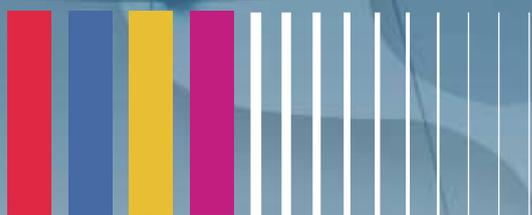
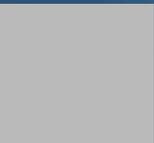


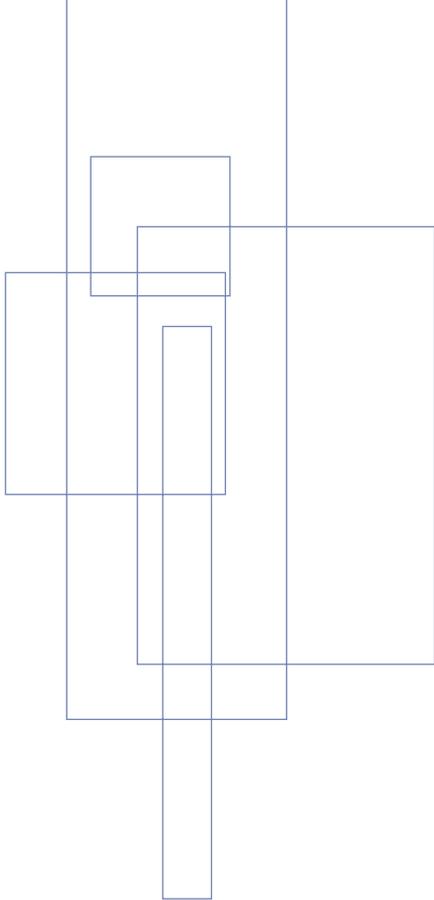
Surface engineering



Our Business : Surface

engineering





Surface engineering

is the HEF group's core business and internationally recognized area of expertise. This discipline builds on the know-how of metallurgists who improve material and mechanical properties, and physicists and physical chemists who optimize their application. Research, quality and creativity are combined to provide state-of-the-art solutions to wear, friction and corrosion. The HEF Group's more than 1100 employees are operating in seven divisions around the globe, in 16 countries and growing.

Engineered Solutions

HEF group research, with more than 80 engineers and technicians, can provide innovative, turnkey technology services, products or equipment. From research & development through technology transfer, H.E.F.'s engineering capabilities are driven by customer need, resulting in solutions that are specific, yet, flexible to meet the ever changing business environment. Those capabilities are:

- Research and development
- Technical Consultation
- Technical Service
- Equipment design and manufacture
- Design and manufacture of mechanical components
- Technology transfer

HEF's Global Presence

For 20 years the HEF group has recognized that local presence is the key to quality service and customer relations. As a result, more than 43 facilities have been established on every continent, with plans for many more. For the future, the HEF group remains committed to immersing itself into global cultures and blending into local industries, providing world-class support for its world-wide customers, wherever they may be.

Our core

Strengths





EF has forged its technical experience and expertise in four areas:

Tribology

Investigation Imagination

The HEF Group is expert in the study of tribology - the science and technology of interacting surfaces in relative motion. Such expertise produces critical information regarding failure mechanisms of mechanical components; resulting in solutions that increase performance and/or reduce costs. Further, the HEF Group has:

- Over 50 years experience in the field of tribology:



- State-of-the-art testing facilities that include more than 50 simulators and test benches capable of reproducing an infinite number of conditions (kinematic, functional, etc.)

- A full range of surface analytical techniques, including SEM, EDAX, and Fluorescence X. This technology provides detailed information on the mechanical behaviour of materials and components in their working environment, establishing the HEF Group as a leader in creating ideas and innovative solutions.

