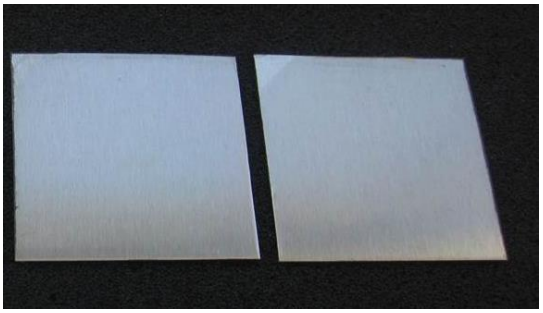
EXTERNAL TEST RESULTS

The following document presents the test results of different natures carried out by external organizations to TECNAN on different metal specimens coated with TECNADIS METALCOAT EASY TO CLEAN.



1. APPEARANCE

Method: Observation by microscopy to determine homogeneity and detect any impurities.

Test conditions: Observation by microscopy with different magnifications of coated AISI 304 and AISI 430 stainless steel specimens.

CONCLUSIONS: ***Homogeneous and without impurities or any kind of contaminations.***

RESULTS: ***POSITIVE***

2. COATING THICKNESS

Method: Observation by microscopy.

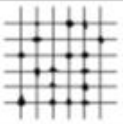
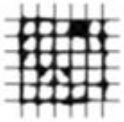
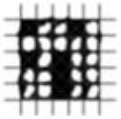
Test conditions: Microscopic observation of the cross-section of a coated AISI 304 sample.

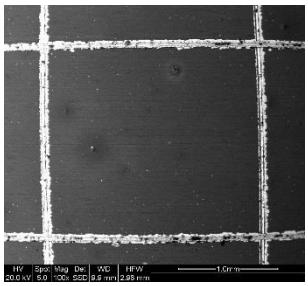
RESULT: ***2 - 4 microns of thickness.***

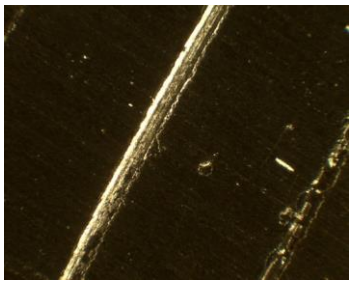
3. ADHESION TO THE SUBSTRATE

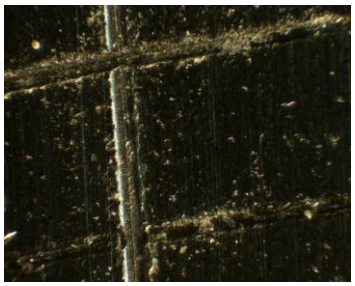
Method: Lattice cutting according to regulations ISO 2409: 2007 and ASTM D3359.

Test conditions: 6 cut blades in parallel separated by a distance of 1 mm. They are held two perpendicular cuts. After the cuts, an adhesive tape sticks with a minimum width of 50 mm and pulled with a force of 6-10 N per 25 mm width of the tape. AISI 304 and AISI 430 coated samples were tested.

Classification ISO 2409 / ASTM D3359	Description	Appearance of surface of cross-cut area from which flaking has occurred (Example for six parallel cuts)
0 / 5B	The edges of the cuts are completely smooth; none of the squares of the lattice is detached.	---
1 / 4B	Detachment of small flakes of the coating at the intersections of the cuts. A cross-cut area not greater than 5 % is affected.	
2 / 3B	The coating has flaked along the edges and/or at the intersections of the cuts. A cross-cut area greater than 5 %, but not greater than 15 %, is affected.	
3 / 2B	The coating has flaked along the edges of the cuts partly or wholly in large ribbons, and/or it has flaked partly or wholly on different parts of the squares. A cross-cut area greater than 15 %, but not greater than 35 %, is affected.	
4 / 1B	The coating has flaked along the edges of the cuts in large ribbons and/or some squares have detached partly or wholly. A cross-cut area greater than 35 %, but not greater than 65 %, is affected.	
5 / 0B	Any degree of flaking that cannot even be classified by classification 4.	---







