HYPERCOAT® RANGE

Aeronautical Sector

Nanotechnology surface protection for aircraft: benefits, product range and laboratory test results

PURE-CHEM



Benefits of the HYPERCOAT® range

Up to 7%

less surface friction

Up to 4%

less turbulence

- Reduced coating erosion
- Higher resistance to dirt and dust
- Weathering resistance: rain, sun, hail, freeze–thaw
- Corrosion resistance against sea salt and water
- Anti-icing: prevents ice from sticking
- Higher hardness and impact resistance
- Lower maintenance costs

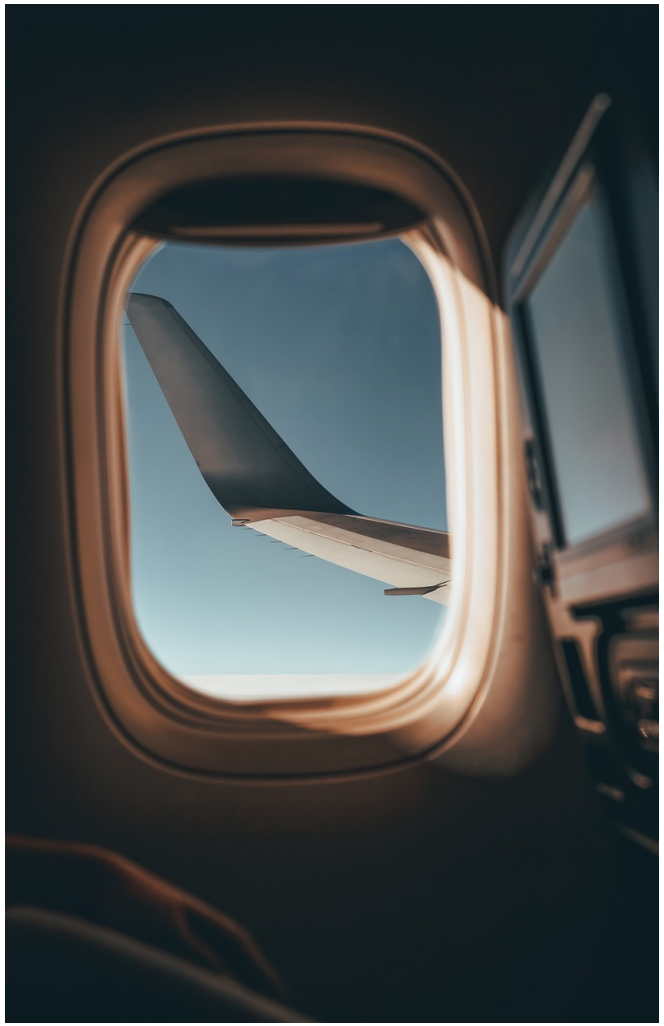


APPLICATIONS

HYPERCOAT® 90103
Aircraft top coat

HYPERCOAT® WS 82
Glass

Properties of the HYPERCOAT® range



- Excellent substrate adhesion
- UV and chemical resistant
- High hardness
- Excellent easy-to-clean properties
- Permanent barrier layer
- Good corrosion protection
- No added weight
- Temperature stability up to 1000 °C
- Excellent weather resistance

Product range

Property	HYPERCOAT® 90103	HYPERCOAT® WS 82
Hardness	●●○	●○○
Friction reduction	●●●	●○○
Flexibility	●●○	●●●
Easy to clean	●●●	●●●

Legend: ●○○ low ●●○ medium ●●● high

Before application

If the surface is very dirty, clean it with PURECLEAN from our range, then dry it with isopropyl alcohol.

After application

The surface becomes easy to clean: water or our neutral cleaning product is all it needs.





LABORATORY VALIDATION

Tests carried out

01 Superficial hardness

02 Thermal cycles

03 QSUN test

04 Friction and turbulence

05 Contact angle

06 Tape test (X-cut) & squaring

07 Adhesion test (ISO 2409)

08 Suntest XLS+ & outdoor UV

Superficial hardness

Experimental hardness tests on carbon fibre panels, untreated vs. treated with HYPERCOAT® 90103.

