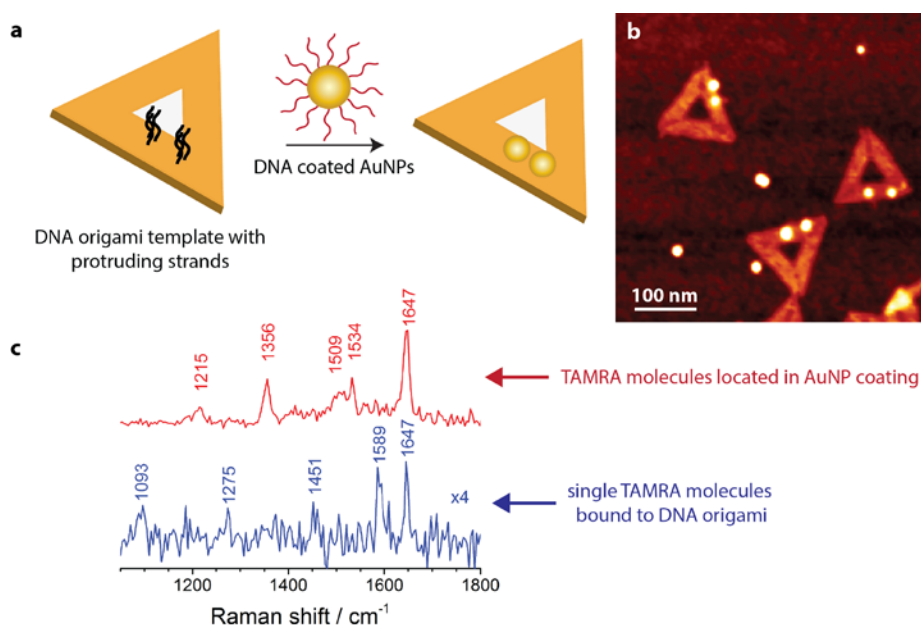


Fig. 1: (a) DNA origami triangles, which serve as a substrate for AuNPs and the analyte molecules, which can be placed at specific positions in-between the nanoparticles. (b) AFM image showing the successful assembly of the AuNP-DNA origami hybrid structure. (c) SERS spectra of TAMRA molecules. Figure adapted from ref. 2.

[1] I. Bald, A. Keller, *Molecules* 19 (2014) 13803.

[2] J. Prinz et al., *J. Phys. Chem. Lett.* 4 (2013) 4140–4145.

[3] L. Olejko, P. J. Cywinski, I. Bald, *Angew. Chem. Int. Ed.* 54 (2015) 673.