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Stimulus-Induced Wetting of Polymer Brushes with Lipid Vesicles: Experimental Challenges and Perspectives

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Adhesion of biological cells and lipid vesicles shares common features with wetting droplets. The main difference from the droplets of simple liquid is that the deformation is not only driven by tension but also by bending elasticity of membranes. Inspired by proteins, we designed polymer brushes that switch the conformation by complexation with heavy metal ions. The switching of thickness, density and interfacial roughness was detected by high energy X-ray reflectivity, and the switching of interfacial viscoelasticity was monitored under systematic variation of heavy metal ion concentrations. The detailed shape and height fluctuation of vesicles were determined by microinterferometry, while the global shape of vesicle was reconstructed from confocal images. From the height fluctuation of the bottom surface of vesicles, we determined the critical threshold that induces a transition from “non-wetting” to “wetting”, and the precise shape analysis near the contact line yielded the free energy of adhesion. Recently, we successfully observed the “dynamic” switching of wetting vesicles in a microfluidic chamber, which opens a possibility to investigate the kinetics of switchable wetting with lipid vesicles.

Primary author: TANAKA, Motomu (Ruprecht-Karls-Universität Heidelberg)

Vortragende(r): TANAKA, Motomu (Ruprecht-Karls-Universität Heidelberg)