



NEW GENERATION OF OFFSHORE TURBINE BLADES WITH INTELLIGENT ARCHITECTURES OF  
HYBRID, NANO-ENABLED MULTI-MATERIALS VIA ADVANCED MANUFACTURING

## Dissemination and Exploitation Open Day Workshop

# Preliminary Agenda

V1.7

**Date:** 8 June 2023

**Time:** 09:00 – 17:00 (BST time)

**Venue:** Homerton College,  
Hills Road, Cambridge  
CB2 8PH - UK

**ZOOM**

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## Carbo4Power Project

Carbo4Power will develop a new generation of lightweight, high strength, multifunctional, digitalized multi-materials for offshore wind and tidal turbine rotor blades that will increase their operational performance and durability while reducing the cost of energy production (below 10 ct€/ kWh for wind turbines and 15ct€/kWh for tidal), maintenance and their environmental impact. The innovative concept is based on nano-engineered hybrid (multi)materials and their intelligent architectures which breaks down as follows:

- 🔍 Nanocomposites based on dynamic thermosets with inherent recyclability and repairability and tailored nano-reinforcements to enhance mechanical properties.
- 🔍 Multifunctional nano-enabled coatings to improve turbine protection (e.g., against lightning and biofouling (e.g. 50% fouling release).
- 🔍 Blade segments will be designed and fabricated by advanced net-shape automated multi-material composite technologies that will allow ca. 20% scrap reduction.
- 🔍 The approach for WTB is to deliver innovative design of modular rotor blade, while the approach for TTB is aimed towards an optimal design for 'one-shot' manufacture.
- 🔍 Recycling of blade materials will be increased up to 95% due to the advanced functionalities of 3R resins and adhesives with debonding on demand properties.

The strategic goal is to provide the frame which will create new pathways for manufacturing of FRPs for multiple processing life cycles, and explore the emerging valorisation opportunities in offshore energy sector. A multidisciplinary team of 18 partners (8 SMEs) from 8 countries provides technological know-how and industrial leadership, with well-balanced dissemination, communication & exploitation impact.

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The Carbo4Power is a 4-year project, which started in November 2020 and it is led by the National Technical University of Athens (NTUA). This project is funded by the H2020-EU.2.1.3. – INDUSTRIAL LEADERSHIP – Leadership in enabling and industrial technologies – Advanced materials Programme (€ 7 8 million – Grant Agreement 953192).





## Carbo4Power Open Day 2023 Workshop – Preliminary Agenda

*Please take notice that all times shown in the agenda are BST*

**08:30** *Arrival, Registration and Refreshments*

**08:50** *Joining for online participants*

**09:00** Welcome and Carbo4Power Open Day Introduction

**Bojan Boskovic**, Managing Director, Cambridge Nanomaterials Technology Ltd (CNT)  
Carbo4Power Exploitation & Dissemination Open Day 2023 Organiser

**09:10** **Stefania Termine**, Project Coordination, National Technical University of Athens

**Title: Carbo4Power Project- New generation of offshore turbine blades with intelligent architectures of hybrid, nanoenabled multi-materials via advanced manufacturing**

Carbo4Power will develop a new generation of lightweight, high strength, multifunctional, digitalized multi-materials for offshore wind and tidal turbine rotor blades that will increase their operational performance and durability while reducing the cost of energy production (below 10 ct€/ kWh for wind turbines and 15ct€/kWh for tidal), maintenance and their environmental impact. The innovative concept is based on nano-engineered hybrid (multi)materials and their intelligent architectures which breaks down as follows: i) Nanocomposites based on dynamic thermosets with inherent recyclability and repairability and tailored nano-reinforcements to enhance mechanical properties. ii) Multifunctional nano-enabled coatings to improve turbine protection (e.g. against lightning and biofouling (eg. 50% fouling release). iii) Blade segments will be designed and fabricated by advanced net-shape automated multi-material composite technologies that will allow ca. 20% scrap reduction. The approach for WTB is to deliver innovative design of modular rotor blade, while the approach for TTB is aimed towards an optimal design for 'one-shot' manufacture. v) Recycling of blade materials will be increased up to 95% due to the advanced functionalities of 3R resins and adhesives with debonding on demand properties. The strategic goal is to provide the frame which will create new pathways for manufacturing of FRPs for multiple processing life cycles and explore the emerging valorisation opportunities in offshore energy sector. A multidisciplinary team of 18 partners (8 SMEs) from 8 countries provides technological know-how and industrial leadership, with well-balanced dissemination, communication & exploitation impact. This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 953192.

**09:40** **Stephen Jones**, Offshore Renewable Energy Catapult, UK

**Title: The development of rain erosion testing methods and material property correlations**



There are several variables which affect the erosion rate of leading edge protection products on wind turbine blades that are not sufficiently considered within current testing standards. Research performed within the Carbo4Power project has aimed to develop correlations between the material properties of candidate erosion-resistant coatings with advanced rain erosion testing methods to support formulation development and provide a more realistic estimation of product lifetime in service.

**10:10 Aratz Genua, FUNDACIÓN CIDETEC, Spain**

**Title: CIDETEC role in the Carbo4Power Project**

CIDETEC is a private organization for applied research founded in 1997 that seeks to contribute value to companies by harnessing, generating and transferring technological knowledge. Located in the Donostia-San Sebastián site of Gipuzkoa's Scientific and Technological Park and with additional facilities at MUBIL, the Gipuzkoa Electromobility Hub, currently employs a workforce of 215. CIDETEC is comprised of three international technological reference institutes in energy storage, surface engineering and nanomedicine. CIDETEC is a member of BRTA (Basque Research and Technology Alliance).

Within the project CIDETEC's work has been focused in two main areas:

- Applying our patented 3R technology for the development of (nano-engineered) resin formulation(s) for the manufacturing of composite materials. Formulations have been adapted to the required specifications and manufacturing processes (infusion and prepregs for ATL manufacturing) and will contribute to improve reparability and recyclability of the WTBs and TTBs fabricated with these materials.
- The second area where CIDETEC is involved is developing of self-cleaning / hydrophobic coating. CIDETEC counts on multiple patents related to omniphobic technology for coatings, that is coatings, which repel "everything" from water to oils and avoid the adhesion of solid. Additionally, these solutions have self-cleaning properties. Within Carbo4Power, CIDETEC is testing different approaches to develop durable low-surface-energy coating for each contaminant and considering the varying technical requirements for WTBs and TTBs.

