HEF® GROUPE | Surface materials engineering

member of HEF® GROUPE

Techniques Surfaces, jobbing subsidiary of HEF Group, provides assistance and guidance to its customers in more than sixty sites across more than twenty countries:

- Germany
- Brazil
- Canada
- China
- Spain
- South Africa
- France
- Hungary
- India
- Italy
- Japan
- Malaysia
- Mexico
- Poland
- Czech Republic
- United Kingdom
- South Korea
- Switzerland
- Thailand
- Turkey
- USA

CONTENTS

Ionic liquid nitriding

The HEF group, with more than 60 years of development in thermochemical treatments, is today the world leader in the field of ionic liquid nitrocarburizing.

The HEF group's nitrocarburizing treatments are patented and marketed under the names SURSULF®, ARCOR®, TENIFER®, TUFFTRIDE®, MELONITE®, NUTRIDE® and QPQ®. These trademarks are grouped under the name CLIN™: "Controlled Liquid Ionic Nitrocarburizing".

They are provided by the HEF group via its international TECHNIQUES SURFACES® jobbing network or by integrating them on the customer site, depending on the project.

CLIN™ technologies consist of introducing and diffusing nitrogen and carbon into the treated part. They are applied mainly to ferrous alloys, from low-carbon to high-alloy steels and even cast iron. They make it possible to combine the corrosion, wear, and fatigue resistance properties of the treated materials while enhancing their tribological behaviour. Corrosion resistance can exceed 700 hours in salt spray, and hardness can vary between 500 and 1500HV depending on then composition of the steel.

The liquid medium, maintained between 500°C and 630°C, provides an unmatched homogeneity of treatment temperature, which allows for optimal uniformity and reproducibility of characteristics on the parts. The liquid medium also ensures high productivity and efficient management of energy use.

With its vertical integration approach, and to best manage the quality of its nitrocarburizing treatments, HEF has acquired expertise in:

- Design, manufacture, optimisation, and maintenance of industrial equipment,
- Chemistry of salts and other consumables,
- Preparation and adjustment of surface conditions by mechanical finishing,
- Recycling and management of effluents to achieve zero waste.

In this way, the HEF Group's CLIN™ technologies have entered both the era of Industry 4.0 through the development of innovative installations and the era of the circular economy through the development of ECOCLIN™ processes.

CLIN™

The various liquid ionic nitriding treatments of the HEF group are grouped under the name CLIN™ meaning "Controlled Liquid Ionic Nitrocarburizing".

Trade name	ARCOR®	SURSULF®	TENIFER®	TUFFTRIDE®	MELONITE®	NUTRIDE®	QPQ®

Treatment parameters:

CLIN™ technologies are mainly applied to ferrous alloys (from low-carbon steel to high-alloy steels and cast irons), and are carried out between 500°C and 630°C for periods of 30 to 240 minutes.

Unlike electrolytic coatings, there is no risk of hydrogen embrittlement with CLIN™ technologies.

Characteristics:

They make it possible to combine the corrosion, wear, and fatigue resistance qualities of cast irons and steels while enhancing their tribological behaviour. Corrosion resistance can exceed 700 hours in salt spray, and hardness can vary between 500 and 1500HV depending on the composition of the steel.

In addition to these major characteristics, CLIN™ technologies can combine many benefits into a single treatment: seizure resistance (ceramic-like compound layer), surface mechanical resistance (diffusion treatment that enables a hardness gradient from the surface), thermal stability (a maximum allowable temperature in use higher than 500°C) and cosmetic appearance (possibility of having a uniform black appearance).

CLIN™ processes can include a mechanical finishing step after treatment to achieve low roughness levels (for an initial roughness of the same order of magnitude).

Safety measures:

Schedule a minimum of 3 hours thermal stress relieving at 20°C above the treatment temperature before final machining. Do not clean the treated parts with solvent.

Examples of use:

CLIN™ technologies, liquid ionic nitriding with low environmental impact, play a key role in meeting the changing requirements in modes of transportation. They are, for instance, at the heart of vehicle electrification and particle emission limitations because they significantly improve the performance of braking and transmission systems. The combined benefits offered by this surface treatment make CLIN™ technologies a robust, high-performance and competitive solution. In accordance with REACH regulations, CLIN™ technologies are positioned as the ideal replacement for harmful procedures like hard chrome plating.
For example, they can be used to combine wear resistance, corrosion resistance, fatigue resistance, and resistance to chipping on parts as varied as:

- Differentials (axles, casings, washers, gears, etc.)
- Braking systems (discs, pistons, pad holders, etc.) and shock absorbers
- Cylinders (rods, pistons, etc.)
- Valves
- Articulated shafts and windshield wipers
- Axle joints
- Crane joints
- Electrical equipment mechanisms
- Gears and camshafts
- Moulds for aluminium alloy casting
- Other

PVD/PACVD Technology coatings

For over 50 years, HEF has been developing and innovating in PVD - PACVD technologies. This technology is used in all types of industries: mobility, construction, medical, defence & space, low-carbon energy, etc.

