GEL-LIKE STRUCTURES OF LONG MIXED WORMLIKE MICELLES

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Over the past few decades, there has been a great deal of interest in the aqueous self-assembly of surfactant molecules into giant wormlike micelles (WLMs). These cylindrical aggregates undergo reversible breakdown processes and in favorable cases can grow up to few tens of micrometers that is comparable with the length of high molecular weight polymer.
Rheometry, small-angle neutron scattering, and cryo-transmission electron microscopy were combined to investigate the structure and properties of mixed WLMs of zwitterionic and anionic surfactants. This system demonstrates the formation of giant linear long-lived WLMs, which even at extremely low surfactant concentration reach a sufficient length to entangle with each other and form a three-dimensional temporally persistent network. Stability of these micelles can be due to electrostatic attraction between the headgroups of the anionic and zwitterionic surfactants and favorable volume/length hydrophobic ratio in the surfactant mixture. Heating of these systems leads to the transition of temporally persistent network with predominantly elastic properties into transient network exhibiting viscoelasticity, which is due to the shortening of long-lived WLMs. At increasing surfactant concentration, the long-lived linear micelles transform into fast-breaking branched micelles, which is due to the screening of electrostatic interactions by salt released from the dissociated surfactant molecules. The transition results in the drop of viscosity and approaches the system to the behavior of Maxwell fluid with a single relaxation time.
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