Treatment technologies in ionic liquid medium

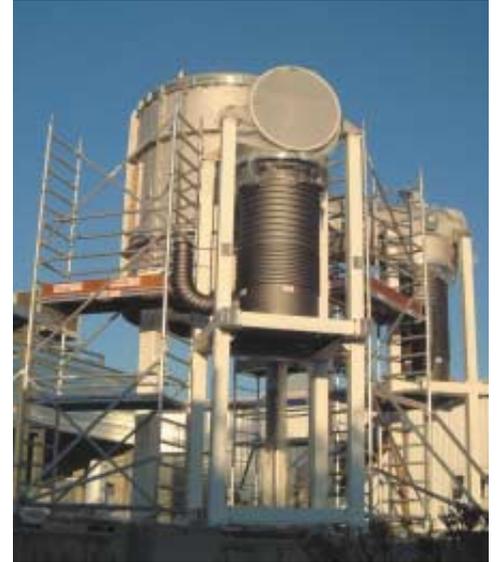
Developing unique processes

The HEF Group is the recognized world leader in thermochemical treatments in ionic liquid medium (nitrocarburizing and oxynitrocarburizing). With a unique combination of engineering properties, these treatments provide superior, yet economical, solutions to problems with friction, wear, and corrosion on ferrous components. Parts treated in these specialized processes can be found in virtually every industry; from automotive to agriculture, and power generation to space exploration. Almost all motor vehicles manufactured today have at least one component treated thermochemically in a liquid ionic process developed by the HEF Group.

PVD and PACVD technologies

State-of-the-art services and equipment

When super-hard, nano-structured, or temperature-resistant coatings are needed, physical vapor deposition and plasma-assisted chemical vapor deposition technologies (PVD and PACVD) are used. Reliable, environmentally-friendly, and extremely versatile, these state-of-the-art technologies represent a major breakthrough in surface treatments for the 21st century. PVD and PACVD coatings can be applied to almost any material, for aerospace, infrared optics, plastics manufacturing, and even Formula 1 racing components. HEF's range of products and services is one of the most complete on the market today, offering everything from the manufacture of equip-



ment, to technology transfer and technical support.

Bushings and Joints

Special designs for extreme conditions

Mechanical devices that operate in harsh environments are subject to complex problems of wear, corrosion, and lubrication.



In response to a growing need the HEF Group has developed an innovative technology to address these problems, and now supplies a range of custom-engineered bushings, rings, and joints for heavy equipment used in construction and other industries.

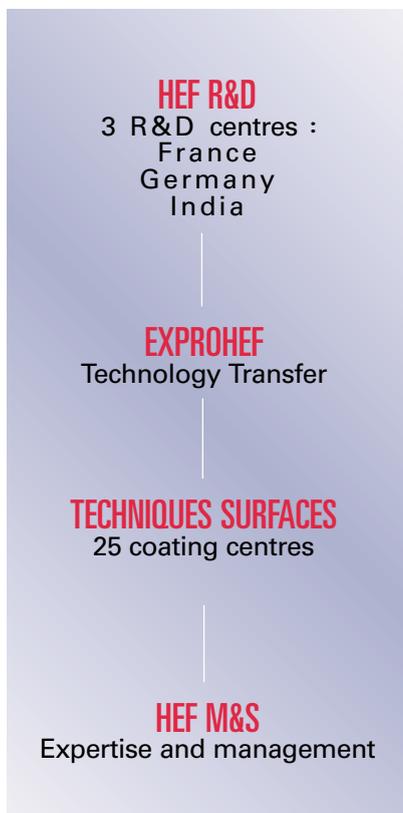
Seven keys to a

total solution



All technologies offered by the HEF Group are exploited through a network of seven business entities; four are dedicated to service and three to manufacturing:

Service: Producing and providing the know-how



Research and Development

HEF R&D develops and deploys its surface engineering expertise through:

- Three research centres; one each in France, Germany, and India,
- About 10% of sales revenue for Research and Development projects,
- Numerous joint work programs in cooperation with government, industry, and academia.
- More than 100 patents.

Technology Transfer

HEF's EXPROHEF division offers technology transfer, technical assistance, licensing, and joint-venture companies as options to promote the processes, products, and know-how of the HEF Group. Currently, there are more than 500 licensees throughout the world that provide HEF processes commercially. Furthermore, collaborations are frequently organized as direct partnerships between the Group and its customers.

