ERC Grants

CENIMAT|i3N

European Research Council
Established by the European Commission

i3N

INSTITUTE FOR NANOSTRUTURES, NANOMODELLING AND NANOFABRICATION

RESEARCH, INNOVATION AND ENGINEERING APPLICATIONS

Since its creation in 2006, i3N has established itself as a leading national and international institute, in the area of advanced materials and nanotechnologies. Pioneering fields such as photovoltaics, thin-film microelectronics, and transparent electronics. With an interdisciplinary structure, i3N comprises six research groups addressing strategic challenges, including sustainable nanotechnology and biomedical engineering. I am proud to highlight the eleven ERC grants already achieved, reinforcing our leadership in Materials Science and Nanotechnology in Portugal.

At i3N, we believe that the collective strength of a collaborative team far exceeds the sum of its parts, particularly in a multidisciplinary field like Nanotechnology. Beyond advancing research, we are also training the next generation for academia, industry, and entrepreneurship. With state-of-the-art tools available at i3N, the sky is no more the limit!

Rodrigo Martins

https://i3n.org

PRR Plano de Recuperação e Resiliência · REPÚBLICA PORTUGUESA · Financiado pela União Europeia NextGenerationEU · fct Fundação para a Ciência e a Tecnologia · ANI Agência Nacional de Inovação · erc European Research Council Established by the European Commission · European Commission

This work is funded by National Funds through the FCT - Fundação para a Ciência e a Tecnologia, I.P., and the Ministério da Educação, Ciência e Inovação under the scope of the projects LA/P/0037/2020, UIDB/50025/2020 and UIDP/50025/2020

my green lab certification.

i3N wet labs, has received in 2025 the certification from "My Green Lab Certification", as a commitment to Sustainable Science! My Green Lab Certification is considered the gold standard for laboratory sustainability best practices around the world and was recognized by the United Nations Race to Zero campaign as a key measure of progress towards a zero-carbon future.

2025

The Impact of ERC Grants on Europe, Portugal, and CENIMAT|i3N

The European Research Council (ERC) represents the highest standard of scientific excellence in Europe, and globally. Its competitive, curiosity-driven funding empowers researchers to pursue breakthrough ideas with boldness and independence, advancing fundamental knowledge and addressing the applied challenges of the future.

In Portugal, ERC-funded projects have become a cornerstone of scientific excellence and international recognition. At NOVA University Lisbon, 39 ERC grants have been secured to date, a major national achievement. Of these, 12 were awarded to researchers at CENIMAT|i3N, representing an impressive 31% of the university's total.

This success goes far beyond numbers. ERC grants have profoundly transformed our Associate Laboratory, strengthening complex research infrastructures, enabling the formation of world-class multidisciplinary teams, and enhancing the international reputation of CENIMAT|i3N.

Recognising the strategic value of the ERC programme, Portugal established the ERC Portugal initiative, coordinated by the Fundação para a Ciência e a Tecnologia (FCT). This national effort comprises several pillars aimed at supporting researchers in preparing competitive ERC proposals, reinforcing institutional capacity, and ultimately boosting Portugal's ability to attract and retain top scientific talent, while fostering a sustainable culture of research excellence.

These projects are not only advancing frontier science, they are actively shaping the future. At CENIMAT|i3N, our focus on advanced materials research contributes directly to Europe's competitiveness and technological sovereignty. The ERC stands not only as a funding mechanism, but as a true source of inspiration, for researchers, institutions, and nations committed to scientific ambition and excellence.

For all these reasons, we are deeply grateful to the ERC, the world's best science funding programme. As Maria Leptin so rightly said: "A stronger Europe starts with science."

MISSION i3N

i3N conducts research in the strongly multidisciplinary field of advanced materials, nanotechnology and nanosciences.

The mission of i3N is:

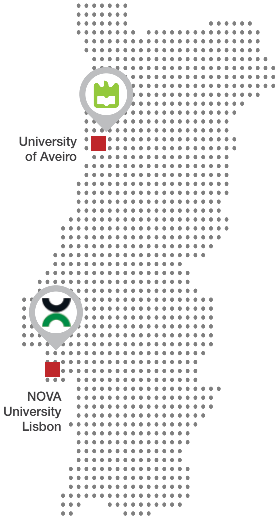
- Promoting scientific excellence and innovation in Sustainable Functional Advanced Materials, using green technologies, to serve a plethora of fields and for socio-economical ends, aligned with the Sustainable Development Objectives and the Green Deal.
- Pushing the international leading edge of research by fostering breakthrough concepts and exploiting materials and device properties at nanoscale level.
- Promoting practical applications of R&D+I results, including their transfer to the industry.
- To provide access of the institute facilities and equipment to the technical-scientific community and lending assistance to industry.
- Training and enabling the continuous education of scientific personnel (including MSc and PhD students) and technical researchers, enabling them to overcome the future challenges of science and technology cross cutting fields.
- Fostering public awareness, engagement and understanding of advanced materials, nanoscale science, engineering and nanotechnology.
- Providing scientific and technical evidences in order to sustain the Public Policies for the changes of the future.

GOALS i3N

i3N focuses on three main issues to pursue its mission:

- To create a top environment for international scientific talent.
- To create strong multidisciplinary cohesion within the infrastructure.
- To be a national leader and international key player in nanotechnology and advanced materials.

ORGANIZATIONAL STRUCTURE i3N



University of Aveiro Hub

José Fernando Mendes
Vice-Coordinator
RG6 Research Group Leader
Theoretical and Computational Physics Group

Florinda Costa
TL3 Thematic Line Coordinator
Nanomaterials Engineering and Functional Interfaces

João Veloso
TL4 Thematic Line Coordinator
Biomedical Devices and Systems

Paulo Antunes
RG2 Research Group Leader
Nanophotonics and Optoelectronics

Manuel Graça
RG3 Research Group Leader
Physics of Advanced Materials and Devices

NOVA University of Lisbon Hub

Rodrigo Martins
Coordinator
TL2 Thematic Line Coordinator
Green and Clean Energy Systems

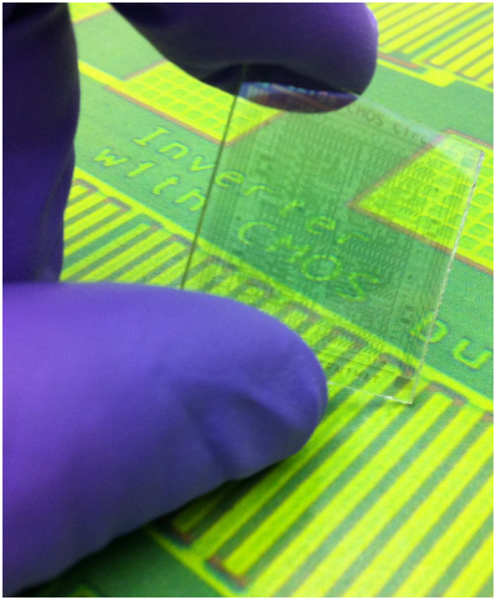
Pedro Barquinha
TL1 Thematic Line Coordinator
Sustainable Micro and Nanofabrication
RG1 Research Group Leader
Materials for Electronics, Optoelectronics and Nanotechnologies

