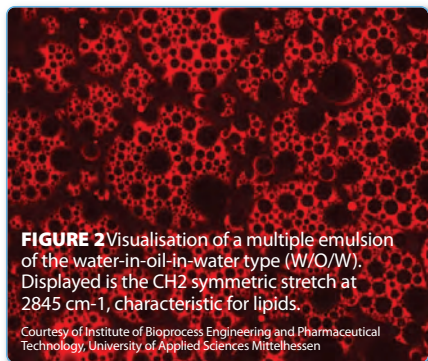# IMAGING LIPIDS IN NATIVE SPECIMEN WITH TCS SP8 CARS – CARS AT VIDEO RATE

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Sophisticated food studies rely mainly on chemical techniques which reveal only a few and often isolated aspects of a sample. As the focus of food science concentrates more on a whole system, like dynamics of lipid components or water in various types of food, more detailed information of these structures is needed. Nowadays it is not sufficient to get information only about the content of a solution or the amount of fat or water in a food sample. Scientists analyse micro- and macrostructures in e.g. chocolate or dairy products or the migration of lipids or water during food processing or storage. The goal is to improve quality, stability and durability of food. Also, subjective properties such as texture and taste are very important.

FIGURE 1 TCS SP8 CARS – the CARS turn-key solution with full functionality of a multi-dimensional confocal platform

CARS (Coherent anti-Stokes Raman Scattering) is a label-free method that visualises the characteristic intrinsic vibrational contrast of molecules. There is no need for any labelling or staining of the specimen. The result is a non-invasive, optical method for analysing samples without disruption of elemental characteristics. In most analysing processes the characteristics of lipids are altered and do not reflect the natural properties of these molecules under natural conditions. With CARS, this drawback can be overcome.

The combination of the CARS technology with the new TCS SP8 (**Figure 1**) confocal platform results in a fully integrated system. This allows an easy and turnkey operation of the system to gain results quickly and reliably. The outcome is highly sensitive imaging at submicron resolution without any staining or altering of the sample. The acquired images contain structural information on internal properties such as lipid composition of food samples.

In consequence, the topology of lipids, their properties or distribution in a given specimen can be obtained. By applying a time lapse experiment, migrations in food samples or solutions containing lipids can be monitored over time, e.g. multiple emulsions of the water-in-oil-in-water type (W/O/W) (**Figure 2**). In this application, it is important to research the sizes, the phase transitions and the distributions of the various shapes on the micrometre scale.

In addition, the Leica TCS SP8 CARS offers the full functionality of a multi-dimensional confocal platform. The turnkey integration of the infra-red laser source allows for multi-photon imaging, thus providing additional contrast using second-harmonic signals, autofluorescence or even extrinsic fluorescence labels as needed. The CARS and multi-photon functionality are supplemented by a broad range of visible lasers up to a super-continuum laser (white light laser) for imaging with maximum flexibility. The entire system design of the Leica TCS SP8 has been optimised for photon efficiency and recording speed. Hence, the TCS SP8 is ideally suited for generation of crisp images with high contrast, even out of weak signals. Furthermore, dynamic processes can be followed at a velocity of up to 428 fps (frames per second), mediated by the new resonant scanner option using 12 kHz line frequency. Thus video rate recording is possible at full confocal resolution.

The TCS SP8 CARS system is Leica's confocal imaging platform with full integration of visible, multi-photon and CARS capabilities with comprehensive upgrade options for upcoming new challenges.

FIGURE 2 Visualisation of a multiple emulsion of the water-in-oil-in-water type (W/O/W). Displayed is the CH2 symmetric stretch at 2845 cm-1, characteristic for lipids.
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