

## BENEFITS OF ANODISED ALUMINIUM FOR ARCHITECTURAL APPLICATIONS

### Introduction

Modern materials must permit design creativity but at the same time they must be:

- ✓ produced responsibly and economically
- ✓ durable, and
- ✓ recyclable at the end of their life

Aluminium, with its exceptional recyclability, minimal maintenance and proven lifetime performance, successfully responds to the need for environmentally friendly and sustainable solutions. In building applications, aluminium virtually always requires surface treatment. Yet, the choice of surface treatment of aluminium is as important as the choice of the material itself.

Anodising enhances the natural qualities of aluminium still further; it permits a strongly contemporary finish with incomparable corrosion and abrasion resistance. Unique amongst surface treatments, such as coatings, anodising is totally integrated with the metallic substrate – it is not simply a film applied to cover the surface. The result – pure aluminium – is a perfectly and repeatedly recyclable material with remarkable performance characteristics.



These same exceptional qualities can be found in new product applications in anodising, which now provide new and infinite texture and design possibilities for building exteriors.

The modern, aesthetic beauty of anodised aluminium is founded on its many unique properties. Anodising is a transparent finish integral with the metal, which retains and enhances the inherent beauty of the aluminium; it is totally UV resistant.

A totally homogeneous appearance can be guaranteed, thanks to the nature of the anodising process and the very tight quality controls on both the aluminium and the surface treatment;

Colours, textures and patterns can be combined with the anodic film, enhancing the natural metallic appearance without affecting the total UV resistance.

The “living” quality of its natural metallic sheen, combining texture with colour, guarantees a creative interaction of the surfaces and shapes of the building with the constantly changing light conditions through the day and across the different seasons. This effect can be accentuated by employing textures and colours.

### Contemporary building with anodised aluminium façade

The anodic layer will retain its original beauty and protection against corrosion throughout the life of the building – as proven by independent inspection of buildings of more than 30 years old.

The following information provides owners, developers, architects, system companies, specifiers and contractors, with an in-depth understanding of the proven benefits of anodised aluminium and explains why this is increasingly the material of choice for buildings of the future:

## **Authentic metallic lustre and feel**

The anodic layer is transparent and integrated in the surface of the metal; the natural metallic appearance and feel of the aluminium are fully preserved. The anodised finish will enhance and reinforce the natural beauty of aluminium to create a living surface constantly interacting with the natural or artificial light playing across its surface.

Regardless of the substrate material – aluminium, steel, plastic – a painted surface always has the same, flat appearance. In trying to achieve the authentic metallic lustre of anodised aluminium, painted aluminium uses multi-layer systems with metallic pigments with the risk of creation of colour variations, including metameric failure.



**Anodised aluminium can fit different façade forms**

## **Excellent corrosion resistance**

Even in its natural state, aluminium does not corrode in the same, destructive, way as iron or steel. Corrosion of aluminium, however, permanently damages the aspect of the metal. The natural oxide layer of aluminium provides a self defence against corrosion.

However, this natural oxide layer of aluminium is thin, irregular and unstructured with only superficial corrosion protection. Anodising creates a thick, perfectly formed and scientifically controlled oxide layer, which ensures a surface of unparalleled corrosion resistance and locks in the pure and natural metallic aspect of the metal. Anodising has been used for external building applications for over 60 years. With an appropriate anodic layer thickness for external use, anodised aluminium will perform without problem, even in the most severe environments. In particular, anodised finishes are highly durable in city and marine environments, due to their resistance to chlorides and sulphates.



**Anodised aluminium can be used to create modern and advanced designs – here on a landmark building in Paris-La-Défense constructed over 25 years ago**

### Proven durability + technical continuity

The technology of anodising has been established for almost 100 years. Whilst the process has been continuously refined, especially in terms of quality, the chemical and technological fundamentals remain unchanged.

