

# Strategic projects



## NeuroStimSpinal – A Step Forward To Spinal Cord Injury Repair Using Innovative Stimulated Nanoengineered Scaffolds

4 years; € 3.5 M; 7 Partners

The NeuroStimSpinal was one of the 3 FET (Future and Emerging Technologies) Open projects coordinated by Portuguese institutions funded in 2018 and the first year of the project was completed last April. FET Open, an Horizon2020 scheme, funds and supports early-stage and high-risk science and technology actions with a radical vision, breakthrough technological target and ambitious interdisciplinary research.

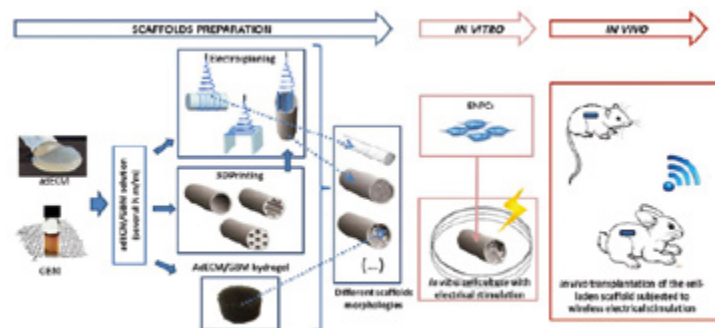
The consortium is composed by 4 institutions and 3 companies from 4 different countries and gathers researchers from areas ranging from biomedical engineering, biomechanics, electronics, biology to neurosurgery. The project coordinator Paula Marques is a Principal Researcher at the Center for Mechanical Technology and Automation (TEMA) and in UA's Department of Electronics, Telecommunications and Informatics, CICECO-Institute of Materials and iBiMED-Institute of Biomedicine, are also involved. Graphenest SA and Stematters SA are the two national companies involved. Internationally, the partnership includes Universidad Complutense de Madrid and Fundacion Tecnalia Research & Innovation both in Spain, the Founddation for Research and Technology Hellas in Greece, and Radboud University in Netherlands.

The goal of NeuroStimSpinal is to contribute with a solution for spinal cord injury (SCI). SCI results in para- and tetraplegia caused by the partial or complete disruption of descending motor and ascending sensory neurons. The aim is to develop an innovative, stimulus responsive, and cell-laden biomaterial, capable to overcome the inhibitory environment following the injury and induce the repair of the nervous tissue. The proposed scaffold for implantation at the injury site is composed of graphene-based materials and a decellularized biopolymeric matrix (from the human adipose tissue) coupled with a wireless electrical stimulation device to promote the growth and reconnection of the ruptured nerves. While the biopolymeric matrix offers an excellent supportive structure with more than 139 proteins and 5 types of collagen, the graphene-based materials present biocompatibility, electrical activity, possibility for biofunctionalization and high surface to volume ratio for drug delivery. Therefore, this new hybrid approach offers great potential to generate substantial breakthrough for SCI.

<https://www.neurostimspinal.eu/>

<https://cordis.europa.eu/project/id/829060>

This project has received funding from the European Union Horizon 2020 research and innovation programme under grant agreement No 829060.



## NMR4CO<sub>2</sub> - Unveiling CO<sub>2</sub> chemisorption mechanisms in solid adsorbents via surface-enhanced ex(in)-situ NMR

