Mentoring European Knowledge of the Chemical Regions

SWOT Analysis and Benchmarking Study

ASTURIAS

Part III
Thematic Priorities

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TOPIC 1. Restructuring and development of industrial sites and chemical sites

SUMMARY

1. HISTORICAL REVIEW OF CHEMICAL SECTOR DEVELOPMENT IN ASTURIAS

Asturias began coal exploitation during the second third of nineteenth century. Coal was an endogenous resource, and its presence generated the growth of steel industry.

A regional economy, based on coal and steel industry, was developed along de first half of the last century.

A situation of strong industrial specialization in steel and coal grew together with the birth of a kind of industry related with a raw material provider, like zinc industry, aluminium industry and electrical energy generations.

Coal also induced a carbochemical industry around the coal mines in the central area.

A policy of intervention on industrial activity like steel and coal in the twenty century was especially significant in Asturias due to the specific weight of industry versus other economic segments.

The growth during sixties and seventies is still positive in Asturias, but lower than in Spain.

The regional economy in the latter quarter of the 20th century is heavily based on the industrial sector. This sector was concentrated on activities deeply harmed by a crisis that previously had affected the European industry.

From the point of view of economy, our chemical sector is not too strong, but its influence goes beyond the limits of economic indexes because of the strong links between steel industry and chemist industry. These links are related to the confluence of intermediate inputs, the high contribution of the sector to exports and the high influence in other industrial backwards activities.

These are some weaknesses traditionally identified in the chemical sector:

- Environment/Pollution
- Size of enterprises
- Trademark or image of products were low appreciated
- Rigid organizations.
- The railway network needs to be improved.
- The port of Gijón has a capacity for unloading 12 million tons of minerals a year. It needs to be extended and become accustomed to the arising requirements of the area. Currently there is an expansion plan to be finished in 4 years.

2 THE CHEMICAL AND PLASTIC SECTOR IN ASTURIAS

2.1. Carbochemical sector

The oldest brunches of chemical industry which are present in Asturias are those that came from coal and steel industry, such as organic and inorganic basic chemistry.

In Asturias nowadays it is produced high specification carbochemical products and foundry coke.

Weaknesses/Threats: Environmental cost, supply of raw materials.

The carbochemical sector in Asturias has coped with numerous changes since its beginning. These changes are mainly related to environmental legislation and requirements which means an increase in costs (technological investments) and a lack of competitiveness.

In addition, it has decreased the exploitation of natural resources, caused by the more rational use of resources and the arising of materials replacement and technological innovation. This fact leads to a reduction in the supply of raw materials which need to be imported with the subsequent increasing costs.

Strengths/Opportunities: Worldwide market, quality as a strategic factor.

During the last decade, there have been taken a series of action in order to develop a competitive environmental policy. These investments are linked to the utilization of the best available technologies, reduction in specific energy consumptions, reduction in S02 emissions, reutilization of carbon residues, etc.

Besides, an Asturias companies´ strength is a Quality based management. There is a main concern with the demands of the ISO 9000 standard and the complying with its requests as a mean to achieve business excellence. In fact, companies belonging to this sub-sector promoted the foundation of the Asturian Quality Club with the aim of making public the benefits that implantation of Quality Management Systems implies for society and to encourage the exchange of ideas and good practices amongst members.

2.2. Fertilizers and explosives

Other chemical brunches also important in Asturias are fertilizers due to the great amount of inputs such as sulphide acid produced by other industries, for example zinc industry. Some years ago there was also an interesting industrial site of explosives, activity that was abandoned because of a lack of competitiveness, leaving large areas with polluted soils that have been recovered nowadays to be used as urban areas.

Weaknesses/Threats: Rigid organization, changing markets

Changes of the agricultural sector are critical and the companies´ structure must be able to adapt itself to these new market conditions. Thus, the Asturian companies in this sector shall invest in organisational adjusts in order to get close to a more demanding consumer.

It is projected by the EU to increase the amount of land that is taken out of productive use, and so on reducing the fertilizer demand. Likewise, national legislation will require the trazability of the products increasing therefore costs for manufacturer.

Strengths/Opportunities: Consumer of secondary products from other industrial sectors.

Zinc industry in Asturias produces surplus of sulphide acid. Currently, it is projected the investment in a new plant of fertilizers based on these inputs.

