Design and characterization of SERS active surfaces for use in analytical applications

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Planar, nanostructured plasmonic substrates have become a basic tool for applications of SERS to analytical problems [1, 2], as such a substrate permits high reproducibility of spectral signals from an analyte. The use of SERS for analytical applications requires stable and reproducible substrates that are easy to prepare so that they can be generated on-demand, directly in the analytical laboratory. A promising approach is the immobilization of nanoparticles by organo silanes that carry a functional group for nanoparticles binding, e.g. an amino group [1],[2], but the enhancement of such surfaces has been characterized very poorly so far.

Here, we report on the characterization of nanoparticle monolayers from four different types of nanostructures immobilized with two different aminosilanes regarding enhancement, signal stability and homogeneity in the SERS experiment. For the characterization of the properties of the nanoparticles in solution and on the substrate, direct (electron microscopy, scanning force microscopy) and indirect methods (UV/Vis absorption) were used.

By immobilization of two different sized monodisperse gold nanoparticles we could show that in contrast to nanoparticle solutions [3] the immobilized nanoparticles show no dependence of the enhancement on analyte concentration. This makes the surfaces ideal substrates for analyte quantification and promising for the use in microstructured SERS sensors.

References

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