Etching Solutions for EV & FCEV Components

Advanced Chemical Etching Ltd.

ADVANCED CHEMICAL ETCHING LTD

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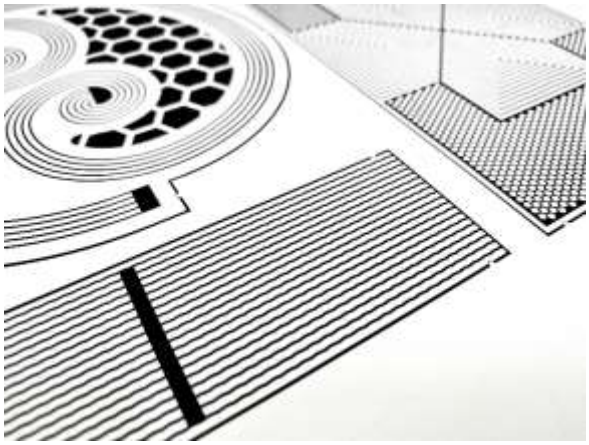
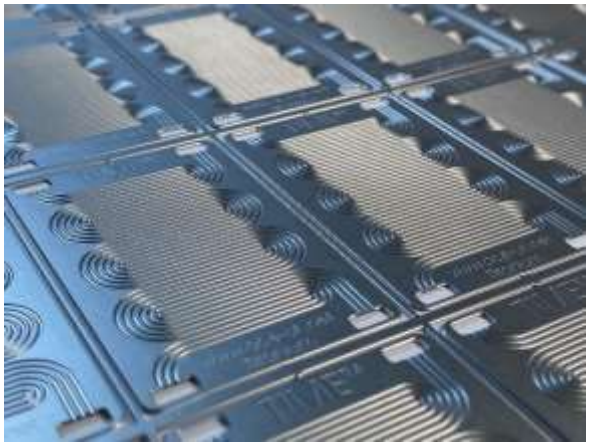
WHAT IS PHOTOCHEMICAL ETCHING?

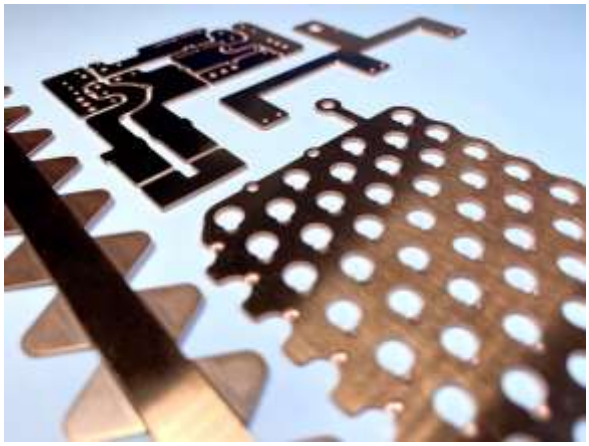
Photochemical etching is a subtractive metal processing technique in which metal is removed selectively from a flat metal surface using a chemical reagent to create specific shapes or patterns.

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.







While it is possible in principle to etch a variety of metals from stainless steels to copper, and from nickel to aluminium, as well as clad materials and SMAs, each of these materials has unique etching characteristics. To achieve process efficiency and high product quality, the etching solution must be tailored to suit the specific material being etched. Propelled by a mindset that is focused on efficiency and continuous improvement, as a market first, ACE is incorporating chemical analysis techniques in its process control plans.

HOW ETCHING IS DEPLOYED IN AUTOMOTIVE APPLICATIONS

The accelerating drive for alternative powertrains fuelled by initiatives like the European Green Deal generates increased demand for new and sustainable mobility technologies. This article explains how etching can support demand from the e-mobility and hydrogen powertrain supply chains serving battery, battery management systems, and fuel cell manufacturers.

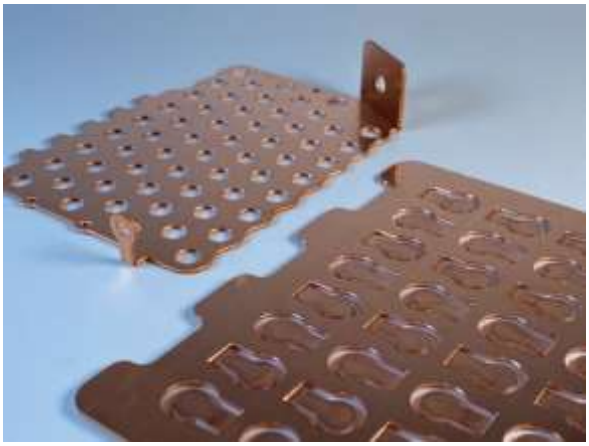
The versatility and precision of photochemical etching make it an ideal process for metal component manufacture within a fast-evolving alternative powertrain supply chain. Prototypes with several design iterations of shims, filters and springs, also in shape memory alloys, may be etched. Reducing weight is one of the main aims in sustainable mobility, and etching can support this in several ways. Etched aluminium, copper and clad components are most suitable for lightweight and effective battery connectors, busbars, loudspeaker covers and laminations. Channels are etched on both sides of a plate simultaneously. Cooling plates for battery management systems can be made from steel, titanium, or aluminium; and bipolar plates for fuel cell stacks can also be etched from the same metals.