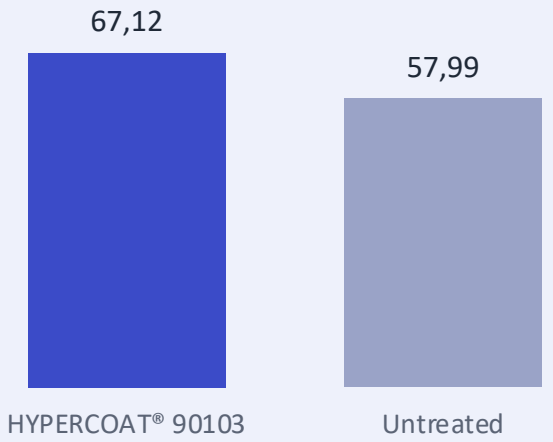
Test set-up	
Apparatus	Durometer
Producer	INNOVATEST
Model	NEMESIS 9000
Indenter	Brinell 2.5 mm
Applied load [kgf]	62.5
Load application time [s]	10



The machine has an optical microscope (up to 10×) and an indenter positioning sensor. Two 50 × 25 mm specimens were cut from each slab, with 3 readings each: 6 hardness acquisitions per slab.

+14%

Brinell hardness vs. untreated plate



Std. deviation: 0.66 (treated) · 1.34 (untreated)

Thermal cycles

The certified laboratory MotivexLab (Avigliana, TO) ran thermal cycle tests on fuselage materials, painted and then treated with HYPERCOAT® 90103.

TEST SET-UP

Equipment: Climatic chamber ID.281

Standard: MotivexLab

Dates: 13–14/06/2023

Duration: 18 hours

BENEFITS

- Excellent consolidation properties
- Water repellence
- Anti-efflorescence

Cycle description

1. T0 = 23 °C ± 1 °C
2. Down to −70 °C at 2 °C/min
3. Hold 3 hours at −70 °C
4. From −70 °C to −51 °C at 2 °C/min
5. Hold 1 h 30 min at −51 °C
6. From −51 °C to +23 °C at 2 °C/min



No defects observed after 3 cycles

QSUN test



800 h

accelerated weathering

Gloss kept

at the initial level

Resistance of the HYPERCOAT® 90103 surface coating on paint, evaluated after 800 hours of alternating UV rays, heat, water and rest periods.

Conclusions

- After 800 hours the protection kept its initial gloss, stayed intact and lost none of its mechanical properties.
- The coating passed the QSUN test: the material was protected from UV rays, hot–cold cycles and outdoor humidity.

Friction and turbulence: test set-up

Effects of the HYPERCOAT® 90103 surface treatment, tested in the wind tunnel of the Department of Civil and Industrial Engineering, University of Pisa.



Wind tunnel

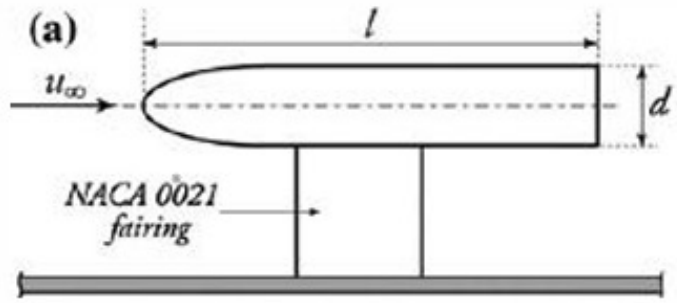
- Closed-circuit subsonic tunnel, open test chamber
- Circular test section: 1.1 m diameter, 1.42 m long
- Free-flow turbulence level: 0.9%

Model: NACA 0021

Two parts in aluminium alloy:

- front body with a 3:1 elliptical profile
- cylindrical main body with a sharp-edged base perpendicular to the axis