Commercial Processing

HEF's TECHNIQUES SURFACES division ensures the industrial application of the treatments and coatings that come from HEF R&D, with:

- More than 43 facilities operating worldwide
- Nearly one hundred treatments and coatings to solve a variety of surface engineering problems, including friction, wear, and corrosion
- More than a billion mechanical parts treated every year

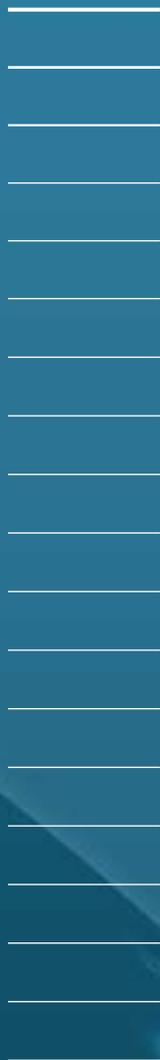
Expertise and Support

HEF M & S, in its capacity as a technical expertise company, provides support to all the Group's customers and companies. Through its technical, legal and financial skills, it also ensures the management of all the Group's various companies.

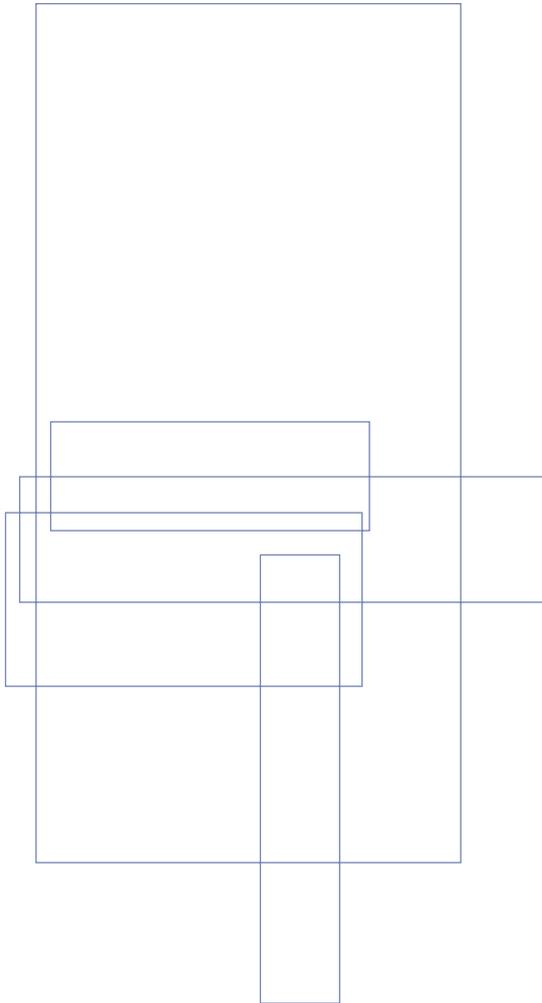


Manufacturing: Combining proficiency with

product



3 Manufacturing entities



Chemical arm
DURFERRIT
 3 units :
 Germany
 Brazil
 India

Mechanical arm
**TECHNIQUES SURFACES
 MÉCANIQUE**
 France
CLERC & CARDONE
 France
EMEPL
 India

Equipment arm
**TECHNIQUES SURFACES
 DÉVELOPPEMENT**

rings, and pins for use in harsh environments. Whether custom-engineered or “off-the-shelf”, these items are designed for, or adaptable to, specific customer needs.

Equipment design and manufacture

HEF TECHNIQUES SURFACES DEVELOPPEMENT is responsible for the design and manufacture of the specialized equipment required for individual surface treatments and coating technologies developed by the HEF Group. For example:

- PVD vacuum equipment, including unique designs with chamber capacities up to 30 m3



Chemicals

DURFERRIT is the chemical manufacturing arm of the HEF Group, providing more than 450 quality products for all HEF thermochemical processes, from three strategic locations: Germany, Brazil, and India.

- Complete rubber vulcanizing installations up to 100 m long
- Complete, fully automated lines for HEF thermochemical surface treatments.