HOW CAN ETCHING BENEFIT SUSTAINABLE MOBILITY?

The etching technology makes it possible to manufacture low volumes of components quickly and economically, such as for R&D purposes. Several design iterations can be produced and tested within a short period of time in order to arrive at the optimal battery connector or fuel cell plate design. Since the process requires no hard tooling, the technology offers a low barrier to entry for design engineers with low costs and fast turnaround.

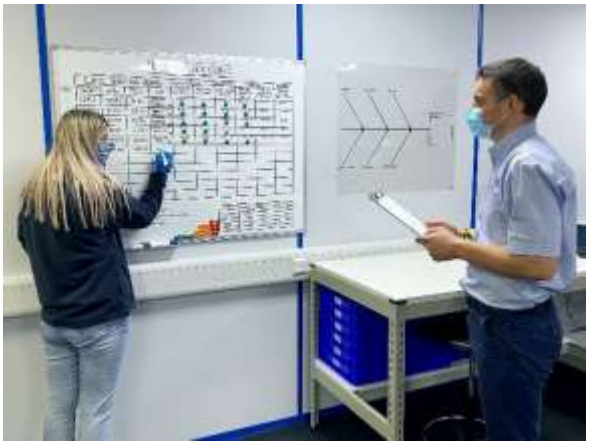
Etching does not produce burr or thermal deformation in the parts, ensuring that no compromise to stack bonding for bipolar plates has to be made. In addition to fuel cell plates brazing foils can also be manufactured free from burr, with complex geometries to tight tolerances.

Channels and geometries are produced within one process step with utmost precision and thus broaden design options. Designers can vary the shape and size of channels and incorporate headers, collectors and port features without additional costs. Depth etched features, for battery connectors for example, can be produced in the same process step as profiles.



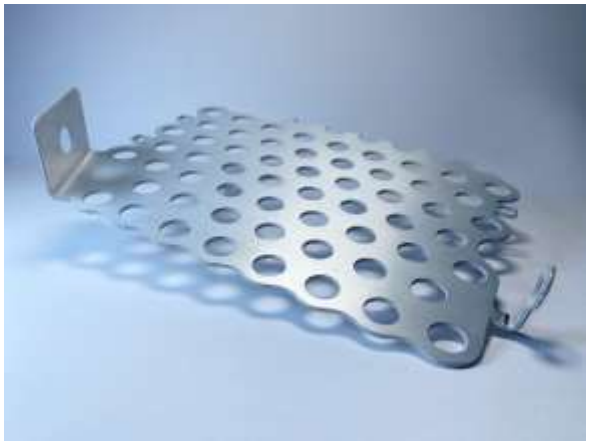
Etched Brazing Foil and Etched Battery Connector with Depth Etched Features

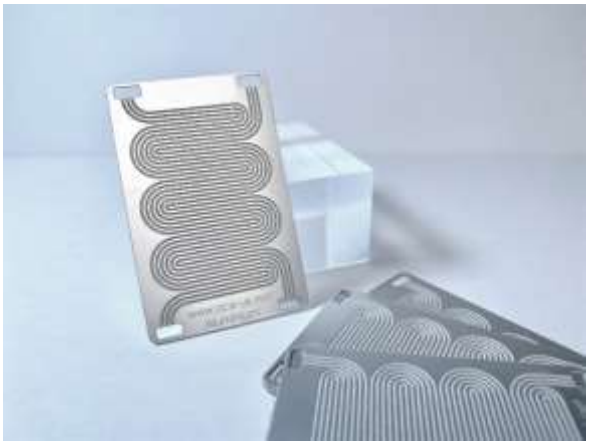
From prototyping to serial production, etching offers a competitive alternative to other manufacturing processes, and automated quality control ensures a consistent quality of parts.



Quality Control and Quality Clinic at Advanced Chemical Etching Ltd.

Lightweighting through bespoke inhouse aluminium and titanium etching supports increased fuel efficiency and reduced CO2 emissions. For example, titanium is a light metal with very good corrosion resistance which can be further improved by coating the metal with a titanium nitride protective finish. Aluminium, which is another attractive metal for fuel cell plates due in large part to its low density (40% lighter than titanium), can be coated with chromium nitride.





