



The evaluation of state-of-the-art anti-icing surface solutions using a large-scale icing test set-up

Sirris | The collective center of the Belgian technology industry

Joey Bosmans, Engineer circular economy, Coatings and durability

Belgian technology centre set-up in 1949 | 160 VTE strong
Multi-disciplinary R&D in different industries

± 1.500 innovation projects per year with 1.100 different
companies (advice, consult, test services, large projects)



www.owi-lab.be

Wind energy knowledge / expertise center set-up in
2010 – coordinated by Sirris, VUB and UGent

Mission: industry driven R&D and Innovation projects
and initiatives

Fundamental & applied RD&I activities;
test & measurement services ; masterclasses & advice



LARGE CLIMATIC TEST CHAMBER



Example: Safety evacuation container



Example: Mid-scale onshore wind case

Specific need for low cost
anti-icing / de-icing and
ice monitoring solutions

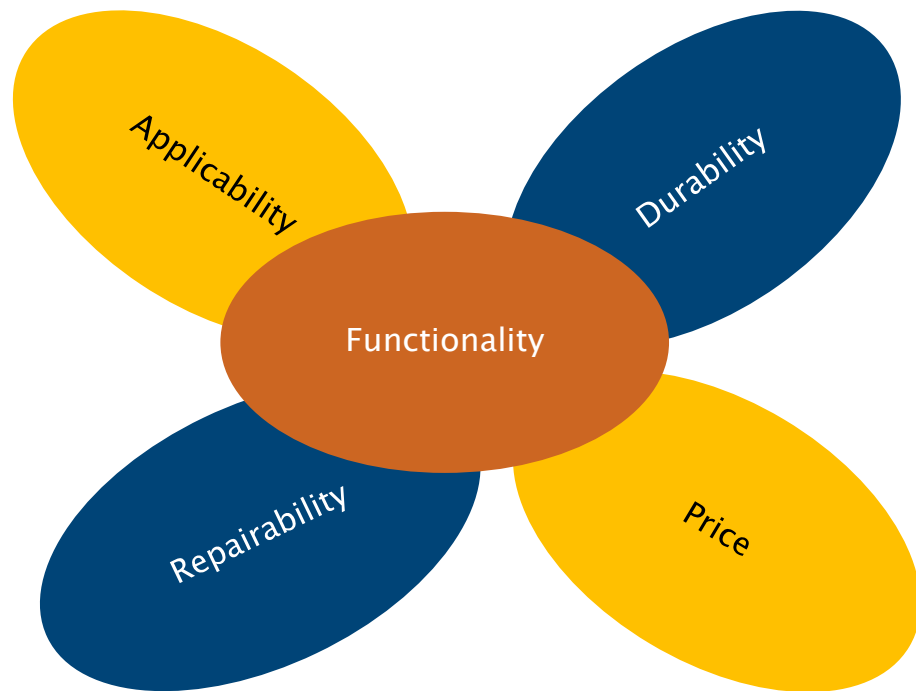


Industrial challenges with respect to icing



Industrial challenges

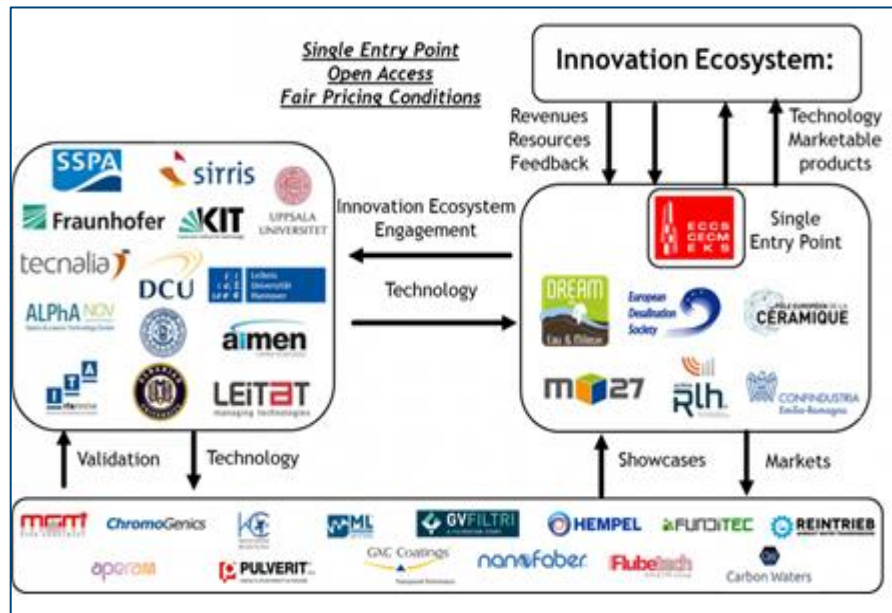
- Finding the right solutions
- Availability of new technologies
 - Sensors
 - Coatings
 - Surface modifications
 - de-icing solutions
- Evaluation and understanding
- Durability aspects
- Future proof



