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[www.industrie.gouv.fr](http://www.industrie.gouv.fr)



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is the national body responsible for promoting, prospecting and facilitating of international investment in France. It also coordinates initiatives promoting the appeal and image of France. The IFA network operates worldwide, with offices in France at both national and local level. It draws on the expertise of specialists in a range of disciplines based at its head office in Paris, as well as in offices in North America, Europe and Asia. In France, IFA works in partnership with regional development agencies to offer international investors outstanding business opportunities and customized services.

[www.afi.fr](http://www.afi.fr)

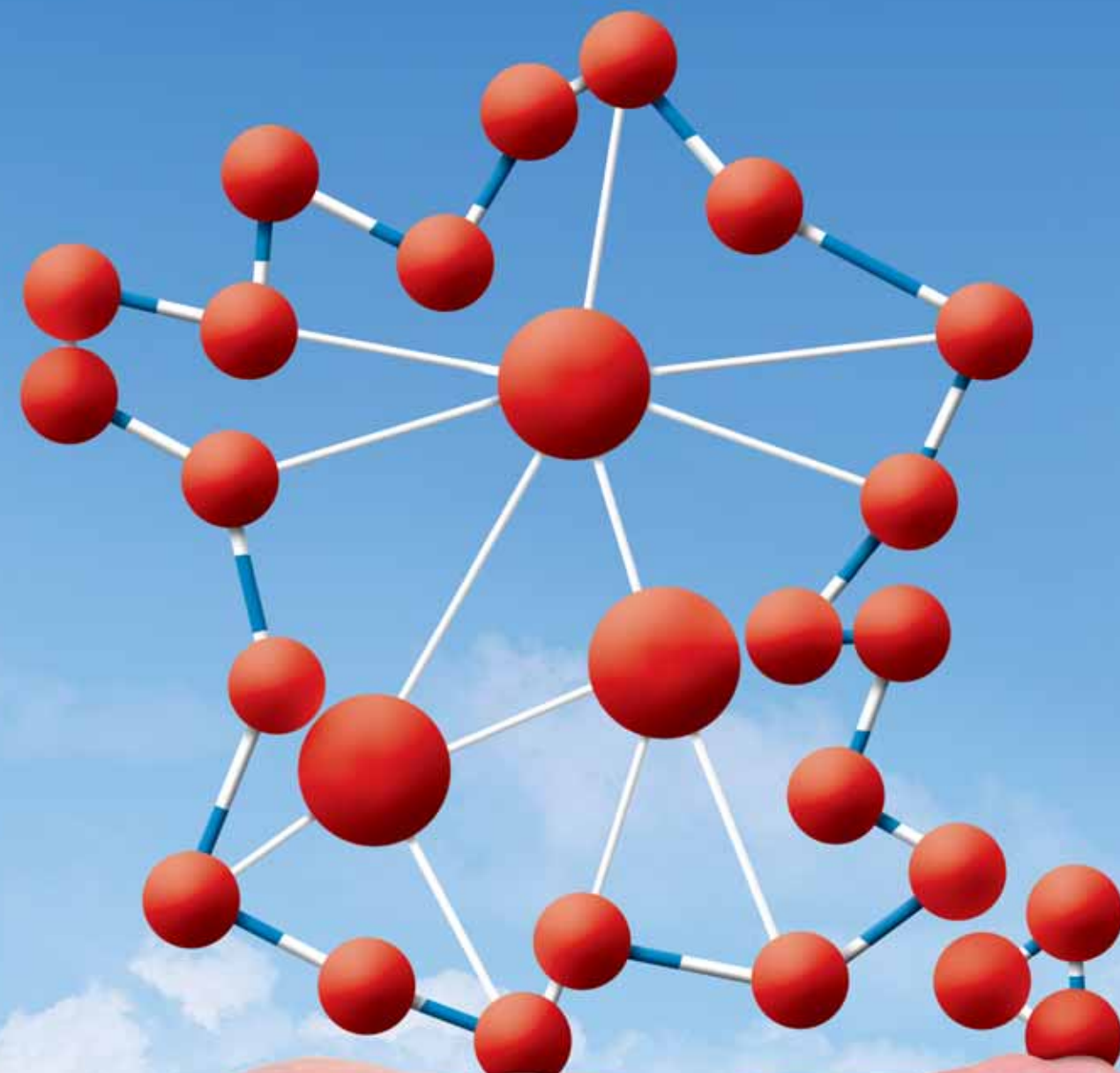


The UIC is the professional body federating all the chemical companies. It provides them with exchange and meeting structures, and encourages their development. It represents and defends them in its various fields of activities, such as social, economic, technical, fiscal and legal affairs.

[www.uic.fr](http://www.uic.fr)

# France,

## where all chemical sectors meet!



# An industry working for the future

## A long scientific tradition

As a science of material structure and transformation, chemistry fascinated French scientists from the beginning. Indeed it was Antoine Laurent Lavoisier who gave an impetus to modern chemistry at the end of the 18th century. Author of the first chemical nomenclature, this famous chemist also solved the mysteries of the composition of air. During the second half of the 19th century, Marcellin Berthelot opened the way to organic synthesis and its numerous industrial applications. Then in 1913, Paul Sabatier revolutionized industry with his theory of catalysis, while Marie Curie had just discovered radioactivity.

Birthplace or adopted home of the greatest chemists, France is, without a doubt, one of the most important countries for fundamental and applied research in this field. And it's not accidental if French scientists have won six Nobel prizes for chemistry, two of them in the past twenty years: in 1987, Jean-Marie Lehn was rewarded for his work in supramolecular chemistry, and in 2005, Yves Chauvin received this supreme award for his discoveries in metathesis.

## A solid industrial fabric

Both a science and an industry, chemistry occupies a central place in our country's economic landscape. Second leading industrial sector behind the automobile industry, with 231 400 direct jobs, the chemical industry (including pharmaceuticals) recorded a global turnover of 95.7 billion euros in 2005. A result which ranks it 2nd in Europe and 5th in the world. Highly competitive internationally, it is the leading French export industry (with 61% of sales on the export market) and 3rd in the world for chemicals and pharmaceuticals.

## Our daily ally

Chemistry plays an essential role in our quality of life. Chemical expertise is behind the considerable progress in the health, agriculture, food, transport, sports and leisure sectors. Chemistry is connected to every aspect of life, although we are not always conscious of this. And all chemical industry customer sectors are present in France. France also hosts all the world's major chemical companies alongside our national leaders such as Arkema, Rhodia, Total Petrochemicals or Air Liquide, not forgetting our 930 SMEs and 1500 very small enterprises (VSEs).

## Very promising innovations

This competitive environment encourages innovation. To support its growth, which is higher than that of all the country's manufacturing industries put together, French chemistry invests heavily in forward-looking sectors such as sustainable chemistry and nanomaterials. Its expenditure on R&D places it above the European average. And for several years, a general effort has been made by public authorities, regions and everyone involved in the sector (chemical companies, social partners, research and training organizations) to support it. The most vivid illustration: the installation of several competitiveness clusters centered on chemistry. A "Conseil stratégique de l'industrie chimique" (strategic council for the chemical industry) (Cosic) was also set up in 2005, bringing together industrialists, customers of this industry and public authorities. Its aim? To ensure the implementation of economic, technical and social conditions which will ensure competitiveness and development of the chemical industry in France. A wide-ranging programme which will enable French chemistry to continue its momentum!

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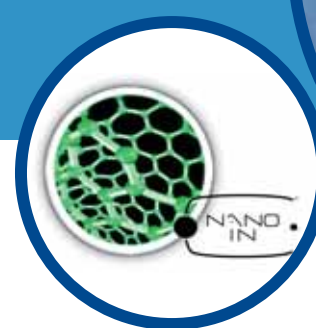


EDITORIAL

Winning the Nobel prize for chemistry is very disconcerting. All of a sudden, your name joins the great names you have admired all your life. And when I think about what brings me close to the Curies or Einstein, I can only see one essential common point in: curiosity. This quality is a vital part of scientific progress, and it stimulates the young researchers, both French and others, with whom I have had the opportunity to work. When I look at them, I have total confidence in the future of French chemistry: the next generation is guaranteed!

