



## 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 DOT	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	CrN <sub>y</sub>	ZrN	MoN

## CERTESS® ELEC

### SURFACE TREATMENT FOR ELECTRICAL USE

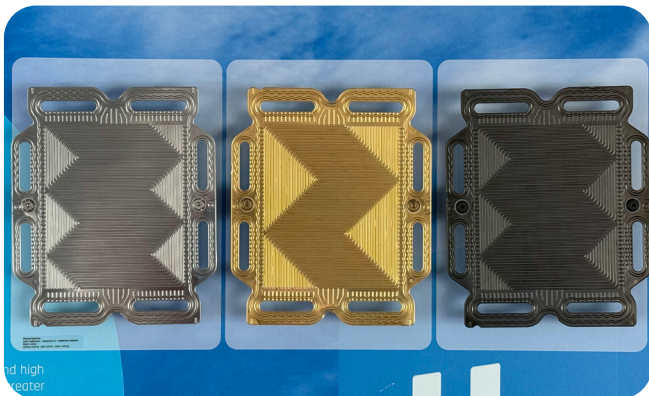
ELEC layers are a series of thin layers used to modify the electrical properties of surfaces. The use of extremely pure materials ensures optimal performance on all types of substrates and all types of geometry through the use of PEMS™ technology.

#### 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 / Platinum

## CERTESS® PROCEM®

### SURFACE TREATMENT FOR ELECTROMAGNETIC SHIELDING

PROCER® 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® PROCER 2	CERTESS® PROCER 3	CERTESS® PROCER 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 (Silver)
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:

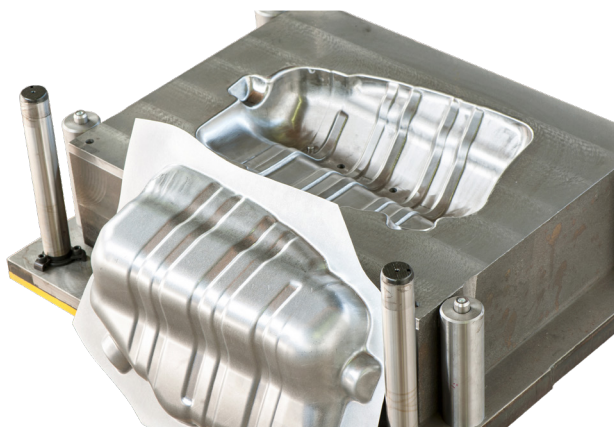
- Wide range of materials that can be deposited: chrome, aluminium, gold, specific alloys
- Very high purity of coatings
- Control of thickness and surface finishes
- Resistance to chemical aggression (depending on type of coating)
- Application suitable for large parts

**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 HRo	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			

## 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:

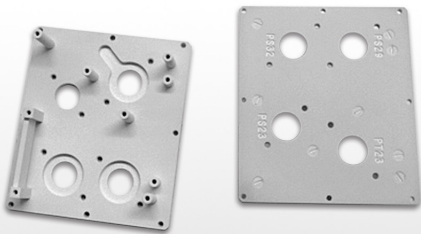
- Hardness from 1000 to 4000 HV
- Resistance to abrasive wear
- Biocompatible
- Chemically inert
- Odourless

**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.

