Design and characterization of new SERS substrates for analytical applications

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With surface enhanced Raman spectroscopy (SERS), it is possible to achieve an enhancement of the Raman signals of 10^6-10^8 due to the high local fields provided by metal nanostructures. As a result, SERS combines the advantages of vibrational spectroscopy (for example a high specificity and much information about the molecular structure of the sample) with a high sensitivity.

In the future, continuous and well-characterized SERS sensors could be the basis for a new generation of *very-high density sensing arrays*, which are characterized by a fast read-out at high precision. Possible applications are the identification of agents in the pharmaceutical industry or in the environment. The first and foremost prerequisites for the use of SERS for analytical applications are stable and reproducible gold and silver nanostructures. Until now, there have been very few reports on stability, reproducibility and selectivity of SERS sensors[1].

Our approach for the design of a SERS sensor is the immobilization of metal nanostructures on a glass substrate via appropriate linker molecules, which have a functional group for binding of the nanoparticles. This approach offers the advantages of a simple feasibility and the possibility of structuring and additional functionalization of the nanostructures. By subsequent functionalization with a monolayer of a specific molecule the surface properties can be affected and an unspecific binding of the analyte to the metal nanoparticles is avoided. Furthermore through the functionalization groups for further binding of molecules (e.g. enzymes) are introduced.

First results on characterization and SERS properties of gold and silver sensors will be presented.

References:

[1] A. V. Whitney; J. W. Elam; P. C. Stair; R. P. Van Duyne, *J. Phys. Chem. C* 111, 16827-16832 (2007).