Abstract

Subject of the investigation is a study of structure and dynamics of complex fluids, i.e. structured fluids. The analysis was performed using time resolved electric birefringence (TEB). Amplitudes yield the Kerr constants B, relaxation times τ_E are determined from the birefringence decay at the pulse end. Additionally to the TEB the time resolved electrical conductivity is measured in oil-continuous systems. As main focus of this study the effect of an electrical field on bicontinuous structures is characterised.

As a model system the bicontinuous, sponge-like L_3-Phase of the system Water/octan/$C_{10}E_4$/(dekanol) is examined. The dependence of B and τ_E on the surfactant volume fraction ϕ_C is determined for the water- and oilcontinuous side. For the Kerr constants the scaling $B \sim a_P \cdot \phi^{-2} - c_P \cdot \phi^{-1}$ is proposed. The prefactors a and c show a distinct increase with d. The relaxation times τ_E exhibit a ϕ_C^{-3}-dependence for all systems investigated. The field jump experiments in the oil-contuinuous L_3-phase show ohmic behaviour in the time resolved electrical conductance. This leads to the conclusion, that at the field strengths applied (up to 10 kV/cm) the topology of the sponge structure is maintained. A viscoelastic model is presented for the explanation of TEB in bicontinuous microemulsions. With this new approach the bending moduli of surfactant membranes (Helfrich model) can be compared.

TEB measurements and the interpretation in the line of the presented concept are also used in explaining the influence of coblockpolymers ("efficiency booster") on bicontinuous microemulsions.

Furthermore the cosurfactant induced conductance percolation of alkylpolyglycosid (APG) microemulsions was analysed for the first time. Through variation of surfactant or water content the cosurfactant induced percolation was followed through TEB-measurements. Kerr-constant B und relaxation time τ_E scale with the distance from the percolation point. This is attributed to the increase of the characteristic system length from the transition of a low-conducting water-drop-emulsion to an high-conducting percolated structure. In contrast to the analysed spongelike systems the percolated structure exhibits a distinct increase of electrical conductance in the electric field (non-ohmic behaviour).