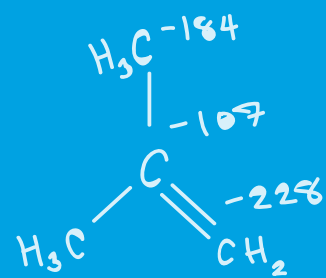


contents

- RESEARCHERS // 04
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 - 28 / AT
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 - 30 / AWARDS
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 - 32 / NEW FACILITIES: INAUGURATION



Senentxu Lanceros-Mendez
Ikerbasque Professor
Scientific Director

*“Knowing is not enough;
we must apply.
Willing is not enough;
we must do.”*

*Johann Wolfgang von Goethe
(1749-1832)*

In the following, the main numbers summarizing a whole year of intense activity at BCMaterials are presented.

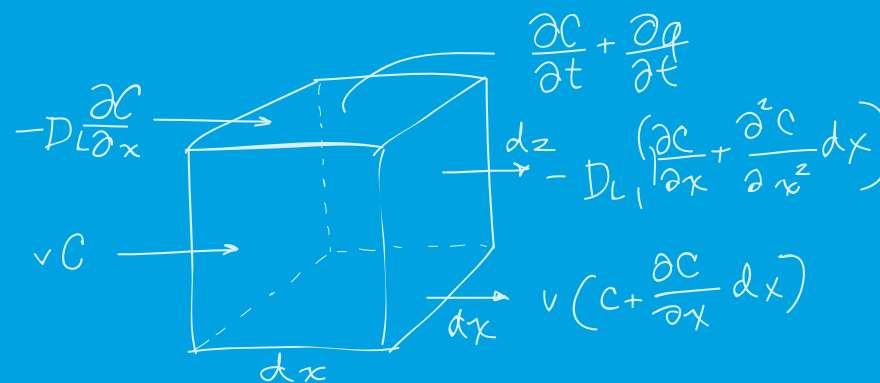
If 2018 was a year for taking important decision for the new configuration and dynamic of the research center, 2019 represented the first steps for the consolidation of BCMaterials as an internationally relevant player in the area of smart and multifunctional materials.

Providing numbers is always a rewarding activity, when they represent the achievement of the goals and increasing performance. On the other hand, they do not properly show the strong effort, dedication and commitment of the growing family of BCMaterials, that with this foreword I truly thank. They do not completely honour either the advances for science and technology that effectively have taken place from BCMaterials and that have been achieved together with an increasing number of national and international partners.

Two main issues have been particularly relevant in 2019: the official inauguration of the new facilities of the center by the Lehendakari, Iñigo Urkullu, and the incorporation of new colleagues: from Ikerbasque Professors and pre-doctoral fellows to associate researchers from the UPV/EHU. Those are true milestones, which valorise the present, shape the future and demonstrate the strong commitment from Ikerbasque and the UPV/EHU with BCMaterials. They also consolidate the center as a place for excellent research at the service of society.

Thus, at the beginning of the new decade, BCMaterials looks optimistic to the future. A future that relies in the consolidation of the desire, determination and will to work together for the common goals of mobilizing our expertise in advanced materials for the generation of knowledge and for addressing the urgent technological, environmental and societal needs that we are facing nowadays. It also relies in the conviction that we are not just able to contribute to them, but that we are also needed for achieving “new materials for a better life”, based both in what we do and in how we do it.

*Let's keep working together in this effort
and with this conviction!*



researchers

The true force of BCMaterials relies in the highly motivated and dedicated colleagues able tackle to most relevant issues in materials science by creating a fruitful inter- and multidisciplinary environment of excellence.

*Coming together is a
beginning, staying
together is progress,
and working together
is success*

Henry Ford

NEW RESEARCHERS

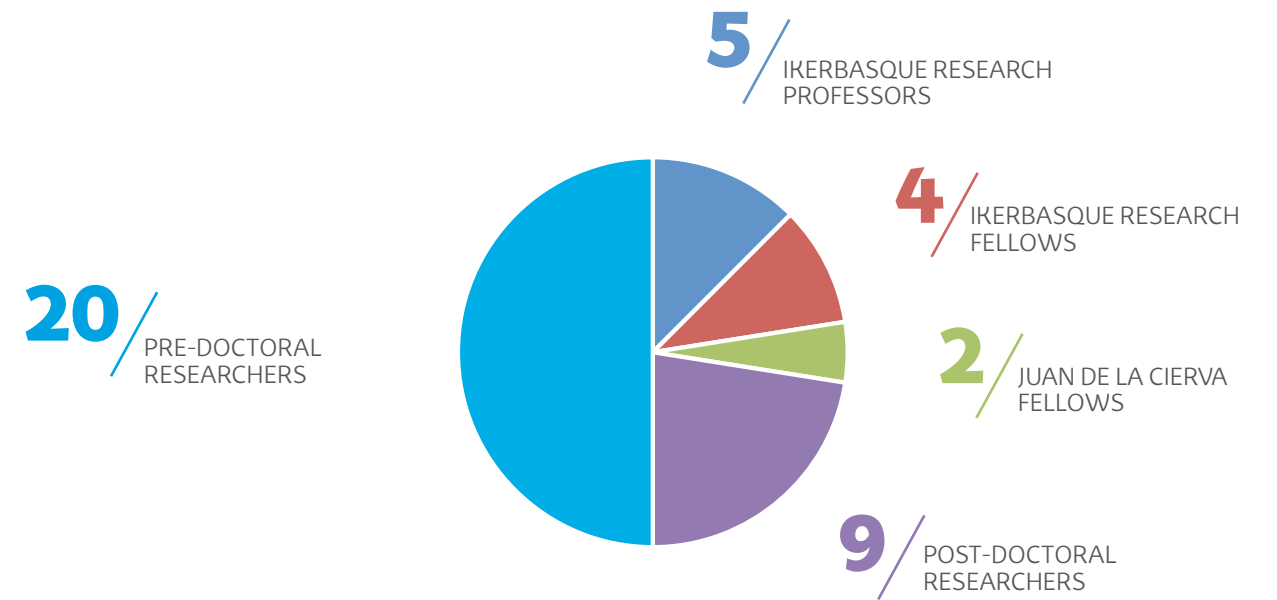
16



DISTRIBUTION BY SEX



CATEGORY



NATIONALITY



SPAIN	22
INDIA	4
CHINA	2
COLOMBIA	2
GERMANY	2
MOROCCO	2
PORTUGAL	2
EGYPT	1
CZECH REPUBLIC	1
SRI LANKA	1
UKRAINE	1

40 RESEARCH STAFF

DISTRIBUTION BY SEX



SEGMENTATION BY RESEARCH PARTNER

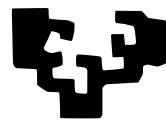
2 / IKERBASQUE & UPV/EHU RESEARCH ASSOCIATE

