

Relation between bending modulus and spontaneous curvature in DGI/SDS/D2O system

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A non-ionic surfactant, n-dodecyl glyceryl itaconate (DGI), self-assembles into bilayer membranes in water having a spacing distance of sub-micrometer in the presence of small amounts of ionic surfactants, and forms multi-lamellar structure which indicates beautiful iridescent color because of Bragg diffraction. We have found that the repeat distance between the bilayers distributes in the scale range between 130 nm (red) and 180 nm (blue) in the suitable concentration range of ionic surfactant and it decreases with increasing the concentration (J. Colloid Inf. Sci. 305 (2007) 308). In order to understand fundamental question why this system maintains long repeat distance on the order of 100 nm, we have studied on membrane dynamics in the DGI/SDS/D2O system. We found that the membrane dynamics can be described very well by the theory of Zilman and Granek (PRL 77 (1996) 4788) and bending modulus κ was increased from 20 kT to 40 kT with increasing the concentration of SDS (decreasing of repeat distance) as shown in Fig. 1. Through other experiments on direct observation of multi-lamellar structure in our previous study, we found that self-assembled DGI forms giant onions consisted of the stacked DGI bilayers and the radius of curvature is changed between 10 (higher SDS concentration, onion structure) and several hundred micrometer (lower SDS concentration, flat onion structure). The relation between the spontaneous curvature and the bending modulus would give us a clue to understand the question.

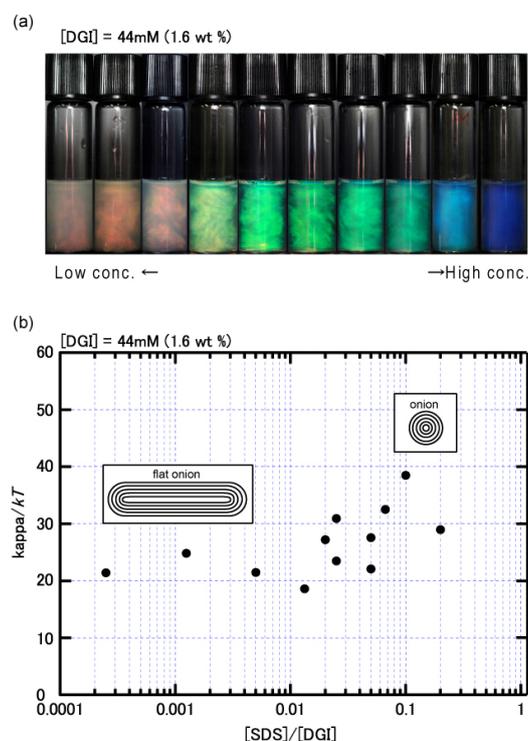


Fig. 1. Iridescent color of DGI/SDS/D2O system (a) and dependence of bending modulus κ on SDS concentration. The insets: schematic representation of onion structures consisted of stacked layers at lower (left) and higher SDS concentrations (right).