

MATGAS



FOSTERING
THE FUTURE OF **SUSTAINABLE**
R&D



MATGAS is a strategic alliance, legally registered as a nonprofit Economical Interest Group, among the company Carburos Metálicos - Air Products Group, the Spanish National Research Council (CSIC) and the Autonomous University of Barcelona (UAB).

Our mission is to establish a center of excellence in material science and gas applications by combining the strengths of industrial, academic and government institutions for the benefits of the founding partners and society.

MATGAS



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The research and development carried out at MATGAS combines modeling with experiments, and it is focused on the life cycle of CO₂, from capture to applications, as well as alternative energies, including hydrogen and new materials for energy, wastewater treatment and food preservation, with a special emphasis on sustainability.

The MATGAS laboratories offer a variety of facilities that allow from the modeling and fabrication of new materials to their physical and chemical characterization, including the test for specific applications.

In the Supercritical Fluids laboratory

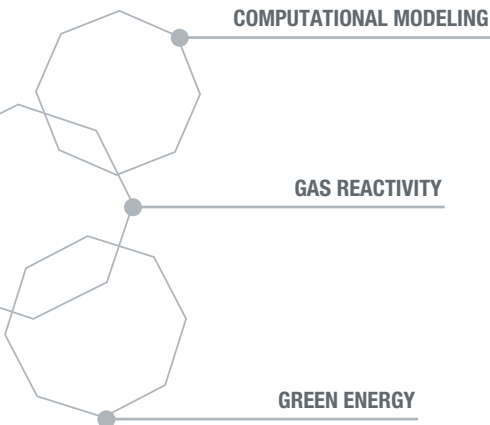
research and development of new applications of supercritical fluids or fluids at high pressures and temperatures is carried out. This includes extraction and concentration of natural products, polymer impregnation, CO₂ transportation and sequestration and synthesis of new materials and catalysts. The laboratory is equipped with several high pressure reactors with different configurations and sizes, from 10ml to 16l; it also includes a pilot plant.

The Nanotechnology laboratory is a last generation lab equipped with the needed techniques for the characterization and manipulation of materials at nanoscale. The equipment includes SPM techniques (AFM and SNOM), particle size determination tools, micro-Raman scattering, nanocalorimetry, and nanoindentation. This laboratory allows a comprehensive study of the properties of nanostructured materials, including size, mechanical, thermal, optical, structural, and electrical properties.

The Gas Reactivity laboratory is designed for the study of the reactivity and adsorption of a variety of gases into liquids or solids materials. This can be done by volumetric as well as gravimetric techniques and over a wide range of pressures and temperatures. Two magnetic microbalances with different configurations allow the gravimetric measurements under real conditions, with the volumetric measurements are done with BET equipment. This laboratory also includes equipment for the preparation of new materials for absorption of gases by sputtering in UHV and several potentiostats for electrochemical studies.

SUPERCritical FLUIDS

NANOTECHNOLOGY



The Computational Modeling laboratory is a permanent calculation infrastructure to provide support to MATGAS projects from a modeling perspective. Simulations performed in this lab help to obtain a deeper understanding of properties and processes at nanoscale and/or for different applications.

Examples of recent projects include hydrogen storage in carbon nanostructures, deposition of copper layers as electrical contacts in microelectronics, the optimization of nanoparticle dispersions, the design and understanding of the behavior of materials for CO₂ capture and the behavior of selected ionic liquids.

The Green Energy laboratory offers facilities related to the study of new sustainable energies. This includes a hydrogen fuel cell test bench, several potentiostats for electrochemical characterization, and different tools for the development of water treatment processes. Equipment for the development of new technologies in the fields of photovoltaics and bioenergy is planned to be located in this lab in the coming year.

Three partners ONE GOAL

The vision of MATGAS is to become a World leading center of excellence that integrates research, technology development and demonstration in Energy, Sustainability and Environment, focused on greener energy solutions, including CO₂ capture and application, waste treatment and alternative energies, by combining modeling and experimental approaches. We will contribute to develop energy related new technologies friendly to the environment working in different angles of this complex problem, combining in a synergetic manner our expertise in the different areas.

As part of the sustainability commitment we use Life Cycle Assessment tools to the new processes and products we develop. We do these developments in close contact with our strategic partners, with other researchers and with final users.





Air Products, the parent company of Carbueros Metálicos, is present in the day-to-day lives of millions of people all over the world, providing solutions for an extensive range of needs and requirements. The company is recognized for its innovative culture, operational excellence and commitment to safety and the environment

Air Products (NYSE:APD) main activity is supplying customers in industrial, energy, technology and healthcare markets worldwide with a unique portfolio of atmospheric gases, process and specialty gases, performance materials, and equipment and services. Founded in 1940, Air Products has built up a leading position in key growth markets such as semi-conductor materials, refinery hydrogen, home healthcare services, natural gas liquefaction, and advanced coatings and adhesives.