Physical vapour deposition and plasma-assisted chemical vapour deposition (PVD and PACVD) are environmentally friendly surface treatment technologies, allowing thin layer deposition under vacuum.

They enable coatings to be obtained with thicknesses from a few nanometres to a few tens of microns and hardness from 1000 to 5000HV. Thanks to its mastery of the process, HEF has developed a complete set of coatings that cover a very wide range of thin layers applications:

- Reducing friction and wear
- Extending the working life of mechanical parts
- Electromagnetic shielding on polymers
- Protecting against corrosion of aluminium alloys
- Protecting against erosion
- Other surface properties: optical applications, decorative applications

HEF's uniqueness is its vertical integration model: our company design our materials and processes in our research centre, then manufacture our equipment and machines in our workshops, and produce our consumables. This verticality enables the best possible use of its technology. HEF is addressing environmental issues by diversifying into markets linked to decarbonated energies, such as hydrogen: from upstream via the production of hydrogen to using hydrogen for electric or combustion mobility, as well as in nuclear energy by making installations safer.

CERTESS® CARBON

SURFACE TREATMENT FOR TRIBOLOGICAL USE

CARBON layers correspond to DLC (Diamond Like Carbon) coatings for tribological use. These coatings usually consist of several sub-layers of different materials: Cr, CrN, WC, WCC, combined with a top layer of hydrogenated (a-C:H) or non-hydrogenated (ta-C) amorphous carbon.

Characteristics:
- Hardness from 500 to 6000 HV
- Excellent friction properties
- No hydrogen embrittlement
- Respect of dimensions and roughness

Materials suitable for treatment: Steels and cast irons - Carbides • Dense sintered materials • Inconel alloys • Aluminium, copper and titanium alloys

Examples of use: • Engine components • Mechanics components • Valves • Camshafts • Tappets • Fork tubes • Gears • Injection systems

Trade name	CERTESS® CARBON DT	CERTESS® CARBON DDT	CERTESS® CARBON DCX	CERTESS® CARBON DCY	CERTESS® CARBON DCZ	CERTESS® CARBON TC
Architecture	WCC	WCC + a-C:H	CrN + a-C:H	Cr + WCC + a-C:H	CrN + WCC + a-C:H	CrN + ta-C

CERTESS® NITRO

SURFACE TREATMENT FOR MECHANICAL USE

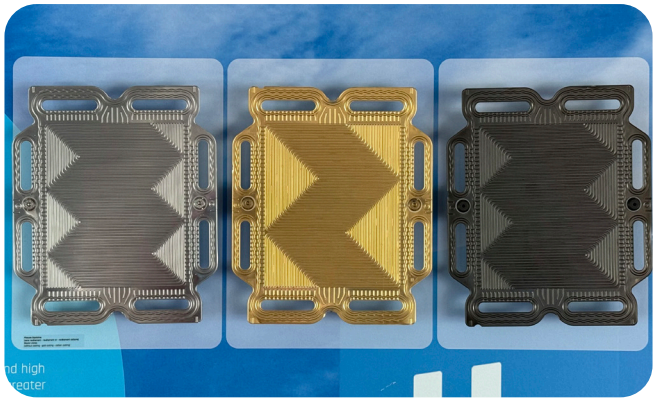
NITRO layers correspond to nitrides produced by the PEMS™ process at low temperature (<200°C). They are used in a wide range of mechanical fields and can be used to solve complex wear problems.

Characteristics:
- Hardness from 1000 to 4000 HV
- Resistance to abrasive and adhesive wear
- Thermal stability up to 800°C
- Resistance to oxidation

Materials suitable for treatment: Steels and cast irons • Carbides • Dense sintered materials • Inconel alloys • Aluminium, copper and titanium alloys

Examples of use: • Parts subject to wear by abrasion (textile machines, paper mill tools, aeronautics, etc.)

Trade name	CERTESS® NITRO Ti	CERTESS® NITRO T	CERTESS® NITRO SD	CERTESS® NITRO X	CERTESS® NITRO G	CERTESS® NITRO M
Architecture	TiN	TiAlN	TiBN	CrxNy	ZrN	MoN



CERTESS® ELEC

SURFACE TREATMENT FOR ELECTRICAL USE

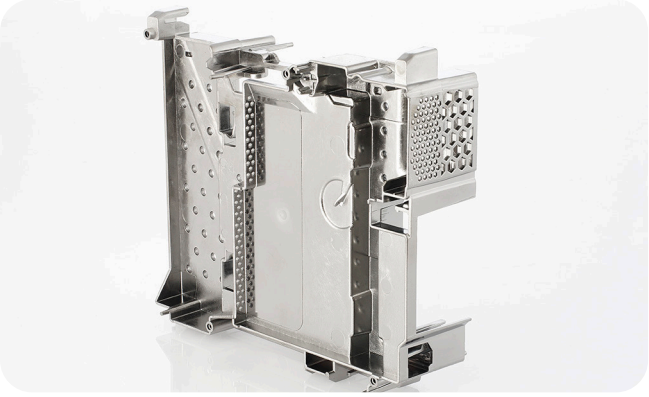
ELEC layers are a series of thin layers used to modify the electrical properties of surfaces. The use of extremely pure materials ensures optimal performance on all types of substrates and all types of geometry through the use of PEMS™ technology.

