



JIKAN

Surface Nano-Engineering



IAT-40

Ice Adhesion Test Machine

A spin off from

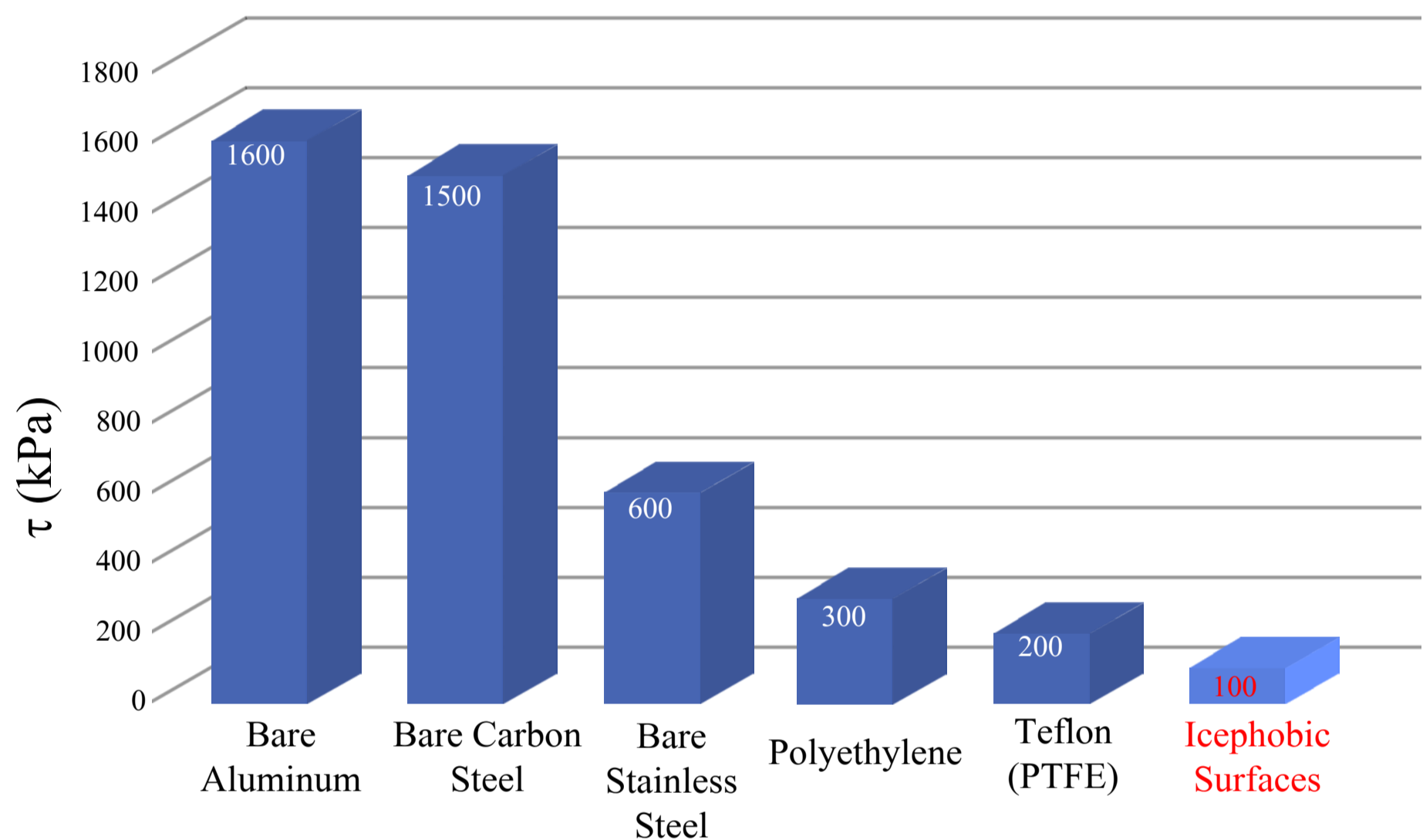




Jikan Surface Nano-Engineering Company is a knowledge-based company based in Tehran, Iran. Jikan was established as a spin-off from SNE Research Center, University of Tehran. In Jikan, we manufacture world-class measurement instruments and perform top-notch research in the field of surface nano-engineering. 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.

