Abstract

Polymeric materials are ubiquitous and unrivaled with regard to their material properties. The refinement of their structure on the nanoscale can lead to amazing physical and chemical properties, resulting in new applications in thermal insulation or lighting. An ideal tool for generation of such materials are microemulsions, which act as templates for polymeric structures. In addition, microemulsions formed with a supercritical fluid as the oil component are the basis for the Principle of Supercritical microemulsion expansion (POSME) developed by *Strey* et al.. However, most monomers are incompatible with water, and thus the formulation of water-free microemulsions was one goal of this work. In systematic studies of the phase behavior of microemulsions of the type sulfolane – hydrocarbon – nonionic surfactant it was shown that these systems behave similarly to aqueous microemulsions. Small angle neutron scattering measurements (SANS) show that sulfolane microemulsions - albeit weakly - are structured. Based on these findings, for the first time expandable sulfolane microemulsions with electrically conductive monomers were formulated. The use of a highly porous hole conductor layer prepared by the POSME process in an organic light emitting diode (OLED) application resulted in a significantly improvement in the coupling of light and thus an 80% increase in the efficiency of the device. In the second part of this work, a new method to fixate the nanostructure of microemulsions through melamine-formadehyde prepolymer was pursued. In order to slow the kinetics of reorganization, amphilphilic block copolymers were embedded into the interfacial film, which increased the rigidity of the amphiphilic films. Time-resolved small angle neutron scattering measurements showed, next to the formation of superstructures, the retention of the initial structure. Thus under optimal conditions, transparent polymers were produced with a feature size of 10-40 nm.