Surface-enhanced Raman scattering on hemoglobin

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Surface-Enhanced Raman Scattering (SERS) has developed into a useful analytical tool, in particular to gain information from biological molecules. Often, noble metal nanoparticles are used as SERS substrates, and high enhancement factors can be achieved. Compared to normal Raman scattering, the high enhancement and the localization to the local electromagnetic field of plasmonic nanostructures could in principle result in new vibrational information of investigated biomolecules, including proteins.

On this poster we present SERS spectra of oxygenated hemoglobin at different excitation wavelengths in the visible and near-infrared using silver nanoparticles. To illustrate the potential of SERS for hemoglobin analysis, the results are discussed in the context of normal Raman spectra under the same experimental conditions. SERS spectra offer different information compared to normal Raman spectra. While the normal Raman data mainly show signals of porphyrin, the SERS measurements give additional spectral information originating from the globin. So far, information about the hemoglobin protein structure is mainly obtained in resonant Raman experiments with excitation wavelengths in the UV-range.[1] In contrast, in SERS we find globin bands as well as additional vibrations of the porphyrin, depending on the excitation wavelength. The contribution of specific porphyrin signals to the spectrum is due to resonance enhancement that occurs in addition to the SERS enhancement affecting both globin and the porphyrin.

Our results have implications for our understanding of the interaction of hemoglobin with silver nanoparticles, in particular the structure of the globin protein.

References

[1] J. Kneipp, G. Balakrishnan, T. G. Spiro, *The Journal of Physical Chemistry B* 108, 15919-15927 (2004).