Ice accretion has negative impact on many industries, e.g. telecommunication towers, antennas, power network systems, aircrafts and ships. The most effective approach is to keep the temperature of the surface above the freezing temperature. Heating the surface is an active approach, but is energy consuming. The other approach is using 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.

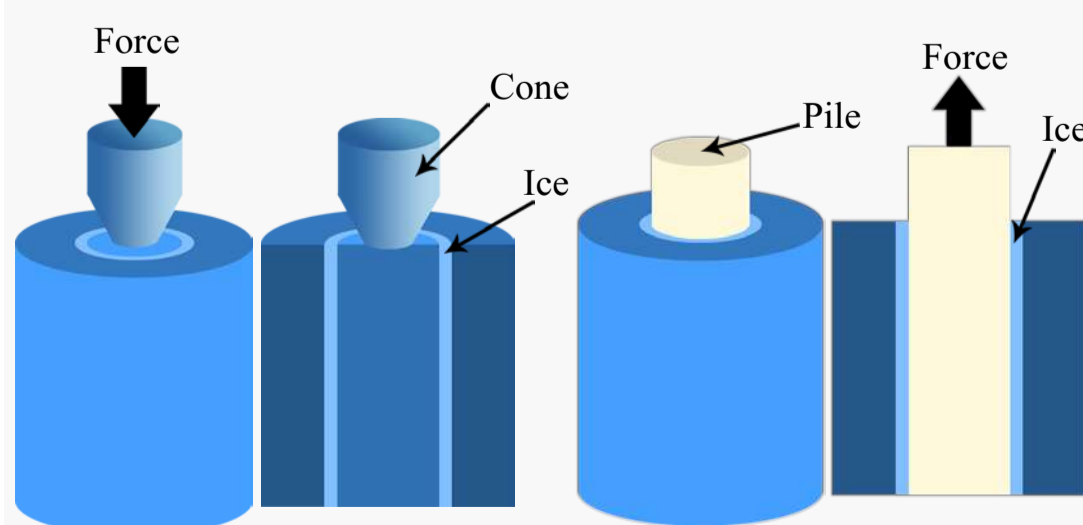


Former Devices for Measuring the Ice Adhesion

Cone Test and Pile Test

Drawbacks:

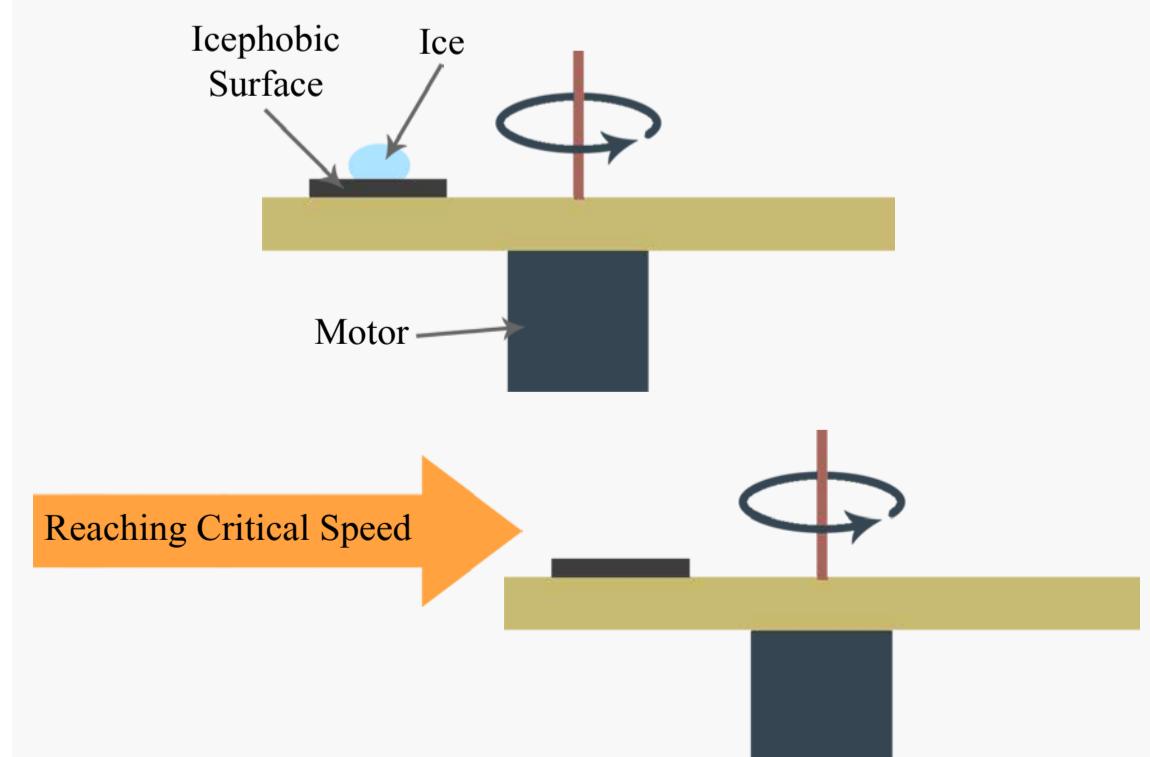
- a) The test takes 48 hours.
- b) Icephobic sample have to be rod shaped which is not trivial.
- c) Holding surface temperature constant is not possible and ice adhesion is highly sensitive to the temperature.