When I started my career, about 50 years ago, France provided me with the conditions and resources to pursue my research in applied and fundamental chemistry. I am very grateful for this and I am delighted to see the introduction of competitiveness clusters which will promote emulation and the exchange of expertise between industry and academia throughout the country, and strengthen the attraction of our country for foreign businesses. More than ever, French chemistry has its place in European and global chemistry!

YVES CHAUVIN,  
NOBEL PRIZE FOR CHEMISTRY IN 2005



## France, at the crossroads of European chemistry

### A privileged geographical situation

*In the heart of the European Union, France has a very well structured and safe road, rail, river and airport structure, communicating with all the neighbouring countries. France also has world-renowned ports. These infrastructures make the country a real gateway to the European market.*

#### An extensive, safe, well-structured network

France has three, particularly well exposed coastlines. It has developed **large port complexes suitable for trade in chemical products**: Le Havre and Dunkerque on the Channel-North Sea coast, Nantes-Saint-Nazaire and Bordeaux on the Atlantic ocean and Marseille-Fos on the Mediterranean sea.

French ports are accessible to all grades of ships with their permanent deep water capacity. They also provide an excellent network linking to major roads, motorways and French and European rail networks as well as the main navigable waterways.

Many specialist service providers offer chemists wagon and tanker container hire services as well as rail transport management. Of these companies, **Ermechem** simplifies this approach with a unique logistics offer including all these sectors.

High-performance **pipelines** supply the country with raw and intermediate products (ethylene). They form part of the European network.

#### Fast-growing exports

The quality of this network promotes large-scale exchanges with the whole world. As a major producer of chemical products, France exports more than it imports. Its trade balance, recording a large surplus, was worth 10.1 billion euros in 2005, with 58.4 billion euros worth of chemical products exported, against 48.3 billion euros in imports.

**The French chemical industry makes 61% of its sales on the export market**, a result which ranks it 3rd in the world, behind Germany and the United States. Its main customer is still Europe (the European Union and Central and Eastern Europe), which receives 66% of its exports. The second largest target market for the French chemical industry is North America, soon to be caught up by Asia (excluding Japan), a fast-growing market in which France is constantly strengthening its positions.



#### CARE: WHEN SAFETY GOES HAND IN HAND WITH EFFICIENCY

Installed at the port of Le Havre, **CARE** was the first port installation for storage and distribution of regulated products to be opened in France. Founded by specialists in hazardous chemicals and Seveso II classified, the site was designed according to the strictest safety regulations. It provides a storage capacity of 12 000 tonnes in 6 800 m<sup>2</sup> of bonded warehouses and offers services for conditioning, marking, weighing and preparing orders as well as management of classified product storage no matter what the packaging, as well as container storage.

Inflammable liquids and solids, combustible, toxic, corrosive or infectious materials, etc: CARE handles most hazardous products, except radioactive and explosive materials. Installed in France's second biggest port, CARE has links to the international motorway network and the port's river network, connecting it to the capital. A special branch line enables the centre to receive and ship hazardous products by rail without breaking loads.

#### A dense industrial fabric

With **more than 30 000 different molecules produced** and some 1200 companies with more than 20 employees out of a **total of 2700 companies**, the French chemical industry is a carbon copy of chemistry itself: with great variety, particularly in the field of speciality chemistry. French chemical businesses are distributed throughout the country. But some sites in the North, Centre, East, South-West and South-East of France concentrate most jobs because they have a strong chemical history. It is in these cradles of French chemistry that competitiveness clusters and chemical platforms have developed.

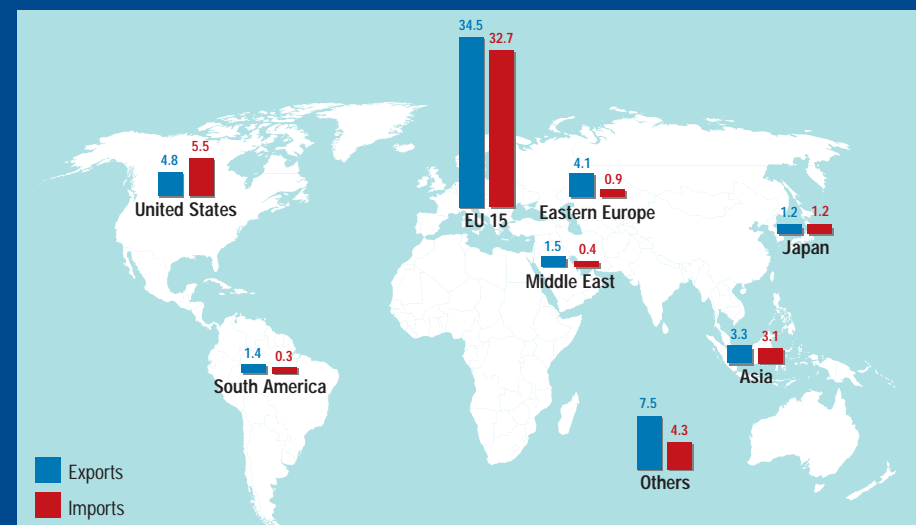
#### A much-appreciated host

France has attracted foreign investors: non-French companies account for about 40% of the country's chemical production. And considering only companies with more than 250 employees, half of the operations in France are performed by companies with foreign capital such as Basell, BASF, Bayer, Degussa, ExxonMobil Chemicals, Ineos, Millennium Chemicals, Rohm & Haas, Shell, Solvay, TOYO Ink, etc.



### FRANCE'S EXTERNAL EXCHANGES OF CHEMICAL PRODUCTS

(2005 data, in billions of euros)



SOURCE: CUSTOMS

## France, at the crossroads of European chemistry

# The main regions for the chemical industry in France

*In France, the chemical industry is established throughout the country. However, it is concentrated in certain regions, according to speciality.*

### Platforms for pooling resources

In France, six major platforms are entirely dedicated to chemistry. Located in areas which are only slightly urbanized and Seveso II classified, they group chemical industries, their subcontractors and suppliers for an effective pooling of needs. A distribution network for industrial fluids, waste processing and disposal: sharing infrastructures significantly reduces investments and running costs. Services provided (maintenance, design office, assistance in opening a new unit, stock and logistics management etc.) are also available at lower cost.

- **Le Havre-Port-Jérôme-Rouen**, in Normandy, is France's leading petrochemicals centre, with Total, ExxonMobil Chemicals and Shell refineries. This platform supplies 50% of French production of plastics and elastomers and 80% of additives and lubricants.
- **Dunkerque**, in the North, has the biggest industrial gas production plant in Europe.
- **Fos-Lavera-Berre**, near Marseille, is the biggest petrochemical site in southern Europe. It includes 40% of French production of ethylene and 60% of butadiene. It is also the only French site and one of the few in the world to supply ethylene oxide.
- **Lyon-Feyzin**, in Rhône-Alpes, is the French leader in mineral and organic chemistry.
- **Chemparc**, in Aquitaine, mainly hosts industrial fine chemistry and speciality industrial units.
- **Carling**, in Lorraine, specializes in petrochemicals and plastics chemistry. The two French giants, Total Petrochemicals and Arkema, employ 1700 people there, to which can be added the 100 employees of Altuglas, a company specializing in methyl polymethacrylate.

### Clusters to stimulate competitiveness

A new tool in French industrial policy, competitiveness clusters group businesses, public and private research centres and training organizations in one place, all working in close cooperation on **technologically innovative projects**. These clusters have international visibility and ambition. The government has awarded the label to 66 clusters in different technological fields. In the chemical sector, four competitiveness clusters have been named:

- **Axelera** (Chemistry and environment), in Rhône-Alpes;
- **Industries et Agroressources**, (Agro Industries), in Champagne-Ardenne and Picardy;
- **Cosmetic Valley** in the Centre, Ile-de-France and Upper Normandy;
- **PASS** (Perfumes, aromas, scents and flavors), in Provence-Alpes-Côte-d'azur and Rhône-Alpes.

