Beitrag ID: **23** Typ: **Poster**

Adaptation of polymer surfaces

Montag, 8. November 2021 17:55 (20 Minuten)

Polymer surfaces can adapt to liquids in many ways: Liquid can penetrates into polymer layers, polymers can reorient, the liquid induces a chemical reaction and many more [1]. These changes in physical-chemical properties at the interface to the liquid may influence drop shape, velocity, advancing angle and receding contact angle. The aim of our work is to investigate the role of adaptation kinetics for the dynamic contact angles and to compare the results to theory [1]. Therefore, we build up a tilted-plate setup allowing us to measure dynamic contact angles, drop velocity etc. Here, we will discuss results of adaptation processes of a variety of polymer surfaces:
(a) The adaptation of a random copolymer made from styrene and acrylic acid (PS/PAA) is mainly given by the reorientation of polymer segments at the liquid interface [2, 3].
(b) The adaptation of the pH-reactive poly (methyl methacrylate-co-8-quinolinyl-sulfide-ethyl acrylate) surface is attributed to the splitting off a hydrophobic group, leading to a more hydrophilic surface. At the same time, the hydrophobic group can act as surfactant for the drop changing the liquid air interface tension. In addition, charge deposition of the sliding drop alters the forces acting on the drop [4].
(c) The adaptation of poly(N-isopropylacrylamide) (PNIPAM) to water lead to a water tail left behind the sliding drop, which can be caused by polymer reorientation at the interface.
(d) In the wetting of cross-linked polydimethylsiloxane (PDMS), we observed different modes of wetting: One with a relatively low contact angle hysteresis and one with a larger hysteresis. We conclude that adaptation of the solid–liquid interface is caused by trapped oligomers in the polymer matrix [5].

References:
[1] H.- J. Butt et al, Langmuir 2018, 34, 11292–11304
[2] X. Li et al, Langmuir 2021, 37, 1571–1577
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[4] X. Li et al, submitted to Nature Physics
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Sitzung Einordnung: Poster session