The on-site behaviour of the anodised surfaces produced today is fully predictable, based on the proven, long term, service experience. Independent inspection commissioned by United Anodisers has confirmed that the anodic protection remains undiminished after more than 30 years.

The chemistry of organic coating is much more recent and, further, due to legal and environmental constraints, has been subject to continuing modifications. As a result, the long term, on-site behaviour of these modern coatings is not proven. Indeed, even some landmark buildings completed in the last 10 years with organic coatings are already showing signs of surface deterioration such as adhesion failure, fading, chalking and filiform corrosion

### No risk of adhesion failure

Anodising is an electrolytic process, which transforms the surface of the metal into an oxide layer integral with the metal itself. It is not a coating applied to the surface of the metal.

**Because it is only a coating, painted aluminium can suffer surface failure over time**

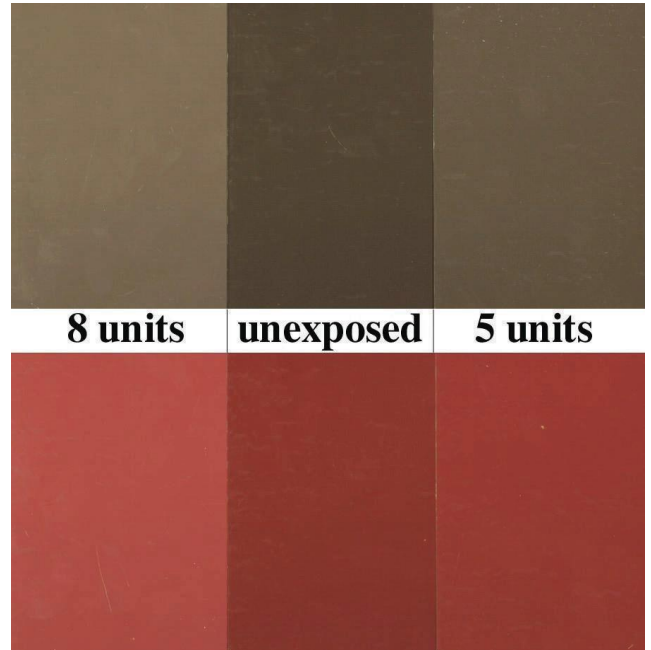
There is, therefore, no risk of adhesion failure such as peeling, blistering, cracking, splitting or chipping which may occur with surface coatings, such as painting. There will be no adhesion failure, even on cut edges or joints.

Certain guarantees for polyester paint specifically exclude adhesion failure.

### No possibility of fading

Natural silver, bronze, Anolok I and Anolok II blue-grey anodised finishes contain no organic elements. No colour fading is possible during the service life of these

finishes. Organic coatings are always subject to fading in varying degrees over the lifetime of a building.



**Accelerated tests to replicate fading on non-anodised surfaces**

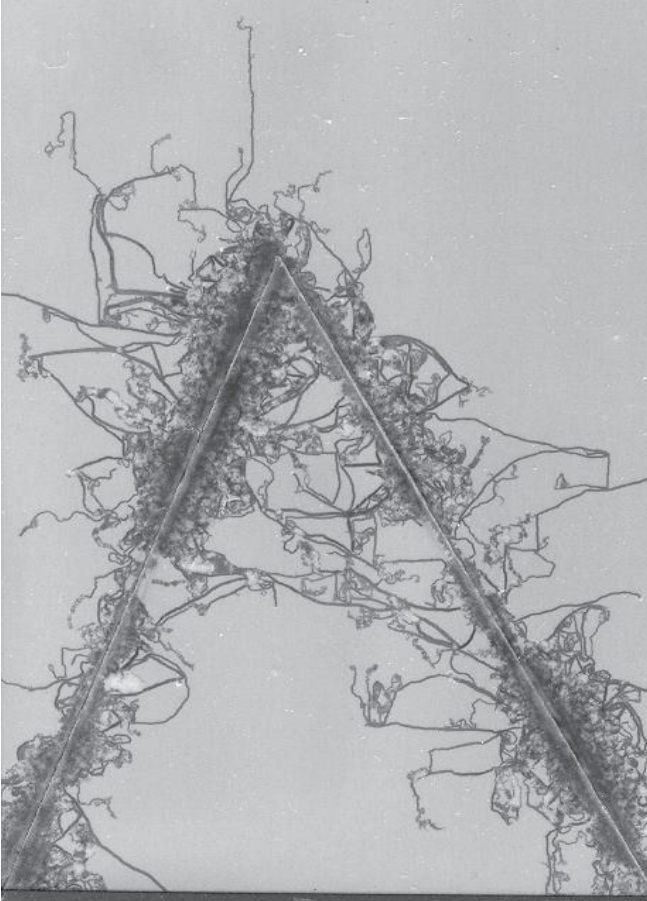
### No possibility of filiform corrosion

