

anopol

going from
strength to strength

ELECTROPOLISHING & CHEMICAL SURFACE TREATMENTS

CLEANING

PICKLING

ELECTROPOLISHING


PASSIVATING



www.anopol.co.uk

The logo for Anopol, featuring the word "anopol" in white lowercase letters on a dark blue rectangular background with a red triangle at the top left corner.

anopol

A stylized, metallic humanoid figure composed of many small, reflective, crystalline facets, standing on the left side of the page.

The name "Anopol" has been associated with chemical and electrochemical treatments for stainless steels for over thirty years. The company's expertise in engineering the surface of stainless steel fabrications to give optimum performance is recognised throughout industry.

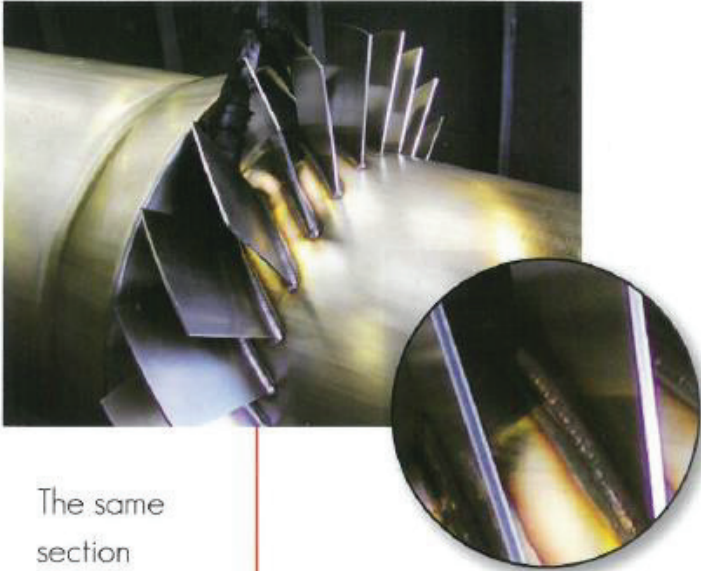
In addition to sub-contract treatment at its state of the art processing facilities for UK customers, Anopol undertakes site work, both at home and abroad.

The main services are pickling and electropolishing of stainless steel items, including castings, forgings, pressings, wirework and welded fabrications. Ancillary treatments also available are general cleaning and passivating of stainless steels, whether ferritic, martensitic or austenitic. Stainless steel is specified principally for its corrosion resistant properties. This resistance to corrosion comes from an extremely thin, invisible, oxide layer on its surface without which it can corrode with potentially serious consequences.

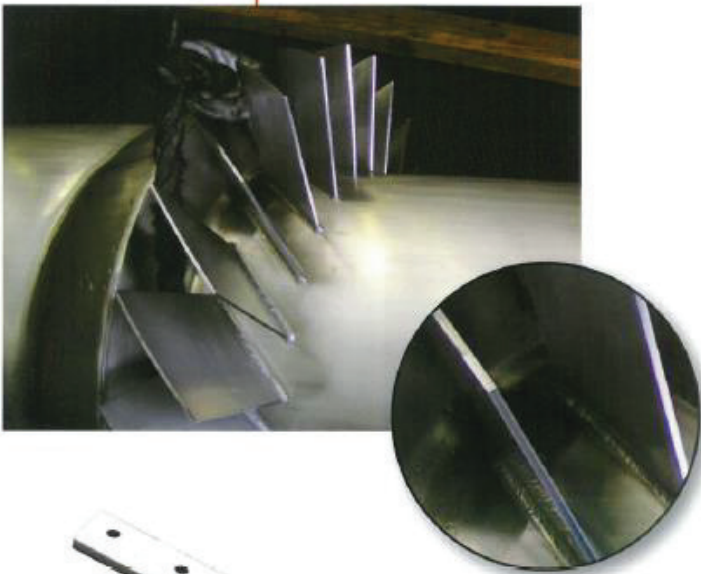
Also known as a passive film, this oxide layer can only form on clean, uncontaminated metal. Welding, grinding, forming, general handling and contact with other metals can result in surface contamination and prevent, locally, the formation of the passive film.

PICKLING STAINLESS STEEL

Tubular section with welded
vanes, prior to pickling



The same
section
after pickling



ELECTROPOLISHING STAINLESS STEEL

Precision lost wax casting after
shot blasting to remove shell



The same casting
after
electropolishing



WHY PICKLE?

