An in-depth analysis of SurTec 313: innovation in aluminium anodising process, now Qualanod approved

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Anodising, an electrochemical process widely used in industry, aims to create a protective oxide layer on aluminium surfaces, improving corrosion resistance, surface hardness, and aesthetic appeal. Among anodising bath additives, SurTec 313 emerges as a cutting-edge solution, Qualanod approved (Approval Number QND-020), offering significant advantages over conventional processes.

Energy savings: an achievable goal

In an industrial context where energy efficiency is paramount, SurTec 313 stands out for its ability to reduce energy consumption. The additive allows operation at higher temperatures and sulfuric acid concentrations compared to traditional methods. This, in turn, increases the bath's electrical conductivity, decreasing the voltage required for the anodising process. Using SurTec 313 can lead to direct energy savings of up to 25%.

Beyond direct energy savings, SurTec 313 helps reduce energy costs related to bath cooling. The ability to work at higher temperatures reduces the need for cooling systems, generating additional savings and making the process more sustainable (**Table 1 and Fig. 1, Table 2 and Fig. 2**).

Crack reduction: a more resistant coating

A common problem in anodising processes is the formation of cracks in the oxide layer, which can compromise its integrity and functionality. SurTec 313 effectively addresses this challenge, offering greater crack resistance, particularly when anodized aluminium is exposed to sunlight or high temperatures. The additive acts during the anodising process itself, creating a protective barrier around the forming anodic oxide, preventing the electrolyte from attacking the oxide and preventing the

formation of weak oxides or burns. Crack resistance has been validated through tests conducted according to automotive standards TL 212 and TL182. Results show that under thermal stress conditions up to 160°C for 24 hours, samples treated with SurTec 313 show no cracking, unlike samples subjected to conventional anodising processes (**Table 3 and Fig. 3**).

Reduced aluminium dissolution: bath efficiency and longevity

Another crucial aspect in anodising is aluminium dissolution in the bath during the process.

This phenomenon not only reduces process efficiency but also leads to increased management costs and shorter bath life.

Bath Temperature (°C)	Voltage (V)	Energy Saving (%)
18	18,11	0,00
19	17,34	4,25
20	17,12	5,47
21	16,83	7,07
22	16,00	11,65
23	15,49	14,47
24	15,24	15,85

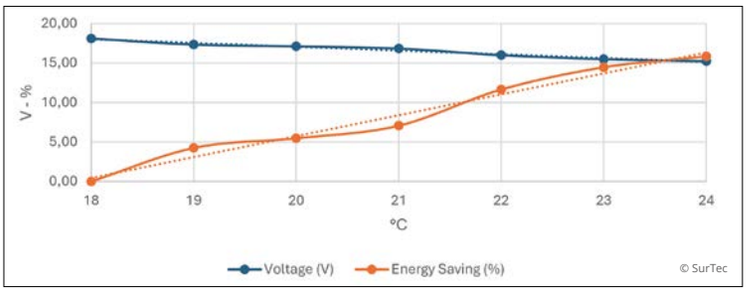

Table 1 and figure 1 -– Energy savings as a function of bath temperature at 1.5 A/dm² at 180 g/l H_2SO_4.

H_2SO_4 concentration (g/l)	Voltage (V)	Energy Saving (%)
180	18,39	0,00
190	17,04	7,34
200	16,99	7,61
210	15,94	13,32
220	15,59	15,23
230	14,94	18,76
240	13,99	23,93

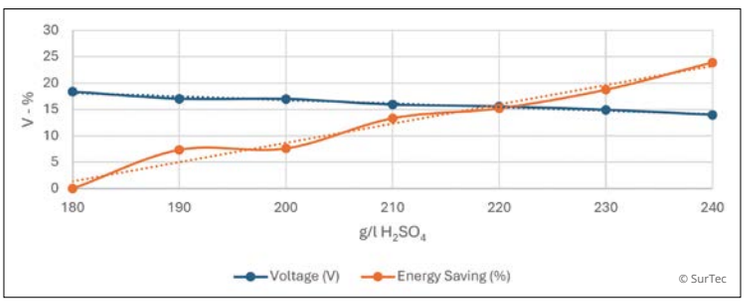

Table 2 and figure 2 - Energy savings as a function of sulfuric acid concentration at 1.5 A/dm² at 18 °C.

Oven at 160 °C for 24 hours (TL 182)	**Anodising: 0.96 dm²/part Load = 6 parts 5.76 dm²/load**	**Sealing:**
Option 1	H2SO4 = 60 g/l ST 313 = 100 g/l 21 °C – 1.5 A/dm² – About 20.3 V 15 min – 6 microns	2 steps: ST 359 Hardwall at 50 g/l at RT for 5 min. ST 345 Hardwall at 90 g/l at 90 °C for 15 min.
Option 2	H2SO4 = 60 g/l ST 313 = 100 g/l 21 °C – 1.5 A/dm² – About 20.3 V 15 min – 6 microns	3 steps: ST 358 Hardwall at 5 g/l at 28 °C for 5 min. ST 359 Hardwall at 50 g/l at RT for 3 min. ST 345 Hardwall at 90 g/l at 90 °C for 15 min.
Option 3	H2SO4 = 190 g/l 19 °C – 1.5 A/dm² – About 14.2 V 15 min – 6 microns	2 steps: ST 359 Hardwall at 50 g/l at RT for 5 min. ST 345 Hardwall at 90 g/l at 90 °C for 15 min.

