

Social Cooperation Program: Frost Protection Science [Physical Principles for Frost Protection]

Frost Protection Science

Department of Fundamental Engineering

Research Center for Advanced Science and Technology

https://www.iis.u-tokyo.ac.jp/en/research/department_center/frost-protection-science/

Fundamental Physical Guidelines for Frost Protection

Frost formation - the growth of ice films from water vapor on cold solid surfaces - is a widespread natural phenomenon of far-reaching importance for engineering and society. Frost formation can significantly reduce the optical transparency of glass and the thermal efficiency of heat exchangers, cause damage to concrete and electric power lines, and endanger the flight stability of aircraft. Nonetheless, the fundamental understanding of the frost formation process is still insufficient, and so far there are no clear physical guidelines for its inhibition.

Therefore, this Social Cooperation Program fuses theory, simulations, and experiments to elucidate the physical mechanism of the non-equilibrium frosting phenomenon from a new hierarchical perspective - from microscopic molecular interactions at the solid/water interface to the macroscopic development of ice films. Through this approach, we aim to clarify the basics of the frosting phenomenon and to establish fundamental guidelines to solve the above-mentioned serious social problems.

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