

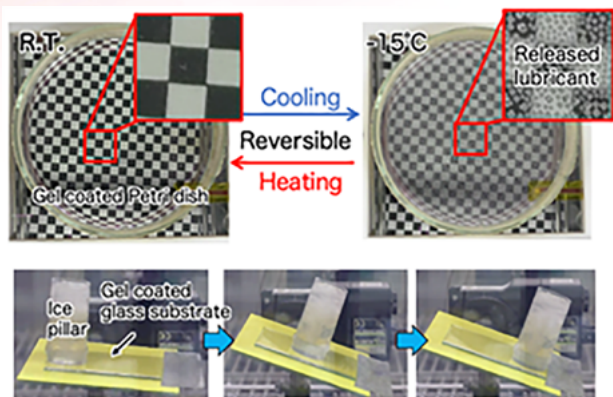
Toward social implementation of snow and ice prevention material using self-lubricating organogel

URATA Chihiro

Nearly half of the land in Japan is considered to be heavy snowfall area, and in these areas, snow and ice adhere to and accumulate on the infrastructures in winter, causing various problems. For example, although the use of LEDs has made signal lights more visible, energy efficient, and longer lasting, a new problem has been emerging: the signal light surface is now easily covered with snow. If surface materials with excellent snow and ice releasing ability can be applied to the surface of the signal lights, it is expected to ensure the visibility of LED signals without using electricity and/or human power. In the Sustainable Infrastructure Research Laboratory, we are working on the practical application of self-lubricating gels, inspired by the antifouling mechanism of slug using mucus, to realize snow and ice free surfaces.

Self-lubricating gels are composed of silicone resins impregnated with lubricating oil and the gels are transparent, making it suitable as a surface treatment for road signs and solar panels as well as signal lights. In addition, lubricant-releasing property of self-lubricating gels can be tuned by controlling the affinity between the silicone resin and the lubricant. For example, it is possible to design an organogel that

reversibly releases lubricants with temperature change. Since the temperature-responsive organogel releases the lubricant only at low temperatures, it can suppress unnecessary release of lubricants at high temperatures, promising long-lasting ice-releasing property. The simulated ice pillar removal test showed that forces required to detach ice on the organogel surface were less than 0.1 kPa, which is much smaller (more than 2000 times) than that of uncoated surfaces, and the ice pillar made on the organogel surface slid only by tilting the sample setup. We believe that the implementation of self-lubricating gel in society can contribute to the realization of a safe and secure society in heavy snowfall areas.



Upper: The thermoresponsive oil-releasing ability of the organogel (coated on a petri-dish). Lower: Anti-icing property of the organogels.