AAF QUEENSLAND

RESEARCH & DATA — 01

ANODISING — THE TECHNOLOGY

Understanding Architectural Anodising and Its Distinctive Properties

Anodising is a unique electrochemical finishing process that transforms the surface of aluminium into a durable, protective metallic finish — rather than applying another material onto the surface.

Introduction — Understanding the Difference

Aluminium has become one of the most widely used materials in contemporary architecture, valued for its strength, light weight, design flexibility and recyclability.

The finish selected for aluminium plays an important role in its appearance, protection and long-term performance.

Two principal finishing technologies are widely used in architectural applications: anodising and powder coating.

Both provide attractive architectural finishes, but they are based on fundamentally different technologies.

Powder coating applies a formulated organic coating onto the aluminium surface.

Anodising uses electricity and an electrochemical process to transform the aluminium surface itself into a protective aluminium oxide layer.

This distinction is important when considering durability, colour, appearance, maintenance and expected service life.

The following sections explain the anodising process, compare the two technologies, and outline the considerations involved in specifying high-grade architectural anodising.

1.1 Understanding the Anodising Process

An Electrochemical Transformation of Aluminium

Aluminium naturally forms a very thin protective oxide layer when exposed to the atmosphere.

Anodising is a controlled electrochemical process that substantially increases the thickness and develops the structure of this natural oxide layer.

During processing, aluminium components are immersed in an electrolyte, typically a sulphuric acid solution, and connected to a carefully controlled electrical current.

The aluminium acts as the anode in an electrolytic cell.

The resulting electrochemical reaction converts the surface of the aluminium into aluminium oxide, creating a protective layer that is integral to the metal.

Unlike conventional painting, powder coating or electroplating, the primary protective anodic layer is formed through conversion of the aluminium surface rather than deposition of a separate coating material.

The Structure of the Anodic Finish

The anodising process produces a controlled oxide layer with microscopic pores.

These pores can be used to introduce architectural colour through suitable colouring processes.

Following anodising and any colouring operation, the surface is sealed to improve resistance to staining and environmental exposure.

The resulting finish provides several important characteristics:

- A protective aluminium oxide layer integral to the metal.
- High surface hardness and resistance to abrasion.
- Improved corrosion resistance when correctly processed and sealed.
- Retention of the natural metallic appearance of aluminium.
- The ability to produce a range of durable architectural colours and lustres.
- Long-term performance when correctly specified, manufactured and maintained.

Because anodising is an electrochemical process, the quality of the resulting finish depends on precise control of the treatment conditions.

These include electrical current, electrolyte composition, temperature, processing time, colouring and sealing.

Anodising is therefore a controlled final stage in the manufacture of finished aluminium, providing both protective and decorative properties.

1.2 Anodising vs Powder Coating — Two Different Technologies

Different Processes, Different Characteristics

Powder coating and anodising are both established architectural finishing systems.

Each has particular advantages, and both have benefited from significant technological development.

However, the fundamental differences between their manufacturing processes influence their appearance, surface properties and long-term performance.

Powder Coating — An Applied Organic Finish

Powder coating involves preparing the aluminium surface, applying a formulated polymer powder electrostatically, and curing it under heat to form a continuous protective film.

Modern architectural powder coatings provide an extensive range of colours, textures and finishes.

Performance grades have progressively improved, with high-durability polyester and fluoropolymer coatings available for demanding architectural applications.

Powder coating offers considerable design flexibility, widespread manufacturing capacity and established performance standards.

However, the protective finish remains a separate organic coating applied to the aluminium surface.

Its durability depends on the chemistry and quality of the coating, surface preparation, curing, environmental exposure and ongoing maintenance.

Anodising — An Integral Oxide Finish

Anodising differs because the protective surface is produced by electrochemically transforming the aluminium itself.

The anodised surface retains the genuine metallic character of the underlying aluminium, rather than covering it with an opaque paint film.

It is inorganic and has different surface characteristics from organic polymer coatings.

When correctly specified, processed and maintained, high-grade architectural anodising can provide exceptional durability.

Historical building examples demonstrate anodised aluminium remaining serviceable for many decades.