CONCLUSIONS: ***The cut edges are completely smooth; none of the corners of the grid is detached. No cutting area affected.***

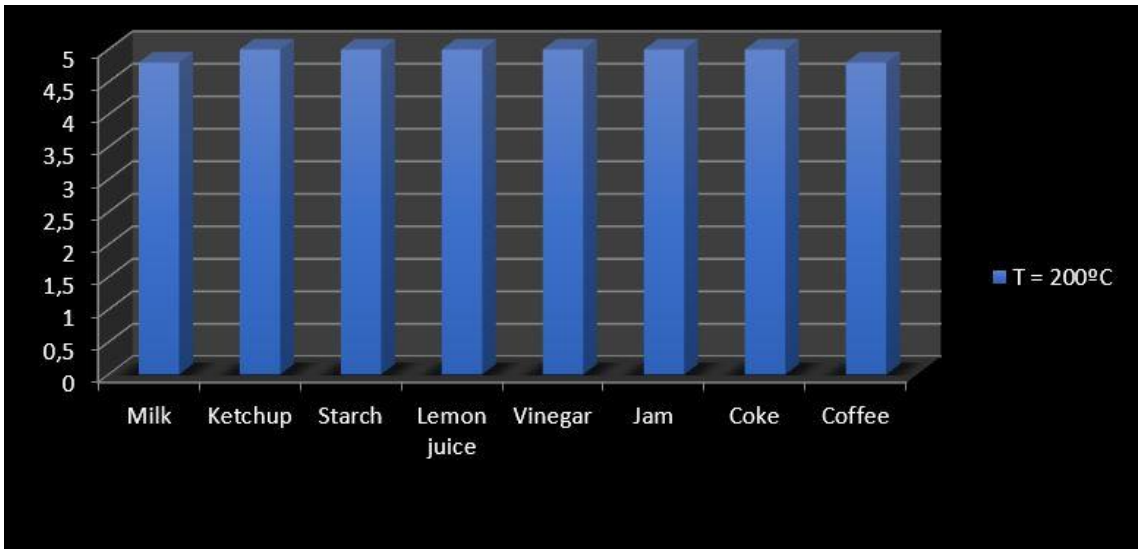
RESULTS: ***Classification 0/5B according to regulations ISO2409:2007 and ASMTD3359 respectively.***

4. EASY TO CLEAN

Method: Easy-to-Clean Test

Test conditions: 9 foods (whole milk sugary, ketchup, olive oil extra virgin, pasta salt starch, lemon juice, vinegar, plum jam, Coke classic and sweetened soluble coffee) cooked in oven for 30 minutes at 200 ° C on coated AISI 430 stainless steel specimens. The cleaning is made automatically according to the following table:

Step	Cleaning liquid	Cleaning device	Cycles	* Force	ETC result
1	None	Soft cloth	5	Little ½ kg	5,0
2	Hot water	Soft cloth	5	Little ½ kg	4,8
3	Hot water	Soft cloth	15	Little ½ kg	4,6
4	Hot water	Soft cloth	15	Little 1 kg	4,4
5	Mild	Soft cloth	15	Little 1 kg	4,2
6	Mild	White sponge	15	Little 1 kg	4,0
7	Mild	White sponge	15	Medium 2 kg	3,8
8	LAC: Vim	White sponge	15	Medium 2 kg	3,4
9	LAC: Vim	White sponge	15	High 4 kg	3,2
10	Mild	Green sponge	15	Medium 2 kg	2,8
11	Mild	Green sponge	15	High 4 kg	2,6
12	LAC: Vim	Green sponge	15	Medium 2 kg	2,4
13	LAC: Vim	Green sponge	15	High 4 kg	2,2
14	Oven* spray, ½hour, cold	Green sponge	15	Medium 2 kg	2,0
15	Oven spray	Green sponge	15	High 4 kg	1,5
16	Oven spray, ½hour, hot	Green sponge	15	Medium 2 kg	1,0
17	Oven spray	Green sponge	15	High 4 kg	0,5
	if not clean after step 17 the result is:				0,0



