aluminium
The international magazine of the aluminium extrusion and finishing industry
1/22
EXTRUSION
and FINISHING
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Summary

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1/22

aluminium EXTRUSION

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Editorial Assistant: Francesca D'Andrea

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Phone +39-059-282390
Fax +39-059-280462
Email: info@interall.it

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Via Marzabotto 20,
41042 Fiorano Modenese (MO), Italy
Phone +39-059-282390 - Fax +39-059-280462
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aluminiumextrusion@interall.it
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Via Marzabotto 20
41042 Fiorano Modenese (MO), Italy
Phone +39-059-282390
Fax +39-059-280462
Email: info@interall.it
President: Walter Dalla Barba

Editorial

THE IMPORTANCE OF MEETING IN PERSON AND IMPROVING OUR KNOWLEDGES

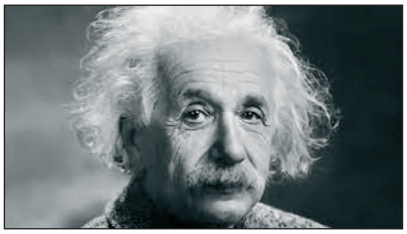
"When we survey our lives and endeavors we soon observe that almost the whole of our actions and desires are bound up with the existence of other human beings. We see that our whole nature resembles that of the social animals.

We eat food that others have grown, wear clothes that others have made, live in houses that others have built. The greater part of our knowledge and beliefs has been communicated to us by other people through the medium of a language which others have created.

Without language our mental capacities would be poor indeed, comparable to those of the higher animals; we have, therefore, to admit that we owe our principal advantage over the beasts to the fact of living in human society.

The individual, if left alone from birth would remain primitive and beast-like in his thoughts and feelings to a degree that we can hardly conceive. The individual is what he is and has the significance that he has not so much in virtue of his individuality, but rather as a member of a great human society, which directs his material and spiritual existence from the cradle to the grave."

"I think it would be very interesting to know the opinion a man who has dedicated his entire life to perfecting and throwing light on principles, has about his science. The way in which he views the post and present in his particular field may strongly depend on what he strives to obtain from the future and on what he hopes to obtain from the present."



Albert Einstein

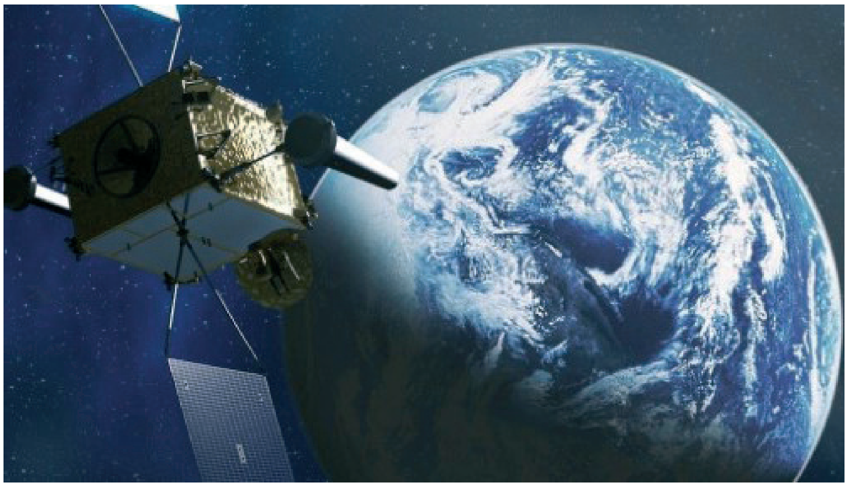
Finally, after two years of video call meetings due to pandemic, we can meet in person.

The next appointment will be: the Aluminium Exhibition Düsseldorf 27-29 September 2022, the next international technical seminar "Extrufinishing 2022" from 22 to 24 September 2022 at the Spezzano Castle, Modena, and finally the 12th edition of Aluminium Two Thousand World Congress 2023, scheduled for 19-23 September in Modena-Rome, will be a few of not-to-be-missed and most important events for the Aluminium Extrusion and Finishing industries, after 2 years of online events or no events at all due to the pandemic.

These new important opportunities will represent not just meeting points between technicians, experts and business men, but they are also opportunities to think about the past, the present and the future of the new technical developments and the economic scenarios of our industry.

Walter Dalla Barba,
Editor and Chairman of the Aluminium Two Thousand World Congress and AluSurface 2022

AIRBUS INITIATES PRODUCTION OF FIRST ALUMINIUM PANEL SKIN FOR SKYNET 6A



On 11th October 2021, the European multinational aerospace corporation, Airbus initiated the production of the introductory aluminium panel skin for the Skynet 6A military communications satellite at its facility in Stevenage, on an occasion in the presence of the UK's minister of defence procurement Jeremy Quin.

Quin stated: "Secure military SATCOM is vital for our ability to conduct operations on a global scale."

"Seeing the first hardware for the next-generation Skynet 6A satellite shows we are on track for launch in 2025 and ready to upgrade and enhance the UK's global military communications network", the minister added.

The international pioneer in the aerospace sector, Airbus in July 2020 secured the contract to design and develop Skynet 6A from the UK Ministry of Defence. In December 2020, the programme attained its Preliminary Design Review.

The design of the Skynet 6A satellite is rooted in the Airbus Eurostar Neo telecommunications spacecraft.

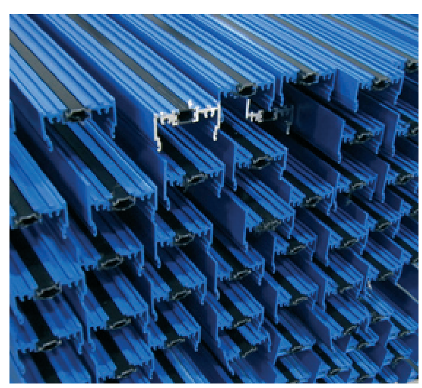
Richard Franklin, MD of Airbus Defence and Space, said: "The Company is looking at future export opportunities which will benefit the wider space ecosystem, while it is also actively engaged with bringing onboard a wider spread of UK SMEs to deliver this essential sovereign capability."

Ref. 1221

UNDERSTANDING AND MANAGING HEAT ENERGY TRANSFER IN ALUMINUM FRAMING

To meet model energy codes and building-specific energy efficiency objectives, manufacturers thermally improve their aluminum-framed windows, entrances, skylights, curtainwall, storefronts and other exterior-facing fenestration products.

As a single source solution, Linetec offers you more choices, fewer steps and less hassle to ensure high-quality, finished aluminum that meets the thermal perfor-



mance requirements of your customers' building envelopes. Whether choosing thermal strut or poured-and-debridged, the goal is the same: reduce heat transfer, and as a result, lower energy consumption and keep the occupants inside more comfortable.

You're getting warmer

Heat, or thermal energy, is created by the intrinsic movement of atoms and molecules in matter. When they move faster, they create more heat. When this thermal energy moves between systems, it is referred to as heat transfer and is measured by temperature. Thermal energy always transfers from a system of higher energy to a system of lower energy, or from hot to cold.

Heat is transferred in three main ways:

1. **Radiation** – transfers heat by electromagnetic energy, also known as infrared radiation (IR). Even though the sun is 93 million miles away, it produces IR waves that travel through space to heat the Earth.

Traditionally, we've used trees and other natural shading to block sunlight. Umbrellas, canopies, awnings and other manufactured shading devices are incorporated into today's built environment. In modern fenestration systems, the glass also can be coated to reflect IR energy and further manage unwanted solar heat.

1. **Convection** – transfers heat though the mass movement of particles in either a gas or a liquid. As a mass of air or liquid heats up, the particles naturally expand and become less dense, causing the warm air or liquid to rise and to push cold masses down. This often creates a circulatory effect, such as seen within weather systems or convection ovens. In cooking appliances, this feature turns on a fan within the oven to circulate the hot air, resulting in faster and more even cooking.

Most building's HVAC systems also use mechanical convection to heat or cool interior spaces. If you open a window, convection will happen through natural ventilation by either letting hot air inside if it's warmer outside, or allowing hot air out if it's warmer inside. Because hot air rises, opening transom and clerestory windows near the ceiling helps let out warm air, keeping the cooler air at floor level.

1. **Conduction** – transfer heat directly from one object to another. Thermal energy moves from molecule to molecule through physical contact, spreading heat through solid objects. You have experienced conduction if you have warmed your feet on a sand beach or burned yourself on the hot handle of a pan.

Metal is a particularly conductive material, and aluminum has very high thermal conductivity. This can be a useful property for numerous applications like cookware, packaging and electronics, but it also can be challenging to manage in exterior building materials, such as fenestration framing systems.

A good break and a welcome disruption

Without a thermal barrier to separate the aluminum framing's exterior and interior surfaces, energy will transfer through it causing heat loss from the interior when it's cooler outside or heat gain when exterior temperatures are warmer.

Uncontrolled, this can interfere the building's HVAC systems, increase energy use and costs, and lead to unproductive, irritable occupants. Adding a thermal "break" and insulating material effectively disrupts the heat transfer in aluminum-framed fenestration products. Linetec offers a choice of either polyamide strut or polyurethane poured-and-debridged thermal barrier systems.

Working with your product engineers, we can meet your thermal barrier specifications for high-performance, finished fenestration systems that help achieve your customers' energy efficiency objectives.

Ref. 1222

MORE EFFICIENCY IN ALUMINUM DIE CASTING WITH MICRO SPRAY LUBRICATIONS

The innovative lubrication technologies, widespread and distributed also in Italy, guarantee the optimal lubrication of the die-casting tool using minimum quantities of release agent.

The avant-garde of new sprays for lubrication in aluminum die casting

The thermoregulation and lubrication of the mold are the few phases of the aluminum die casting process where it is still possible to obtain savings and better efficiency. Today every foundry is able to achieve effective lubrication, but is this lubrication also efficient? Effectiveness indicates the ability to achieve the set goal, while efficiency indicates the ability to achieve it using as few resources as possible. Regarding the lubrication of the tool, the new release agents (oils or concentrates) are changing the philosophy of lubrication: while in the past lubrication was used to cool the surface of the mold, today it is only used to create the separation film between the mold and the jet.

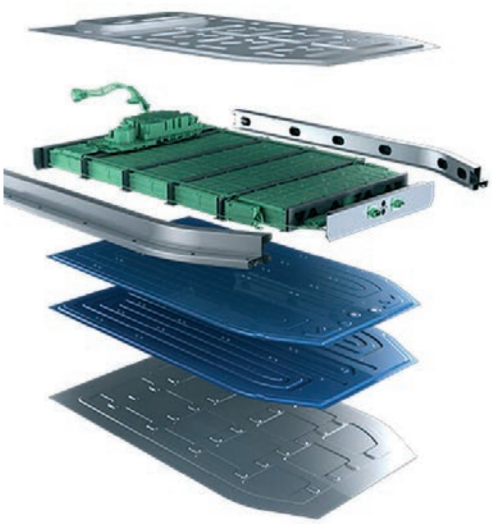
Consequently, the thermoregulation of the mold must be optimized as much as possible: the heat removed in the past by the water spraying, must now be removed by the thermoregulation. In addition to this, the discriminating factor is the technology used to apply these products: to obtain the best results, the release agents must be micro-dosed. The accuracy and repeatability of micro-lubrication are crucial, and can only be achieved by using suitable technologies. The new spray technologies can achieve the goal in different ways that adapt to the different needs of foundries, with long-lasting production or frequent mold changes. The amount of release agent sprayed per nozzle can be reduced down to 0.01 ml. Furthermore, once the desired quantity has been set, this will remain stable and constant and independent of external factors such as the pressure of the release agent or the air pressure.

Multiple objectives can be achieved:

- - shorter cycle time (in some applications, it is theoretically possible to achieve a spraying time of 1 second)
- - reduction of the release agent (going from a few dozen to a few units of concentrated release agent)
- - reduction of water consumption (only necessary if thermoregulation cannot be effective in some areas of the mold)
- - reduction of air consumption (thanks to the shorter spraying time and the fact that it is not necessary to dry the matrix)
- - cancellation or reduction of water disposal costs (water is not used or less is used during spraying)
- - longer life and greater availability of the mold (thanks to the reduction of thermal shocks)
- - better quality of the castings and reduction of waste (thanks to the more homogeneous temperature of the mold and the reduction of porosity caused by water).

Ref. 1223

NOVELIS INTRODUCES SECOND-GENERATION ALUMINIUM INTENSIVE BATTERY ENCLOSURE SOLUTION FOR ELECTRIC VEHICLES



Dida: Novelis has announced the introduction of new design innovations with Generation II of its lightweight electric vehicle (EV) battery enclosure solution for the rapidly growing EV market

Building on the results achieved with the Generation I concept, which introduced the first of its kind sheet-intensive aluminium battery enclosure, Generation II expands the portfolio of innovations available for global applications. The advanced aluminium-sheet-intensive design maximises weight reduction, reduces costs, and delivers higher pack energy density compared to traditional EV battery enclosures made from steel or aluminium extrusions. Since launching the first-generation battery enclosure solution in 2019, Novelis has worked with industry partners and automotive engineers to optimise the design and introduce production-feasible innovations, including high-strength aluminium roll forming, advanced cell-to-pack (CTP) modular architecture and a structurally integrated thermal management bottom plate. These innovations, combined with Novelis' advanced material technology, result in a best-in-class frame mass efficiency of below 1.0 kg/Kwh, and a mass reduction improvement of more than 20% versus the benchmark aluminium production enclosure from a leading European electric SUV manufacturer. The improved CTP package efficiency and structural performance also delivers a 30% improvement in energy density versus the benchmark.

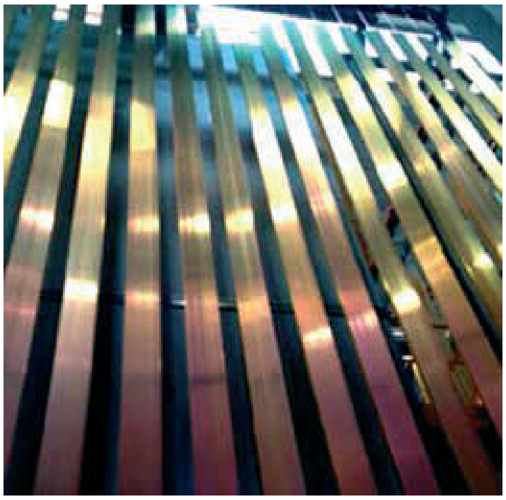
Designed using high-performing Novelis Advanz-TM s650 alloy in roll-formed frame sections, the new EV battery enclosure is 50% lighter than traditional steel enclosures, and more cost-effective than extrusions in most cases. As a result, it can be easily adapted to accommodate specific OEM vehicle designs. By utilising Novelis' highly formable alloys, the enclosure provides automakers the ability to achieve deep drawn, complex shapes. In addition to the detailed design solutions, Novelis has developed first-of-its-kind engineering methodology and design guidelines to specify lightweight aluminum for top cover applications, while referencing many of the most stringent global thermal runaway resistance requirements. The simulation-derived guidelines will allow companies to quickly determine the optimal specifications to achieve their unique vehicle objectives, replacing steel with aluminium in a top cover application.

"The Second-Generation battery enclosure is the direct result of listening to the feedback from the market and working in close collaboration with our partners and customers," said Pierre Labat, Novelis Senior Vice President, Chief Strategy & Sustainability Officer (below left). He continued, The new enclosure is developed and designed specifically for automakers to use advanced, CTP battery packaging architecture, which is 15% to 20% more compact than traditional cell configurations and requires fewer parts to build. CTP enclosure architecture is lighter weight, lower cost and increases volumetric energy density.

The Second-Generation solution also demonstrates the inherent benefits of aluminum over other materials for EV battery enclosures. Aluminum is more corrosion-resistant, infinitely recyclable and has superior thermal conductivity properties. Those attributes promote more efficient battery use for longer range.

Ref. 1224

LL-ALUGOLD SCR



CONVERSION LAYER IN REDDISH BROWN COLOUR, FREE OF CHROME PREATMENT FOR ALUMINUM AND ITS ALLOYS BEFORE PAINTING.

Pretreatment, a key point of quality!

LL-ALUGOLD SCR is a liquid product characterized by a balanced combination of inorganic acid salts t CONVERSION LAYER IN REDDISH BROWN COLOUR, FREE OF CHROME PREATMENT FOR ALUMINUM AND ITS ALLOYS BEFORE PAINTING.

Pretreatment, a key point of quality!

