

Dynamics of Amphiphilic Systems Probed by Highly Time-resolved SAS Experiments

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Amphiphilic molecules form a large variety of self-aggregating structures that are highly dynamic with time scales ranging from μs to weeks. Often morphological changes can be triggered by mixing with other surfactants, additives, or solubilisates. In our experiments rapid mixing was studied by coupling the stopped-flow technique to high-flux SANS/SAXS instruments which allows to obtain detailed structural information with a time-resolution of 5-50 ms. By this method a large variety of different structural transitions were investigated, e. g. the formation of unilamellar vesicles by admixing oppositely charged surfactant or a cosurfactant. For both cases slow formation of monodisperse unilamellar vesicles is observed that takes place in a way purely governed by diffusion. Both, kinetics and the final structure depend strongly on the electrostatic conditions of the system. In other experiments the disintegration of micelles when mixing with a bad solvent was followed, which passes through a minimum aggregation stage before smaller micellar structures are reformed. This applies also to much larger block copolymer micelles of the PIB-PAA type. Their response to changes of ionic strength and also their complexation with oppositely charged polyelectrolytes was studied. For all cases the details of the transformation can be studied and in particular it is possible to identify intermediate structures, a point which is very important for a systematic control of the dynamics of self-aggregating systems.

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