Comparison of Architectural Characteristics

Characteristic	Anodising	Powder Coating
Finishing technology	Electrochemical surface conversion	Applied organic polymer coating
Protective layer	Integral aluminium oxide	Separate protective polymer film
Appearance	Natural metallic depth and lustre	Extensive colours, textures and effects
Colour formation	Controlled anodising and colouring processes	Pigments and additives within coating formulation
Surface hardness	Hard oxide surface	Dependent on coating formulation
Corrosion resistance	Dependent on oxide thickness, sealing and exposure	Dependent on coating grade, pretreatment and integrity
Durability	Documented long-term architectural performance	Varies by coating chemistry and performance grade
Design flexibility	Alloy and process-dependent metallic finishes	Very broad colour and decorative choice
Quality control	Alloy, surface preparation, electrical processing, film thickness and sealing	Pretreatment, application, coating thickness and curing

Selecting the Appropriate Technology

The choice between anodising and powder coating should be based on project requirements rather than appearance or initial cost alone.

Important considerations include the architectural design, desired finish, environmental exposure, maintenance expectations and intended service life.

Powder coating provides extensive colour and texture options, with advanced coating systems suitable for many architectural applications.

Anodising provides a distinctive metallic appearance, an integral protective surface and demonstrated potential for very long architectural service life.

Both technologies have a role in sustainable architecture. Understanding their differences assists in selecting the most suitable finish for each project.

Further environmental and life cycle comparisons are addressed separately in AAF Research-02.

1.3 High-Grade Architectural Anodising

Not All Anodising Is the Same

Anodising is used across a wide range of industries and applications.

General commercial anodising may be selected primarily for appearance, modest surface protection or functional requirements.

High-grade architectural anodising is intended for applications where consistent appearance, environmental resistance and long-term durability are particularly important.

External architectural applications frequently involve demanding service conditions, including strong sunlight, temperature variation, moisture, pollution and airborne salt.

The specification and manufacturing controls applied to the anodising process are therefore critical.

The Importance of Anodic Film Thickness

The thickness of the anodic oxide layer is one of the important factors influencing the protective performance of anodised aluminium.

Thickness is generally measured in micrometres, commonly referred to as microns or μm.

Different applications and exposure conditions may require different anodic film thicknesses.

For example, architectural projects may specify nominal thicknesses such as 15, 20 or 25 μm, subject to the relevant standard, environment, process and project requirements.

However, greater thickness alone does not guarantee better architectural performance.

Successful high-grade anodising also requires appropriate aluminium selection, controlled processing, effective sealing and quality assurance.

Process Control and Sealing

The quality of anodised aluminium is influenced by a series of interconnected manufacturing stages.

These include:

- **Aluminium selection:** Using suitable alloys and understanding how metal composition and extrusion conditions affect appearance and finishing response.

- **Surface preparation:** Selecting the required etched, satin, bright or other pretreatment finish.
- **Anodising:** Controlling electrical conditions, bath chemistry, temperature and treatment time to develop the specified oxide layer.
- **Colouring:** Achieving the required metallic colour within established production tolerances.
- **Sealing:** Completing the anodic treatment to provide the required protective characteristics.
- **Testing and quality assurance:** Verifying relevant process requirements and finish characteristics.

Architectural Standards and Quality Assurance

Australian and international standards provide guidance for the specification and testing of anodised aluminium.

In Australia, AS 1231 addresses anodic oxidation coatings on aluminium and aluminium alloys.

Project specifications may also refer to relevant international architectural anodising standards.

Quality assurance should include appropriate production records, inspection and testing against the agreed requirements.

Where independent certification is specified, the applicable certification scheme and its scope should be confirmed.

The AAF Queensland Architectural Hardcoat Range

AAF Queensland provides general commercial anodising together with a selected range of seven AAF Evershield® Architectural Hardcoat finishes.

The architectural range is intended to provide high-grade finishes supported by defined processing requirements and project-specific specification guidance.

AAF Queensland can assist architects, designers and fabricators in selecting suitable finishes, confirming physical samples and identifying the processing requirements appropriate to their projects.

Project-specific warranty arrangements are available for eligible work, subject to the applicable written conditions and approval.

High-grade architectural anodising depends on the complete finishing system — not simply the colour or nominal anodic thickness.

1.4 Natural Metallic Colours and Finishes

The Distinctive Appearance of Anodised Aluminium

One of anodising's most recognisable architectural qualities is its natural metallic character.

Unlike an opaque applied coating, an anodised finish retains the visual qualities of aluminium beneath its transparent or coloured oxide surface.

This creates a distinctive appearance, reflecting the metal's natural texture, depth and lustre.

Anodised aluminium can provide finishes ranging from natural clear and silver tones through champagne, bronze, grey and dark metallic colours.

The final appearance is influenced by the aluminium itself, surface preparation, colouring method and anodic film characteristics.

