Jikan

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Surface Nano-Engineering

IAT-40

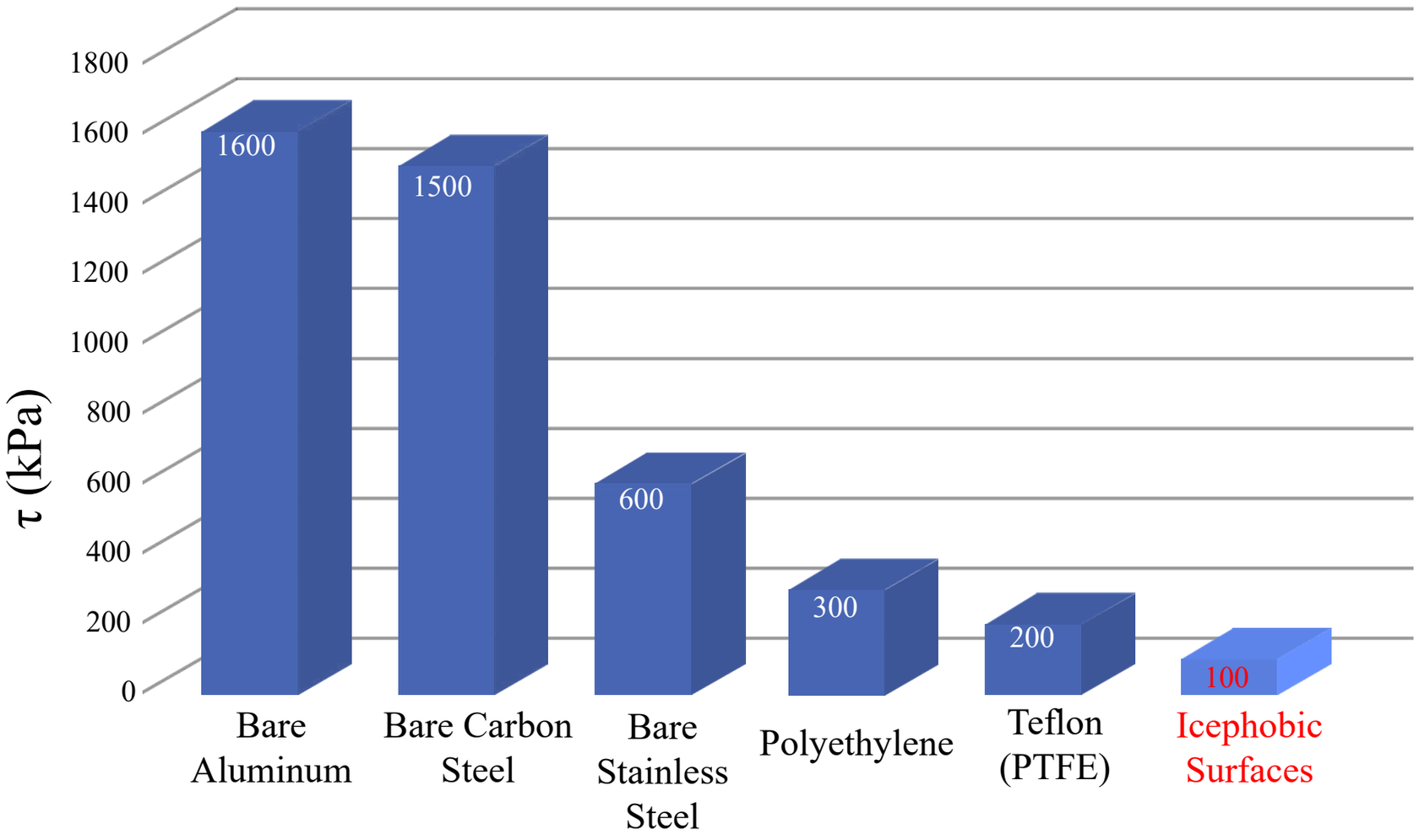
Ice Adhesion Test Machine

A spin off from SNE Research Center

Icephobic Surfaces

Ice accretion makes negative impact in many occasions, concerning telecommunication towers, antennas, power network systems, aircrafts and ships. An effective approach is to keep the temperature of the surface above the freezing temperature. Heating the surface is an active approach, but it's energy consuming. The other approach is to use chemicals such as derivatives of glycol ethers. These chemicals lower the freezing point, but most of them are not effective in the long run and some are banned in many countries. Currently, there are many materials commercially available and marketed as icephobic, where ice adhesion is very small on these surfaces. Ice adhesion is defined as the physical and chemical bonding of ice and substrate.