Diameter d = 70 mm, length l = 400 mm



Friction and turbulence: results

–7.0%

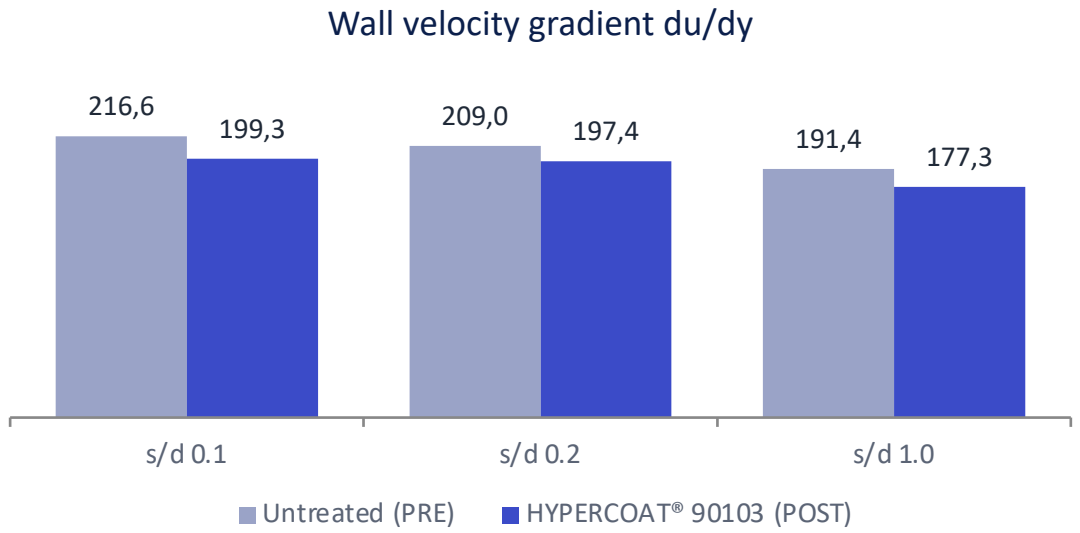
surface friction

–4%

turbulence

Velocity and pressure were measured around an axisymmetric body to evaluate the effect of the surface treatment. The boundary layer thickens with the treatment.

The pressure maps show less suction on the base, and therefore lower pressure drag.

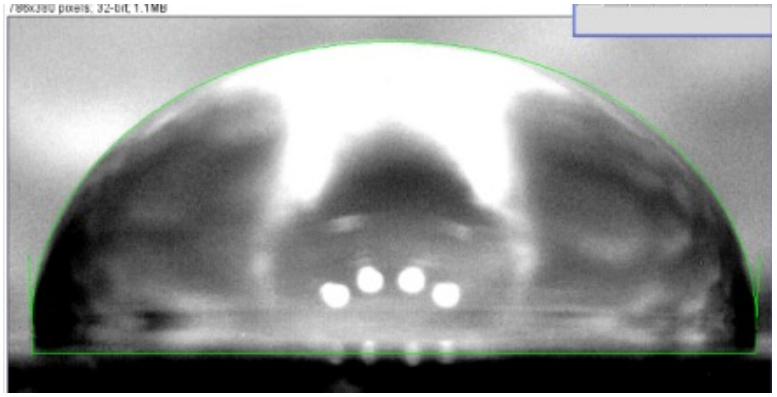


$$\tau_0 = \mu \left. \frac{\partial u}{\partial y} \right|_{wall}$$

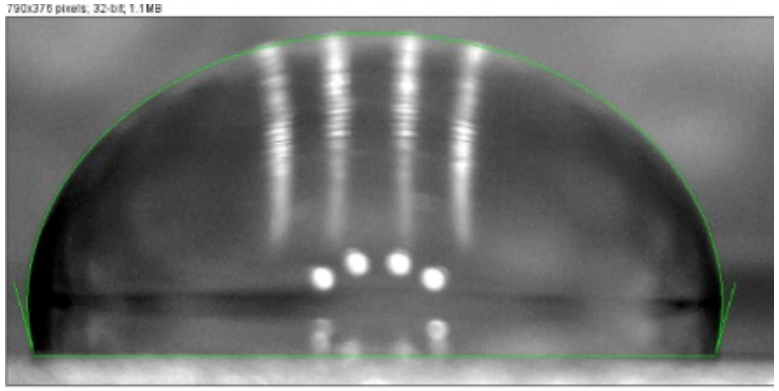
s/d	du/dy PRE	du/dy POST	Reduction
0.1	216.6	199.3	**8.0%**
0.2	209.0	197.4	**5.6%**
1.0	191.4	177.3	**7.4%**

Friction derives from the slope of the wall velocity profile.

Contact angle



Untreated sheet metal



Sheet metal with HYPERCOAT® 90103

Sample	Contact angle	Rolling angle
Untreated sheet metal	92.3°	15°
Sheet metal with HYPERCOAT® 90103	105°	13°

A higher contact angle means a more water-repellent surface; a lower rolling angle means drops run off more easily.