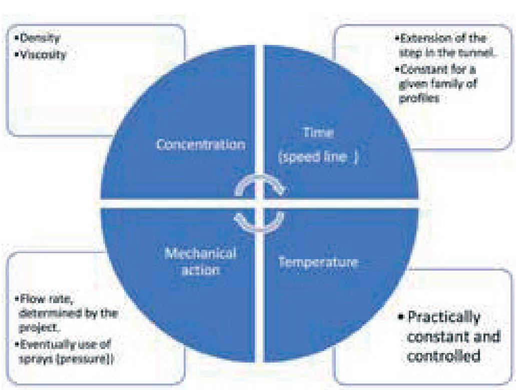
hat in contact with aluminum reacts, forming a colored layer in the **REDDISH BROWN COLOR** of metallic complexes, specially developed for the treatment of aluminum before painting.

This unique and special feature allows immediate and visual control of the conversion layer formed on the surface of treated aluminum.

1. **COMPLETELY FREE OF CHROMIUM VI or III.**
2. **HIGH LEVEL INTERNATIONAL QUALITY – ABNT 14.125 - BRASIL, QUALICOAT APPROVAL - Europe, AND AAMA - USA.**
3. **EXCELLENT CORROSION RESISTANCE**
4. **EXCELLENT PAINT ADHESION, BOTH DRY AND WET TESTS**

The **LL-ALUGOLD SCR** product can be applied by spray or immersion and this innovation comes continuously in evolution, always searching better results concerning: ENVIROMENT, SAFETY AND COST.

Schematically, particularly important key points are highlighted for the achievement of the results.



1. Reaction time / Contact time
2. Mass loss or removal rate (g/m²)
3. Weight gain or layer “thickness” (g/m²)
4. Rinsing flow rate as a function of drag out rate that depends on geometry of the aluminum profiles, speed line

Italtecno Do Brasil:
Avenida Angélica, 672, Santa Cecilia, São Paulo, Brasil

RESISTANCE AGAINST INTERGRANULAR CORROSION OF 6XXX ALUMINIUM EXTRUSIONS

H. Gers*
HAI Extrusion Germany GmbH, Germany

Abstract

According to numerous literature references low strength 6xxx aluminium extrusions are resistant to Intergranular Corrosion (IGC). For automotive applications the demands on properties of aluminium extrusions have increased within the last years. Medium and high strength alloys are used for e.g. suspension parts. To prove the resistance to IGC of these applications a number of shorttime tests are established. Experiences with the practical use of these tests methods, the results of a Round-Robin-Test and the latest development on an IGC resistant alloy EN AW-6082 are described.

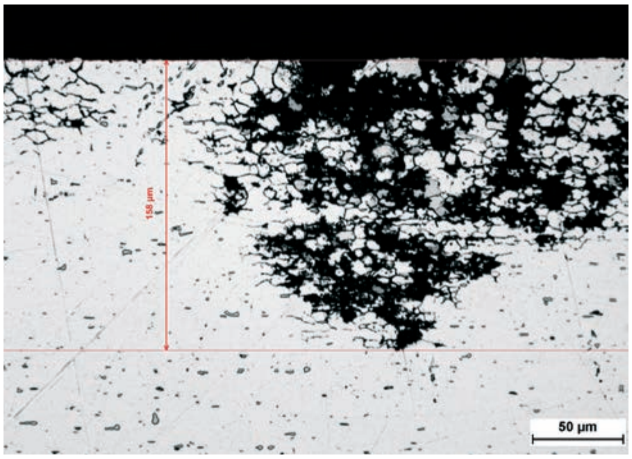


Figure 1: IGC at Aluminium Extrusion

Introduction

Intergranular corrosion (Fig. 1) is a selective attack of the grain boundary zone, with no notable attack of the matrix. The mechanism of corrosion is caused by a difference in electrochemical potential in a local galvanic cell. The local galvanic cells are formed between precipitates and the depleted zone in the matrix [1]. It is a special form of local corrosion where precipitates at grain boundaries or boundary zones are dissolved.

Fig. 2 shows the mechanism of IGC [2]. Cathodic precipitates on the boundary cause a anodic depleted zone on either side of the boundary. The difference in electrochemical potentials forms local galvanic cells. The anodic area of the depleted zone will be dissolved. Remnants of the precipitates will be detached from the matrix [3].

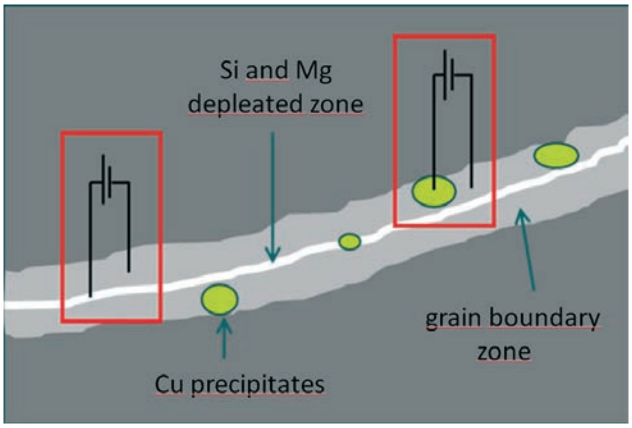


Figure 2: Mechanism of IGC [2]

Literature references give some information about the most influencing variables.

Alloy composition:

Generally, aluminium of the 6xxx series alloys has a good corrosion resistance. However, various alloying elements reduce the resistance. Iron and copper in particular have the clearest impact [4].

Aging:

[5] describes the influence of the aging process on the sensitivity to IGC (Fig. 3). A uniform IGC appears right from the start of the aging process. Minimum of IGC was found at an optimum combination of temperature and holding time.

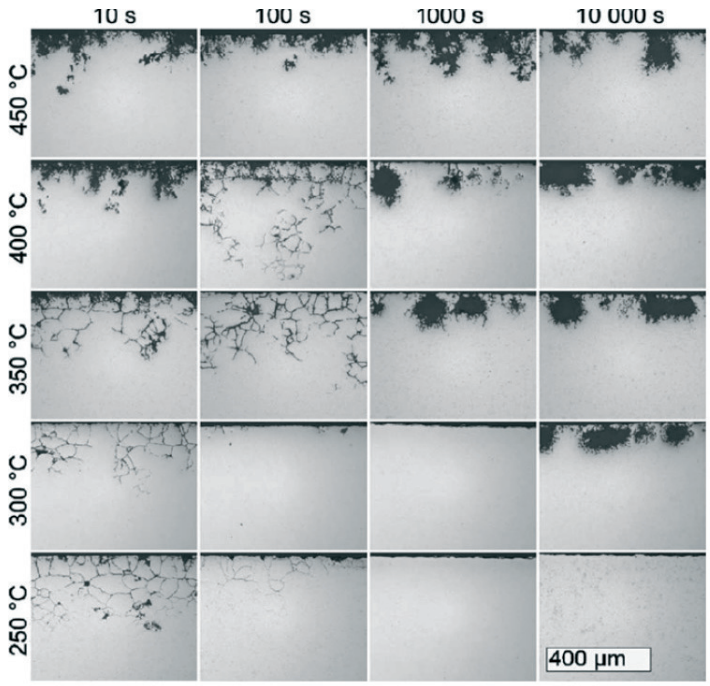


Abb. 12. Korrosionsverhalten von einem AlMgSi-Flachprofil (~ AW-6005A + 0,13% Cu) nach Lösungsglühen und Stufenabschreckung auf verschiedene Temperaturen mit verschiedenen Haltezeiten [*Svenningsen et al. 2006b*]

Figure 3.: Corrosion behaviour with varying aging time for aluminium extrusions after solution heat treatment [5]

Requirements for automotive applications

The importance of IGC resistance of aluminium extrusions is considerably increased for automotive application especially for suspension parts. To save weight the parts are designed with smaller wall thickness. Even small cracks can lead to a failure of the component. With regard to the use of particularly aggressive de-icing salts on roads, the crack propagation induced by IGC must be considered.

Therefore in addition to standard corrosion tests, laboratory tests have been developed by various automobile manufacturers to simulate the corrosion attack during the lifetime of the components.

Table 1 provides a summarized overview over the test procedures and compares the main parameter [6, 7].
These are laboratory tests with tightened conditions compared to normal environmental corrosion influence. This is achieved with aggressive electrolytes to shorten the time of testing. The correlation between laboratory test results and corrosion under normal environmental conditions has been proved.

	DIN ISO 11846 Method B	VW PV1113
	4 – 20 cm²	not defined
staining	NaOH (5-10%) water nitric acid (70%)	no staining allowed
test solution (1000 ml)	30 g NaCl 10 ml hydrochloric acid (37%)	20 g NaCl 100 ml hydrochloric acid (25%)
test duration	24 hrs at room temp.	2 hrs at room temp.
evaluation at cross-section	100-500 x mag.	20-50 x mag.
Evaluation of test result	depth, relative extent of attack	depth and extent of attack

Tab. 1: Overview over short time corrosion tests [6, 7]

Round Robin Test

The members of the project team "Corrosion Chemistry" at the GDA compared these tests by means of a round robin test.
Two alloys where chosen for this test: EN AW-6060 and EN AW-6082. The extrusion billets out of one casting lot for each alloy where extruded and after aging samples of each alloy where tested at 6 laboratories. There the IGC tests where performed according to the existing test instructions. The evaluation was carried out by measuring the maximum depth of IGC attack.

Fig. 4 shows the results of the evaluation of extrusion profiles in alloy EN AW-6082 in T6 condition for each laboratory and two test procedures.

The diagram shows the spread of the results of 4 measuring values.
One can notice immediately, that there is a large variation between the results of the different laboratories, especially between lab 1 and lab 2. Generally the PV 1113 generates higher values for the IGC depths than the ISO test. The results within

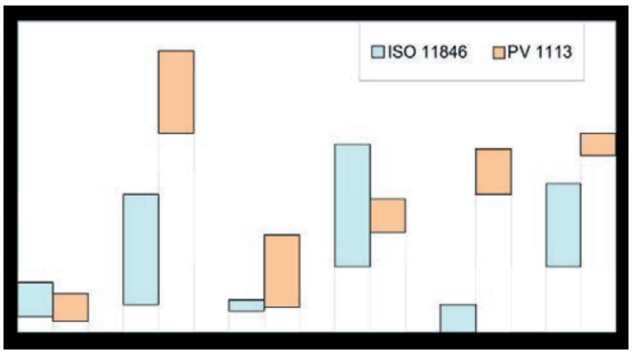


Figure. 4: IGC corrosion depth on profiles of alloy EN AW-6082 after laboratory test [8]

Figure 5: IGC corrosion depth on profiles of alloy EN AW-6060 after laboratory test [8]

a laboratory are often relatively consistent. There are several reasons for the differences of measured IGC attack. Small scratches on the surface can be a preferred starting area for the corrosion attack, poor circulation of the electrolyte and last but not least the testing time itself. The PV1113 allows a testing time of 2 to 2,5 hrs, which is very long for an aggressive corrosion test.
Fig. 5 shows the test results of alloy EN AW-6060. It is noticeable that in this case the test results according to ISO 11846 are significantly higher than to PV 1113.
But generally the measured corrosion depths of alloy EN AW-6082 T6 were smaller than of alloy EN AW-6060 T6. This can be explained by difference in the Si/Mg ratio. This was 0,98 for the EN AW-6060 and 1,43 for the EN AW-6082. A larger influence has the cooling rate of the extrusion. The EN AW-6060 extrusion was air cooled at the press and the EN AW-6082 was water quenched. The aging conditions were the same for both alloys.
To achieve reliable and repeatable results with the short time corrosion tests the test parameters had to be adjusted to tighter tolerances and the handling procedures of the material had to be described much more accurate. This was fixed in a recommendation of the GDA experts for the test procedures.

Development of a high strength IGC resistant alloy

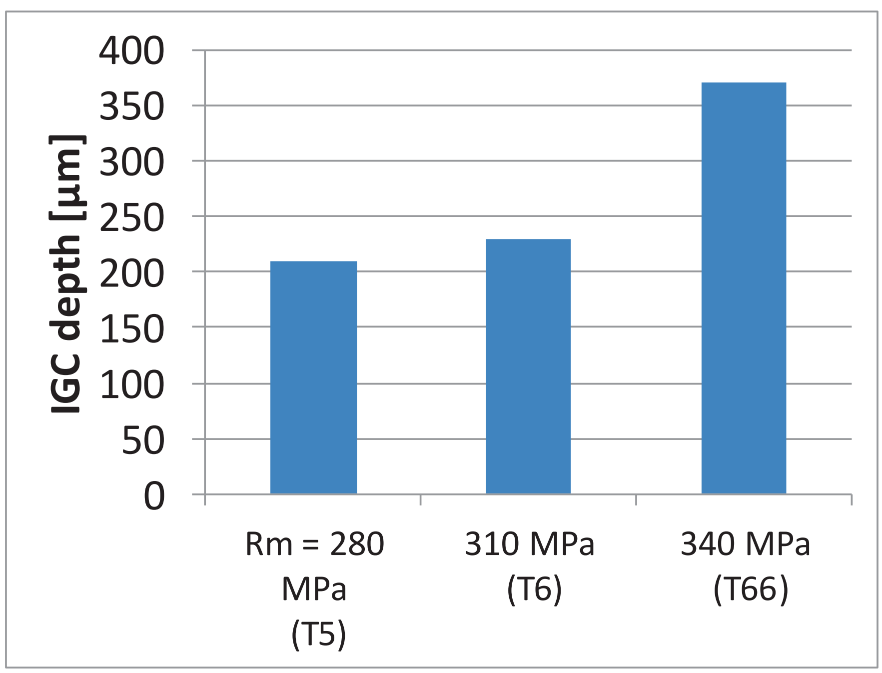


Figure 6: Effect of aging condition on IGC depth of alloy 6082

The following test results are achieved with the test procedure PV113. Fig. 6 shows the

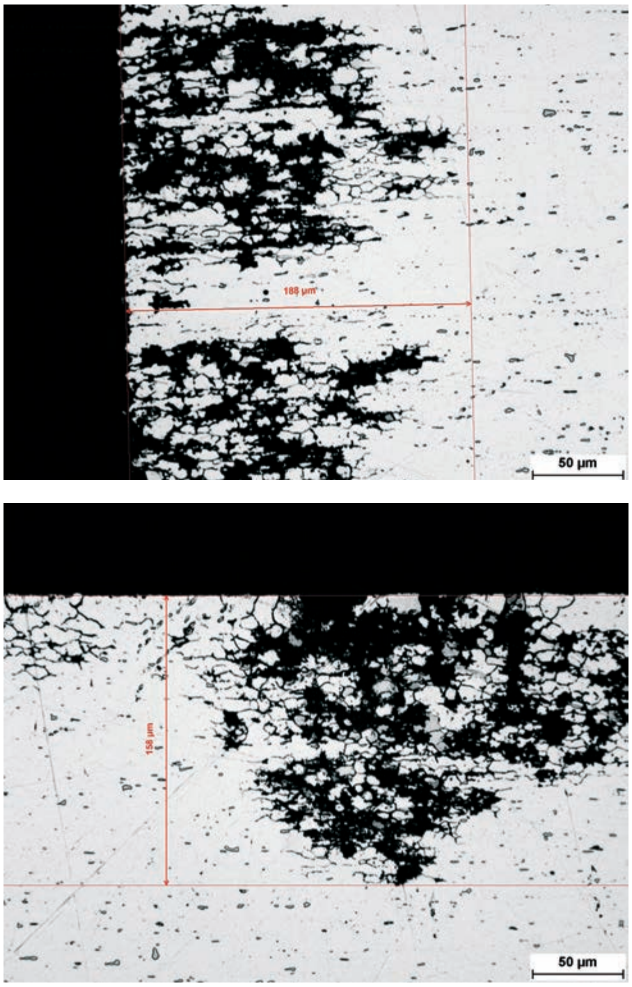


Figure 7: Effect of grain structure on corrosion depth: sawed surface (left) and extruded surface (right)

typical IGC attack of alloy EN AW 6082 with different tensile strength. With increasing strength the maximum depth of the corrosion attack increases as well. Due to the higher requested strength of this alloy it contains more alloying elements. Main cause of the corrosion attack is the distribution of the precipitates within the matrix and in the grain boundary zones.
The corrosion depth depends also on the grain structure of the EN AW-6082 extrusions. It is not only sufficient to measure the corrosion attack on the extruded surface. It is important to consider that the extrusions are sawed to shorter length and on this “secondary” surface there is a non-recrystallized grain structure. The corrosion attack on this surface may get even deeper than on the regular extrusion surface (Fig. 7).
To develop an aluminium alloy with higher tensile strength and a better resistance to IGC important steps of a production line of aluminium extrusions were analyzed:

- Chemical composition
- Homogenization and cooling rate
- Extrusion conditions
- Aging procedure

At the present stage corrosion attack cannot completely be eliminated. However, up to

