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Dynamic wetting and dewetting processes on adaptive surfaces

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When a droplet is sliding on surfaces, adaptation of surfaces leads to changes of the dynamic contact angles [1, 2]. Hereby two adaptation processes play a role: (i) the adaptation of the surface upon bringing it in contact to the drop (wetting) and (ii) the adaptation of the surface after the drop passed and the surface is in contact with air again (dewetting). In order to study both adaptation processes, we investigated samples made from polystyrene (PS)/polyacrylic acid (PAA) random copolymers by using a tilted-plate method, florescence microscope and by sum-frequency generation spectroscopy (SFG) [3]. For the wetting process, the advancing and receding contact angles of water droplets decreased when PS/PAA surface adapted to water. Here, both water diffusion and polymer reorientation play a role in the adaptation process, which were verified by florescence microscope measurement and SFG measurement respectively. For subsequent droplets, the sliding velocity decreased which indicates a permanent adaptation. Only by heating the adapted surface over its glass transition temperature (Tg), restored the surface. After this treatment, the droplets reached again the velocity of pristine samples. SFG result indicated that only heating can surface signal recover. Thus, reorientation of the PS-PAA copolymer at the surfaces dominates the dewetting process.

Reference:
[1] H.- J. Butt et al, Langmuir 2018, 34, 11292–11304
[2] X. Li et al, Langmuir 2021, 37, 1571–1577
[3] X. Li, M. Encheva et al, submitted to Macromolecular Rapid Communication 2021

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