2.3. Painting industry

The painting industry in Asturias is a good example of well-conducted family business that has made important efforts in developing new products with environmental behaviour. Most of these firms are now involved in Studies of Life Cycle Analysis.

Weaknesses/Threats: Small size, environmental adaptation

The threat of the multinational companies in terms of price and quality is the main disadvantage of asturian painting industry.

Reduction in VOC´s emissions and other investment focused on minimising environmental pollution will decrease their competitiveness and profitability, at least in the short term. Nevertheless some local firms have turned this disadvantage into strength thanks to their rapid answer to these requirements.

Strengths/Opportunities: Flexibility, proximity to target market.

Features as flexibility and proximity to the target market allow this industry to develop those products specifically adapted to the needs of the final consumers. For instance, they are specializing themselves in environmental-friendly products like ecologic water based paints free from solvents, ammonia or any other component harmful for nature or humans.

2.4. Pharmaceutical

Some other industrial sites manufacture pharmaceutical products. In Asturias it is produced the largest amount of salicylic acid powder of the world, but the aspirin is conformed out of the region, so the plant in Asturias is understood as a supplier of raw material to other plants of the same company. R&D is neither faced up in the region –unless R&D is focused on improved manufacturing- and therefore knowledge is developed out.

There is also manufacturing of generics to the health industry. The activity of the plant has been certificated by FDA allowing the company to introduce their products at the United States market; however they are also understood as a raw material supplier to the pharmaceutical

industry. The existing plants, in cooperation with some local R&D infrastructures, develop an interesting R&D activity.

Weaknesses/Threats: Lack of final consumer products in the market. Plants which are far form decision makers.

The fact that these firms do not sell their products to the final consumer makes them obtain fewer profit margins.

In some cases plants are not the decision makers and strategic policies such as the selection of distributors, key investments or implementation of restructuring plans are settled up in the headquarters.

Strengths/Opportunities: Highly qualified labour, R&D infrastructures available, exporting orientation, quality and environmental concern.

The current R&D infrastructures in the regional firms allow them to invest in technological diversification and in the searching of new markets. It is observed a great effort of regional companies to extend markets to Asian countries.

Besides, some companies are setting up agreement contracts with the University of Oviedo with the aim of achieving significant process efficiency improvements by utilizing the most efficient equipment and technologies in their production process.

It is also significant the Quality control activity developed by these plants as well as the environmental concern translated into several investments in the last 5 years.

2.5. Agar-agar production

Other products are manufactured in Asturias, like agar-agar, with two plants, both family businesses, with similar characteristics like flexible production and the manufacturing of high level quality products; great efforts are required to guarantee the supply of seaweed and to consolidate market in agro food industry and research segment.

Weaknesses/Threats: Small size, raw material supplying, high energy cost processes.

In this sector companies have a small size and the manager usually deals with excessive tasks. Companies must undertake a continuous control of operating costs of their plants.

Strengths/Opportunities: flexibility, consolidated market, closeness to raw material collecting areas.

In Asturias it is located the main agar-agar manufacturing plant in Europe, with a consolidated market. Its brand names are worldwide known and recognized as leader in the manufacture of agar-agar.

The Cantabrian coast, where plants are situated, has the higher quality and quantity seaweed needed for production.

2.6.- Industrial gases sector

Industrial gases industry is also present in Asturias with two plants belonging both to multinational groups, one oriented to medical assistance and the other one to the industrial supplies. Both have been widely modernized. This sub-sector has seen reduced its presence due to the long time industrial restructuring in the region that has decreased the industrial activity.

Weaknesses/Threats: A reduction of industrial activity.

Strengths/Opportunities: Activity directly connected to other industrial activities (frozen equipment).

2.7. Plastics

In the plastic sector it is located an important industrial site which produces polyurethane package for agro food industry. This firm was founded by asturian entrepreneurs who later on searched for a technological and distribution multinational partner.

Weaknesses/Threats: Environmental legislation (for the use of the product), recycling requirements.

The polyurethane package is meant to be used as trays for meat and fruit product; hence, all the legislation with regard to these products healthiness directly affects to the manufacture of the packages in terms of quality and environmental control.

Considering the recycling of plastics as a market and social threat, the plant has received the know-how from its multinational partner that carries out several processes to recycle both plastics and paper through to the manufacture of finished products from recycled materials.

Strengths/Opportunities: R&D projects with local partners, environmental standards, exports orientation.