ikerbasque
Basque Foundation for Science



28 / UPV/EHU RESEARCH ASSOCIATE

eman ta zabal zazu



Universidad del País Vasco Euskal Herriko Unibertsitatea

30

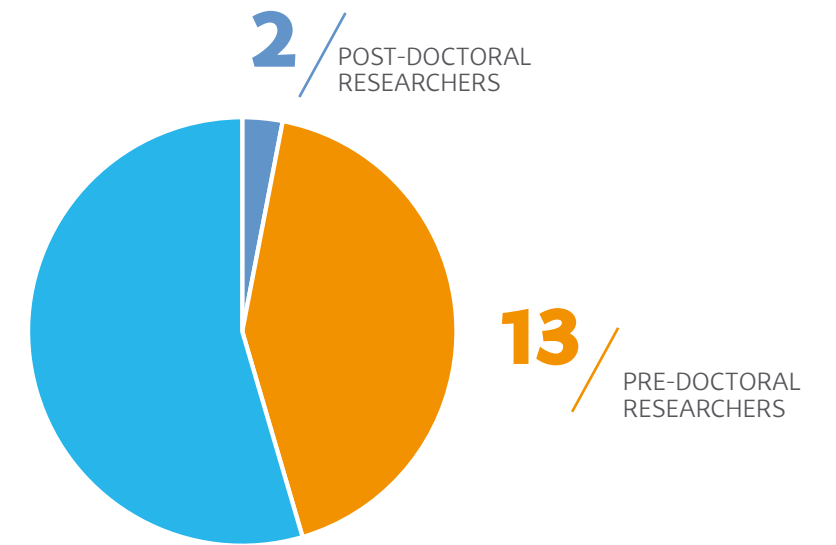
ASSOCIATED RESEARCHERS

DISTRIBUTION BY SEX

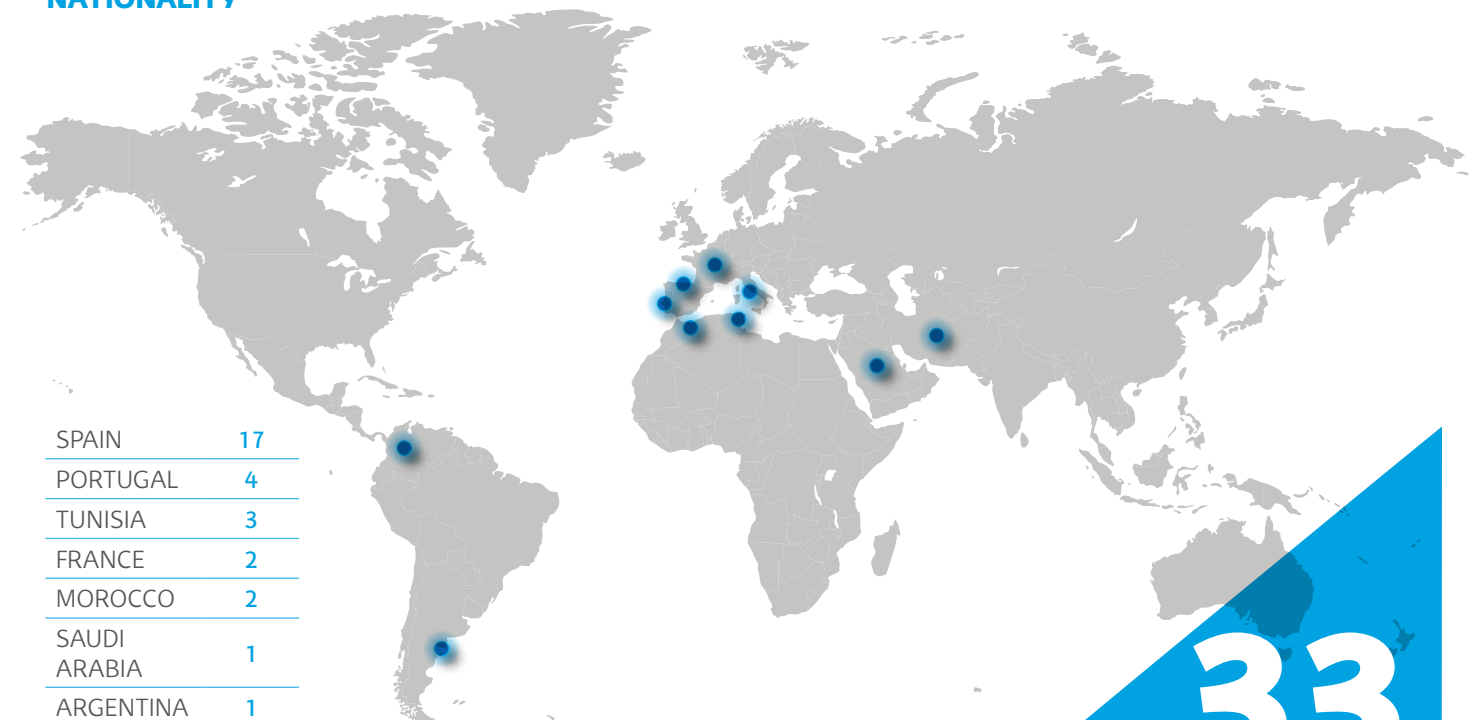


CATEGORY

18 / STUDENTS



NATIONALITY



SPAIN	17
PORTUGAL	4
TUNISIA	3
FRANCE	2
MOROCCO	2
SAUDI ARABIA	1
ARGENTINA	1
COLOMBIA	1
IRAN	1
ITALY	1

33

TOTAL VISITORS

research activity

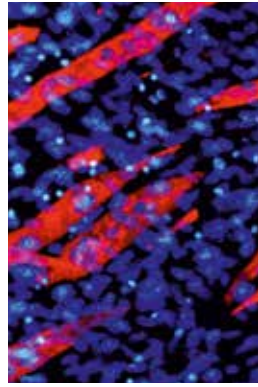
Research lines and areas are dedicated to generate knowledge in the new generation of smart and multifunctional materials, and to apply them to tackle the most relevant challenges of modern society, ranging from environmental, energy and biomedical issues, to develop materials for the new production and intercommunication paradigms. In short, they are designed to provide "new materials, for a better life"!

