# TECHNICAL INFORMATION
# ON THE PROCESSES OF ANODIZING ALUMINUM
# IN RELATION TO THE 10681 NORM

**Here following is a list of some characteristics of anodic layers.**

**For companies that work in the anodizing aluminum sector, there's a norm of reference called UNI 10681:2010 which describes the provisions to follow in the production process, the different properties of the anodic layer, the control methods and the coding of the preliminary treatments to the anodic process.**

These provisions mainly involve UNI and ISO standards related to test methods for the characterization of the oxide layer and procedures for statistical quality control.

## IDONEITA' MATERIALI PER L' OSSIDAZIONE ANODICA

The surface appearance of the finished products is conditioned by the type of alloy used. The possible consequences in appearance created on finished products depend on the main alloying elements and impurities of the alloy. The elements considered are the following: iron, silicon, copper, manganese, magnesium, zinc and chromium. We'd like to point out that the percentage of each element or the combination of more elements contained in an alloy is fundamental to the final aesthetic outcome. According to the percentage of these metals, the aesthetic finishing can vary even piece by piece.

## ELEMENTS FOR THE COMPOSITION OF ALLOYS:

**Iron:** This is the main impurity present as heterogeneous separation which causes, even in small amounts, a decrease of specular gloss in alloys of high purity. Iron additives to 99.99% aluminum cause the formation of a dark grey oxides or black streaks. In alloys for extrusion, oxide layers of a more or less gray color may appear.

**Zinc:** Even for values up to 5% you obtain a protective oxide layer which can be transparent when zinc is present in solution or brown if it is in the form of heterogeneity.

**Chromium:** A value of 0.3% causes a yellowing of the oxide layer.

**Manganese:** For values up to 1%, the oxide layer remains generally transparent or even gray, brown or mottled depending on the history of metal and particles sizes. With a high oxide thicknesses, a concentration of 0,30,5% can cause brown staining.

**Magnesio:** E' l'elemento maggiormente tollerato in fase di anodizzazione. Fino a valori del 3% può dare uno strato d'ossido chiaro e trasparente; ciò è dovuto probabilmente al fatto che il magnesio ha un indice di riflettività (1,736) molto vicino a quello dell'ossido di alluminio (1,69).

**Copper:** Up to 2% of the layers that are obtained with alloys treated under certain conditions are transparent. Higher values result in a less transparent oxide, the oxidation becomes more difficult and the layer that you get is tenderer, with a lower protective efficiency.

**Silicon:** This element causes a milky opacity when not in solid solution, but about 0.9% remains dispersed. When some iron is present as an impurity, it has a beneficial effect. In aluminum-magnesium alloys, silicon passes easier into solution. At levels of 5%, you get a dark gray or black oxide. There are difficulties anodizing material produced by fusion.

Information as to the quality of the materials to be used for decorative and protective finishes, polished and industrial use are also given.

## SURFACE PRE-TREATMENT

The preliminary stages of anodizing treatments are particularly important since, according to the process used, you can get different surface morphologies.

Here following will list the following types of pre-treatment:

Degreasing and deoxidation
Sanding
Brushing
Polishing
Sanding and brushing
Sanding and polishing
Chemical etching
Chemical or electrochemical brightening
Polishing and chemical buffing

In regards to surface appearance, the norm foresees that this is agreed between the client and the anodizing company and suggests a preparation of samples to indicate the limits of acceptability.

## CONTROL TESTS

Control tests of the oxide layer foresee the application of the sampling procedures to be agreed between the customer and the supplier. The norm of reference is ISO 2859 (sampling from production as a function of the lot quantity).

## PROPERTY OF THE OXIDE LAYER

The oxide layer deposited on the final product must be agreed upon between the parties following the provisions of the norm of reference.
The oxide layer has the following characteristics:
thickness, quality of the hot and cold sealing, appearance and color, corrosion resistance, resistance to cracking by bending, resistance to light and UV radiation, mass per unit area.

## THICKNESS -MICRON

The oxide layer is classified according to the minimum value allowed for the average thickness expressed in µm.

These values as well as a useful guide for interpreting the average thickness and accuracy as well as for the choice of thickness class based on the environment in which the finished product will be used are can be referenced in the following table:

| CLASS | MINIMUM THICKNESS | PRODUCT USE |
|---|---|---|
| 5 | 5 | For internal use without frequent handling |
| 10 | 10 | For internal use |
| 15 | 15 | For external use |

| | | |
|---|---|---|
| 20 | 20 | For exposure to a urban environment or an aggressive marine environment |

Note: for work abroad sometimes class 25 is required meaning a minimum thickness of 25µm.

To measure thickness, one of the following three methods can be used: induced current system, metallographic microscope, optical microscopy. In case of dispute, for thicknesses greater than 5µm, the method to be considered as a reference is that of induced currents.

## APPEARANCE AND COLOR

The assessment of defects must be conducted at a distance of 5 meters for exterior surfaces and of 3 meters for internal surfaces. The color and surface appearance should be agreed on between customer and supplier. It is appropriate in this case that the acceptable limits are established by at least two agreed upon reference samples.

## SEALING QUALITY

Reference tests for assessing the quality of sealing are listed; this is an essential step in the anodizing treatment, achieved by two different treatments known as **hot** or **cold** treatments. In case of dispute the sealing quality must be determined by the destructive method of weight loss, performed in accordance with **UNI 9178** norms. The maximum value of weight loss should not exceed 30mg/dm2 of anodized surface. The rule also sets the limits of acceptability for the measured values with the evidence of admittance (<20ms referring to a thickness of 20mm) and loss of absorbing value based on which the sealing is considered satisfactory if the residual value of the stain is less than or equal at 2.

## CORROSION RESISTANCE

Upon specific request of the customer, an evaluation of corrosion resistance can be carried out, for example by an acetic salt spray test in accordance with ISO 9227 norms. **The evaluation of the corroded samples can be carried out in accordance with the provisions of the prEN 12373 project parts 19 and 20.**

## RESISTANCE TO LIGH AND UV RADIATION

The norm provides as a method of evaluation of the colored oxide layer the one that is specified by the **UNI 4529** norm by which acceptable limits are 5 for internal applications and 9 for external applications. For colored oxide layers for external applications, which must have high resistance to light, a fast track method is indicated which evaluates its resistance to UV radiation, as specified in the ISO 6581 norm. Since it is much more severe than the previous one, this method permits quicker evaluations of light resistance for many colors.

## RESISTANCE TO CRACKING BY BENDING

Even in this case the test shall be performed only if requested by the client; the method indicated by the standard is the bending of the oxide layer specified in prEN 12373-16.

## MASS PER SURFACE UNIT

At the request of the customer the mass per unit area must be determined in accordance with the UNI 3396 norm.

This information has been compiled based on our experience and the referencing norm 10681:2010 general characteristics of anodic oxide layers for decorative and protective use.