Characteristics:
- Excellent reproducibility of electrical properties
- Very high purity of coatings
- Control of thickness and surface finish
- Resistance to chemical aggression (depending on type of coating)
- Application suitable for large parts

Materials suitable for treatment: • Glass • Engineering plastics • Organic composites • Ceramics • Cermets • Metals and alloys

Examples of use: • Electrical components • Connections • Sensors • Printed circuits

	Fuel Cell		Electrolyzers
Trade name	CERTESS® ELEC FC / FC+	CERTESS® ELEC G	CERTESS® EA / EP electrolyseur
Architecture	Carbon base	Gold	Gold / Platinium



CERTESS® PROCEM®

SURFACE TREATMENT FOR ELECTROMAGNETIC SHIELDING

PROCEM® layers are conductive multilayer metallic coatings designed for the electromagnetic shielding of polymers and composite materials. These PVD treatments make it possible to reconcile these various requirements while providing other advantages linked to the implementation process: the dimensional accuracy, the quality of any sparing, the negligible impact on the weight of the objects.

Characteristics:
- Discharge of electrostatic charges
- EMI shielding
- Multifunctionality (resistance to chemical aggression, friction or abrasion, etc.)
- Negligible impact on the weight and precision of objects
- Possible application on large parts

Materials suitable for treatment: • Glass • Engineering plastics • Organic composites • Ceramics • Cermets • Metals and alloys

Examples of use: • Weaponry components • Captors • Telephony • Connections • Sensors • Printed circuits • Heating elements • Satellite antennas

Trade name	CERTESS® PROCEM 2	CERTESS® PROCEM 3	CERTESS® PROCEM 4
Architecture	Silver base	Copper base	Aluminium base

CERTESS® LOOK

SURFACE TREATMENT FOR TECHNICAL DECORATIVE USE

LOOK layers are a series of thin layers developed for technical decorative applications where both the visual and mechanical functions are crucial.

Characteristics:
- Hardness from 1000 to 4000 HV
- Resistance to abrasive wear
- Chemically inert
- Odourless
- Hypoallergenic
- Metallic feel and touch

Materials suitable for treatment: • Steels • Aluminium, copper and titanium alloys • Glass • Engineering plastics • Organic composites • Ceramics

Examples of use: • Brands • Luxury market

Trade name	CERTESS® LOOK B (Black)	CERTESS® LOOK G (Gold)	CERTESS® LOOK S (Sliver)
Architecture	Carbon base	Titanium or zirconium base	Chrome base

CERTESS® OPTAL

SURFACE TREATMENT FOR OPTICAL USE

OPTAL layers are a series of thin layers used for optical coatings such as reflectors, anti-reflective, and anti-scratch solutions, to provide a wide range of solutions for photonic components.

Characteristics:
- Wide range of materials that can be deposited: chrome, aluminium, gold, specific alloys
- Very high purity of coatings
- Control of thickness and surface finishes
- Resistance to chemical aggression (depending on type of coating)
- Application suitable for large parts

Materials suitable for treatment: • Glass • Plastics • Organic composites • Ceramics • Cermets • Metals and alloys

Examples of use: • Visors • Screens • Bottles • Architecture • Lenses

Trade name	CERTESS® OPTAL HRa	CERTESS® OPTAL HRs	CERTESS® OPTAL HRo	CERTESS® OPTAL ARv	CERTESS® OPTAL ARw	CERTESS® OPTAL ARir	CERTESS® OPTAL SRo
Architecture	Aluminium base	Silver base	Oxide base	Oxide base	Oxide base	Carbon base	Oxide base

CERTESS® EJECT

SURFACE TREATMENT FOR MECHANICAL USE OF MOULDS

EJECT layers are coatings developed for plastic and aluminium shaping tools to ensure very low wear in the injection area and easy unmoulding for many materials. The aim is to increase tool life, improve the quality of the parts produced, reduce lubrication, reduce tool maintenance and encourage the reuse of tools.