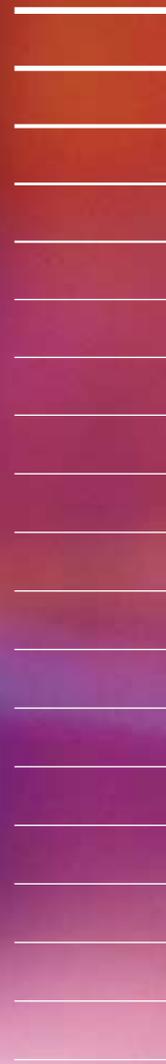
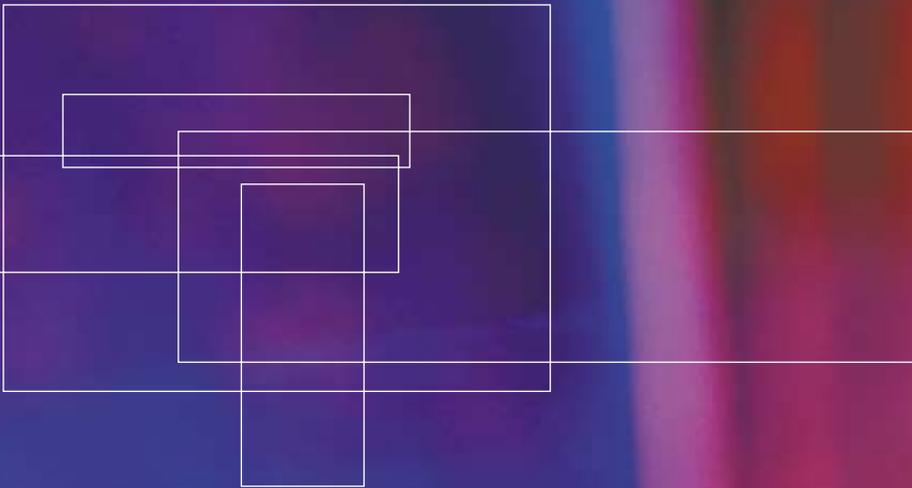


Mechanical Engineering and manufacturing : bushings and joints

TECHNIQUES SURFACES MECANIQUE, CLERC & CARDONE, EMEPL constitute the Mechanical Engineering side of the HEF Group, producing a complete supply of finished mechanical components such as joints, bushings,

Focus on the

future





uring the next decade the HEF Group plans to strengthen its position as a leader in the field of surface engineering by expanding the scientific, technical, and technological skill that has characterized HEF; and by continuing to pursue the goal of international growth.

Cooperation, a recipe for success

HEF intends to intensify cooperation with major public research bodies by:

- Creating framework agreements
- Establishing joint laboratories,
- Forming technology platforms

Initial results from these cooperative efforts are expected in 2005, including:

- An electronic chip with integrated micro-generators
- Innovative gas-in-plasma treatments
- A new nano-structured material with advanced tribological properties

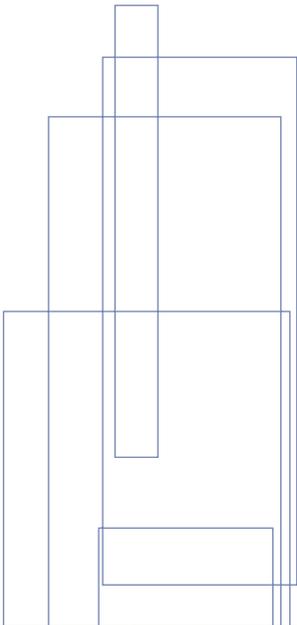
Proximity, the key to international development

The HEF Group has defined a plan to extend it's international scope - in industrialized countries like Germany, Japan and the US, and in countries with strong development potential, like China, Brazil, India, and Central and Eastern Europe. Everywhere, the HEF policy will be one of cooperation and customer service.

Innovation and performance at the heart of industrial development

The HEF Group is keenly aware that the creation of new ideas and technologies are vital for growth. Here are examples of R&D projects under development for the coming years:

- Replacement of hard chrome-plating processes using hexavalent chromium, by thermochemical processes that are completely environmentally friendly,
- Bearings that can run dry for several thousand hours, saving thousands of dollars in the cost of labor and replacement parts, and, perhaps more importantly, contributing significantly to environmental conservation by saving thousands of tons of lubricant every year.
- PVD equipment for continuous treatment, enabling both increased productivity and reduced costs,
- Thin-layer microbatteries, for micro-system power supplies.





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