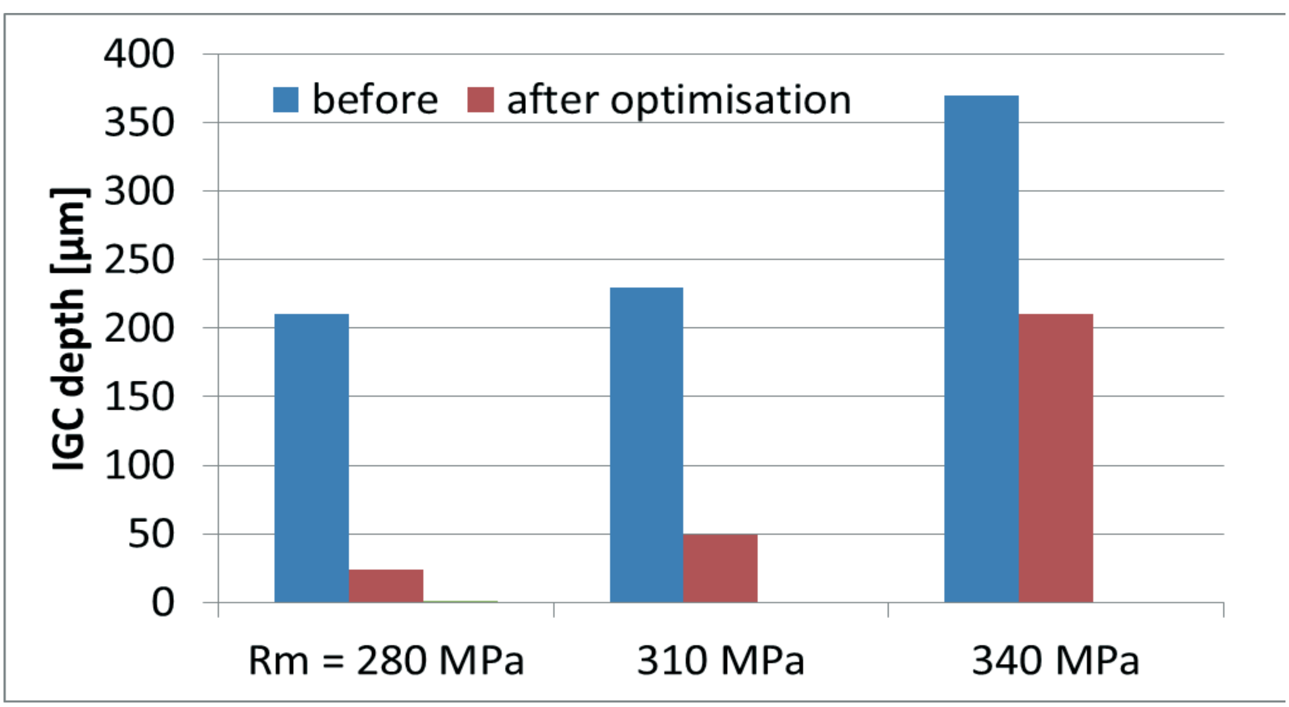


Figure 8: Improvement of the corrosion behavior of a modified EN AW-6082

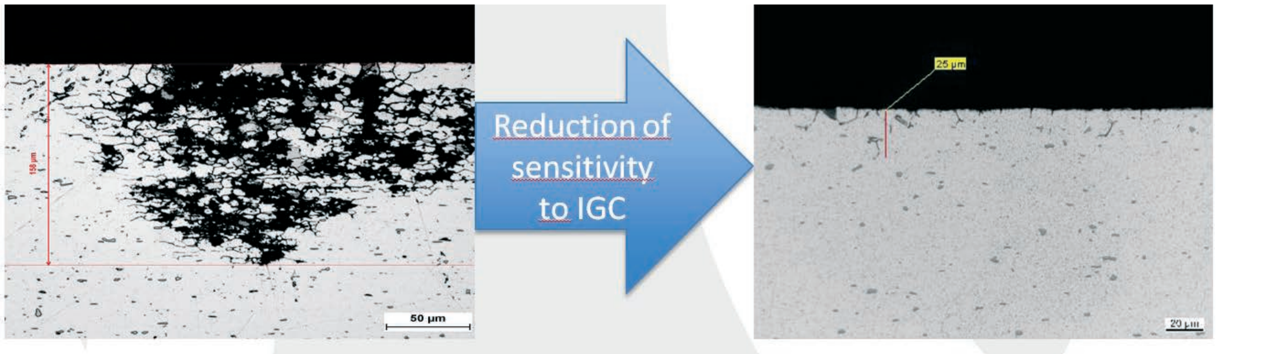


Figure 9: Reduction of sensitivity to IGC on extruded surface

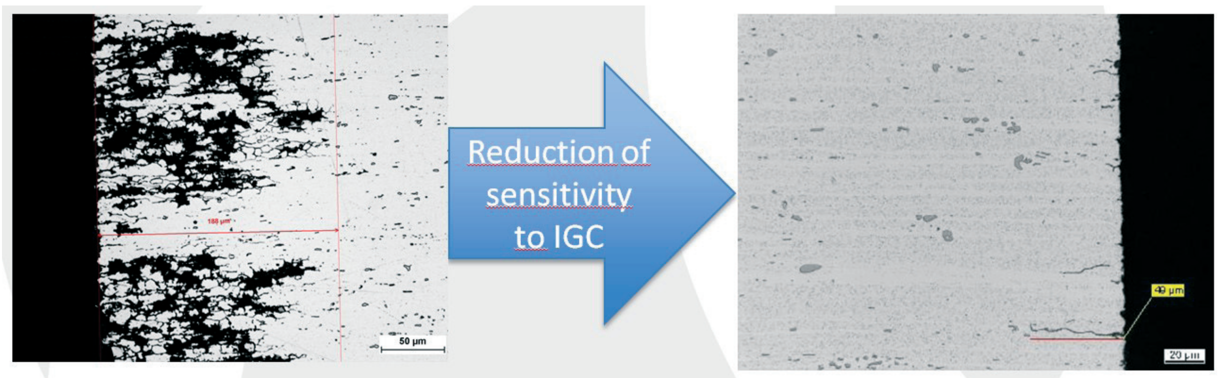


Figure 10: Reduction of sensitivity to IGC on sawed surface

a moderate tensile strength of 310 MPa the corrosion depth can be reduced by around 80% (Fig. 8).

But not only the corrosion depth has been reduced significantly, also the appearance of the IGC attack has clearly changed from overall corrosion to sporadic appearance (Fig. 9).
This was achieved on the extrusion surface as well as on the sawed surface (Fig. 10)

HAI was able to extend the portfolio medium to high strength alloys which has a clearly reduced sensitivity to IGC.

Summary and conclusion

Some recommendations after practical experiences of the last years may be given:

The test lab has to have a lot of experience with the test procedures. The repeatability and reliability of the test results (also with the lab of your customer) have to be ensured.

Production parameters have to be established and controlled within very tight tolerances:

- Reduction of alloying elements as low as possible
- Identical homogenization and cooling condition for every billet
- Isothermal extrusion
- Enforced cooling of the profiles
- Aging time as short as possible

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[8] GDA, German Aluminium Industry Association, Düsseldorf

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INFLUENCE OF SPECIMEN MACHINING AND CROSS-SECTIONAL AREA MEASUREMENT ON TENSILE TEST RESULTS (FIRST PART)

Ramakumar Jayachandran[1], Jesus Mendoza[2]
[1]Hydro Extruded Solutions, Operational Excellence (OpEx), Extrusion Europe, Norway [2]Hydro Extruded Solutions, Innovation and Technology, Sweden

Abstract

The tensile test is often considered as a primary test method for quality assurance and certification of extruded products. This paper presents how the specimen machining and the cross-sectional area measurement affect the tensile test results.

A set of aluminium samples with similar mechanical properties were tested at two different reference laboratories. The agreement of test results between these laboratories was good, and there were little variations among the individual measurements made at these labs. Following this more samples were taken from the same material and sent to different laboratories of extrusion plants for tensile testing. Fifty percent of the samples were pre-machined for tensile testing at one of the reference laboratories with the cross section measured and documented. The remaining fifty percent of samples were intended to be machined and tested at the extrusion plant laboratories.

The cross-sectional measurement and tensile test results data from the extrusion plants were collected and evaluated. The values reported from the other laboratories showed disagreement with the values measured by the reference laboratories. In some cases, the average reported values were very different from the reference values.

The outcome of the study showed two significant factors affecting the accuracy of tensile test results.

1. A significant part of the deviations from the reference labs was due to machining quality of the specimen
2. The second most significative contribution was the inaccurate measurement of sample cross-sectional area.

Introduction

The use of aluminium extrusions in automotive applications is gaining more interest particularly due to their high strength to weight ratio. The U.S. Aluminum Association states that, "pound for pound, the light metal absorbs twice the crash energy of steel and performs as well in an accident". A lighter vehicle also provides advantages in reducing the stopping distance, improved vehicle handling and performance [1]. The increased use of aluminium extrusions in safety critical products in automotive applications also requires the extruders to deliver products of higher standards than general extrusion application needs. The implications for the extruders are: increased cost which includes high level of process scrap, testing cost and additional control to qualify the products to meet the customer requirements.
Tensile test is the predominant test method used in extrusion industry to ensure that the mechanical properties required by the product are met. The two most governing

standards to perform the tensile test are the ISO – EN 6892-1 (2016) [2] and the ASTM–E8.16 [3]. The tensile test provides valuable information on the material property such as tensile strength (Rm), elongation (A) and yield strength (Rp0,2) [4]. This paper presents the two areas that affect the tensile test results accuracy and there are two outcomes of inaccurate test results. The first outcome is the test results being over- reported (too high values) which could lead to failure of the part and such a failure on safety critical part will be catastrophic. Inaccurate testing process and reporting can also lead to either civil or criminal litigations. The second outcome is under-reporting (too low values) of the test results which could result in increased scrap cost for the extruders, unnecessarily scrapping good quality material. Both the outcomes are not desirable, this paper presents how the tensile test results accuracy is affected by the two important parameters "specimen machining" and "cross-sectional area" measurement.

EXPERIMENTAL

Material

The material for the tests was taken from a hollow section produced with a 606035-aluminium alloy from one of the extrusion plants in Europe. A part of the profile from where the specimen was taken is shown in Fig 1.

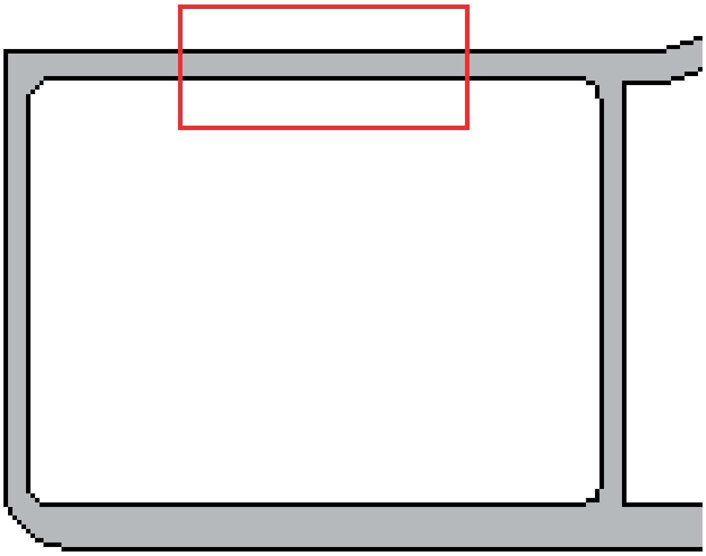


Fig.1: Section from which the specimen was taken

The section was chosen because it has been studied thoroughly in the ProExtru [5] project and the mechanical properties of this section were stable (through the whole order and along the complete extrusion length) when the same billet charge is used and the extrusion process parameters are kept within the operating process window. The profile was produced with a two-cavity die and there was a very small theoretical difference in mechanical properties between the cavities, but this difference was normally within the range of normal measurement uncertainty.

Test protocol

The selected area of the section was cut into two pieces. Every cut piece was labelled to ensure traceability.

A total of 240 pieces were made and 130 of them were machined to a 12,5 mm width at one of the reference laboratory (R1).

Hundred machined specimens and hundred unmachined pieces henceforth called "blanks" were sent to ten Hydro Extruded Solutions laboratories in Europe for testing and the summary of the test protocol is shown in Fig.2. The blanks were machined at the respective labs. Both the pre-machined specimens and the blanks were randomly selected for each lab. The labs were given an instruction document detailing what to be measured, what parameters to be documented. In addition to the crucial parameters, Rm, Rp0.2, and A50 (gauge length 50 mm), the labs were instructed to document measured specimen dimensions and the E-modulus used in the calculations. Ten pre-machined specimens from R1 were sent to the second reference lab (R2) to validate the homogeneity of the material. The cross-sectional dimensions of every pre-machined specimen were measured at R1 and documented against their specimen number.

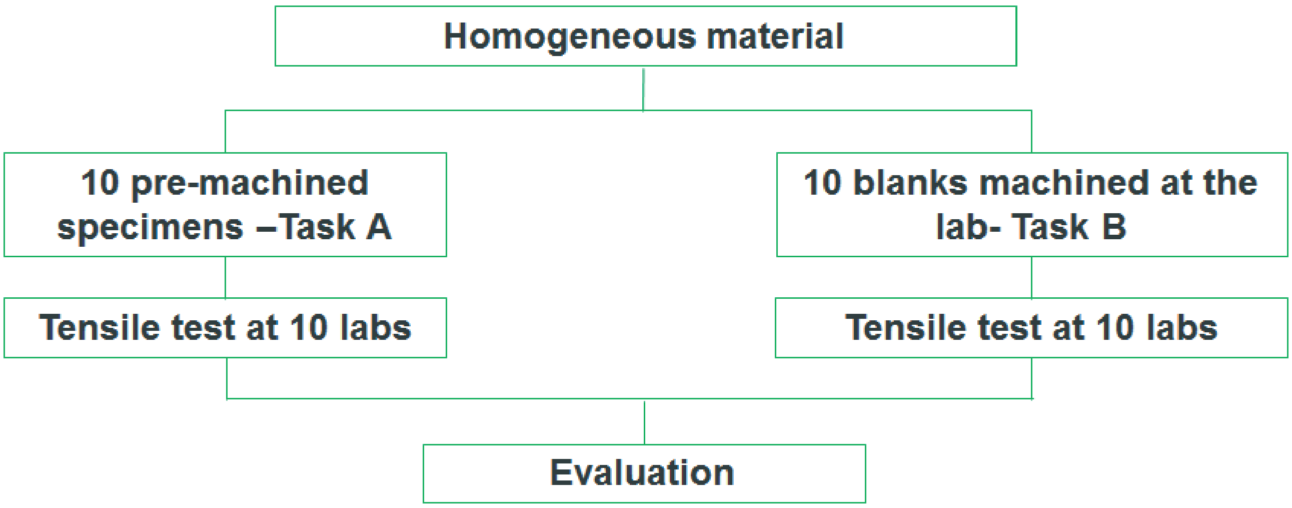


Fig.2: Test Protocol

Results

The laboratories in Hydro Extruded Solutions reported the test outcomes from both the tasks A and B. The results are presented in two sections; Task A demonstrating the effect of cross sectional area measurement and Task B demonstrating the effect of specimen machining.

Task A: Influence of cross-sectional area measurement:

Ten laboratories in Hydro Extruded Solutions tested ten pre-machined specimens each. The laboratories reported the test results through a spreadsheet with the details of each specimen such as specimen number, thickness, width, Rp0,2, Rm, modulus of elasticity and elongation to fracture.

Fig. 3 and Fig. 4 show the results of yield strength and tensile strength values reported by the ten labs and by the reference labs R1 and R2 respectively.