**10:40 Coffee break and Networking (Online exhibition - [www.carbo4power.net/expo](http://www.carbo4power.net/expo))**

**11:00 Elena Rodríguez Senín & Lourdes Blanco Salgado, AIMEN Technology Centre, Spain**

**Title: Advanced Composite Manufacturing processes in multidisciplinary sectors.**

An overview of the different advanced composite manufacturing and the application sectors will be done describing some examples, results and the AIMEN's on-going projects. Furthermore, a description of AIMEN's role and work within the Carbo4Power project.

**11:20 Dionisis Semitekolos, National Technical University of Athens, Greece**

**Title: Development of nano-enhanced sizing solutions for carbon fibres**



The goal of this research is to create sizing solutions boosted by nanoparticles that are compatible with epoxy resins for coating carbon fiber. Functionalized nanoparticles (plasma modified carbon nanotubes, or CNTs, and few layer graphene, or FLG), were added to a commercial sizing solution (Michelman's Hydrosize® HP2-06). The solutions were utilized to size Toray's FT300B 6000-40D carbon fiber.

The commercial sizing solution was exposed to the nanoparticles via water dispersions. The stability of dispersion as well as the ratios of solid and nanomaterial content were studied. In order to evaluate 18 total sizing solutions, two distinct nanomaterials (CNTs / FLG) were tested with three different kinds of functionalization (plasma treatment with N<sub>2</sub>, NH<sub>3</sub>, or O<sub>2</sub>) and three different concentrations (0.1%, 0.25%, and 0.5% wt).

**11:40 Daniel Gomez, INEGI, Portugal**

**Title: Novel UD tapes based on comingling yarns.**

INEGI is a Research and Technology Organisation (RTO) focused on research and technology-based innovation activities, technology transfer, consulting, technological services and advanced training, oriented to the development of industry and economy in general.

In the Carbo4Power project, INEGI, has:

- Optimized the production of comingling yarns composed of carbon fibres and polyphenylene sulfide, (PPS), fibres.
- Designed and developed a setup for the production of unidirectional thermoplastic tapes from the comingling yarns.
- Mechanical characterization of composite laminates produced by tape hand layup and subsequent hot pressing.

**12:00 Xiaoying Li, University of Birmingham, UK**

**Title: Improved IFSS of CFRF composites by CF surface and resin modification**

Fibre/matrix interfacial shear strength (IFSS) is very important factor for the performance of carbon fibre reinforced polymer composites (CFRPC). The current research reported some effective methods in terms of active screen plasma (ASP) and chemical treatments of the CFs and modification of the resin, to improve interface share strength (IFSS) of the CFRPC.

A novel single fibre push-out testing method was developed to evaluate the IFSS of the composites. The composites made using the most promising ASP treated fibres and modified 3R-resin compared with the untreated CFs and resin. The IFSS values were calculated based on the push-out tests results and the outcomes have showed a significant IFSS increase.

**12:20 Antonine De FONTGALLAND, IRT Jules Verne, France**

**Title: Activities and role of IRT Jules in the Carbo4Power Project**



12:40 *Discussion*

13:00 *Lunch & networking - Online exhibition - [www.carbo4power.net/expo](http://www.carbo4power.net/expo)*

14:00 **Andreas Flanschger**, bionic surface technologies GmbH, Austria

**Title: Shark skin inspired surfaces in Carbo4Power and beyond**

The presentation will cover the following topics:

- Actual status of available technologies for Riblets (Shark Skin)
- Demonstration of Riblets' benefit for Carbo4Power demonstrators
- Commercialisation chances beyond Carbo4Power

14:20 **Agustín Chiminelli**, ITAINNOVA, Spain (*online*)

**Title: Introduction of induction heating capabilities in adhesives**

The induction heating capability has been identified in Carbo4Power as an additional functionality that can be introduced in the adhesives that can help to improve debonding procedures. The technique may allow to localize the heating on the bond-lines, reducing the probability of damaging the substrates.

In Carbo4Power, this functionality has been investigated through the incorporation of magnetic nano-particles into an epoxy adhesive. Different types of particles, concentrations and induction conditions have been studied looking for an efficient and controlled heating of the adhesive. In addition, the dispersions obtained through different mixing procedures have been evaluated.

14:40 **Cindy LE ROY**, Sense IN, France (*online*)

15:00 *Coffee break and Networking (Online exhibition - [www.carbo4power.net/expo](http://www.carbo4power.net/expo))*

15:20 **Xingguo Zhou**, University of Strathclyde, UK

**Title: Fully Coupled CFD-FEA Analysis of a 15MW Wind Turbine**

This work presents a comprehensive study on the fully coupled Computational Fluid Dynamics-Finite Element Analysis (CFD-FEA) analysis of a 15MW wind turbine, with a focus on enhancing its performance and structural integrity. As wind energy continues to emerge as a prominent renewable energy source, the need to optimize the design and operation of large-scale wind turbines becomes increasingly critical. This research addresses the challenges associated with accurately capturing the dynamic interactions between fluid flow and structural response in a 15MW wind turbine, providing insights to improving efficiency, reliability, and performance.

The study employs a fully coupled CFD-FEA approach, which enables the simultaneous analysis of the fluid flow and structural behaviour of the wind turbine. The CFD simulations capture the complex aerodynamic phenomena surrounding the wind turbine blades. The FEA models



account for the structural dynamics, deformations, and stresses induced by the aerodynamic loads. By seamlessly integrating the two domains, the dynamic interaction between the fluid and structural systems is accurately captured, providing a comprehensive understanding of the turbine's behaviour.

**15:40 Kayleigh McEwan**, Haydale Composite Solutions, UK

**Title: Introduction to Haydale**

Haydale are a global technology solutions company, passionate about creating the next generation of advanced materials to improve mechanical, thermal and electrical properties for our customers products.

We bring together cutting-edge technology and engineering expertise alongside our patented HDPlas<sup>®</sup> functionalisation process which revolutionises repeatable performance and continued commercialisation of nanomaterials. Our world leading HDPlas<sup>®</sup> process has the potential to be a major spearhead in the drive to keep the UK at the forefront of world technology.

We have established a secure, robust and sustainable supply chain to support the manufacture of advanced materials. This enables us to deliver repeatable, consistent and outstanding performance.

The key to repeatable performance and continued commercialisation of nanomaterials is functionalisation. Functionalisation underpins everything we do.