Apart from these four essentially chemically-oriented clusters, chemical companies contribute to the success of twenty other competitiveness clusters. Health, agrifood, textiles, automobile, aeronautics, materials: chemical fields of intervention are practically limitless!

### CHEMPARC, A MODEL OF INTEGRATION IN THE SOUTH-WEST

Located near Pau, in southern France, the 4 interconnected platforms at Chemparc provide chemical professionals with a range of very high quality services. Apart from natural gas and sulfur (liquid and solid), Chemparc provides users with a wide range of products of different degrees of purity, including that required by the pharmaceutical industry. The site has exceptional land coverage: more than 60 ha fully laid out and available immediately. Widely approved by professionals, this area with a strong chemical culture hosts many international companies: Air Liquide, Arkema, Sanofi-Aventis, Finorga and SBS in the Novasep group, Hydra (Norway), the North Americans Acetex and Lubrizol, the Japanese Calliope (Arista group) and Soficar (Toray group).

[www.chemparc.com](http://www.chemparc.com)



## SUSCHEM: FOR DURABLE EUROPEAN CHEMISTRY

The movement towards creating networks extends beyond our frontiers. European chemical industries, federated by the Cefic, have cooperated with the European Commission to set up a European platform for chemical research. Called Suschem, its purpose is to drive research and innovation as far as 2025 in white biotechnology, process engineering and materials and nanotechnology. Three fields which cover more than 30% of the global chemical market.

The French government supports businesses at competitiveness clusters with financing, tax relief and reduced social contributions for researchers involved in State-approved R&D projects, for a total of 1.5 billion euros over 3 years.

## COMPETITIVENESS CLUSTERS AND PLATFORMS IN THE CHEMICAL SECTOR



SOURCE: UIC JULY 2006

## France, at the crossroads of European chemistry

# United we stand Focus on the 4 Chemical competitiveness clusters

Creating highly qualified jobs, the competitiveness clusters are anchored in a dynamic, high-performance local economic fabric. These showcases for French chemical expertise will provide the French chemical industry with international influence in forward-looking sectors.

### Axelera (Environmental Chemistry)

The Rhône-Alpes region is already in the European Top 10 for chemical industries, with a 12.3 billion euro turnover in this sector and nearly 48,000 direct jobs, including 3000 researchers. The Environmental Chemistry cluster, named Axelera, has the strategic aim of **developing forward-looking chemistry** which includes environmental issues from the design stage of processes and products, and of being a long-term member of the European "Top 5" within 10 years. The cluster's operators have decided to concentrate on three technological themes: catalysis, process intensification and materials. Twelve cooperation projects have already been initiated between industries and laboratories for a global research budget of more than 82 million euros from 2005. The fields explored go from water treatment to eco-design of light materials or the development of renewable materials which can be used as basic chemical ingredients instead of oil-industry-based resources.

*Main operators: Rhodia, Arkema, Suez, CNRS, IFP.*  
[www.axelera.org](http://www.axelera.org)

### Industry and Agro-resources

The Industry and Agro-resources cluster targets emerging markets based on **using all the constituents of plants for industrial, innovative and competitive purposes**: biofuels, biolubricants, biopolymers, surfactants and niche markets with very high added value such as cosmetics, pharmaceuticals and speciality chemistry. Although the United States and Brazil are already major forces in the agro-resource sector, France intends to be the European leader by 2015, through this cluster.

The Industry and Agro-resources cluster is based in Champagne-Ardenne and Picardy, among the biggest agricultural production and agroindustrial areas in the European Union. It has abundant and varied plant resources (cereals, lucerne, beetroot, oleaginous plants, hemp, grapes, wood) grouped in European scale sectors.

*Main operators: twenty companies and cooperative organizations (Tereos, Euroluz, Soliance, Champagne Céréales, Capsom, Nouricia, etc.), some 25 research and training centres and chambers of industry and commerce for both regions.*  
[www.industries-et-agroressources.fr](http://www.industries-et-agroressources.fr)

With a global turnover of 14.6 billion euros, 8 billion of which earned in international markets, France is the world's leading exporter in the Perfume-Cosmetics industry.



### COMPETITIVENESS CLUSTERS FOSTERING MUTUAL BENEFITS

In the opinion of Pascal Barthélémy, R&D director at Rhodia and chairman of Axelera, the main asset of competitiveness clusters is their ability to bring together industries working in innovation. "By breaking through the barriers which normally separate the different operators in clusters, these

technological platforms should allow us to develop a new way of doing research. Collegiality and resource pooling are assets for rapid progress, while maintaining competition between the different partners, with an interdisciplinary approach to projects and a critical mass which should soon give us international visibility."

### Cosmetic Valley (Science of beauty and well-being)

Recently labelled as a competitiveness cluster, for the past 10 years Cosmetic Valley has represented an image of luxury and "Made in France" perfumes and cosmetics in the eyes of the world. This reputation is based on many types of expertise, from growing aromatic plants to the perfume industry, via the extraction of drug substances, formulation, conditioning, plastic injection, packaging and logistics. The cluster includes the biggest names in French perfumery. It groups 70% of industries in the sector, some 200 businesses, 16 000 jobs and € 2.5 bn. of turnover, with the medium-term objective of federating 300 companies representing 20 000 jobs.

The Cosmetic cluster's ambition is to consolidate its position as **the region where the most innovative, high-performance and safe cosmetic products are developed**. Two of the twelve projects have already been launched. The "Cosmeto-textile" project, proposed by Spincontrol in partnership with Tours University, has led to the creation of the first private research laboratory working on intelligent fabric. "Natural substances in the protection of cosmetic formulation", led by Adonis/Alban Muller International, will work on research into new raw materials developed by green chemistry.

*Main operators: Dior, Garnier, Guerlain, Hermès, Gemey Maybelline, Shiseido, Yves Saint Laurent, etc.*

*Nearly 1000 researchers work in the private sector (250 at LVMH) and in the public sector (hospitals and universities at Orléans and Tours, Inserm, CNRS, Inra, IRD).*

[www.cosmetic-valley.com](http://www.cosmetic-valley.com)

### Perfumes, aromas, scents and flavors (PASS)

In a context of growing competition and increasingly complex regulations, the Perfumes, aromas, scents and flavors cluster (PASS) aims to become a **major European cluster for characterizing and evaluating the ingredients used in perfumes, aromas, cosmetics and agricultural aromatics**. With its three cooperative programmes ("Characterization of natural products", "In vitro models of toxicological analyses" and "International regulations and standards centre"), the cluster will aim to anticipate the safety requirements of consumers and European Reach regulations, as well as combating allergies and exploiting the anti-obesity and anti-caries effects of certain plant extracts.

With 90% of the country's distilleries, Provence-Alpes-Côte d'Azur is the leading French region for the production of aromatic plants and essential oils, and the world's leading area for lavender production. One of PASS's objectives will be to protect and develop traditional, reasoned agriculture in Provence.

*Main operators: Mane et Fils, Yves Rocher, Derma-Développement, Galderma, Skinethic, Robertet, University of Nice, University Paul Cézanne in Marseille.*

### DIRECTION GÉNÉRALE DES ENTREPRISES (DIRECTORATE GENERAL FOR ENTREPRISE) (DGE)

Under the authority of the Minister of Economy, Finance and Industry and the Industry Minister, the Directorate General for Entreprise (DGE) is responsible for preparing and implementing French industrial policy. Its objective is to stimulate business competitiveness in an international context, initiate and promote an environment favourable to the development of companies and jobs, and support innovation and industrial research.

In this context, the DGE pilots the setting up of competitiveness clusters and supports their development, particularly providing support for their R&D programmes and international strategy.

[www.industrie.gouv.fr](http://www.industrie.gouv.fr)

### COMPETITIVENESS CLUSTERS PROVIDE OPPORTUNITIES FOR SMES

"Belonging to a competitiveness cluster gives us privileged access to university laboratories and all the other expertise in the network", explained Patrick Beau, director of Spincontrol, an SME heavily involved in Cosmetic Valley, particularly the Cosméto-textile project. A real "open Sesame!" Not forgetting financial factors, in the form of significant subsidies. Research projects at the clusters can be up to 45% financed by the State and local authorities.