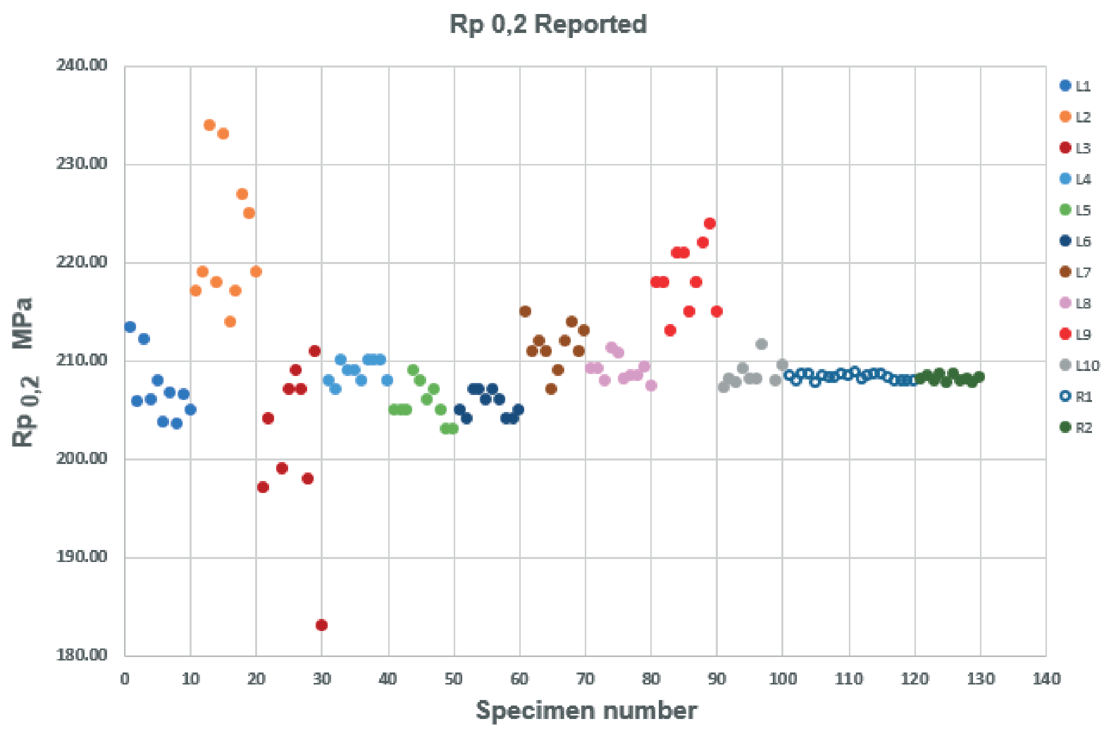


Fig. 3: Rp0,2 values reported

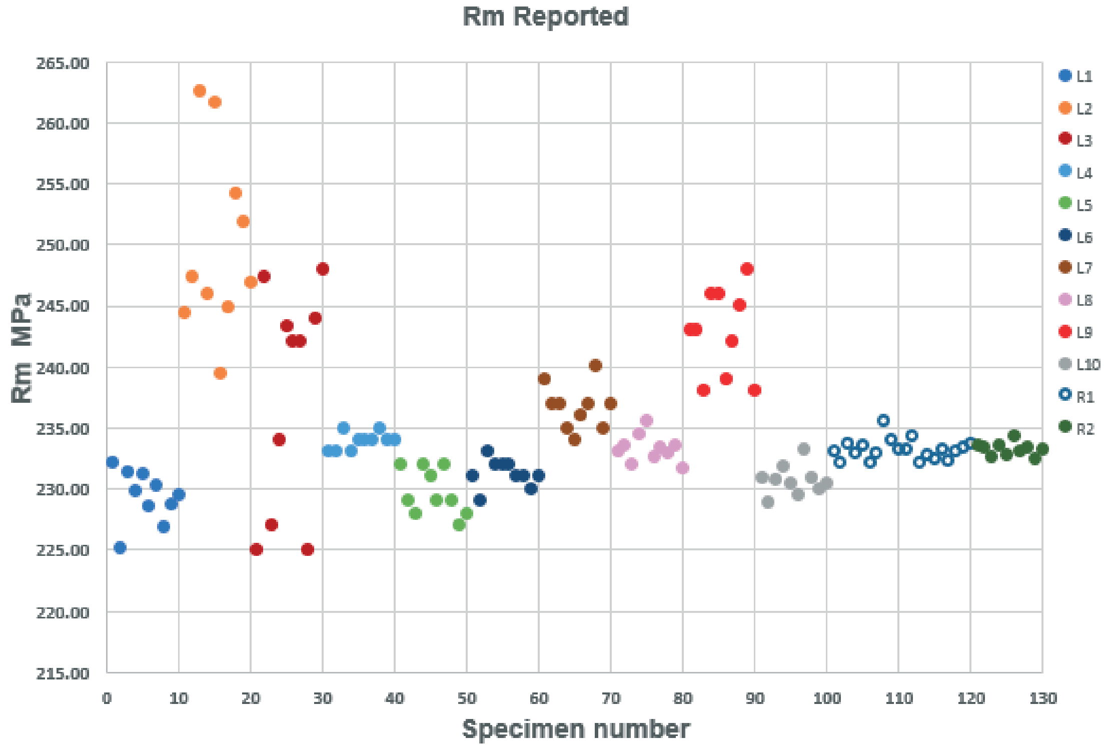


Fig.4: Rm values reported

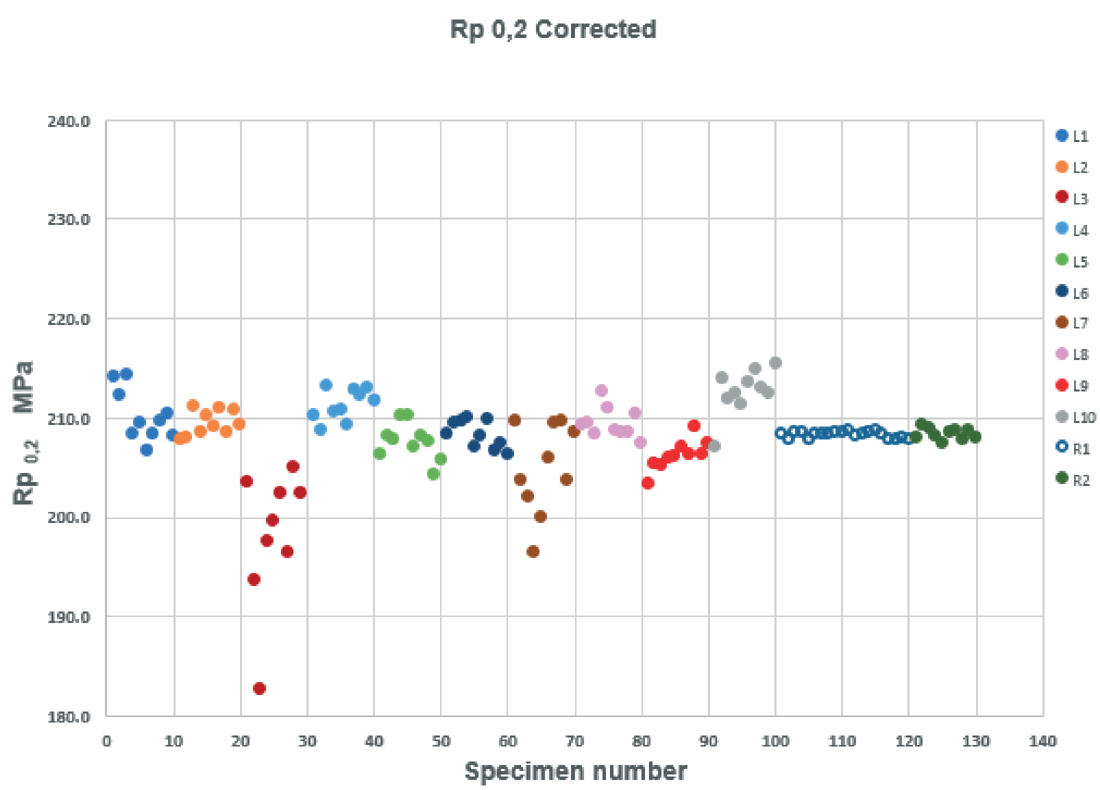


Fig.5: Corrected Rp0,2 values

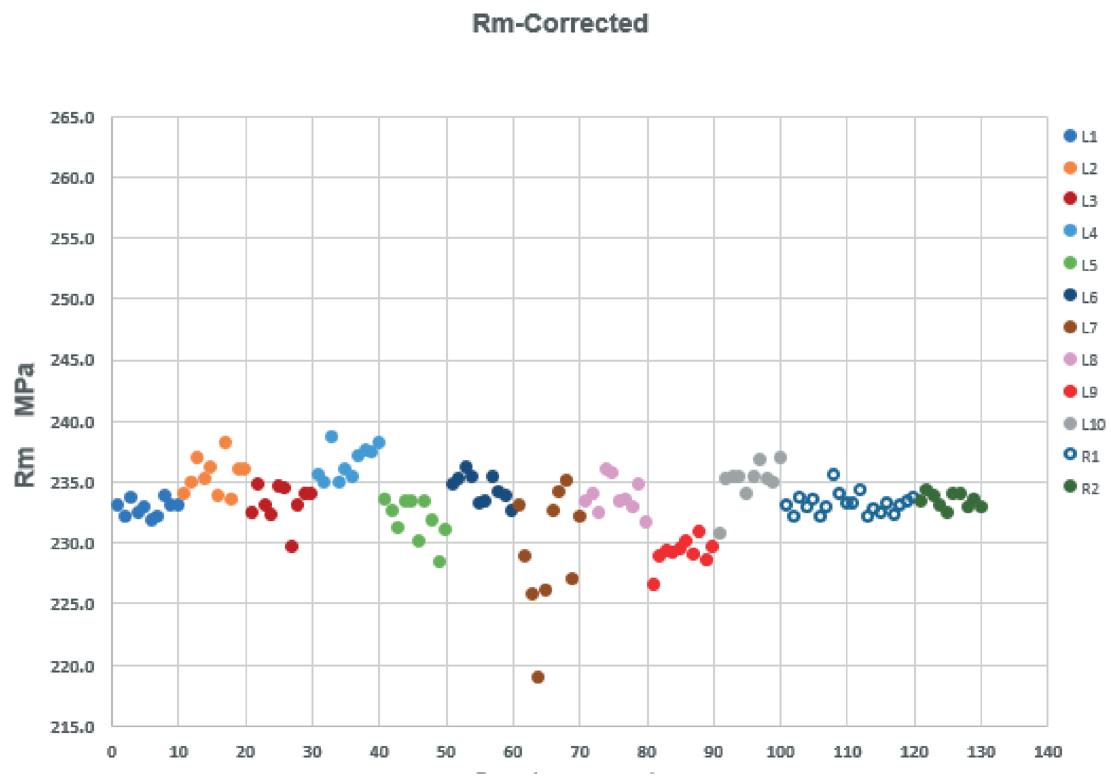


Fig.6: Corrected Rm value

To interpret the results, the following two factors need to be considered

- The points representing results from a lab should lie as close as possible to the values represented by R1 and R2
- The scatter of the results should be as small as possible

As seen in Fig. 3 labs L4, L5, L6, L8 and L10 show a good correlation with reference lab data. The rest of the labs do not show a good accuracy and precision in their data. In many cases the average values are significantly different from the reference values and high standard deviation reflects the fact that the measurements are scattered.

As seen in Fig. 4 labs L4 and L8 show a good correlation with reference lab data, while some labs especially L2 and L3 display a larger scatter. The large scatter is an indication that some parameters influencing the test results are not repeatable. In addition to reporting the measured values of the mechanical properties the labs also reported the measured specimen dimensions. It turns out that the precision of the cross-sectional dimension measurements was low in some cases.

According to the standard [2], the error in determining cross sectional dimension shall not exceed ± 2% and to achieve test results with a reduced measurement uncertainty the cross-sectional dimension shall be measured with an accuracy of ±1 % or better. Inaccurate cross-sectional dimensions will give incorrect values of Rp0.2 and Rm. The cross-sectional dimensional values of each specimen were replaced with the cross section dimensional values measured at R1. The Rp0,2 and Rm values for each specimen were re-calculated. The corrected values of Rp0,2 and Rm are shown in Fig. 5 and Fig. 6 respectively.

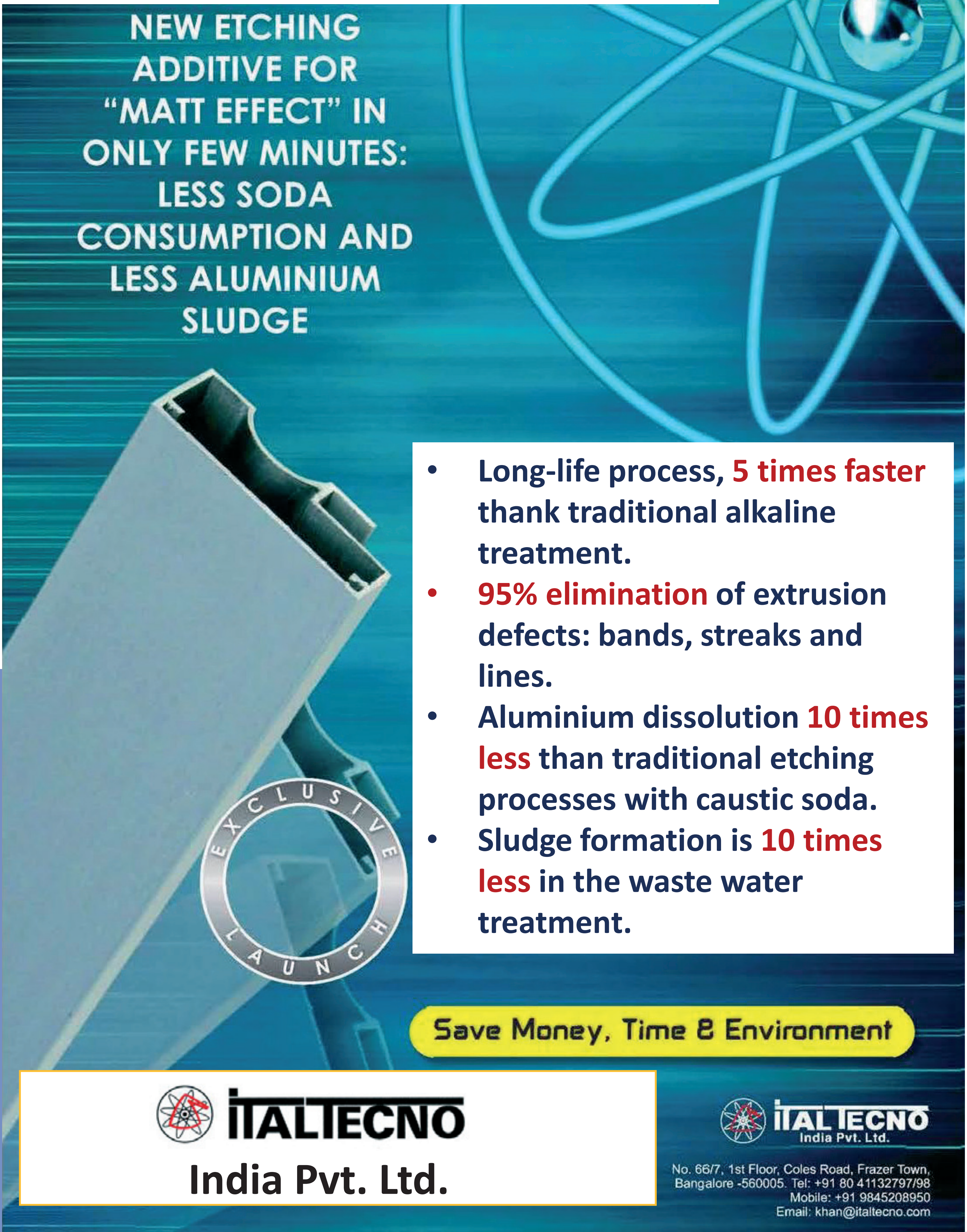
Table 1 shows the average deviation in cross sectional dimensions measured by the ten labs and reference lab R2. The average deviation (lack of accuracy) in cross sectional area shows deviation in average measurements of 10 specimens measured against the reference lab R1, while standard deviation shows the variability (lack of precision) within the ten measurements.

Table 1: Average deviation and standard deviation in cross-sectional area measurement

The average deviation in cross-sectional area from labs L2, L7 and L9 exceeds the 2%, required by the standard [2]. Similarly, labs L2, L3, L7 and L9 also have the largest standard deviation in cross sectional dimension measurements which also reflects the largest scatter values in Fig 4 and Fig 5. Lab L8 and R2 measured the cross-sectional area with an error of less than 0,5% and hence the test results from these labs were close to the reference lab R1.