To date, Air Products:

- Employs 18,300 people all over the world.
- Registered a turnover of 9,000 M. € in 2010.
- Is active in more than 40 countries.
- Has been supplying the industrial, energy, technology and health sectors for more than 70 years.

The company operates in the following business areas:

Merchant Gases

Tonnage, Equipment and Energy Gases

Electronic and performance materials

Merchant Gases

This area supplies oxygen, nitrogen, argon, helium and hydrogen as well as certain speciality and medical gases for a wide variety of clients in the industrial and medical sectors ranging from soldering and entertainment to foodstuffs, research or analytical processes. This area of the company also provides services and treatment in the home for more than 325,000 people throughout the world.

This area of the business supplies large quantities of hydrogen, syngas, carbon monoxide, oxygen and nitrogen mainly for oil refineries and clients in the metals and chemical sectors with long-term contracts.

The Equipment business area provides liquefied natural gas (LNG), heat exchangers, air separation plants, hydrocarbon recovery and purification equipment, and helium distribution equipment to industry. Within Energy, Air Products operates power

generation and flue gas treatment facilities and is developing technologies for the energy markets of the future including gasification and alternative energy technologies.

Electronic and performance materials

Thanks to the Electronic and performance materials area of the business, Air Products is able to provide solutions for a wide range of industries, supplying speciality and tonnage gases, special chemical products and bulk, services and equipment for the electronics industry for the manufacture of semi-conductors and silicon compounds, as well as screens and photo-voltaic devices. This area also provides solutions for plastification, adhesives, inks, civil engineering, personal care, cleaning, mining, oil fields, polyurethane and other materials.



Corporate Social Responsibility



The company is well-known for its strong commitment to the environment and the communities in which it is active. For this reason, the company develops a range of Corporate Social Responsibility programmes as well as increasingly environmentally-sustainable technologies.

Air Products makes contributions and donations worth more than \$ 6m to different causes. The company also operates a corporate policy allowing employees to spend company time working on voluntary projects.

This commitment is also reflected in the company's research and development projects into different technological solutions which contribute to cleaner sources of energy.

With more than 50 years experience, Air Products has acquired extensive know-how in the field of hydrogen, making it the biggest supplier of hydrogen to third parties in the world. They serve a variety of sectors including oil, chemicals, thermal metal treatment and electronics.

Using their experience in the industrial sector, the company is vigorously promoting the use of hydrogen as an energy vector through the development of new technologies such as hydrogen service stations or "hydro-stations". In this way, they aim to provide the necessary infrastructure to be able to energize vehicle batteries or cater for station applications.

tell me more

www.airproducts.com

Air Products is also carrying out different projects related to the recovery, storage and sustainable industrial uses of CO₂. For example, amongst other projects, the company is taking part in Germany, in the first world-wide demonstration to recover and hold CO₂ using oxy-fuel technology, is working jointly with the United States Energy Department for the design and construction of a CO₂ purification system and has carried out a study on CO₂ recovery for gasification with the Alberta Energy Research Institute.

In Spain, Air Products has the MATGAS institution, a centre of excellence in CO₂ and sustainability encompassing everything related to the recovery, storage and sustainable uses of CO₂, as well as other greener energy solutions.

Spanish National Research Council

Its
achievements
are made
possible by the
efforts of a
workforce of
13,538 people.

The Spanish National Research Council (CSIC, Consejo Superior de Investigaciones Científicas) is a public institution devoted to research present in all the Spanish Autonomous Communities with 128 centres and over 160 associated units with universities and other institutions.

CSIC conducts basic research in strategic areas and devotes efforts to solving technical and socio-economic problems, promoting applied research and pursuing sustainable development. As well as

doing research, CSIC also plays an important role in promoting science culture, a key feature to spread knowledge to society.

CSIC is a multidisciplinary organisation and it works collaboratively in a wide range of fields with a variety of research organisations, universities, institutions and companies. Therefore it plays a central role in Spain's national research, development, and innovation system.





Research Institutes & Associated Units

Institutes: 128

77 CSIC only Centers

51 Joint Centers

10 Service Centers

1 Technical Center

Associated Units: 160

Scientific and technical areas

Humanities and Social Sciences

Landscape Archaeology,
Archaeometry and
Ethnoarchaeology
International Relations in the
construction of Modern World
Population Movements and
interethnic relations
Social and Cultural Change.
Cultural Patrimony and Humanities
Edition and Study of Texts
Spanish of today and its linguistic
variance
Theory of Literature, of Theatre
and Media. Critic of literature
Moral Philosophy
Science, Technology and Society
Studies
Environmental, Rural and Urban
Economies
International and Development
Studies. Globalization
Knowledge Management.
Scientific Activity Assessment