## France, at the leading edge of all chemical sectors

### Widely diversified chemical specialities

High-performance materials, phytopharmaceuticals, resins, paints, glues, inks, chemicals for industrial use, etc: France offers a diversified, complete and innovative range in the field of paracheimistry.

#### A robust industry

Speciality chemistry, or paracheimistry, differs from basic chemistry (see p. 14-15) in having broader ranges of highly processed products, with specific performances and lower tonnages. This sector of activity employs more than 50 000 people in France in 350 businesses of various sizes, including 300 SMEs. This vital force provides the country with the means to meet the needs of all its industrial sector customers as well as those of mass consumption.

#### A strong presence in seed and plant protection

France is Europe's leading agricultural nation. It therefore represents a strategic market for major global groups which specialize in phytopharmaceuticals and they have all established subsidiaries here. This sector employs 4500 people for a turnover of 1.9 billion euros of which 50% in exports. **Bayer Cropscience France, Syngenta Agro** and **BASF Agro** occupy 60 to 65% of this consolidating market. Two other groups also play their part: **Cerexagri**, an **Arkema** subsidiary specializing in plant and harvest protection products, and **De Sangosse**, based in the South-West, specializing in anti-toxins and adjuvants.

#### Rhodia and Arkema: two world leaders

Leading figures in French speciality chemistry, the Arkema and Rhodia groups lead the way as major players in global chemistry. Both make more than 5 billion euros turnover and each has nearly 20 000 employees.

**Arkema**, resulting from the reorganization of the Total group's chemical branch, was successfully listed on the Stock Exchange in May 2006. The group has organized its activities in three coherent and integrated centres:

- Vinyl products (24% of turnover),
- Industrial Chemistry (intermediaries, 42%),
- Performance Products (34%).

Arkema is in the leading group in the world in many fields, particularly thiochemistry and speciality polyamides. The group is known throughout the world for its leading trademarks, including **Altuglas®/Plexiglas®** (acrylic polymers), **Rilsan®** (polyamides 11 and 12) et **Forane** (cooling fluids).

**Rhodia** is also organized into three activity centres:

- Performance Materials (45% of turnover),
- Applications Chemistry (35%),
- Organics and Services (20%).

The group is leader in most of its sectors, particularly polyamides, and also n° 1 in the world for high-performance silicas used in tyres, for mild amphoteric surfactants used in shampoos and soaps and for products based on rare earths used for automobile catalysis and electronics.

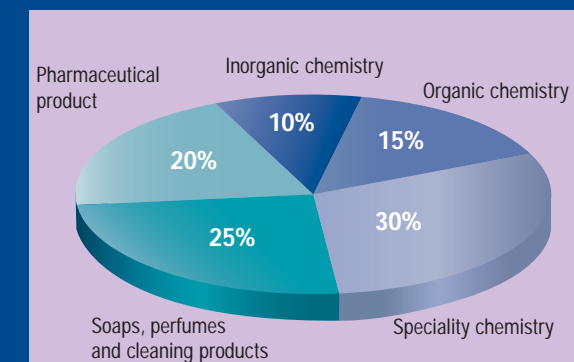
#### Resins with high technological content

In the field of resins, France has one world-class operator: the division of the **Total** oil company which includes **Cray Valley, Cook Composites & Polymers** and **Sartomer**. With 4000 employees and a turnover of 2 billion euros in 2005, this unit is the world's second largest producer of resins. Its innovative product range meets the sector's requirements in coatings (paints, inks, varnish, adhesives) and thermosetting composites based on unsaturated polyester resins.

#### Carbon, solutions for future applications

Supplier of materials of the future, the carbon fibre segment of industry is growing rapidly. Global demand should therefore grow by more than 10% per year to reach 34 000 t/year in 2008. Very well positioned in this niche, **Soficar** (Société des fibres de carbone – carbon fibre company) is a preferred supplier to the aeronautical industry (Airbus, Boeing, etc.) and sports and leisure industries. Demand for industrial applications is also in full expansion. Based at Abidos in the Pyrénées-Atlantiques, Soficar is a joint venture, 30% held by Arkema and 70% by the Japanese company Toray.

### THE DIFFERENT CHEMICAL INDUSTRY SECTORS IN FRANCE



SOURCE: UIC

#### ARKEMA AND NANOTECHNOLOGIES

This French chemical company set up a semi-industrial plant at the beginning of 2006, for continuous production of carbon nanotubes using a fluidized bed batch process. Installed as part of the Lacq Research Group, this unit will have had 10 million euros in investments. Its current capacity is 10t/year. And the 2010 objective is to install an industrial unit of several hundred tonnes per year to meet the constantly growing demand of the nanomaterials market.

#### BIOHUB, CEREAL-BASED CHEMISTRY

BioHub is one of the first six projects approved by the Industrial innovation agency (AII). It aims to get the most out of agricultural resources by developing new industrial processes to synthesize chemical products. The R&D programme, with an estimated budget of €98m, will be supported by the AII to €43m, spread over seven years (see p.19).

Led by **Roquette Frères**, world leader in polyols and n° 4 in starch derivatives, the consortium includes major European groups such as **Arkema, DSM, Sidel** and **Cognis**, SMEs such as **Metabolic Explorer** or the polymer producer **Tergal Fibres**, as well as public research laboratories. Links are also planned with the Axelera and Matériaux à usage domestique (Materials for domestic use) competitiveness clusters (see p. 8-9). BioHub should create 600 jobs. The project will notably study the use of isosorbide (a sorbitol derivative) for the production of new polymers for use in heat-resistant food packaging, or the production of plastifiers to replace phthalates, and new solvents and road binders.

France, at the leading edge of all chemical sectors

## Fine chemistry in France: internationally-recognized expertise

*This sector of excellence represents a free market in France worth about €4 bn, to which can be added a captive market (production used internally, not marketed) of about the same size. These figures reflect the drive and talent of French companies.*

### Complex molecules with high added value

Produced by the "large intermediaries" in basic chemistry or plant and animal extracts, the products of fine chemistry are generally the result of numerous chemical reactions in series at the end of an intense research and development process. Pharmaceutical, cosmetological and phytosanitary active substances, food flavourings, perfumes, additives, explosives, photographic products, colorants, etc: these complex molecules have high added value and supply many booming downstream markets.

### Pharmacy, cosmetics, agrochemistry and electronics

Several French groups have diversified into fine organic synthesis for the pharmaceutical, cosmetics, agrochemistry and electronics industries. **PCAS**, devotes half of its activity to the production of synthesis intermediates and drug substances for the pharmaceuticals industry. Also present in several of these sectors, **Isochem** a **SNPE**, group subsidiary, specializes in complex synthetic processes and produces customized molecules for its customers. The company manages chemical risk in reactions such as nitration, phosgenation and hydrogenation.

Other companies such as **Minakem**, **Synkem**, **Provence Technologies**, **Oril Industrie** or **AtlanChim**, have become experts in customized synthesis for the pharmaceutical trade.

### Aromas and perfumes

The French aromatics industry includes the perfuming materials used in perfume, beauty, personal hygiene, soaps, detergents and cleaning products, as well as the sector of aromatics for the food and pharmaceutical industries. With its roots in the distant past, this national industry constantly evolves with technology, legislation and fashion and today is spread throughout the world. This sector represents 10% of the global market, with a turnover of €1.1 bn. It includes 130 companies, employing some 6000 people, half in the Grasse region in South-Eastern France, the main perfume producing region in the world. Many of these companies also have foreign subsidiaries making up a powerful sales force, so that 65% of turnover is made outside France.

The sector relies on teams of very high level researchers. **Mane et Fils** has 16 R&D centres throughout the world and devotes 10% of its turnover to them. The same applies to **Robertet**, with 10 R&D centres across the world. The company bases its brand image on exploiting natural aromatic products and provides a unique range of raw materials with innovative properties for use in the composition of aromas and perfumes. Smaller companies, such as **Moraflor** and **Expressions parfumées** also play an active part in the creativity and international reputation of this French sector.

