# OFFwind Highlights No. 18 – FEBRUARY 2026

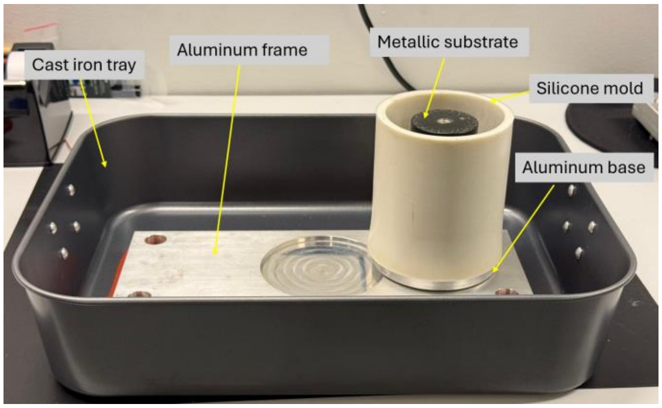
## DEVELOPMENT OF ARCTIC TEST

To mitigate problems due to ice accumulation, thermally sprayed icephobic coatings have been widely studied, particularly polymer-based coatings which exhibit low ice adhesion strength. Ice adhesion strength is commonly measured using the centrifugal ice adhesion test or the pushing type ice adhesion test. However, these techniques are primarily designed for small and flat samples, which limit their applicability to larger or non-planar geometries. This limitation led to develop a dedicated test method capable of measuring ice adhesion strength of cylindrical and larger samples and components.

A new shear ice adhesion strength measurement method for cylindrical samples, referred as the Arctic Test, is developed in Tampere University (TAU) in response to the limitations of existing ice adhesion measurement techniques for non-planar geometries. To evaluate the reliability and consistency of the Arctic Test as a measurement approach, icephobic coatings and bare metallic materials are systematically examined.

### Assembly of Arctic Test

The Arctic test is designed as a modular setup for measuring the shear ice adhesion strength of cylindrical samples. The complete assembly consists of a cylindrical test specimen, a flexible silicone mold, aluminum base as external support structure, and an aluminum frame as platform to ensure mechanical stability during ice formation and testing as shown in Picture 1.




*Picture 1. Sample holder for Arctic Test*

Picture 2 presents the complete assembly which is consists of a vertically aligned cylindrical sample positioned within a flexible silicone mold. Silicone mold provides uniform annular gap for ice formation around the specimen. The mold is externally supported by an aluminum ring and a removable polymer base to provide accurate alignment and platform for the specimen. The complete assembly is placed on an aluminum frame for mechanical testing.

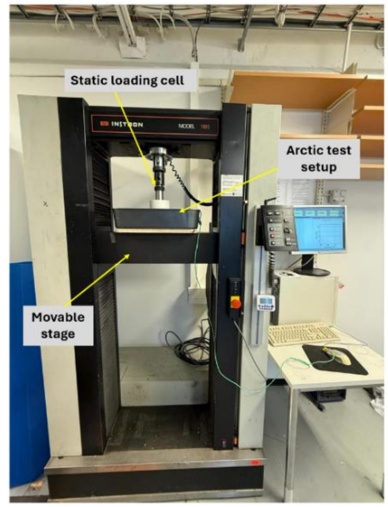
*Picture 2. Assembly of Arctic test*

## Arctic Test Process

The Arctic test is conducted over three days. On the first day, the assembled setup is cooled to -10°C overnight inside the temperature-controlled room as shown in Picture 3. On the second day, pre-cooled pure water near 0°C is poured into the annular gap and keep it inside the room overnight for static ice formation.

*Picture 3. Cold room at TAU*

On the final day, the polymer platform is removed, and the assembly is transferred to a mechanical testing machine as presented in Picture 4. The constant loading speed of 1 mm/min is applied until ice detachment. The shear ice adhesion strength is calculated as the ratio of the maximum force at which ice detached to the ice and sample contact area.




*Picture 4. Tensile testing machine modified for Arctic Test at TAU*

## Arctic Test Validation

Flame sprayed polyethylene coating showed lower ice adhesion strength than bare metallic materials. Aluminum alloy exhibits higher adhesion than bare stainless steel. This trend is in line with the literature, confirming that the Arctic Test is well calibrated. The detailed results of the Arctic Test are presented in Muhammad Arsalan's [Master´s Thesis](#).

## Future Work

The Arctic test will be conducted to measure ice adhesion strength of brittle substrates, such as concrete, and to evaluate shear ice adhesion strength under saline ice conditions.

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