Lab	Average deviation in cross sectional area-indicates lack of accuracy in measurement	Standard Deviation- Cross sectional area-indicates lack of precision in measurement
L1	-1.52%	0.93%
L2	5.70%	2.69%
L3	1.78%	3.69%
L4	-1.15%	0.38%
L5	-0.95%	0.41%
L6	-1.39%	0.67%
L7	3.1%	1.70%
L8	-0.24%	0.22%
L9	5.59%	1.52%
L10	-1.88%	0.84%
R2	-0.11%	0.31%

CHEMICALS FOR ANODIZING AND COATING PRETREATMENT



PROCESS OPTIMIZATION OF COATINGS ON ALUMINIUM COILS BY REAL-TIME COATING THICKNESS MEASUREMENT

M. Stouff[1], A. Bariska[2]*
[1]MIRALU, France
[2]Winterthur Instruments, Switzerland

Abstract

At MIRALU, a manufacturer of pre-coated aluminium, a system for noncontact, inline coating thickness measurement, the coatmaster from Winterthur Instruments, has been installed for inline measurement of coating thickness before curing. The system is well-suited to measure thickness of coatings before and after curing, directly in the coating line. It is based on the principle of Advanced Thermal Optics (ATO) [1].
Coating thickness is determined at multiple spots across the coil by positioning of the measuring optics with an automated traversing unit. Measurements are conducted at a spacing of 30mm for a tight net of measurement data.
The real-time thickness measurement provides immediate information on the state of the coating process. It thus allows the coating line operator to setup his coating process and to react to process deviations very quickly. As a result, it is now possible to reach coating specifications from the first few meters. The main benefits are the reduction of setup-time after colour change, reduction of coating material consumption due to tight process control and 100% documentation of coating process suitable for quality assurance and process optimization. The system has also been used to accelerate the setup of the coating section of a new coating line in 2017.

Introduction

In this article, we present the findings of introducing a new system to measure thickness of powder coatings before curing in the production line of a producer of pre-painted aluminum. The pre-painted aluminum is used mainly for facades and signaling posts (example see Figure 1). For these applications, the pre-painted aluminum is subject to weather

Figure 1: The pre-painted aluminium from MIRALU is used for highly demanding and exposed applications, e.g. for facades. Shown in the photo is Le Garance, Paris. Source: MIRALU [3].

exposure and deformation, whilst at high public visibility, requiring highest homogeneity and reproducibility of the colour [3].
In addition, customers demand production flexibility, with small production batches sometimes down to 500kg. In the following we describe how these demands are met by a highly optimized production at MIRALU.

Production of pre-painted aluminum at MIRALU

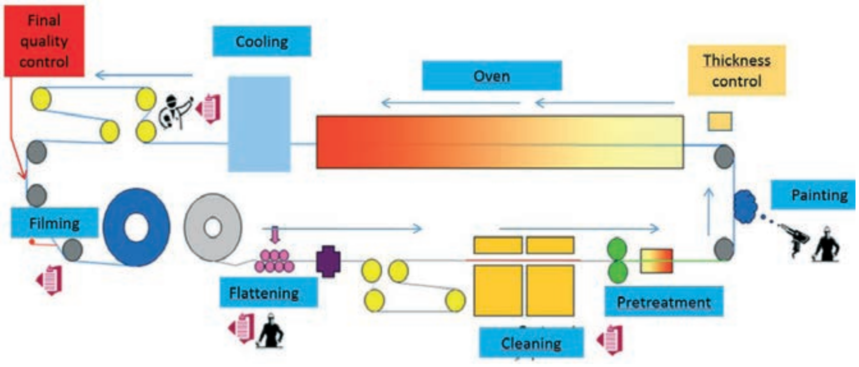


Figure 2: Production schematic of coil coating process at MIRALU. Source: MIRALU.

The aluminum is processed in coils, with sheet width between 800 mm to 1600 mm. The coils are unrolled, cleaned, pretreated, coated and finally protected with an adhesive film. Coils can be successively cut into panels, see Figure 2.

The powder coating section is implemented with two coating booths, where one is active while the other one is cleaned and prepared for the next colour. The booths can be alternatively switched into the production line on a rail to minimize down-time of the coating application for the colour change.

Industrialization of closed-loop coating application

Previously, the coating thickness was measured by using contacting measurement probe, manually positioned on the surface of the coating to be measured. The probe was positioned on the moving aluminum sheet directly after the oven. This is the first position in the coating process where the thickness of the cured coating was ready to be measured. This measurement process was subjected to variability and the coating thickness information was orally communicated from the measurement position to the coating booth operator, who had to optimize the coating application accordingly. The main drawback of this procedure is the long time delay between the application of the coating and the measurement process. This delay made the control of the coating application very difficult, and impossible for smaller production batches.

As MIRALU planned to implement a new production line with double production capacity and therefore also double the production speed, the drawbacks of the manual thickness measurement would have been amplified. As a measure to increase the production efficiency and quality and to be able to respond to market demands of decreasing batch sizes while running at double the production speed, MIRALU decided to implement an inline coating thickness measurement system, with thickness measurement directly on the uncured coating. The process manager at MIRALU carefully evaluated inline noncontact thickness measurement systems on the market and found only one suitable for this purpose, the coatmaster [2]. The coatmaster, based on the measurement principle of Advanced Thermal Optics (ATO) is patented by the supplier of the system. Using the ATO principle, the measurement is conducted by slightly warming the surface of the coating with light and consequently recording the dynamic surface temperature response with high-speed infrared sensor, as depicted in Figure 3.

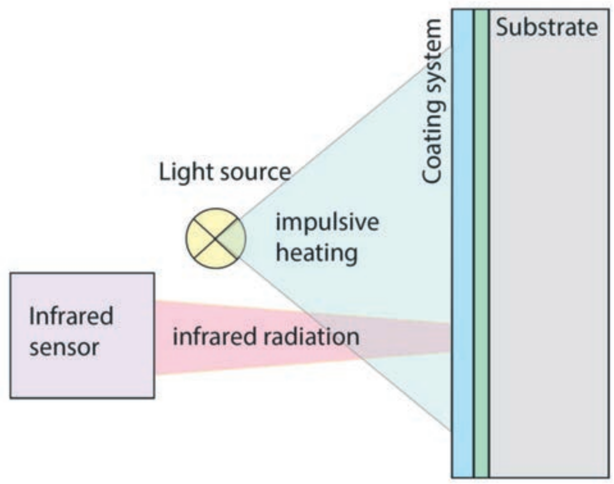


Figure 3: Schematic of the coatmaster measurement principle ATO. Coating thickness is measured by evaluating the temperature response on the surface after briefly warming the coating surface with light. Source: Winterthur Instruments.

The large area excitation with the ATO light source enables thickness measureability also on fast moving surfaces, before or after curing, for all kinds of coatings, paints or adhesives.

The measuring optics is mounted on a traversing arm to provide thickness information across

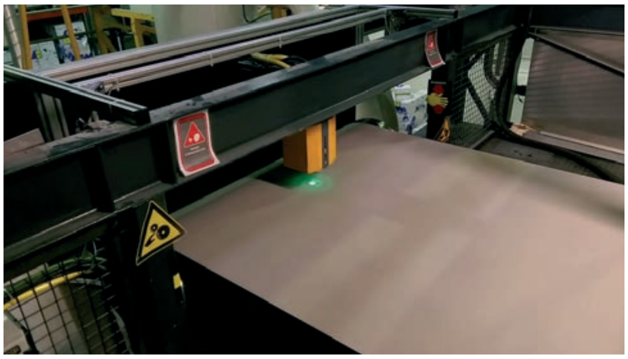


Figure 4: Integration of the inline thickness measurement system coatmaster in the coil coating line at MIRALU. The measurement position is indicated with a green light marker on the coil. The measuring optics is mounted on a traversing axis, moving back and forth across the width of the sheet. This provides a finely resolved thickness profile which is displayed to the coating booth operator, enabling him to react to process deviations quickly and thus produce constant and optimal coating thickness from the first production meters. Source: MIRALU

the whole width of the aluminum coil (see Figure 4). Thickness information is displayed to the operator of the coating line, who can act to optimize production based on the thickness information.
To control the coating process, the operator of the powder coating application needs immediate information about the coating thickness. He needs to know the average thickness of the coating, which may not fall below a minimum value in order to guarantee colour stability and protection of the aluminum. In addition, the thickness distribution across the width of the coil is important to adjust relative output of the guns to each other, to be able to produce an even distribution.
This information is provided in form of a visualization of the thickness profile, which is updated after each traversion of the measurement optics (Figure 5)
Using this visualization, the operator can easily monitor the coating process. Any deviations of the process are thus detected as soon as they occur. The effect of counter measures initiated by the operator are also immediately visualized, so that a stable process can be achieved within few production meters.

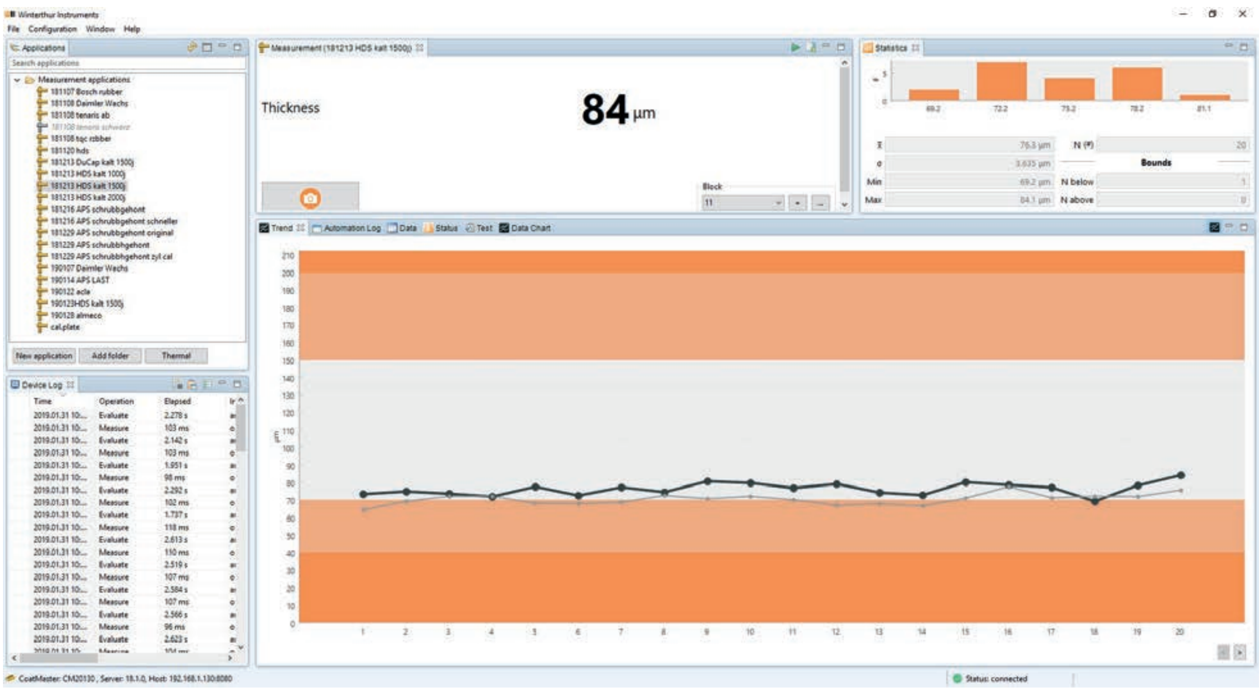


Figure 5: Display of measurement values to coating booth operator. Current thickness value and statistics are displayed in the top frames. In the bottom frame contains the thickness profile. The current profile is displayed in bold black, the previous profile is displayed as light grey so that the operator easily sees changes from his coating output adjustments. Source: Winterthur Instruments.

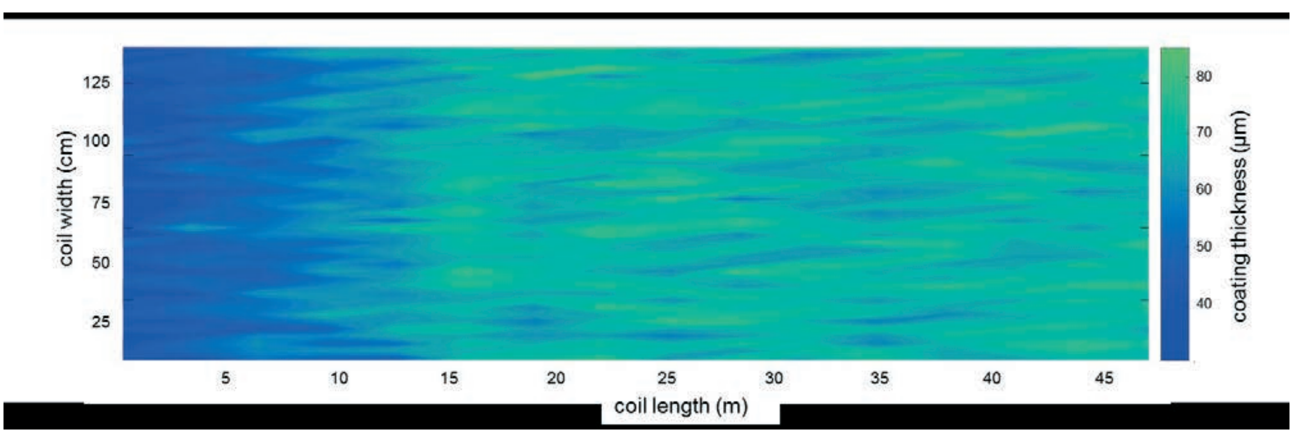


Figure 6: After starting of production of a new color, the coating thickness is lower than the targeted 60µm (dark blue area thinner than 40µm, light green area thicker than 80µm). The operator reacts quickly based on the immediate feedback of the inline coating thickness. After about 8m of production, thickness is in target range. Source: Winterthur Instruments.

Examples of achieving process control

To visualize the thickness distribution of the coating on the coil we use a two dimensional color map, where the thickness is encoded by color. The horizontal axis shows the length and the vertical axis shows the width of the metal sheet. This provides an easy to read visualization of coating thickness distribution over the whole coil. In the following we show two examples of how the coatmaster system is used at MIRALU for correcting process deviations. In the first example, at the start of production of a new colour, the coating system is producing too thin thickness (see Figure 6). Even though the production line was configured in the same way as for the last production, sometimes environmental parameters outside the control of the operators (e.g. changes in temperature, humidity etc.) can cause such deviations.

However, as the operator has immediate feedback of this situation, he can react by increasing thicknes. After 8m, the process is on tolerance.

Before, a correction would have been possible only after several tens of meters, as the manual measurement would have to be done after the curing oven. As MIRALU is only accepting highest standards for shipped products, this means that reject material due to such events were significantly reduced thanks to the inline and real-time thickness measurement. In the second example, a narrow strip of high coating thickness was detected (see Figure 7). Corrections to the coating application resulted in homogeneous distribution without defects.

Conclusions

The coatmaster system for real-time coating thickness measurement directly in the production line installed at MIRALU, has significantly improved efficiency for the coating production. Personnel previously engaged in manual measurement, reporting and documentation was freed to work in the production. The possibility to visualize both process deviations and the effect of operator reaction to these deviations makes it possible to quickly bring the coating process stable into the tolerance range. This allows to reduce the coating material consumption to a minimum without risking to breach quality standards. More importantly, also rejects and thus waste metal could be reduced.

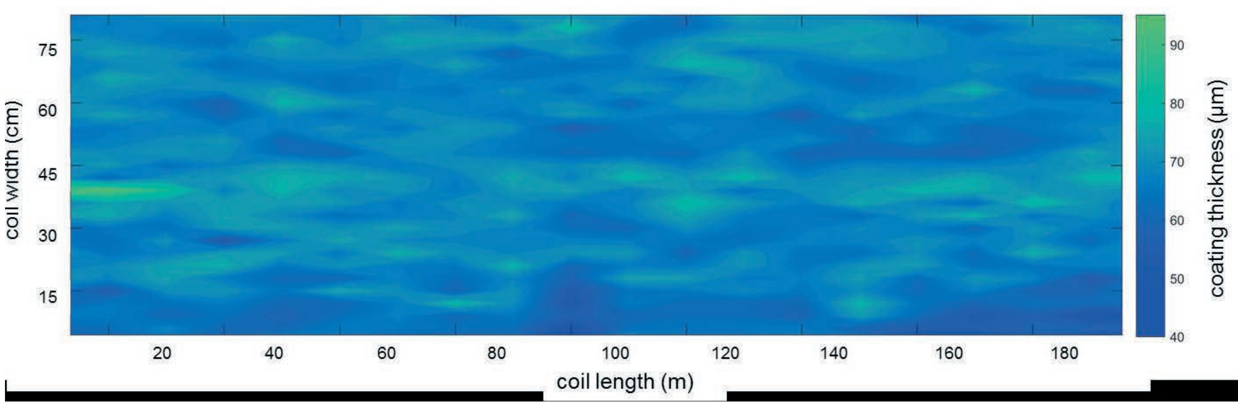


Figure 7: Correction of coating inhomogeneity on coil based on inline thickness measurement. The area of too highcoating thickness for about 35m at the beginning of the coating process was corrected by immediate adjustment. After the correction, the coating process is on tolerance. Source: Winterthur Instruments.

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[1] A. Bariska, N. A. Reinke, “Berührungslose thermische Schichtprüfung”, Swiss Engineering vol. 3 (2011), pagg. 16-17.