### WHY CARRY OUT YOUR RESEARCH IN FRANCE?

For Prestwick Chemical, an American company working in medicinal chemistry, France has proved to be the best location for its service industry. "As well as the aid provided by local authorities while we set up, we benefited from our status of Young Innovative Company and from research tax credit granted by the French government, which relieves us of taxes until 2007" explained Paul Bikard, financial director. "The Strasbourg region, close to many of our major customers in the pharmaceutical and biotechnology industry, also provides us with highly-qualified labour. And recruiting a PhD qualified chemist is 35% cheaper here than in the United States, including social contributions. Furthermore, we have not noted any negative impact of the "35 hours" rule on our employees' productivity. It has even had a beneficial effect on their motivation!"

### THE UNION OF CHEMICAL INDUSTRIES (UIC)

A professional federation representing nearly 1200 businesses (more than 230 000 employees), the UIC is the voice of the chemical industry in France. It defines common positions and actions, identifies the themes of a planned industrial policy and promotes it with governmental authorities and international organizations. Its effectiveness is based on a network of 17 regional UICs and 18 sectoral unions. On a European scale, it is particularly active as a member of Cefic, the European council for the chemical industry. Further information on [www.uic.fr](http://www.uic.fr) and [www.cefic.be](http://www.cefic.be)

### INVEST IN FRANCE AGENCY (IFA)

is the national body responsible for promoting, prospecting and facilitating of international investment in France. It also coordinates initiatives promoting the appeal and image of France. The IFA network operates worldwide, with offices in France at both national and local level. It draws on the expertise of specialists in a range of disciplines based at its head office in Paris, as well as in offices in North America, Europe and Asia. In France, IFA works in partnership with regional development agencies to offer international investors outstanding business opportunities and customized services.

Infos on [www.investinfrance.org](http://www.investinfrance.org)



## France, at the leading edge of all chemical sectors

# Solid basic chemistry

France occupies a leading place on the global market for basic chemistry and has several global groups such as Air Liquide and Total Petrochemicals.

### An important industry

Unlike fine chemistry and speciality chemistry, basic chemistry produces high tonnages in large capacity installations involving major capital investments. These products are manufactured with just a few reaction stages, using easily accessible raw materials (water, air, minerals, hydrocarbons, biomass), and are made using inorganic chemistry (chlorine, soda, nitrogenous fertilizer, industrial gases) or organic chemistry (ethylene, propylene, polyethylene, polypropylene, etc.).

It is a **highly concentrated industry** which is organized between thirty large groups with more than 500 employees, French (**Air Liquide, Total Petrochemicals**), European (**Shell Chemicals, Ineos, Nova Innovene, Solvay, Basell**) and American (**ExxonMobil Chemical, Dow Chemical**). These groups make a large proportion of their turnover in French production, estimated at €29.8 bn in 2005.

### Total Petrochemicals, from hydrocarbons to polymers

Total Petrochemicals, the Total group's petrochemical activity and 4th biggest oil company in the world, covers many domestic and industrial markets, including the packaging, construction and automobile industries. Through its membership in the oil group, Total Petrochemicals has strong links to its refining activity, particularly in Europe and the United States, as well as its exploration/production activity, notably in the Middle East (Qatar) where the company is a major producer of ethylene from ethane. With a global labour force of more than 7 000 people and a 2005 turnover of €11.4bn, Total Petrochemicals has 17 industrial installations in Europe, the United States, the Middle East and Asia. In France, the company has three sites, largely integrated in oil and petrochemical complexes in Normandy, Lorraine and the Rhone basin. It also has a centre for technical expertise in Lyon and a research and development centre at Mont/Lacq in South-West France.

### Air Liquide, close to its customers

Founded in 1902 in France, the Air Liquide group is the world leader in industrial and medical gases, pure or mixed, and their associated services. Of its 36 000 employees throughout the world, Air Liquide has about 11 000 in France. The group provides solutions for industries as different as iron and steel, refining, health, chemical, electronics and agrifood.

For optimal proximity and reactivity towards its 300 000 French customers, Air Liquide is organized in regions grouping all its customers' service structures and has 21 production sites in France, close to the main industrial areas which are served by pipeline. Furthermore, to draw closer to small industries and SMEs, Air Liquide has about 2800 distributor partnerships. The group works within a sustainable development policy. It made €10.4bn in 2005, an 11% increase on 2004.

### Biofuels, a new direction for basic chemistry

Whether considering biodiesel, obtained from vegetable oils and blended into diesel fuel, or bioethanol and bio-ETBE, stemming from fermentation of cereal or sugar crops and blended into gasoline, **the French biofuels sector is booming.**

With an ambitious government plan in favour of these "green" fuels, a large number of plants are being built. The French **Diester Industrie**, leading European producer of biodiesel, is investing in seven new units with a total production capacity of 1.35 million tonnes per year.

There are as many projects in the bioethanol sector and these should take France's production capacity from 100 000 tonnes in 2005 to 900 000 tonnes in 2008. **Roquette Frères**, the world's leading producer of polyols, has begun construction of a new unit with an eventual capacity of 160 000 t/year in Alsace. The group is also piloting the BioHub project approved by the Agency for industrial innovation (see p. 11) to optimize the use of agricultural resources in chemistry. The sugar producer **Tereos** has two projects in progress: a wheat distillery of 3 million hectolitres per year (i.e. 240 000 t/year) in Seine-Maritime and a beetroot distillery with the same capacity in the Aisne. We can also mention the Cristanol project, in the Marne, headed by the sugar producer **Cristal Union** and the Champagne Céréales cooperative. The unit, which will use both beetroot and wheat, will have a production capacity of 280 000 t/year of bioethanol.

Separately, chemical producer **Lyondell** selected its Fos-sur-Mer facility to set up the world's largest bio-ETBE production unit. Its potential maximum capacity is 750 000 tonnes/year. **Lyondell** is the largest producer of this biofuel in the world.

France has also attracted foreign investors, with the Spanish group **Abengoa Bioenergy**, European leader in ethanol, which has formed a joint venture, **AB Bioenergy France**, with **Aquitaine Industrie Innovation** and the holding company **Oceol**, which groups the AGPM (Association générale des producteurs de maïs - General Association of Maize Producers) and all the agricultural cooperatives and traders in Aquitaine and the Midi-Pyrénées who are interested in the project. This operation will lead to the construction, in the South-West, of a plant producing 180 000 t/year of ethanol from maize. An investment of €150m which should lead to the creation of 100 direct jobs and 150 indirect jobs for an expected turnover of €135m per year.

The French government has launched a large-scale plan to develop biofuels. By 2015, they should be incorporated in the final product up to 10%: which is twice the European objective.



### SOLVAY PROFITS FROM THE BOOM IN FRENCH BIODIESEL

It is no accident that the Belgian chemical firm invested in its French site at Tavaux in the Jura to install the first industrial unit for demonstrating a new epichlorohydrin production process (a substance used in the production of epoxy resins, reinforcing paper and water purification). Known as Epicerol, this process is based on the transformation of natural glycerine, a sub-product of trans-esterification, which replaces propylene in the classic process. **Solvay** is therefore benefiting from the dynamic biofuels market in France and the availability of large quantities of glycerine at a reasonable price. The group has signed a long-term contract with the French company **Diester Industrie** for the supply of extremely pure glycerine produced by the Axens process, developed by the French Petroleum Institute (IFP).





## The new horizons of French chemistry

# Chemistry serving the environment

*A new chemical era began in the 1990s: green chemistry. And in this field, France is already a length ahead!*

### Internationally renowned environmental expertise

Whether for water, air or waste processing or recovering polluted land, French competence is recognized everywhere. Our companies have developed many products and processes beneficial to the environment and are taking part in the emergence of cleaner industries.