João Paulo Borges
RG4 Research Group Leader
Soft and Biofunctional Materials

João Pedro Oliveira
RG5 Research Group Leader
Structural Materials

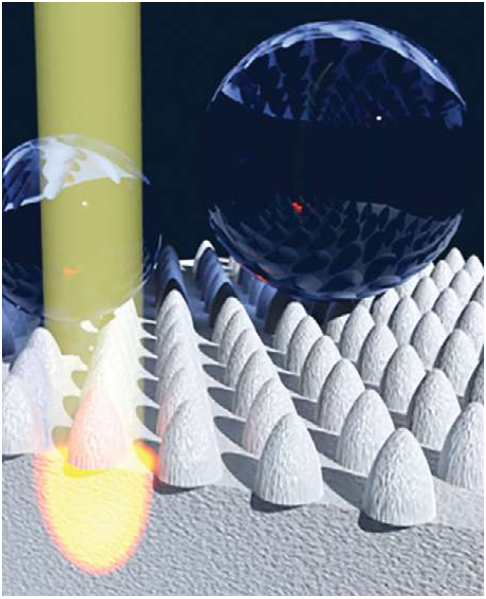
TL1
SUSTAINABLE MICRO AND NANOFABRICATION

Since 2003, i3N has been a leader in oxide thin-film transistors (TFTs). While materials like indium-gallium-zinc oxide (IGZO) are explored industrially, i3N pursues breakthrough advances, on more sustainable semiconductors.



TL2
GREEN AND CLEAN ENERGY SYSTEMS

We focus on consumer-oriented renewable power systems exploring cost-effective energy harvesting (e.g. photovoltaics improved with photonics, mechanical from motion, thermal) and storage (e.g. batteries and supercapacitors, solar fuels) aiming for a fully decarbonized society.

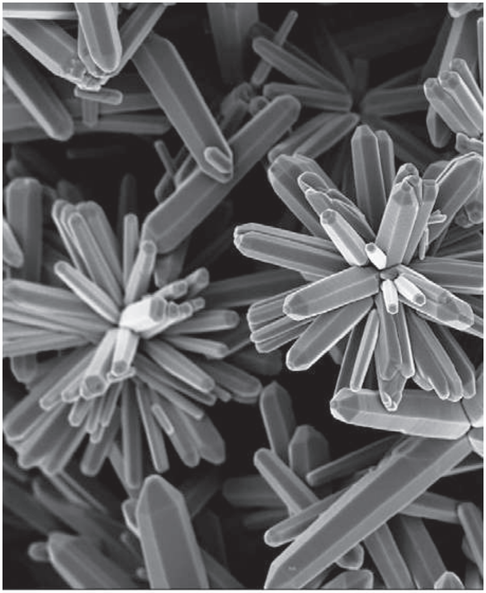


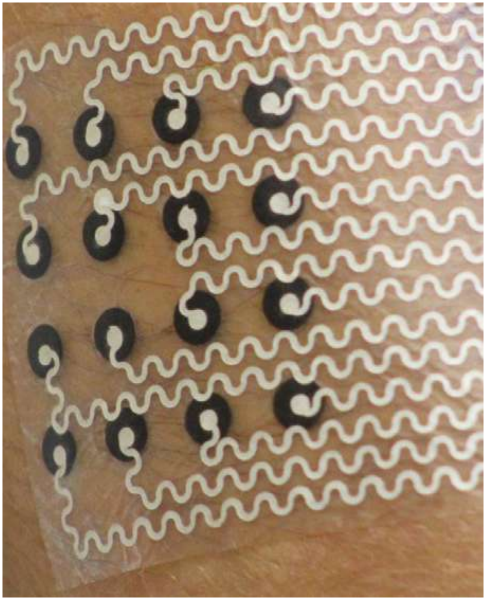
TL3
NANOMATERIALS ENGINEERING AND FUNCTIONAL INTERFACES

Our emphasis is on developing materials and nanoparticles for energy, optoelectronic, electronic, and bio applications. We also functionalize interfaces for diverse applications.

TL4
BIOMEDICAL DEVICES AND SYSTEMS

We work on innovative biomedical solutions for disease prevention and precision medicine, developing medical devices, imaging systems, and regenerative medicine to improve longevity.



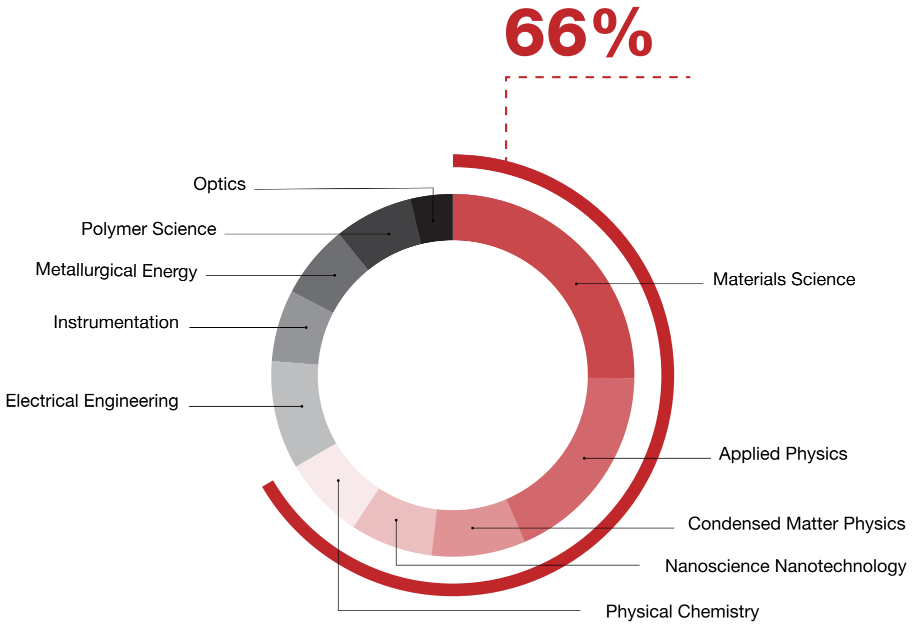


MAIN SCIENTIFIC AREAS OF PUBLICATION

i3N

+70%
HIGH-RANKING JOURNALS

63%
INTERNATIONAL COLLABORATION



SCIENTIFIC INDICATORS 2018-2023 i3N

SCIENTIFIC PUBLICATIONS	+1600
HIGHLY CITED PAPERS	42
PATENTS ISSUED	58
HIGH-RANKING JOURNALS	70%
INTERNATIONAL COLLABORATION	63%
CITATIONS	+60000
i3N H-INDEX	111
CONFERENCE ORGANIZATION	+30
PLENARY / KEYNOTE	78
INVITED	170
COMMUNICATIONS	+1400

