

CARS microspectroscopy of a stratum corneum model system

P. Nandakumar, A. Kovalev, and A. Volkmer
3rd Institute of Physics, University of Stuttgart, Pfaffenwaldring 57
70550 Stuttgart, Germany
E-mail: a.volkmer@physik.uni-stuttgart.de

In recent years, coherent anti-Stokes Raman scattering (CARS) microscopy has emerged as a novel analytical tool that uses the intrinsic molecular vibrational properties of a microscopic sample as contrast mechanisms through optical microscopy. It has been demonstrated to exhibit high sensitivity, spatial and temporal resolution, noninvasiveness, and three-dimensional sectioning capability. In particular, the possibility of CARS microscopy for spatially and frequency resolved spectroscopic measurements provides a wealth of information in the noninvasive characterization of mesoscopic objects within a complex heterogeneous system (e.g. a biological cell or tissue). As such, multiplex CARS microspectroscopy allows for simultaneous acquisition of the Raman spectra over a wide range of Raman shifts. It allows the chemical identification of unstained molecules on the basis of their characteristic Raman spectra and the extraction of their physical properties, e.g. their molecular structures. In this work, we report on the point-by-point spectral mapping by means of multiplex CARS microspectroscopy of a lipid model system of stratum corneum, the top most barrier on the epidermis that prevents the penetration of external reagents through the skin. Investigations are carried out on mixtures consisting of ceramides, stearic acid and cholesterol, the three main lipid species of stratum corneum. The spectral analysis reveals evidence for the formation of cholesterol-rich domain structures in the electroporated stratum corneum model system.

Multiplex CARS spectral imaging of a Stratum Corneum model systems