Characteristics:
- Hardness from 2000 to 6000 HV
- Resistance to abrasive and adhesive wear
- Chemically inert
- Thermal stability up to 800°C
- Resistance to oxidation

Materials suitable for treatment: • Steels and cast irons • Inconel alloys • Aluminium, copper and titanium alloys

Examples of use: • Punches • Dies • Cavities • Mould peripherals • Ejectors • Slides

	EJECT C						EJECT T			
Trade name	CERTESS® EJECT DT	CERTESS® EJECT DTX	CERTESS® EJECT DDT	CERTESS® EJECT DCX	CERTESS® EJECT DCY	CERTESS® EJECT DCYm	CERTESS® EJECT Ti	CERTESS® EJECT T	CERTESS® EJECT SD	CERTESS® EJECT X
Architecture	Carbone base						Ti based			CrxNy

CERTESS® LIFE

SURFACE TREATMENT FOR MEDICAL USE

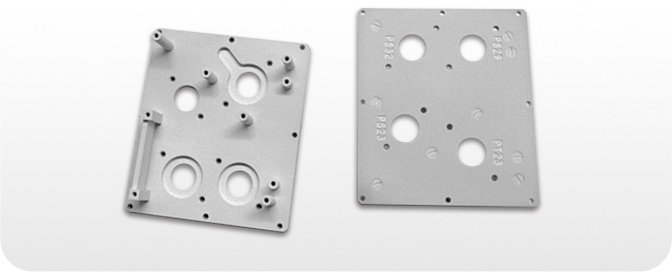
LIFE layers are a series of layers developed for medical applications such as medical tools by providing anti-reflective, anti-wear or anti-microbial properties.

Characteristics:
- Hardness from 1000 to 4000 HV
- Resistance to abrasive wear
- Biocompatible
- Chemically inert
- Odourless

Materials suitable for treatment: • Steels • Inconel alloys • Aluminium, copper and titanium alloys • Glass • Engineering plastics • Organic composites • Ceramics

Examples of use: • Surgical instruments • Medical devices

Trade name	CERTESS® LIFE B (Black)	CERTESS® LIFE G (Gold)	CERTESS® LIFE S (Sliver)
Architecture	Carbon base	Titanium base	Chrome base



CORRALU® V

VACUUM DEPOSITION FOR CORROSION PROTECTION

Deposition of a pure aluminium layer of 10 to 50 µm.

Characteristics:

- Corrosion protection
- Electrical continuity

Notes:

Dimensions from one centimetre to 2 metres. Beyond that, please consult us. Additional treatment possible (SiOx, chemical conversion, Surtec 650, Corralu, varnish, chetylic alcohol).

Materials suitable for treatment:

Steels • Stainless steels • Aluminium alloys • Refractory alloys • Titanium • Any metal compatible with vacuum deposits • Possible application on plastics, glass and ceramics

Examples of use:

• Fighter aircraft structural parts • Screws and bolts • Aeronautics • On-board electronics housings • Sensor supports • Connector bodies

CERTESS® BLAST

VACUUM DEPOSITION FOR EROSION PROTECTION

Multi-layer metal/nitride PVD treatment.

Characteristics:

- Thickness from 10 to 50 µm
- The nature of the metal can vary according to conditions.

Materials suitable for treatment: Any metallic or ceramic substrate. For polymers or composites, contact us.

Examples of use: • Moving parts subject to erosion for aeronautics • Power stations.

Laser process

We use laser processes to develop specific textures and functionalities requested by our customers. This involves creating a dedicated process, accompanied by in-depth studies, to achieve the desired final functionality.

Our laser processes are unique in that they deliver very high power in a very short time. This unique property enables us to sublimate the material while controlling thermal effects, and this for all materials, from the hardest to the most fragile. HEF can thus modify the surface of materials in multi-scale dimensions ranging from the micrometer to the nanometer.

Ultra-fast laser treatment enables functionalization, texturing or micromachining to be carried out rapidly, without damaging the material, in 2D and 3D on a wide range of materials.

HEF masters and implements high-power femtosecond lasers on an industrial scale, combining reliability, cost, automatic processes and vision systems.

TECHNICAL FEATURES OF OUR ULTRA-FAST LASER PROCESSES:

- All materials, from the hardest to the most fragile
- Extreme precision
- Thermal control
- No post-treatment (pre or post)
- Reproducibility
- Wide range of surface geometries: flat 2D & complex 3D
- All part sizes from µm² to m²
- Material removal without burrs or thermal impact
- Dimensional control

OPERATIONAL CHARACTERISTICS OF OUR ULTRA-FAST LASER PROCESSES:

- Accelerated productivity
- Cost optimization
- Enhanced end-product performance (increases intrinsic material performance)
- Low carbon footprint: low power consumption, non-contact technology, no additives or consumables

Applications

LASER ENGRAVING

Ultra-fast laser technology enables precision engraving with rapid machining (mm³/s) and sub-µm roughness without material damage in 2D and 3D.
The laser enables engraving with thermal control and preservation of material health for the creation of microchannels, tribology, sealing or aesthetics...

MICRO AND NANO TEXTURATON

Ultra-fast laser surface texturing can be used to modify the structural properties of the material to bring technical functionalization to the part.
Laser technology enables high-speed ablation texturing (mm³/s) at very high resolution (µm) without damaging 2D and 3D materials.
The laser can also be used to create nanometric surfaces for various functionalities:

- Wettability (hydrophobic, hydrophilic...)
- Sealing
- Anti-icing
- Tribology (friction, adhesion, rubbing, etc.)
- Conductivity
- Coloration (absolute black, iridescent effect...)