**16:00 Lydia Peraki**, IRES - Innovation in Research and Engineering Solutions, Belgium (*online*)

**Title: Safe-and-Sustainable-by-Design: Early design framework of technological projects**

Continuous research and technological innovation on materials and processes have instigated the need for a complete and thorough design framework ensuring the delivery and production of chemicals and materials safely and sustainably along their life cycle. Safe-and-sustainable-by-design (SSbD) is a health, safety and sustainability management framework build around the concept of identification and treatment of safety and environmental/ecological issues at the early design of a technological project, in contrast to approaches that implement risk mitigation steps during manufacturing, process or use of a given technology. Hazard assessment of the chemical/material, as well as the human health, safety aspects and the environmental and socioeconomic concerns in the production and processing phase are constantly under consideration to provide stakeholders with the most applicable options for addressing safety and environmental concerns.

The presentation will provide the current status of the SSbD assessment, tools and the methodologies involved for a complete assessment. Assessment involves the evaluation of safety aspects of the production lines and the health risks faced by the process operators, as well as the life cycle assessment (LCA) and life cycle costing (LCC) on the environmental, economic, and social aspects of the manufactured parts throughout their life cycle. Finally, an example of the steps for a holistic SSbD analysis will be presented focusing on the production of the turbine blades.





**16:20 Ana Bankovic Cassidy** Cambridge Nanomaterials Technology Ltd (CNT), UK

**Title: Development of Circular Economy Eco-system and Innovation Management Strategy**

European competitiveness, strategic autonomy and jobs depend on development of advanced materials circular economy. Steps towards the creation of the necessary environment needed for successful innovation management strategy, related to circular economy of advanced materials, will be discussed.

**16:40 João Cardoso**, FibreGY Project, INEGI, Portugal

**Title: FibreGY Project: Manufacturing of FRP demonstrators for the next generation of large Offshore Wind and Tidal Power (OWTP) platforms.**

This presentation will primarily discuss the development of Fibre-Reinforced Polymer (FRP) demonstrators for Offshore Wind and Tidal Power (OWTP) platforms, manufactured within the scope of the FibreGY project. Attendees will gain insights into the process of designing, manufacturing, and testing FRP demonstrators at various scales, showcasing their potential for revolutionizing the renewable energy sector. The presentation will emphasize the project's comprehensive testing, validation, and demonstration plan, culminating in the construction of prototype and real-scale FRP-based OWTP platform demonstrators.

**17:00** *Closing remarks and end of session*

**Note** It is planned that all presentations would be followed by Q&A discussion. The organisers reserve the right to change the programme or speakers should circumstances require. For any further enquires please do not hesitate to contact directly the **Carbo4Power Open Day 2023** organiser Dr Bojan Boskovic from Cambridge Nanomaterials Technology Ltd on [info@cnt-ltd.co.uk](mailto:info@cnt-ltd.co.uk) or [Bojan.Boskovic@CNT-Ltd.co.uk](mailto:Bojan.Boskovic@CNT-Ltd.co.uk) or on his mobile phone +447780874335.



## Carbo4Power Open Day 2023 Workshop - Speakers

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Dr Bojan Boskovic (*Carbo4Power Partner & Organiser*)

**Cambridge Nanomaterials Technology Ltd**

14 Orchard Way, Lower Cambourne

Cambridge CB23 5BN

UK

**Dr Bojan Boskovic** is the Founder, Managing Director, and Principal Consultant of the company. He has more than 20 years of hands-on experience with carbon nanomaterials and composites from industry and academia in the UK and Europe. Previously, he worked as a R&D Manager at Nanocyl, one of leading carbon nanotube manufacturing companies in Europe. He also worked on carbon nanotube synthesis and applications as a Principal Engineer-Carbon Scientist at Meggitt Aircraft Braking Systems, as a Research Associate at the University of Cambridge, and as a Senior Specialist at Morgan Advanced Materials. During his PhD studies at the University of Surrey he invented low temperature synthesis method for production of carbon nanomaterials that has been used as a foundation patent for the start-up company Surrey Nanosystems. He was a member of the Steering and Review Group for the Mini-IGT in Nanotechnology that advised the UK Government on the first nanotechnology strategy policy document. Dr Boskovic was working as an advisor for the European Commission (EC) on Engineering and Upscaling Clustering and on setting up of the European Pilot Production Network (EPPN) and European Materials Characterisation Cluster (EMCC). He has experience in exploitation and dissemination management on a number of FP7 and H2020 European projects, including UltraWire, NanoLeap, OYSTER, M3DLoC, Genesis, nTRACK, Repair3D, Carbo4Power, nanoMECommons, DOME-4.0, TRIankle and AM4BAT. Also, in UK Government InnovateUK funded projects, such as UltraMAT, GRAPHOSITE and HiBarFilm. He is also a leader of two private membership-based consortiums: Nano-Carbon Enhanced Materials (NCEM) and Advanced Materials for Additive Manufacturing (AMAM).



Stefania Termine (*Carbo4Power Partner*)

**National Technical University of Athens,**

9 Heroon Polytechniou str., Zographou

Athens, Greece, GR-15780

**Stefania Termine** is a material scientist from the department of Materials Science in University of Patras. She has received her Master studies on Material Science and Technology at NTUA. She has worked on the growth of carbon-based nanomaterials with CVD method as well as functionalization of carbon fibres with carbon nanotube with CVD and epoxy-based composite manufacturing through vacuum infusion process.

Furthermore, she is experienced in the electromechanical response and self-sensing abilities of carbon-based CFRPs through electrical resistance change method. Part of her research has been presented in national and international conferences and also has peer reviewed publication.



Dr Stephen Jones (*Carbo4Power Partner*)  
**Offshore Renewable Energy Catapult**  
UK

**Dr Stephen Jones** is a Senior Research Engineer at ORE Catapult specialising in Materials. He is responsible for creating and performing collaborative research projects to develop materials-based products and services for the wind sector.

Stephen holds a PhD in Chemistry from the University of Reading and an MChem in Chemistry (Industrial) from Durham University. His areas of expertise include material characterisation, product and test method development, and polymer science.



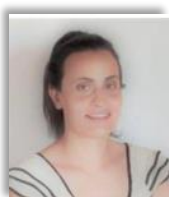
Dr Aratz Genua (*Carbo4Power Partner*)  
**FUNDACIÓN CIDETEC**  
Spain

**Dr Aratz Genua** has a PhD in Chemistry at University of Basque Country (Spain) in 2013. She graduated with a thesis entitled: “*Superficies metálicas con propiedades innovadoras mediante nanorrecubrimientos funcionales*”. She works in CIDETEC since 2010 where she works as a senior researcher & project manager at the Polymers & Composites Unit, focused on the development of dynamic polymer networks based on reversible chemical bonds. She has been involved in several national and European R&D projects and she was the coordinator of the ECOXY European Project (on biobased recyclable, reprocessable and repairable (3R) thermoset composites for automotive and construction sectors). She is co-author of 13 scientific publications, a book-chapter and co-inventor of a patent related to dynamic chemistry.