Imagination is more important than knowledge; for knowledge is limited, whereas imagination embraces the entire world stimulating progress, giving birth to evolution

Albert Einstein

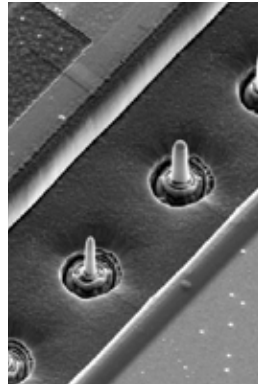
BIOMEDICINE

BCMaterials is focussing on the development of materials and new approaches for nanoparticle based biomedicine, from hyperthermia to point of care microdevices, as well as on the incorporation of active scaffolds and microenvironments for tissue engineering.



ENVIRONMENT

The strong technological advances of recent years are leaving important footprints in our environment. BCMaterials is strongly focussed on the development of environmental friendlier technologies, sensors for environmental monitoring and remediation of contaminated.



ADDITIVE MANUFACTURING

BCMaterials is working on the development of smart and multifunctional materials with improved integration through advanced manufacturing processes. Self-sensing, self-cleaning and self-repairing materials are being developed and integrated into functional prototypes.



ENERGY

BCMaterials specifically focus on the conversion between solar energy, and chemical energy in applications such as perovskite and kesterite based solar cells. Other research activities include the development of energy harvesting systems, new active materials for Li and Na- batteries and for solid electrolytes and printable batteries.



areas

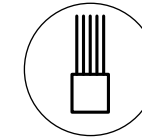
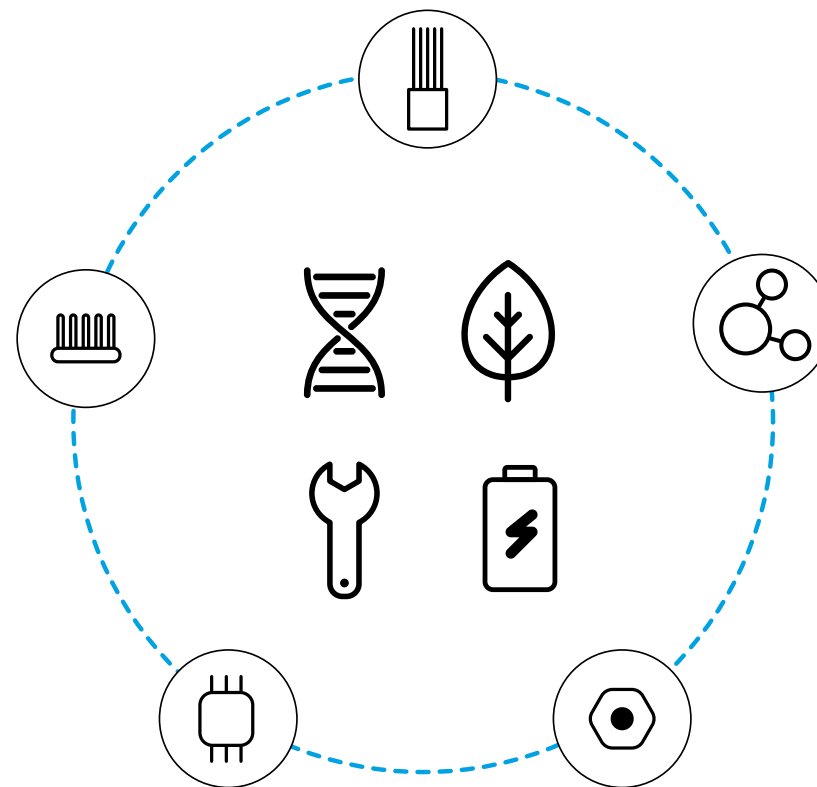
The mission of BCMaterials is to develop high-quality interdisciplinary research in multifunctional and active materials with advanced properties, from their basic understanding to explore new applications.

This specific research is developed in the framework of four main areas.

lines

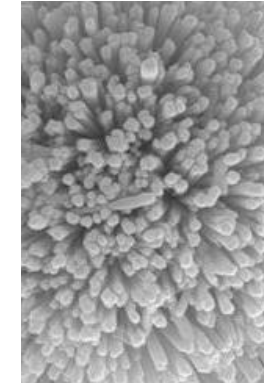
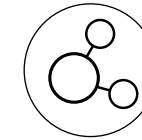
The Research Lines are focused on the in-depth investigation and development of specific Advanced and Multifunctional Materials.

Within the Research Areas, one or more of these Research Lines work together in order to give answer to specific technological and society challenges.



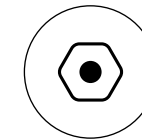
ACTIVE AND SMART MATERIALS

A deep understanding on the structural and molecular modifications of materials allow to tailor active response, processability and device integration. Thermally, electrically, magnetically and light responsive materials are designed, understood, and integrated into proof of concept device applications.



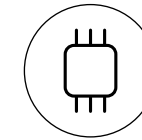
NANOSTRUCTURED MATERIALS

Nanostructures are developed in order to take advantage on their specific tailored properties and to make use of them in the development of multiresponsive composites. Magnetic nanoparticles produced by bacteria are investigated, together with novel magnetic, plasmonic and photocatalytic nanoparticles, among others.



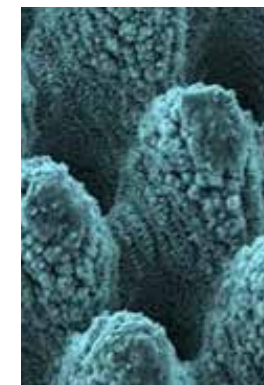
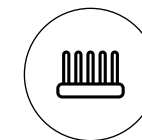
ADVANCED FUNCTIONAL MATERIALS

BCMaterials focuses on the rational design and engineering of materials for energy application, including energy conversion and storage. Critical element free permanent magnets and magneto caloric materials are being developed, as well as molecular engineering of organic and inorganic semiconductors and their electro-optical properties.



MICRO AND NANO-DEVICES

We design and develop small demonstrator devices that show the materials full potential at work. This line explores how material properties change as a function of physical dimensions. The ultimate aim is to exploit the unique properties of the nano- and micro- scales at the size of more familiar everyday objects.



FUNCTIONAL SURFACES AND COATINGS

We are focused into a game-changing approach of coating and surface design underpinned by digital, plasma and laser technologies. The goal is to enhance surface energies and develop new materials that provide a unique performance such as ultra-low friction, super-hardness, self-repairing, self-diagnostics and autocatalytic.



SPECIAL ACTION



neutron science

Among the wide variety of multifunctional materials being constantly developed, neutron sciences are playing an essential role in the study of their properties.

The important improvements that are being implemented in the different neutron sources available worldwide, with special attention given to the construction of the European Spallation Source in Lund, Sweden, provide the scientists with plenty of possibilities to explore the physical, chemical, engineering and/or biological properties of new materials.