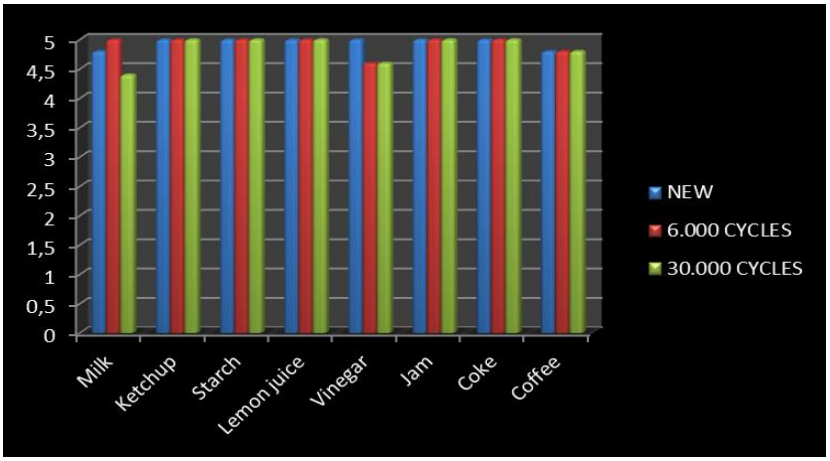
CONCLUSIONS: ***Good non-stick properties getting 99% of the maximum possible score.***

RESULTS: ***It complies with the objective set for this test, surpassing the minimum score required for the test at 200ºC of 3.8 for each stain.***

5. DURABILITY – ABRASION RESISTANCE

Method: Repeat cleaning cycles in partial compliance with ISO11998:2006 standards.

Test conditions: Easy to clean assessments are repeated every 15 cycles of abrasion (round, 30 passes in total) on coated AISI 304 and AISI 430 stainless steel specimens. For abrasion cycles an automatic equipment type Elcometer 1720 with a speed of 37 cycles / min and a load of 2 kg is used. As abrasive agent a white sponge (3M nº163) moistened with a solution of dishwashing detergent is used. 3,000 abrasion cycles are considered a year of use in real application. The cleaning test at 200ºC described in section 4 is carried out. Easy to clean, after 6,000 and 30,000 abrasion cycles, which means 2 and 10 years of simulated life, respectively.



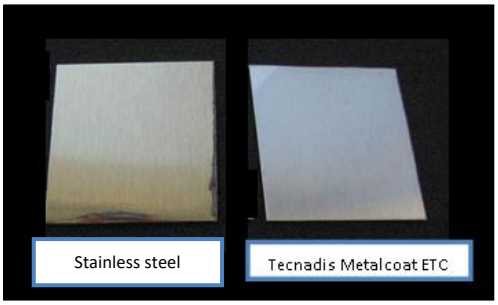
CONCLUSIONS: ***High durability and abrasion resistance, losing only 2% of its non-stick performance after 30,000 cycles of abrasion-cleaning combined (AISI 304). Good resistance to solvent rub: > 100.***

RESULTS: ***10 years of shelf life keeping practically all its properties.***

6. HIGH HEAT SHOCK RESISTANCE

Method: Colour differential measurement system CIELAB after thermal shock.

Test conditions: AISI 304 and AISI 430 pieces, with Tecnadis Metalcoat Easy to clean coating and without coating, are subjected to 30 minutes cycles in oven at different temperatures. The change of colour or yellowing is assessed.



ΔE	T =200ºC	T =250ºC	T =300ºC
AISI 430 coated	1.8	1.8	1.3
AISI 430	7.9	15.3	21.3
AISI 304 coated	1.5	1.0	1.2
AISI 304	7.0	13.5	20.8

CONCLUSIONS: ***The coating has good resistance to thermal shock and also protects the metal against discoloration produced by it around 90 - 95%.***

RESULTS: ***POSITIVE***

7. HARDNESS – SCRATCHING RESISTANCE

Method: Pencil test according to regulation ASMTD3363.

Test conditions: Visual comparison between AISI 304 stainless steel samples coated with Tecnadis Metalcoat Easy to Clean and uncoated samples after superficial scratching with agents of different hardness. Scratching cycles with hardness pencils 4H, 6H, 8H and 9H, with copper sponge and with 3M blue and green sponge. A 50g/cm^2 load is applied to the sponges.

