

## Indication for (negative) charges at the air/water interface of foam films and wetting films

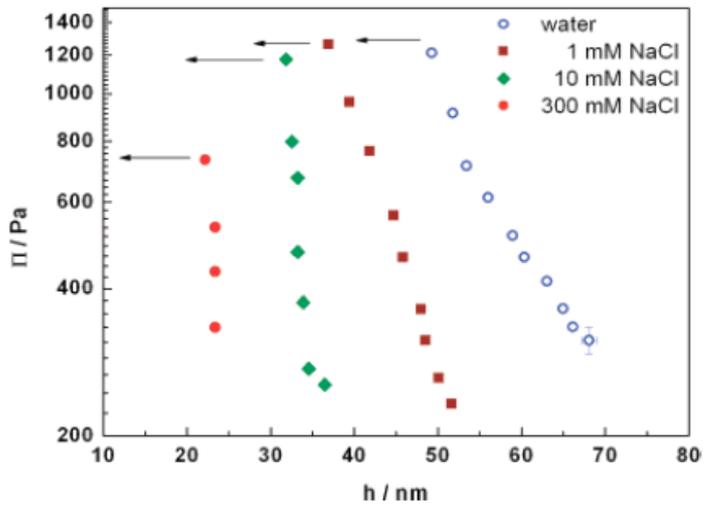
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The (de)stability and functionality of thin liquid films plays an important role for processes in technical applications, like foaming, emulsification and flotation. The forces between the opposing interfaces depend on the composition of the film interfaces and of the film fluid. In the present paper the sum of interactions between the film surfaces is determined quantitatively by the disjoining pressure isotherm (disjoining pressure vs. film thickness) and it is measured by varying the outer pressure in a so-called thin film pressure balance (TFPB). Usually, this apparatus is used for disjoining pressure measurements at free-standing foam films (air/liquid/air). Freestanding symmetric (foam) films containing non-ionic surfactants are electrostatically stabilized. With increasing surfactant concentration or ionic strength (by addition of salt) the films become thinner and even unstable. Of course, the sign of interfacial charges cannot be easily determined by force measurements at *symmetric* films. Therefore we extended our TFPB studies to asymmetric wetting films (air/liquid/solid) [1], which gives the opportunity to fix the charge of one of the interfaces. In order to modify the interactions within the wetting film the solid surface was pre-coated with polyelectrolytes of different charge. Water films in presence of  $10^{-4}$  mol/l NaCl are stable against negatively charged interfaces like bare Silicon at pH 5 – 6 or against surfaces coated with negatively charged polyelectrolytes. The films become thinner and less stable with increasing ionic strength. Hence, the results give a clear evidence for negative charges at the free air/water interface [2]. The surface charge at the air water interface is changed by the addition of surfactant molecules and water insoluble amphiphiles of different charge. The results support the hypothesis of negative charges at the air water interface. The origin of negative charges at the air/water interface is not clear so far, but first experiments on pH influence show that the film thickness increases with increasing pH. This indicates an excess of  $\text{OH}^-$  ions at the air/water interface.

Contact angle measurements show that hydrophobic interaction can be neglected [3].

1. R. v. Klitzing, Adv. Coll. Interf. Sci., 2005, **114/115**, 253.
2. K. Ciunel, M. Armelin, G.-H. Findenegg, R. v. Klitzing, Langmuir, 2005, **21**, 4790.
3. K. Hänni-Ciunel, G.-H. Findenegg, R. v. Klitzing, Soft Materials, in press.



*Water film against bare Silicon wafer: Disjoining pressure vs. film thickness at different salt concentrations*