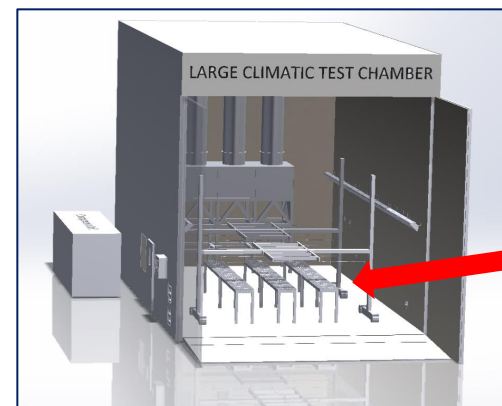
Related projects – Newskin



Horizon 2020
European Union Funding
for Research & Innovation



→ Upgrade large climate chamber with large scale ice spray array



<https://www.sirris.be/nl/newskin-project>

<https://www.newskin-oitb.eu>



driving industry by technology

Climate chamber upgrade



- 25 spray nozzles
- spray coverage area between 22m²–30m²
- Different types of icing: rime/glaze/mixed
- Array/ product testing under different angles

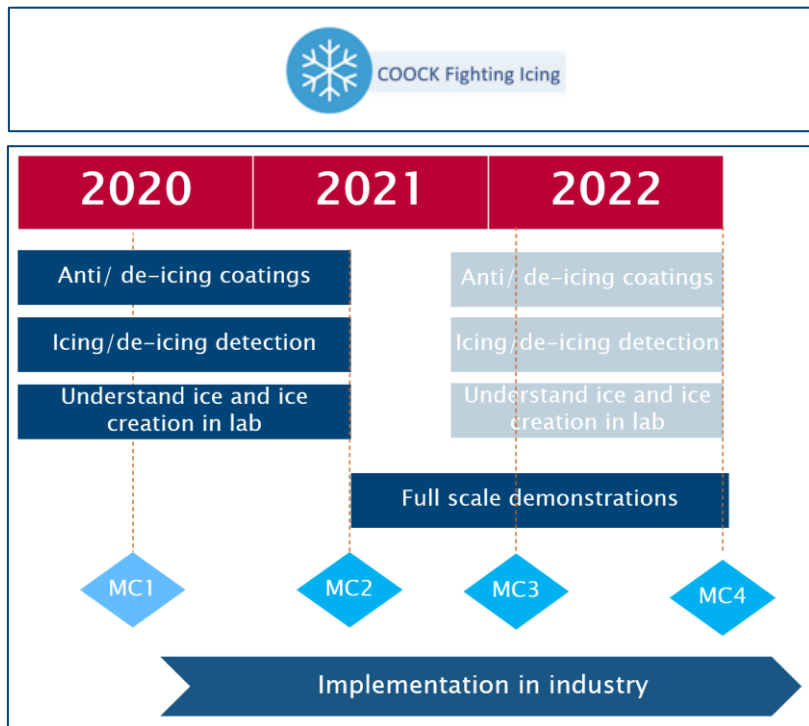


driving industry by technology



driving industry by technology

Related projects – Fighting icing



AGENTSCHAP
INNOVEREN &
ONDERNEMEN

COOCK = Collective R&D & Knowledge transfer

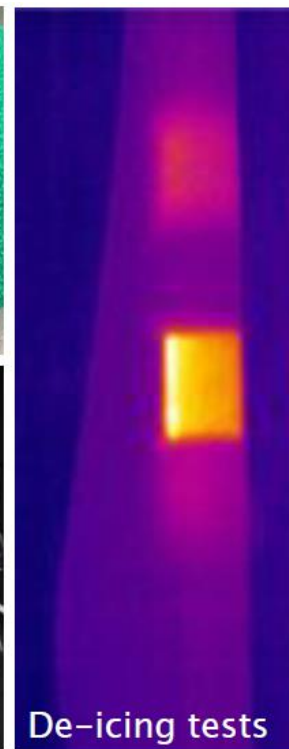
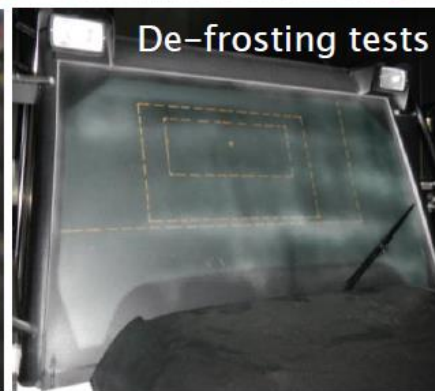
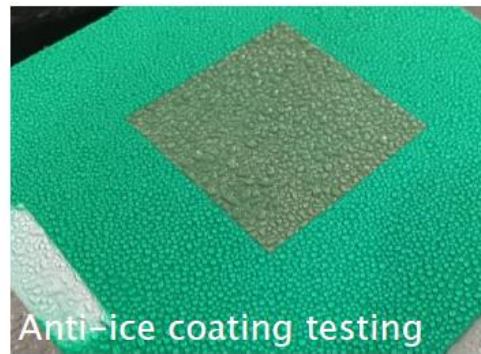
<https://www.sirris.be/fighting-icing>

40 involved companies from different sectors



- Monitoring
- Detecting (detectors, sensors)
- Ice simulation
- Surface testing

Ice testing – examples



Preliminary testing

Evaluation of coatings to prevent ice formation of splash ice on the hull of ships.