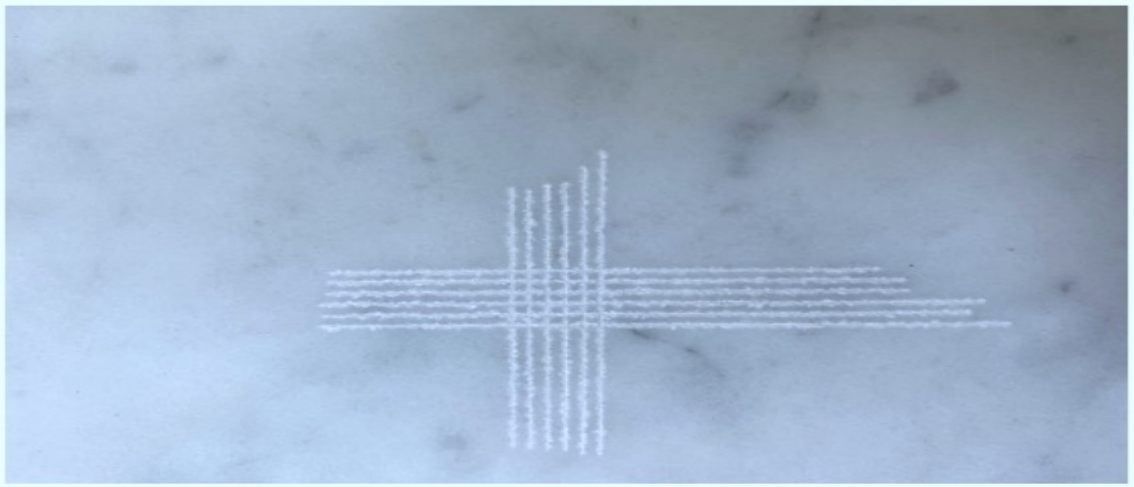
+14%

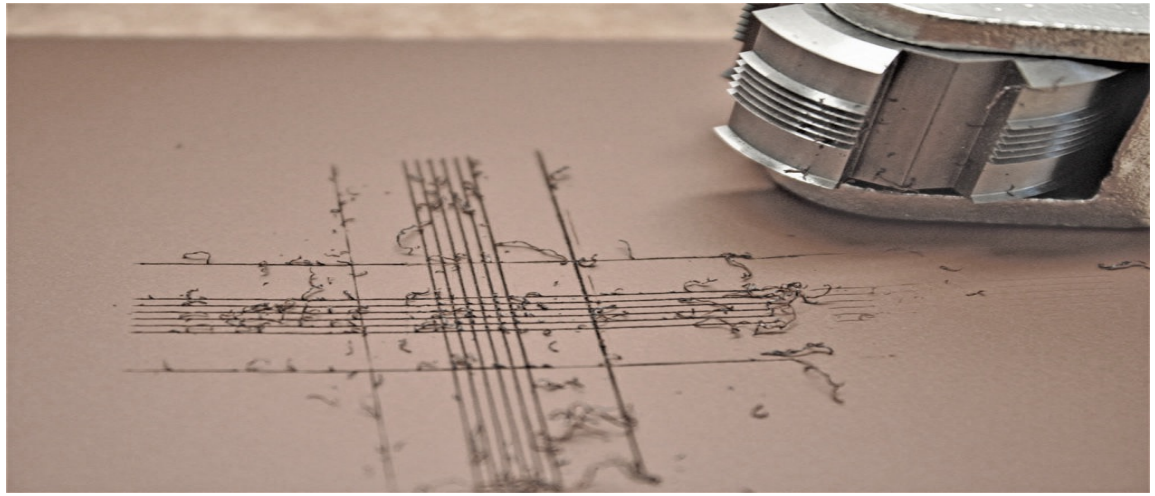
higher contact angle than the same untreated sheet metal

92.3° → 105°

Tape test (X-cut) and squaring

Sample type: epoxy paint coated with HYPERCOAT® 90103





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RATING

Squareness test

UNI EN ISO 2409:2020

No detachment of the surface treatment

4A

RATING

Tape test

ASTM D3359 method

No detachment of the surface treatment

Adhesion test (ISO 2409)

Adhesion test
According to ISO 2409

System	Sample	Rating
Standard paint	Sample 1	**ST0**
	Sample 2	**ST0**
	Sample 3	**ST0**
With PURE-CHEM coating	Sample 1	**ST0**
	Sample 2	**ST0**
	Sample 3	**ST0**

Adhesion after water immersion
14 days at RT, according to ISO 2812-2 and ISO 2409

System	Sample	Rating
Standard paint	Sample 1	**ST0**
	Sample 2	**ST1**
	Sample 3	**ST0**
With PURE-CHEM coating	Sample 1	**ST0**
	Sample 2	**ST0**
	Sample 3	**ST1**

All samples meet the requirements
Adhesion test: ST0 · Adhesion test after water immersion: ST0 or ST1

Suntest XLS+ and outdoor UV exposure



Suntest XLS+

1500 h exposure (300–800 nm)

Standard paint	No impact on colour and gloss
With PURE-CHEM coating	No impact on colour and gloss

Outdoor UV exposure

3 months

Standard paint	No impact on colour and gloss
With PURE-CHEM coating	No impact on colour and gloss

No impact of the HYPERCOAT® coating compared with the standard paint system