#### 1/ Water treatment

In this field, France has several world leaders such as **Veolia Water**, world leader in water services, or **Suez**, pilot of the Rhodanos cooperation project at the Axelera competitiveness cluster (see p. 8-9). **SNF Floerger** is the world's leading producer of polymers for water treatment, enhanced oil recovery and reagents for mines. Beside these large companies, innovative SMEs occupy niche markets. This is particularly the case of Stradia, a Basque start-up which has produced a new substance based on stabilized potassium ferrate in solid form: a first in the field of water treatment! This compound carries out oxidation, coagulation and disinfection actions.

#### 2/ Treating air and fumes

Processes for scrubbing and absorption, oxidation, adsorption on active carbon or zeolith: there are many air and gas purification techniques. The French specialist in this field is **Lab S.A.**, a member of the CNIM Group, very active in the environmental sector. The company offers turnkey installations. It is particularly reputed for mercury elimination and the destruction of dioxins. Its Dedioxlab technology is currently the only wet catalytic process working at the adiabatic temperature of the gases (around 60°C).

**Europe Environnement** also offers a wide range of solutions for treating noxious, corrosive and odoriferous gaseous effluent, with emphasis on gas scrubbing.

Photocatalysis, emerging technology in air treatment, is one of the specialities of the **Saint-Gobain** group. It is also a research theme followed by **Ahlstrom**, a Finnish company with a research centre at Pont-Evêque, near Lyon. This commercialized process has already proved itself in the destruction of odours in effluent from pig farms, wine and oil production plants, lagooning, composting stations, etc. And in the medical field, it is used to destroy bacteria and viruses.

In the field of active carbon, France has one major operator: **Ceca**, 2<sup>nd</sup> largest European producer of this compound largely used in air purification and odour control and the recovery of volatile hydrocarbons. This **Arkema** subsidiary, which is also the world's n° 3 in molecular filters, makes more than 70% of its turnover outside France.

Developed by **Solvay** in France, the Neutrec dry process is used for maximum purification of industrial fumes and fumes from domestic waste incineration plants by sodium bicarbonate. It guarantees that standards governing atmospheric emissions of acids, heavy metals and dioxins are respected without transferring pollution to the water or soil.

#### 3/ Industrial waste treatment and soil depollution

France also has many large groups specializing in industrial waste collection, treatment, recycling and waste-to-energy recovery, such as **Veolia Propreté** (previously Onyx), **Séché Environnement** or **Inertec**. Most of these groups have also diversified their activity to treating and rehabilitating polluted sites and soils. **Veolia Propreté** is also working with CNRS on a phytoremediation process for soils polluted by sludge spreading.

### A strong commitment to durable chemistry

The concept of durable development has rapidly invaded every aspect of the economy. With this, **green chemistry** is changing the basis of the chemical industry. Products and processes are now designed to reduce their negative effect on health and the environment, increasingly use raw materials and renewable energy sources, and optimize yield and energy efficient processes. France has invested in this sector from the start. Furthermore, it forms the basis of the work done by its three main competitiveness clusters in chemistry, Axelera, Cosmetic Valley and Industries et Agroressources (see p. 8-9).

### A priority: to fight against global warming

In France, the chemical industry is taking part in the joint effort to reduce greenhouse gas emissions while respecting the Kyoto protocol. In 2002, its companies set an objective to reduce these emissions by 30% between 1990 and 2010. And the objective is about to be achieved in spite of activity growing by about 3% per year during this same period.

With recognized expertise in the field, **Rhodia** has decided to export its technology to its adipic acid production sites at Onsan (South Korea) and Paulinia (Brazil). These are the two biggest projects recorded to date in the world, within the context of clean development mechanisms (CDM) defined in the Kyoto protocol. Planned investments on these two sites will enable Rhodia to market 11 to 13 million tonnes of CO<sub>2</sub> emission credits per year from the beginning of 2007. Between 1990 and 2010, the group with thus have reduced its CO<sub>2</sub> equivalent emissions by 56%.

### A pact for the quality of life

Conscious of its responsibilities, the chemical industry voluntarily undertook to control risks and protect the environment by initiating a "Commitment to Progress" 15 years ago. This programme guides companies towards permanent improvement in the safety of people and property and environmental protection. Through this procedure, the chemical sector records one of the lowest rates of occupational accidents and severity indices.

### Reach: to protect the environment and human health

The French chemical industry is promoting a new European policy relative to chemical substances. It shares the objectives of the European regulation project Reach, which aims to reduce health and environmental risks and plans to introduce a system of recording, evaluation and authorization concerning 30 000 substances produced in or imported into the European Union. However, the French chemical industry is defending the idea of a regulation which does not penalize competition and innovation, which can really be applied by all businesses, including SMEs.

### PRIZES FOR INNOVATION TO IMPROVE THE ENVIRONMENT

In 2006 the first scientific and technological prizes on the theme of chemical innovation for environmental application were launched. These Pierre Potier prizes honour industrial success in four areas:

- designing, producing and marketing clean products which respect the environment
- the reasoned use of renewable resources for chemical processes
- the creation of companies using technology based on green chemistry
- projects intended to improve the environment through the use of technology and chemical products.



### HELP SMES TO APPLY REACH

The Direction générale des entreprises (Directorate General for Enterprise) (DGE) and the Union of Chemical Industries (UIC) is launching a major joint action so that 800 SMEs which produce, import use and/or distribute chemical substances can prepare to implement Reach. These actions, performed in 2006 and 2007, take four separate forms:

- presentation sessions provided free of charge over half a day;
- two-day joint training actions;
- value chain actions, particularly in the presence of customers and suppliers in the same sector;
- individual support on the industrial site for certain SMEs.

A provisional timetable is available at <http://www.uic.fr/fr/reach04.htm>



## The new horizons of French chemistry

# Innovation, the driving force of French chemistry

*French chemistry has always been at the leading edge of research. And if, at a time when global competition is increasingly fierce, it is so well positioned in the race for innovation, this is due to the excellence of its researchers and heavy investment in R&D.*

### Dynamic research

The Institut de science et d'ingénierie supramoléculaires de Strasbourg (Strasbourg Institute of Science and Supramolecular Engineering), the École supérieure de chimie physique électronique de Lyon (Lyon Advanced School of Electronic Physical Chemistry) (CPE Lyon), the Institut de chimie de la matière condensée de Bordeaux (Bordeaux Institute for Condensed Matter Chemistry), the Laboratoire de chimie de coordination de Toulouse (Toulouse Laboratory of Coordination Chemistry), the Institut européen des membranes de Montpellier (Montpellier European institute of Membranes). And the list goes on...

**Public research in chemistry is widespread across France.** The CNRS (Centre national de la recherche scientifique – National centre for Scientific Research) is a member or partner of all these structures and devotes 8% of its resources to the discipline. The CEA, another major actor in public research in France, also allocates considerable resources to the field of chemistry. And partnerships between these structures and the private sector are constantly developing. Private financing represents, for example, 3/4 of the budget of the Laboratory of Organometallic Surface Chemistry, a CNRS laboratory installed in the ENS CPE Lyon premises. Three thousand teacher-researchers attached to French universities also make a very significant contribution to academic research in chemistry.

**In the chemical industry, nearly 12 000 people are engaged in research and development, including 4400 researchers.** French industries devote more than 3% of their turnover to R&D. The Institut français du pétrole (French Oil Institute) (IFP) holds more than 12 000 patents, a portfolio which gives evidence of the innovative force of this independent research institute.

### KEY FIGURES IN PUBLIC FRENCH RESEARCH IN CHEMISTRY

	2006 data from the Ministry of Research	2006 data from the CNRS Chemistry Department
Number of researchers	4500 (including 3000 teacher-researchers)	1760
Number of laboratories	240	170
2006 budget (M€)	80,0*	26,4

### Innovative SMEs

SMEs are also very active in R&D. They employ 32% of the total number of researchers in the chemical industry. AtlanChim, Mapaero, Nanoledge and Solvionic, to mention just four of them, give a perfect illustration of the variety and creativity shown by French SMEs and VSEs.

**Rewarded with the status of Jeune entreprise innovante (Young Innovative Company) (JEI), The Nantes laboratory AtlanChim,** is an expert in customized synthesis of complex molecules and provides rare expertise: selective marking by stable isotopes. Subcontractor to research laboratories in the pharmaceutical, cosmetology, biotechnology and agrochemical industries, it supports its customers in the discovery and development of their drug substances.

