

Phase Separation in Wetting Ridges of Sliding Drops on Soft and Swollen Surfaces

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Drops on soft substrates can induce capillary-mediated phase separation of free polymer chains (oligomers) in wetting ridges. The separation is particularly interesting for moving ridges as the material makeup in the ridge governs friction dissipation and, hence, the drop dynamics. In this talk, I present drop-sliding experiments on soft PDMS gels (3-5 kPa) swollen with oligomeric silicone oil (10 to 16 times the dry network volume). The separation of oligomers at the ridge tip is resolved directly in time and space with confocal microscopy, and the differing phases (oligomers and gel) are discerned with differing fluorescence tags. We find that the two phases (oligomers and gel) separated to different degrees, depending on the sliding speed and the amount of swollen oil. A diffusion-advection model that considers the chemical potential in the respective phases is developed and validated with experimental data. The model helps to explain I) the degree of phase separation, and II) the mobility of the silicone oil in the PDMS network.

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Sitzung Einordnung: Short Talks