Centrifugal Test

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.

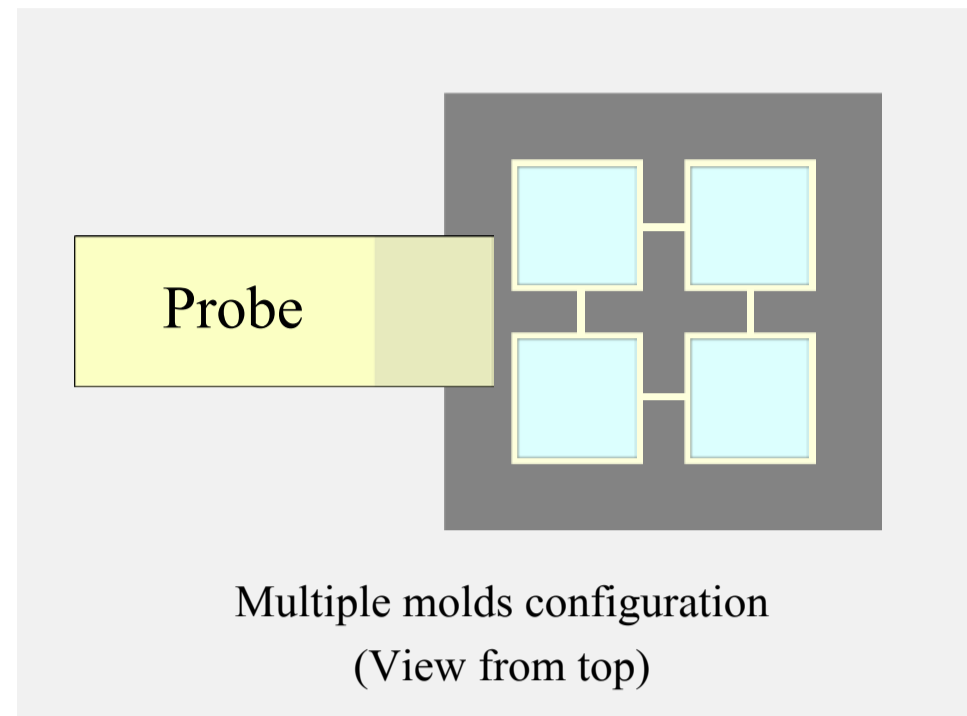
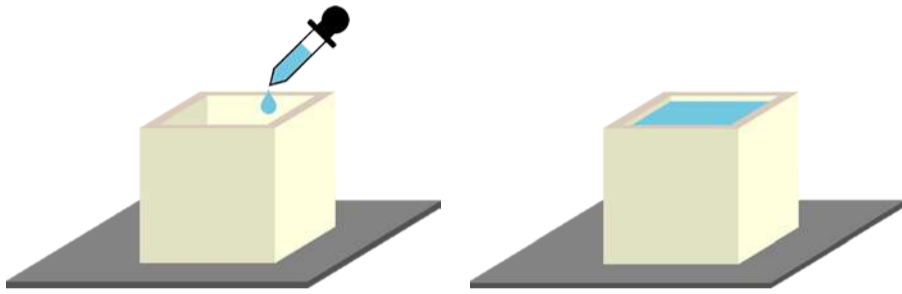


