

Shear-induced transformation of polymer-rich lamellar phases to micron sized vesicles

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Shear-induced structures in ternary or quaternary surfactant containing systems have been widely investigated. There are structures which are only stable during shear (L3 to L α) and those who are metastable like multi-lamellar vesicles (MLV). In the presentation the focus lays on the metastable multi-lamellar vesicle structure, which can be transformed to from a lamellar phase[1] containing four components: A) D₂O B) *o*-xylene C) EO₂₁-PO₄₇-EO₂₁ (Pluronic® PE9400) D) C₈TAB. First, we investigated the phase behaviour with different methods. Optical observation was used to find the one-phase regions in the system. The microstructure was then investigated with small-angle X-ray scattering (SAXS), Diffusion ordered spectroscopy (DOSY) NMR and with electric conductometry. The system exhibits a lamellar phase at a specific composition and it has clearly been identified with SAXS due to the very prominent structure factor (*Bragg Peaks*). Hence, the lamellar phase was sheared with a rheometer and the system exhibits a rheopex behaviour which confirms the transformation of the lamellar phase to vesicles. Additionally, the rheometer was equipped with a *rheo*-small-angle light scattering (SALS) module which allows the direct determination of the size of the shear-induced vesicles during the shear process[2]. The vesicle radius nicely follows the predicted linear dependence on $\dot{\gamma}^{-\frac{1}{2}}$. Also, the existence of MLVs has been proven with different optical microscopic methods (Polarized light-, Phase-contrast-, Difference interference contrast microscopy) and with *cryo*-scanning electron microscopy (*cryo*-SEM).

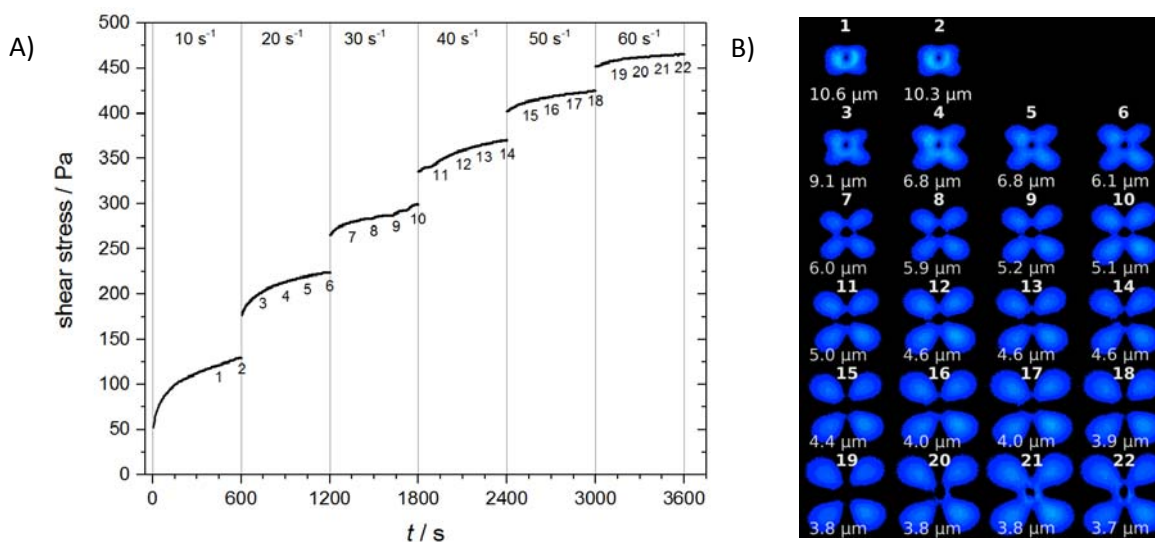


Figure 1. A) Shear-stress increases with time and shear-rate and shows rheopex behaviour. B) *rheo*-SALS depolarized scattering intensities at different times and shear-rates including the corresponding sizes (numbers refer to 1A).

[1] Diat O., Roux D., Nallet F., *J. Phys. II France*. **3** (1993), 1427-1452.

[2] Samuels R., *Journal of Polymer Science Part A-2: Polymer Physics* **9** (1971), 2165-2246

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