PROJECTS GRANTED 2018-2023 i3N

+61 M€

45 DEMONSTRATORS/ PROTOTYPES DEVELOPED

07 ERC 2018 — 2023

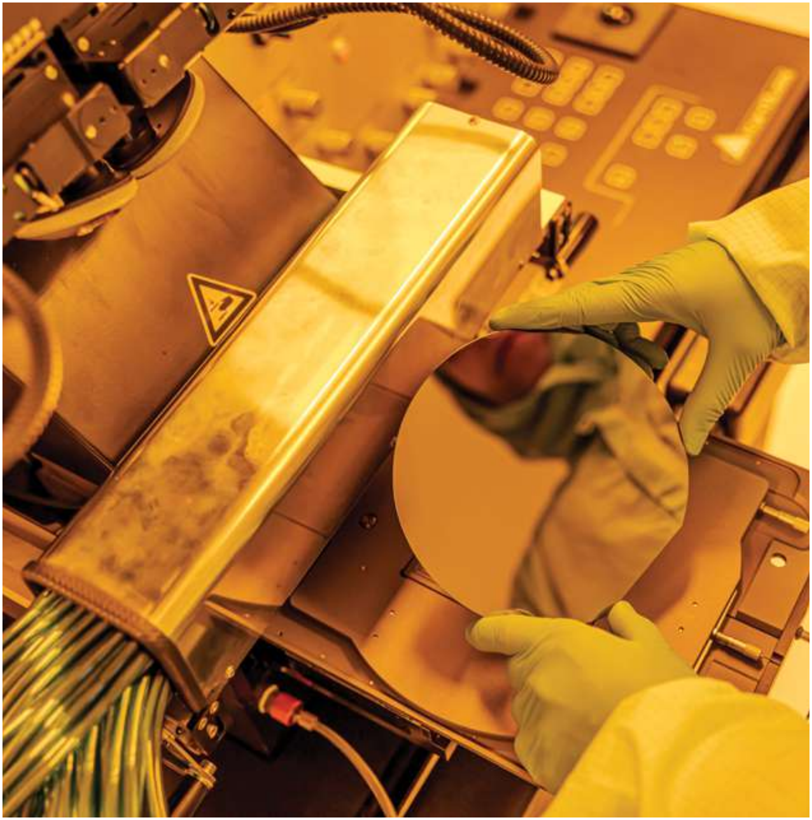
102 PROJECTS

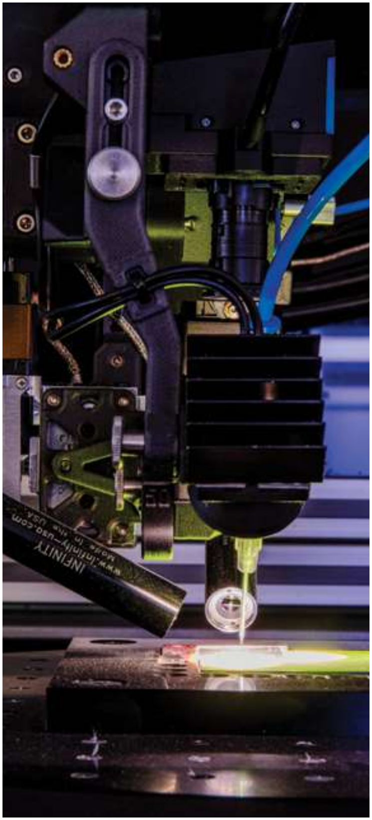
i3N

RESEARCH FACILITIES

_ material device/ fabrication

i3N Microelectronics Laboratories are state-of-the-art thin film based semiconductor research and fabrication facilities that support the design, fabrication, and testing of novel devices and systems.





