

DEVELOPMENT OF AN INNOVATIVE «SUPER» SEAL WITH IMPROVED ACID CORROSION RESISTANCE AND NEW FEATURE: RESISTANCE TO ALKALI

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Abstract

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In the last few years, Italtecno has developed a new sealing, called Superseal, able to meet the new requirements from the market, in particular the need of an ecological and user-friendly product able to resist to acid and alkaline environments and with better corrosion resistance.

This type of sealing has been particularly appreciated in the automotive, electronics and cookware markets, where there is the need to pass the most severe tests such as the car washing resistance, the corrosion resistance, the dishwasher resistance and many other.

The Superseal process passes the test of resistance to alkaline agents as – but not only – Volkswagen TL 212, TL 182, General Motors GMW14665 and FIAT 9.57448.

While the big news of this Superseal is the resistance to alkaline environments there are, however, also huge improvements as regards the resistance to acid and corrosive environments and anti-fingerprints. In fact, the Superseal process guarantees significantly improved results to conventional sealing tests such as the weight loss test ISO 3210, the drop test ISO 2143 and the Anotest DIN-EN-ISO 12373-5 (ASTM457-67).

Superseal is ecological, non-toxic, easy to use, to analyze and not particularly affected by pollution.

The sealing have been industrially implemented with great success in a few countries, especially in North America and in the Far East, and is able to meet the standards of different European, American and Asian car manufacturers.

After a few years of industrial use, we can summarize the results obtained with this process.

Introduction

The main shortcoming of the conventional sealing treatments until today has been not to provide adequate protection to aluminium automotive parts to alkaline agents in general so consequently limiting the possible uses.

Cars bodies with anodized aluminium outside in general are subject to heavy corrosion stress mainly due to car wash with alkaline cleaners.

Lately, the market is more and more often requesting new features and new performances to anodized aluminium in order to open new developments for new applications to ensure the competitiveness of the anodized aluminium vs other materials and/or types of treatment.

In particular, the requests received were:

- Resistance to alkaline agents
- Improved performance to sealing tests
- Anti-print treatment and sweat resistant
- Ecological process
- A process easy to use, easy to analyze, not very sensitive to pollutants and not too affected by small changes in the operating parameters used on the plants.

Based on these requirements a new super seal has been developed. Below is how the new super seal meets the requested criteria.

Experimental part – the new process and its resistance to alkaline agents

The anodized and sealed aluminium (by means of the new super seal) has been tested with various alkaline solutions according to a few international standards; mainly those of the major car manufacturers.

The tests made are slightly different from each other, in general, however, they mainly consist in the partial immersion of a piece of aluminium sealed in an alkaline solution at different pH according to the test but, normally, between 12,5 and 13,5. The immersion usually lasts about 10 minutes after which the piece is washed, dried and evaluated visually. To pass the tests there must not be any visible change in appearance.

During the execution of the tests one may see the development of the gas bubbles formed in the immersed part of the pieces sealed with traditional sealing processes. The gas bubbles highlight the chemical attack of the alkaline solution on the anodic oxide not capable of resisting the aggression of the alkaline solution. At the same time, in the immersed part of the pieces sealed with the new super seal, one will not notice any formation of gas bubbles; a signal that there is no aggression of the alkaline solution on the anodic oxide .

All tests made show, visually, a very strong chemical attack on the pieces sealed with conventional sealing processes whether at cold, medium or hot temperature while no variation can be seen on the

pieces sealed with the new super seal. The difference in performance is, therefore, particularly striking (see figure 1)



Figure 1: Result of the test of alkaline resistance FIAT 9.57448. Piece sealed with Superseal process (no visible attack).

Results after 2 hours from the end of sealing (immediate):

#	Sealing description	Visual inspection of the sealed parts	Pre-dip (mg/dm ²)	Total weight loss (mg/dm ²)	Alkali resistance test (TL 212)
1	Cold sealing *	No defects	5.93	28.27	Failed
2	Cold sealing + water ageing at 65 °C for 15 min without Superseal 2S	No defects	4.20	12.47	Failed
3	Cold sealing + water ageing at 65 °C for 15 min +	No defects	2.87	9.27	Passed

	Superseal 2S for 3 min				
4	Cold sealing + water ageing at 65 °C for 15 min + Superseal 2S for 8 min	No defects	2.80	8.27	Passed
5	Cold sealing + water ageing at 65 °C for 15 min + Superseal 2S for 15 min	No defects	2.60	7.13	Passed
6	Cold sealing + Superseal 2S for 3 min	No defects	2.80	14.07	Passed
7	Cold sealing + Superseal 2S for 8 min	No defects	2.67	11.20	Passed
8	Cold sealing + Superseal 2S for 15 min	No defects	2.60	8.67	Passed

Table 1

***Italtecno patented products: see references**

Comments:

The Superseal perfectly replaces the hot water ageing. At the same time works as ageing, improving weight losses, and gives resistance to alkali.

Test with tap water and weight loss. Immediately and after 4 hours

Cold sealing:

Hardwall 3 CB/1: 5 g/l

in demineralized water.

Sealing time: 15 min (1 min/micron)

Temperature: 30 °C

Superseal 2S: as described in data sheet

in tap water, 1/tap e 1/demineralized water and demineralized water (see table below).