LASER CUTTING AND DRILLING

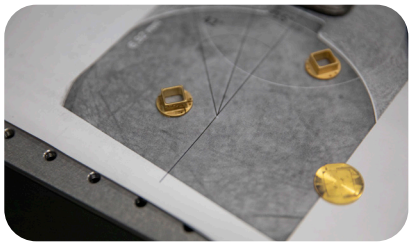
Laser drilling produces small holes (up to 5 µm in diameter) with a variety of geometries, for applications on glass as well as metals and plastics.
Laser technology enables through-cutting of various materials (thickness ≤ 1 mm) at high speed (1 m/s in a straight line and ≥ 0.2 m/s for more complex geometries).
The laser preserves the substrate thanks to controlled thermal effects and clean, burr-free cutting edges.

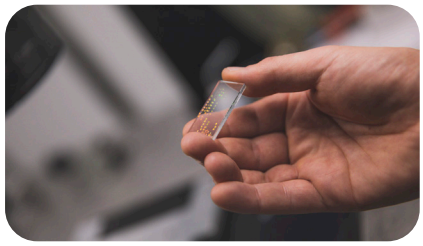
SELECTIVE ABLATION OF THIN FILMS

Laser ablation of thin films (or “decoating”) enables selective etching without delamination, burrs or microcracks of a layer on its substrate.

LASER MARKING

Laser marking involves indelibly modifying the contrast of a part.
The process is flexible, clean (no additives), non-contact (no wear) and maintenance-free. It can also be used to engrave serial numbers or as an anti-counterfeiting system.





Functionalised powders

For over 10 years, HEF has been designing and manufacturing smart powders that are multi-material. There are two manufacturing pathways, either by surface modification or by core processing. HEF uses fluidised bed or mechanical synthesis technologies.

The composition of these innovative powders is uniform at the particle scale with control over the size (from micrometre to millimetre) and shape of the grains. This makes it a product that is easy to implement. The powders are used for the production of coatings or high-performance solid parts.

HEF provides several base/coating powder combinations, including metal/metal, ceramic/metal, metal/polymer, single or multi-layer functionalisation, depending on the specifications. HEF also develops epoxy and/or polyester resin-based powder paints.

All the group's technical powders are specially formulated to obtain high-performance functional coatings. Their use as coatings on parts improves surface properties such as hardness, lubrication, conductivity, diffusion barrier, anti-corrosion, and even wettability. Their use in the manufacture of parts makes it possible to obtain unique and homogeneous microstructures.

The HEF group offers a comprehensive service package that includes powder formulation, manufacturing, and implementation.

DEPTON®

Zinc/tin alloy and metal deposits by mechanical means to protect ferrous alloy parts against corrosion.

Characteristics:
- Good regularity of the deposited thicknesses
- No hydrogen embrittlement
- Ductile deposits susceptible to deformation after treatment
- Good corrosion resistance

Notes: Possible passivation of deposits and organo-mineral finishing.

Materials suitable for treatment: All steels, in particular high yield strength steels

Examples of use: • Automotive fasteners • Springs, washers • Grating fasteners • Forks • Letter box locks • Crankshaft pins • Grommets • Locking collars • Pointed screws • Mirror spindle lugs • Circlips • Mountain climbing accessories • Embedding nails

ROMAX™

POLYMER COATING

Organic coating for technical or decorative use.

Characteristics (depending on type of coating):
- Corrosion protection
- High resistivity (electrical insulation)
- Low resistivity (EMI shielding)
- Accepts friction
- Variety of colours

Note: Polymer coatings may be classified in two main categories: liquid coatings and powder coatings (fluidized bed, electrostatic spraying, etc.).

Materials suitable for treatment: All types of substrates.

Examples of use: • Industrial fans • Industrial cabinets and enclosures • Generators • Engine casings • Screw heads • Submarine and ship parts • Tunnel equipment parts • Electronic covers • Various screws • Bodywork • Bus bars

Other technologies

In recent years, surface treatments have grown so much that there is no sector that does not directly or indirectly rely on them. Today, the technologies and know-how of Techniques Surfaces are used in practically all fields of activity that are concerned, directly or indirectly, with the design or protection of surfaces. Thus our know-how is applied to fields as diverse as aeronautics, aerospace, electricity, public works, automotive industry, armaments and consumer products.

This privileged position is based on four major assets:

- Our range of products applicable to most materials (steel, cast iron, light or copper alloys, ceramics, glass, polymer, etc.).
- Our solutions adapted to all functions: mechanical, optical, electrical, etc.
- Our ability to combine several treatments and/or technologies to provide the appropriate response to a specific need to create a new surface function.
- Our ability to adapt to a given environment of proven technologies in other fields.

PHOSPHATING

Chemical conversion treatment providing a crystalline phosphate layer (Mn, FeMn, Zn, ZnFe, ZnCa).