There are several R&D projects with the University of Oviedo to improve products and to develop new ones. Nowadays the plant has launched a new product to further reinforce its position as Spanish market leader.

Additionally to the severe environmental legislation that demands a continuously updating, the plant operates to its own standards that exceed government regulations. The products are designed utilising optimum lightweight and low energy specifications.

Other activities in the plastic sector are related to building and furniture sector, based neither chemical nor other chemical engineering processes.

2.8. DuPont Complex

The most important chemical site in Asturias is the DuPont complex, which is one of the most advanced production centres of Europe. There are three different processing plants nowadays: Nomex, Sontara and Herbicide, fungicide products.

Last March 2004 the company decided to stop the production of THF. This decision was taken as part of a restructuring plan in the company connected to the sale of Lycra fibre business.

It is remarkable the benefits that the company has brought out for asturian economy. It has supported the creation of downstream businesses based on Dupont products and the establishing in Asturias of suppliers of both services and raw materials.

Weaknesses/Threats: Off shoring to other regions with lower labour costs and higher support for investments.

Strengths/Opportunities: High knowledge staff, R&D projects in cooperation with local partners, a company with great concern regarding environment and ecology.

3. THE CHEMICAL PROCESS SECTOR IN ASTURIAS

The region has another important industrial activity based on chemical engineering processes, which contribution to regional economy is even higher than chemical sector and it is also important for the same reasons of chemical sector described above.

These chemical process industries in Asturias are:

1. A wood pulp manufacturer that currently belongs to the State paper manufacturer group. (NACE 21.1)
2. A zinc producer by hydrometallurgical process from minerals. (NACE 27.4)
3. Aluminium production from an electrolysis process. (NACE 27.4)
4. Floated glass process for flat glass, belonging to a multinational Group. (NACE 26.1)
5. Two plants for cement manufacturing. (NACE 26.5)

Common to these industrial activities are those:

Most of them belong to national or international industrial groups .

Most are managed far from Asturias.

All have large number of employees.

All are intensive in capital, with large investment requirements.

All are sustained with chemical engineering knowledge.

All require safety and health models.

All present pollution hazards.

All required movement of bulks for stocks and goods.

Other industrial activities of interest, also related to chemical engineering processes are Metal foundry (NACE 27.5) and Ceramics NACE(26.2).

These two activities are usually developed by SMEs, and until not many years ago, productions were under local market demand. During the last decades these sectors have made a great effort to introduce their products into international markets.

The industrial activity described along this document should be focused from two different points of view; in one hand the specific SMEs matters and on the other hand the large industrial sites, essential to understand the chemical development in our region.

4. QUESTIONS.

1. How could be induced other industrial activities developed by SMEs, upstream or downstream to chemical engineering activities?
2. What kind of knowledge should be provided to workers and staff to release competitiveness based only on labour costs?
3. What kind of financial resources are more interesting to these activities?
4. When, How and in Which context took place the evolution of chemical sector in Lombardia from basic commodities producer plants to SME´s specific demanded market products?

TOPIC 2 – Development and strengthening of cluster structures for the support of innovation

Introduction

Some entrepreneurial approaches related to competitive issues such as quality assurance and excellence, innovation management tools and industrial environmental grew up in Asturias along the 90's. As a result of these approaches the Club Asturiano de Calidad (Asturian Quality Club), Club Asturiano de Innovación (Asturian Innovation Club) and Fundación Asturiana de Medio Ambiente, FAMA (Asturian Environmental Foundation) were founded.

In the beginning of the 21st century, with mentoring of the University of Oviedo through the Chemical Engineering Department, and the support of the Regional Government via IDEPA, it was created a new association with the aim of working on the chemical sector matters. This question constituted one of the first steps for the Regional Development Agency regarding the develop of sectorial policies on technological aspects.

ASOCIACIÓN DE INDUSTRIAS QUIMICAS Y DE PROCESOS, AIQPA

The Association of Chemical Industries and Process of Asturias represents the most remarkable and interesting associative initiative in the sector in Asturias.

The Association of Chemical Industries and Process of Asturias (AIQPA) gathers together some of the most representative companies of the Asturian chemical sector. Among them we can find enterprises of great tradition in the region -Industrial Química del Nalón, CEASA, or FERTIBERIA-, as well as multinationals worldwide recognized -BAYER or DUPONT-, besides other chemical process companies of minor volume or recently set up such us ROKO or ASTURPHARMA.