	Stainless Steel	Tecnadis METALCOAT ETC
4H Pencil	Low scratch	OK
6H Pencil	Scratch	OK
8H Pencil	Scratch	OK
9H Pencil	Scratch	OK
Blue 3M Sponge	OK	OK
Copper Sponge	Scratch	Low scratch
Green 3M Sponge	Scratch	Scratch

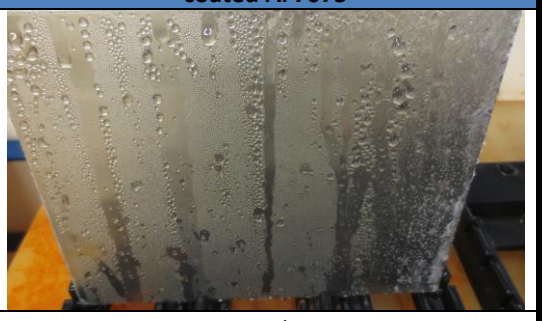
CONCLUSIONS: ***Significant difference in terms of scratch resistance of coated and uncoated steels.***

RESULTS: ***More than 9H hardness.***

8. CORROSION RESISTANCE

Method: Corrosion resistance test according to regulation ASMTB117.

Test conditions: Cleaning of the treated and untreated aluminium alloy Al 7075 samples in an ultrasonic bath of methanol for 5 minutes. Subsequent immersion for 1 minute in alcohol and dried with heat gun. Placement in saline chamber with mist flow at 5% constant and stable temperature of 35 °C. Samples are visually inspected at different times.

Al 7075	coated Al 7075
	
168 h	528 h

CONCLUSIONS: ***Considerable difference in corrosion resistance in coated and uncoated aluminium. In the case of uncoated aluminium alloy 7075, the specimens were corroded in less than 100 hours and with red oxide at 168 hours, while the specimens treated exceeded 500 hours without showing any signs of corrosion.***

RESULTS: ***Anticorrosive coating according to regulation ASMTB117.***

9. ACCELERATED AGING

Method: Xenotest according to regulation ISO105-B02:2014.

Test conditions: Placement of coated AISI 304 stainless steel samples in an accelerated aging chamber Xenotest and visual inspection at different times is made.

CONCLUSIONS: ***No change or deterioration observed after 1700 h in accelerated aging chamber.***

RESULTS: ***POSITIVE.***

10. MECHANICAL RESISTANCE

Method: Different mechanical tests according to applicable European regulation (see table).

Test conditions: Tests carried out on AISI 304 stainless steel specimens.

Test	Regulation	Result
Impact resistance	ISO6272-1:2012	OK
Resistance to bending (1.5 – 2 T)	ISO7438:2006 ISO1519:2011	OK
Drawing resistance	ISO1520:1999	OK

CONCLUSIONS: ***Good mechanical resistance according to current European regulation.***

RESULTS: ***POSITIVE.***

SUMMARY

TEST	RESULTS
APPEARANCE	Homogeneous and without impurities/contaminations.
COATING THICKNESS	2 - 4 µm of thickness.
ADHESION TO THE SUBSTRATE	Classification 0/5B according to regulations ISO2409:2007 and ASMTD3359 respectively.
EASY TO CLEAN	Good non-stick properties getting 99% of the maximum possible score.
DURABILITY – ABRASION RESISTANCE	High durability and abrasion resistance, losing only 2% of its non-stick performance after 30,000 cycles of abrasion-cleaning combined. Good resistance to solvent rub: > 100.
HIGH HEAT SHOCK RESISTANCE	The coating has good resistance to thermal shock and also protects the metal against discoloration produced by it around 90 - 95%.
HARDNESS – SCRATCHING RESISTANCE	More than 9H hardness
CORROSION RESISTANCE	It exceeds 500 hours without showing any signs of corrosion on aluminium.
ACCELERATED AGING	No change or deterioration observed after 1700 h in accelerated aging chamber.
MECHANICAL RESISTANCE	Impact resistance : OK Resistance to bending (1.5 – 2 T): OK Drawing resistance : OK