Exploiting Soft matter at Interfaces for Functional Materials Production

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The performance of functional materials is governed by their ability to interact with the surrounding environment in a well-defined manner. Recent advances enable manipulation of the structure and the properties of soft materials with exquisite precision, providing the means to create composite materials where the surface and the bulk of the material can be independently engineered. In this talk, we utilize the ability to separately tune the surface and bulk properties of a nanostructured polymer thin film. A new physical concept, "zwitter-wettability", whereby the film readily absorbs water vapor while simultaneously exhibiting hydrophobic character to liquid water is described and exploited to design zwitter-wettable films with significantly enhanced antifog and even frost-resistant behavior. Then, we show how we utilize the precise flow control of multi-phasic fluids in droplet-based microfluidics to prepare novel functional materials that otherwise would have been inaccessible. These emulsion drops exhibit interesting properties and great technological potential for encapsulation and controlled release of challenging and important active materials.