The scientific research community at BCMaterials is intensively devoted to the use of neutron sciences as a transversal key research tool applied to the study of multifunctional active and smart materials, materials for energy generation and storage, materials for biomedical applications and tissue regenerations and materials for environmental prevention and remediation



The BNS2019 was among all the Neutron Scattering schools currently offered in Europe, the only and first one focused in science and instrumentation for CANS facilities. The School aims at educating graduate, PhD students and young researchers on neutron scattering techniques and on the neutron instrumentation design focused on CANS.



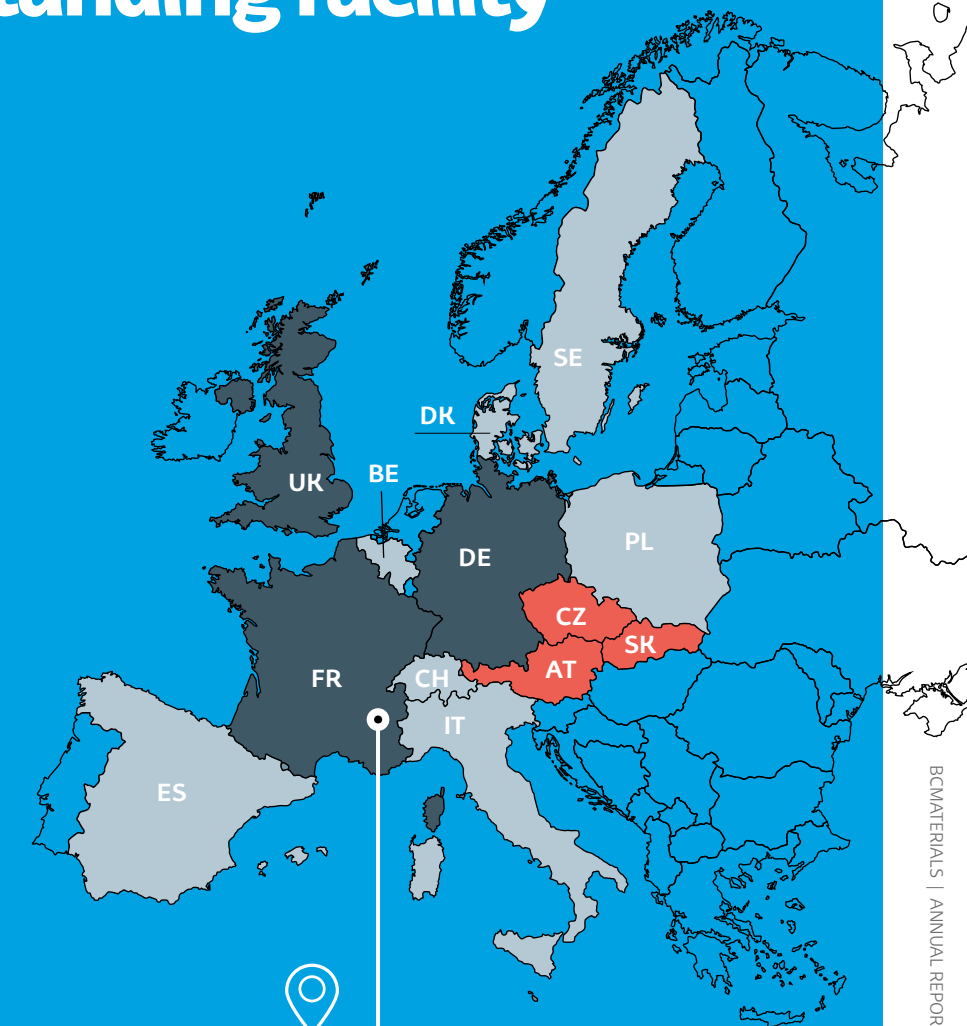
NEUTRONS FOR SCIENCE

- ILL Associate countries
- ILL Scientific Member countries
- CENI: Central European Neutron Initiative

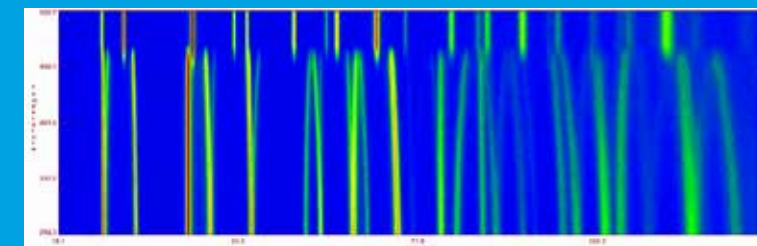


The D17 neutron reflectometer instrument at the Institut Laue Langevin, ILL, in Grenoble, France. Two of our scientists, M.S., Juan de la Cierva Fellow, and J.M.P., Ikerbasque Fellow, performing a neutron reflectometry experiment in perovskite solar cells with varied cation compositions to study their degradation mechanisms.

outstanding facility



INSTITUT LAUE-LANGEVIN
71 avenue des Martyrs
CS 20156, 38042 GRENOBLE
Cedex 9 - France



Thermodiffractogram acquired with the D1b neutron powder diffractometer, the Spanish CRG instrument at the Institut Laue Langevin, ILL, in Grenoble, France. The thermodiffractogram evidences a first order structural phase transition, from a low symmetry tetragonal martensite phase to a high symmetry cubic austenite phase in a ferromagnetic shape memory alloy

PROJECTS

28

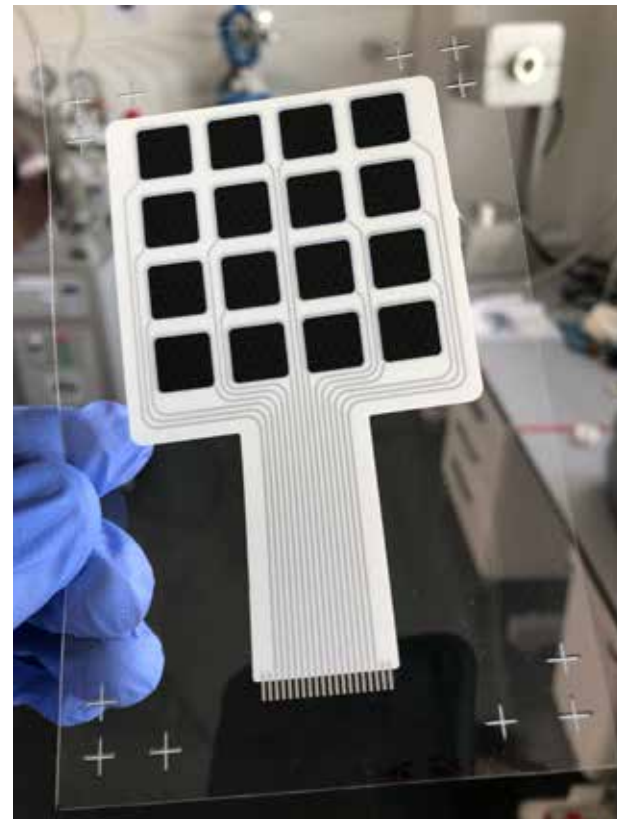
INTERNATIONAL	7
NATIONAL	7
REGIONAL	12
PRIVATE	2

