International Graduate Research Training Group 1524
– SSNI –
Self-Assembled Soft-Matter Nanostructures at Interfaces

Tuesday, March 21th, 2017, 16.15h

Technische Universität Berlin
PC-Building, Room PC 203
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„Unique Colloidal Systems from Simple Components – Utilization of 2D Phase Transition –“

This talk includes variety of unique colloidal events, such as wetting transition to a molecularly thin film in equilibrium with oil droplets, spontaneous merging and splitting of oil droplets at the air-water interface, solid monolayer and bilayer formation in cationic surfactant - alkane mixed adsorbed film, and the switching of the oil-in-water emulsion stability. All these events can be realized by commercial cationic surfactants, paraffin oil (alkanes), and water with the aid of two dimensional phase transitions.

In general, the adsorbed film of amphiphiles have three different physical states which respectively correspond to two-dimensional gas, liquid, and solid phases. If the 2D gas-liquid transition of cationic surfactants is occurred at the air-water interface, droplets of liquid alkane placed on the water surface undergo the wetting transition by the gain in the mixing entropy in the adsorbed film. The wetting transition simultaneously induces droplet splitting which requires spontaneous increase in the air-oil-water 3-phase contact. The latter events suggests that the thermodynamic stability of 1D system (3-phase contact) changes at the wetting transition and is related to the sign of line tension.

In most cases, the electric and/or hydration repulsions between head groups hinder the formation of close pack monolayer, therefore, the 2D solid film is limited for sparingly water-soluble nonionic amphiphiles such as long-chain alkanols. We utilized the mixed adsorbed film of cationic surfactant and alkane occurring as a result of above mentioned wetting transition to obtain the 2D solid film, where the penetrated alkane molecules enhance the lateral van der Waals attraction between hydrophobic chains with keeping the distance between cationic surfactant ions. The character of the solid film depends on the relative lengths of the hydrocarbon chains of the surfactant and alkane. For similar chains, the solid film is a monolayer type whereas an unusual bilayer film was formed in some cases.

In the last part of the talk, I will briefly mention the application of the 2D liquid-solid phase transition to control foam and emulsion stabilities.

We cordially invite everybody who is interested.

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