Characteristics:
MANGANESE TYPE PHOSPHATING:
• Decrease friction
• Improved adhesion of lubricating films
ZINC TYPE PHOSPHATING:
• Improved corrosion resistance
• Excellent adhesion base for organic topcoats

Materials suitable for treatment: Ferrous alloys • Aluminium alloys • Zinc alloys • Cadmium coatings.

Examples of use: Straight gears • Gleason gears • Gearboxes pinions • Camshafts • Rocker shafts • Automatic weapons chambers • Parts for rifles • Fish joints• Tap ball valves • All overmoulding applications • Car screws and bolts

SDA® - GRAPHLUB™

Organic coatings providing solid lubricants to the surface of the treated parts, such as molybdenum or graphite.

Characteristics (depending on type of coating):
• Decrease of friction coefficient, producing a transfer film on the antagonist surface (solid lubricant/solid lubricant friction)
• Dry friction
• Corrosion resistance
• Fretting-corrosion resistance
• Wear resistance
• Decrease of sound levels
• Resistance to radiation, and more

Materials suitable for treatment: All types of friction materials.

Examples of use: • Loaders for rifles • Receivers of automatic weapons • Crane joint pins • Oil connectors • Ball joints • Valve casings • Slides • Mould linings.

TEGLISS™

Organic coatings using thermal hardened or thermo-stable polymers (PTFE, POLYIMIDE).

Characteristics (depending on type of coating):
• Low friction coefficient
• Seizure resistant
• Anti-adherent
• Chemically inert
• Fretting-corrosion resistance
• Food compatibility

Materials suitable for treatment: All types of metal substrates.

Examples of use: • Injection moulds • Valves stems • Hinge pins • Connectors rings • Tie rods • Bearings • Special screws and bolts • Automotive locksmithing • Brake linings • Food mixers

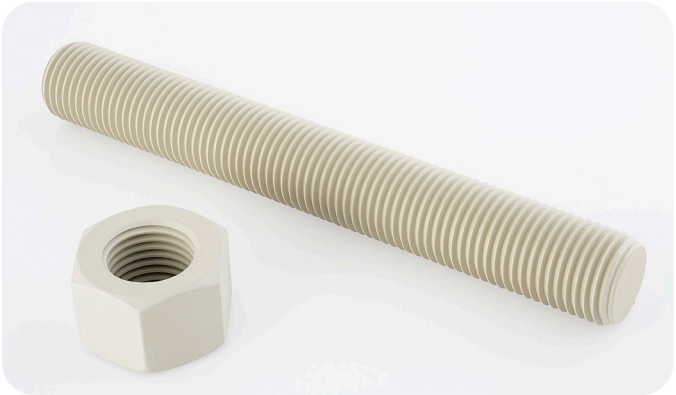
DOT™

Organometallic coatings that are resistant to extreme conditions of corrosion.

Characteristics:
• Excellent protection against corrosion (can exceed 1,000 hours in salt spray test)
• Control of frictions
• No hydrogen embrittlement
• Good resistance in aggressive environment

Materials suitable for treatment: All types of metal substrates.

Examples of use: • Screws • Staples • Washers • Securing clips • Transmissions • Synchronisation bushings • Rollers • Joint holders • Springs • Locks • Various axles • Collars



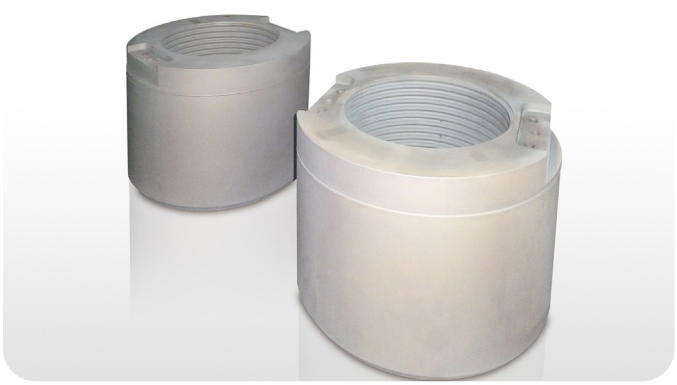
STANAL® 400 HEF Patent

As a solid-phase metal diffusion treatment at 400°C (752°F), STANAL 400 improves the resistance to seizure of stainless steel parts without changing the corrosion resistance.

Characteristics:
- Increased surface hardness
- Improved wear and seizure resistance
- Good intrinsic corrosion resistance
- Excellent support for self-lubricating coatings

Materials suitable for treatment: • Austenitic stainless steels • Martensitic stainless steels • Structurally hardened stainless steels • Refractory steels • Alloyed steels

Examples of use: • Electrical connectors for aeronautics • Hot gas recovery joints on aircraft engines • Hydraulic joints • Stainless steel nuts and bolts for nuclear industry • Various parts of nuclear valves• Hinge pins for submarine doors • Steam turbine blade fixing pins



DELSUN® HEF Patent

Surface treatment for the prevention of wear and seizure of copper alloy parts. This treatment is obtained by tin base electrolytic plating followed by diffusion heat treatment at 400°C (752°F).