The AIQPA was constituted in 2001 with the aim, among others, of promoting the development of the chemical sector in the region.

Throughout its two years of activity, the AIQPA has carried out a serie of actions related to safety and technical regulations. This actions are meant to assist both members and other companies located in Asturias.

Some relevant examples of workshops organized by the AIQPA are the following ones:

- Legal Frame of the Industrial Security
- Regulations on equipments with pressure
- New regulation on the storage of chemical products
- The national authority for the prohibition of chemical weapon: position and implications for the chemical industries
- Experiences, functioning and perspectives of the Association of Chemical and Basic Industries of Huelva

- Experiences, functioning and perspectives of the Managerial Chemical Association of Tarragona
- Implications of the Directive Seveso II for the Administrations and for the chemical companies and of process
- Situation of Asturias in relation with the Directive Seveso II
- ADR, RID, IMO-IMGD 2003. Common aspects and principal differences of special transports
- Development of Directive IPPC and medium-term implications for the chemical companies
- Basic Directive and elaboration of safety studies
- The new electronic system of report of accidents DELTA
- Preventive Management: organization, models, alternatives.. in any case integration
- Technical Guide for the application of the RD 374/2001 on chemical agents
- National legislation on explosive atmospheres

It is important to underline that the AIQPA is not the kind of association which defend business interests, but it has technical aims of common interest to the chemical sector of process, such us safety, environment, quality or innovation, as well as the public image of the sector in the region.

The most ambitious project for the year 2003 was the organization, in Asturias, of a National Congress of companies of the chemical sector. This congress was organized with the support of the Institute of Economic Development of the Asturias (IDEPA). The Congress was carried out during the 6th and 7th of November, 2003 and it had the participation of companies -Dupont, Saint-Gobain, Unilever, Ence, Almiralll, Abengoa…- as well as institutions -FEIQUE (national sector association), CEFIC, FARMAINDUSTRIA, etc.- The topics of the Congress were the threats and opportunities for the sector, in matters like the new technical regulation that concerns the chemical sector, the transport of chemical products, the energetic sector and the implications of the new international regulations, etc.

It is a challenge for the AIQPA to give continuity to these meetings, and to create a forum of discussion about technological aspects that could influence the chemical sector. The periodicity, which will be fixed depending on the commentaries and feedback of the participants in the congress, is estimated initially between two and four years.

In addition, the AIQPA has organized its internal running by Commissions dedicated to topics of common interest as the safety and the environment, the human resources, the production and maintenance etc.

The purpose of the Commission of Safety and Environment is to promote the activities of each individual company of the Association, by means of the common support and the establishment of standards of work. These standards will help to the least developed companies in these fields to speed their progress up .

The Commission of Safety has been the organizer of many technical workshops mentioned above. These workshops have been attended not only by members, but also by other companies of the chemical sector and process sector not members, as well as professional, academicians and university pupils.

Companies of the Association: Asturpharma, Dupont, Fertiberia, Roko, Grupo Empresarial Ence, Praxair and Industrial Química del Nalón S.A.

Other initiatives engaged with cooperation activities among enterprises in Asturias, also interesting for chemical sector, are:

CLUB ASTURIANO DE LA INNOVACION:

The Innovation Asturian Club is an entrepreneurial association which main goal is contributing to the diffusion and promotion of innovation amongst enterprises. There are more than one hundred of companies members of the organization.

One of the most worthy of note activities carried out by the Club in collaboration with the University of Oviedo and the IDEPA was a Technology Transfer Exhibition in which all University Technological Offer was shown to directives of companies.

Other interesting activities are, for instance, seminars on Innovation Management Tools, projects to promote the R&D&i standard, Industry open doors for journalist in order to show innovative projects or a yearly award for the best news based on innovation.

FUNDACION ASTURIANA DE MEDIO AMBIENTE

The Environmental Asturian Foundation is an entrepreneurial foundation for environmental industry issues. Its aim is to help companies to develop themselves in a sustainable way.

More than twenty five enterprises belong to the foundation together with the three regional Chambers of Commerce and the Federation of entrepreneurial regional associations.

The regional government is developing some other cluster initiatives regarding steel, environment, agro-food and information and communication technologies supported at the beginning by the ERDF Innovative Measures.