Sealing time: 15 min

Temperature: 65 °C

6 panels were sealed - anodizing: 15 micron at 20 °C in 40 minutes at 14.5 V

TEST RESULTS:**Results after 4 hours from the end of sealing and immediate:**

#	Sealing description	Visual inspection of the sealed parts	Pre-dip (mg/d m ²)	Total weight loss (mg/d m ²)	Note	Alkali resistance test (TL 212)
1	Cold sealing + Superseal 2S for 15 min in demineralized water	No defects	2.73	22.40	Weight loss immediate	Passed
2	Cold sealing + Superseal	No defects	6.60	16.60	Weight loss after 4	Passed

	2S for 15 min in demineralized water				hours	
3	Cold sealing + Superseal 2S for 15 min in $\frac{1}{2}$ demineralized water and $\frac{1}{2}$ tap water	No defects	2.60	19.60	Weight loss immediate	Passed
4	Cold sealing + Superseal 2S for 15 min in $\frac{1}{2}$ demineralized water and $\frac{1}{2}$ tap water	No defects	6.27	15.47	Weight loss after 4 hours	Passed
5	Cold sealing + Superseal 2S for 15 min in tap water	No defects	2.40	17.73	Weight loss immediate	Passed
6	Cold sealing + Superseal 2S for 15 min in tap water	No defects	5.40	15.13	Weight loss after 4 hours	Passed

Table 2

Comments:

The Superseal works well with both demineralized and tap water.

Weight losses, although already good when done immediately, slightly improve if done after 4 hours.

New cold sealing, nickel-free, with Superseal

New nickel-free cold sealing:

in demineralized water.

Sealing time: 4 min (0.2 – 0.3 min/micron)

Temperature: 25 °C

Superseal 2S: as described in data sheet

in demineralized water.

Sealing time: 15 min

Temperature: 75 and 85 °C

6 panels were sealed - anodizing: 15 micron at 20 °C in 40 minutes at 14.5 V

TEST RESULTS:

Results after 2 hours from the end of sealing (immediate):

#	Sealing description	Visual inspection of the sealed parts	Pre-dip (mg/dm ²)	Total weight loss (mg/dm ²)	Alkali resistance test (TL 212)
1	New nickel-free cold sealing for 3 min + Superseal 2S at 75 °C for 15 min	No defects	1.69	8.54	Passed
2	New nickel-free cold sealing for 4 min + Superseal 2S at 75 °C for 15 min	No defects	1.86	7.69	Passed

3	New nickel-free cold sealing for 3 min + Superseal 2S at 85 °C for 15 min	No defects	0.45	2.53	Passed
4	New nickel-free cold sealing for 4 min + Superseal 2S at 85 °C for 15 min	No defects	0.34	1.80	Passed
5	Only Superseal 2S at 75 °C for 15 min without cold sealing	No defects	18.47	212.09	Failed
5	Only Superseal 2S at 85 °C for 15 min without cold sealing	No defects	16.84	164.32	Failed

Table 3

Comments:

The new nickel-free cold sealing, in combination with Superseal provides a unprecedented quality sealing, with weight losses very low and, at the same time, excellent resistance to alkali.

The Superseal process is a 2 step process, requiring a mandatory preliminary step, which may preferably be cold, with or without nickel or hot or medium temperature.

Industrial implementation:

After preliminary laboratory studies, the product was tested industrially, first in small test tanks, until the process was refined and, once the industrial test phase was positively completed, the process was also implemented during production.

In particular, the process has been successfully adopted for both automotive and electronic applications.

In the automotive field, many tests have been passed, including, but not limited to, resistance tests in acid and alkaline environment, corrosion resistance test in neutral salt spray, acetic salt spray and CASS, high temperature resistance test to cracks, abrasion resistance test and car washing simulation. Also in the electronic field, several tests have been passed, including, but not limited to, resistance tests to different chemical agents, marker removal tests, corrosion resistance tests.

The first country where this process was adopted was China.

After successfully installing the process in the first anodizing line it was decided to increase the number of lines where the process is used.

After China the process was also implemented in Italy and the United States, always for automotive applications, for other automobile companies.

Final technical considerations:

The Superseal process is not particularly affected by pollutants and is therefore very stable and strong in time.

Superseal is a two-step process: it can be used after cold, hot or medium temperature sealing.

In case of cold sealing, Superseal also guarantees excellent performances also if the cold sealing bath is not in optimal conditions (for example, with low fluorides). This can be useful for some anodizers that have problems maintaining the cold sealing bath within the correct parameters.

A new nichel-free cold sealing has also been developed. It is environmental-friendly and not hazardous and it guarantees, with low temperature and short time, exceptional results in combination with Superseal. It is possible to reach very low weight losses and also an excellent resistance to alkaline agents.

Conclusions:

In the last few years, Italteco has developed a new sealing, called Superseal, able to meet the new requirements from the market, in particular the need of an ecological and user-friendly product able to resist to acid and alkaline environments and with better corrosion resistance.

This type of sealing has been particularly appreciated in the automotive, electronics and cookware markets, where there is the need to pass the most severe tests such as the car washing resistance, the corrosion resistance, the dishwasher resistance and many other.

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