[2] http://www.coatmaster.ch

[3] http://www.miralu.fr

ADMITTANCE TEST ON ANODIC OXIDE FILMS SEALED BY IMPREGNATIO (First Part)

W. Dalla Barba
Italtecno Srl, Italy

Abstract

Prior to the introduction of cold sealing (or sealing by impregnation), the measurement of admittance according to ISO 2931 was a practical method by which to check the quality of anodic oxide film sealing on aluminium and its alloys.
This paper describes new parameters for admittance values pertaining to material sealed at low temperatures and the correlations with currently used tests.
The obtained results are comparable to those given by weight loss (ISO 3210), confirming the acceptability range of quality.
Acceptability limits for aluminium coloured by means of the tin salt based electrocolouring processare also proposed.
The pertinent terms qnd relative technologies have been explained as clearly as possible in order to make the subject more easy to understand.

Sealing

The process by which the pores of the film of anodic oxide (natural or coloured) are closed in arder to maintain an unaltered finish and ensure corrosion resistance, is conventionally called sealing.
The most common sealing techniques are the following (1-16,25-26):

- by steam;
- with boiling water (98-l00°C) plus the possible addition of nickel salts and/or buffer substances and/or products able to inhibit the formation of brittle pseudo-boehmite in the outermost films (owing to the so-called sealing smut);
- by impregnation of nickel salts and fluorides (plus additives in arder to avoid greenish shades, to catalyze the sealing reaction, to minimize the negative effects of contaminants and to improve the anticorrosion performance) active at temperatures of 20-30°C;
- by deposition of an electrophoretic paint (usually transparent) subsequently subjected to a hot polymerizing process (at about 200°C).

The first two systems were most commonly used until about ten years ago (1) but after its introduction, the impregnation treatment or, more commonly, the "cold" treatment became much more popular (2) (3).
The electrophoretic deposition procedure is almost unknown in Europe and is usually used to achieve particular finishing characteristics.

Test methods

There are many methods by which to test sealing quality (3, 5, 7, 10, 13, 14). The following ones are the most common:
a) Dye spot test (Scott test, ISO 2143) whereby the residuai absorption power of the oxide film is tested with a drop of acid solution (eg.: 25 ml/l fluorosilicic acid) followed by a drop of dye (eg.: Sanodal Red B3 LW, 10 g/1); contact time 1 min. each.
b) As amply illustrateci further on, admittance measurement (ISO 2931) involves gauging the admittance (or, on the other hand, the impedance) indicating the conductivity presented by the film of oxide.
The impedance of the film increases (thus the admittance decreases) as does the amount of closed pores (and the sealing quality). This measurement is taken by a special instrument.
c) Weight loss in phosphochromic solution (ISO 3210) where the weight loss of the sample in question is checked after it has been immersed for 15 min. in a soluti on of 35 ml/1 phosphoric acid and 20 g/1 chromic acid T = 38 ± 1 °C;
d) Weight loss in sodium sulphite solution (Kape test, BS 6161 part 4: 1981) where the sample is immersed in a solution of 10 g/1 sodium sulphite, acetic acid to reach pH 3.6 -3.8 and sulphuric acid 5N to reach pH 2.5, T= 90-92"C,t= 20 min.;
e) Weight loss (ISO 2932) in a solution of 0.5 g/1 sodium acetate, 100 mg/] acetic acid, T= 98-l00°C, t= 15 min.;
f) Alkali test (in compliance with JIS H 8610-1968);g) Acid test (or Kape test); weight loss in a solution of 30 ml/1 fluorosilicic acid.

Description of the admittance method

Measurement of impedance, i.e. of the resistance presented by the film of anodic oxide to the passage of alternate current under precise conditions is inserted in the intemational normatives (ISO 2931, BS 6161, part 6: 1984 and ASTM B457- 69); several specific measuring instruments are available on the market.

The apparatus, which operates according to the Wheatstone bridge principle, uses an adhesive disk as measuring cell. This disk, with an internal area of 133 sq.mm, is applied to the surface of the oxide film. A few drops of 35 g/1 potassium sulphate solution are placed in this cell.

Measurement is carried out by immersing one of the terminals of the instrument into the solution in the above celi, while using a special clamp to connect the second terminal to the aluminium metal sublayer, thus perforating the oxide film. Impedance of the aluminium oxide film according to the model of Hoar and Wood (20), Z =

$$= \sqrt{R^2_s + \frac{1}{4\pi^2 f^2 C^2_s}} = \sqrt{\frac{R}{1+4\pi^2 f^2 R^2_p \quad C^2_p}}$$

where Z is the modulus of impedance measured by the instrument

Rs is the resistance of the oxide film, considered in series

Cs is the capacity of the oxide film, considered in series f is the frequency; this equals 1000 Hz in the instruments currently available on the market

Rp and Cp are the same quantities, considered in a circuit in paralleL Admittance Y is given by Y = 1/Z.

Frorn a practical point of view, it is more sirnple to use instruments to read adrnittance, which is expressed in uS.

MEASURING ADMITTANCE ON ANODIC OXIDE FILMS

Since, sealing quality being equal, the adrnittance value for conventional high temperature sealing depends on the thickness of the anodic oxide film (all the lower, the more the film thickness increases) and on the temperature at which the measurernent is made (it decreases as the temperature drops), the current standard ISO 2931 cornpares the read value (Yrn) to that of a 20 um sample film measured at 25C (Y 20).

The temperature factor is indicateci in Tab. 1.

Tab. 2 gives the maximum values recommended for adrnittance.

Tab. 3 gives the values found in natural coloured anodized samples and those subjected to a tin salt based electrocolouring process, sealed in a 10 g/l solution of nickel sulphate in boiling distilled water.

The weight loss values according to ISO 3210 are given by way of comparison (21).

Colouring was achieved in a bath containing tin sulphateand an antioxidant additive at a temperature of 18-20C, by means of a two-step process. Following the indicateci times, it was possible to obtain three distinct colours, the third of which very dark. Sealing was achieved in a 10 g/l solution of nickel sulphate in boiling distìlled water freshly prepared day by day This prevented pH c01Tections from being required.

Weight loss was obtained in a phosphochromic solution in compliance with ISO 3210 provisions.

The thickness was measured with a FISCHER EW PERMASCOPE.

Admittance was measured with a FISCHER ANOTEST.

The admittance measuring cells were used once only in order to be certain of a constant tack.

MEASURING ADMITTANCE ON COLD SEALED ALUMINIUM

When the colei sealing treatment was industrially introduced into Europe, back in spring 1981, use of admittance measurements as pararneter by which to check sealing quality was already widely popular in certain European countries being both easy and quick to take. It was,therefore,an unpleasant surprise to learn that the results obtained on cold sealed materiai were completely beyond the limits of current practice. As can be seen in Tab. 4 -5 (samples 15, 31, 32), readings made a few hours after treatment on cold sealed materiai without further post-treatments, gave an

off-scale value (300 microSiemens) with a 133 sq.mrn cell. Onlyafter materiai which had just been sealed was subsequently immersed in water or a aqueous solution (usually nickel sahs) was it possible to achieve results comparable to those obtained with hot sealing processes (using steam, buffered deionized water, nickel salt solutions).

Tab. 4 gives the readings (7) of admittance measurements on cold sealed aluminium aeeording to the variation in treatment times, with subsequent immersion in water (varying both time and temperature).

Qualanod (22) recently issued a document indicating the recornrnended characteristics for the cold sealing treatment. These include the following hmits for the sealing solution:

INSERIRE FOTO 2

Ni^{++}	1.2 - 2.0 g/l
F^-	0.5 - 0.8 g/l
pH	6 +/- 0.5

Immersion time 0.8 -1.2 min/micron for the sealing solution and for the "ageing" (or hydration) solution (post treatment).
In view of the above, we therefore considered it interesting to check out the possibility of using admittance rneasurement as parameter by which to ascertain sealing quality introducing new acceptability limits if necessary, for both natural colour anodized materiai and that subjected to a tin salt based electrocolouring process.

Experimental part
All tests were conducted on 6061 aluminium alloy sheets measuring 75 x 100 mm and fitted on to aluminium rod hooks able to bear 2 sheets each. Four hooks carrying 2 plates each were usually treated per anodizing load. Four samples were therefore available for each test. One of these was used for admittance measurements while the other 3 were subjected to weight loss (according to ISO 3210) at various tirnes.
Here are the treatrnents to which the sarnples were subjected:

1. Cleaning in a watery solution of

Italtecno Cleaner MG 19 L	50G/L(*)
Temperature	30-40° c
Immersion time	10 min

2. Etching in a solution of

NaOH	70 g/l
Italtecno additive MG 40	15 g/l (*)
Dissolved aluminium	80 g/l
Temperature	50 ± 2°C
Immersion time	10 min

3. Rinsing in running water

4. Anodizing under the following conditions

H_2SO_4	200 g/l
Dissolved aluminium	7.5 g/l
Temperature	18.5 – 19.0 °C
Current density	1.8 A /sq.dm

Oxide thickness as indicated in the chart

5. Rinsing in running water

6. Pore closing treatment in the below indicated solution (**)

Ni++	1.6 g/l
F-	0.8 g/l
pH	6.0
Temperature	29 ± 1 °C
Immersion time	0.5 – 1.25 min/micron

7. Rinsing in running water

8. Ageing (or hydration) treatment in a solution of:

Nickel sulphate	7.5 g/l
pH	6.0-6.5
Temperature	30-70°C

as specifically indicated in the tables

Treatment time	0.5 – 1.25 min/micron

9. Rinsing in running water

10. Drying. The samples were left to dry in the air at ambient temperature, after which they were detatched from the hooks, numbered and stored without particular precautions while waiting for the findings.

11. Colouring of the samples, when indicated, was accomplished by immersing the material from point 5 in the below indicated electrolytic solution.

Tin sulphate	18g/l
Italtecno additive Salmix NF 40	36 g/l
Sulphuric acid	8 g/l
Temperature	18 °C
Voltage	15.5 Vac
Treatment time	0.5 – 15 min

After which the material was thoroughly rinsed and the process continued from point 6 onwards.

Notes:
(*) Product formulated and marketed by Italtecno s.r.l.
(*) We intentionally avoided use of commercially available formulas in order to simply and clearly conduct the tests within the concentration ranges established by Qualanod.

a) In order to duplicate a badly operating sealing solution, (27) we used calcium and aluminium salts to pollute a portion of solution 6 which, after filtration, presented the following parameters:

Ni^{++}	1.4 g/l
F^-	0.25 g/l

This solution was subsequently called 1la.

b) The composition of the ageing solution was not varied since the concentration effect is hardly significant if compared with that of temperature (as part of immersion time).
c) As reference of a sealing process with slightly different parameters from those indicated by the provisions of Qualanod, we used a process known by the commercial name of Hardwall (*) ECOSEAL 90 (*). This is characterized by a low nickelcontent in the treatment solution and by the complete recovery and recycling of the Ni++ ion. This makes it possible to eliminate the Nickel ion from the rinsing waters and, thus, from the residual sludges (the legal provisions in merit are very restrictive in many countries).

Findings

a) Measurernent of the thickness of the oxide film by rneans of the eddy current method, using a FISCHER PERMASCOPE.
b) Dye spot test in compliance with ISO 2143 (Scott test). The values have not been given since they are poorly discriminating with reference to the samples in question.
c) Calculation of weight loss according to ISO 3210 (the operative parameters of which have already been indicated).
Without further cleaning, since this was unnecessary, the samples were weighed and immersed in the indicated solution.
After imrnersion, they were rinsed in running water and left to dry in the air at ambient temperature then weighed again.
We preferred to avoid force drying the samples in hot air since it would have then been necessary to wait a certain period to allow the samples to reach a constant weight (thus involving several weighing operations).
d) Calculation of admittance by means of a previously calibrated FISCHER ANOTEST instrument and using 133 sq.mm size cells. Measurements were taken (as explicitly indicated in the tables) after 2-4 hours, 48 hours and 14 days. We opted for this method in view of the following factors.
1. During the normai industria] productive cycle, at least 2 hours elapse from the end of the cycle to the quality control phase carried out when the profiles are detatched or before packing.
2. Admittance measurement (with conventional hot sealing processes) is sensitive to the ageing time, thus measurement is advisable within 48 hours after treatment.
3. The value after 14 days can be reasonably used as minimum limit value and used as reference number by anodized aluminium dealers and by building companies.

Tab. 1 – Multiplication factor to bring the read admittance value in line with that referred at T = 25 °C

Measuring temperature	Multiplication factor	
0 °C	1.5	
5 °C	1.4	
10 °C	1.3	
15 °C	1.2	
20 °C	1.1	
25 °C	*1.0*	*Reference temperature*
30 °C	0.9	
35 °C	0.8	
40 °C	0.7	
45 °C	0.6	

Notes: When calculating the weight loss according to ISO 3210, we avoided preimmersion in nitric acid (50%, 10 min.) since it was nol expressly included (even though the lechnical commission which drafted the provision seems favourable towards its use). Furthermore, it would have been of scarse significance for the samples in queslion, which featured good quality sealing. The test results are listed in Table 5.

Tab. 2 – Maximum admittance values at T = 25 °C recommended by Qualanod for the sealing quality of the anodic oxide aluminium layer

Oxide layer thickn. (µm)	Maximum admittance limits Y = (400/µm) = µS	
6	66.66	
8	50.00	
10	40.00	
11	36.36	
12	33.33	
13	30.76	
14	28.57	
15	26.66	
16	25.00	
17	23.52	
18	22.22	
19	21.05	
20	*20.00*	*Reference thickness*
21	19.04	
22	18.18	
24	16.66	
25	16.00	
28	14.28	
30	13.33	

Tab. 3 – Misures of admittance on natural and tin-based electrocolored anodic oxide aluminium layers

			Anodizing			Sealing				Admittance		
no.	colour	Colo. time	µm	A/dm2	°C	°C	pH	min/µm	W. Loss mg/dm2	Ym	Y20	Yc/Yn
01	natur.	--	21	1.7	18	99±1	6	2	12.9	19.0	20.1	--
02	clear	30"	21	"	"	"	"	"	15.6	24.0	25.4	1.26
03	natur.	--	16	"	19	"	"	"	13.3	27.5	21.0	--
04	clear	30"	16.5	"	"	"	"	"	12.8	34.5	27.4	1.30
05	natur.	--	21	"	18	"	"	4	14.2	11.5	12.2	--
06	clear	30"	21	"	"	"	"	"	13.3	14.5	15.3	1.25
07	natur.	--	16	"	19	"	"	"	11.7	15.7	12.0	--
08	clear	30"	16	"	"	"	"	"	13.0	19.0	14.5	1.21
09	natur.	--	22	"	18	"	"	2	12.8	16.0	17.8	--
10	medium	2'	22	"	18	"	"	"	14.5	31.0	34.6	1.95
11	natur.	--	16	"	"	"	"	"	13.2	25.0	19.1	--
12	medium	2'	16	"	19	"	"	"	14.0	51.0	39.0	2.04
13	natur.	--	19	"	18	"	"	"	9.1	10.0	9.4	--
14	medium	2'	22	"	"	"	"	4	11.3	17.0	19.0	2.02
15	natur.	--	21.5	"	"	"	"	"	12.7	10.0	10.9	--
16	medium	2'	22.5	"	"	"	"	"	11.4	19.0	21.8	2.00
17	natur.	--	20.5	"	17	"	"	2	13.2	18.0	18.5	--
18	dark	4'	20.5	"	"	"	"	"	14.0	74.0	76.2	4.12
19	natur.	--	16	"	18	"	"	"	13.3	25.0	19.1	--
20	dark	4'	16	"	"	"	"	"	14.2	105	80.3	4.20

cont.d

Tab. 3 – Misures of admittance on natural and tin-based electrocolored anodic oxide aluminium layers

no.	colour	Colo. time	Anodizing µm	Anodizing A/dm2	Anodizing °C	Sealing °C	Sealing pH	Sealing min/µm	W. Loss mg/dm2	Admittance Ym	Admittance Y20	Yc/Yn
21	natur.	--	20.5	1.7	17	99±1	6	4	12.3	10.8	11.1	--
22	dark	4'	22	"	"	"	"	"	13.5	40.0	44.7	4.03
23	natur.	--	16.5	"	18	"	"	"	10.9	14.0	11.1	--
24	dark	4'	18	"	"	"	"	"	11.3	50.0	44.1	3.97
25	natur.	--	23.0	"	"	"	"	2	----	16.0	18.8	--
26	dark	15'	25	"	"	"	"	"	----	437.1	565.5	30.08
27	natur.	--	24	"	"	"	"	4	----	10.4	12.8	--
28	black	15'	23	"	"	"	"	"	----	376.0	442.3	34.56
29	natur.	--	20	"	17	"	"	2	----	17.5	17.5	--
30	black	10'	21	"	"	"	"	"	----	242.0	256.0	14.63
31	natur.	--	20	"	19	"	"	4	----	11.0	111.0	--
32	black	10'	20	"	"	"	"	"	----	143.3	143.3	13.03

Notes – Anodizing was carried out in a solution containing 210 g/l of sulphuric acid, 7 g/l of dissolved aluminium at the current density and temperature as above indicated.
Electrocoloring was made in a conventional solution containing sulphuric acid, tin sulphate and an antioxiding agent.
Sealing was made in a solution of 10 g/l of nickel sulphate in distilled water, daily freshly prepared.
Thickness was measured by means of FISCHER-PERMASCOPE EW and admittance by means of FISCHER-ANOTEST.
The measuring cells were used once at all having constant adesivity.
All the measurings on black colored samples were made using 28.33 mm^2 cells and referred to 133 mm^2 cells mulptiplying by 4.7.
Ym = read admittance; Y20 = admittance referred to 20 µm thickness.