03

CLEAN ROOM FACILITES WITH 1080 m²

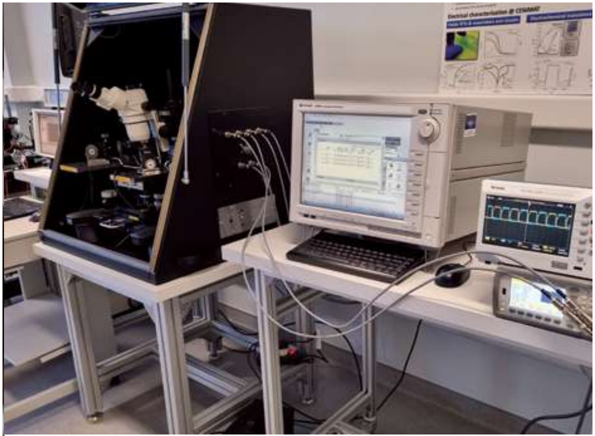
i3N

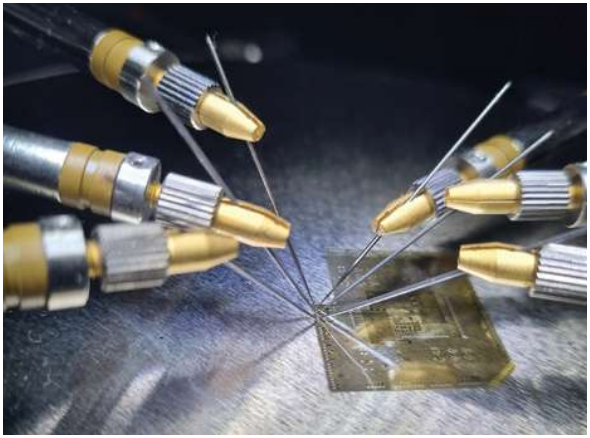
RESEARCH FACILITIES

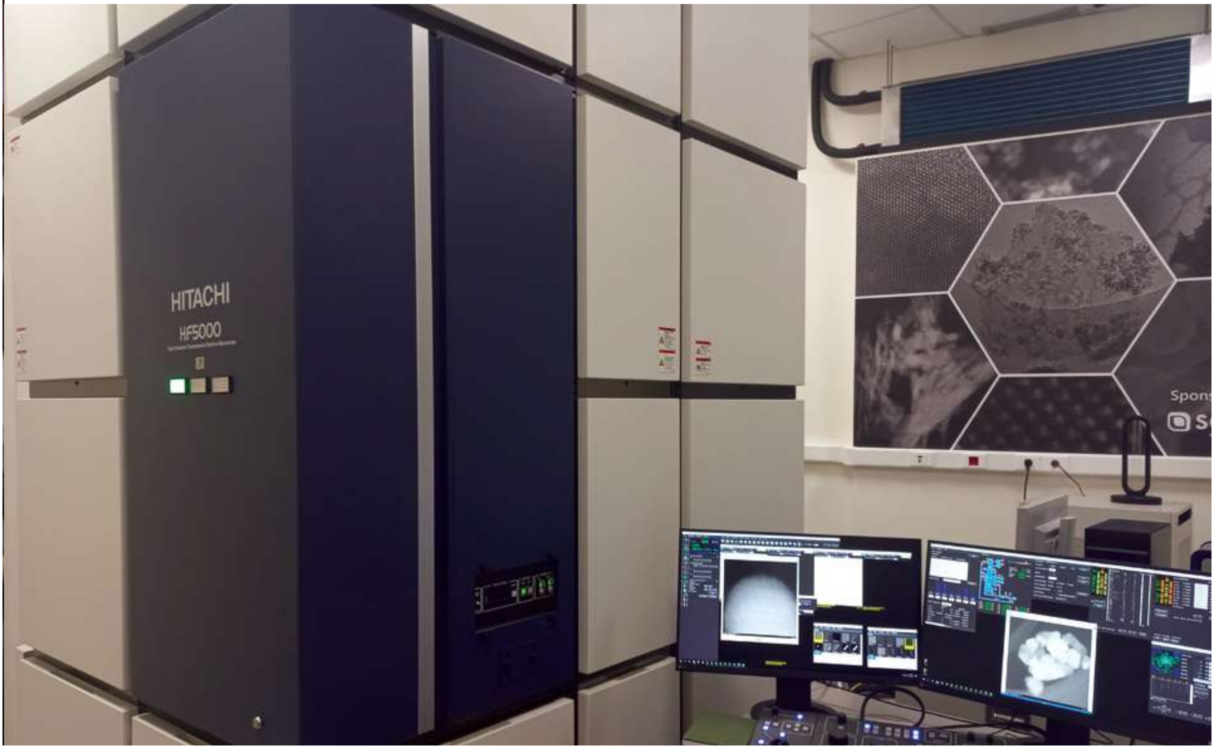
_ material device/ characterisation

A state-of-the-art infrastructure that provides access to advanced equipments, ranging from design to fabrication and characterisation:

— Advanced Electron Microscopy
— Micro and Nanofabrication
— Nanophotonics & Bioimaging
— Materials Characterisation






HITACHI
HF5000

i3N

SCIENCE & SOCIETY

PUBLIC AWARENESS

Fostering public awareness, engagement and understanding of advanced materials.

ERC Grants

CENIMAT|i3N

European Research Council
Established by the European Commission

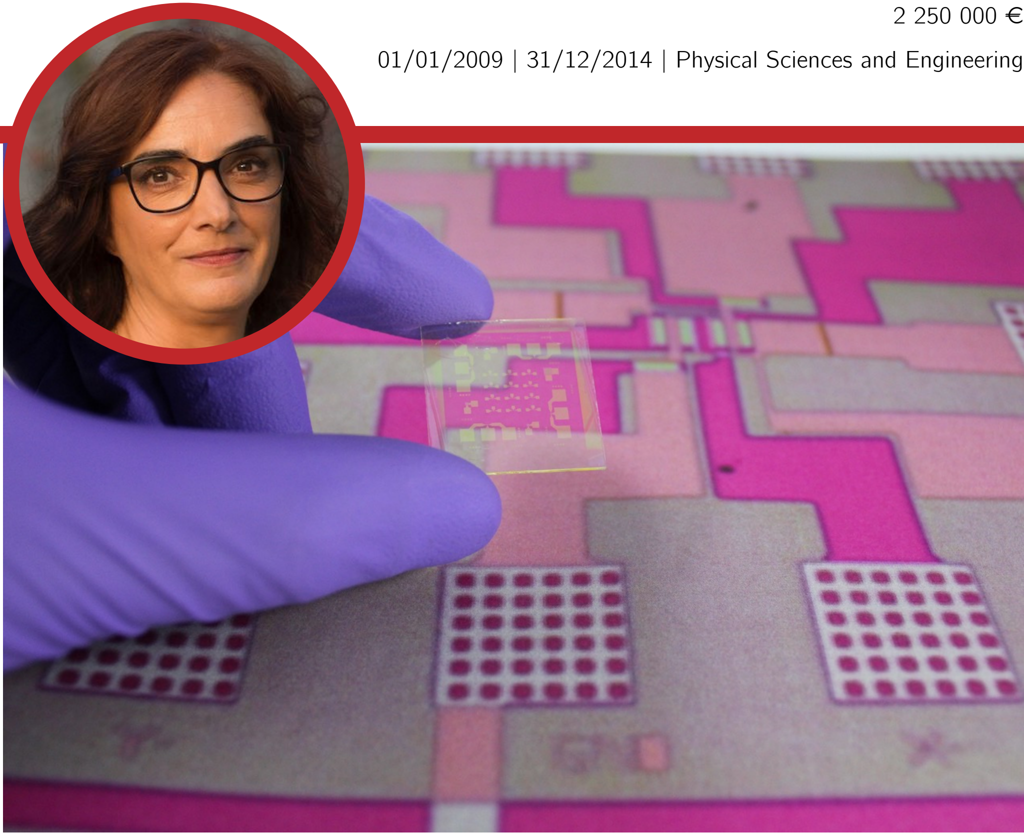
2008 | Advanced Grant | Elvira Fortunato

INVISIBLE

Advanced Amorphous Multicomponent Oxides for Transparent Electronics

2 250 000 €

01/01/2009 | 31/12/2014 | Physical Sciences and Engineering



2008

Advanced Grant | Elvira Fortunato

INVISIBLE

Advanced Amorphous Multicomponent Oxides for Transparent Electronics

Imagine having a fully transparent and flexible, foldable, low cost, displays or at the glass window of your home/office, a transparent electronic circuit, do you believe on that? Maybe you are asking me if I am writing science fiction. No I am not. In fact this is a very ambitious objective but is tangible in the framework of this project due to the already acquired experience in the development of transparent thin film transistors using novel multifunctional and multicomponent oxides that can behave as active or passive semiconductor materials.

This is an interdisciplinary research project aiming to develop a new class of transparent electronic components, based on multicomponent passive and active oxide semiconductors (n and p-types), to fabricate the novel generation of full transparent electronic devices and circuits, either using rigid or flexible substrates.

The emphasis will be put on developing thin film transistors (n and p-TFTs) and integrated circuits for a broad range of applications (from inverters, C-MOS like devices, ring oscillators, CCDs backplanes for active matrices, biossensor arrays for DNA/RNA/proteins detection), boosting to its maximum their electronic performances for next generation of invisible circuits. By doing so, we are contributing for generating a free real state electronics that is able to add new electronic functionalities onto surfaces, which currently are not used in this manner and that silicon cannot contribute. The multicomponent metal oxide materials to be developed will exhibit (mainly) an amorphous or a nanocomposite structure and will be processed by PVD techniques like rf magnetron sputtering at room temperature, compatible with the use of low cost and flexible substrates (polymers, cellulose paper, among others). These will facilitate a migration away from tradition silicon like fab based batch processing to large area, roll to roll manufacturing technology which will offer significant advantages.