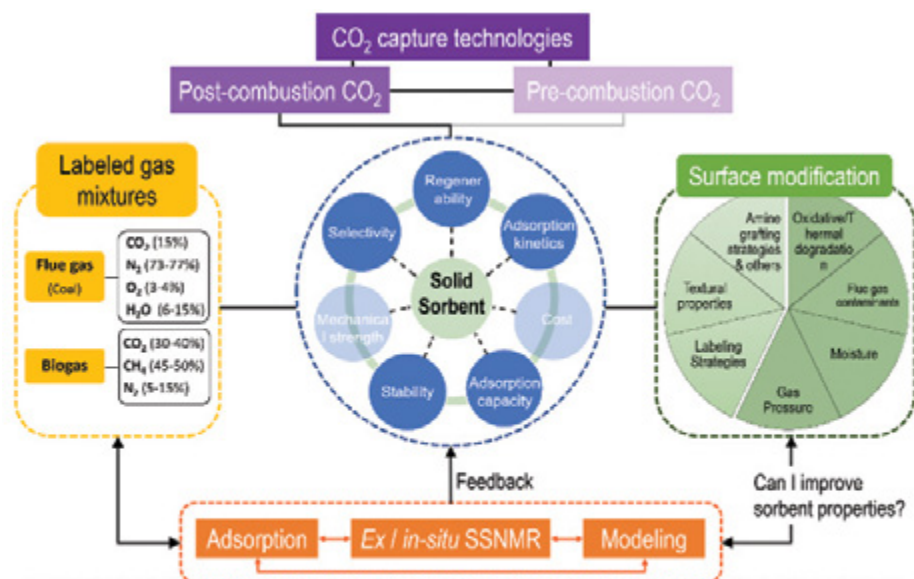
60 months; € 2 000 000

The European Research Council (ERC) has awarded Luís Mafra, researcher from CICECO-Aveiro Institute of Materials and Chemistry Department of the University of Aveiro, a prestigious ERC Consolidator Grant (ERC-CoG) to explore Nuclear Magnetic Resonance (NMR) spectroscopy for studying gas-solid interfaces and gas sorption mechanisms in modified solid adsorbent materials for gas capture. This funding scheme supports innovative ideas proposed by researchers pursuing frontier research that are in the stage of consolidating their independence by establishing a research team and continuing to develop a success career.

Motivation: the improvement of CO<sub>2</sub> removal technologies plays a critical role to tackle the environmental challenge humankind is facing. Because of their lower regeneration cost, modified porous silica-

based solid materials are among the most promising CO<sub>2</sub>-adsorbents for replacing the decades-old liquid amine scrubbing technology as they are moisture-tolerant and selectively chemisorb CO<sub>2</sub> from low-concentration mixtures, important features for operating under large-point CO<sub>2</sub> emission source conditions. The nature of CO<sub>2</sub> species formed on adsorbent surfaces determines the gas adsorption capacity/kinetics, selectivity, stability, and regenerability. However, a molecular-scale understanding of the CO<sub>2</sub>-surface adsorption process and thermal / oxidative degradation mechanisms remain elusive, hindering our ability to design improved sorbents.

The EU-funded NMR4CO<sub>2</sub> project addresses this need, using – for the first time – state-of-the-art surface-enhanced solid-state NMR to study the chemistry of acidic gases (mainly CO<sub>2</sub>) adsorbed on adsorbent materials and of gas-solid interfaces using simulated industrial gas mixtures. This interdisciplinary project combines the expertise of spectroscopists, chemists, and engineers to tackle this grand challenge.



smart strategies ranging from surface modification (green box) to key isotopic labeling (yellow and green boxes) and NMR technical modifications are used to enable surface-enhanced solid-state NMR spectroscopy. This multidisciplinary characterization approach (orange box) aims at providing atomic level insight about confined gas dynamics and gas-solid interactions at materials surfaces thus providing feedback on i) key surface modifications and ii) sorbent degradation mechanisms that will tailor target physico-chemical properties of the studied solid sorbents (middle circle).

<https://cordis.europa.eu/project/id/865974>

This project has received funding from the European Union's Horizon 2020 research and innovation programme under the grant agreement No 865974.