**Installed close to Toulouse, the SME Mapaero** attracted Airbus with its water-dilutable paints. They only contain 10 to 15% of solvent, compared with 70% in traditional paints. Another invention is a low-density undercoat which should lighten the A380 by 100 kg.

**The patented technology "Nano In" belonging to the young Montpellier company Nanoledge** is used to incorporate any type of carbon nanotubes in different polymer matrices for the sports, aeronautics, automobile, electronics and construction industries. This integration technology transfers the exceptional properties of carbon nanotubes to the final product, to manufacture high-performance materials (improved mechanical properties or new electrical and thermal conductivity properties).

**Solvionic, a young VSE in the Midi-Pyrénées, is the only French producer of ionic liquids.** These non-volatile and non-inflammable products have excellent solvation powers coupled with very good selectivity and give excellent yield in many chemical reactions. They therefore attract the pharmaceutical and petrochemical industries in particular. Ionic liquids also make very good electrolytes and Solvionic has signed a partnership with Hydro-Québec, Canada's electricity board, to develop new materials for lithium-ion batteries, fuel cells and hybrid supercapacitors.

\* This amount is distributed between allocations to laboratories, allocations in response to calls for bids (concerted actions, priority actions, etc.), research allocations to finance doctoral students and help in international cooperation.

### A range of incentives

Conscious of the need to innovate in order to stay in the lead, France has recently introduced more incentive measures to encourage research and create a competitive environment.

**Competitiveness clusters** (see p. 8-9) were launched by the government in July 2005 and piloted by the Direction Générale des Entreprises (Directorate General for Enterprise). These clusters are intended to stimulate local synergy by supporting the development of innovative industrial activities and jobs throughout France. The ANR, AII and OSEO are involved in financing research projects at these clusters [www.competitivite.gouv.fr](http://www.competitivite.gouv.fr)

**By introducing the status of Jeune entreprise innovante (Young Innovative Company) (JEI) in 2004,** France has become the most attractive European country for fiscal incentive for innovation. This status allows SMEs less than 8 years old (with fewer than 250 employees and turnover less than €40m) devoting at least 15% of their total costs to research and development, to benefit from fiscal and social advantages. JEIs are exempted from social security contributions for personnel working in research. They also benefit from an exoneration of income tax or professional tax (total for the first three years, reduced by 50% during the next 2 financial years), exoneration from annual flat-rate tax as long as it has JEI status, immediate reimbursement of research tax credit over 3 years, and 7 years exoneration from council tax.

**"Crédit d'impôt recherche" (Research tax credit) (CIR)** has been supporting R&D since 2004. It has two components: one part in volume (10% of annual R&D expenses committed) and one part equivalent to 40% of the increase in R&D expenses relative to the average for the two previous years. Amounts allocated to human and material resources for research, subcontracted R&D work, technology watch, patents and their defence are all taken into account.

**The "Agence de l'innovation industrielle" (Industrial Innovation Agency) (AII)** creates, selects and finances major programmes for structuring industrial innovation proposed by large companies, with global market prospects and the aim of obtaining a significant share of the market. The AII has a capacity for intervention starting at €2bn, later continuing at €1bn per year. [www.aii.fr](http://www.aii.fr)

In less than 20 years, two French chemists have been awarded the Nobel prize: Jean-Marie Lehn in 1987 and Yves Chauvin in 2005.

**The public group OSEO** was created in 2005 through an association between the "Agence nationale de la valorisation de la recherche" (National Agency for Research Enrichment) with the "Banque du développement de PME" (SME Development Bank) with the aim of promoting the development of innovative companies and spreading innovation through the SME network by providing advice and financing (advances at zero interest rate, reimbursed in the event of success, loans, etc). [www.oseo.fr](http://www.oseo.fr)

**The Agence nationale de la recherche (National Research Agency) (ANR),** created in 2005, is in charge of supporting fundamental and applied research. It helps transfer the results of public research to businesses within the context of collaboration projects involving at least one company and one public research centre. [www.gip-anr.fr](http://www.gip-anr.fr)

### France, leader of European projects

French research centres are partners in many European research projects. Some of these projects are led by French researchers.

#### Impulse:

##### for future process intensification

Inventing the chemical industry of the future, making it cleaner and safer by radically changing the production systems used in chemical industries: this is the challenge taken up by Impulse, one of the flagship projects in the 6th European framework programme for technological research and development (PCRDT) and Suschem durable chemistry technology platform (see p. 6-7). The challenge is to incorporate production microstructures (intensified devices) into existing macrostructures. Coordinated by Michel Matlosz, professor at Nancy LGSC-CNRS, Impulse includes 20 industrial and university partners from seven European countries, notably GlaxoSmithKline, Degussa, Procter & Gamble Europe and Siemens.

#### Topcombi:

##### combinatorial chemistry for catalysis

Another project introduced by the Suschem platform, Topcombi is intended to accelerate the discovery of alternative synthesis routes by a factor of 10 to 100, using combinatorial chemistry applied to catalysis. These are decisive technological breakthroughs which will meet the European Union's urgent need for durable energy, chemistry and environmental protection. This consortium of 22 partners from 11 European countries is coordinated by Claude Mirodatos, research director at the CNRS institute of Catalytic Research. It involves major European chemical companies such as Arkema, Dow-Benelux, Procter et Gamble, Johnson Matthey, etc.

## The new horizons of French chemistry

# Engineering and service companies and equipment suppliers: the essential partners of chemistry

Remarkably positioned at the cross-roads of all the chemical sectors, France also has a complete network of partners meeting all the industry's needs. Engineering companies, service companies and equipment suppliers support laboratories and industries in research, production, environmental protection, process control, regulation, etc.

### Technip: excellence engineering recognized throughout the world

With a workforce of 21 000 people and annual turnover of about 5.4 billion euros, **Technip** is classified in the first 5 world leaders in engineering, construction and services in the hydrocarbon and petrochemical sectors. With expertise in processes and technology, Technip has carried out hundreds of projects on five continents, from simple units to the most complex projects. For example, the group was chosen by Qatar Petroleum, Chevron Phillips Chemical and Total Petrochemicals to build their ethane cracker in Qatar, with a capacity of 1.3 Mt/year. The engineering company covers all sectors of the chemical industry: production of organic intermediate products, plastics and fibres, inorganic intermediate products, lubricants, paints, amino acids, pesticides, pigments, etc. Its technologies are leaders in the field of electrochemistry (particularly sodium chlorate) and its unique range of software and solutions applied to formulation and discontinuous processes are recognized as being among the most efficient.

### De Dietrich Process Systems: an ancestral industrial tradition

While developing strongly internationally, **De Dietrich Process Systems** is still deeply attached to its origins in Alsace, where the company was started more than three hundred years ago. Today DDPS is a global supplier of integral equipment for processes, systems and services for fine chemistry and pharmaceuticals. Its global offer and ability to serve customers throughout the world, mainly large international groups, is based on three specialities: vitrified steel equipment (double-wall reactors or coil reactors, storage tanks, columns, agitators etc.), filtration and drying equipment and anti-corrosion glass components. Established industrially or commercially in fifteen countries, DDPS employs 1200 people, of whom 600 are outside France, and makes 90% of its turnover elsewhere.

### Environnement S.A: instrumentation and the environment

European leader in instrumentation for analyzing and measuring the environment, **Environnement S.A** designs, produces and markets devices for constant measurement of air quality, industrial emissions and exhaust gas control and water quality surveillance, using the most advanced technologies. The company was successfully listed on the Stock Exchange Alternext market in January 2006.

Equipment suppliers in the chemical sector cover a global market worth 100 billion euros. With about 5% of this market, French companies, mainly SMEs, have an important part to play!

### Coreau: expert in complex gear pumps

**Coreau** has been designing, building and manufacturing gear pumps at a very high level of technology for more than 15 years. From prototype to large production runs, from the smallest to the biggest pump (more than 2500 kg), Coreau meets the requirements of the chemical, pharmaceutical, cosmetic and agrifood industries.