The maximum force needed for shedding the ice from the surface divided by the surface area, i.e. shear stress (τ), is a criteria for comparing the icephobicity of surfaces. Icephobic surfaces are surfaces which their shear stress is less than 100 kPa.



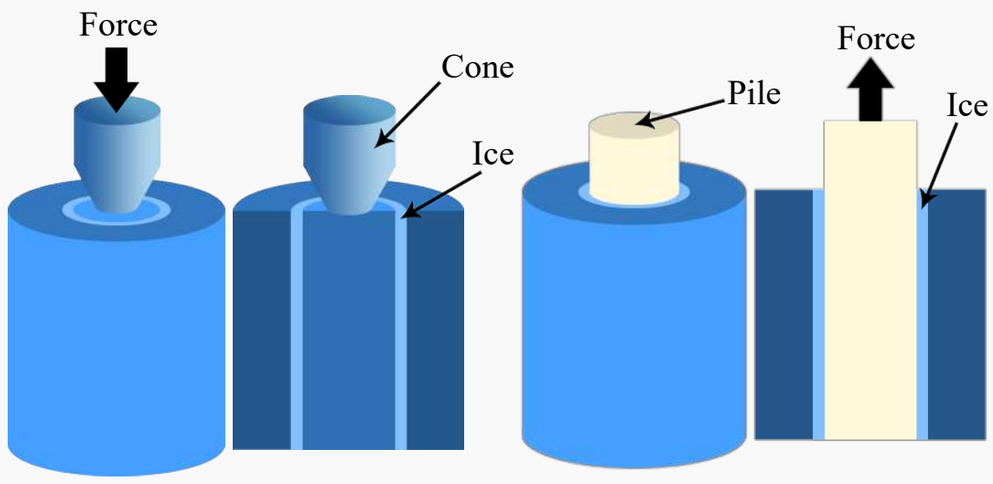
Methods for Measuring Ice Adhesion

Cone Test and Pile Test

in this method a rod-shaped sample adheres to a hollow cylinder, the force needed to pull out the rod, shows the ice adhesion

Drawbacks:

a) The test takes 48 hours.
b) Icephobic sample have to be rod shaped which is not trivial.
c) Holding surface temperature constant is not possible and ice adhesion is highly sensitive to the temperature.