## ThermoRise - Rise of the 3rd dimension in nanotemperature mapping

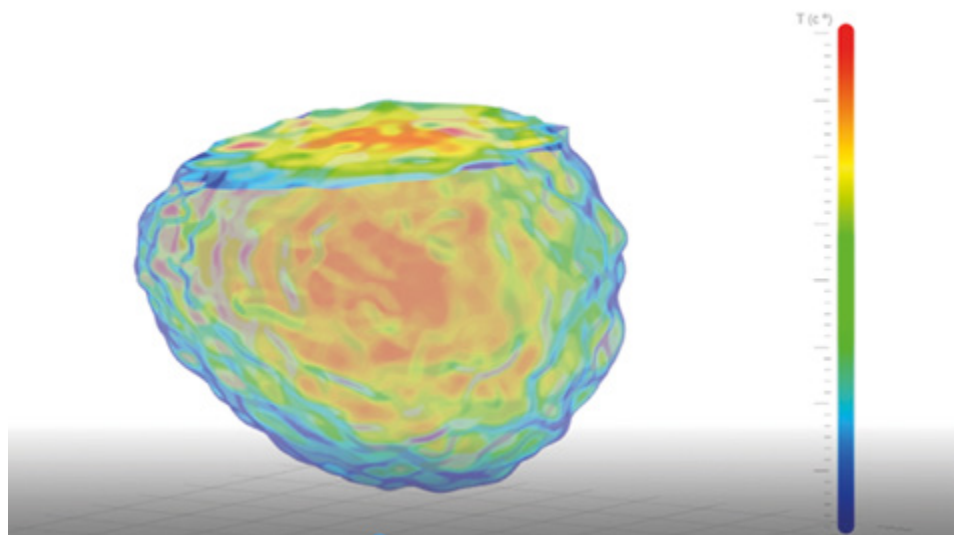
60 months; € 1 9 88 353,75

The European Research Council grants support researchers at different career stages: starting, consolidator and advanced levels. Nuno Silva is at the consolidator stage and, together with his team at CICECO -Aveiro Institute of Materials and Department of Physics of University of Aveiro, they have been working on the development of temperature sensitive and temperature-recording magnetic nanoparticles that open the door for a three dimension temperature mapping with high space resolution approaching the nanoscale and well below the surface of Human body.

The ERC consolidator grant will support the establishment of a research group with the appropriate resources to make three-dimension temperature mapping with nanoscale resolution a reality. ThermoRise is a project designed to develop nanoparticles and methods to determine temperature without using contacts, in depth, in three space dimensions and with a space resolution approaching the nanoscale. This will impact both on fundamental and application levels, including understanding the thermal properties of nanostructures and temperature control during tumor ablation and during heat-controlled release of drugs.

<https://cordis.europa.eu/project/id/865437>

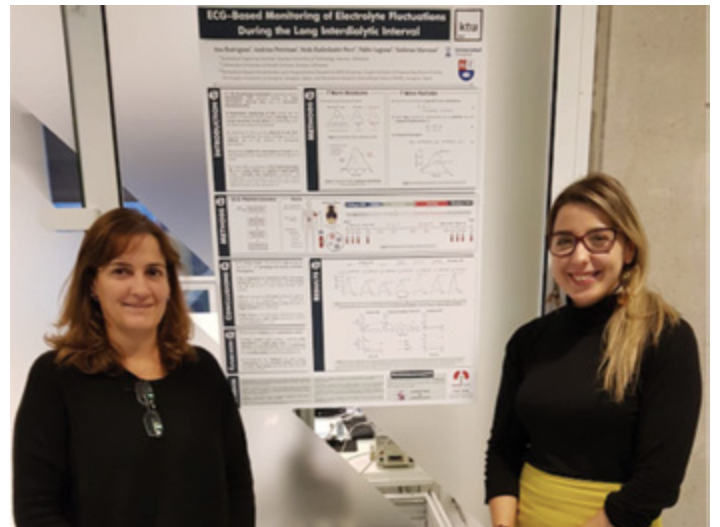
This project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No. 865437.



Envisaged 3D temperature mapping and at distance ad in-depth, using the magnetic field created by nanoparticles.

## ECIU Mobility Fund

The European Consortium of Innovative Universities (ECIU) recognizes the importance of cooperation in science, technology and innovation for universities to become world-leading research institutions. This scheme is intended to work as an incentive to explore and deepen research collaboration within the ECIU network, for instance, in terms of joint research funding grant applications, scientific publications and research projects. Ultimately it supports professional development of ECIU researchers, by supporting know-how exchange in an international high-quality research environment. 8 UA researchers were awarded with this support in 2019.