### SGL Carbon Technic: pumps for all purposes

**SGL Carbon Technic** manufactures centrifuge pumps from 2 to 3500 m<sup>3</sup>/h and heat exchangers from 0.5 to 1000 m<sup>2</sup>, with unrivalled quality in terms of reliability and resistance to corrosion, temperature and abrasion. Indeed, it has developed a composite material which solves these problems: named Diabon, it is produced from graphitized carbon and organic polymers. Pumps and heat exchangers made of Diabon are entirely designed, produced, assembled and tested in the Grenoble area.

### Equip Labo: everything for the laboratory

**Equip Labo** specializes in the design, manufacture and installation of laboratory fittings (benches, hoods and fume cupboards, furniture and storage cabinets, etc.). With its experience and ability to handle any type of project – from design to installation – Equip Labo has gained the loyalty of its customers, including the biggest names in the chemical, pharmaceutical, cosmetic, oil and agrifood industries, not forgetting the research laboratories, universities, high schools and secondary schools.

### Noviloire: precision required!

Specializing in the design and manufacture of automatic analytical systems for 25 years, **Noviloire** also uses its expertise in automatic sampling methods and the distribution of microquantities of liquid (from 1 microlitre to several millilitres). Noviloire also makes OEM modules for integrators: manipulator arms, syringe pushers, rotation module, etc.

### Manoir: metal for petrochemicals

For more than 40 years **Manoir Industries** has been designing and using alloys and processes to manufacture high-performance moulded and forged metal parts. In the field of petrochemicals, the group's 2nd biggest customer market, Manoir Industries particularly develops tubes, fittings and complete harnesses for cracking furnaces and reforming furnaces for the production of ethylene, methanol, ammonia and hydrogen.

### Tennaxia: a global offer of advice and software

Combining its consultancy skills with those of its computer engineers enables **Tennaxia** to provide global solutions to industry. Its software package Tennaxia Environnement includes 3 modules: waste, conformity and indicators. It attracted the **Rhodia** group which has utilized this product in 13 plants in France for a global vision of its waste problems.

## CHEMICAL EQUIPMENT UNIONS

**Gific** (Groupement interprofessionnel des fournisseurs de l'industrie chimique - Interprofessional Group of Chemical Industry Suppliers) includes six professional unions for pumps, valves and fittings, compressors, boiler-making, reactors and process equipment, command-control, measurement and electrical equipment. These unions represent 650 French companies making a turnover of 5 billion euros, of which 45% is exported.

**Fabrilabo** is the union of laboratory equipment manufacturers and traders. This union includes 31 companies employing 7000 people.



## The new horizons of French chemistry

### A complete training system

*Reputed for its high quality labour, France is also internationally renowned for its engineering schools. The extremely varied French training system has adapted to the many facets of chemistry and provides schemes for all the sector's specialities.*

#### Engineering schools: the highest level

Distributed throughout France, forty schools prepare students for an engineering diploma in chemistry and chemical engineering. They are usually classified into 3 categories:

- 1/ the 17 schools of chemistry and chemical engineering within the Gay Lussac Federation, training some 1500 engineers every year.
- 2/ the general schools, which include programmes or specific options for a particular field of chemistry or material engineering.

These two types of schools recruit their students two years after high school graduation and train engineers in 3 years. This highest level selects candidates through a highly selective competitive exam and attracts many foreign students who represent nearly 10% of students. Internationally open, these schools offer courses in other countries as well as exchange schemes with foreign students and teachers.

- 3/ the application schools are open to young qualified engineers who want to specialize in particular fields of chemistry (fats, rubber, ceramics, etc.).

#### University training: for research and teaching

The new system of European higher education, the LMD (Licence-Mastère-Doctorat – Undergraduate degree – Masters – PhD) is now well established in French universities and engineering schools. Diplomas are awarded after 3, 5 and 8 years of study. This harmonization gives greater coherence to national diplomas: recognised in 32 European countries as well as the United States and Canada, they facilitate mobility between countries for students and young qualified professionals.

Generally speaking, the university route suits future teachers and researchers, in both the public and private sectors.

#### Professional training: provides highly qualified labour

For young people, the opportunity to work in companies through apprenticeship and day-release courses is important: more than 3500 day-release contracts are signed every year.

Technical high schools (lycées professionnels) prepare 4 specialities which concern chemical industries: Process Industry, Transformation Bio-industry, Surface Treatment and Controlling Automated Production Systems. With a professional diploma, these highly qualified workers are appreciated in industry.

Two series of technological Baccalaureats (high school graduation level) (STL – Science et Techniques de Laboratoires (Laboratory Science and Techniques) and STI – Sciences et Technologies Industrielles (Industrial Science and Technology) prepare students for senior technician qualifications. They can choose between 8 BTS (brevet de technicien supérieur – senior technician's diploma), 5 DUT (diplôme universitaire de technologie – university diploma in technology) and a number of DEUST (diplôme d'études universitaires scientifiques et techniques – university scientific and technical studies diploma), with programmes suited to regional needs. These professional courses, which have links with the industrial environment, offer direct outlets into the workplace.

Finally the professional degree and masters degree certify high level professional training in well-defined fields. These diplomas are widely appreciated by businesses.

#### [www.lesmetiersdelachimie.com](http://www.lesmetiersdelachimie.com)

A website with an evocative name, [www.lesmetiersdelachimie.com](http://www.lesmetiersdelachimie.com), gives young people a new type of interactive guide: in just a few clicks, they can build their own training scheme through various routes in chemistry (research, production, logistics, sales, marketing).

#### [www.edufrance.fr](http://www.edufrance.fr) : GUIDE FOR FOREIGN STUDENTS IN FRANCE

Attracting more than 250 000 foreign students, France is without a doubt a much sought-after destination for following all or part of a scientific education. The site [www.edufrance.fr](http://www.edufrance.fr), translated into 15 languages, groups all useful information (sectors, diplomas, equivalences, etc.) to make the right choice and enjoy your stay in France.

#### Ongoing training: for career development

Essential in a constantly-growing sector, ongoing training is largely incorporated in chemical businesses. They devote 3.5% of their payroll to training their employees (during and outside working hours), which is above the national average of 3.2% and among the European leaders.

The GRETA Chimie (public training organization - Chemistry) (Paris), the Conservatoire national des arts et métiers (National Conservatory for Arts and Trades) (CNAM) and the Association pour la formation professionnelle des adultes (Association for Professional Training for Adults) (AFPA) offers appropriate courses. And more specifically, 5 organizations in the Paris region, Marseille, near Lille, Lyon and Rouen are dedicated to ongoing training for chemical businesses.



#### CHEMISTRY VILLAGE

Since 2004, the Parc Floral in Paris has hosted the Village de la Chimie every year in March. A visit to the Village is essential for school-leavers, sixth formers and higher education students who are interested in chemistry and biotechnology. In 2006, 6000 young visitors discovered the wide diversity of the chemical industry (300 business professionals were present). They also had the opportunity of learning more about the different training schemes and the variety of professional training courses available.

#### DIRECTORATE FOR DEVELOPMENT PROJECTS INVOLVING THE EXPORT OF TECHNOLOGICAL, TECHNICAL AND PROFESSIONAL EDUCATION PROGRAMMES

The French Ministry of Education, Higher Education and Research has set up a department to promote the export of French technological, technical and professional courses. Partnered with French businesses and foreign training institutes, the department organises trainings courses tailored to local realities, meeting corporate needs and focusing on school-business relations.

Contact : [dirpro.int@education.gouv.fr](mailto:dirpro.int@education.gouv.fr)

#### A WIDE NETWORK OF CHEMICAL ENGINEERING SCHOOLS



FOR FURTHER INFORMATION ON THESE INTERNATIONAL SCHOOLS:  
- [WWW.UIC.FR](http://WWW.UIC.FR) : WEBSITE OF THE UNION OF CHEMICAL INDUSTRIES  
- [WWW.GAYLUSSAC.NET](http://WWW.GAYLUSSAC.NET) : WEBSITE OF THE FEDERATION GAY-LUSSAC