Questions:

What kinds of activities are carried out by chemical cluster initiatives?

Which benefits, economical or not, are received by companies participating in chemical cluster initiatives?. Identify and quantify.

How are chemical cluster initiatives managed?. How are they financed? Where do incomes come from?

TOPIC 3. Innovative approaches for the development of human resources

SUMMARY

1. Vocational Training Program

1.1.- The Initial Vocational Training.

1.2.- Occupational training for unemployed people.

1.3.- The Continuous training for employed people.

2. University of Oviedo.

3. INCAR-CSIC Centre.

4. FOUNDATION ITMA: Technological Institute of Materials.

5.QUESTIONS.

Innovative Approaches for the development of Human Resources

The development of Human Resources for Chemical Industry in Asturias is a result of several measures fostered by both public and private institutions:

1. Vocational Training Program to improve workers skills.
2. University of Oviedo, which provides a high level education.
3. Other Scientific and Technological Centres which offers not only support for R&D projects, but also high level qualification for instructed people: INCAR-CSIC Centre and Foundation ITMA.

1. Vocational Training Program:

The Vocational Training New Program, signed in March, 1998, divides the Vocational Training System in three subsystems interrelated and placed in a European dimension:

1.1.- The Initial Vocational Training :

In the structure of the new educational system, there are placed the Formative Cycles of Specific Vocational training, since once overcome the Secondary Obligatory Education has the possibility of choosing between two differentiated options:

- To deal a Formative Cycle of Medium Degree, which allows obtaining a Technician's Degree in the professional career chosen after overcoming a period of training in the company. The duration of this option is one year and a half or two years, depending on the Formative Cycle.
- To deal a type of "secondary education" that, after two years, enables the access to one of two following routes:
- To deal a Formative Course of Advanced Degree, which allows obtaining a Degree of Advanced Technician in the chosen profession. Its duration is one year and a half or two years, and includes a practical training in the company.
- To make University Studies.

In Asturias there are 61 Centres distributed throughout the region which, regarding chemical industry, offer the following professional courses:

Professional Families
Food Industry: Elaboration of lacteal products, food industry, slaughterhouse and butcher's
Maintenance and Services to the Production: Installation and electromechanical maintenance of machineries and driving of lines, montage and maintenance of facilities of cold, air conditioning and production of heat, maintenance of industrial equipment, development of facilities projects of fluids, thermal and of subsistence
Chemistry: Laboratory, analysis and control, environmental chemistry

1.2.- Occupational training for unemployed people:

It is carried out by the National Institute of Employment (INEM), together with the Government of Asturias, and focuses in the groups with major difficulties of labour insertion - first employment, unemployed with low qualification and / or under formative level etc. The main objective is providing a specific and / or suitable qualification to unemployed.

1.3.- The Continuous training for employed people:

It is managed by the Foundation FORCEM, and its aim is to provide an accurate qualification to the employed people that enable them to cope with new companies´ needs such as technological improvements, quality orientation or environmental behaviour.
On January 1st 2004 there has come into force the new System of Permanent Vocational training, regulated by the Real Decreto 1046/2003, of August 1st. This regulation describes the different initiatives as follows:

1.- **Actions of Continuous training in companies, including Personalized Training:** those actions that are planned, organized and managed by the companies for their workers. It also includes the personalized training which aim is to impart official studies plans to workers who attempt to improve their personal and professional qualification, without costs for the companies they work for. The main purpose for the companies is to improve their competitiveness through the increasing of employee's qualification.

2.- **Contract Programmes for worker's training:** INEM, previous report of the Board of the State Foundation for the Formation in the Employment, FORCEM, designs training plans for the most representative managerial federations and / or Trade Unions in the state level by means of setting up contract programmes. The aim of these plans is the training of workers in several sectors of the economical activity. The INEM is also able to sign contract programmes with the associations of self-employed workers.