Biology and Biomedicine

Genetics and Molecular Biology of model organisms

Biotechnology of plants and
microorganisms
Structure and Design of
macromolecules
Cellular cycle, development and
differentiation
Genetics and Physiopathology of
human diseases
Immunology Neurobiology and
Neuropathologies Parasitology and
Virology Pharmacology
Genome, gene regulation and
signal transduction

Natural Resources

Biodiversity. Systematics, biogeography and evolution

Biology and physiology of
organisms
Evolutive ecology, ecology of
populations and communities
Ecosystems and macroecology
Oceanography and litoral systems
Acuiculture
Structure and Dynamics of Solid
Earth
Earth surface processes
Conservation and management of
natural resources
Environment and environmental
impact

Agricultural Sciences

Water in agriculture Contamination of soils and soil restoration

Soil conservation, quality and
organic matter
Beneficial plant-microorganism
interactions
Plant nutrition
Photosynthesis
Pomology and Forestry
Plant Breeding
Environmental stress
Phytopathology: viruses, fungi and
nematodes
Agricultural entomology and weed
science
Animal Science

Through its network of institutes and Associated Units, CSIC collaborates with more than 70 universities and institutions.

Physical Sciences and Technology

Optics
Robotics
Artificial Intelligence
Micro and nanosystems
Circuits and integrated systems
Acoustics and ultrasounds
Cosmology and gravitation
Astrophysics
Distributed computation (e-grid)
Experimental physics
Theoretical physics and mathematics
Particle physics
Quantum information and Cryptology
Fundamental and applied mathematics

Materials Sciences and Technology

Functional Materials and Nanomaterials
New Materials Processing Methods
Materials for high industrial Production Sectors
Theory and Structure of Matter
Technological Support and Historical Heritage Activities

Food Sciences and Technology

Analytical methods for food characterization, traceability and safety
Physical, chemical and biochemical principles of quality
Modeling and optimization of traditional processes and new processing
Development of new products and bioactive packaging
Biotechnology of edible plants and microorganisms valuable to food technology
Production of functional foods and ingredients
Bioavailability and risk-benefit ration of food nutrients
Lipid metabolism
Immunonutrition and nutrigenomics

Chemical Sciences and Technology

Organic synthesis
Biological chemistry and medical chemistry
Organometallic chemistry and coordination compounds
Chemistry and environmental technology
Energy and energetic resources
Catalysis and chemical processes
Physical chemistry interphases
Molecular physical chemistry
Materials chemistry and nanotechnology
Fundamentals and technical and instrumental chemical applications

A true city of knowledge

UAB has led it to advance with determination towards standards of excellence, through active policies of internationalisation and attraction of talent, and which has earned it recognition by the Government of Spain as an International Campus of Excellence.

Universitat Autònoma de Barcelona (UAB) is a European benchmark university, as much for the quality of its teaching staff as for the innovative nature of its research. Founded in 1968, it has become a model to follow due to its firm commitment to contributing to social progress through the training of professionals required by the most cutting edge economic and social sectors.

Located only 25 minutes from Barcelona's centre, UAB develops its activity on three campuses based in Barcelona and its outskirts.

The main campus, with 263 hectares and located in Bellaterra, is a true city of knowledge. It is home to most of the faculties, departments,

institutes and services, as well as to a significant scientific and technological cluster. The campus of Bellaterra is also home to the UAB Research Park.

The campus of Sabadell, alongside the Bellaterra campus, houses part of the School of Engineering and a part of the Faculty of Economics and Business Studies. At the city of Sabadell houses the Teaching Unit of Parc Taulí (affiliated to the Faculty of Medicine).

The UAB campus in Barcelona includes three of the six teaching units of the Faculty of Medicine: Teaching Units of Sant Pau, Vall d'Hebron and Hospital del Mar. The city of Badalona houses the Teaching Unit of Germans Trias i Pujol.





Quality in teaching

UAB imparts a high quality and rigorous education that is characterized by an elevated practical component. It offers, by way of an agile and innovative teaching programme, degrees, masters, graduate certificates, PhD's and postgraduate courses and specialized courses in disciplines as diverse as Humanities, Social Sciences, Health Sciences, Experimental Sciences and Engineering. This combination of disciplines on campus is one of its strongest elements of excellence.

Multidisciplinary research

UAB is internationally renowned for its quality and innovation in research, and promotion in excellence and competitiveness. Its main areas of investigation include Biotechnology and Biomedicine, Animal Health and Food Technology, Environmental Sciences, Energy, Materials Sciences, Information and Communications Technologies, Social Sciences and research in Humanities. This wide range of disciplines helps to promote multidisciplinary in research, making UAB a breeding ground for quality researchers and a centre for the dissemination of knowledge and technologies.



