Etching Solutions for Medtech Components

Advanced Chemical Etching Ltd.

ADVANCED CHEMICAL ETCHING LTD

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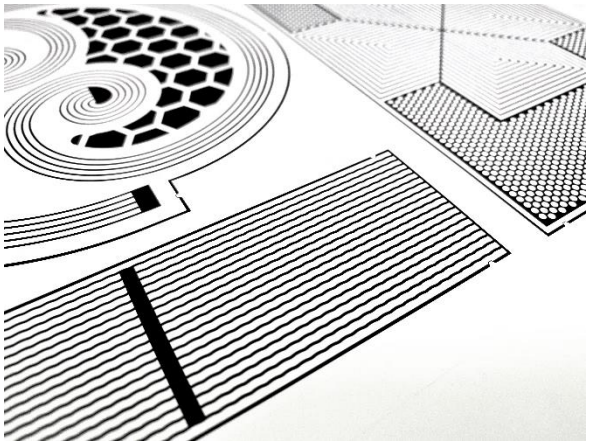
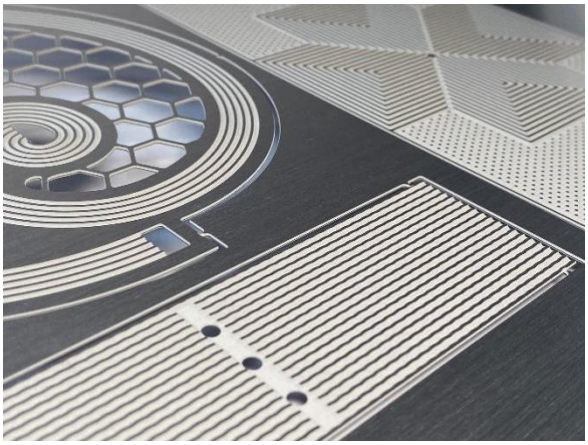
What is Photochemical Etching?

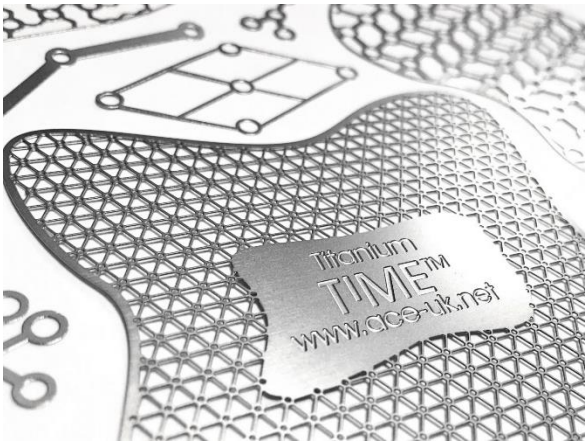
Photochemical etching is a subtractive metal processing technique in which metal is removed selectively from a flat metal surface using a chemical reagent to create specific shapes or patterns.

The process uses CAD drawings transferred onto transparent photo-tools and used to create a negative image on a photosensitive polymeric film (photoresist) applied to the metal surface.

This process produces high resolution parts, often with complex geometries or with arrays of variable aperture profiles in relatively thin flat metal sheets from several tens of microns to ~2 mm in thickness. The process has a number of technical and economic advantages over other techniques such as traditional metal cutting and stamping.







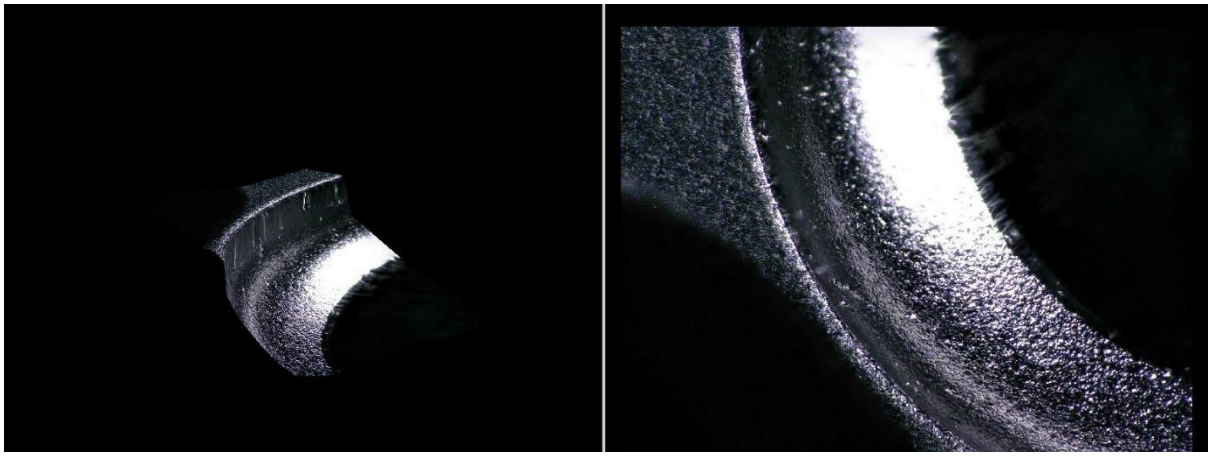
An Innovative Process for Medical Implants and Devices

The trend towards miniaturisation in medical implants places special requirements on the manufacturing methods used to create these implants. Photochemical etching is a versatile net shape technology that can produce metal precision components with high accuracy, repeatability and the ability to create small features and burr-free edges.