Proposals submitted

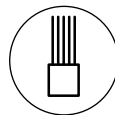
37

ACCEPTED	7
PENDING	7

WEARPLEX WEARABLE MULTIPLEXED BIOMEDICAL ELECTRODES H2020



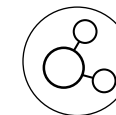
Wearplex project is aiming to develop smart electrodes for wearables applications in areas such as biomedicine and gaming. By implementing new approaches for additive manufacturing and printed electronics, it is possible to improve the performance of the device for monitoring and stimulation of muscular activity.



UNESCO MINE TAILING REVALORIZATION



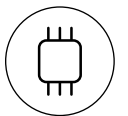
BCMaterials together with 6 partners from around the world, will explore the possibility to recover highly valuable Rare Earth Elements from mine tailings. The consortium will explore a greener bio-alternatives to extract the REE valuable metals, and recover them through specific and high capacitive adsorbent materials.



ACTIMAT SMART MATERIALS FOR ADVANCED MANUFACTURING PRODUCTS AND PROCESSES



It is an open platform created by different agents of the Basque Network for Science Technology and Innovation experts in materials. We have worked together very closely during 12 years to develop strategic research in Advanced Materials to cover the needs in Additive Manufacturing area.



PUBLICATIONS

135

33 H-INDEX

1781 CITATIONS

D1 69 D1 51 %
OTHER 49 %

Q1 113 Q1 84 %
OTHER 16 %

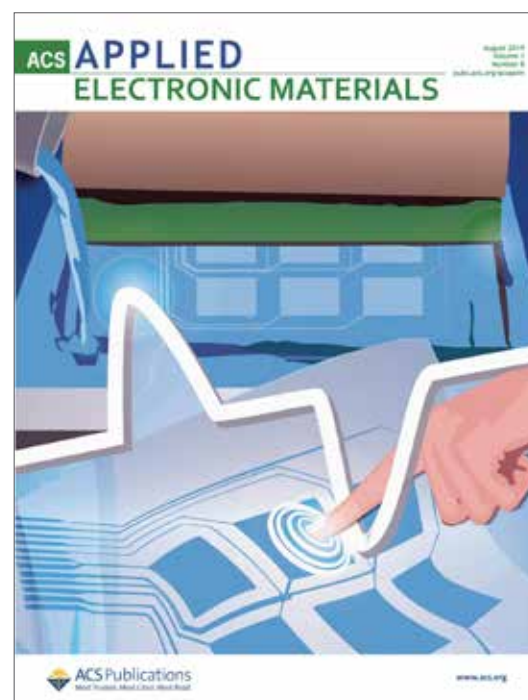
OPEN ACCESS 40 OPEN ACCESS 70 %
OTHER 30 %

14 BOOK CHAPTERS

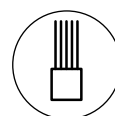
source SCOPUS

ENVIRONMENTALLY FRIENDLY PRINTABLE PIEZOELECTRIC INKS AND THEIR APPLICATION IN THE DEVELOPMENT OF ALL-PRINTED TOUCH SCREENS

Sérgio Gonçalves Jivago,
Serrado-Nunes Juliana,
Oliveira Nelson,
Pereira Loic,
Hilliou Carlos M. Costa,
Senentxu Lanceros-Méndez.



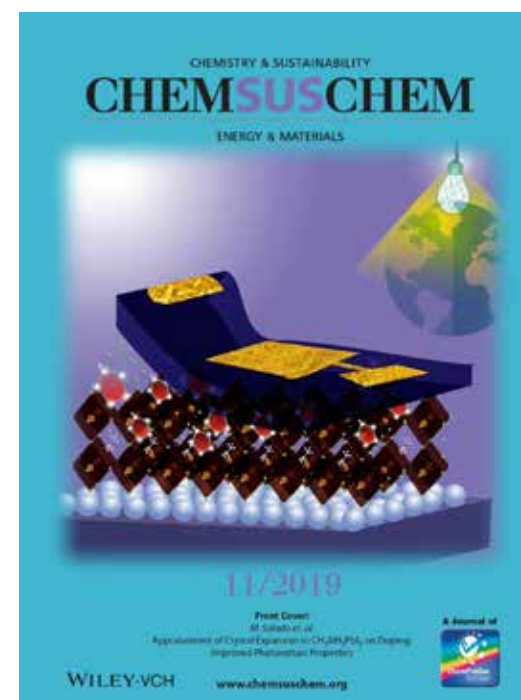
Development of a piezoelectric ink based on an environmentally friendlier solvent. The ink has been optimized for different printing techniques, including solvent casting, spray-printing, and screen-printing. The piezoelectric ink has been used to produce fully printed and highly sensitive touchscreens, detecting both touch and release events.



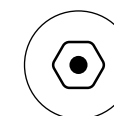
ACS Appl. Electron. Mater. 2019, 1, 8, 1678-1687

APPRAISAL OF CRYSTAL EXPANSION IN CH₃NH₃PbI₃ ON DOPING: IMPROVED PHOTOVOLTAIC PROPERTIES

Manuel Salado,
Samrana Kazim,
Mohammad Khaja,
Nazeeruddin,
Shahzada Ahmad.



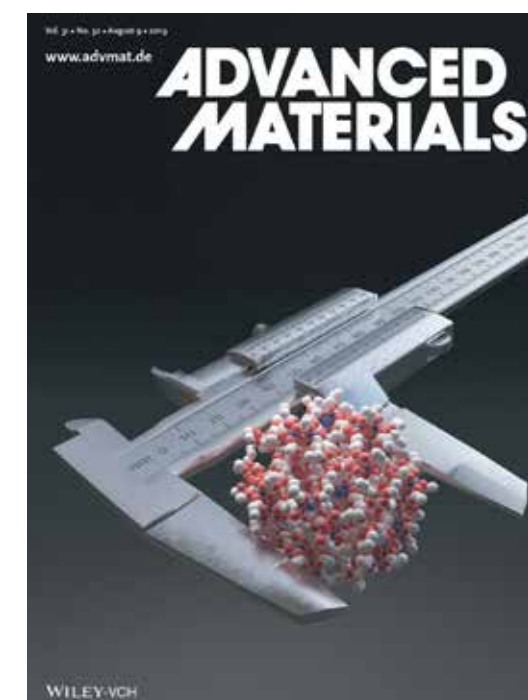
How the inclusion of imidazolium iodide (ImI) can play a role in the expansion of CH₃NH₃PbI₃ crystal, which is beneficial for perovskite solar cells fabrication. Optimized inclusion of ImI can not only improve the stability but also the performance of the perovskite solar cells.