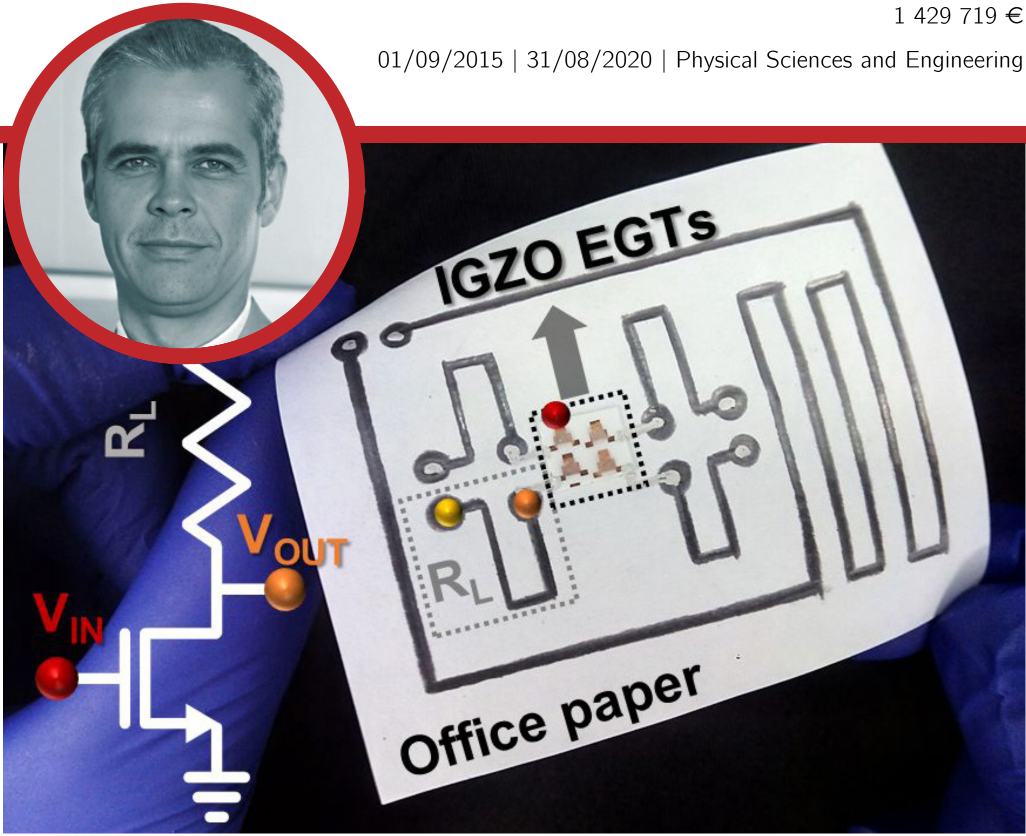
2014 | Starting Grant | Luis Nunes Pereira

NEW_FUN

New Era of Printed paper Electronics based on advanced functional cellulose

1 429 719 €

01/09/2015 | 31/08/2020 | Physical Sciences and Engineering



2014

Starting Grant | Luis Nunes Pereira

NEW_FUN

New Era of Printed paper Electronics based on advanced functional cellulose

Fully recyclable and low cost electronic goods are still far from reality. My interest is in creating environmental friendly advanced functional materials and processes able to result in new class of paper based electronic products. This represents a reborn of the paper millenary industry for a plethora of low cost, recyclable and disposable electronics, putting Europe in the front line of a new era of consumer electronics.

While the vision of the proposal is a very ambitious one, my ground-breaking research work to date related with oxide based transistors on paper (from which I am one of the co-inventors) has contributed to the basic technological breakthroughs needed to create the key elements to establish a new era of paper electronics. Field effect transistors (FETs), memory and CMOS devices, with excellent electronic performance and using paper as substrate and dielectric have resulted from my recent work. What I am proposing now is to reinvent the concept of paper electronics. In NEW_FUN I want to develop a completely new and disruptive approach where functionalized cellulose fibers will be used not only as dielectric but also as semiconductor and conductor able to coexist in a multilayer paper structure. That is, assembling paper that can have different functionalities locally, on each face or even along its entire thickness/bulk. This way issues such as failure under bending, mechanical robustness and stability can be minimized. Doing so, electronic and electrochemical devices can be produced not only on paper but also from paper. The outputs of NEW_FUN will open the door to turn paper into a real electronic material making possible disposable/recyclable electronic products, such as smart labels/packages (e.g. food and medicine industry), sensors for air quality control (car, house and industry environments); disposable electronic devices such as bio-detection platforms, lab-on-paper systems, among others.

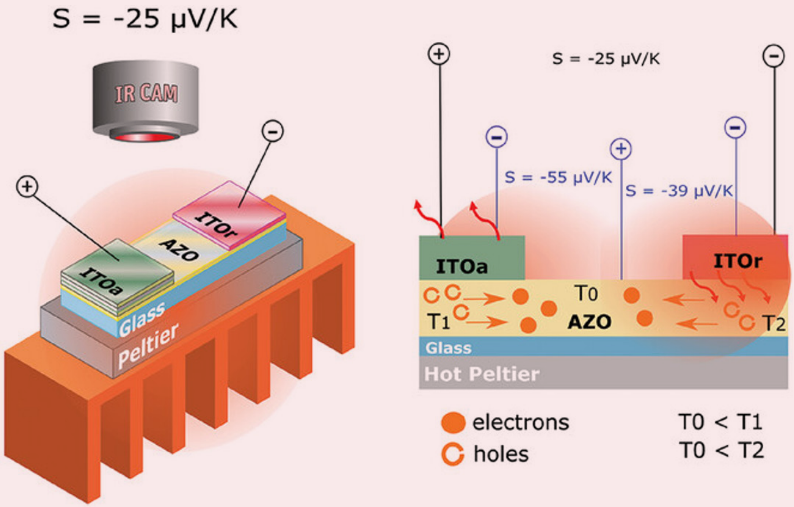
2015 | Consolidator Grant | Isabel Ferreira

CapTherPV

Integration of Capacitor, Thermoelectric and PhotoVoltaic thin films for efficient energy conversion and storage

1 999 375 €

01/07/2015 | 31/07/2022 | Physical Sciences and Engineering



2015

Consolidator Grant | Isabel Ferreira

CapTherPV

Integration of Capacitor, Thermoelectric and PhotoVoltaic thin films for efficient energy conversion and storage

The possibility of having a unique device that converts thermal and photonics energy into electrical energy and simultaneously stores it, is something dreamed by the PI since the beginning of her research career. To achieve that goal, this project aims to gather, in a single substrate, solar cells with up-conversion nanoparticles, thermoelectrics and graphene super-capacitor, all made of thin films.

