CURTISS-WRIGHT

Surface Technologies

www.cwst.co.uk

COMPANY PROFILE

Curtiss-Wright Surface Technologies (CWST) offers a single source solution and point of contact for all your surface treatments. We can reduce your turnaround times and costs through our network of over 75 worldwide facilities.

Our proven surface treatments meet industry demands for lighter materials, improved performance and life extension in key markets such as Aerospace, Automotive, Energy and Medical. We can prevent premature failures due to fatigue, corrosion, wear, galling and fretting.

Surface Technologies is a Division of Curtiss-Wright (NYSE:CW) a global innovative company that delivers highly engineered, critical function products and services to the commercial, industrial, defense and energy markets. Building on the heritage of Glenn Curtiss and the Wright brothers, Curtiss-Wright has a long tradition of providing reliable solutions through trusted customer relationships.

CURTISS-WRIGHT

Preventing premature failures and extending component life

Early or sudden failure of equipment is a problem in any major industry resulting in costly delays and downtime. Surface finishing techniques are proven to extend the life of components and ensure optimum operating performance and should be considered, especially where components are exposed to harsh environments and challenging operating conditions.

Through our network of over 75 facilities worldwide, Curtiss-Wright Surface Technologies (CWST) has the experience, reliability and capability to handle the processing and logistics of all your surface treatments as a single source, reducing both costs and turnaround times. The introduction of robotic engineering has allowed our processes to be strictly controlled, repeatable and highly accurate with portable equipment also available to perform onsite work to the same high standard, where components are too large or impractical to move.

Our services form an integral part of the manufacturing supply chain for leading organisations in Aerospace, Defence, Automotive, Medical and Energy industries, as well as supporting the maintenance and repair of equipment. All our services have undergone rigorous laboratory and field testing to ensure the highest reliability in extreme operating conditions. Our facilities operate to current industry and customer approvals including AS9100 Rev C, NADCAP, ISO 9001:2008, ISO 13485 and FAA.

Surface processes:

- Controlled shot peening
- Laser shock peening
- C.A.S.E.™ super finishing

Engineered Coatings:

- Thermal spray
- Dry Film Lubricants
- Organic
- Diffusion
- Parylene conformal coatings

For more information on all our services and full worldwide contact details: www.cwst.co.uk

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Controlled shot peening

With a proud history dating back to the Wright Brothers and Glenn Curtiss, we continue to evolve today through experience and innovation offering a diverse range of services to meet our customer's needs.

Residual tensile stress typically introduced during the manufacturing process and also unexpected service conditions are a major cause of premature failure in components. Controlled shot peening can convert this harmful stress into beneficial residual compressive stress by modifying the characteristics of the material at the surface and sub-surface. *Figure 1: Shot peening influence on applied stress.* This technique is also successful when applied to welded structures such as the change of section and areas of high stress intensity. Controlled shot peening can also be used to correct distortion in components which has occurred during the manufacturing process and reinstate any loss of beneficial compressive stress.

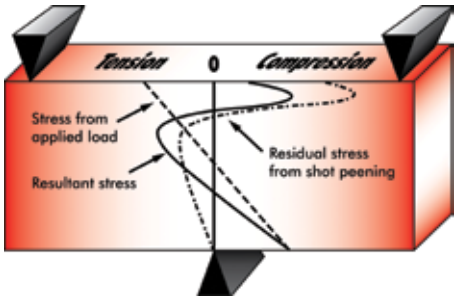


Figure 1: Shot Peening influence on applied stress

Laser shock peening

Laser shock peening has the ability to surgically place residual compressive stress via a laser beam pulse into key areas of a component to retard crack initiation and growth. For most applications the Controlled shot peening process will give excellent results but in some circumstances Laser shock peening is the preferred method where a far deeper layer of beneficial compressive stress can be achieved. The process will give resistance

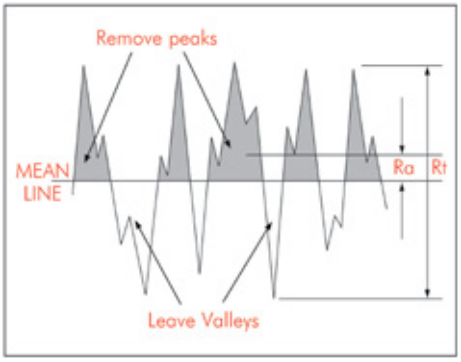


Figure 2: C.A.S.E.™ process surface topography

to low cycle, high stress situations (LCF) and high cycle, low stress situations (HCF) in a deteriorating surface environment. Examples of applications include electrical power gas and steam turbines, jet engine fan blades and automotive engines.

