Bioinspired interfaces and adhesion in complex wet and icy environments

Alla Synytska

Bavarian Polymer Institute (BPI), Faculty of Engineering Science - University of Bayreuth, Universitätsstraße 30, 95447 Bayreuth, Germany

Soft interfaces and materials with freeze-tolerant and ice resistant properties are irreplaceable in life and materials science including engineering applications. Examples include cryopreservation, ice-templating, and robustness in functional coatings. Current advanced anti-icing strategies based on hydrophilic and hydrophobic materials exist but have intrinsic disadvantages, which limit their applicability.

Ice formation from supercooled water drops is initiated by nucleation when the size of an ice embryo reaches a critical value. The lack of controlling the inception of heterogeneous nucleation and the rate of solidification, which depend on the properties of the substrate, temperature, and impact parameters of the liquid drop, poses a very serious challenge to the design of effective ice-preventing materials. Our group aims to develop amphiphilic materials combining advantages of different ice preventing strategies such as supressing of freezing point using colligative properties or kinetic inhibition as well as de-icing strategies using low surfaces energy components. Fundamentally, we aim at the understanding of molecular origins of ice nucleation and formation at chemically heterogeneous interfaces and their correlation to macroscopic ice adhesion. [1-3]

[1] Kirillova, A., Marschelke, C., and Synytska, A. *ACS Appl. Mater. Interfaces*, **2019**, *11*, *10*, 9643.
[2] Kirillova, A., Ionov, L., Roisman, I., and Synytska, A. *Chem. Mater.* **2016** *28, 19,* 6995.
[3] Schwarzer, M., Otto, T., Schremb, M., Marschelke, C., Tee, H., Wurm, F., Roisman, I., Tropea, C., and Synytska, A. *Chem. Mater.* **2019**, *31*, 112.