These three main components will be developed separately and integrated sequentially. The innovation proposed is not limited to the integration of components, but rely in ground-breaking concepts:

1) thermoelectric elements based on thin film (TE-TF) oxides;

2) plasmonic nanoparticles for up conversion of near infrared radiation to visible emission in solar cells;

3) graphene super-capacitors;

4) integration and optimization of all components in a single CapTherPV device.

This ambitious project will bring new insights at large area, low cost and flexible energy harvesting and comes from an old idea of combining energy conversion and storage that has been pursued by the PI. She started her career in amorphous silicon thin film solar cells, later she started the development of thin film batteries and more recently started a research line in thermoelectric films.

If approved, this project will give financial support to consolidate the research being carried out and will give independence to the PI in terms of resources and creative think. More importantly, will facilitate the concretization of the dream that has been pursued with hard work.

2016 | Starting Grant | Pedro Barquinha

TREND

Transparent and flexible electronics with embedded energy harvesting based on oxide nanowire devices

1 500 000 €

01/01/2017 | 31/12/2021 | Physical Sciences and Engineering

2016

Starting Grant | Pedro Barquinha

TREND

Transparent and flexible electronics with embedded energy harvesting based on oxide nanowire devices

The Internet of Things is shaping the evolution of information society, requiring an increasing number of objects with embedded electronics, sensors and connectivity. This spurs the need for systems where summing to performance and low cost, multifunctionality has to be assured. In this context, TREND aims to take transparent electronics into as-of-yet unexplored levels of integration, by combining on flexible substrates transparent and high-speed nanocircuits with energy harvesting capabilities, all based on multicomponent metal oxide nanowires (NWs).

For this end, sustainable and recyclable materials as ZnO, SnO_2, TiO_2 and Cu_2O will be synthesized in different forms of heterostructured NWs, using low-temperature and low-cost solution processes. For precise positioning, NWs will be directly grow on flexible substrates using seed layers patterned by nanoimprint lithography. This will be crucial for integration in different nanotransistor structures, which will be combined into digital/analog nanocircuits following planar and 3D approaches. Energy will be provided by piezoelectric nanogenerators with innovative structures and materials. Final platform of nanocircuits+nanogenerators will make use of NW interconnects, bringing a new dimension to the systems-on-foil concept.

The research will be carried out at FCT-UNL, in a group pioneering transparent electronics. My PhD on oxide materials/devices and proven expertise on circuit integration, oxide nanostructure synthesis and nanofabrication/characterization tools will be a decisive contribute to the implementation of the proposal.

TREND is an ambitious multidisciplinary project motivating advances in materials science, engineering, physics and chemistry, with impact extending from consumer electronics to health monitoring wearable devices. By promoting new ideas for practical ends, it will contribute to place Europe in the leading position of such strategic areas, where sustainability and innovation are key factors.

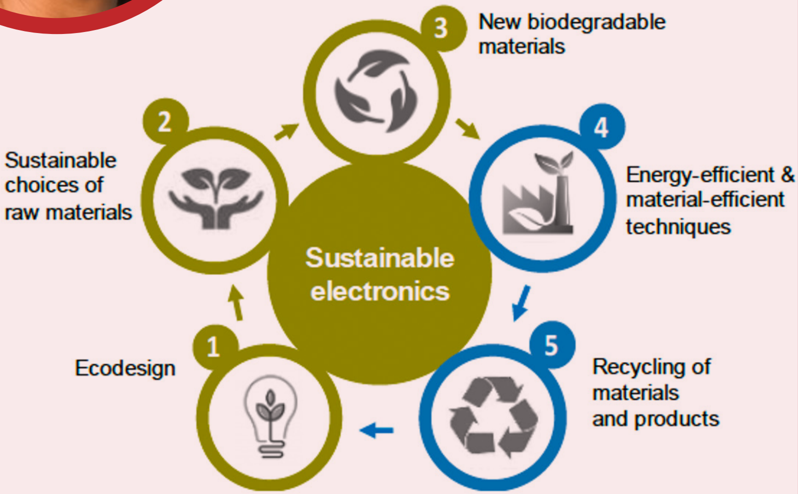
2017 | Advanced Grant | Elvira Fortunato

DIGISMART

Multifunctional Digital Materials Platform for Smart Integrated Applications

3 495 250 €

01/01/2019 | 31/12/2023 | Physical Sciences and Engineering



2017

Advanced Grant | Elvira Fortunato

DIGISMART

Multifunctional Digital Materials Platform for Smart Integrated Applications

DIGISMART creates new avenues into two main areas:

1) processing nanomaterials/nanostructures applied to electronic devices by exploring a new digital multifunctional direct laser writing (LDW) method for in situ synthesis of small-sized nanomaterials/nanofilms micro-patterned growth by selective photothermal decomposition of semiconductors, dielectrics and conductors precursors, and

2) provide simultaneously multifunction to single based metal oxide devices (like thin film transistors, the workhorses for large area electronics having electron, charge and color modulation), as the basic unit to promote systems' integration by exploring the use of new advanced materials with unique multi-functionalities using low cost process solutions.

This new fabrication process will be very useful for low-cost, eco-friendly, and efficient fabrication of nanostructures and thin films-integrated microelectronic devices due to its low-power, simple setup as well as excellent reliability. This new and disruptive concept will be achieved with low cost and non-toxic materials (new metal oxides, MO semiconductors, conductors, dielectrics and electrochromics free of In and Ga) associated to a low cost process multifunctional platform technology (ALL-IN-ONE TOOL) well supported by high-resolution nano-characterization techniques.

With DIGISMART new and unexplored materials will be produced as well as to boost the original properties of conventional materials in order to contribute to the needs for low cost and flexible electronics. If we succeed to embed some level of intelligence in every object, this would change electronics and it would change society, ranging from embedded window displays to a wide range of biomedical electronics, just to mention a few and this is what the Internet of Things is looking for.