Dr Elena Rodríguez Senín (*Carbo4Power Partner*)  
**AIMEN Technology Centre**  
Spain

**Dr Elena Rodríguez Senín** has a degree in Chemistry (University of Santiago de Compostela) and PhD in Materials Engineering (Universidad Carlos II of Madrid). She is the Head of Advanced Materials. She has more than 15 years of experience in polymeric materials, characterization and development of new materials and joining technologies with a special focus on composite and MM manufacturing and new processing routes.



Lourdes Blanco Salgado (*Carbo4Power Partner*)  
**AIMEN Technology Centre**  
Spain



**Lourdes Blanco Salgado** holds both a MSc in Chemistry (Physical-Chemistry) and a MSc in Welding Engineering from the University of Vigo (Spain). She has experience in non-destructive inspection of materials. She has more than 10 years of experience in composite materials and testing. She was involved in several projects in the field of advanced manufacturing processes for composite and multi-materials for the automotive, naval, aeronautical and wind sectors.



Dionisis Semitekolos (*Carbo4Power Partner*)  
**National Technical University of Athens,**  
9 Heron Polytechniou str., Zographou  
Athens, Greece, GR-15780

**Dionisis Semitekolos** is a chemical engineer PhD candidate, graduate of the National Technical University of Athens since 2016. In 2018 he completed the postgraduate program “Material Science and Technology”, while in his master thesis he developed the vacuum infusion technique for the manufacture of composite materials with modified carbon fiber fabrics.

His research interest focuses on reinforced polymer matrix composites, surface modification of carbon fiber fabrics and fibers, macro scale mechanical properties and micro computed tomography. He has designed and developed two pilot lines; one for the surface treatment of CFs through electropolymerisation and one for the sizing of CFs with nano enhanced sizing solutions. A part of his research work has been published in scientific journals and presentations at international and domestic conferences.



Daniel Gomez (*Carbo4Power Partner*)  
**INEGI**  
Portugal

**Daniel Gomez** has a Master's degree in Mechanical Engineering from FEUP since 2019. He has been involved in industrial projects focused on innovative and sustainable solutions, and in European projects dedicated to the development of smart materials and systems (SmartFan), particularly in optimising the pre-impregnation process and spread-tow stage. This optimization included the design and development of a setup to increase the carbon fibre volume fraction of the prepreg materials. Currently, Daniel Gomes is involved in the Carbo4Power project, specifically in activities dedicated to the design and development of thermoplastic unidirectional (UD) tape, through the pultrusion of comingling yarns.



Dr Xiaoying Li (*Carbo4Power Partner*)  
**University of Birmingham**  
UK

**Dr Xiaoying Li** is a senior research fellow of Surface Engineering and research manager of the Surface Engineering Research Group in The University of Birmingham. She is an expert in developing novel surface engineering technologies and characterisation of surface engineered materials.



Antoine de Fontgalland (*Carbo4Power Partner*)  
Composite Materials R&D Engineer  
**IRT Jules Verne**  
France

**Antoine de Fontgalland** is a Composite Materials R&D Engineer at IRT Jules Verne. He got a degree in Mechanical Engineering from the HEI - Hautes Etudes d'Ingénieur.



Dr Andreas Flanschger (*Carbo4Power Partner*)  
**bionic surface technologies GmbH**  
Liebenauer Hauptstrasse 2-6  
A-8041 Graz  
Austria

**Dr Andreas Flanschger** received his degree in mechanical engineering and business at Technical University of Graz. He specializes in project management and technical management accounting. He is Co-Founder and CEO at bionic surface technologies GmbH since 2008. He is part of several different innovative multinational research projects in a managing position.



Dr. Agustín Chimmelli Sarría (*Carbo4Power Partner*)  
**ITAINNOVA**  
Spain

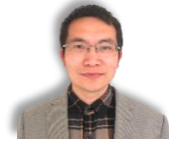
**Dr. Agustín Chimmelli Sarría** is Materials Engineer from the Instituto Jorge Sabato (University of Gral. San Martín – National Commission of Atomic Energy, BA, Argentina) and obtained his PhD from the University of Zaragoza in 2006. In 2007 he entered ITAINNOVA as researcher of the Materials and Components Division, and since then he has been leading and developing projects of materials engineering and particularly in the field of polymer matrix composites, adhesives and smart and multifunctional materials. More specifically, his areas of expertise cover: materials modelling, design and simulation of composite components and structures, advanced characterization techniques, transformation processes and joining technologies. Since his incorporation at ITAINNOVA he has been working in numerous projects both at national and European level, in many of them as principal researcher. Between 2005 and 2013 he was also associated professor in the Mechanical Engineer Department of the University of Zaragoza. He is co-author of many indexed articles and has participated in numerous national and international conferences. Currently he is responsible of the R&D line about Smart and Multifunctional Materials at ITAINNOVA.



Cindy Le Roy (*Carbo4Power Partner*)  
Materials Research/Development Engineer  
**SENSE in**  
/ IRDL - Smart Plastics Group  
France



**Cindy Le Roy** has worked as Materials Research/Development Engineer at **SENSE in**, for the last 2 years.



Dr. Xingguo Zhou (*Carbo4Power Partner*)  
Centre of Precision Manufacturing  
**University of Strathclyde**  
UK

**Dr. Xingguo Zhou** (Centre of Precision Manufacturing, University of Strathclyde) is a highly skilled professional with a strong background in Finite Element Analysis (FEA), material modelling/testing, programming and electronics. With a passion for engineering and a drive for innovation, Xingguo has conducted research and practical investigations on the mechanical behaviour and properties of different materials, ranging from metals to composites. This expertise enables him to accurately model material responses and develop robust simulation models for predicting the performance and durability of engineering structures. In parallel, Xingguo possesses a keen interest in electronics. He has applied his knowledge of electronics in the design and implementation of data acquisition systems for experimental testing setups. Their interdisciplinary background allows him to seamlessly integrate electronic sensors and measurement devices into structural testing protocols, enabling comprehensive data collection and analysis



Dr Kayleigh McEwan (*Carbo4Power Partner*)  
**Haydale Composite Solutions**  
UK

**Dr Kayleigh McEwan** joined Haydale Composite Solutions in July 2018 as a Senior Development Engineer and focusses on project management in both the commercial and UK and EU grant funded sectors of Haydale. Kayleigh's key project applications utilise functionalised nanomaterials in a range of thermoplastics and coatings for enhancements to properties such as electrical and thermal conductivity, mechanical strength and barrier properties, as well as having active projects within the wider application area of nanocomposites.



