



Nitriding in ionic liquid medium

ARCOR® : MULTIFUNCTIONAL SURFACE TREATMENTS

ARCOR® treatments have been developed to provide multifunctional surface properties. They simultaneously enhance the wear, seizure, surface fatigue resistance and corrosion resistance (can now exceed 800 hours as per neutral salt spray testing). These treatments comply with the increasingly severe operating conditions required on steel or cast-iron based mechanical components.

The ARCOR® series is based on oxynitrocarburizing followed by various post-treatments, and offers an efficient, economical solution, complying with the environment protection regulations.

State-of-the-Art solutions via the CLIN™ technology (Controlled Liquid Ionic Nitriding), developed by HEF™ Groupe, ensure a real optimization of the treatment parameters.



COMPARISON OF CORROSION RESISTANCE OF 41/40 STEEL WITH ARCOR® TREATMENT, WITH HARD CHROME COATING, AND WITHOUT TREATMENT

ARCOR® : MULTIPLE PROPERTIES

ARCOR® treated components exhibit :

- High mechanical properties :
 - Surface fatigue resistance ;
 - Brinelling resistance ;
 - Adhesive and abrasive wear resistance ;
 - Pitting resistance.
- Good frictional properties :
 - Anti-seizure behaviour ;
 - Running-in improvement ;
 - Surface conformability ;
 - Oil film load bearing capacity ;
 - Low friction coefficient.
- High corrosion resistance :
 - Can reach more than 800 hours tested as per ASTM B117.
- Surface roughness functionalities :
 - bearing curve adjustments for lubrication optimization ;
 - Low Ra, Rt, Rz for no leakage on hydraulic components ;
 - Deep black highly durable cosmetic aspect.



ARCOR® TREATED COMPONENTS

ARCOR® treatments provide :

- No hydrogen embrittlement ;
- Low cycle time processes ;
- High reproducibility and consistency ;
- Evenness of treatment on complex shape components ;
- Adapted for small, medium and large series.

CLIN™: AN ADVANCED TECHNOLOGY

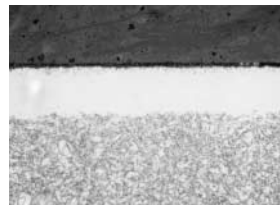
The CLIN™ technology is based on the most recent developments in the field of liquid oxycarbonitriding of HEF™ R&D, research center of HEF™ Groupe.

Components are processed in an ionic liquid medium. The liquid state during the treatment provides homogeneous surface properties whatever the shape of the components. It also contributes to the absence of part deformation and thermal shock effects.

This CLIN™ technology allows accurate control of both nitrogen and oxygen concentrations at the surface of the components. This technology results in a series of multifunctional treatments where frictional properties, surface fatigue resistance and corrosion resistance can be adjusted to fit a particular application.

Post treatments like polymer impregnation, high quality surface polishing have been developed to further increase the corrosion resistance of treated components (more than 800 hours as per ASTM B117 test), or to adjust the surface roughness for low friction against polymeric sealing components.

This technology can comply with the most stringent environment protection regulations with a zero liquid and gaseous waste concept, and solid waste recycling.















CROSS SECTION OF A LAYER OF A QUENCHED AND TEMPERED AISI 1045 STEEL, **ARCOR®** TREATED.
E IRON NITRIDE LAYER ASPECT



1. GAS COLLECTION AND TREATMENT SYSTEM
2. WATER RECYCLING SYSTEM

THE SERIES OF **ARCOR**[®] TREATMENTS

	Without treatment	ARCOR [®] C	ARCOR [®] N	ARCOR [®] V
CORROSION RESISTANCE				
SUPERFICIAL MECHANICAL RESISTANCE				
PROCESS TEMPERATURE				 630 °C 490 °C

COMPARISON OF VARIOUS **ARCOR**[®] PROPERTIES AND FEATURES

The **ARCOR**[®] series offers the widest range of surface treatments for components that require either single or combined frictional properties, anti-seizure behaviour, corrosion and surface fatigue resistances. The surface properties of all types of ferrous materials could be improved with the **ARCOR**[®] treatments (steel, cast iron, sintered ferrous alloys...).

Via the **CLIN**[™] technology the **ARCOR**[®] treatments allow one to adjust the nitrogen and oxygen concentration at the surface of the parts. In combination with the adjustment of process parameters like time and temperature (from 490 °C to 630 °C), and pre or post heat treatments, specific properties can be achieved (corrosion resistance, anti-seizure behaviour, brinelling resistance). The **ARCOR**[®] series can also be combined with heat treatments like carburizing, induction hardening. Components processed with these combined treatments exhibit high volumic and sub-surface mechanical properties together with friction and corrosion resistance properties.

Today recognised as a standard surface treatment in automotive industry with its **C** version, the **ARCOR**[®] series is completed with the new **N** and **V** types, providing respectively extreme corrosion resistance and outstanding superficial mechanical properties.

