Influence of surface hydrophobicity on the structure of bicontinuous microemulsions at solid surfaces

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The increasing use of bio-inspired surfactants in microemulsions leads to an increasing interest in these thermodynamically stable self-assembled structures of oil, water and amphiphiles. Although the interaction between such microemulsions and solid surfaces is essential for many desired functionalities, only few is known about local structure and dynamics of a microemulsion in the vicinity of a solid surface. In particular, the influence of surface hydrophobicity, surfactant adsorption, bending elasticity of the amphiphilic interface and related properties have to be investigated in future studies. Especially bicontinuous microemulsions are of great interest and the physico-chemical properties of these structure in the bulk phase were studied in many surfactant systems but much less is known about the behaviour or changes of this structure in the presence of a solid surface. We used neutron reflectometry to resolve the structure of the interface between the sugar surfactant based microemulsions and hydrophilic and hydrophobic solid surfaces. Using an oscillating profile of the neutron scattering length density of the complex fluid in the vicinity of the solid silicon surface we found domain sizes and correlation lengths vertical to the surfaces which are different from the corresponding bulk phase values. While these length scales are comparable in the case of bulk phase and at the hydrophilic surface significant changes occur in case of the hydrophobic surface indicating a structural change induced by the presence of the hydrophobic surface. Additionally, we discuss these reflectivity measurements in comparison with complementary measurements addressing wetting properties at different oil-water ratios at hydrophilic, -phobic and partially hydrophobic surfaces.