

Technical Insight

Ice adhesion to Notak[®] and various SilcoTek surfaces

Synopsis:

Geoff White, our Intellectual Property Specialist and Council, was contacted by an individual wondering if we have any surfaces with icephobic characteristics, or surfaces with weak ice adhesion properties. Although we do not have specific instrumentation to quantitatively test this property, we were able to devise a simple qualitative proof of concept test. Using a standard food storage freezer (at 0°F / -18°C), a variety of SilcoTek surfaces were placed in the freezer and 1-2ml of DI water dropped added to the middle of each room-temperature coupon. The coupons were enclosed within the freezer overnight. The next morning, a metal pick was used to laterally remove each ice ball from the coupon surfaces. The degree of removal difficulty was subjectively rated on a scale of 1-10 (1 = easy, 10 = difficult) with accompanying observations. In summary, only Notak displayed icephobic properties where the frozen droplet completely removed from the Notak coupon surface with relative ease, giving a rating of 3.

Background:

Low energy surfaces that prevent ice adhesion may provide substantial benefits for applications utilizing heat exchangers, as well as applications that are negatively affected by the accumulation of ice. Notak[®] has a low surface energy of approximately 10.5 mN/m compared to an untreated 316 SS surface of approximately 45.8 mN/m. This low surface energy may allow ice to release from a Notak surface with little effort. Additional SilcoTek surfaces will be evaluated for comparative analysis.

Data and Discussion:

Coupons of various SilcoTek surfaces (and an uncoated control) were placed on a rack within a commercial freezer at 0°F / -18°C. Upon placement, approximately 1-2ml of DI water was dropped on to the center of a coupon. The coupons resided in the freezer with the door closed for 16 hours.



Upon opening the freezer door (see photo), each coupon was individually removed and rapidly tested to avoid the potential impact of thawing. A metal pick inserted at the point of ice attachment to the coupon was used to laterally remove the ice. The effort required (1 = easy, 10 = difficult) to remove the ice and associated observations are listed in the table below.

316 SS Coupon Surface	Effort (1-10)	Observations
Notak	2	complete removal with little effort
Dursan	6	partial removal from surface with effort
Silcolloy 1000	7	partial removal from surface with greater effort
Dursox	8	difficult, bulk chipped with minimal surface separation
Uncoated	8	difficult, bulk chipped with minimal surface separation

Conclusion:

The subjective data indicates an opportunity for the application of Notak surfaces for the prevention of ice accumulation and/or provide ice release with little effort.