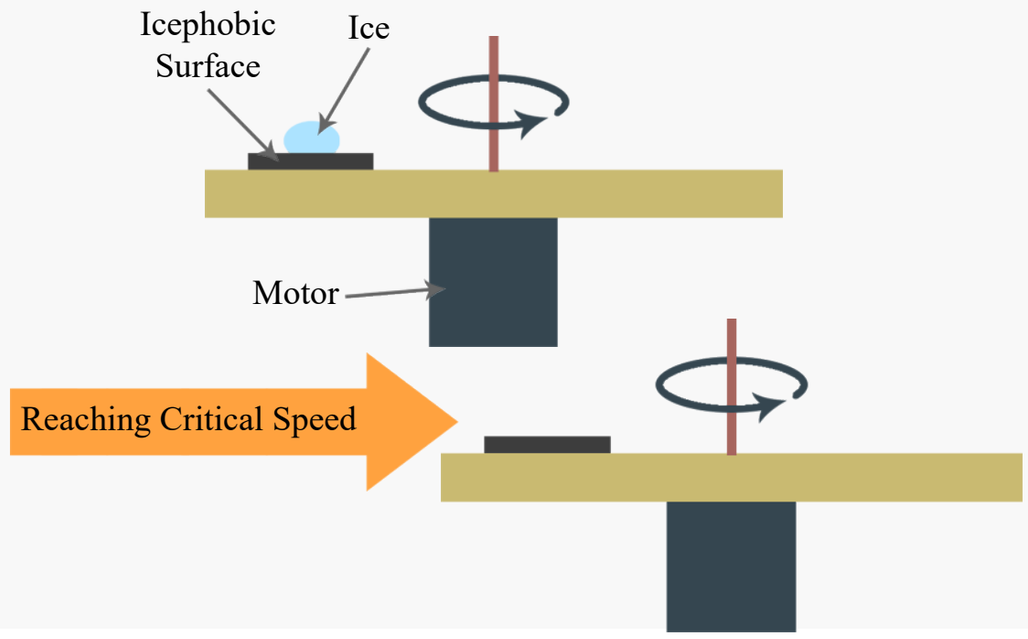


Centrifugal Test

the sample is attached to a rotating disc, and a piece of ice is on its surface, by increasing the rotating speed the ice will be detached, showing the ice adhesion.

Drawbacks:

a) For each test, the adhesion area changes.
b) Air drag force on the drop is neglected.
c) Keeping the temperature constant is not easy.

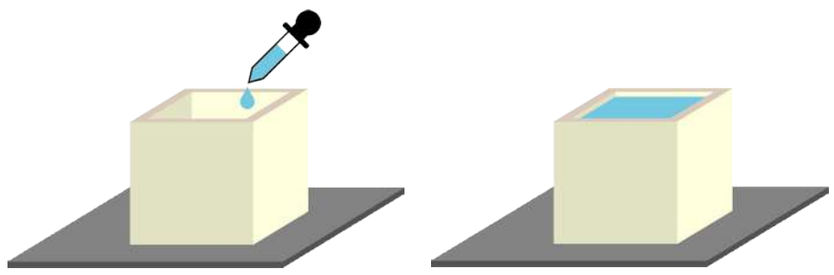


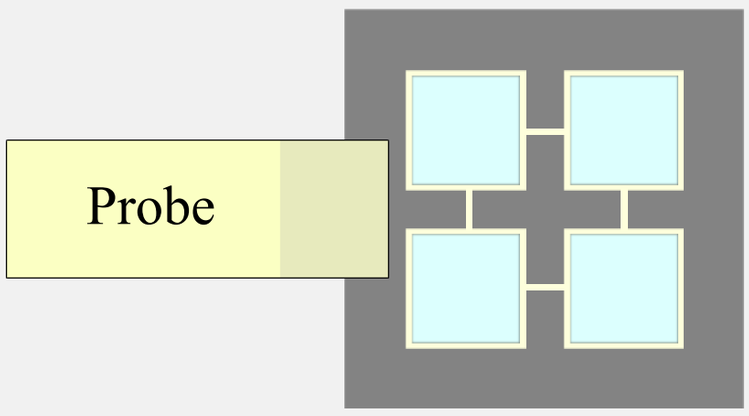
Current Device

Ice Adhesion Test Machine IAT-40

The procedure

First, adjust the surface temperature to -10 °C. Put a mold on Icephobic sample. Then pour water until all the water freezes. We keep the surface temperature constant (i.e. 10 °C), separate the mold from the ice, and begin the test.