Current Device

Ice Adhesion Test Machine IAT-40

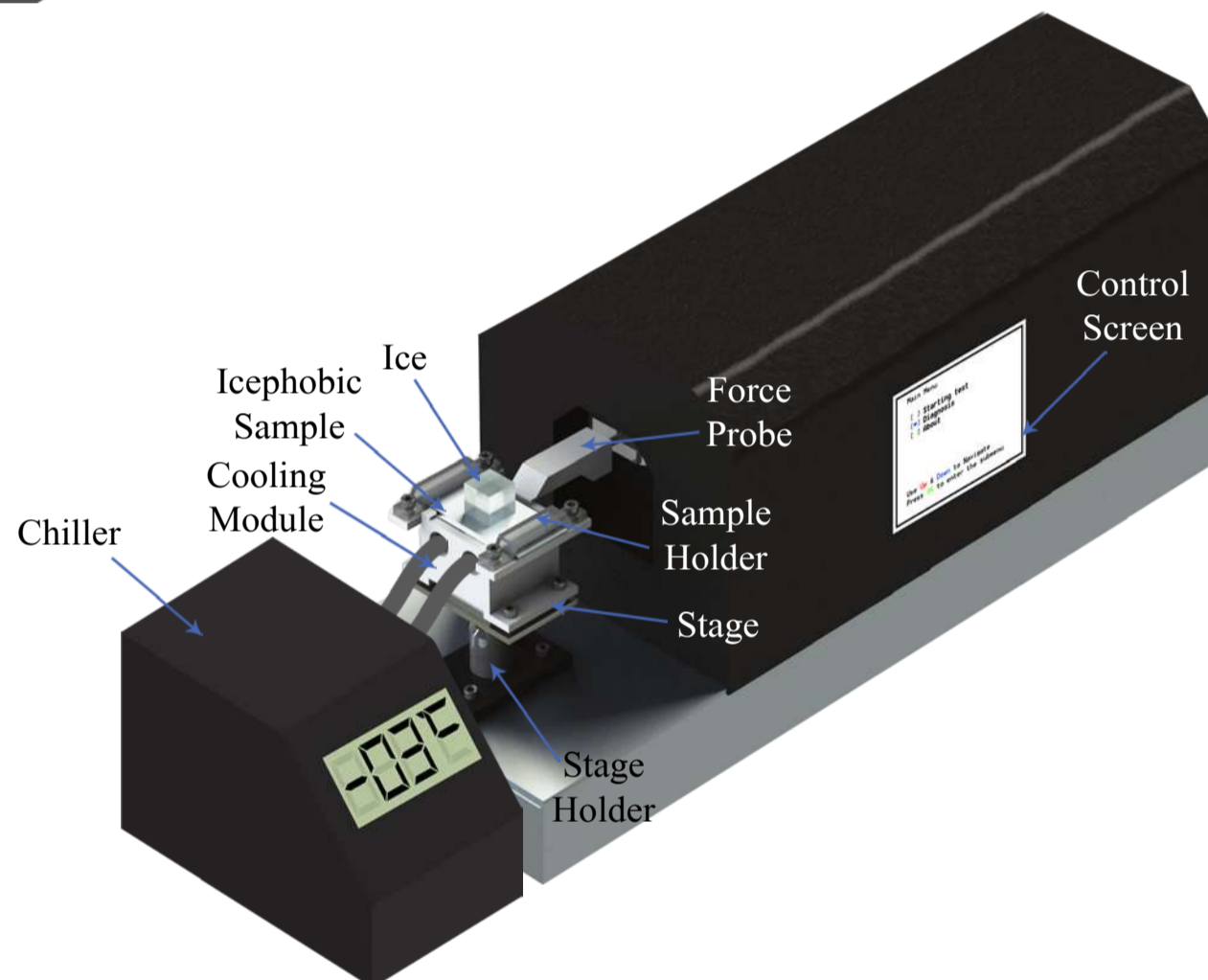
The procedure

