Anti-Corrosion and Adhesion Anodic Coating Technology

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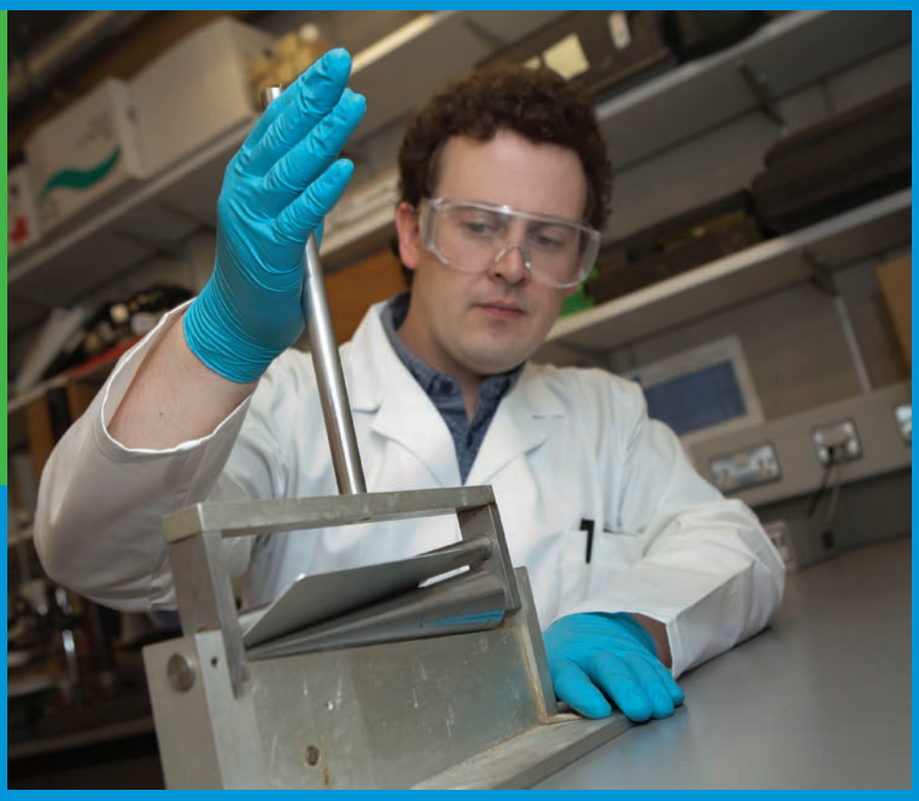
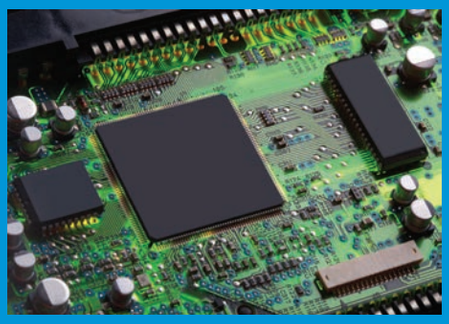
New Technology from DIT





Novel corrosion-resistant and adhesive coating technology for the automotive, aerospace and electronics industries

This technology represents a novel anodising process that has been designed for the coating of metal components in aerospace, automotive, electronics and outdoor architectural applications. Anodising is an electrolytic passivation process that allows for better wear and corrosion resistance while providing improved adhesion properties for paints, primers and glues over bare metal surfaces.

The current industry-benchmarked technique based on chromic-acid is very effective, but due to the carcinogenic nature of these substances, the use of chromate in manufacturing is either being restricted or phased out entirely. As such, there exists a real need for a replacement to chromate, with the ideal solution offering corrosion resistance as well as improving the adhesive properties of the metal surface in a single anodising treatment.

When combined with hybrid sol-gel treatments, this patented anodising process offers superior performance to chromate. This process has been tested using aluminium alloys for the aerospace and automotive sectors.

Laboratory results show superior performance to chromate-based technology and tartaric sulphuric anodising, while allowing for the incorporation of anti-corrosion and adhesion on the same metal surface.

Applications

The applications for this technology include:

- A replacement for traditional anodising and sealing processes based on chromate.
- Any application requiring the combination of corrosion resistance and adhesion to be achieved on the same metal surface.
- Providing corrosion resistance of aluminium components for outdoor use in the aerospace, automotive and architectural building sectors (scaffolding, exterior trim, window frames).
- Use in the electronics sector for metal-to-plastic bonding.

Opportunity

Chromate-based anodising is very effective, but due to the carcinogenic nature of these substances, they are either used for restricted applications or are being eliminated from the anodising industry altogether.

Replacement technologies with comparable adhesion and corrosion resistance properties are urgently required. There are existing anodising technologies that provide sufficient corrosion resistance, such as tartaric sulphuric acid (TSA), however the adhesion properties remain poor. Similarly, other treatments, such as phosphoric acid anodising (PAA) can be tailored to provide excellent adhesion properties, however corrosion resistance is compromised.

As such, there exists a real need for the incorporation of the corrosion resistant nature of TSA as well as the adhesive properties of PAA in a single anodising treatment with performance that, at a minimum, meets the chromic-acid industry benchmark.

This technology has been shown to have excellent adhesion properties while the final protection can be easily tailored to achieve superior corrosion resistance compared to TSA or chromate based treatments.

This technology is primarily aimed at the aerospace and automotive sectors, but also has applications in the outdoor architectural space and electronic assembly segments.

Advantages

This technology offers a number of advantages:

1. Performance that exceeds the well-known industry benchmark based on chromate technology.
2. Allows the incorporation of the anticorrosion and fatigue resistance properties as well as the adhesion and abrasion properties on the same surface.
3. Reduces the number of process steps currently used to prepare a metal surface – removing up to six chemical treatments from a typical anodising and electro-brightening cycle.
4. Dual layers approach allows significant flexibility and optimisation in the formation of layers for particular applications and end uses.
5. Additional protection can be easily provided by forming sol-gel alumina composites on the surface.

> “Enabling improved adhesion and corrosion resistance on the same metal with performance that exceeds chromic-acid anodising”

6. Addition of corrosion inhibitors provides a similar corrosion resistant mechanism to tartaric-sulphuric anodising.
7. Increases the mechanical resistance of the applied coating, primers, glues, etc.
8. Offers a more environmentally-friendly alternative to chromic acid anodising.

Stage of Development

This anodising process was developed in the Centre for Research in Engineering Surface Technology (CREST), based in the Dublin Institute of Technology (DIT) Focas Research Institute. CREST is the only dedicated surface coating laboratory in Ireland, delivering innovative coatings solutions for companies in the engineering, construction, healthcare and biomedical industries.

DIT is currently seeking expressions of interest from companies interested in licensing and developing products based on this technology.

An initial patent application titled ‘Method for forming a multi-layer anodic coating’ was filed in 2013 - GB1322745.9. A PCT patent application was filed in late 2014.

The process has been proven on clad and unclad 2024 for use in the aerospace sector, and 3003 for the automotive sector. A range of tests have been carried out, including neutral salt spray, electro-chemical impedance, and rain erosion testing, with 20 litres of the coating material produced in-house.

Corrosion resistance is tested according to the following standards:

- ISO 9227
- Mil A-8625F
- BS EN 12373-19

Layer characterisation has been carried out using electron microscopy showing the unique nanoporous structure of the developed technology.

Further development work by a licensee will likely be required for validation testing on customer components, scale-up to industrial quantities and series production, with support available from CREST as required.

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