Table 3 - Cracking after exposure in oven at 160 °C for 24 hours (TL 182).

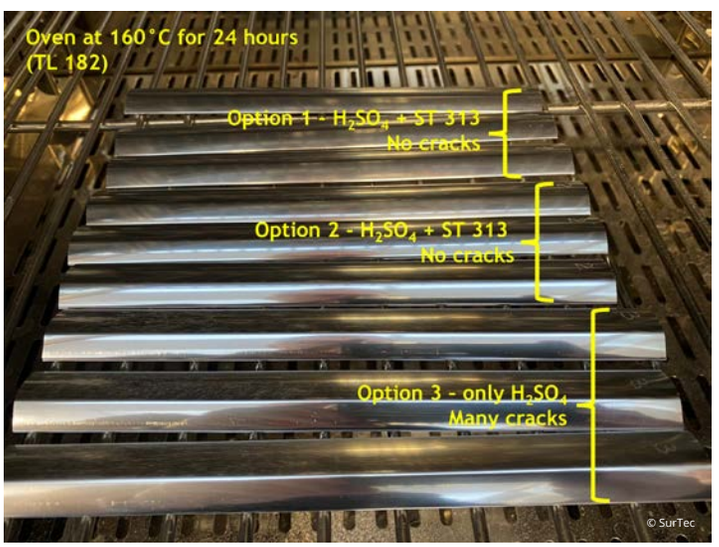

Figure 3 - Under thermal stress conditions of up to 160 °C for 24 hours, the samples treated with SurTec 313 show no cracking, unlike to the samples subjected to conventional anodizing processes.

SurTec 313 proves effective in mitigating this problem, significantly reducing the amount of aluminium that dissolves in the electrolyte. The reduction in aluminium dissolution translates into two main advantages:

◆ increased bath life: SurTec 313 extends the useful life of the anodising bath by up to 3-4 times, reducing bath replacement frequency and associated costs.

◆ ability to work at higher aluminium concentrations: thanks to its ability to limit aluminium dissolution, SurTec 313 allows operation at higher aluminium concentrations in the bath, up to 26 g/l, without compromising anodic coating quality (**Table 4 and Fig. 4**).

Superior anodic oxide: hardness and compactness

The ultimate goal of any anodising process is to obtain a high-quality anodic coating that offers desired properties in terms of corrosion resistance, hardness, and appearance. SurTec 313 distinguishes itself by its ability to produce a harder and more compact anodic oxide compared to traditional processes, even under non-ideal operating conditions.The additive enables achieving superior coating quality even in the presence of bath temperature fluctuations or suboptimal cooling systems. Its ability to form hard and compact oxide is maintained even at elevated temperatures, ensuring a reliable and high-quality final result (**Fig. 5**).

Compatibility and approval: reliability and compliance

Beyond technical benefits, SurTec 313 offers advantages in terms of compatibility and compliance with quality standards. The additive is compatible with anodising bath purification systems (Acid Purification Units). This facilitates bath management, reducing the environmental impact of the anodising process.

Further confirmation of SurTec 313's reliability and quality is its recent approval by Qualanod. Qualanod, an international organization that certifies anodising process quality, has recognized SurTec 313 as an additive compliant with its rigorous quality and performance standards. This approval gives manufacturers confidence in using a product that meets the industry's highest quality standards.

Industrial case study: energy savings with SurTec 313

Numerous companies in the anodising sector already use SurTec 313 in their processes to improve energy efficiency and reduce operating costs. Among various success stories, we now examine one as a case study: a customer requested improvements to achieve electrical current savings during the anodising process and implemented the process with SurTec 313 additive, making significant modifications to their process. Before introducing the additive, the company used a sulfuric acid bath at 190 g/l, maintained at 20°C without additives. With the addition of SurTec 313, it was possible to make several operational changes, including:

Time (minutes)	Dissolution without additive (g/m²)	Dissolution with ST 313 (g/m²)
0	0,00	0,00
10	0,44	0,21
20	1,77	0,89
30	2,15	1,07
40	3,43	1,71
50	3,76	1,95
60	4,49	2,24