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

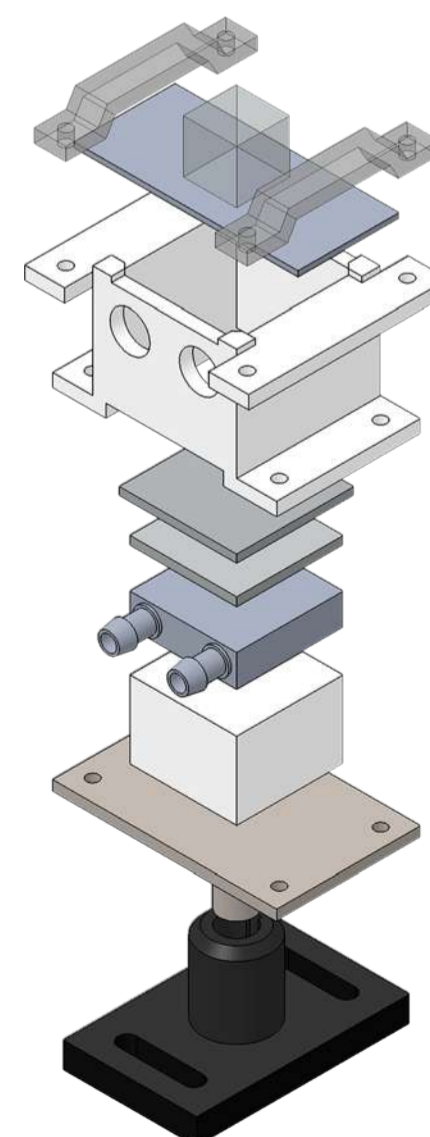
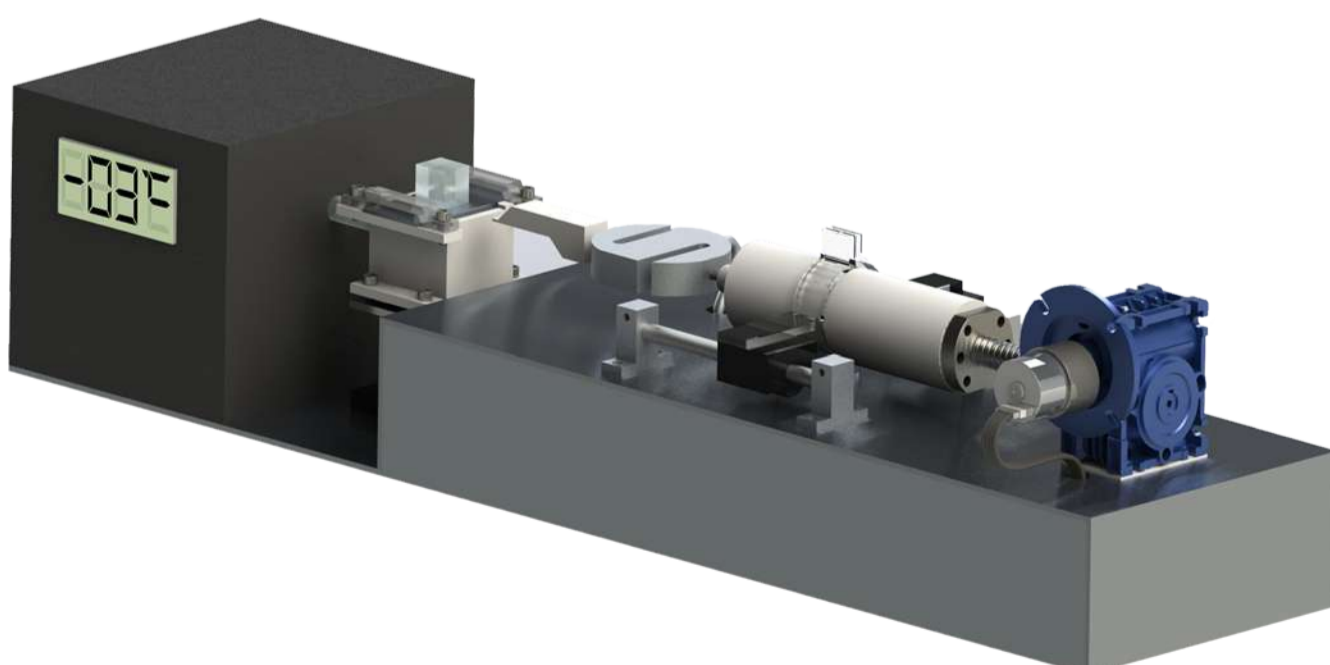