Characteristics:
- Increased surface hardness
- Improved adherence of lubricating films
- Reduced friction coefficient on lubricated parts
- Excellent abrasion resistance

Materials suitable for treatment: Bronze • Brass • Copper-aluminium alloys • Copper-nickel alloys.

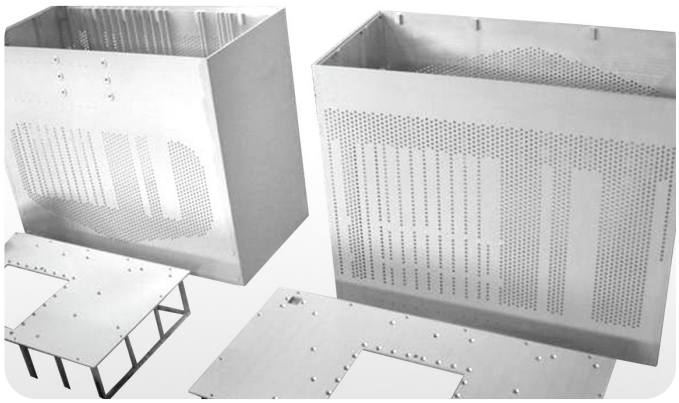
Examples of use:
• Tap and fitting nuts and screws • Shell bearings • Worm screw gear reducer wheels • Spherical gates • Support plates • Pump bodies • Gearboxes synchronisers • Guide bushes • Idle gears forks • Valves • Hinging rings • Machine tool wedges • Linkages, couplings • Valve guides

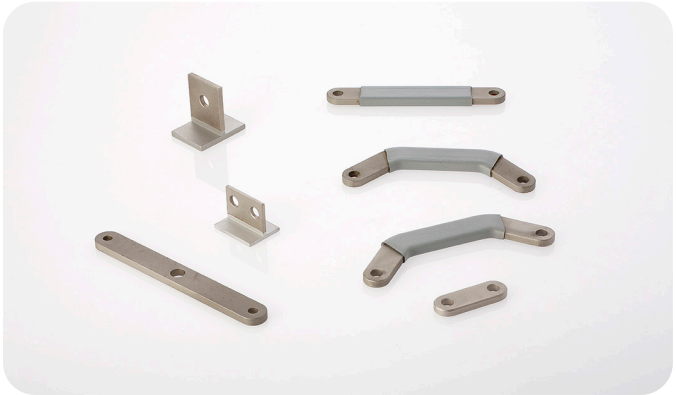
CORRALU® B / SURTEC 650

Chemical conversion of aluminium alloys that is hexavalent chrome free both in the deposited layer and in the products used to make it. Its performance in terms of anticorrosion, preparation and electric continuity make Corralu® B a solution for the future in the aeronautic field. It enables compliance with regulations and directives DEEE, RoHS, VHU...

Characteristics:
- Processing temperature 30 - 40°C
- Coat weight 300 g/m^2
- Application method loose or tied
- Temperature resistance up to 100°C
- Contact conductivity < 0.8 mΩ/cm^2

Note:
Thanks to its expertise in this specific range, CORRALU™ B meets the requirements of corrosion resistance on a wide range of aluminium alloys used in aeronautics.





NICALEC Pechiney Licence

Nickel coating plated on aluminium or aluminium-alloy parts to provide optimal electrical conductibility.

Characteristics:
- Globular structure offering numerous contact areas between connected surfaces (contact resistance decreased)
- Very ductile and low residual stress corrosion
- Very stable temperature-conductivity

Materials suitable for treatment: • Pure aluminium • Aluminium alloys of the type 6060 (AGS)

Examples of use: • Weak signal electrical connections • Copper-aluminium electrical connections • Power current transmissions in rolling stock and electrically controlled aircraft • Automobile connections

SULF BT™ HEF patent

Molten salt bath electrolytic conversion of the surface of the base material to create an iron sulfide layer to improve resistance to seizure and to strengthen adherence of lubricating films. The layer has excellent self lubricating properties.

Treatment parameters:
SULF BT treatment is done at a temperature of 190 ± 5°C (374 ± 40°F).

Remarks:
Treatment is possible on heat-treated steels with low tempering temperature, especially case hardened steels.

Precautions to be taken:
SULF BT is not suitable for steels with chromium content greater than 12%.

Examples of use: • Surface hardening and case hardened gears • Camshafts • Engine linings • Ball joints • Pushrods • Differential satellites • Differential spiders • Universal joints • Shafts and bushings • Gearboxes forks • Gearboxes spacer rings • Steering screw • Racks-pneumatic hammer pistons • Stop washers for gearboxes…

MOAP™ HEF Patent

Graphite-based sliding coating with metallic binder.

Characteristics:
• Used for temperature applications, mainly in glassware for gob transfers
• Improves significantly the gob slippage with a perfect evenness over time
• Excellent wear resistance
• Repetitive use of tooling after a simple cleaning

Materials suitable for treatment: • Steels • Cast irons • Aluminium alloys • Stainless steels

Examples of use: Glassware parts particularly for gob transfer.