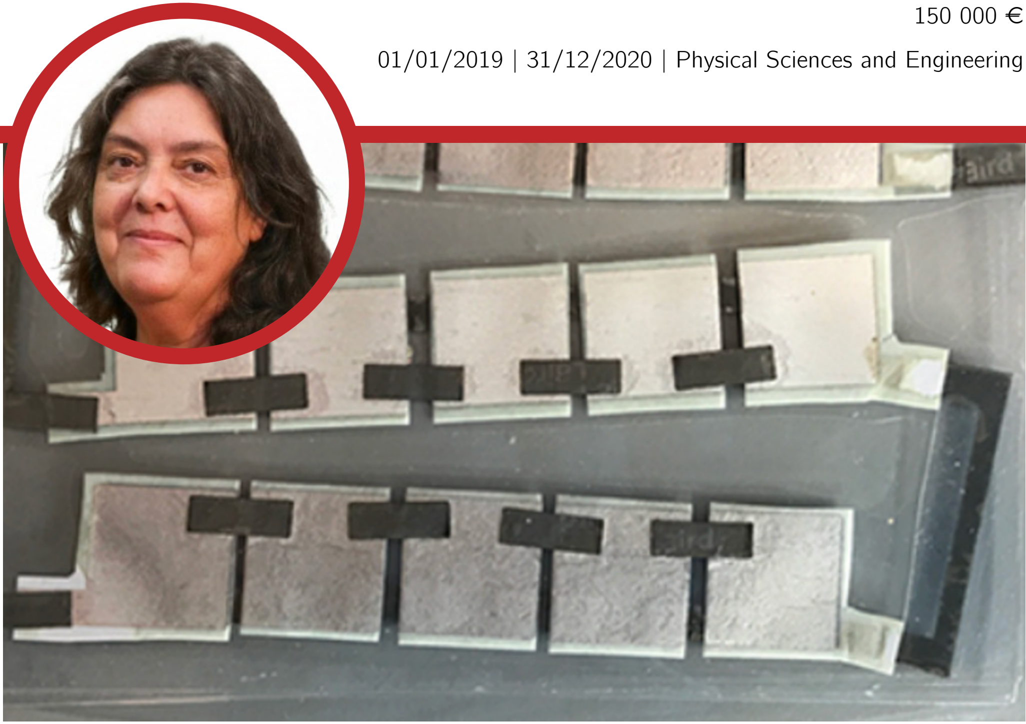
2018 | Proof of Concept | Isabel Ferreira

CAPSEL

Cellulose Aluminium Polymer multi-ions composite Solid-electrolyte

150 000 €

01/01/2019 | 31/12/2020 | Physical Sciences and Engineering



2018

Proof of Concept | Isabel Ferreira

CAPSEL

Cellulose Aluminium Polymer multi-ions composite Solid-electrolyte

Efficient batteries rely heavily on liquid electrolytes and lithium. The EU-funded CAPSEL project developed a new solid electrolyte that can efficiently replace liquid electrolytes. It contains selected cellulose, aluminium and ions.

These materials are more abundant than lithium, cause no harm to the environment and can be recycled through conventional processes. Aluminium is also a cheaper and less reactive metal than lithium.

Besides solving many of the safety risks in commercially available batteries, solid electrolytes allow a significant reduction in battery size and weight. The proof-of-concept system holds important implications for low-cost, disposable applications, such as electronic paper, smart labels and smart packing.

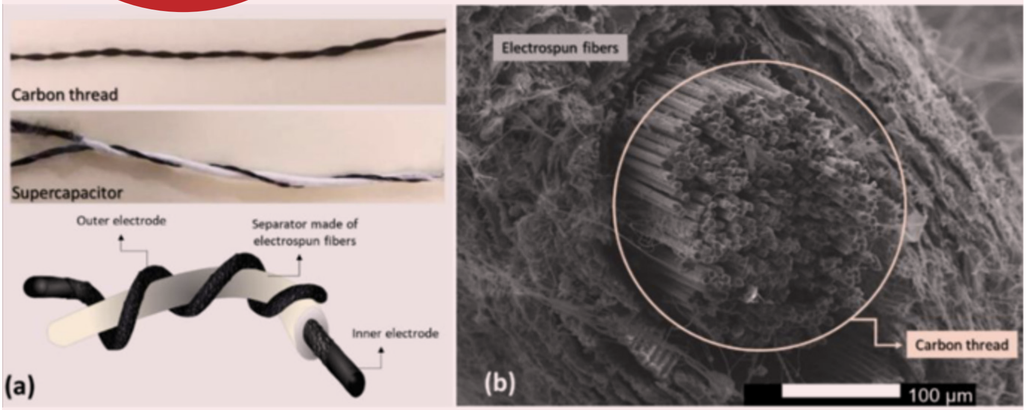
2020 | Proof of Concept| Isabel Ferreira

INSOLENSYS

Integrated Solar Energy System

150 000 €

01/07/2021 | 31/12/2022 | Physical Sciences and Engineering



2020

Proof of Concept | Isabel Ferreira

INSOLENSYS

Integrated Solar Energy System

The management of solar intermittency relies on costly and polluting external storage systems. The EU-funded INSOLENSYS project proposes an integrated approach to the production and storage within photovoltaic cells, which is flexible and adaptable to all types of solar cells, from home systems to large-scale industrial installations.

It ensures around-the-clock generation of stable energy and eliminates the need for external storage. It also facilitates the greater widespread of the renewable energy, uses eco-friendly and available raw materials, and it is in line with the goals of the EU's Green Deal.

The project will prove its viability on a pre-industrial level through extensive testing and validation, investigate its commercial potential and increase its Technology and Investment Readiness Levels.

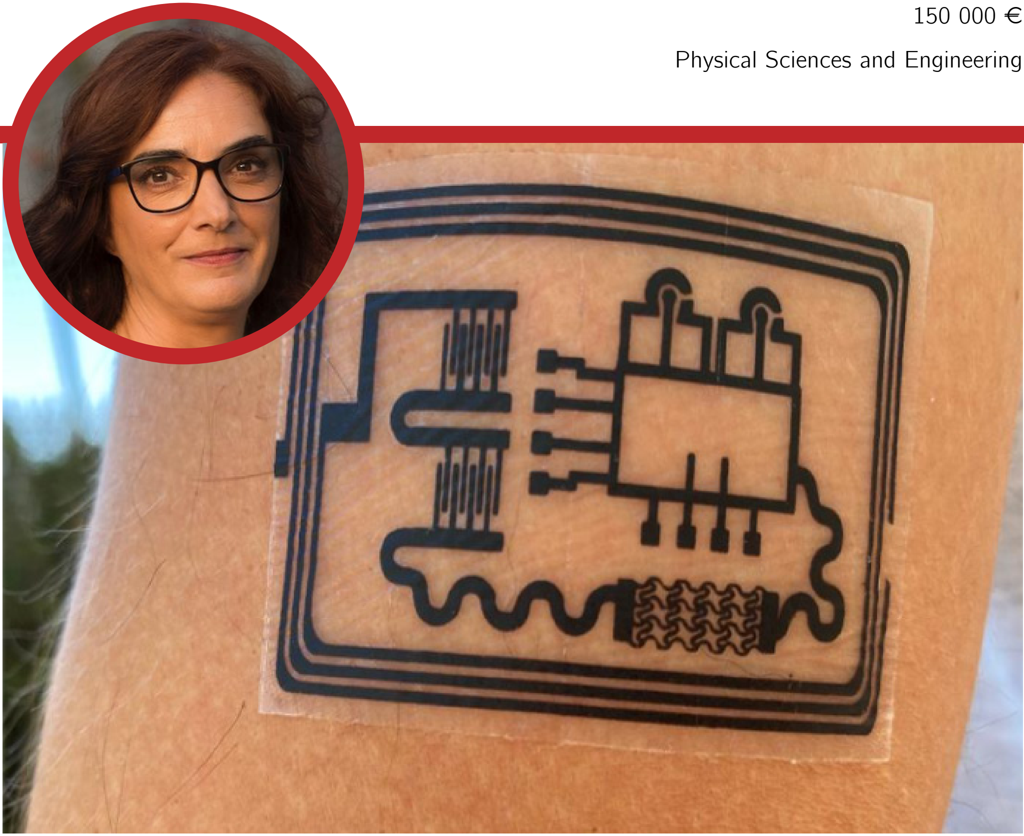
2021 | Proof of Concept | Elvira Fortunato

e-GREEN

From forest to electronics: green graphene

150 000 €

Physical Sciences and Engineering



2021

Proof of Concept | Elvira Fortunato

e-GREEN

From forest to electronics: green graphene

E-waste is one of the fastest-growing waste streams on the planet and represents a strong bottleneck for our society, concerning lack of raw materials and excess of high-tech trash produced, for which we expect harmonious growth with comfort and prosperity. So far, it has been produced around 50 million tons per year of e-waste! This constitutes to the electronics industry a critical challenge: how to balance, decreasing supplies with growing volumes of e-waste, where printing circuit boarding are a major and essential part?

The solution is the use of new sustainable approaches, either in terms of materials or technological processes. e-GREEN project aims to answer to these concerns by the direct formation of high conductive 3D graphene-based patterns as printed circuits on recyclable flexible substrates, avoiding the need to use scarce and non-environmentally friendly metallic materials apart from expensive, pollutant and time-consuming processes.

The objective of this project is so, to develop a proof of concept towards market applications prototypes with a small series production in order to evaluate the electrical performances over time, as well as to perform an extensive market analysis, in order to establish an accurate and robust business plan.

We strong believe that this disruptive technology process will open new opportunities for sustainable electronics alongside with advantages in terms of cost, time with clear environmental benefits.

2022 | Proof of Concept | Pedro Barquinha

FLETRAD

Flexible and transparent platform based on oxide transistors for detection and readout of ionizing radiation

150 000 €

01/10/2022 | 30/06/2024 | Physical Sciences and Engineering

2022

Proof of Concept | Pedro Barquinha

FLETRAD

Flexible and transparent platform based on oxide transistors for detection and readout of ionizing radiation

Ionising radiation, high-energy radiation that can remove electrons from atoms or molecules causing them to become ionised, can damage cells and their DNA. Monitoring the dose of ionising radiation in applications from energy and healthcare to civil security is of utmost importance.

Flexible and wearable X-ray detectors are an emerging potential solution in next-generation technologies, yet no innovation currently combines portability, high resolution, low cost and complexity and other desired traits.

The EU-funded FLETRAD project will develop a flexible and transparent platform addressing all current challenges by exploiting patented oxide transistors as direct ionising radiation detectors.

2023 | Consolidator Grant | Manuel Mendes

X-STREAM

Power-to-X: STREAMing Hydrogen from 3-Band Solar Cells boosted with Photonic Management

1 999 608 €

01/05/2024 | 30/04/2029 | Physical Sciences and Engineering

2023

Consolidator Grant | Manuel Mendes

X-STREAM

Power-to-X: STREAMing Hydrogen from 3-Band Solar Cells boosted with Photonic Management

Conventional photovoltaic technologies, while effective at harnessing solar energy, suffer from limited efficiency in converting sunlight into electricity, while also lacking energy storage capability.

Funded by the European Research Council, the X-STREAM project aims to revolutionise sustainable energy deployment with innovative photovoltaic systems capable of storing energy through coupling with electrochemistry.
The research will develop technology to pronouncedly boost the efficiency of nanostructured solar cells by converting a wider range of sunlight into electricity.

Moreover, it will utilise electrochemical flow cells to power the electrolysis of water and synthesise hydrogen fuel, thereby supporting an environmentally friendly hydrogen economy. Ultimately, X-STREAM aims for industrial deployment with customisable prototypes.

2023 | Proof of Concept | Luis Nunes Pereira

EXCELL

CELLulose nanocomposite separators for the nEXt generation of smart batteries

150 000 €

01/06/2023 | 30/12/2024 | Physical Sciences and Engineering

2023

Proof of Concept | Luis Nunes Pereira

EXCELL

CELLulose nanocomposite separators for the nEXt generation of smart batteries

The growing popularity of electric vehicles is accompanied by the challenge of managing the increasing number of end-of-life batteries, with projections showing 2 million tonnes worldwide by 2030.

Additionally, battery production suffers from high scrap rates, especially during ramp-ups, while the scarcity of raw materials adds pressure on Europe to localise supply chains.

These challenges underscore the urgent need for greater sustainability in the battery value chain. In this context, the ERC-funded EXCELL project will introduce a revolutionary battery separator made from 100 % natural cellulose nanocomposites.

With tunable mesopores and the ability to integrate sensing elements, this new separator will enhance the lifespan and recyclability of batteries, paving the way for smarter, eco-friendly cell components.

2024 | Synergy Grant | Helena Godinho*

ALCEMIST

A typical Liquid Crystal Elastomers: from Materials Innovation to Scalable processing and Transformative applications

2 336 961 €

2025 | 2029 | Physical Sciences and Engineering

* Together with Jan P.F. Lagerwall from University of Luxembourg and Eugene M. Terentjev from University of Cambridge

2024

Synergy Grant | Helena Godinho

ALCEMIST

A typical Liquid Crystal Elastomers: from Materials Innovation to Scalable processing and Transformative applications

Traditional engineering relies on passive static components, such as beams, wires, and joints, which are driven by active dynamic elements like motors, dampers, and sensors. This approach limits the potential for more integrated, flexible systems.

The ERC-funded ALCEMIST project seeks to improve this by combining the functionalities of both passive and active components in a single material. The project focuses on liquid crystal elastomers (LCEs), which are unique, responsive materials that change shape, colour, and properties in response to stimuli.

ALCEMIST's sustainable, cost-effective LCEs, made from polysaccharides, will be reprocessable and reusable, opening up innovative applications in areas like adaptive building elements, medical devices, and smart materials, with a transformative approach to large-scale industrial use.

ALCEMIST challenges the conventional engineering mindset where passive static components (beams, wires, joints) are driven by active dynamic ones (motors, dampers, sensors); our innovative materials enable the combined functionality in a single component. This bold ambition is feasible because our research will unlock the full potential of liquid crystal elastomers (LCEs), unique responsive materials that reversibly change shape, colour, adhesive or damping properties, triggered by stimuli like heat, light, humidity or strain.

We propose a radically new sustainable materials platform based on polysaccharides, functionalising precursors such that anyone-using click chemistry-can make LCEs that are powerful yet biocompatible and biodegradable, at one tenth of the cost of state-of-the-art LCEs. Further, using bond-exchange chemistry, ALCEMIST LCEs will be re-processable and re-usable.

We also present a ground-breaking processing approach based on flow patterning to make large-scale LCEs of complex shapes and actuation modes. The synergy of three perfectly complementary and highly productive scientists, each a recognised leader in their field, enables this transformative approach to making atypical LCEs.

Notes

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