Lydia Peraki (*Carbo4Power Partner*)  
**IRES - Innovation in Research and Engineering Solutions**  
Brussels,  
Belgium

**Lydia Peraki** holds a BSc in Industrial Management and Technology from the University of Piraeus and a Master's at the University of Twente in the department of Environmental and Energy Management. Focus on sustainable development and circular economy thus, in her thesis she analyzed the carbon neutrality in a dutch wastewater treatment plant by creating a calculating tool for the estimation of biogenic and anthropogenic direct and indirect emissions. Further, her passion for circular economy led her to the creation of a research team for urban development with the utilization of wastewater in high-rise buildings. Her experience as an Environmental and technical consultant gave her knowledge on the implementation of good practices of ISO 14001. Moreover, her aim is to expand her knowledge and experience in the actual implementation of circular economy ideas at a local level.



Dr Ana Bankovic Cassidy (*Partner & Organiser*)  
Senior Innovation Consultant.  
**Cambridge Nanomaterials Technology Ltd.**  
14 Orchard Way, Cambourne  
Cambridge CB23 5BN, UK

**Dr Ana Bankovic Cassidy** is a Senior Innovation Consultant. She joined CNT team in February 2021. Ana graduated from the Faculty of Physics, University of Belgrade Serbia, winning the award for the best BSc (Honors) Thesis of the year 2007. The main aim of her PhD study and further research was to identify and explain specific kinetic phenomena that occur in positron transport in electric and magnetic field due to non-conservative nature of positronium formation. Ana applied the basic phenomenology of charged particle swarms to study the interaction of positrons with biologically relevant molecules, in order to develop and establish a benchmark for Monte Carlo codes used in positron emission tomography (PET) modelling. Her research activities were undertaken in Centre for Non-Equilibrium Processes at the Institute of Physics in Belgrade, Serbia, a large interdisciplinary group with interests ranging from theoretical, numerical and experimental studies of low temperature plasmas, to studies of positron swarms and their applications, modelling particle detectors and conducting experiments at applying plasma physics methodologies to medicine and biological applications.

As a Visiting Researcher at the Open University, Milton Keynes in 2014/15, she worked on quantum chemistry treatment of positron interactions with atoms and molecules using the UKRmol quantum chemistry software.



João Manuel Vieira Cardoso (*Guest Speaker*)  
**INEGI**  
Portugal

**João Manuel Vieira Cardoso** is an Aeronautical Engineer with a 5-year background in composite materials and structures, experienced in both the aeronautical manufacturing industry and R&D, participating in several technology transfer projects.

## Carbo4Power Open Day 2023 Workshop – Partners

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National Technical University of Athens - R-NanoLab - Greece

Web: [www.nanolab.chemeng.ntua.gr](http://www.nanolab.chemeng.ntua.gr)



The “**Research Lab of Advanced, Composite, Nano Materials & Nanotechnology**” (**R-Nano**) is situated at the School of Chemical Engineering, **National Technical University of Athens (NTUA)** in Greece. The R-Nano Lab’s research group has extensive experience in Design, Production and Characterization of Advanced-, Composite- and Nano- Materials. The core expertise involves the development of carbon based novel advanced nanocomposite materials for aerospace, naval, civil engineering, and energy applications. The laboratory has been actively involved in research for more than a decade, enhancing



its infrastructure and producing a large volume of peer reviewed scientific publications. It is committed to provide knowledge, services and expertise to both private enterprises and public organizations in material developing, manufacturing and testing. R-NanoLab has a strong presence in European Research Activities in Materials Science, through participation in numerous EU and national funded projects. As part of the European Technological Community, R-NanoLab is an active member of several Clusters: European Materials Characterisation Council (EMCC), European Pilot Production Network (EPPN), European NanoSafety Cluster (NSC) taking part in establishment of new standard methodologies, provide suitable background for regulation and nanosafety, and support EC policy development.

## IRT JULES VERNE – France



Web: [www.irt-jules-verne.fr](http://www.irt-jules-verne.fr)

**IRT Jules Verne** is an industrial and collaborative research centre dedicated to advanced manufacturing technologies. Focused on the needs of 4 strategic industrial sectors – aeronautics, automotive, energy and shipbuilding – it carries out research in collaborative mode by joining forces with the best industrial and academic resources in the manufacturing field. Together, they strive to develop innovative technologies in five main research areas: Forming and Preforming Processes | Assembly and Joining Technologies | Additive Manufacturing Processes | Mobility in the Industrial Environment | Manufacturing Flexibility. The results of this research are then to be deployed in factories in the short and medium term.

In order to offer global solutions up to full-scale demonstrators, the IRT Jules Verne relies on a set of exclusive state-of-the-art equipment, including a multiaxial test bench, an automated injection platform for composites or an additive metal manufacturing platform.

Since 2012, IRT Jules Verne is in line with an ecosystem of innovation and deploys a coordinated strategy with the EMC2 Competitiveness Cluster.

## AIMEN



Web: [www.aimen.es](http://www.aimen.es)

**AIMEN** is a Non-Profit association, located in the Northwest of Spain and constituted by about 90 companies, which supplies technological support to more than 400 companies dedicated to industrial activity related to metallurgy, automotive sector, shipbuilding, etc. It is highly specialized in materials and in advanced manufacturing technologies, especially joining technologies and laser technologies applied to materials processing, robotics and automation.

## Fundación CIDETEC



Web: [www.cidetec.es/en/home](http://www.cidetec.es/en/home)

**CIDETEC** is a private organization for applied research founded in 1997 that seeks to contribute value to companies by harnessing, generating and transferring technological knowledge. Located in the





Donostia-San Sebastián site of Gipuzkoa 's Scientific and Technological Park, CIDETEC is comprised of three international technological reference institutes in energy storage, surface engineering and nanomedicine. Each institute has its own offices and installations furnished with top-of-the-line equipment, among them a pilot plant for integrated battery manufacture; equipment to synthesise, characterise and process polymers and advanced composites; laboratories completely equipped for surface study, characterisation and treatment; and 150 m2 of rooms classified and prepared for GMP-standard product manufacture in the biopharmaceutical sector.