3.- **Complementary actions to Formation:** The objective of these actions is the research and exploration of the labour market in order to forecast changes in the productive processes which could affect workers, to analyse the effects and benefits of the permanent training in the competitiveness of the companies and in the workers qualification and, summing up, to predict the training needs to contribute to the economic development of industry in the whole economy.

www.educastur.princast.es

2. University of Oviedo:

University of Oviedo has a long history which starts in year 1608 with Studies of Law. The first important enlargement of studies took place during the second half of the nineteenth century, when linking to the industrial settle down in the region studies of Chemistry, Industrial Techniques and Mining Techniques began to be implemented.
Nowadays, the Studies Programmes based on Chemistry offered by the University of Oviedo are both Chemistry Degree and Chemical Engineering Degree.
A wide range of PhD Programmes are also offered by the University of Oviedo. Those related with Chemical Professional activity are:

- Science and technology of materials.
- Processes and environmental Engineering
- Organic and Organometalic Chemistry
- Chemical, Bio-chemical and Structural Advanced Analysis
- Electro-Chemist. Science and Technology
- Theoretical and Computational Chemistry
- Organo-metalic Chemistry

In the University of Oviedo there are 20 Research Groups concerning the chemistry. They have numerous scientific publications and they hold approximately 18[1] patents. They are grouped in 2 sections:

Physical and analytical chemistry.
Organic and inorganic chemistry.

Regarding to their relationship with the business sector, it is remarkable the narrow collaboration existing with some Asturian companies in the development of joint projects, particularly with AsturPharma, DuPont Ibérica or Linpac Plastic.
Other relevant research groups for Chemical Industry are Chemical Engineering, Environmental Science, Bio- Chemistry or Molecular Biology.
All these groups together comprise the most efficient research group of the Oviedo University.
The University of Oviedo boost Thematic Associations (Clusters of knowledge) with group experts of different departments of the University. This is a way to organize multidisciplinary groups with experts from different sectors. At present there are 4 clusters and in two of them takes part the department of chemistry of the University :

[1] They are the following ones: Inmuno electroanálisis (5); Spectrometry (5); optical Sensors (1); Bioorgánica (5) and inorganic Polymers (7)).

-The Thematic Association of Steel has been created in order to coordinate the different research activities of the University of Oviedo in relation with the field of the steel. These activities include the aspects of production and manufacturing of finished materials, including the different applications of these products. As a result, they involve fields of basic investigation, technological and economic organization.
-The Thematic Association of Nanotechnology studies materials of very small dimensions, in general lower the micron. There is great interest concerning the importance of these substances and materials from the point of view of their society implementation.
This field of investigation also includes areas of Physics, Chemistry, the Engineering or Robotics, as well as other fields such as biology, medicine or environment.
The Scientist - Technical Services (STS) of the University of Oviedo supports structures addressed to research groups of the University, besides other public institutions and private companies.
From its foundation in 1987, its main objective has been the optimization of the scientific resources of the Institution, making them accessible to other external researchers.
The final aims of the Scientist-Technical Services are the following:
· To offer investigative support to the different Research Teams.
· To develop methods and technologies of support to the research.
· To offer services to public centres or private companies.
According to these objectives, the Scientist-Technical Service will develop the following functions:
·Attention to users and maintenance of equipments.
·Applied research: In order to take advantage to the maximum of the instrumentation, to increase the presentations and to solve problems rose to the users.
·Training and spread of knowledge.
The services offered by
The Scientist-Technical Services are: Chemical measures (Magnetic nuclear resonance, spectrometry of masses, etc.), characterization of solid, biomedicine and technologies of image and technological support.
www.uniovi.es

3. INCAR-CSIC Centre:

Another great infrastructure available in Asturias to encourage innovative approaches and to develop human resources is the **Instituto Nacional del Carbón-National Coal Institute-** (INCAR), founded in 1947 and located in Oviedo, which belongs to the CSIC-Spanish Council for Scientific Research. It is an Autonomous Organism attached to the MCYT-Spanish Ministry of Science and Technology. INCAR is included, with other ten Institutes, within the area of Chemistry and Chemical Technology, one of the eight research areas of the CSIC.

From the beginning, INCAR has devoted its knowledge in scientific and technical research to many aspects of domestic and imported coals, conversion processes including combustion for energy generation and coking for metallurgical coke production-, in order to achieve a more efficient and clean utilization of coal and its products. INCAR also performs an important activity on the development of new carbon materials, whose structural, textural, electric, electrochemical and catalytic properties are investigated for the most modern applications, from composites to super capacitors. The picture is completed by a modern research line in nano-structured ceramic materials. Financial support is obtained from public resources (Local and National Research Programmes and European Programmes), as well as industrial research contracts (Mining and Steel Industry, Coke and Tar Refining, Oil Companies, Electricity Utilities, etc).