The most cost-effective method for obtaining a clean passive surface is by pickling in a solution of dilute acids. Anopol has extensive facilities for pickling any size of item, including very large fabrications. When items are too large to immerse in pickle tanks, spray-pickling techniques can be employed.

IS JUST CLEANING SUFFICIENT?

For certain applications, it is sufficient to degrease and thoroughly clean a surface for the passive film to form. However, where weld heat oxide is present, pickling is necessary. In some cases it may only be necessary to pickle the welds locally using a pickling paste. Anopol can advise which treatment or combination of treatments best suits a specific application.

IS CHEMICAL PASSIVATION NECESSARY?

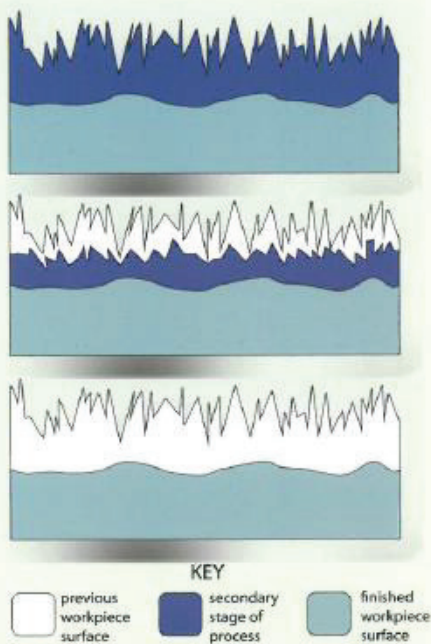
A clean stainless steel surface will generate its own passive layer in time, when exposed to clean air. However, the process is accelerated

by chemical passivation, which at the same time will remove light ferritic contamination if present.

Chemical passivation is especially important where surfaces are starved of oxygen, as in the case, for example, of pipework or enclosed vessels.

WHAT IS ELECTROPOLISHING?

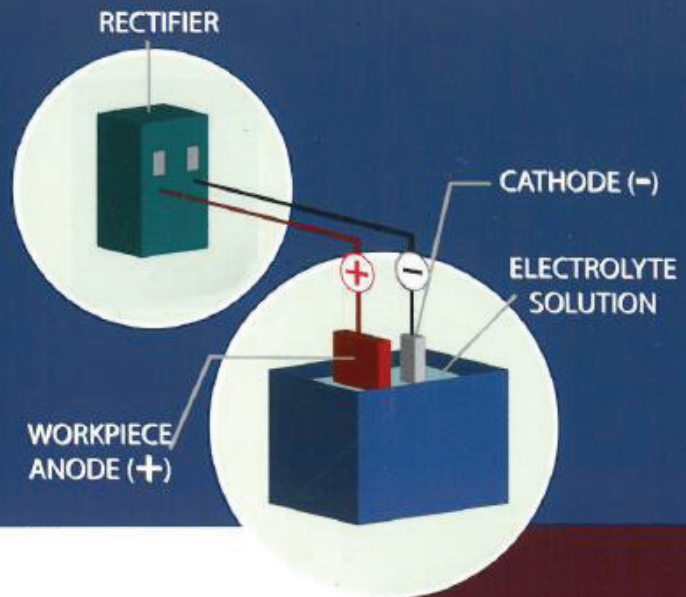
Electropolishing is the electrochemical removal of a surface layer by making a metal item anodic and immersing it in a suitable electrolyte solution containing metal cathodes. In simplified terms, it is the opposite of electroplating and is often referred to as 'reverse plating'. It can be applied to several metals, but is employed predominantly on austenitic, martensitic and ferritic stainless steels, typically the 300 and 400 grades of steel. Nickel and high nickel alloy metals and Duplex grades can also be electropolished successfully.



Schematic diagram showing the progressive levelling of a surface through electropolishing



SCHEMATIC LAYOUT OF A STANDARD ELECTROPOLISHING SYSTEM



WHAT ARE THE EFFECTS OF ELECTROPOLISHING?