Etched and Formed Aluminium Busbar and Etched Aluminium Plates with Channels

Through ongoing R&D, ACE continues to push the boundaries of the photochemical etching technology in order to meet the evolving demands of the sector. The innovative etching processes use advanced analytical techniques such as x-ray fluorescence to monitor and control the etching chemistry, resulting in consistent quality. ACE is committed to developing innovations that contribute to sustainable and lighter e-mobility for a sustainable future.

SUMMARY

Photochemical etching can be used to create flow channels of different shapes and dimensions and on different types of metal alloys. The flexibility, low cost and fast turnaround times of the etching process make this the ideal manufacturing process for bipolar plates. Various designs can be produced and tested quickly. The process is capable of etching stainless steel, nickel-based alloys, copper, aluminium, titanium and other alloys. Advanced chemical analysis techniques can be used to monitor and control the etching chemistry, making it possible to etch large production volumes with consistent quality. Through R&D, ACE will continue to push the boundaries of the photochemical etching technology in order to meet the evolving demands of the EV sector.

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 with longstanding experience in electromobility parts. 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!

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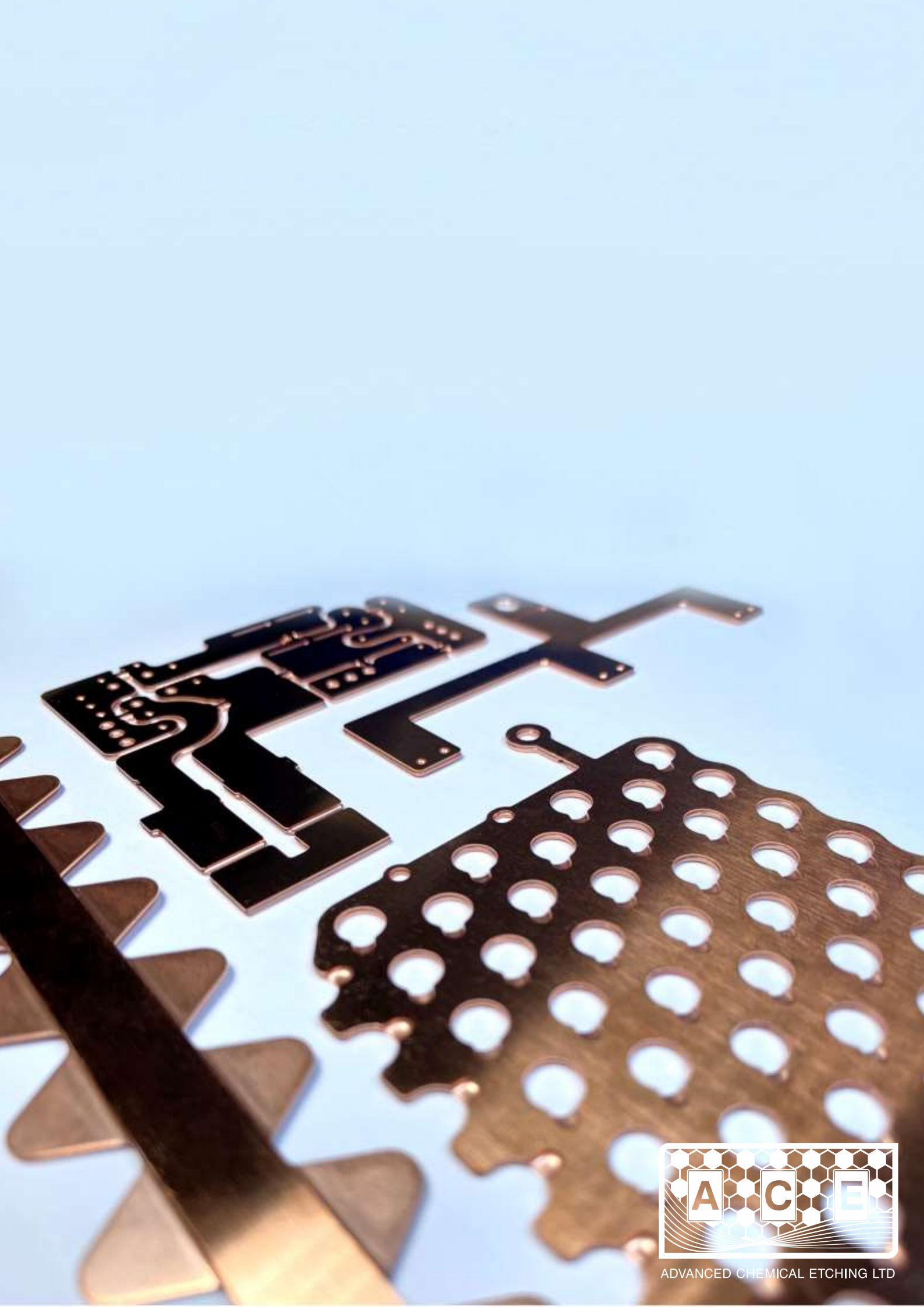
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