

A bending elasticity approach to the three-phase coexistence of microemulsions

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In mixtures of water, oil, and surfactant, a microemulsion phase with a bicontinuous microstructure may coexist with water and oil excess phases. A common theoretical description of microemulsion properties is based on the energy of the curved bending elastic interface. The aim of the article in hand is to model the microstructures and phase behavior of microemulsions in the vicinity of the three-phase region. To this end, we compare the energy of several microstructures as function of volumetric constraints and preferred curvature parameters. Two major developments were necessary to do so: i) A new bending energy function is introduced capable of explaining the coexistence of the bicontinuous microemulsion with both water and oil. ii) An analytical geometric model of bicontinuous structures with variable volume ratios of the two domains is presented suitable for computing the local curvatures over the whole interface.

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