Tab. 4 – Admittance (µS) results after water immersion

Aging	Im-mer. t min	20 °C Cold Seal Immer. t (min) 1	2.5	5	8	12.5	50 °C Cold Seal immer. t (min) 1	2.5	5	8	12.5	100 °C Cold Seal immer. t (min) 1	2.5	5	8	12.5
1h	5	>300	>300	>300	>300	>300	>300	>300	>300	190	230	>300	>300	54	42	53
"	30	>300	>300	>300	300	>300	>300	>300	230	95	90	27	25	13	15	17
"	60	>300	>300	>300	200	>300	>300	>300	110	70	70	12	9.6	6.5	7.8	7.7
24h	5	>300	>300	65	54	72	>300	>300	100	64	58	160	200	42	35	52
"	30	>300	>300	70	65	60	>300	>300	72	60	53	28	17	13.5	13.5	17.5
"	60	>300	>300	75	46	57	>300	>300	45	45	48	10.8	7.6	6.6	7.8	9.4
14d	5	>300	70	15	12	25	>300	>300	12	16	17	17	25	10	24	12
"	30	>300	90	14	20	14	>300	200	13	14	13	24	19	10.5	12	13
"	60	>300	55	11	10.6	16.5	>300	60	13	16	14	10.8	8.8	7.2	7.5	8.2

Notes – The cold sealing composition is not reported. The oxide layer is indicated about 25 microns.

PRELIMINARY PROGRAM

23rd INTERNATIONAL TECHNICAL SEMINAR

EXTRUFINISHING INTERNATIONAL 2022

Innovation in Extrusion, Anodizing
Powder Coating, Waste Water Treatment
and Die Cleaning
Special focus on Aluminium Extrusion and Finishing Technologies
for Architecture and Automotive Industries

22 – 24 September 2022

Spezzano Castle
Fiorano Modenese – Modena, Italy

INNOVATION FOR
LEADER COMPANIES

OFFICIAL LANGUAGES:
ENGLISH AND ITALIAN

Event Organized by

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THURSDAY, 22 SEPTEMBER 2022

Participation is subject to acceptance of Italtecno Srl and other Italtecno business partners

8,30-10,00 Welcome coffee and Registration

10,00 Welcome to all Participants and Presentation of the Seminar by Dr. Walter Dalla Barba

Morning

10.30-11.00: How to get a perfect aluminium extrusion for a positive impact on high quality anodized finish
(to be announced, Italy)

11.00-11.30: Innovation in extrusion plants. Latest technologies with high degree of automation: the press and after press equipment for architectural and automotive industry
(S. Mancini, Cometal, Italy)

11.30-12.00: Advanced technologies for fully automatic die cleaning plants and related caustic soda recovery. Examples of payback from actual customers
(A. Panini, Italtecno Srl, Italy)

12.0-12.30: Extrusion defects affecting quality of anodizing
(W. Dalla Barba, Italtecno Srl, Italy)

*12.30 – 14.00 LUNCH**

Afternoon

14.00-14.30: Handlings for packaging, transport of profiles; cutting machines and precision pushing machines; platforms and hydraulic presses
(G. Marchionni, Meka Srl, Italy)

14.30-15.00: Surface mechanical treatments: polishing, brushing, grinding and protective film machines
(G. Marchionni, Meka Srl, Italy)

14.30-15.00: The market of aluminium today and the "Green Aluminium"
(M. Conserva, A&L Magazine, Italy)

15.00-15.30: Update on the European and Global aluminum market during the second half of 2022 and prevision for the 2023
(M. Conserva, A&L Magazine, Italy)

15,00 END OF SESSION

Meeting room

Spezzano castle

*VISIT TO FERRARI MUSEUM, MARANELLO**

16,00 Meeting Point at the Ferrari Museum

ADMITTED ONLY SEMINAR PARTICIPANTS REGISTERED BY 20 AUGUST 2022 BY EMAIL CONFIRMED BY INTERALL

- Museo Ferrari is a Ferrari company museum dedicated to the Ferrari sports car marque. The museum is not purely for cars; there are also trophies, photographs and other historical objects relating to the Italian motor racing industry. In addition to that, the exhibition introduces technological innovations, some of which had made the transition from racing cars to road cars.

It is located just 300 m from the Ferrari factory in Ferrari's home town of Maranello, near Modena, Italy. The museum first opened in February 1990, with a new wing being added in October 2004. Ferrari itself has run the museum since 1995. The total surface area is now 2,500 square meters. The number of annual visitors to the museum is around 180,000. The exhibits are mostly a combination of Ferrari road and track cars.

20.00: DINNER IN A LOCAL RESTAURANT HOSTED BY ITALTECNO SRL*

FRIDAY, 23 SEPTEMBER 2022

Morning

9.00-9.30: Freeal 3: the new generation of "intelligent" sulphuric acid recovery system in order to keep constant the concentration of Al^{3+} in anodizing baths
(B. Lazzari – F. Tosi, Italtecno Srl, Italy)

9.30-10.00: New generation of Italtecno equipment for reduction of sludge of 50%: Dryplus 2
(G. Garuti, Italtecno Srl, Italy)

10.00-10.30: Updating on TPP software for preventing defects and rejects in anodizing
(A. Panini, Italtecno Srl, Italy)

10.30 – 11.00 COFFEE BREAK

11.00-11.30: Powder coating plants with high efficiency of production and powder recovery
(M. Ferè, Italtecno Srl, Italy)

11.30-12.00: Zero liquid discharge from anodizing and powder coating plants: the new frontier of waste water treatment, nowadays a reality
(B. Lazzari – G. Garuti, Italtecno Srl, Italy)

12.00-12.30: Decorcoat-Decormatt-Aludecor. Three new processes for aluminium decoration
(P. Lancini, Italtecno Srl, Italy)

*12.30 – 14.00 LUNCH**

Afternoon

14.00-14.30: Focus on latest developments of Decorcoat: special new effects on anodized and coated aluminium sheets
(P. Oliani, Italy)

14.30-15.00: Modern automatic anodizing plant with innovative feature
(P. Lancini – B. Cavuoto, Italtecno Srl, Italia)

15.00-16.00: Sustainability and energy saving in anodizing
(Fabio Vincenzi, Surtec International, Italy)

16.00-16.30: New generation chrome-free passivation
(Federico Vincenzi, Surtec Italia, Italy)

16.30-17.00: The metallurgy of anodizing. Connecting Science to Practice
(J. M. Runge, Compcote, USA)

17,00 END OF SESSION & COFFEE BREAK

SPECIAL GUEST SPEAKER: Dr. J. M. Runge
…and many other well known Aluspecialists

Dr. Judy Runge is a practicing scientist and consultant in the areas of metallurgical engineering and interfacial science with thirty-six years of experience in industry, government and academia. She is the president of CompCote International, Inc., a company focused on materials engineering problem solving and consulting that utilizes her expertise as a surface scientist and manufacturing process engineer.

17.30: VISIT TO THE CASTLE AND TO THE ACETAIA, WHERE THE TRADITIONAL BALSAMIC VINEGAR OF MODENA IS PRODUCED*

20.00: DINNER IN A LOCAL RESTAURANT HOSTED BY ITALTECNO SRL*

SATURDAY, 24 SEPTEMBER 2022*

Social tours – half day

SALSE DI NIRANO, 9.00-11.00*

"THE CELEBRATED MUD CONES OF THE NATURE RESERVE ARE AMONG THE MOST WELL-PRESERVED IN EUROPE"

The 'Salse di Nirano' (or mud volcanoes) are eruptions of cold mud, produced by rising sea water mixed with mainly gaseous hydrocarbons (methane) and a small quantity of liquid ones (oil), which cross faults and fractures in the earth as they rise to the surface, dissolving the clay present and creating the typical cone or spring-like formations.
The phenomenon has been known since ancient times, as demonstrated by the numerous archaeological finds in the area, and studied by celebrated scientists of the past, with highly imaginative theories about the so-called 'mud volcanoes'.

PALAZZO DUCALE OF SASSUOLO*, 11.30-13.00

"ONE OF THE MOST IMPORTANT BAROQUE RESIDENCES IN NORTHERN ITALY"

The story of the Palazzo goes back in time, probably dating back to the time of Matilde of Tuscany. During the thirteenth century, it was recorded as part of the Della Rosa kingdom until the Este conquest of 1373. It was the Marquis (and later Duke) of Ferrara himself, Borso d'Este, who initiated the works to convert the Palazzo from a fortified manor into a court residence which included the frescoes by Agnolo and Bartolomeo degli Erri, now lost.

PLEASE NOTE

****Lunches, dinners and social tours ARE FREE OF CHARGE for Italtecno Customers***

**** Other participants will receive information about costs of lunches, dinners and social tours in the registration card***

To get detailed information and to register to the event, send an email to info@interall.it

Finishing news

LINETEC'S SPATTERCOAT FINISH ON DISPLAY IN SILICON VALLEY

Reflecting the creative, innovative and unique brands of Silicon Valley's high-tech businesses, the new 1199 Coleman office building showcases a one-of-a-kind spattercoat finish by Linetec. Designed by Gensler with design-build contractor Devcon Construction, the high-profile project is pursuing LEED® certification through the U.S. Green Building Council.
In anticipation of the project's completion in 2020, media and technology company Yahoo! signed a long-term lease on the eight-story, 603,363-square-foot property. Paired with the adjacent amenities facility, the buildings are intended to serve an estimate 3,400 employees as its new innovation hub. Part of the new multi-building Coleman Highline corporate complex still under construction, the development is named for the outdoor, third-floor pedestrian walkway connecting the buildings known as the "highline."
The 1199 Coleman building, campus welcome center and amenity pavilion were acquired in December 2021 by AGC Equity Partners. The $780 million purchase, approximately $1,185 per square foot, was reported as a record-breaking price for a single office property in the city. Contributing to the building's value and respecting its architectural vision, Architectural Glass & Aluminum (AGA) designed, engineered and installed the entire façade system on 1199 Coleman's L-shaped structure. Hundreds of articulated, vertical sun shades compose a signature exterior. AGA's project executive, Jason Gillard, DBIA, noted, "It's both decorative and functional."
Bringing the project from concept to construction, AGA worked closely with Linetec to visually harmonize the aluminum sun shades on the upper stories and the glass fiber reinforced concrete (GFRC) that clads the ground-level podium and glazing system junction points. Mimicking the GFRC's color and pattern, Linetec created a precise palette and handcrafted spattercoat finish for the sun shades. To meet the architect's expectations for a seamless appearance across the building envelope's components, numerous finish samples were provided by Linetec and AGA. Linetec's proprietary spattercoat process combines computer-matched custom colors with hands-on artistry to determine the exact mix and texture to achieve the desired look and feel.
Gillard complimented Linetec's work saying, "They matched the GFRC perfectly. If you're standing 2 feet away, you can't tell the difference."

Ref. 1225

KLAPP 200, A NEW PLIER

KLAPP 200 – ABlack plier has been studied for a better ergonomics for technicians and for a better hook and release.
Also, the electrical contact between profiles and racks is improved.
Thanks to this the new patented super black resin, the plier is very resistant to shocks and manipulations and spring is more performing, hard enough but also elastic.

Ref. 1226

MEETING GREEN GROWTH WITH RED LIST FREE ANODIZED ALUMINUM

Green growth, "green" finishes

Green building activity is projected to grow over the next three years, according to the "2021 World Green Building Trends" report by Dodge Data and Analytics, produced in collaboration with the U.S. Green Building Council (USGBC). Of the 1,207 respondents surveyed for the report, 51% said they plan to use "green" finishes in the next five years. You can be confident you're recommending a finish that supports sustainability when you specify our eco-friendly anodize. Compared with traditional, caustic-etch, our improved acid-etch process reduces energy use, produces 90% less waste and generates recyclable byproducts. This reliable, resilient finish meets or exceeds all AAMA 611 performance specifications. It resists the ravages of time, temperature, corrosion, humidity and warping. It is an inert material that is not combustible, 100% recyclable and poses no health risks.

RED LIST FREE

Supporting occupant health and wellbeing, more project teams are expecting manufacturers to supply in-depth and detailed material ingredient information for their products. There's no need to worry or delay when you're asked for documentation on anodized aluminum.

Linetec's anodize finishes have earned a Declare Label as Living Building Challenge™ (LBC) Red List Free. This means that our anodize finishing is in full compliance with the highest level of LBC criteria established through the International Living Future Institute.

We have disclosed 100% of the product ingredients to 100 ppm and confirmed they do not contain any Red List chemicals. Our Declare Label for anodized aluminum indicates that there are no applicable VOCs associated with this product and lists a life expectancy of 40 years.

Ref. 1227

SLUDGE REDUCTION AFTER ANODIZING

One of the main problems in wastewater treatment for anodizing line is the disposal of aluminium hydroxide sludges. The volume of the sludge to be treated in the plants where the chemical etching is performed is very high.

The DRYPLUS process has the aim to dramatically increase the "dry part" of the sludge. DRYPLUS allows to obtain a "dry part" equal to 40-50% of the total aluminium hydroxide sludge, instead of the usual 20-25% achieved in the traditional processes.

The DRYPLUS process can be integrated in a conventional wastewater treatment (physical – chemical).

The benefits of using the DRYPLUS technology are:

- Less sludges volume
- Less trucks to transport the sludges
- Cost reduction compared with a traditional system

The paper studies the plants installed in several parts in Europe and USA in order to verify the reliability of the system and the costs after some years of work. The last approach in terms of water treatment actually consist of the integration of several methods aimed to the reduction of waters consumption improving the rinsing

quality in the anodizing process line.
The technology described in this paper has been researched and patented with the aim to dramatically increase the “dry part” in the sludge produced as a waste in aluminium anodizing lines; it allows to get a “dry part” equal to 40-45% of the total aluminium hydroxide sludge, instead of the usual 20-25% achieved in the traditional processes.; the environmental and economic advantages of the sludge reduction technology are evident, since the volume of sludge considered as an “industrial waste” is actually halved, and the number of truck used to transport this volume of sludge is also halved.
The wastewater treatment works by collecting all the solutions coming from the rinsing tanks in special reactors. The mixing of the solutions takes place in these reactors until the best pH value for the precipitation of the aluminum hydroxide is reached (from 7.5 to 9.0). The chemical reactions involved in the neutralizing process are the following:

1) $6NaOH_{(sol)} + Al_2(SO_4)_{3(sol)}$ ® $3Na_2SO_4(sol) + 2Al(OH)_3(s)\downarrow$
sodium hydroxide + aluminium suplhate ® sodium sulphate + aluminium hydroxide

2) $2NaAlO_{2(sol)} + H_2SO_{4(sol)} + 2H_2O$ ® $Na_2SO_4(sol) + 2Al(OH)_3(s)\downarrow$
sodium aluminate + suplhuric acid + water ® sodium suphate + aluminium hydroxide

The aluminium hydroxide precipitated by the traditional process looks like a "gel" because of the large amount of water contained in its typical molecular conformation. The percentage of water in this sludge is normally between 75 and 85% and can be removed only by drying process. This sludge should be disposed of by specialized companies (according to the local ecological regulations).
In our study, we considered the possibility to obtain the formation of a drier aluminium hydroxide from industrial solutions with high content of dissolved aluminium: alkaline solution coming from static rinse after etching process and acid solution coming from acid recovery system or static rinse after the anodizing process). The physical parameters involved in the neutralizing reaction are highly relevant in order to change water content into the obtained solid.
The temperature, the dosing and the mixing system has been investigated comparing the results in terms of water content in the obtained samples of aluminium hydroxide.

