

Phase behavior of Surfactant-Water systems by time-lapse polarized light microscopy

Rosalia FERRARO, University of Naples Federico II

Concentrated aqueous solutions of surfactants pastes are widely used in industrial productions. One of the most common anionic surfactants is Sodium Lauryl Ether Sulfate (SLES). Depending on the SLES-Water composition, surfactant nano-molecules can assume different morphologies, such as micellar phases (30%w), cubic structures (~60%w), or lamellar liquid crystals (>60%w), which are characterized by nanoscale ordered structures [1, 2]. Beyond concentration, temperature also plays a key role. For this reason, we investigated the temperature concentration phase diagram of the SLES-water system coupling advanced imaging analysis with rheological characterization. Using Time-lapse microscopy, the dynamic evolution of the phase changes as a function of temperature was analyzed for samples with different SLES concentrations. Images acquired using crossed polarizers were analyzed to measure the mean light intensity and identify temperature and concentration ranges of isotropy/anisotropy, due to different system morphology. Rheological characterization was also performed to study the fluid viscosity and moduli as a function of the surfactant concentration and temperature (in the range 35-72%wt and 25-60°C). The Optical and Rheological results have been finally compared to obtain a complete nanoscale characterization of the phase diagram.

[1] R.I. Castaldo, R. Pasquino, M.M. Villone, S. Caserta, C. Gu, N. Grizzuti, S. Guido, P.L. Maffettone, V. Guida, Dissolution of concentrated surfactant solutions: from microscopy imaging to rheological measurements through numerical simulations, *Soft matter* 15(41) (2019) 8352-8360.

[2] A. Capaccio, S. Caserta, S. Guido, G. Rusciano, A. Sasso, Dissolution of a surfactant water lamellar phase investigated by combining time-lapse polarized light microscopy and confocal Raman spectroscopy, *Journal of Colloid and Interface Science* 561 (2020) 136-146.