Structured surfactant systems: What NMR can tell us

Claudia Schmidt

Department Chemie, Universität Paderborn,
Warburger Str. 100, 33098 Paderborn
claudia.schmidt@uni-paderborn.de

Surfactants are an important class of chemicals; they are used not only as detergents but also in many other areas, for instance, in cosmetics, pharmacy, and the food industry. In aqueous solution, surfactants form aggregates due to their amphiphilic character. This self-assembly leads to micelles and liquid crystalline phases with a variety of structures. Furthermore, non-equilibrium structures such as vesicles can be formed, for example, due to shear forces applied when mixing formulations. The structure of a surfactant solution has a large influence on its rheological properties. Thus, by tailoring the structure of a solution it becomes possible to control its rheological behavior and to adapt it for processing or application purposes. On the other hand, shear forces may change the orientation and structure of surfactant solutions.

For a better understanding of the relationship between structure and macroscopic properties a detailed knowledge of the structures at equilibrium and under shear is important. Here, NMR techniques can make important contributions. NMR may yield information on the size of aggregates (via relaxation measurements) and allows us to determine phase diagrams (via deuterium NMR spectra of D_2O). By pulsed field gradient NMR diffusion constants can be measured, from which structural information can by derived.

The focus of this lecture will be on NMR investigations of surfactant solutions which contain lamellar or vesicular aggregates. In particular, the role of shear forces in the formation of structures will be discussed [1,2].

[1] Claudia Schmidt, *Rheo-nuclear magnetic resonance spectroscopy: a versatile toolbox to investigate rheological phenomena in complex fluids,* Spectroscopy Europe **26(6)**, 11–14 (2014) (www.spectroscopyeurope.com).

[2] Bruno Medronho, Ulf Olsson, Claudia Schmidt, and Petrik Galvosas, *Transient and steady-state shear banding in a lamellar phase as studied by rheo-NMR,* Z. Phys. Chem. **226**, 1293–1313 (2012).