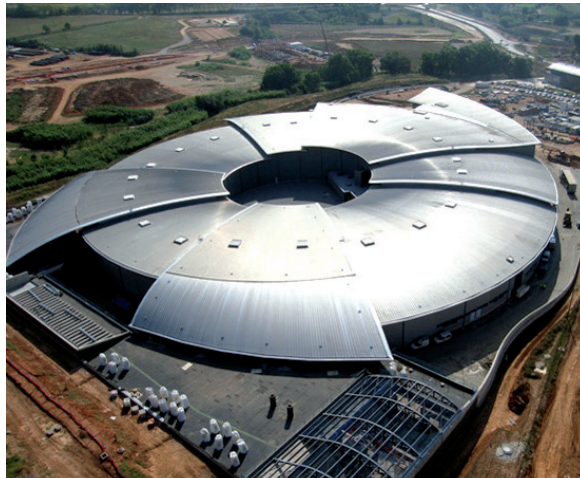
Promoting knowledge, encouraging innovation

Together with its associated centres at UAB Research Park, ALBA synchrotron facility and Vallès Technology Park, UAB has become one of the main scientific and technology poles of southern Europe.

UAB is pioneer in terms of fostering research and has established firm links with research centres abroad, especially with those of the European Community.

The UAB Research Park coordinates research centres and consortia specifically involved in research at the UAB campus. It meets the specific needs of both entrepreneurs and companies.

The universities promotes new business projects and directs all productive activity towards its socio-economic surroundings, while the quality of its research and knowledge transfer capacity are key differential elements in this highly innovative environment.



Figures*

Studies

78 undergraduate degrees

125 master's degrees

75 doctoral programmes

679 continuing education programmes
(2008-2009)

Teaching

13 faculties and schools

28,283 undergraduate students

2,227 master's degree students

2,857 doctoral students

9,377 continuing education students

Internationalization

3,065 foreign students

1,445 international exchange students

1,343 international Study Abroad
programmes students

928 International exchange UAB students



Research

218 research groups

57 departments

21 centres of study and research

7 UAB university research institutes

465 doctoral theses (2008-2009)

368 research agreements

1.788 Articles published in indexed journals (ISI)

30 Research centres at the UAB Research Park

15 Associated medical research centres at the UAB Research Park

50 spin-off companies**

70.90 Resources destined for research (in millions of euros)

Human resources

3.566 teaching and research staff

1.105 research staff in training

2.399 administration and services staff

* Data from the Annual Report for the 2009/10 Academic Year

** Data from 2011

UAB Research Park

Knowledge generated at the UAB Research Park is distributed in six clusters:

- **Material Sciences and Energy: nanotechnology & microelectronics**
- **Information and Communication technologies**
- **Biomedicine and Biotechnology**
- **Environmental sciences and sustainability**
- **Animal Health and Food science**
- **Human and Social sciences**



The UAB Research Park (PRUAB) is an organization founded by the Universitat Autònoma de Barcelona (UAB), the Consejo Superior de Investigaciones Científicas (CSIC) and the Institut de Recerca i Tecnologies Agroalimentàries (IRTA), whose aim is to stimulate and improve technology and knowledge transfer, to promote entrepreneurship activity through new science-based companies and, in general, to provide interaction between research, industry and society.

The UAB Research Park is the centre of one of the major scientific hubs in Southern Europe, developing into a uniquely dynamic innovation cluster. Unique scientific infrastructure such as the Clean Room of the National Microelectronics Centre or the Centre for Animal Biotechnology and Gene Therapy, close ties to five major Barcelona Hospitals and a location right in the «industrial heart» of Catalonia makes for a unique innovation potential.



6 scientific clusters



The Eureka building is an area for knowledge and technology transfer, a place where businesses that want to move into the UAB Research Park can find a modern, technologically advanced workplace in accordance with their needs.

The Eureka building has 5,000 m² of constructed floor area above ground level, distributed over a ground floor and three upper floors. It also has a basement with a car park for 50 vehicles. The spaces for rent, starting at 54 m², offer very flexible modulation so they can be adapted to business' current and future needs.

Main figures of the UAB Research Park

5.500 researchers

1.600 m² spin-off company incubators

5.000 m² for business activities

600 research contracts yearly

50 patents yearly

50 spin-off companies since 2001

25 free-standing research centres and institutes*

15 associated medical research centres

* Apart from the centres from the UAB.

The Eureka area is an ideal environment for:

- **Established companies** interested in boosting their technological innovation. These companies have areas of between 81 and 1,232m² on the same floor to incorporate their R+D+I departments.
- **Small and medium-sized enterprises** with activities based on researches that want to establish themselves there to be in contact with the scientific world.
- **Spin-off businesses.** The Eureka building has an area set aside to house businesses from the UAB Research Park that are at the incubation phase. Some of these areas are adapted with extractor hoods for fumes and laboratory tables.



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Campus de la UAB

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