In collaboration with Hogere Zeevaartschool Antwerpen,
Master Thesis by Arthur Buyck

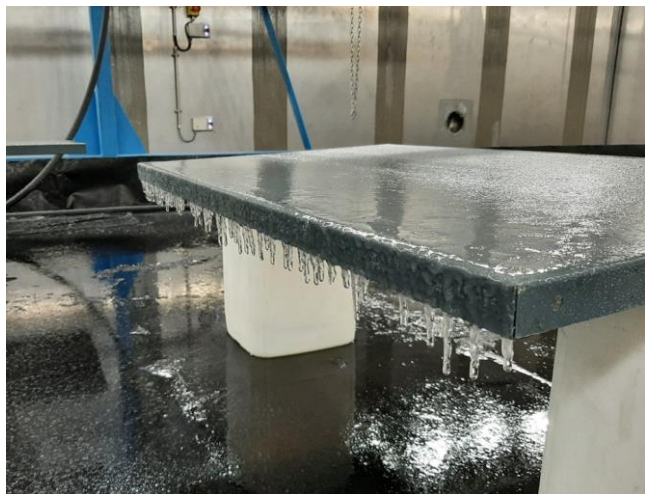


- Influence of coating thickness, coating roughness
- salinity of water, water temperature
- Icing period, ice thickness

Preliminary testing



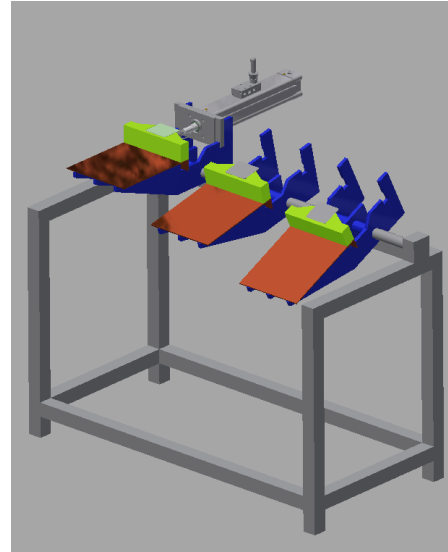
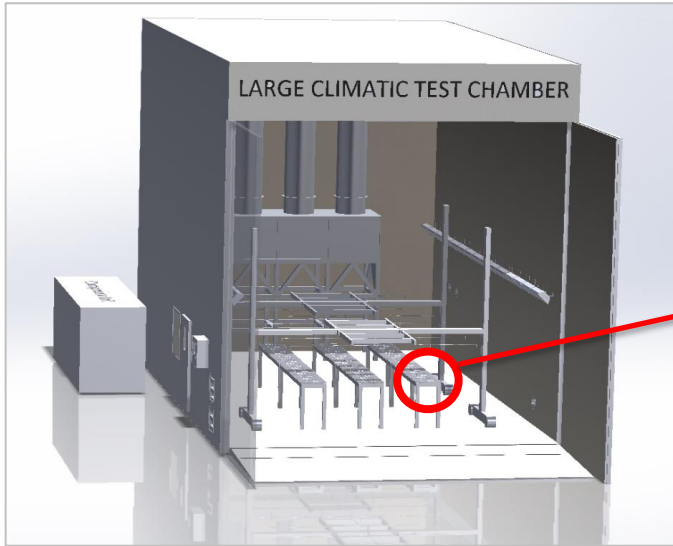
Planned tests with coatings & functional surfaces



Technology	# Coatings
High performance PU, epoxy coatings = Benchmark Reference	2
Hydrophobic elastomeric coatings	3
SLIPS (type) coatings	2
Hydrophobic sol-gel coatings	2
Superhydrophobic coatings	2
Crack initiating coatings	1
Phase change materials (research stage)	1
Heatable coatings	2
Lasertextured surfaces	2

Coatings are applied to 4 different substrates: aluminium, coated steel, composite and glass.

Upcoming test campaigns (part 1) – coatings



Ice adhesion
test set-up

Evaluation of functional surfaces

- Ice accretion
- Ice adhesion strength (Icing PUSH test)
- Durability level of surfaces
- Combination of active and passive de-icing systems
- Reapplication and repair of coatings
- Comparison of structured surfaces

Overview

	Ice and water repellency	Low ice adhesion	Durability	TRL level
Elastomeric/hydrophobic	***	**	****	*****
Super-hydrophobic	****	****	*	***
PDMS-based/SLIPS	****	*****	**	**
Sol-gel/nano-coating	**	***	****	***
PCM	***	***	**	**
Heatable	****	***	****	****

Future plans

- Evaluation of new technologies (coatings & surface structures)
- Collaboration with other research institutes
- Collaboration with coating producers
- 1-on-1 projects with companies
- New collective projects (Rainbow)
- Large scale component ice testing





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driving industry by technology

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