P123 Adsorption at a Solid-Liquid Interface

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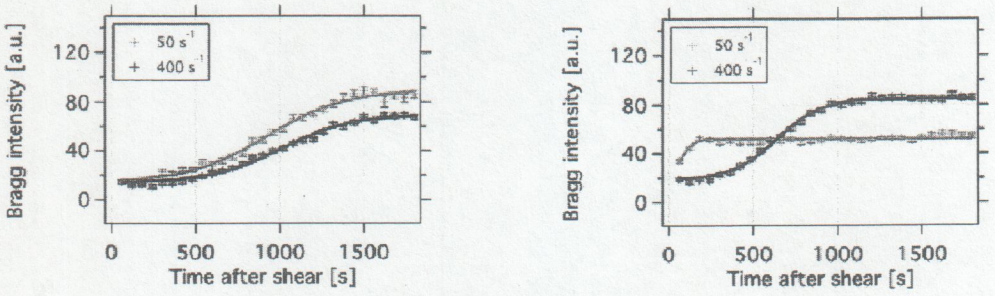
Surfactants from tri-block copolymers are well known for the reduction of surface tension or friction at an interface [1]. We investigate the tri-block copolymer Pluronic® P123 consisting of a central part of 70 propylene oxide (PO) units terminated by two end groups of 20 ethylene oxide (EO) units (EO_{20} - PO_{70} - EO_{20}). In concentrated solutions above 27 weight percent (wtp) and at intermediate temperatures the micelles self-assemble into crystalline structures [2].

In addition we found a near surface crystallization for a diluted P123 system below the critical temperature and concentration for bulk crystallization. Different chemical surface treatments (hydrophilic or hydrophobic) influence this near-interface ordering. The initiation of crystal growth is preferred at an attractive interface [3], whereas no layering of micelles is observable for a hydrophobic coating. The buildup of a Bragg peak at $Q \approx 0.05$ Å^{-1} observed in reflectometry provides evidence for a micellar layering at the surface. We note, that this dense surface structure is present under conditions where there is no bulk crystallization. To access the stability of the surface layer, we have studied the destruction and the kinematic recovery of this surface layer under shear. To this end we have built a cone-plate shear device suitable for in-situ neutron reflectometry. The recovery of the adsorbed micellar layer in dependence of a previously applied shear rate, temperature and polymer concentration yields a nucleation time for layer growth. In addition, the structural fidelity of the adsorbed layer system is elucidated by the integrated Bragg intensity [4].



Integrated Bragg intensity after the cessation of shear (50s-1 and 400s-1) of 1 wtp P123 at 48° C (left panel) and 64° C (right panel).

REFERENCES

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