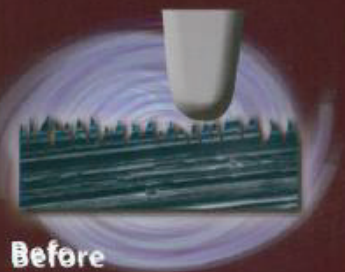
During electropolishing the removal of a surface layer occurs in a particular way. High spots or peaks are eroded at a faster rate than low spots or valleys. This also applies to edges of components where fine burrs are often present and which can be removed by electropolishing. Mechanical surface treatments, such as grinding or lishing can produce contamination in the form of inclusions of grit, lubricant and other debris. The surface produced by electropolishing is clean, smooth and stress-free, possessing the optimum passive layer. As a consequence, further chemical passivation is not necessary. As a general rule, the surface is bright, reflective and extremely corrosion resistant after electropolishing.

The relatively small amount of metal removed, typically 20 micro-metres, means that the process will not remove scratches and other visible surface irregularities.

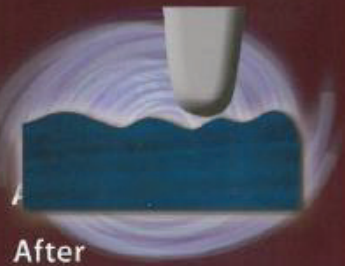
As the process generates oxygen at the metal surface, there is no risk of hydrogen embrittlement.

SCHEMATIC DIAGRAMS SHOWING A STYLUS TRAVERSING A FINELY GROUND SURFACE AND THE SAME SURFACE AFTER ELECTROPOLISHING

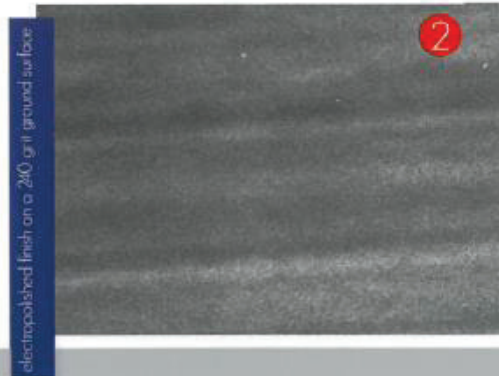
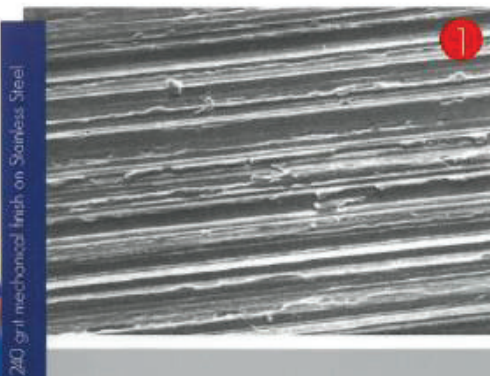
DEPENDING UPON THE SIZE OF THE STYLUS TIP, IT IS POSSIBLE TO OBTAIN A HIGHER RA READING FOR THE ELECTROPOLISHED SURFACE, SUGGESTING FALSELY THAT THE GROUND FINISH IS THE SMOOTHER.



Before



After



THE BEFORE AND AFTER EFFECT OF ELECTROPOLISHING

Fig 1: 240 grit mechanical finish on stainless steel.

Fig 2: Electropolished finish on a 240 grit mechanical finish.

WHAT ARE THE TYPICAL APPLICATIONS FOR ELECTROPOLISHING?

The unique surface finish produced by electropolishing has benefited numerous industries where corrosion resistance, reduction in adhesion and friction and crevice-free surfaces are of paramount importance. Representative applications include:-

AUTOMOTIVE Many items, such as radiator grilles, bezels, bull-bars etc are treated for both decorative and functional enhancement.

PHARMACEUTICAL & PROCESS EQUIPMENT Process vessels, purified water storage tanks, polymerising reactors, pipes and valves are electropolished to micro-smooth the surface profile thereby reducing adhesion problems of products such as powders, latex and plastic polymers and the risk of bacterial growth in crevices.

MEDICAL Surgical needles, instruments and medical devices such as Stents are electropolished. The surface is micro-smooth, particle free, and exhibits reduced pathogen and pyrogen growth. Fine edges are deburred, the items have a bright aesthetic finish with improved corrosion and are easily cleaned and sterilised.

FOOD & BEVERAGES Brewing vessels are internally electropolished to prevent build-up of product on vessel walls. Food mixer blades are treated to increase sharpness and ensure maximum corrosion resistance after grinding.

PULP & PAPER Large critical components are electropolished to avoid build up of fibres and prevent 'snow-balling'. Holes and slots in screen cylinders can be increased with precision to suit the type of paper being produced and simultaneously prevent clogging.