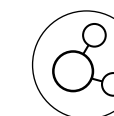
ChemSusChem, page 2366 in Issue 11, 2019

NANOPARTICLE CHARACTERIZATION: NANOPARTICLE CHARACTERIZATION: WHAT TO MEASURE?

Mario M. Modena,
Bastian Rühle,
Thomas P. Burg,
Stefan Wuttke.



Despite the large variety of measurement techniques, determining the key physicochemical properties of nanoparticles remains a critical challenge for scientists. Mario M. Modena, Stefan Wuttke, and co-workers discuss established and emerging methods for investigating the key parameters defining a nanoparticle sample, namely size, shape, surface charge, and porosity. In addition, they propose some recommendations on how these physicochemical parameters should be investigated, according to the intended nanoparticle use.



Adv. Mater. 32/2019

research network

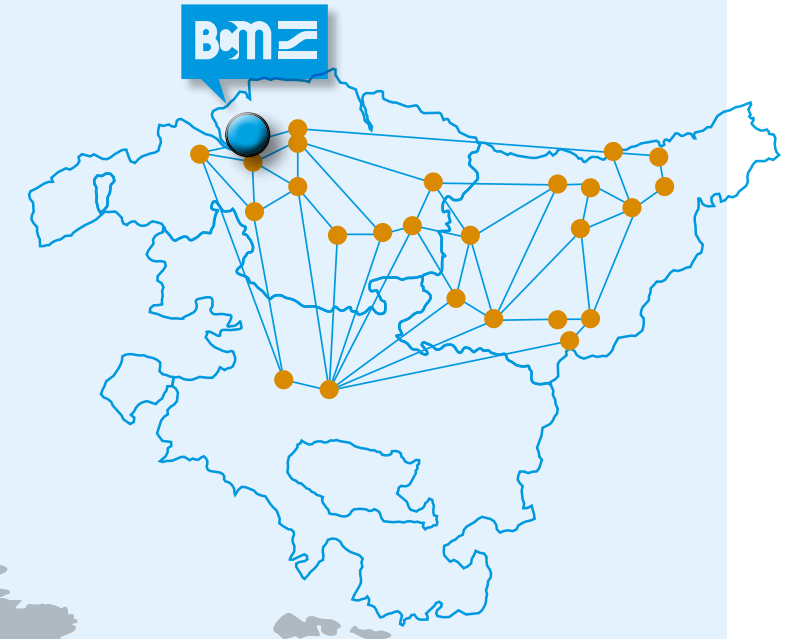
90
PARTNERS

44
INTERNATIONAL

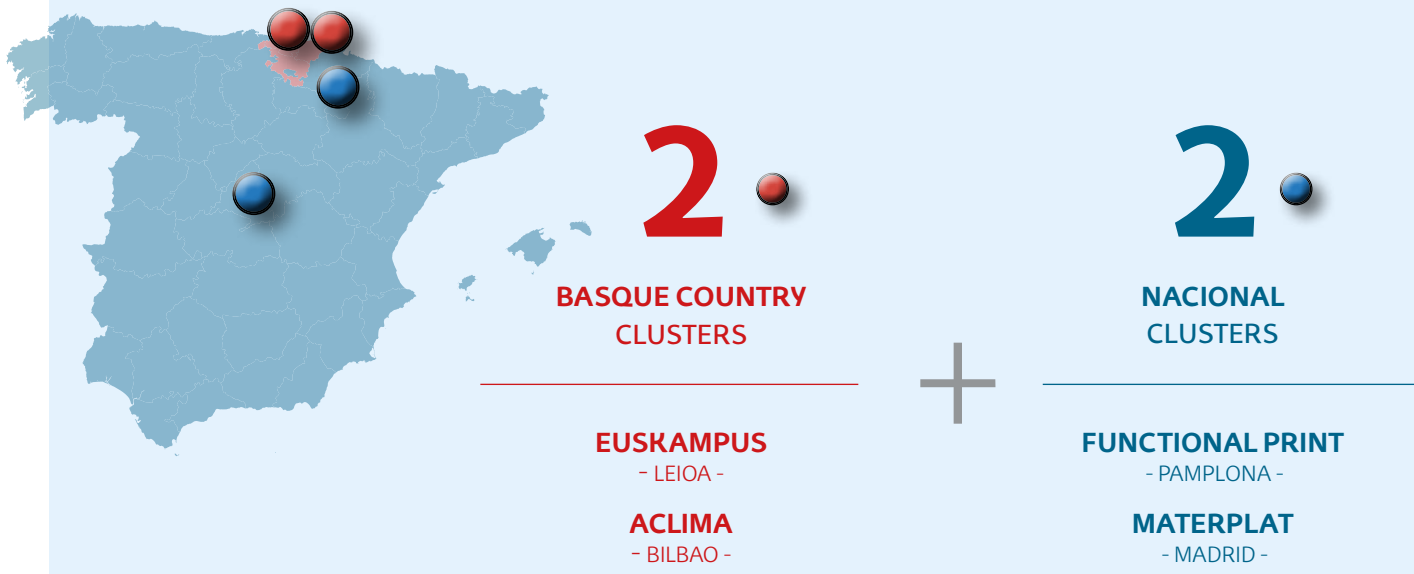
15
NACIONAL

31
REGIONAL
20 RVCTI + **11** PRIVATE COMPANIES

EUSKADI
BASQUE COUNTRY



clusters / asociations



usage of large facilities

1

SPRING-8 SYNCHROTRON
HYOGO, JAPAN

www.spring8.or.jp

6

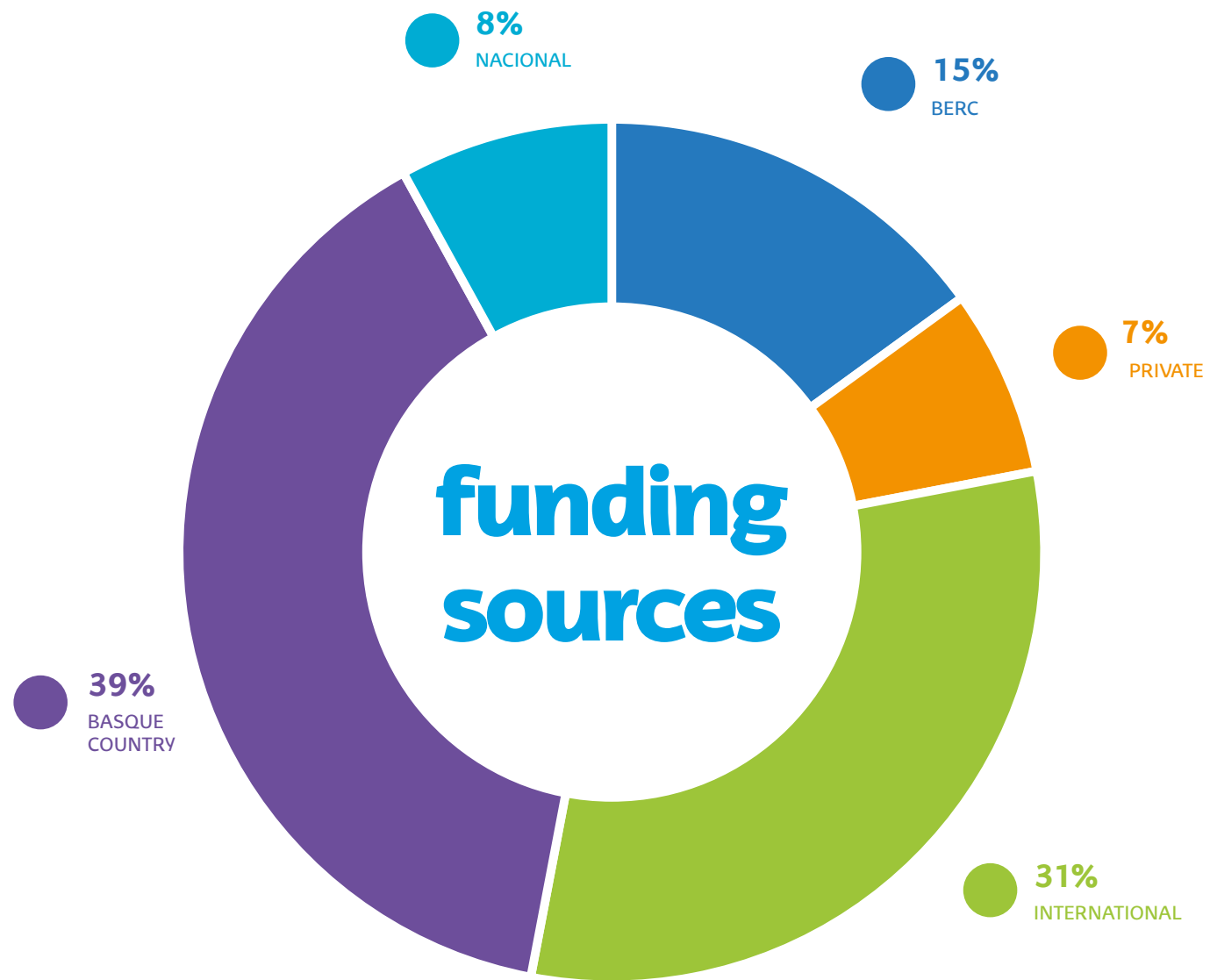
INSTITUT LAUE LANGEVIN ILL,
GRENOBLE, FRANCE