The versatility and precision of photochemical etching make this technique ideal for the manufacture of dental, orthopaedic, ostheosynthetic and cardiovascular implant components from biocompatible metals including stainless steel 316L, Titanium (grades 1-4) and Nitinol. The etching reaction is a reduction-oxidation (redox) reaction in which the metal is oxidised by the etching reagent, which in turn is reduced. The oxidised metal dissolves into the solution. An extra process step within the T^{i}ME process ensures that results are burr free, replicable and controlled while using safe chemistry. In particular, the innovative Titanium Molecular Etching (T^{i}ME) method, developed by Advanced Chemical Etching Ltd, enables the manufacture of etched titanium components to a high level of surface quality eliminating the need for secondary processes such as de-burring.

Cleaning of the metal sheets takes place before and after etching to remove grease, particulate matter, and any other contamination. The process uses chemical agents (degreasing and dilute acid solutions), as well as automated mechanical surface cleaning.

While other techniques may produce a directional surface finish, photochemical etching yields a non-directional surface finish. In addition, profiled apertures can be etched to enable a perfect fit for countersunk screws used in ostheosynthetic applications.



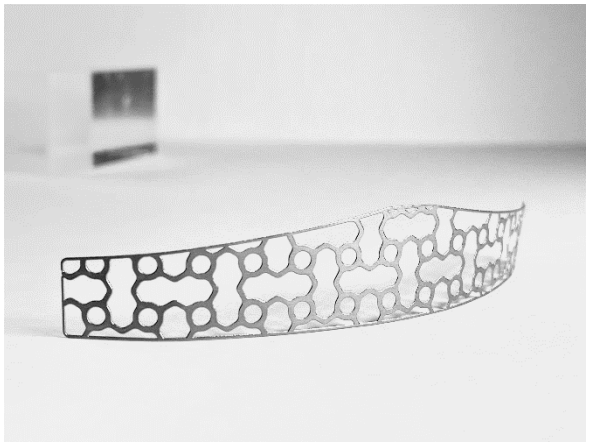
200 times magnification of an etched counterbore profile

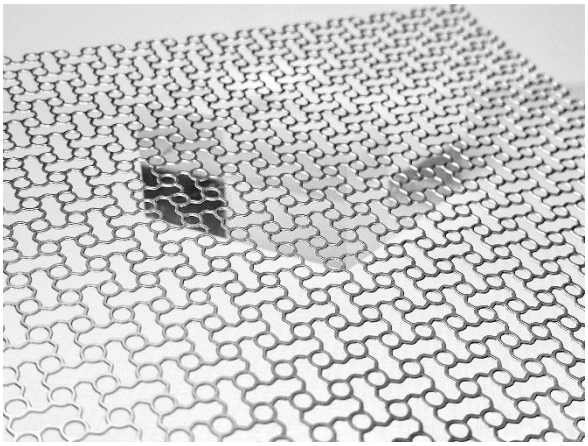
To produce the required dimensions of the etched features on the final etched product, the CAD drawing must account for a phenomenon known as ‘undercut’ – the lateral etching taking place under the edge of the photoresist. The photo-tool drawing compensates for this by including an etch allowance applied to all dimensions affected by undercut. The process yields high dimensional accuracy and precision and is able to achieve tight tolerances.

Importantly, etching does not alter the mechanical and chemical properties of Titanium and Nitinol, namely, their super-elasticity, shape memory and biocompatibility.

Titanium and Nitinol for Medical Applications

ACE routinely etch titanium implants for osteosynthesis and orthopaedic applications, e.g., bone meshes, bone plates, support components for hip implants, dental implants and also battery grids for pacemakers and hearing aid components. Superior results are achieved on mesh components compared to parts manufactured using laser cutting/machining methods.





Etched Titanium mesh components

Nitinol is especially useful for medical applications, where it is used for implants in orthopaedics and orthodontics. It is also becoming widely used in devices for minimally invasive interventional procedures, such as stents, graft support systems and filters. Super-elastic stents are guided into the body while they are tightly compressed, and, when released, spring back to their original larger shape, thus holding open the blood vessel to improve blood flow. Moreover, the corrosion resistance of Nitinol contributes to its biocompatibility. After passivation treatment, Nitinol surfaces become covered by a titanium-rich oxide layer that is both stable and uniform. This oxide layer protects the alloy from bio-corrosion and creates physical and chemical barriers against nickel oxidation. Research has also shown that this oxide film is able to sustain large deformations induced by the shape memory effect, and that it is more resistant to chemical breakdown compared to the oxide film on passivated 316L stainless steel.