Main Body Parts:

- 1- Ice
- 2- Icephobic Sample
- 3- Force Probe
- 4- Sample Holder
- 5- Stage
- 6- Stage Holder
- 7- Cooling Module
- 8- Control screen
- 9-Chiller



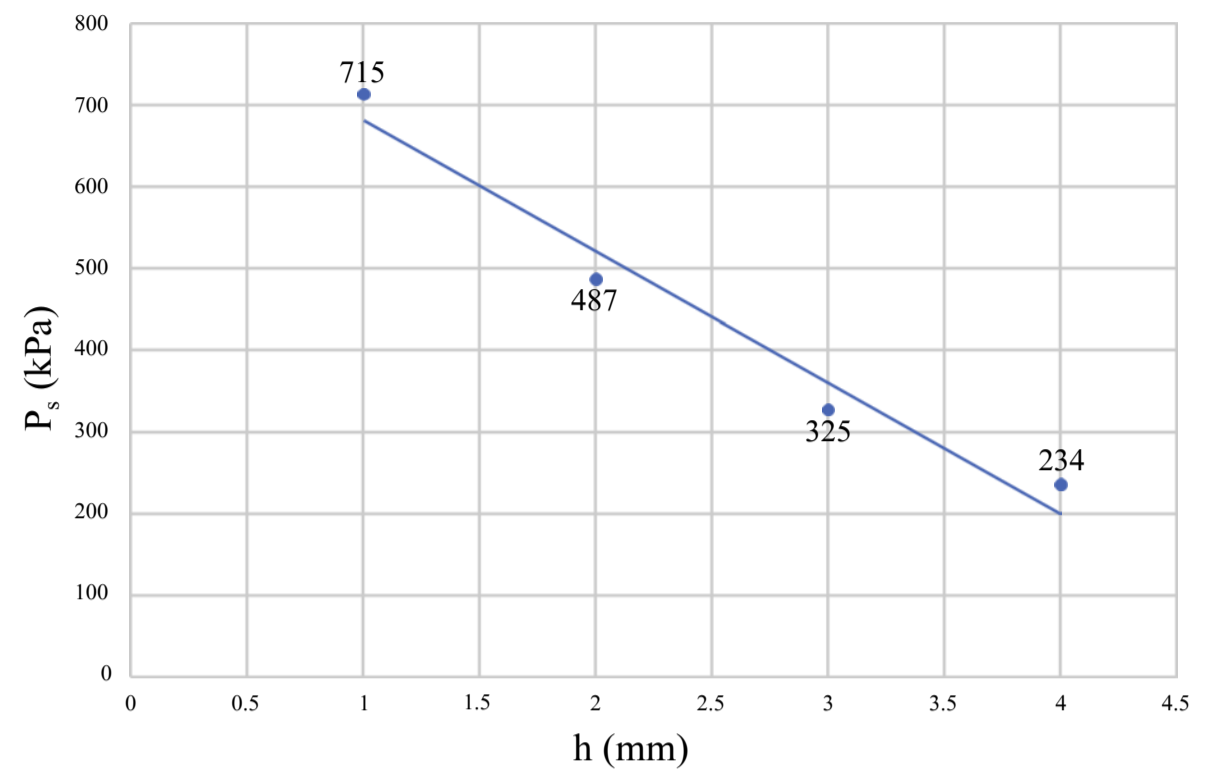
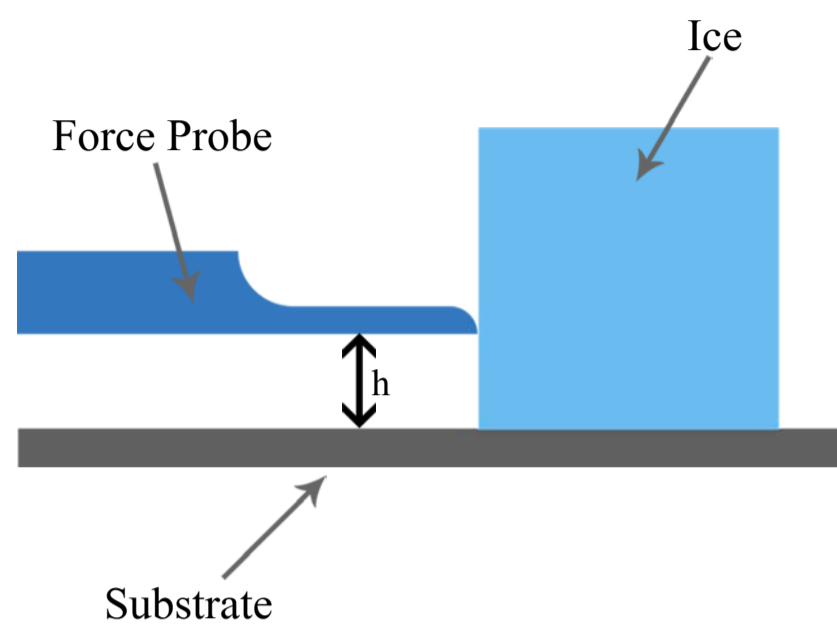
Here is a better look:



Exploded View

Note:

The vertical distance of the force probe (h) results in a significant error in the results. So, the distance between the point and the surface should be less than 1 mm.



Load Range

Mold Size (cm ²)	τ (Pa)	Resolution (Pa)
1 cm × 1 cm	10^3 to 10^6 Pa	100 Pa
1.5 cm × 1.5 cm	4.44×10^2 - 4.44×10^5 Pa	44.4 Pa
2 cm × 2 cm	2.5×10^2 - 2.5×10^5 Pa	25 Pa
4 cm × 4 cm	62.5 - 6.25×10^4 Pa	6.25 Pa

Technical Data	
Surface Temperature Resolution	± 0.1 °C
Maximum Sample Size	80 mm × 40 mm
Force Sensor Accuracy and Resolution	± 250 Pa
Operating Voltage	110-240 V 50-60 Hz
Force Probe Dimensions	1 mm × 20 mm
Force Probe Speed	0.5 - 0.8 mm/min
Stage	Manual adjustment
Ice (Mold) Size	Multiple config.
Thermoelectric power	72 w
Test Chamber Humidity	10 % - 50 %
Test Chamber Temperature	-20 °C - 0 °C (accuracy 0.1 °C)
Cooling Water Temperature	0 °C - 10 °C (accuracy 0.5 °C)
Chiller Cooling Capacity	100 w
Chiller Input Power	200 w



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Ice Adhesion Test Machine

Other Products:

Jikan provides you with accurate laboratory devices and services used for measurement and enhancement of mechanical, physical and chemical properties of materials.

Jikan concentrates on surface thermodynamics, surface engineering and surface Nano-engineering. Our products include for application and evaluation of coatings and Nano-engineered surfaces. Some of the coatings are self-cleaning, corrosion resilient, icephobic and heat transfer enhancement coatings.

At Jikan, we are open to new ideas and produce customized devices and coating based on your engineering requirements and applications.

Laboratory Services:

Jikan provides fast and accurate services and consulting in all fields of surface Nano-engineering.



Thermocycle Test Chamber TTC-30



Contact Angle Goniometer CAG-10



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