www.ill.eu

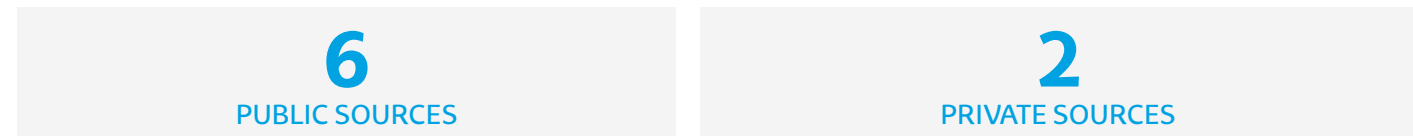
1

ISIS NEUTRON SOURCE,
UK

www.isis.stfc.ac.uk



Financial Entities



collaborations with academic degrees

7
PHD
THESIS

doctoral thesis

5
MSC

Master of Science



www.ehu.es

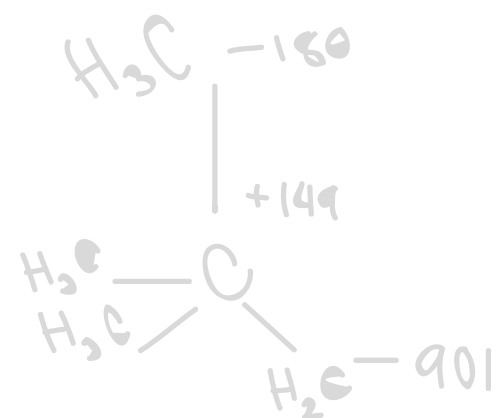


www.ucm.es



Universidade do Minho

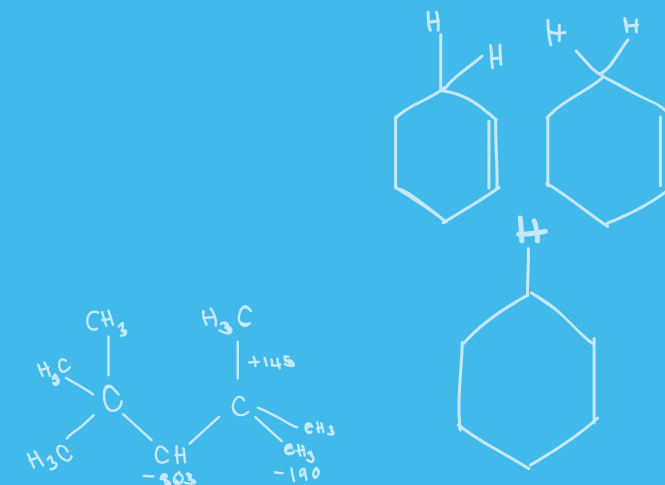
www.uminho.pt



facilities

2019 was the year for consolidation of the structural changes, which also implied the consolidation of our new infrastructures to achieve our mission as a centre of international excellence.

Our mission is clear: to work in materials for a better life. This can be only achieved with the implementation of high quality laboratories.



*Our mission is clear;
work in materials for a better life!*



outreach

Science is a key factor for social and economic development. We believe that the communication of Science to our society is essential, so one of our most important commitments is to contribute to the development of "scientific culture" and to the generation of scientific vocation.

*New scientist for
a better life!*

"There are two ways of spreading light: to be the candle or the mirror that reflects it."

