New hybrid probes for NIR-SERS sensing

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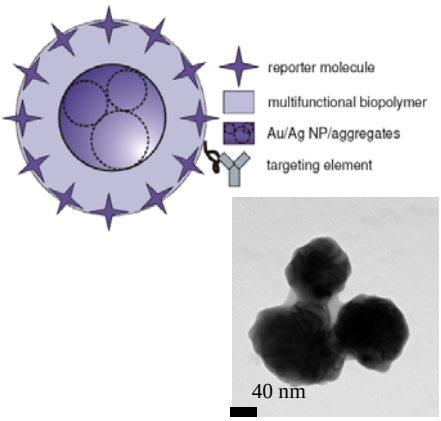
Raman Spectroscopy is an analytical method that offers several important advantages: As a rapid, low-level readout and non-destructive tool, it provides vibrational fingerprints of chemical and biological compounds. Surface-enhanced Raman spectroscopy (SERS), a highly versatile, selective method with which Raman scattering efficiencies can even be enlarged by a factor of ~10^6 in an ensemble, allows more sensitive detection and has attracted considerable interest for the application in sensitive optical detection. Additionally, intrinsic problems such as photobleaching, broad emission profiles and spectral overlapping in multiplex experiments are avoided. High spatial resolution on the nm-scale is provided due to local optical fields surrounding noble metal nanoparticles (NP) which are excited by the incident electromagnetic field. In addition, SERS offers numerous opportunities in the study of spectral changes during molecular interactions in complex biosystems. Such observation is possible by introducing Raman reporter molecules which can, e.g., serve as indicators of molecular binding events. Further, utilization of Raman reporters enables the identification of labelling different SERS probes in multiplexed approaches. We studied the multiplexing capability of different reporter molecules implementing multivariate methods.

Our work is concerned with the design of Au and Ag nanoprobes surrounded by a biopolymer coating, which serves as a scaffold for the covalent and/or hydrophobic linkage of various Raman reporters and targeting units. Stabilization of our BSA-functionalized NP/NA was studied using UV/VIS screening in case of designing biocompatible stable probes for *in vitro* studies in eukaryotic cells. We present first results of hyperspectral mapping analysis providing us information about the cellular uptake, localization and amount of the Raman reporter para-Aminothiophenol (PATP) bound to Au NA inside living 3T3-cells. In the case of our SERS probes, we optimized the number of reporter molecules in order to achieve a good enough SERS identification of our particular probe. Further, we were successful in delivering intrinsic information on composition from the biosystem [1,2].



References:
[1] J. Kneipp et al., *Analytical Chemistry* 77, 2381-2385 (2005).
[2] J. Kneipp et al., *Journal of Raman Spectroscopy* 40, 1-5 **(**2009).