DISTORTION OF SURFACTANT LAMELLAR PHASES WITH PARTICLES AND ROUGH INTERFACES

Adrian R. Rennie, Uppsala University
Adrian.Rennie@physics.uu.ser Shirin
Nouhi, Uppsala University
Maja S. Hellsing, Uppsala University

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Even simple liquid crystal phases of surfactants display a rich variety of behavior and the understanding of the physical principles of factors that cause changes is important. It has been suggested recently that defects in liquid crystals can be important in respect of biological function of cells[1]. Inserting large colloidal particles even at low concentrations is known to perturb strongly the lamellar phases of non-ionic surfactants[2]. Our recent work has explored the difference between small perturbations of the order of the lamellar spacing and larger distortions that may primarily change the curvature and geometry by comparing effects of different size particles and by observing the modifications due to roughness in the proximity of solid/liquid interfaces. The interplay of thermal fluctuations as described by Helfrich[3] that stabilize these phases and the perturbations is significant. For example both the spacing and orientation are modified with temperature and roughness near an interface. Studies of bulk and near surface behavior will be reported and discussed in terms of theoretical ideas.

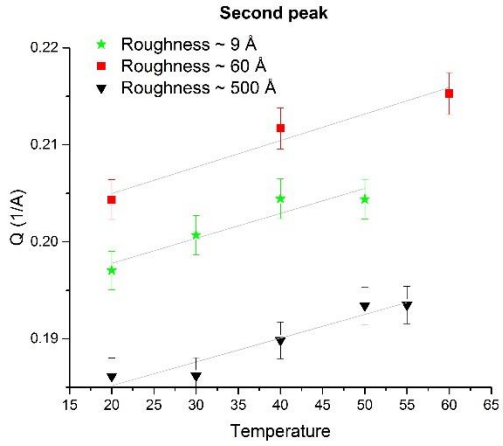

Figure 1. Reflection measurements of average interlamellar spacing for $C_{12}EO_5$ 55% in water (D_2O) measured near a silica surface measured with neutron reflection

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[1] L. S. Hirst, G. Charras, 'Liquid crystals in living tissue' Nature, 544, (2017), 164-165. T. B. Saw et al. 'Topological defects in epithelia govern cell death and extrusion' Nature 544, (2017), 212-216.

[2] See e.g. M. Imai, Y. Suganuma, K. Nakaya, S. Komura, 'Surfactant mesophases mediated by colloidal particles' J. Phys.: Condens. Matter 17, (2005), S2929-S2935.

[3] W. Helfrich 'Elastic Properties of Lipid Bilayers: Theory and Possible Experiments' Z. Naturforsch. C. 28, (1973), 693-703