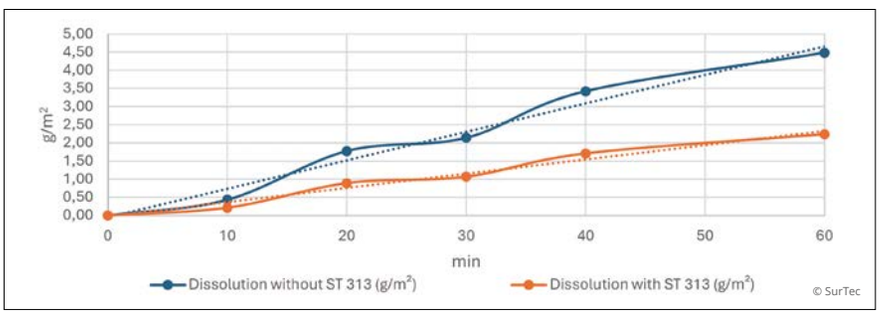

Table 4 and figure 4 – Aluminium dissolution, oxidizing at 1.5 A/dm² in 190 g/l sulfuric acid at 19 °C as a function of time with and without ST 313 (30 g/l).

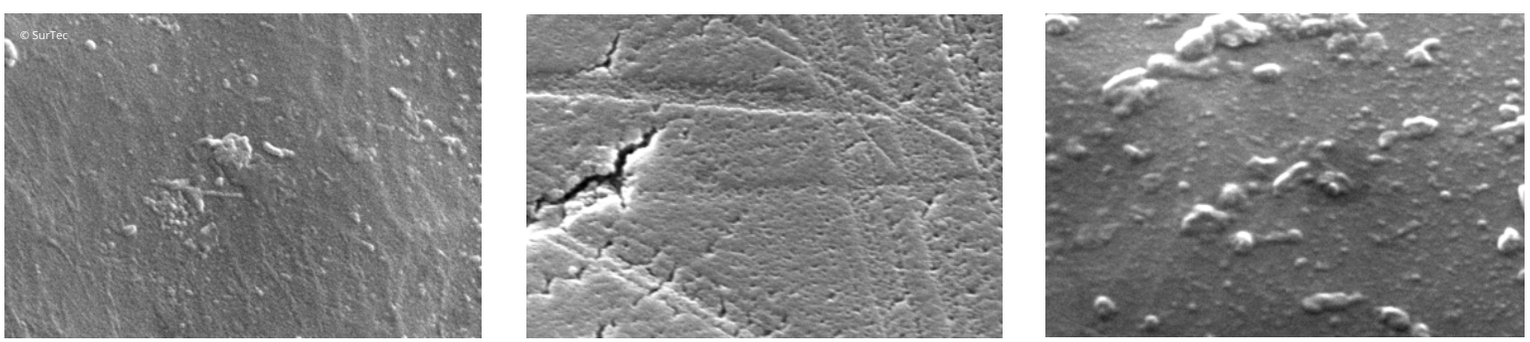

Figure 5 – SEM images of anodic layers obtained at different temperatures with and without ST 313.

◆ increasing sulfuric acid concentration to 240 g/l
◆ raising bath temperature to 24°C.
These adaptations, made feasible by using SurTec 313, allowed reducing process voltage from 17V to 13V, with electrical current savings of approximately 25%.
Achieved benefits:
◆ better conductivity: increased sulfuric acid concentration and bath
◆ temperature improved solution conductivity, reducing resistance to current flow.
◆ reduced voltage and energy consumption: the lower voltage needed to maintain the same current density translates into reduced energy consumption, with consequent reduction in operating costs (**Fig. 6**).

Conclusions: a step forward in anodising

In conclusion, SurTec 313 represents a significant innovation in aluminium anodising. Its multiple advantages, ranging from energy savings to crack reduction, from longer bath life to superior anodic oxide formation, make it an ideal solution for modern anodising processes. Compatibility with purification systems and Qualanod approval add further value to this additive, confirming its reliability and compliance with the highest quality standards. The adoption of SurTec 313 represents a step forward toward a more efficient, sustainable, and high-quality anodising process.

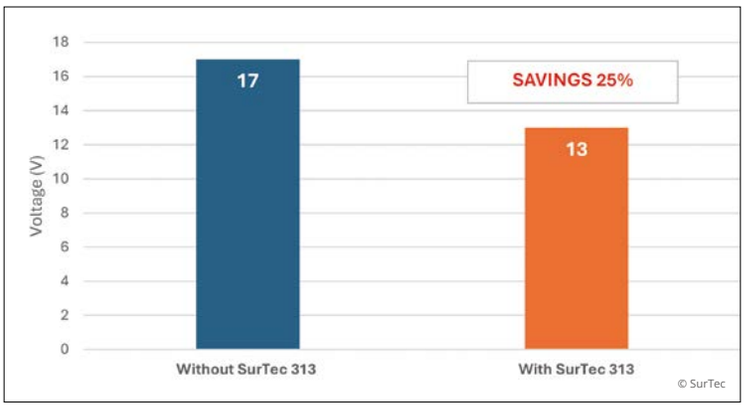

Figure 6 – Industrial case study: voltage reduction and electrical energy savings with and without SurTec 313 (actual data provided by customer).