Edith Wharton (1862 - 1937)

5
WORKSHOPS
ORGANIZED



9
INVITED TALKS AT
BCMATERIALS



2019 was a journey for expanding our horizons and sharing all our knowledge with the society and the scientific community.



"Science knows no country, because knowledge belongs to humanity, and is the torch which illuminates the world."

Louis Pasteur (1822 - 1895)

60
ORAL PRESENTATIONS

34
INVITED TALKS



During 2019 we have crossed frontiers and visited many different countries. We have shared our experience and we have made new partners and created new projects.



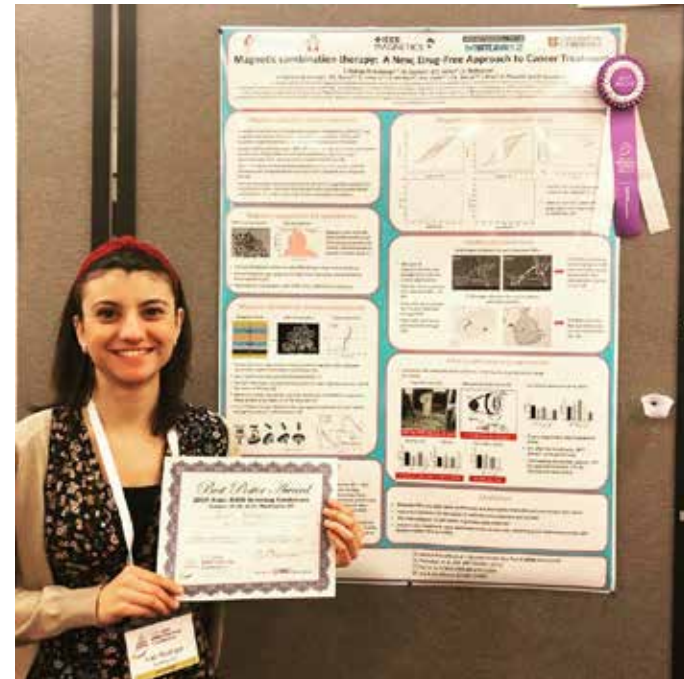


awards

2019 was also the year to collect the fruits of our effort. We are an excellence center and our researches are excellent in all possible ways.

"Excellence is never an accident. It is always the result of high intention, sincere effort, and intelligent execution; it represents the wise choice of many alternatives - choice, not chance, determines your destiny."

Aristotle (384 b. C - 322 b. C)



7



science for society

Share our knowledge with society is our biggest aim. Communication of science and technology can improve the quality of life, inspiring the next generation of scientist to create a better future.

We work in materials for society and for a better life!

15

EVENTS

BCM AT RADIO EUSKADI:
NEW MATERIALS FOR A
BETTER LIFE

XVII SCIENCE WEEK
UPV/EHU

@BCMATERIALS



SCHOOL
VISITS



INTERNATIONAL
WOMEN AND GIRL IN
SCIENCE DAY



PINT OF SCIENCE

Participating partners and sponsors:

- kafé arizkoria
- dock
- hika ateneo
- precipita
- ACHUCARRO
- LA RIBERA EAT MUSIKA TERRAZA BAR
- ACHUCARRO
- GUJ
- CSIC
- vallejosong

FESTIVAL PINT OF SCIENCE JAIALDIA

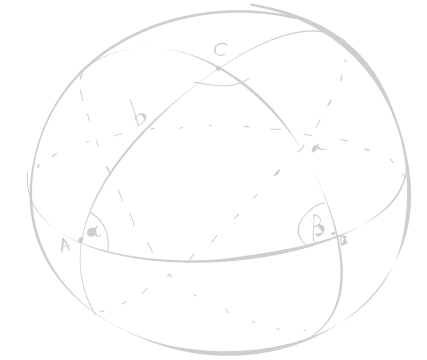
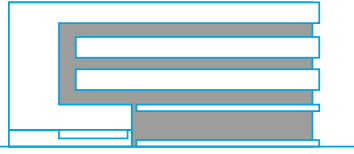
Bilbao

2019ko Maiatzaren 20tik 22ra
20-22 de Mayo 2019

#pint19BIO

PINT OF
SCIENCE

new facilities: inauguration



One of the highlights of the year was the inauguration of the new facilities at the UPV/EHU Science Park by the Lehendakari, Iñigo Urkullu.

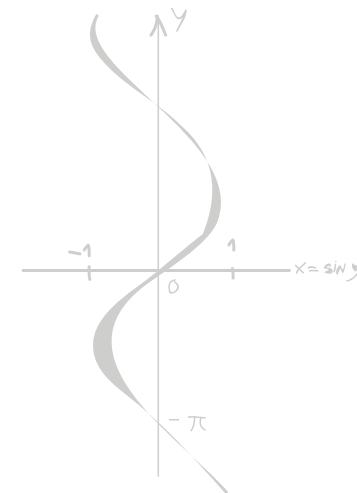
The new facilities are the result of the coordinated efforts of the Ikerbaque Foundation, UPV/EHU and BCMaterials to provide the centre with high-level facilities with dedicated laboratories for the main research areas of BCMaterials.

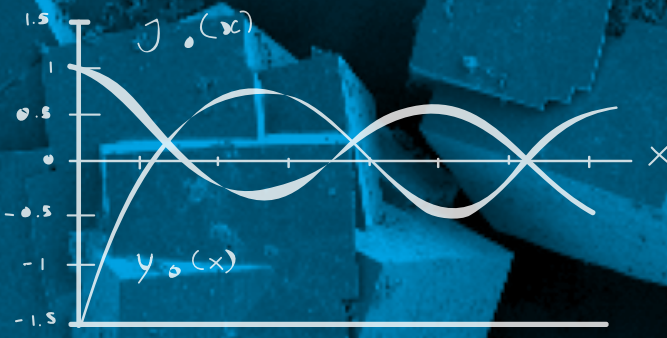
Those facilities will allow us to better achieve our mission of generating knowledge and technologies on new generation of multifunctional materials.

Our new home in which everyone is welcome to share our passion for science and technology.

BCMaterials commitments are in the field of research and innovation, technology transfer and also in the communication of the scientific culture to our society

Iñigo Urkullu





is the intersection of $f^{-1}(c_0)$ and $p^{-1}(d_0)$.
 $y_1 = \bar{b}_0$
in $C\{c_0\}$ satisfy $\Delta(y_1) = \Delta(y_2)$
only if there are elements a in $A\{a_0\}$, δ in $D\{d_0\}$ such that
 $y_1 = f(a) y_2 p(\delta)$.
 $B\{b_0\}$ is the pullback of $A\{a_0\} \xrightarrow{f} C\{c_0\} \xleftarrow{p} D\{d_0\}$