Research Topics:

Currently, INCAR is comprised of four Research Departments, two Support Units and one Administration Division. The research activity of INCAR includes R & D in the following five fields:

- Coal: Evaluation of natural resources, soil contamination caused by coal industry, removal of potentially toxic species by advanced coal cleaning processes.
- Carbonization Process: Optimization of coal blends for metallurgical coke production, extension of the coke oven life, recycling of industrial and plastic wastes.
- Combustion and Gasification: Fluidized-bed combustion, optimization of coal blends, reduction of NOx and toxic metals emissions, development of catalysts for NOx removal in gaseous emissions.
- Carbon Materials: Advanced physical and chemical characterization of precursors, preparation of pitches with low PAH content, preparation of carbon fibres and composites (C/C, C/polymer and C/Metal), for structural and conventional applications, preparation of synthetic graphites, preparation and applications of carbon adsorbents (activated carbons, molecular sieves, activated carbon fibres, monoliths), preparation of carbon materials for energy applications (batteries and super-capacitors).
- Nano-structured Ceramic Materials: Metal-Ceramic Nano-materials for functional applications and nano-materials for biomedical applications.

Environmental Chemistry, Chemistry of Materials

In addition to the technical support which is offered by its four Research Departments, INCAR has two Support Units:

-Analysis Unit

-Technical Unit

These units are meant to assist in the research activities of the four Research Departments. In addition to the specific technical support which is offered by the Research Departments the

Analysis Unit provides general analytical support to the Industry related to coal mining, steel, oil, tar refining, electricity, etc.

4. FOUNDATION ITMA: Technological Institute of Materials:

The Technological Institute of Materials (ITMA) was born in 1990 as a national research association thanks to the effort made by 15 Asturian industry enterprises, the collaboration of the Principality of Asturias (Institute of Regional Promotion - current IDEPA) and the Ministry of Industry and Energy. At present it is integrated by 30 enterprises. Public entities still contribute to its financial support.

As a non-profit organization, the Foundation ITMA is designed to serve as a Technological Centre for the supporting of innovation processes that enterprises undertake as a mean of remaining competitive in the marketplace. ITMA has 4 different departments: Department of R&D, Laboratory, Legal Metrology and Quality Services.

The Laboratory Department offers technological advanced services to the companies. The wide range of analysis and tests available allows the materials industry to maintain its quality systems operative. The analysis and testing offered are the following: chemical analysis, characterization of physical properties, determination of mechanical properties, microstructural characterization and thermal treatments, besides the high qualification of its human resources and technical knowledge allows to give service to numerous industrial sectors.

Moreover, in order to guarantee the plottability of the results, the ITMA has its own workshops available to take out and prepare the test tubes.

The R&D Department gives two types of services. On the one hand R&D Projects and on other one Technical Assistance.

The *R&D Projects* are designed with the aim of anticipating the needs for innovation imposed by today's market. The ITMA has established a few strategic lines of technological development which, in summary, are: corrosion, joint technologies, surface technologies, mechanical characterization and service behaviour, materials and raw materials development and processing, numerical simulation and chemical technology. They cover aspects like: materials design, development and characterization of materials, process technologies, development and fine tuning of characterization techniques, and are addressed to the following industrial sectors: metallurgy, equipment goods, energy, wrapping and packaging, chemical technology.

The *Technical Assistance* has the necessary technical knowledge to answer the everyday needs of the companies:

- Installation set-up
- Programmed stops of maintenance
- Faults analysis, in which the possible causes of defects at the:
- Design
- Materials and raw materials supply or selection
- Manufacturing
- Variations in services conditions stages are studied
- Waste recovery
- Materials selection
- Expert Studies - Design and simulation
- In service behaviour and remnant life

- Homologation of processes and products.

5. Questions:

Which are the most effective and understanding models for the transferring of knowledge about new technologies (nanotech, biochemistry, etc.) to entrepreneurs?
Which are the most accurate financial models for innovation already implemented in the other regions?
Which are the approaches to encourage self-employment in chemical industry? Which is the average level of qualification and studies concerning this group in the regions?
Which is the correlation between the type of job (manager, technician, workers…) and the qualification of the employees?
How do the regions foresee and identify RRHH needs concerning knowledge to cope with the continuous changes in chemical industry (for instance new technologies). Which are the means to offer Qualification Programmes adapted to the most up-to-date techniques?