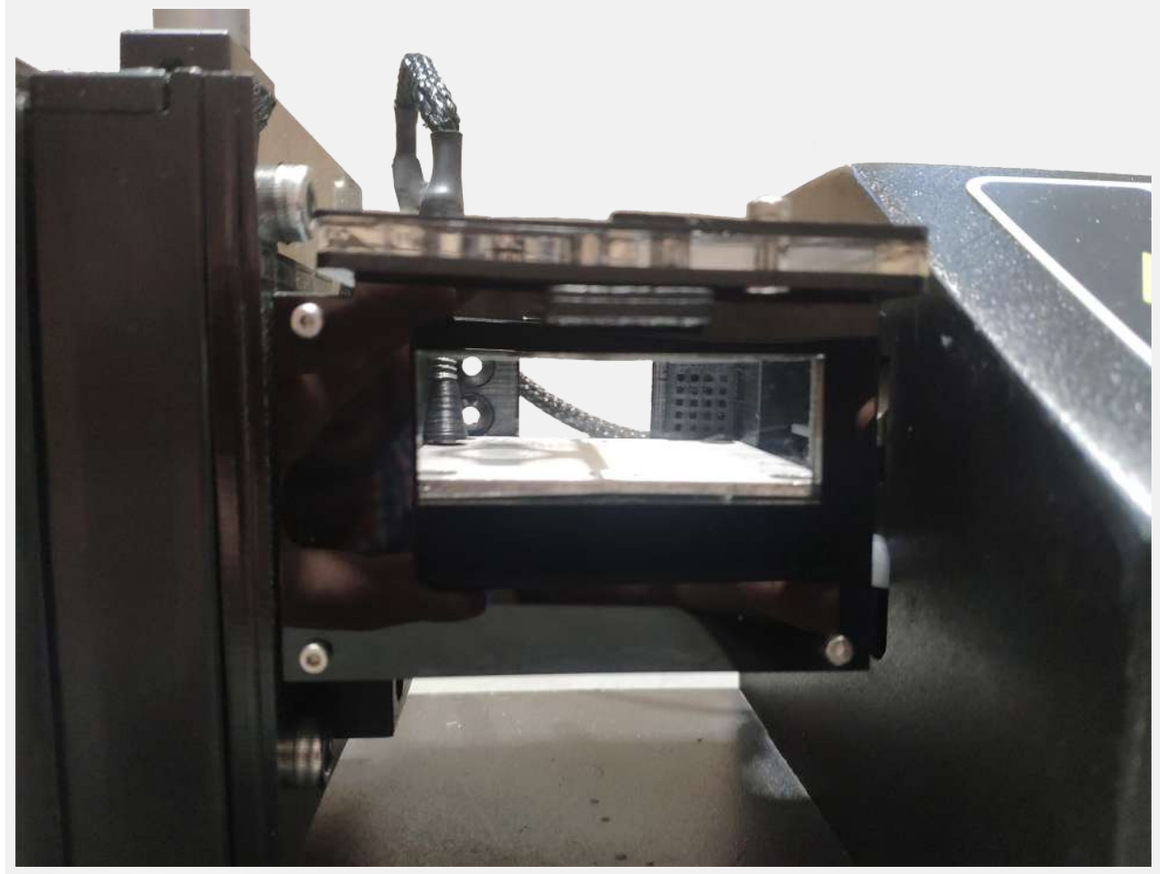
Multiple molds configuration
(View from top)

Dehumidification system

to improve the accuracy of, the test it is needed to control the humidity, this automatic system turns it down to almost zero for maximum reproductibikity

Two Stage Cooling

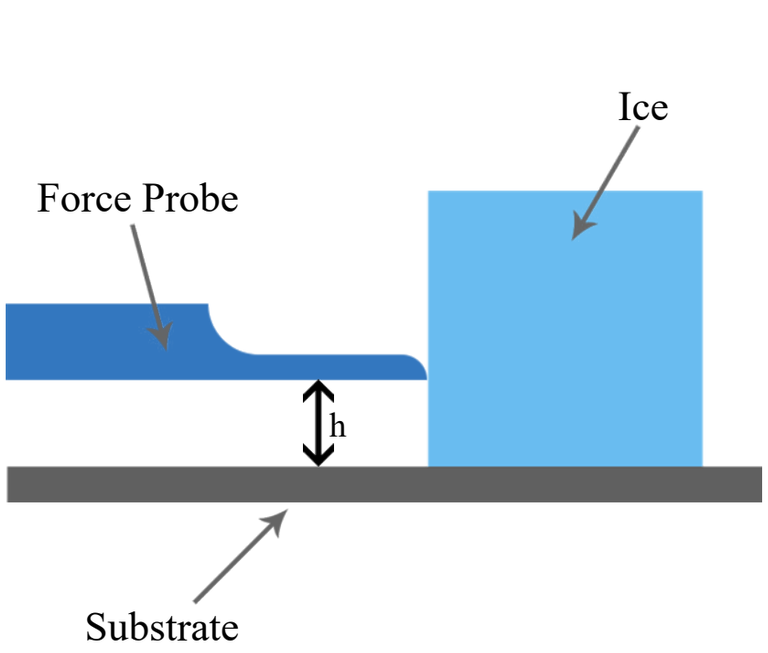
the device benefits from a two stage peltier-based cooling system that could be customized to lowest lowest degrees