C.A.S.E.™ super finishing

In circumstances where both sliding and rolling of metals in contact occurs, the C.A.S.E.™ super finishing technique will reduce operating temperatures, noise and friction and also improve resistance to macro and micro pitting, but still retain critical lubrication. *Figure 2: C.A.S.E.™ process surface topography.* It is a two part process where the component is first shot peened and then followed by an isotropic finishing technique where the component is gently rolled and rotated through oxalic acids and non-abrasive finishing stones to gradually hone the peak surface areas, but retain the valleys for optimum lubrication.

Peen forming

Peen forming uses the compressive stresses induced by shot peening to alter the stress pattern, magnitude and depth within a structure to deliberately create a change in the component shape. Gentle curves within the elastic range of the material are regularly formed to consistent tolerances. This process can also be used to correct distortion in components caused during manufacture.

Engineered coatings

The application of the correct engineered coating system will protect components against corrosion, improve part wear life and performance and also reduce maintenance costs. There are a wide range of coatings available depending on the operating conditions and substrate material which when combined with pre-treatments and primers will give excellent protection from adverse corrosion, environmental and chemical attack as well as preventing friction, aid lubrication and reduce noise.

The following is a brief outline of the typical coatings used in the industry:

DRY FILM LUBRICANTS

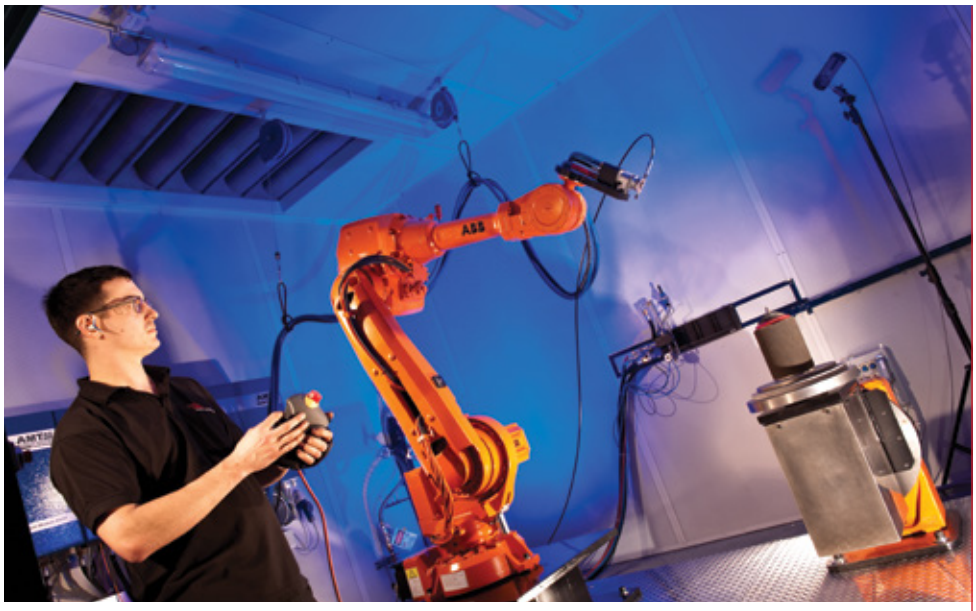
Everlube® coatings and products are widely used to provide both corrosion protection and dry film lubrication. The range includes Everslik 1201/1301 which is a core coating system consisting of an extremely tough and durable coating primer with salt spray resistance of 2500hrs, followed by the application of a high loading MoS_2 based dry film lubricant. This coating system is typically used for pumps, valves, connectors, actuator systems and shafts, fasteners and jack screws.

DIFFUSION COATING

Typically used for substrate materials such as cobalt and nickel based super alloys and steels used for gas turbine engine components, pump impellors and gate valves. Diffusion coatings offer a high level of resistance to corrosion, erosion and oxidation. The components are coated with a non-corrosive material and usually applied in a controlled chamber at high temperature.

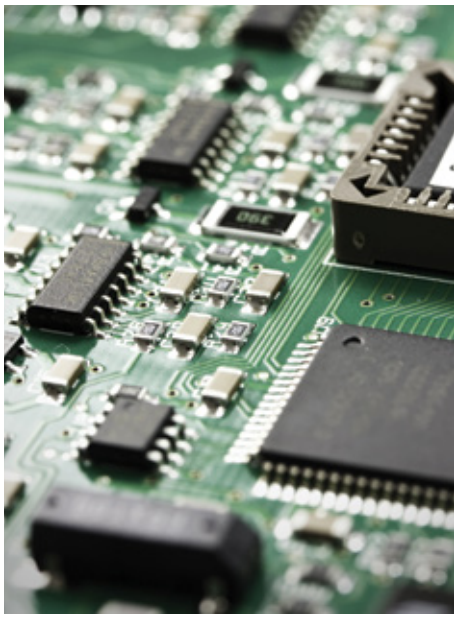
Thermal coatings

Thermal spray coatings provide abrasion resistance, high temperature oxidation/ corrosion protection and solid particle erosion control. It is robotic controlled which allows for a uniform coating of



multifaceted and complex shapes. In some cases worn parts can be brought back to original specification.