How Anodised Colours Are Produced

Architectural anodising uses several colouring technologies.

Natural or clear anodising preserves the aluminium's metallic appearance while providing a protective oxide layer.

Electrolytic colouring introduces metallic deposits into the pores of the anodic layer, producing a range of architectural colours, including bronze and darker tones.

Other colouring methods are available for particular applications and effects.

The chosen colouring system can influence appearance, colour stability and suitability for external exposure.

The Importance of Aluminium Alloy Selection

Aluminium alloys are not all identical.

Differences in composition, manufacturing history, extrusion conditions and surface structure can affect the finished appearance.

Two components processed under similar conditions may exhibit differences in colour or lustre if the original aluminium is not sufficiently consistent.

For this reason, architectural anodising should be considered early in the design and material-selection process.

Where consistent facade appearance is important, aluminium alloy, extrusion source, surface preparation and colour reference requirements should be coordinated with the anodiser.

Surface Preparation and Lustre

Anodising can preserve or enhance a variety of metallic surface appearances.

Depending on the aluminium and processing requirements, finishes may range from matt and satin through to brighter, more reflective metallic effects.

The final appearance is influenced by mechanical or chemical surface preparation before anodising.

These characteristics provide architects with opportunities to use the genuine metallic appearance of aluminium as an architectural design feature.

Colour Matching and Physical Samples

Anodised colours can vary according to alloy, substrate condition, processing requirements and viewing conditions.

Digital screens, photographs and printed brochures cannot precisely reproduce the appearance of metallic finishes.

Physical samples are therefore important when selecting and approving an architectural finish.

For larger projects, agreed colour references and acceptable production variation should be established before processing begins.

AAF Queensland provides physical samples of its selected architectural finishes and can assist with project-specific colour matching and finish selection.

The objective is not simply to reproduce a colour, but to achieve a suitable metallic finish with the appearance, consistency and performance required for the completed building.

Conclusion — Understanding the Technology

Architectural anodising offers a distinctive approach to aluminium finishing.

Rather than applying an additional organic coating, the anodising process electrochemically develops a protective oxide layer from the aluminium surface itself.

This provides a combination of metallic appearance, surface hardness, corrosion resistance and potential long-term durability.

However, successful architectural anodising requires more than the basic electrochemical process.

Aluminium alloy selection, surface preparation, film thickness, colouring, sealing and quality assurance all contribute to the final result.

Understanding these requirements allows architects and specifiers to make informed decisions about the suitability of anodising for individual projects.

AAF Queensland is committed to maintaining the availability of high-grade architectural anodising, together with the technical guidance needed to support its successful use.

A finish truly for generations begins with understanding the technology and specifying it correctly.

Research References and Further Reading

1. Standards Australia
AS 1231 — Aluminium and Aluminium Alloys: Anodic Oxidation Coatings.
Australian requirements for anodised aluminium finishes.

2. Standards Australia
AS 3715:2025 — Thermoset Powder Coatings for Architectural Applications.
Requirements for architectural powder coating systems.

3. Brace, A. W. and Sheasby, P. G.
The Technology of Anodizing Aluminium.
A technical reference on anodising chemistry, processing and application.

4. Wyllie, B. (2025)
Low-carbon Aluminium is a Great Start — Next, Aluminium's Journey to Further Optimise Sustainability.
7th Australasian Aluminium Extrusion Conference, Brisbane.

5. Stacey, M. (2015)
Aluminium and Durability.
International Aluminium Institute — Towards Sustainable Cities research programme.

6. American Architectural Manufacturers Association
AAMA 611 — Specification for Anodized Architectural Aluminum.
Architectural anodising performance and quality requirements.

Original technical standards and publication editions should be checked for currency and relevance to the specific application before final specification.

Explore Further

Research-02 — Low-Carbon Aluminium Is Only the Beginning
Understanding how architectural finishes and long service life can extend the sustainability benefits of aluminium.

Research-03 — Environmental Performance and Life Cycle Research
Independent studies comparing the environmental impacts of architectural finishing systems.

Research-04 — Architectural Durability: Beyond the Warranty
Real-world evidence of anodised aluminium performance over many decades.

Research-05 — How to Specify High-Grade Architectural Anodising
Practical guidance for architects, designers and aluminium fabricators.

Discuss Your Project with AAF Queensland
Our team is available to assist with aluminium selection, finishes, samples and project-specific anodising requirements.

AAF Queensland Research & Data Centre
Research-01 — Anodising: The Technology | Website Draft 2 | November 2026

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