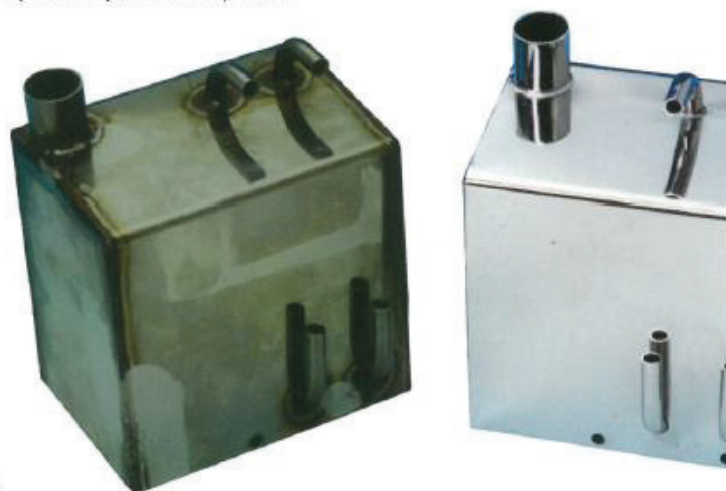
SEMICONDUCTOR Pipework, valves, etc. for the transport of gases, used in micro-chip manufacture, are internally electropolished to produce particle-free surfaces.

ARCHITECTURAL Complex patterned gates, door furniture, durbar plate flooring, handrails, lampposts and sculptures have all been electropolished to improve both finish and durability in service.

LEISURE To combat the high chlorine concentration in swimming pools, items such as tubular ladders, pool lifts for the physically handicapped, etc. are electropolished to slow down corrosion and aid cleaning.

HIGH-VACUUM Vacuum systems benefit from electropolishing by eliminating occluded surface gases and thereby significantly reducing pump-down times.

TEXTILE Electropolished dyeing vats have considerably lower changeover times between dye batches and produce less mechanical snagging of synthetic materials.

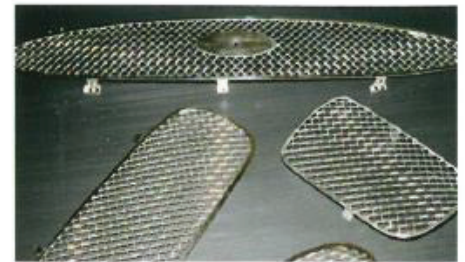




Stent - A tiny stainless steel tubular device used to alleviate vascular conditions by expanding narrowed or blocked arteries. Electropolished for cleanliness and removal of micro-burrs.



A Stent in close-up



WHAT TECHNIQUES CAN BE APPLIED?

The most common technique for electropolishing employs a tank of electrolyte solution and a rectifier for supplying the d.c. power requirements. It is a high amperage/low voltage process. For fabrications which are too large for tank treatment, other techniques are available. For example, the internal surfaces of large cylindrical vessels can be electropolished by partially filling with electrolyte, inserting suitably engineered cathodes and rotating the vessel during treatment. Large batches of small components, such as stainless steel fasteners, can be processed in proprietary barrel equipment.



ON-SITE SERVICES WORLDWIDE

There are certain applications where pickling or electropolishing require being carried out in-situ. Examples include plant and machinery already installed and commissioned, large or heavy fabrications, where transportation would be expensive or impractical.

Projects have been undertaken in America, India, the Middle East and throughout Europe.

Electropolished dished end ready for welding to a 3.8m dia process vessel at the fabricator's works



Electropolishing critical component surfaces at a paper making plant in India

TREATMENT PLANT AND CHEMICALS

In addition to subcontract services, we design and supply plant and equipment to companies wishing to carry out treatments in-house. This includes providing the necessary chemicals and giving extensive advice and information on their use.

The range of Plant and Chemicals available includes:

- Manual and automatic electropolishing lines
- Pickling and passivating plant installations
- Water treatment plants
- Stainless steel pickling and passivating chemicals
- Electropolishing electrolyte solutions
- Weld cleaning machines
- Weld pickling gels and pastes
- Stainless steel cleaning products

Because of our substantial subcontract facilities, we are able to carry out extensive trials under normal working conditions. Consequently, we are able to establish the most favourable parameters for treating customer's components. The plant installation can be developed and designed around these practical parameters.

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