APPLICATIONS OF **ARCOR®** TREATMENTS

- Substitutions for hard chrome plating, zinc plating, cadmium and nickel coatings, replacement of certain types of carbonitriding.
- Replacement of stainless steel by less expensive **ARCOR®** treated steel.
- Hydraulic components :
ball valves, gas springs, gate valves, manifolds, piston rods for hydraulic jacks, shock absorbers, tubes...
- Automotive components :
ball pins, brake rotors, calliper pistons, camshafts, clutch discs, crankshafts, cylinders, differential carriers, door stop cams, drive shafts, gears, gear box actuators, hubs, latches, piston wrist pins, rocker arms, starter motor shafts, steering racks and pinions, turbo charger forks, valves, wiping systems output shafts...
- Mechanical components :
fasteners, pins, pulleys, shafts, slides, spindles, yokes...
- Tools :
dies, forging tools, forming tools, injection moulds...



ARCOR® TREATED COMPONENTS



HEF™ GROUPE : SERVICES SUPPLIER

■ Specific developments to meet your specialized technical need :

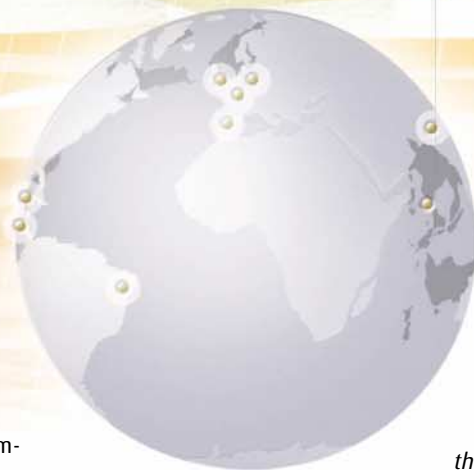
Thanks to continuous innovation, renewal of processes and equipment research, **HEF™ Groupe** offers you the best solution for your project.

In order to optimize the treatment requested for your field of industry and applications, **HEF™ Groupe** research center can generate specific developments.

■ A customized access to the technology :

HEF™ Groupe is able to adapt their technology offer and their technology transfer to the customer's need, as following :

- through their production units, **TECHNIQUES SURFACES**, present all over the world (and especially close to major customers),
- through their worldwide Joint-Ventures network,
- through their own international licensees network,
- by integration of our technology on your production site : technology transfer, technical assistance, sale of equipment and consumables.



HEF™ Groupe offers a large choice of technological transfer with the best customer's service in terms of quality, price, and delivery time.

■ An international quality policy :

HEF™ Groupe ensures to their customers that all the treatments will be handled with the most recent quality systems.

The procedure covers the monitoring and control, from the inspection of incoming material to their cleaning, processing, inspection and shipment.

Production units, such as **TECHNIQUES SURFACES** which are ISO 9002 certified, enforce the quality policy. The licensees and partners also comply with the quality standards set by **HEF™ Groupe**.

*(You may find at the end of the brochure a list of the **HEF™ Groupe** plants in your country.)*

LICENSING OF **ARCOR**[®] TREATMENTS

HEF[™] **Groupe** technologies are also available through licensing. 350 licenses have been granted by **HEF**[™] **Groupe** in 30 countries, on different patents.

Licensing covers technological transfer, raw materials supplying, staff training, and also the equipment supplying according the customer's request.

This technological transfer ensures the technical assistance to partner companies for the resolution of specific problems, continuous process improvement through the introduction of the latest technology developments.

EQUIPMENT OF **ARCOR**[®] TREATMENTS

Within **HEF**[™] **Groupe**, **TECMACHINE** is the company in charge of development and manufacturing of equipment for the **ARCOR**[®] series.

The line could be fully automatic lines where all steps of the treatment are automatically performed, even the steps of loading and unloading, thus keeping the associated labor costs at their minimum levels.

The zero liquid and gaseous waste concept that could be implemented on these **HEF**[™] **Groupe** processing lines contributes to environment protection.

These treatment lines can process up to 2500 tons of parts per year.



1. MANUAL INSTALLATION OF **ARCOR**[®] TREATMENT
2. AUTOMATIC PLANT OF **ARCOR**[®] TREATMENT

RESEARCH IN HEF™ GROUPE

HEF™ Groupe latest developments rely upon the research center.

HEF™ R&D center is one of the leading European research centers, with more than 80 international patents in the field of Surface Engineering. Their team of 40 researchers has been involved in 20 European research projects (EUREKA, BRITE-EURAM) and 7 on-going programs.

It has its own facilities for coatings and processes development, as well as friction and wear assessment through its Tribology Department.

For constant renewal, this research center seeks innovations for advanced processes, better controlled treatment parameters and optimization of materials surface properties.

And specially in the following directions,

- Over saturation mechanisms in modelling of diffusion and precipitation – diffusion during nitrocarburizing,
- Influence of oxobases on electrochemical transducer answers developed for ionic liquids,
- Study of the influence of solvolysis reactions on nitrogen transfer mechanisms in ionic liquids.



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2. TRIBOLOGY DEPARTMENT
3. ANALYSIS LABORATORY

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