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

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1. ABSTRACT

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 molecules can assume different morphologies, such as micellar phases (<30%w of SLES), hexagonal liquid crystals (>30%w), cubic structures (~60%w), or lamellar liquid crystals (>60%w)[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 microstructural characterization performed by Electron Paramagnetic Resonance (EPR) using suitable molecular probes, and 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. EPR results allowed the supramolecular organization of the various phases to be investigated. 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, EPR and Rheological results have been finally compared to obtain a complete characterization of the phase diagram.

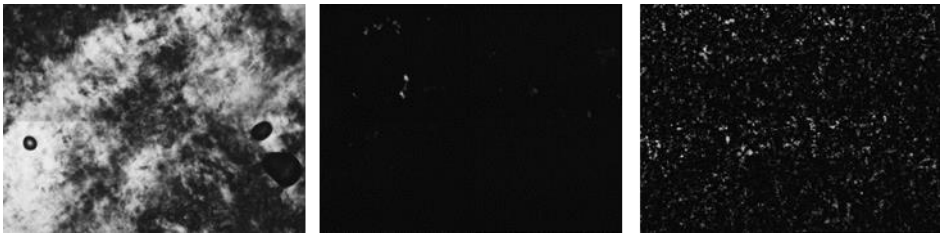

Figure 1. Images of SLES-Water (50-60-72%wt, T=25°C) acquired of using crossed polarizers showing the different morphologies depending on the composition.

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