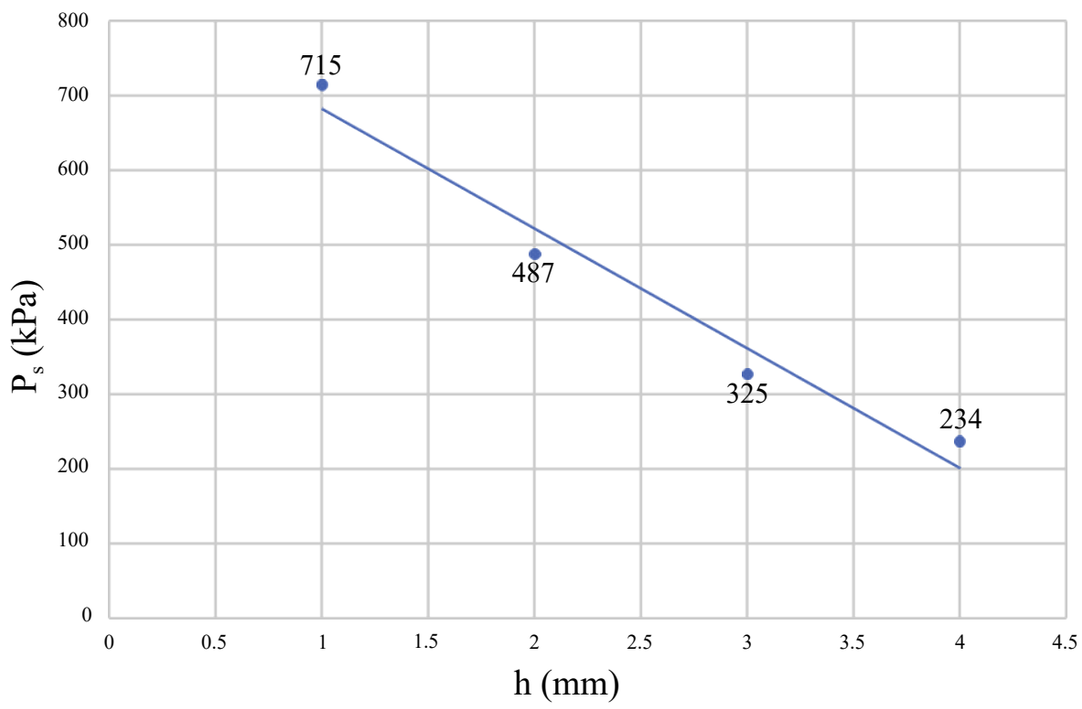


Automatic height adjustment

motorized heght adjustment of the sumple makes you able to test samples of various size in an extremely easy way

A Closer Look:





Technical Data

Test Chamber Temprature	-20 °C - 0 °C (Accuracy 0.1 °C)
Surface Temperature Resolution	-20 °C - 0 °C (Accuracy 0.1 °C)
Force Sensor Accuracy	0.1 - 1000 kPa (Accuracy 0.1 kPa)
Force Probe Speed	0.1 - 500 mm/min (Accuracry ±1%)
Sample Stage	Motorized Height Adjustment
Moisture Absorber	Automatic
Cooling Water Temprature needed	0 °C - 10 °C (Compatible with Jikan RMC-10)
Ice (Mold) Size	Multiple Config. (1 - 8 cm^3)
Thermoelectric power	72 W
Force Probe Dimensions	1 mm × 20 mm
Maximum Sample Size	100 mm × 40 mm
Dimensions	410 mm×180 mm×160 mm
Operating Voltage	110-240 V 50-60 Hz
Power Consumption	250 W

Jikan

Jikan Surface Nano-Engineering Company is a knowledge-based company based in Tehran, Iran. Jikan was established as a spin-off from SNE Research Center, University of Tehran. In Jikan, we manufacture world-class measurment instruments and perform top-notch research in the field of surface nano-engineering. Jikan is also a service provider and is well-known for its accurate, customizable, and quick services. We are in the process of developing new standards and protocols for our products and procedures, to secure our share both in domestic and international markets.

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