PLASMA THERMAL SPRAYING

Dense coating of metals, ceramics or cermet by spraying melted particles by plasma arc.

Characteristics:
• Refractory coatings
• Abrasion-erosion resistance
• Fretting-corrosion resistance
• Wear resistance
• Corrosion resistance
• Conductivity and/or thermal or electrical insulation
• Improves friction properties in hostile environments

Materials suitable for treatment: All non-organic materials, except copper

Examples of use: • Wire guides • Seals • Medical prostheses • Drawing punches • Locking inserts • Bearing seats • Capstan rollers • Printing and paper cylinders • Seal seats • Bearings for friction in water • Furnace bearings

ARC THERMAL SPRAYING

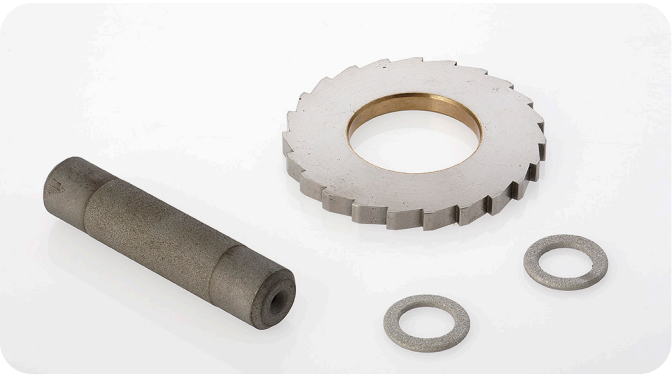
OXYACETYLENE - ELECTRIC ARC

Metal and metal alloy coating by spraying melted particles.

Characteristics:
• Wear resistance
• Corrosion resistance
• Conductivity and/or thermal or electrical insulation
• Decreased friction with lubrication

Materials suitable for treatment: All materials, except copper

Examples of use: • Capstan rollers • Paper mill cylinders • Gearbox synchros and forks • Fan blades • Parts of turbo compressors • Repair of worn or defective parts • Joint pins and stops.

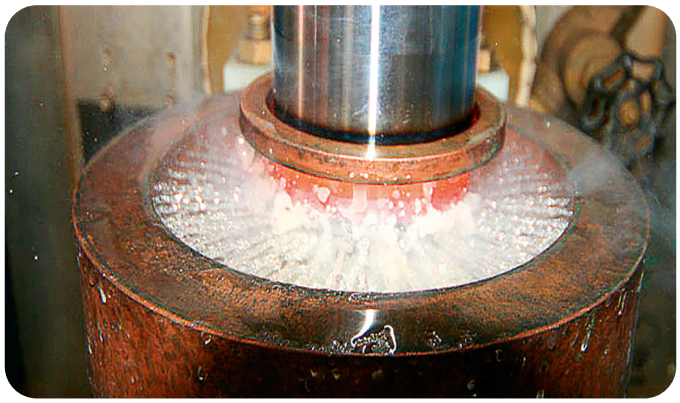


INDUCTION HARDENING

Characteristics:
- Increased surface hardness
- Increased friction wear resistance
- Increased fatigue resistance under non-uniform stress (bending, twisting)
- Increased rolling fatigue resistance under heavy load
- Low distortion
- Very localized or total hardening as required

Materials suitable for treatment: Carbon steels • Low-alloy steels • Cast irons

Examples of use: • Axles • Shafts • Gears • Spindles • Wheel shafts • Camshafts • Crankshafts • Seal seats • Bearing seats • Cylinders • Cylinder rods • Racks



LOW PRESSURE CARBURIZING

Characteristics:
- No surface or intergranular oxidation
- Reduction in deformations
- Removing or reduction of excess grinding thicknesses
- Bore carburising from few tenths of a millimetre of diameter
- Control of the carburised depth (± 5/100mm)
- Good repeatability of results
- Easy to protect the areas to be spared

Materials suitable for treatment: All MnCr, MnB, NiCrMo, CrNiMo steels, etc. (each product has its own specific range of low-pressure carburising)

Examples of use: • Gearbox gears • Steering gears • Power steering pump gears • Nuts • Injectors • Sprayers • Pump bodies • Various gears • Bearing bushings • Wear bushings • Bushings with seals

SILVER PLATING • ELECTROLYTIC NICKEL COPPER AND COPPER ALLOY PLATING

Electrolytic coatings of silver, tin, nickel, copper and copper alloys for electrical and mechanical applications.

Characteristics:
- Very good electrical conductivity
- Excellent friction properties
- Gloss or semi-gloss plating
- Weldable plating
- Ductile deposits
- Good accommodation and deformability

Materials suitable for treatment: All types of conducting substrates • Stainless steel when improved resistance to seizing is required.

Examples of use: • Soldering connections • Crimping connections • Linking lugs • Manifolds • Contact blades • Soldering clamps • Panel strips • Fuse tips • Valve seals • Ball valves • Flexible braided connectors

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