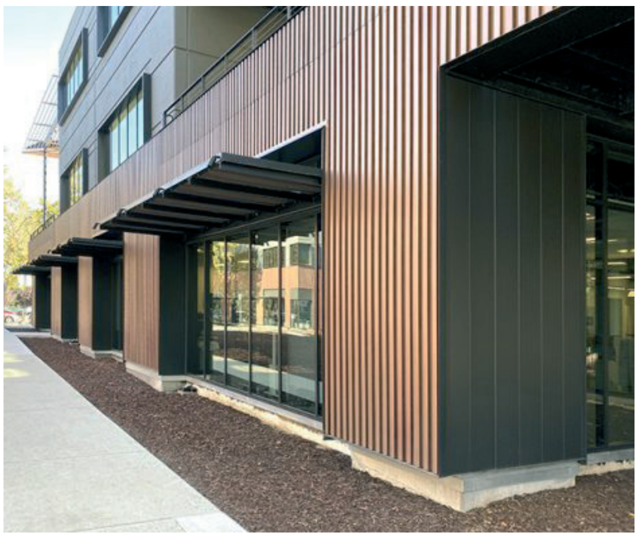
Following the results of this industrial experiment, we assumed the range of concentration when, according with the rinsing efficiency, it is necessary to renew the rinsing solution. After the treatment of "exhaust" rinsing solution, the precipitate obtained has been filtrated using a laboratory filter press with filter cloth MK 40 HC black.
Using the Dryplus process, the water content in the sludge is dramatically reduced providing valuable savings in terms of solid waste disposing (up to 50% less).
The following table shows the average savings considering 10 tons of aluminium anodized per day:
The chemical reactions involved in the precipitation of the aluminium hydroxide can be controlled by the new system named Dryplus. This system can be integrated in the existing wastewater treatment (physical – chemical).
The industrial applications confirmed the 40-50% of sludge reduction thanks to the reduction of water content. Practically the water content can be reduced to 50% in the final sludge (the traditional process provides approx. 80% of water content).

The benefits of using the DRYPLUS technology are:
- Less sludges volume thanks to the lower water content
- Less trucks to transport the sludges
- Cost reduction compared with a traditional system
- Better quality of the rinsing solutions
- Lower workload of the existing waste water treatment plant

In conclusion this system is a valid option for the conventional waste water treatment: it gives a lot of benefits in terms of reduction of the cost for disposing materials and in terms of reduction of the working load to the waste water treatment. Under specific condition, it is also possible to obtain a relevant reduction of the sulphates emission in the treated waters.

Ref. 1228

LINETEC'S DURABLE COPPER ANODIZE ENHANCES APPEARANCE, PERFORMANCE, SUSTAINABILITY OF ARCHITECTURAL ALUMINUM PRODUCTS



Linetec's Copper Anodize enhances the appearance and performance of architectural aluminum products, while supporting their sustainability and durability. The finish's rich metallic tone resembles that of a copper penny and will keep its original shine for years to come.

All of Linetec's anodize finishes, including Copper Anodize, have earned a Declare Label as Living Building Challenge™ (LBC) Red List Free. This means that Linetec's anodize finishing is in full compliance with the highest level of LBC criteria established through the International Living Future Institute (ILFI).
Declare LBC Red List Free products are recognized by the U.S. Green Building Council's LEED Rating System, the International WELL Building Standard, and the U.S. Environmental Protection Agency's Recommendations of Specifications, Standards and Ecolabels for Federal Purchasers. The Declare Label for Linetec's anodize lists a life expectancy of 40 years and indicates that there are no applicable VOCs associated with this product.
Unlike real copper, Linetec's Copper Anodize finish will not stain adjacent building materials with salt run-off or patina with time. Compared with actual copper, anodized aluminum is one-third of the weight, a fraction of the cost and more durable.
"New construction projects will look as fresh as the day they are installed without turning the dated green color of pure copper seen on historic properties," said Linetec's marketing manager Tammy Schroeder, LEED® Green Associate.
She added, "For buildings seeking to regain their former luster, anodized aluminum in a bright elemental Copper Anodize can replicate the original intended appearance, while reaping the benefits of modern materials."
Anodizing protects and enhances the aluminum in both exterior and interior applications, such as:

- Window, skylight, curtainwall, storefront and entrance framing systems
- Doors, column covers, wall panels
- Façade and rainscreen systems
- Canopies, sunshades and other shading devices
- Coping, fascia and louvers
- Ornamental and decorative elements, trim and railings

Linetec's proprietary Copper Anodize finishes are achieved through an eco-friendly, three-step electrolytic coloring process. The anodize finish meets AAMA 611 Class I industry specification standards, providing excellent resistance to abrasion, weather, UV exposure and salt spray, and exceptional wear in high-traffic environments. Introduced in 2005, Linetec's Copper Anodize has been on a test fence in south Florida, for nearly 20 years, with no significant change to color or gloss.
Because it is an integral part of the substrate, anodization produces an oxide film that

is uniform, hard and protects the rest of the aluminum from deterioration. After installation, their longevity contributes to lowering the need for repairs or replacement. These durable finishes also require minimal maintenance, reducing the associated labor and saving costs. Further supporting wellness, sustainability and circularity, anodized aluminum can be made from recycled material and can be recycled at the end of its useful life on the building. Because there is no degradation to the aluminum's inherent properties and strength, these metal materials can be "upcycled" as future building components or other products.

Ref. 1229

INNOVATIVE ZERO LIQUID DISCHARGE PLANT AFTER ALUMINIUM ANODIZING

We take care about the environment by respecting the strictest standards, reducing water consumption and guaranteeing the stability of environment quality.

In order to reach the high standard above mentioned, we developed an innovative technology plant regarding the waste water treatment with zero liquid discharge.

This new technology can be applied to:

- aluminum and steel electrostatic coating plant (powder or liquid)
- aluminium powder coating
- other applications

It is applied to new or preexistent plants.

SYSTEM DESCRIPTION

- Overall adequate lay out
- Specific software to guarantee the online registration of all the parameters of the production process with the possibility of automatic error correction
- It can be applied fully or partially
- Flexible technology that can be made up of those necessary parts according to the production it is intended for, to the customer's needs and to the requirements of the legislation
- The main parts of the system (deionizers, osmosis) are made up of special technology resins and membranes that guarantee the final result
- Innovative technology for the recovery of soda based on the electrochemical method
- Innovative technology for the recovery of phosphoric acid based on an appropriate ion exchange method
- Filter presses with suitable technology
- Special technology evaporators that guarantee the lowest possible energy cost

Ref. 12210

Conferences & Exhibitions

2022

SEPTEMBER 2022

22 SEPT. – 24 SEPT. - 23RD INTERNATIONAL TECHNICAL SEMINAR, EXTRUFINISHING INTERNATIONAL 2022, MODENA, ITALY

Presentation of the latest technologies and equipment for Extrusion and Aluminium Finishing developed in the recent years by main leader companies.

For information:
info@interall.it

27 SEPT. – 29 SEPT. - ALUMINIUM 2022 - EXHIB. CENTRE DÜSSELDORF, GERMANY

The world's leading trade show and B2B platform for the aluminum industry and its main application industries - the show focuses on solutions for automotive, mechanical engineering, building and construction, aerospace, electronics, packaging and transportation.

For information:
https://www.aluminium-exhibition.com/en-gb.html

OCTOBER 2022

4 OCT. – 6 OCT. - AAC FALL CONFERENCE & EXPOSITION – KANSAS CITY, US

ALUMINUM USA is an industry event covering the entire value chain from upstream (mining, smelting) via midstream (casting, rolling, extrusions) to downstream (finishing, fabrication). Every two years, ALUMINUM USA offers a forum leading suppliers and industry professionals to come together for face to face meetings, exhibition, cutting-edge conference and educational programming and technology-based networking opportunities. ALUMINUM USA is the ideal event for end-users from application industries such as automotive, aerospace, construction, packaging and electrical & electronics.

For information:
sspohr@tso.net

2023

SEPTEMBER 2023

19 SEPT. – 23 SEPT. – 12TH ALUMINIUM TWO THOUSAND WORLD CONGRESS, TOGETHER WITH THE 7TH ICEB (INTERNATIONAL CONFERENCE ON EXTRUSION AND BENCHMARK) – MODENA, ITALY

The two not-to-be-missed AluEvents can be held together, again.
After 11 editions, it has become a very important and irreplaceable meeting point for all the operators working in the Aluminum industry.
Highly qualified "Aluspecialist" from companies, universities and associations come from all over the world to present to a specialized and international audience the most innovative technologies and applications in the aluminium field.
The International Conference on Extrusion and Benchmark (ICEB) has become the biggest event in Europe related to the recent developments on Extrusion Technology and its analysis by FEM simulation.
The aim of the conference is to join together technical and scientific experts, to widespread their knowledge and to form an international community for the discussion of state of the art, as well as future developments, in the field of extrusion and in its most powerful tool, the numerical simulation.
Also for the 2023 edition the ICEB conference will keep all its main features, by merging technical sessions on the "Latest advances in the extrusion of light alloys" with the contest "Extrusion Benchmark" of simulation codes.

For information:
www.aluminium2000.com

FREEAL PLUS

Just input the chemical analysis of Al^{3+} in each anodizing tank

FreeAl Plus will automatically regulate the working parameters and Al^{3+} will remain constant

Set Tank 1 | Set Tank 2 | Set Tank 3 | Set Tank 4 | Alarms

FREEAL is now available in an enhanced version featuring a specific software for the automatic functioning of the unit.

This means that the software will automatically command the functioning time and parameters in each individual tank, with the automatic calculation of the right parameter necessary to keep aluminium concentration constant in all tanks.

In this way it is not any longer required the intervention from the operator in order to determine the working time of the unit and the related parameters.

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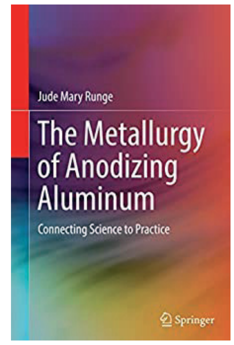
Books

Integral MateriThe Metallurgy of Anodizing Aluminum

Connecting Science to Practice

By J. M. Runge

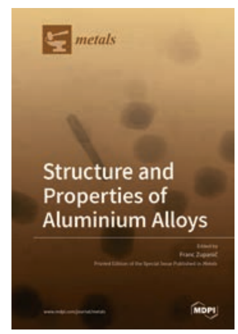


In this book, the history of the concepts critical to the discovery and development of aluminum, its alloys and the anodizing process are reviewed to provide a foundation for the challenges, achievements, and understanding of the complex relationship between the aluminum alloy and the reactions that occur during anodic oxidation. Empirical knowledge that has long sustained industrial anodizing is clarified by viewing the process as corrosion science, addressing each element of the anodizing circuit in terms of the Tafel Equation. This innovative approach enables a new level of understanding and engineering control for the mechanisms that occur as the oxide nucleates and grows, developing its characteristic highly ordered structure, which impact the practical function of the anodic aluminum oxide.

REF. 12211

Structure and Properties of Aluminium Alloys

By Franc Zupani



The annual world production of aluminum and aluminum alloys has been increasing in recent decades, reaching more than 70 million tons in 2020. The future of this industry is bright, as the applications of Al and its alloys have strongly diversified in automotive, aerospace, building, and other industries. Aluminum's main property is its low density, and, more importantly, very high specific properties compared to other metallic and nonmetallic materials. The properties of aluminum alloys can contribute to a significant decrease in energy consumption and CO_2 emissions, especially in transportation. The main prerequisite for the future success of aluminum and its alloys is further improvements in existing alloys, and the development of novel aluminum alloys. In addition to conventional fabrication methods (casting, forming, powder metallurgy), additive manufacturing technologies enable further tailoring of alloys' microstructure and new combinations of properties. The properties of aluminum alloys are mainly based on their structure, from the atomic scale to the macrostructure, as seen by the naked eye. This book focuses on the relationships between the manufacturing, structure and properties of aluminum alloys. The papers presented give an account of the scientific and technological state-of-the-art of aluminum alloys in 2020.

REF. 12212

Aluminium and aluminium alloys

By Maria Stoicanescu, Ioan Giacomelli

Aluminium and aluminium alloys constitute a category of materials that accompanied mankind's evolution . In recent years, new and diversified materials have emerged. This process does not diminish the importance of aluminium, but rather represents a challenge. In order to achieve greater performance it is necessary to know in detail the structure of these materials, as well as the possibilities they offer through the existence of solid state transformations. This paper offers to those interested by the field of materials science the elements required for the knowledge of aluminium and the its alloys, of their properties of use and possibilities of modification in the intended manner.

REF. 12213

Books

Mechanics of Corrugated and Composite Materials

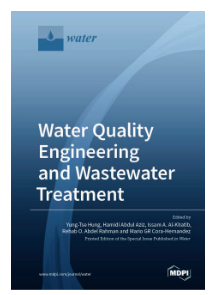
By Tomasz Garbowski, Tomasz Gajewski and Jakub Krzysztof Grabski

One of the challenges in research by modern engineers is the acquisition of new materials for the creation of various constructions in order to improve their properties, including mechanical ones. One possible way to achieve this goal is through composite materials. Moreover, the use of such materials in various real constructions leads to material, cost, energy and environmental savings, e.g. by reducing the weight of the products, significant reductions in fuel consumption, exhaust emissions and costs during transport can be achieved. Therefore, composite materials are of great practical importance, as seen in various applications in the automotive and aerospace industries, building construction and many other fields. Composite materials are inhomogeneous materials consisting of at least two various materials of different properties. Considering the construction of the composites, one can distinguish some typical examples, e.g., fibrous composites, when one component of the composite is made of fibers and the other is called a matrix. Another kinds of composite materials are sandwich or layered plates, in which their components are arranged in layers. Both of them have a wide range of applications in various engineering fields. On the other hand, there are multiple methods for analyzing the mechanical properties of these composites, including experimental, analytical or numerical studies. Corrugated cardboard, commonly used in the packaging industry, is a special type of corrugated material. In the case of corrugated cardboard boxes, the key is to obtain a durable and stable structure with a relatively low weight. Another important issue is the modeling of structures made of composite or corrugated materials. Their specific design and heterogeneity make it very expensive to build a complete model while maintaining all the details and is thus also very time-consuming. Therefore, both the material of individual components (layers) and the cross-sectional geometry are usually a priori homogenized to simplify and speed up the calculations. The simplification should not, however, distort the results that would be obtained using the full model. Therefore, the selection of an appropriate homogenization method is often a key issue when analyzing structures made of corrugated or composite materials. This Special Issue is devoted to the mechanics of composite materials, particularly corrugated materials, e.g., corrugated cardboard or multilayer boards with a soft core. In addition, the articles published in this Special Issue of Materials present different approaches to the research and application of various computational methods and the homogenization of selected composite materials.

REF. 12214

Water Quality Engineering and Wastewater Treatment

By Yung-Tse Hung, Hamidi Abdul Aziz, Issam A. Al-Khatib, Rehab O. Abdel Rahman and Mario GR Cora-Hernandez



Wastewater treatment is crucial to prevent environmental pollution. Wastewater sources include domestic households, municipal communities, or industrial activities. Wastewater that is discharged to the environment must be treated to prevent pollution to the environment. However, wastewater remains one of the major pollutants of our inland waterways. To satisfy the tighter regulatory requirements, the implementation of more advanced design in wastewater treatment technologies is required. Treatment of wastewater usually includes physical, chemical, and biological processes. Today's wastewater treatments are much more technologically advanced than they were in previous years. Many centralized mechanized treatments are run via a computer system, and they are run more efficiently. In this Special Issue, we attempted to discuss and address the state-of-the-art of wastewater quality, treatment, and its management. This special issue is composed of 18 innovative papers and reviews that address water quality engineering and wastewater treatment. The study areas in which these topics are developed include wastewater treatment from acid mine drainage, municipal wastewater, landfill leachate, groundwater, greywater, industrial wastewater, and urban wastewater. The issue also covers the degradation mechanism of one of the nonsteroidal anti-inflammatory medications most widely used, diclofenac (DIC), by an MnO2 catalyst. In addition, the issue also present papers on eutrophication, wastewater de-nitrification, micropollutants treatment, nanoparticles application in wastewater treatment, and a paper each for a new ecotoxicity measuring tool by using optical camera and inactivation and loss of solar irradiation infectivity of Enterovirus 70. The three review papers include the use of natural polymers' modification in wastewater treatment of toxicant dye compounds, metallic iron for environmental remediation using metallic iron (Fe0) as a reactive agent, and the utilization of ionizing radiation in wastewater purification.

REF. 12215

12th Aluminium Two Thousand World Congress
7th ICEB (International Conference on Extrusion and Benchmark)

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INTERALL SRL: Via Marzabotto 20, 41042 Fiorano Modenese (MO), Italy
Phone: +39 059282390 - aluminium2000@interall.it - www.aluminium2000.com