Efficient Manufacture of Precision-etched Parts

Our T[i]ME etching capabilities for miniature and precision etched medical components are supported by continuous improvement and development activities. Ongoing R&D, state of the art material and process control and quality inspection offer a high degree of reliability and repeatability which is essential in the medical industry. Through R&D, ACE will continue to push the boundaries of the photochemical etching technology in order to meet the evolving demands of the medical sector.

Summary

ACE bespoke etching solutions deliver advantages for metal medtech component developers and manufacturers, with its capability for miniature precision, its support of design complexity, its potential to eliminate subsequent processes and its cost saving potential.

Who is Advanced Chemical Etching Ltd.?

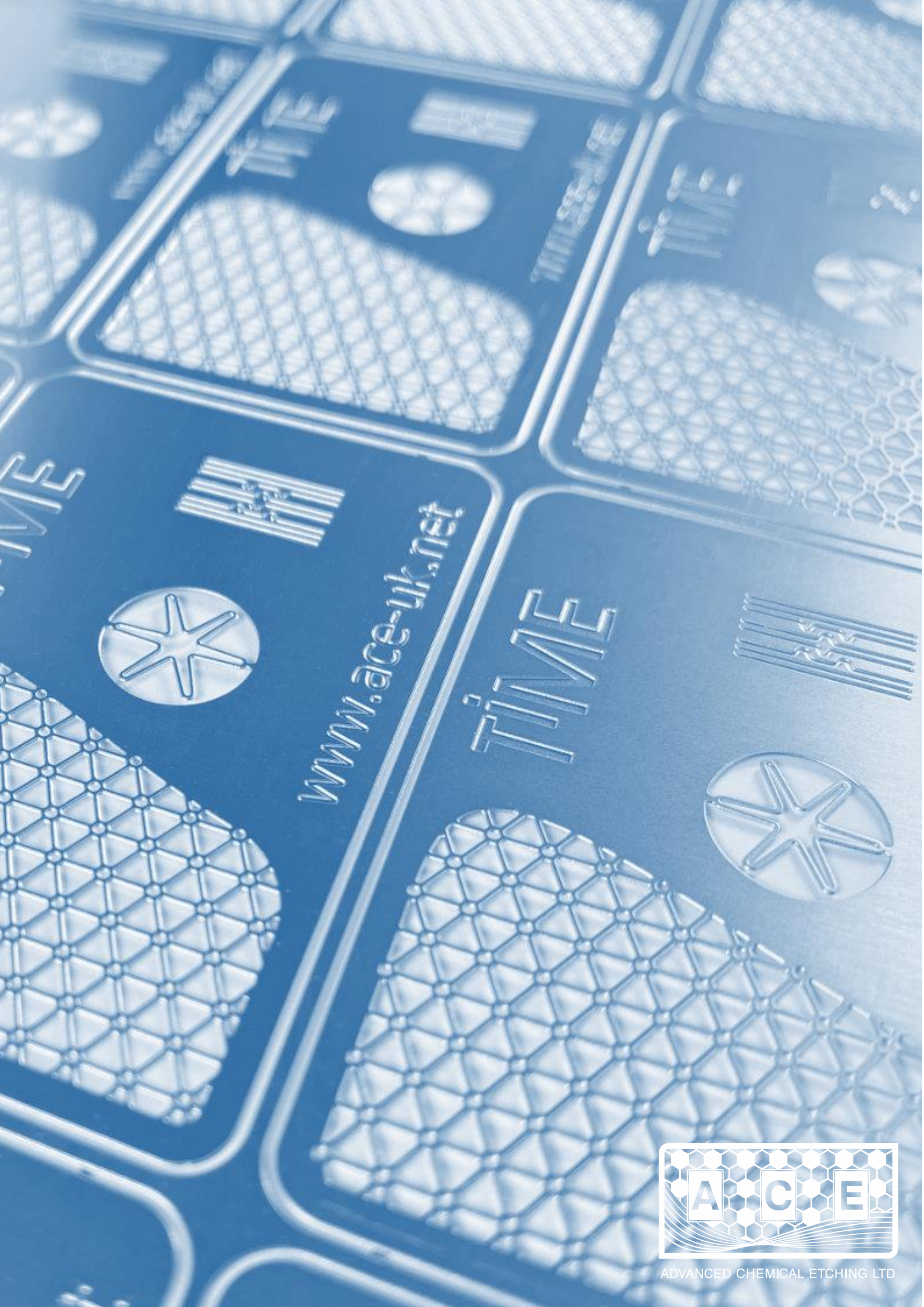
Founded in 2000, Advanced Chemical Etching Ltd. are a specialist manufacturer of photochemically etched precision metal components. We are a dynamic team of experts with longstanding experience, who take pride in producing outstanding quality with our customers' requirements at the heart of every step of the way.

We are specialised in prototyping, pre-production and mid-size production runs. Providing solutions to our customers who seek to overcome challenges in their product development projects is at the core of our business.

Let's talk about your next project!

Advanced Chemical Etching Ltd.
Units 31-34 Hortonwood 33
Telford, Shropshire
TF1 7EX
United Kingdom

+44 (0) 1952 416 666
sales@ace-uk.net
www.ace-uk.net



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