STRUCTURAL AND VISCOELASTIC PROPERTIES OF MOLECULAR AND PARTICLE MONOLAYERS AT THE AIR-WATER INTERFACE

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The structural and viscoelastic properties of monolayers at the air-water interface are of substantial interest from a scientific point of view, as well as of paramount importance for technological applications from soap films to surface coatings.
We currently investigate two classes of materials for such monolayers, namely a) semifluorinated alkanes and b) colloidal particles.

a) Semifluorinated alkanes:

The molecules of interest are linear alkanes, which carry in one half of the molecular chain fluorine atoms instead of hydrogen. Due to the incompatibility of the fluorocarbon and hydrocarbon sections, such molecules are considered amphiphobic and tend to locally phase separate into intriguing 3D and 2D structures. This intrinsic structuring capability is anticipated as novel building motif in supramolecular architectures.
For this purpose it is of fundamental importance to understand the structural and dynamic behaviour of these molecules, which we try to assess in monolayers at the air-water interface of a Langmuir trough in combination with an interfacial stress rheometer (ISR). While the structural organization was investigated on the water by neutron reflectivity and after transfer to solid substrates by atomic force microscopy, the rheological behaviour was studied for the floating Langmuir film by the ISR.

b) Colloidal monolayers:

Colloidal particles can be used to tailor the rheological properties of interfaces (like in Pickering emulsions). However only limited information is available in the literature on the viscoelastic behaviour of such systems. This work reports on compression and surface shear measurements of colloidal particles monolayers by ISR, and on novel preparation methods for solid-supported colloid films of single particle types or binary mixtures.
In the compression experiments it was found that the b oth the chemical composition of the particle surface and the pH of the subphase influence the 2D packing and interfacial behavior of particles. When bidisperse colloid mixtures composed of small and large particles were simultaneously spread at the air-water interface, intriguing 2D periodic packing structures were observed after compression and transfer to solid supports. The specific packing geometry depended on the number and size ratio between the large and the small spheres, and by controlled variation different stoichiometries and particle arrangements could be achieved.

The results of these investigations for both systems will be presented.