

Abstract

Microemulsions are gaining importance as templates since a great deal is known about how to tune the structure and the size of the domains. The concept for the synthesis of a nanoporous polymer via microemulsions is well known, namely "arresting" the oil (water) phase and polymerizing the water (oil) phase. However, a general route for the 1:1 replication of the bicontinuous structure has not been found yet. A new approach to achieving this goal entails arresting the oil (aqueous) phase by gelling it, *i.e.* by forming an organogel (a hydrogel), and polymerizing the aqueous (oil) phase. To start off the study the ternary base system water - n-dodecane - Lutensol®A05 (technical-grade nonionic n-alkyl polyglycol ether with an average molecular structure of C_{13/15}E₅), the organogelator 12-hydroxyoctadecanoic acid (12-HOA), and a polymerizable aqueous phase containing the monomer N-isopropylacrylamide (NIPAm) and the cross-linker N,N'-methylene bisacrylamide (BisAm) were chosen. To understand how the addition of 12-HOA to the oil and NIPAM + BisAm to the aqueous phase, respectively, influence the phase behavior and thus the microstructure, the phase diagrams were studied after each compositional change. The respective phase diagrams are presented and discussed in terms of their potential use as templates. The microstructure of the gelled microemulsion was studied by self-diffusion NMR, SANS, electrical conductivity, and TEM measurements based on which a suggestions for a possible structure of the gelled microemulsion is made. After the bicontinuity of the gelled microemulsion was confirmed suitable systems were polymerized. The resulting polymer hydrogels were investigated by SANS measurements.