## Innovation in Research and Engineering Solutions – IRES



Web: <https://innovation-res.eu/>

**IRES** is a research and innovation-oriented consulting company, established in 2015 providing specialized services in the fields of Environment, Health and Safety (EHS), Nanotechnology and Digitisation of Materials Characterisation, incorporating Data driven methodologies (Machine learning and Artificial Intelligence). Our team comprises of highly skilled engineers and scientists focusing on delivering customized and tailored innovative nanotechnology solutions. In detail, “green” and sustainable solutions are based on Life Cycle Assessment (LCA), Social, Environmental & Carbon footprint and Circular economy, joined with (nano)safety consulting towards accurate occupational risk evaluation and Safer-by-Design process optimization, taking into account the up-to-date EU Standards and Regulations. At the same time, our data management planning and data-driven solutions can identify and prevent potential business risks. Currently, IRES is a member of 20 EU funded research projects consortia, in the field of advanced materials, piloting, research ethics and nanosafety.

## Sabella

Web: [www.sabella.bzh/en](http://www.sabella.bzh/en)



Founded in 2008, **SABELLA** is a French pioneering tidal and ocean stream turbine developer, supplying reliable turnkey energy solutions worldwide. Based in Quimper in Brittany region of France, the company counts twenty-five employees and so far, has manufactured, installed and test two tidal turbines in real conditions, D03 and D10. The D03 was installed in the Odet estuary for 12 months in 2008 and was the first tidal turbine installed in France. In 2015, the D10 became the first tidal turbine to inject electricity into the French grid.

## Aragon Institute of Technology - ITAINNOVA

Web: [www.itainnova.es/es](http://www.itainnova.es/es)



**ITAINNOVA is the Aragon Institute of Technology**, a non-profit center linked to the Department of Science, University and the Knowledge Society of the regional government of Aragon. The institute has been created in 1984 and its main facilities are located in Zaragoza, Spain.



The mission of **ITAINNOVA** is to support companies through technological research and innovation, helping them increase their competitiveness by developing new products and improving their processes, and by fostering the smart use of technology in regional, national and international contexts. The staff is composed of 240 employees, of which 18% hold a PhD degree and 66% hold a higher education degree. The Materials and Components Division, which is the main group involved in Carbo4Power, integrates 70 researchers and technicians. The division includes the Materials Laboratory, focused on new materials development, processing and advanced characterization techniques; and the Materials and Structures Modelling and Simulation group, focused on development of material models, advanced FE/CFD simulations, multiscale techniques, reduced-order modelling and optimization tools applied to product and process simulation.

## SENSE in

Web: <https://sense-in.fr/en/>



After 15 years of research on nano-composite sensors, the Smart Plastics Group of the University of South Brittany (UBS) in Lorient (France) has spined off its technology in 2018 and 2 researchers created **SENSE in** to industrialize innovative and customized solutions of structural health monitoring (SHM) for composites. The company now employs more than 10 people. The R&D, the production and the commercial teams are based in Lorient (Brittany, west coast of France).

## Fraunhofer IFAM

Web: [www.ifam.fraunhofer.de/en.html](http://www.ifam.fraunhofer.de/en.html)



Research of practical utility lies at the heart of all activities pursued by the **Fraunhofer-Gesellschaft**. Founded in 1949, the research organization undertakes applied research that drives economic development and serves the wider benefit of society. Its services are solicited by customers and contractual partners in industry, the service sector and public administration.

The Fraunhofer IFAM is one of the most important research institutions in Europe for adhesive bonding technology, surfaces, shaping and functional materials. We put our central principles into practice: scientific excellence, a focus on the application of technology, measurable utility for customers and ensuring the highest quality. Our round about 700 employees, working in 20 departments and numerous working groups combine their broad technological and scientific knowledge and expertise into core competencies: Metallic Materials; Polymeric Materials; Surface Technology; Adhesive Bonding Technology; Shaping and Functionalization; Electromobility; and Automatization and Digitalization.

## The University of Birmingham

Web: [www.birmingham.ac.uk](http://www.birmingham.ac.uk)





Founded in 1900, the **University of Birmingham (UoB)** is one of the leading research-based universities in the United Kingdom; the breadth of research expertise is a distinctive characteristic of the University. University of Birmingham is 81st in the 2020 QS World University Rankings, cementing our position in the top 100 universities globally. The University of Birmingham has extensive experience of EU collaboration and partnerships and in-depth expertise of Framework Programme matters including management, reporting and auditing. The University has been involved in 315 FP7 projects and 284 projects so far in H2020 (March 2020). The School of Metallurgy and Materials at UoB is one of the European materials research centres equipped with world-class materials research facilities. Established in 1983, the Birmingham Surface Engineering Research Group (BSERG) was the first multi-disciplinary research group to be committed to the subject of surface engineering and continuous to be one of the world's premier research centres in surface engineering. The Birmingham Surface Engineering Research Group (BSERG) and Non-Destructive Testing & Condition Monitoring (NDTCM) Groups in the School of Metallurgy and Materials will be involved in this project.

## University of Strathclyde

Web: [www.strath.ac.uk](http://www.strath.ac.uk)



The **University of Strathclyde** is a top ranked university in the UK national Research Excellence Framework in 2013 (top 20 overall and the manufacturing in top 10 in research power). The Centre for Precision Manufacturing (CPM) has over 40 researchers who conduct internationally leading research in materials processing, product/machine design and manufacture. The activities relevant to this project include Materials Forming Processes, Material/Structure/System Analysis, Tools, Machinery and Manufacturing System Development, Condition Monitoring, Exploitation & Dissemination.

The University of Strathclydes' operational capacity is reflected strongly by its experience in conducting world leading materials processing research and machine designs, having over 100 researchers in the directly related fields and being accessible to over 40 million pounds worthy world-class manufacturing research facilities, and substantial experience in managing large-scale collaborative RTD projects. The members of the staff of the Centre for Precision Manufacturing (CPM) have generated a series of product, process, tool and machinery designs and analysis results respectively for energy, materials, electronics, automotive, aerospace, and machinery industries. As an internationally leading research centre, the group has developed a series of forming processes, forming tools and machinery designs.

## Cambridge Nanomaterials Technology Ltd

Web: [www.cnt-ltd.co.uk](http://www.cnt-ltd.co.uk)



**Cambridge Nanomaterials Technology Ltd (CNT Ltd)** is an innovation management and nanotechnology consulting company based in Cambridge, UK.