Filiform corrosion is an attack on the hidden inter-layer between the aluminium and the surface finish which results in the propagation of corrosion under the surface finish. It cannot be remedied. It originates from surface defects, surface damage or scratches.

With anodising, the oxide (anodic) layer is integral with the aluminium. There is no inter-layer between the metal and this protective oxide layer.

As a result, the finish will remain free from filiform corrosion. If the surface is punctured or damaged, the aluminium will simply repair itself through natural oxidation.

The absence of an inter-layer zone ensures that there can be no corrosion as found with painted products.



Example of filiform corrosion on a painted metallic surface (Source: CoRI, Belgium)

## No chalking

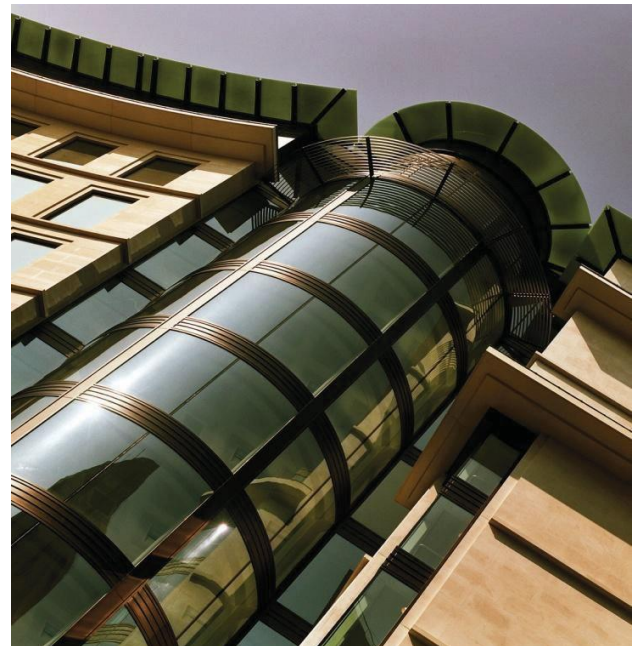
Chalking is the formation of a fine powder on the surface of the paint film during weathering. It can cause significant deterioration in surface appearance, with a reduction in the gloss level, surface lustre and colour. Anodised aluminium does not suffer from this disfiguring condition, even when exposed to difficult exterior environmental conditions, such as marine locations or very sunny and/or humid climates.

## Uniform surface finish for all metal shapes and textures

Anodising is a process which can be carried out prior to or after the transformation of the metal. Since it is an electro-chemical immersion process rather than an applied finish, anodising provides a particularly uniform

and regular finish on most metal shapes and textured surfaces, such as perforated sheets, tread plates, finished or brushed metal, mesh material, stucco surfaces etc.

Anodising avoids the risk of localised high coating thickness or orange peel effect, typically associated with organic coatings on such surfaces.



Building exteriors blend different materials with anodised aluminium without problems

## Optimum coverage

Anodising, as an electro-chemical immersion process, achieves a more uniform surface coverage, especially for extruded sections. With spray paint processes and, especially with powder-coating, the non-visible surface is often not coated.