### **Olena Okhay**

Department of Mechanical Engineering  
Research unit: TEMA  
Position: Researcher  
Mobility period: 15-26 July 2019  
Host Institution: Tampere University  
Contact: Sampo Tuukkanen, Associate Professor  
School/Department: Faculty of Medicine and Health Technology (MET)  
Outcomes: *"Deep study / measurements / analyse of piezoelectric materials and materials for the electrodes for the supercapacitors as well as discussion of obtained results."*

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### **Alexandra Ambrósio Polido**

Department of Social, Political and Territorial Sciences  
Research unit: GOVCOPP  
Position: Researcher  
Mobility period: 22 September-5 October 2019  
Host Institution: University of Aalborg  
Contact: Lone Kørnøv  
School/Department: Department of Planning, The Danish Centre for Environmental Assessment  
Host Institution: Linköping University  
Contact: Eva Lövbrand  
School/Department: Department of Thematic Studies: Environmental Change  
Outcomes: *"The mobility fund allowed me to network with two eminent scholars, helping me to develop my career in terms of international collaborations for future project calls and high-impact papers"*

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### **Maria Teresa Ferreira Herdeiro**

Department of Medical Sciences  
Research unit: Ibimed  
Position: Professor  
Mobility period: 24-30 November 2019  
Host Institution: Kaunas University of Technology  
Contact: Vaidotas Marozas  
School/Department: Biomedical Engineering Institute  
Contact: Veysel Kayser  
School/Department: Clinical Pharmacy  
Outcomes: *"Meetings with the staff of the Biomedical Engineering Institute and with the Faculty of Pharmaceutical Sciences, Department of Clinical Pharmacy and Institute of Physiology and Pharmacology"*

### **Vanda Alexandre Marques dos Santos**

Department of Education and Psychology  
Research unit: CIDTFF  
Position: Researcher  
Mobility period: 1-23 June 2019  
Host Institution: Dublin City University  
Contact: Gabriel-Miro Muntean  
School/Department: DCU Glasnevin Campus/Electronic Engineering  
Outcomes: *"The result of the mobility plans and opportunities for funding applications is a proposal for Horizon 2020 together."*

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### **Nuno Miguel Freitas Ferreira**

Department of Physics  
Research unit: I3N  
Position: Researcher  
Mobility period: 11-24 August 2019  
Host Institution: Aalborg University  
Contact: Alireza Rezaniakolaei  
School/Department: Department of Energy Technology  
Contact: Lasse Rosendahl  
School/Department: Department of Energy Technology  
Outcomes: *"Mutual knowledge transfer regarding the processing and assembling approaches for thermoelectric materials and modules built/test."*

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### **Eskilla Venkata Ramana**

Department of Physics  
Research unit: I3N  
Position: Researcher  
Mobility period: 6-26 October 2019  
Host Institution: University of Twente  
Contact: Evert Houwman  
School/Department: Department of Science and Technology  
Contact: Monica Morales-Masis  
School/Department: Department of Science and Technology  
Outcomes: *"Very useful discussion with the experts in the field was commenced in this mobility. This in future could strengthen the collaboration between the two groups".*

### **Jorge Manuel Alexandre Saraiva**

Department of Chemistry  
Research unit: LAQV-REQUIMTE  
Position: Researcher  
Mobility period: 25 October-14 November 2019  
Host Institution: Tecnológico de Monterrey  
Contact: Jose Antonio Torres  
School/Department: School of Engineering and Sciences  
Outcomes: *"As the more immediate opportunities, 1 or 2 PhD students are expected to start the PhD on 2019 in cotutelle with Tecnológico de Monterrey."*

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### **Paula Celeste da Silva Ferreira**

Department of Materials and Ceramic Engineering  
Research unit: CICECO  
Position: Researcher  
Mobility period: 6-7 June/ 8-11 July 2019  
Host Institution: University of Twente  
Contact: A.J.H.M. Rijnders  
School/Department: Faculty of Sciences and Technology, IMS, Mesa+  
Host Institution: Dublin City University  
Contact: Silvia Giordani  
School/Department: School of Chemical Sciences  
Outcomes: *"Enlargement of European network to strengthen personal career and open opportunities to the research group collaborations".*