Typical application techniques include HVOF (high velocity oxy fuel) combining hydrocarbon fuel and oxygen which is ignited within a combustion system resulting in a high pressure flame which propels semi-molton material onto the surface. This coating is built up in layers to form a secure bond as each particle cools which can withstand extreme mechanical loads and severe wear conditions.
The Plasma spray technique uses a controlled gas stream which is electrically ionised to create a high temperature plasma plume.



Parylene coating

This is an ultra-thin, bio-compatible coating which is pinhole free and completely conformal, whatever the size and shape of the component. It is widely used in the medical market, but also used to shield electronic systems from electromagnetic interference and corrodants, corrosive chemicals and solvents.

Material testing services

Material testing, failure analysis, chemical analysis and weld testing are essential to ensure design and manufacturing integrity to give optimum performance.

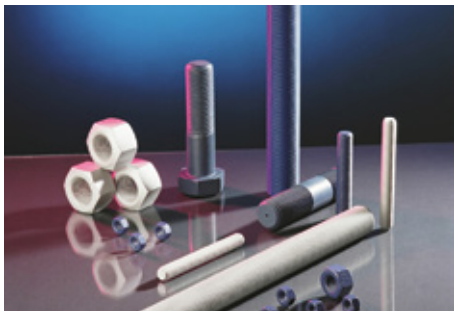
Repair and overhaul

As well as new manufacture, we also offer both component repair and refurbishment of gas and steam turbine components. These services range from 'tip repair' of compressor blades and vanes, repairs to combustion/ flame tubes, replacement honeycomb seals, specialised welding, fabrication and strip, inspection (including laboratory reports), braze/welds repair and re-coating of turbine blades, vanes and NGVs.'

Coatings

Our wide range of coating systems includes:

- Thermal coatings – HVOF (High Velocity Oxy Fuel), Plasma, Arc Wire and Flame Spray
- Dry Film Lubricants – MoS_2, PTFE, Graphite and WS_2
- Corrosion, chemical and environmental protection
- Impingement coatings – WS_2
- Parylene conformal coatings – highly lubricious ultra-thin ruggedized protection
- EMI/RFI shielding
- Organic and inorganic overlay and diffusion coatings
- Coating products, including: Everlube®, Microseal®, Flurene®, Lube-Lok®, Lubri-Bond®, Ecoalube®, Ever-Slik®, Esnalube®, Perma-Slik®, Kal-Gard®, Electrobond® and Formkote®
- REACH compliant, chrome free aerospace coatings



Surface treatment technology continues to evolve today as manufacturers demand greater strength and performance from lighter and ever more complex components and structures. Our mission is to make sure that we continue to meet these exciting challenges today but also look at what requirements and challenges might present for our customers and the industry in the future.

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As well as providing protection and improving performance and life, our services also prevent the premature failure of components by addressing the issues of:

FATIGUE – initiation and propagation of cracks can be prevented or delayed by the tailored induction of engineered compressive residual stresses

GALLING – contact adhesion between opposing surfaces can be minimised by the application of a suitable coating and/or surface modification.

FRETTING – the protection of the base material through coatings and/or alteration of the mating surface contact points and by introducing deep residual compressive stresses, can minimise fretting damage which can lead to fretting fatigue

STRESS CORROSION CRACKING – replacing surface tensile residual stresses with an engineered layer of compressive residual stress can eliminate stress corrosion cracking

CORROSION – the application of a suitable coating system and, where appropriate, the induction of residual compressive stresses can protect components from corrosion

INTERGRANULAR CORROSION – disrupting the grain boundary network at the metal surface, removes the pathway for the corrodant to travel, avoiding the possibility of intergranular attack

WEAR – improving friction characteristics and increasing mating hardness reduce wear

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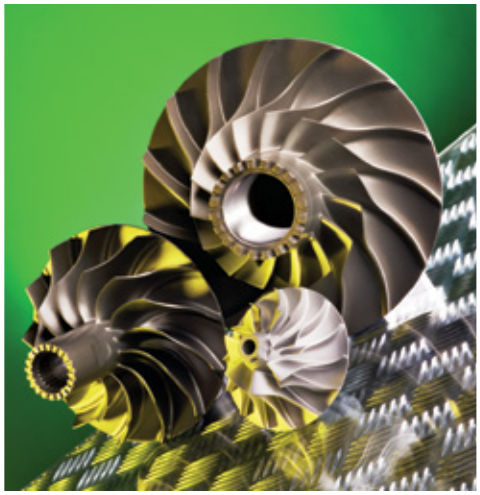

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