Center for Molecular and Engineering Thermodynamics

CMET Seminar:

- Wednesday, December 10, 2008
- 1:30 P.M.
- 366 Colburn Laboratory

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"Investigation of the Dynamics of Self-aggregating Systems by Means of the Stopped-flow Technique"

Self-aggregating systems exhibit a large variety of different structures that depend mainly on molecular structure and concentration of the amphiphile, and on external parameters such as temperature, pH or ionic strength. Typically self-aggregating structures are highly dynamic species where the characteristic times for structural reorganisations may range from μs to weeks. For a comprehensive understanding of such complex amphiphilic systems, not only the investigation of the static phase behaviour is required but also the knowledge of their dynamics is a central factor. This even more so as in many circumstances self-aggregating systems are not in equilibrium under application conditions.

Morphological changes in amphiphilic systems can often be triggered by mixing with other surfactants, additives, or solubilisates. In our experiments, rapid mixing was done by the stopped-flow technique and followed with turbidity, conductivity, or fluorescence detection or by coupling it 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 variety of different structural transitions has been investigated, e.g. the formation of unilamellar vesicles by admixing oppositely charged surfactant or a cosurfactant, solubilisation processes in microemulsions, formation of nanoemulsions, disintegration processes of micelles in bad solvents, or the formation of interpolyelectrolyte complexes, IPECs by admixing oppositely charged polyelectrolytes with charged block copolymer micelles of the polyisobutylene-b-polyacrylic acid (PIB-PAA) type. These processes were followed in structural detail and especially with respect to intermediate, non-equilibrium structures involved. Another central aspect is the dynamics of solubilisates in amphiphilic systems that can also be studied by this method. In general, it is to be expected that investigations of the dynamics of structural transitions in amphiphilic systems will become of increasing importance as in many of their applications they are not present under equilibrium conditions and since dynamical aspects of self-aggregating systems are often not considered in thorough detail.

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