The CNT Ltd helps companies, academic and government institutions to develop world-class innovative solutions for nanomaterials related R&D and IPR strategy, partnership, products, technologies, funding and markets. CNT Ltd is specialised in carbon nanomaterials R&D consulting and collaborative R&D project management, including exploitation and dissemination management,



consortium and supply chain building. CNT has done a number of patent landscaping and market research analysis studies regarding production and use of various nanomaterials helping to link inventors and technology developers with end-users and investors. The CNT Ltd is a leader of two private consortiums: Nano-Carbon Enhanced Materials (NCEM) and the Advanced Materials for Additive Manufacturing (AMAM) with members coming from leading multinational companies and research institutions. Through both private consortiums NCEM and AMAM, as well as private and public contracts, CNT Ltd has established strong relations to the aerospace, automotive, construction, electronics, materials development, biomedical and chemical industry.

In March 2019 CNT Ltd opened a sister company CNT Innovation based in Brussels, Belgium, with the aim to support and complement their work, especially in European related activities.

## Haydale Composites Solutions Ltd.

Web: <https://haydale.com/>



**Haydale** are a global technology solutions company, passionate about creating the next generation of advanced materials to improve mechanical, thermal and electrical properties for our customers products. We bring together cutting-edge technology and engineering expertise alongside our patented HDPlas<sup>®</sup> functionalisation process which revolutionises repeatable performance and continued commercialisation of nanomaterials. Our world leading HDPlas<sup>®</sup> process has the potential to be a major spearhead in the drive to keep the UK at the forefront of world technology. We have established a secure, robust and sustainable supply chain to support the manufacture of advanced materials. This enables us to deliver repeatable, consistent and outstanding performance. We are also ISO 9001:2015 and ISO 14001:2015 certified. The key to repeatable performance and continued commercialisation of nanomaterials is functionalisation. Functionalisation underpins everything we do. Haydale Graphene Industries Plc has two UK based subsidiaries: **Haydale Composite Solutions Limited** and Haydale Limited. Haydale Composite Solutions Ltd (HCS) is the Group Innovation and Application Centre based in Loughborough, Leicestershire, UK specialising in the development and application of nanomaterial enhanced polymers, composites, coatings and elastomers. The company has extensive knowledge of composites, elastomers and polymers which extends into manufacturing processes, structural design and applications across a broad range of industries. The company has a wealth of experience in the deployment of nanomaterial enhanced materials into the market, utilising the latest in computer aided design systems and has access to its own prototyping workshops for manufacturing and testing.

## AIDEAS OU

Web: [www.aideas.eu](http://www.aideas.eu)



**AIDEAS** is a highly innovative technology and data solutions provider. The company is building machine learning and AI-power technology to unlock the value hidden in huge volumes of data, reducing the time to find, diagnose, comprehend and act at a speed that is impossible for humans, thereby generating new faster insights. AiDEAS portfolio is built on leading-edge AI technologies including data mining and machine learning/deep learning to (i) enable data-rich and knowledge-lean automation of valuable tasks of perception, classification and numeric prediction as well as (ii) collect,



organise, analyse and discover hidden patterns and value in voluminous amounts of structured and/or unstructured data.

**AiDEAS** staff comes from different computer science backgrounds with over 15 years' experience and a particular focus in developing novel algorithms as well as leading award-winning academic research for solving important existing and emerging problems in various industries such as Healthcare, Industry 4.0 and Oil & Gas. The core team of AiDEAS is also experienced in the definition, execution and management of big EU projects in the R&D area within an extended European growing network consisting of universities, research centres, SMEs and large enterprises.

## Bionic Surface Technologies GmbH

Web: [www.bionicsurface.com/en/](http://www.bionicsurface.com/en/)



**bionic surface technologies GmbH (BST)** is a research and development company based in Graz, Austria.

Thanks to many years of experience and know-how BST is one of the leading, globally operating companies regarding Riblets. Twenty high skilled employees (MSc & PhD level) working with a high-performance data center to improve knowledge in Computational Fluid Dynamics and testing.

## INEGI

Web: [www.inegi.pt/en/](http://www.inegi.pt/en/)



**INEGI** is an industry-oriented Research and Technology Organization (RTO) with an organizational structure based on three pillars of activity: research with applied focus, innovation and technology transfer and consulting and advanced engineering services. Recognized by the Portuguese Government as being of public utility, INEGI is currently considered an active agent playing a significant role in the development of the Portuguese industry, and in the transformation of its competitiveness model. In the KETs main fields, ongoing European-level projects are framed in H2020, FP7, ESA, CleanSky and Interreg programs. INEGI has active presence in the main European and National technology platforms and initiatives related with materials, manufacturing technologies and transports, specifically in EARTO (European Association of Research and Technology Organizations), EFFRA (related to Factories of the Future PPP), EARPA (automotive sector) ESA (aerospace sector), ACARE (aeronautics sector) and Vanguard Initiative (smart specialization). INEGI has an active role in these initiatives and has contributed to the definition of R&D&i priorities at European or national level, including the RIS3-NORTE strategy. INEGI is also present in other national and international expert panels, consulting committees, groups and societies, sectorial industry clusters (automotive, aeronautics, tooling, additive manufacturing, sea economy and energy).

With more than 30 years working on composites processing technologies, the Composite Materials and Structures Research Unit (UMEC), of which we are part, is one of the key units of INEGI with relevant experience in sectors such as the aerospace, automotive, sea, energy, construction, among others.



## BioG3D- New 3D Printing Technologies

Web: <http://biog3d.gr/>



**BioG3D** is an R&D company, dedicated to innovative 3D printing solutions and “smart” product customization. **BioG3D** team consists of Additive Manufacturing and Computational Design specialists, Materials and Mechanical Engineers, aiming to provide end-to-end solutions and 3D printing services, from initial conception to functional prototype production. The company's mission is to enable new uses for the unique potential offered by Digital Manufacturing, by employing advanced feedstock materials, cutting-edge physical and digital tools to optimize designs, towards a holistic approach for the fabrication of fully customized products that incorporate advanced functionalities. In this context, BioG3D team has leveraged its experience and know-how to cover the whole range of Additive Manufacturing process chain, from advanced design, custom robotic solutions, AM process optimization and design verification, as demonstrated through numerous EU-funded projects.

## ORE Catapult

Web: <https://ore.catapult.org.uk/>



**ORE Catapult** was established in 2013 by the UK Government and is part of a network of Catapults set up by Innovate UK in high growth industries. It is the UK's leading innovation centre for offshore renewable energy.

Independent and trusted, with a unique combination of world-leading test and demonstration facilities and engineering and research expertise, ORE Catapult convenes the sector and delivers applied research, accelerating technology development, reducing risk and cost and enhancing UK-wide economic growth.

Active throughout the UK, ORE Catapult has operations in Glasgow, Blyth, Levenmouth, Aberdeen, the Humber, the East of England, the South West and Wales and operates a collaborative research partnership in China.

## Carbo4Power Open Day 2023 Workshop – Guests participating projects

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### 3FIBREGY Project

Web: <https://fibregy.eu/>



The overall objective of the FIBREGY project is to enable the extensive use of FRP materials in the structure of the next generation of large Offshore Wind and Tidal Power (OWTP) platforms.

In order to achieve this objective, the project will develop, qualify and audit innovative FRP materials for offshore applications, elaborate new design procedures and guidelines, generate efficient production, inspection and monitoring methodologies, and validate and demonstrate advanced software analysis tools.



## Carbo4Power Open Day 2023 Workshop - External Organisations

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### City, University of London's



Web: [www.city.ac.uk](http://www.city.ac.uk)

<https://researchcentres.city.ac.uk/composite-focused-research-group>

City, University of London's five specialist Schools and over 30 departments are home to our outstanding academic departments, faculties, divisions and research centres. City prides itself on its innovative approach to education. Our courses are enriched by the research of our academic staff.

75.7% of City's submission to the Research Excellence Framework (REF) was rated as being of world leading 4\* and internationally excellent 3\* quality.

### TWI



Web: [www.twi-global.com](http://www.twi-global.com)

**TWI** is one of the world's foremost independent research and technology organisations, with expertise in materials joining and engineering processes as applied in industry. TWI specialises in innovation, knowledge transfer and in solving problems across all aspects of manufacturing, fabrication and whole-life integrity management. Established in Cambridge, UK in 1946, the organisation has gained a first-class reputation for service through its teams of respected consultants, scientists, engineers and support staff. With around 800 employees, it works with over 1800 Industrial Member companies in over 70 countries. TWI currently operates from 54,000 square metres (581,000 square feet) of manufacturing, testing and training space; five UK and 13 overseas facilities serve both its Industrial Membership and its training and examination needs. A successful international Training and Examinations programme sees around 25,000 students trained each year in welding and inspection technologies.

### Centro Tecnológico LEITAT



Web: [www.leitat.org/english](http://www.leitat.org/english)

**Leitat** is a private technical institute with more than 110 years of experience in industrial innovation processes. We transform technological and scientific results into economic and competitive value for our clients and collaborating entities. Over 1500 customers benefit from our talent, creativity and strong commitment. We bring knowledge and innovation to our customers through applied research and technical testing in the fields of chemistry, energy, environment, materials, engineering and life sciences. We rely upon our 240 highly skilled team members who deliver flexible solutions to face any industrial challenge.



## Cranfield University



Web: [www.cranfield.ac.uk/manufacturing](http://www.cranfield.ac.uk/manufacturing)  
[www.cranfield.ac.uk/centres/enhanced-composites-and-structures-centre](http://www.cranfield.ac.uk/centres/enhanced-composites-and-structures-centre)

**Cranfield** has a distinctive approach to manufacturing research. We combine expertise in design, technology and management along with research into materials sciences together, all with a focus on manufacturing.

We teach more than 300 postgraduate students in areas ranging from manufacturing technology to systems and management. Research students work in fields as diverse as ultra-precision engineering to the novel application of Virtual Reality technologies to support maintenance and through-life engineering services. We work in Technology Readiness Levels (TRL) 1-6.

Cranfield offers a part-time executive manufacturing Master's programme to develop industry professionals who can lead business change and innovation. From 2016 we will also run a Manufacturing Leadership Programme for SMEs and a Manufacturing Directors Programme.

We work with more than 1500 businesses and governments around the world. Through our industry connections guest lecturers, often senior managers in leading companies, provide insight into current industry challenges. Many industry contacts actively recruit our graduates.

## Fraunhofer Institute for Casting, Composite and Processing Technology IGCV

Web: [www.igcv.fraunhofer.de/en.html](http://www.igcv.fraunhofer.de/en.html)



**Fraunhofer IGCV** stands for applied research with a focus on engineering, production and multi-material solutions. We enable innovations at the level of manufacturing processes and materials science, machines and process chains as well as the factory and company networks. Our unique selling point lies in interdisciplinary solutions from the areas of casting, composite and processing technology. Within the composite department our main research topics are pultrusion, automated fiber placement (AFP) and the recycling of composites as well as development of test methods for composites.

With around 150 employees at our locations in Augsburg and Munich / Garching, we are a reliable partner for SMEs, large companies and concerns.

## Nanolayr

Web: [www.nanolayr.com](http://www.nanolayr.com)



**NanoLayr** manufactures quality functional nanofibre textiles on a huge scale. Having perfected our nanofibre manufacturing solution, NanoLayr can supply any size business and put our product into existing production lines.





UCL

Web: [www.ucl.ac.uk/physics-astronomy](http://www.ucl.ac.uk/physics-astronomy)



UCL is a world-leading university situated in the heart of London, UK. UCL was 1st in the UK for research strength at the last UK university research assessment (UK REF 2014). ~40,000 undergrad+post grad students, ~7,000 Staff.

The Physics and Astronomy Department at UCL is located in the heart of the historical area of Bloomsbury. Scientific research and study has been a strong feature of UCL since its inception in 1826 and the Department is one of the top rated Physics departments in the country and the world.

TÜV

Web: [www.tuv.com/world/en](http://www.tuv.com/world/en)



**TÜV Rheinland** stands for safety and quality in virtually all areas of business and life. Founded almost 150 years ago, the company is one of the world's leading testing service providers with more than 20,600 employees and annual revenues of around 2 billion euros. TÜV Rheinland's highly qualified experts test technical systems and products around the world, support innovations in technology and business, train people in numerous professions and certify management systems according to international standards. In doing so, the independent experts generate trust in products as well as processes across global value-adding chains and the flow of commodities. Since 2006, TÜV Rheinland has been a member of the United Nations Global Compact to promote sustainability and combat corruption.

TMBK Partners Sp. z o.o.

Web: [www.tmbk.pl](http://www.tmbk.pl)



**TMBK Partners** is an R&D company specialised in providing solutions for producers of polymer composite structures offering new functionalities for expanding their application range and increasing their market value.

- We manufacture ultralight nonwovens (veils) based on thermoplastic polymers, carbon nanotubes and other fillers whose introduction into the composites' structure improves the electrical, mechanical and thermal properties.
- We offer services for the development of processing and testing conditions for plastics with fillers, including nanofillers.
- We provide expert opinions in the field of metallic, ceramic, polymeric material and composite engineering.
- We participate actively in European research projects which offer us access to the latest technology and product solutions.