## Highly impermeable anodic layer

A properly sealed anodic layer is impermeable. An organic coating is always porous. Furthermore, when severe environmental temperature fluctuations occur, the anodic layer is not subject to damaging physical changes and consequential embrittlement. With an organic coating, these changes may occur when the coating is subjected to temperature cycles above and

below its glass transition temperature – the pivot temperature at which the mechanical properties of the organic coating will change from elastic to brittle.

## Abrasion resistance

Aluminium oxide is a very hard compound which is second only to diamond, on the Mohs scale of mineral hardness. Anodised aluminium surfaces offer, therefore, superior scratch and abrasion resistance than coated surfaces.



**Anodised surfaces are very hard – 80% of the hardness of diamond**

## Quality controls

The tightly controlled quality assurance in the anodising process can be followed up on site without damage to the anodised surface.

## Environmental benefits of pure anodised aluminium

One of the key advantages of aluminium over other materials is that it can be recycled repeatedly through simple re-melting with minimal loss on each cycle. In Europe, more than 30% of aluminium consumption is satisfied with recycled aluminium and over 90% of the aluminium used in buildings is recycled at the end of the building's life. The recycling process requires only 5% of the energy required for the production of primary aluminium – a significant contribution to environmental sustainability.

Anodised aluminium is unique, comprising only pure aluminium, its alloying elements and oxygen. As pure aluminium, it is fully recyclable without intervening chemical processes and emissions. Because of this and the ready market for quality aluminium scrap, the anodised aluminium will have a cash value to offset the cost of demolition at the end of the useful life of the building.



**Fully recyclable, anodised aluminium answers all the environmental imperatives of today and tomorrow**

Modern architectural anodising plants are capable of responding to the most stringent environmental standards with full chemical recycling and a large recovery of waste water. Anodising does not require environmentally sensitive pre-treatment like chromating. The anodising process does not produce CO<sub>2</sub> or solvent emissions.

## Guarantees

Guarantees are often considered by specifiers or building owners to provide reassurance about the long term performance of a surface finish.

In recent years, there has been a trend of extending guarantees for longer and longer periods as a way of outbidding competing surface finishes.

But, guarantees have often been full of exclusions and reservations. Invoking guarantees, often years after the event, frequently involves costly litigation. Further, even if the guarantee is successfully invoked, replacement of defective parts may be impossible without partial demolition of the building.

Where this is not practical, the owner of the building will be simply left with the problem over the long term; legal recourse for aesthetic damage is notoriously difficult to assess. Surface failure may render a building impossible to sell or otherwise seriously blight its open market value.

Historically, quality claims against leading architectural anodisers have been negligible. In the highly unlikely event of a claim, the anodiser alone bears full responsibility for all properties of the anodic layer.

Guarantees are important, but only if they are simple, straightforward and long term – this is only possible when they can be given backed with the full confidence of proven, long-term, on-site performance.

As a result of recent independent surveys of long term on-site performance of anodising – including in polluted and marine environments – a simple, straightforward, unequivocal design life guarantee for anodising is available for the first time, exclusively from United Anodisers.

Guarantees for organic coatings are not backed by the same site exposure history. For any organic coating, the responsibility for any failure is necessarily divided between the paint manufacturer and the paint applicator. The guarantees available from the manufacturers of polyester powder specifically exclude adhesion.

## Selection of the architectural anodiser

In order to obtain all the advantages of anodising described above, it is of key importance that both the aluminium and the anodising treatment are perfectly suited to the performance requirements of both buildings and their surrounding environment.

United Anodisers is the world leader amongst an elite group of anodisers specialising in architectural applications, with the capability to ensure a homogeneous, high quality architectural finish with a lifetime performance.



For further information and advice on anodised aluminium applications for architectural projects, please contact United Anodisers at:

