



UltraWire 2021

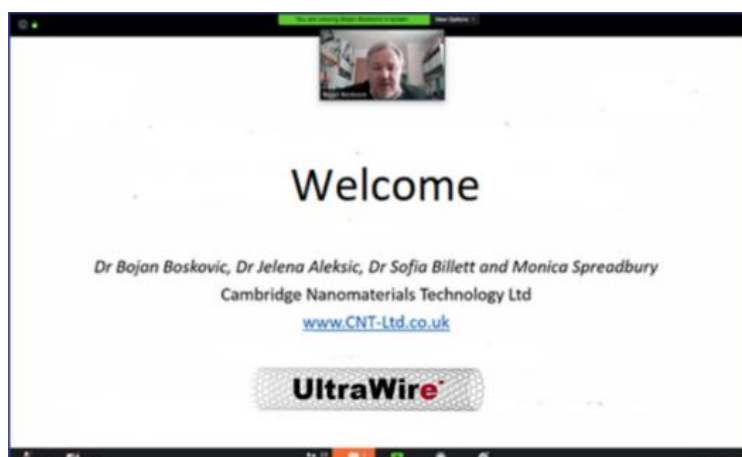
Conductive Materials Solutions Workshop & EXPO

Preliminary Agenda, Speakers and Participating organisations

Date: 15th July 2021

Meeting Venue: ZOOM Online Platform

Time: 09:30 – 16:30 (UK – BST)




www.ultrawire.eu

www.ultrawire.eu/expo/

UltraWire Workshop 2021

The **UltraWire Workshop 2021 “Conductive Materials Solutions Workshop”**. (<http://ultrawire.eu/workshops/>), is taking place on 15th July 2020. This event is co-organised by Cambridge Nanomaterials Technology (CNT) and its sister company, CNT Innovation.

The **UltraWire Workshop 2021** is organised in order to support in order to support commercialisation of new technologies providing conductive materials solutions, including nano-carbon and metal-based composite materials for a number of applications, such as; electrical energy transmission, structural health monitoring and light-weight transport by bringing together technology development leaders and industrial end-users. The **UltraWire 2021 Workshop** would be an opportunity to learn about progress in the development of nano-carbon wire technologies for improving electrical conductivity properties. It would also be a platform to exchange experience for all technology developers in industry and researchers in academia.

This is also an opportunity to link the workshop with the **GRAPHOSITE** Project  (www.graphosite.co.uk). The GRAPHOSITE is a project funded by Innovate UK (reference 104266) which started in August 2018 and will run until July 2021. The main objective of the project is to develop a Graphene Sensor for Defect Detection and Predictive Maintenance in Composite Materials for use as a highly efficient, more convenient composite monitoring tool. This technology is based on an enhanced graphene-substrate interaction, with the ability to embed within a composite structure. It has the participation of 6 Partners: *Advise-DETA (Project Coordinator), Brunel University London, Cambridge Nanomaterials Technology Ltd, DZP Technologies, Haydale Composite Solutions Ltd and TWI.*

Preliminary agenda

Please note that the times shown in the agenda are UK (BST) Time.

09:30 *Arrival, Welcome & individual Introduction of the participants*

Bojan Boskovic, CEO, Cambridge Nanomaterials Technology Ltd, UK
CEO CNT innovation SPRL/BVBA, Belgium

10:30 **Atif Aziz**, The Nanoscience Centre, University of Cambridge, UK:

Title: Light Weight Cu/CNT Cables: a Dream or a Reality

Over the last decade many multimillion-dollar research studies there have been conducted in creating lightweight conductors. In particular, copper and carbon nanotubes (CNT) based conductors have been studied in great detail. However, the dream of creating usable continuous cable which outperforms copper in terms of its electrical, mechanical, and specific properties has yet to be realized. In this talk, I will discuss different fabrication techniques we have used for making Cu/CNT composite wires. I will discuss the merits and demerits of each technique and its associated properties. I will summarize the current state-of-the-art cables and discuss technical issues which need to be addressed. I will also try to gauge how far we are from achieving the dream of creating such cables.

Contributors: Atif Aziz, Basel Bazbous, and Mark Welland

11:00 Amaia Zurutuza, GRAPHENEA, Spain

Title: Developing a Graphene Industry

Graphene alone or in combination with other materials such as quantum dots or silicon has shown to provide enhanced performance in many applications. However, in order to integrate graphene in semiconductor devices in a cost-effective manner, it will require combining it with CMOS technology while processing the graphene into functional devices.

The fabrication of graphene at an industrial scale will require to overcome numerous challenges such as wafer scale uniformity with a high charge carrier mobility, tight control of metal contamination, etc. However, wafer scale device fabrication is also critical for a successful graphene integration. At present, there is no commercial foundry able to process graphene in order to produce graphene devices (GFETs). As a consequence, we have recently launched a platform to commercialise graphene-based field effect transistor (GFETs) and thus help customers to focus on their applications rather than wasting time on graphene processing. At the same time, taking the first steps into providing a graphene commercial foundry service.

11:30 Break – networking/exhibition

11:40 Park Jung-hu and Ashraf Ahmed, Songsil University, South Korea

Title: Skin Effect-Related AC Resistance and High-Power Converter Applications Using Macroscopic Scale Carbon Nanotube Yarn

This paper presents a study on the skin effect-related AC resistance of macroscopic scale carbon nanotube (CNT) yarn. The range of interest frequency in this study is up to 10 MHz which is considered conventional high-frequency power converters operating range. AC resistance of both CNT yarn and copper (Cu) wires are measured by impedance analyzer for the small-signal frequency-response. The 1-turn core-less layout of inductors made of both CNT yarn and Cu wire are implemented to eliminate the proximity effect and magnetic core. The measurement results are compared with the theoretical model results based on Bessel-Kelvin function. The results show that the increasing rate of AC resistance in CNT yarn is lower than in Cu wire as frequency increases so that it causes lower CNT yarn resistance at higher frequencies. It was found that the Cu wire measurement result follows the theoretical model whereas CNT yarn does not. Therefore, a new skin effect related AC resistance correction factor for CNT yarn is introduced. To verify the same trends in large signal level of current, conduction losses for both CNT yarn and Cu wire are tested as an inductor component in a power converter circuit working like a large signal generator. The losses were collected and presented for the same frequency range (between 1 and 10 MHz). The results show less losses with CNT yarn inductor. Finally, another CNT yarn-based inductor was constructed and tested in around 200 W power converter circuit. The results show 91.72% of high efficiency at 3.125 MHz switching frequency. The study shows that, for power converter circuits working in the range higher than 1 MHz, the CNT yarns are reasonable to replace Cu wires due to the lower skin effect-related losses.

Index Terms—AC resistance, carbon nanotube (CNT) yarn, copper (Cu), high-frequency conductivity, skin depth, skin effect.

12:10 Ronald Tellas, Technology and Applications Manager, Enterprise Networks, Belden, USA

Title: Belden Overview

Belden connects and protects organizations worldwide with the industry's most complete suite of end-to-end networking solutions. We are continuously innovating to provide leading connectivity, automation and cybersecurity solutions. We have a long legacy as a manufacturer of high quality and reliable products, and have a presence globally to deliver on your needs and ensure you are successful in your endeavours. For nearly 120 years, Belden has a reputation for quality, ingenuity and value. Founded by Joseph Belden in 1902, our products have played a part in major innovations in TV, radio and computer networking throughout the years. One of

our earliest and perhaps most well-known customers was Thomas Edison, a great American inventor. Shifting to Belden today – Roel Vestjens is our President and CEO; he was appointed in 2020 after a long tenure in various senior roles at Belden. We are headquartered in the USA in St. Louis, Missouri and have nearly 8,000 employees worldwide.

12:40 Mehmet Ertugrul, Ataturk University, TURKEY

Title: Improving Ampacity of the CNT/Graphene-Al/Cu composite wires

In this study, CNT-Al/Cu metal composites were produced and their current carrying capacities were investigated. For this purpose, first of all, CNTs in a solution were coated on the metal wire surface with the help of DC voltage. Then, randomly distributed CNTs were made parallel to each other by a voltage. After that, the CNTs were welded together using an AC voltage to prevent electron scattering at the CNT-metal interface. The surface of the CNT network, where the continuity of electrical conduction is ensured by welding to each other, is covered with metal with the help of an inverted magnetron coating device, and this process is repeated many times to obtain CNT-metal (Al, Cu) layered structure. In order to obtain the final composite structure, the wires were heat treated in an inert gas environment at a temperature close to the melting temperature of the metal. Thus, a CNT-metal composite structure in which the CNTs are embedded in the metal was produced. In addition, to ensure continuity in carbon nanostructures, the metal wire surface is coated with graphene with the help of CVD. With the developed system, the graphene-coated Cu wire was coated with Cu without being taken out from the chamber. This process was repeated until a multi-layered structure was obtained. This sample was heat treated and then the current carrying capacity of all samples was measured. As a result, it was found that the graphene/Cu layered structure provided the best result, and CNT-Al wire could show the same performance as pure Cu wire. In addition, contrary to some other studies in the literature, an improvement in the electrical resistance of composite wires was observed.

13:00 Lunch break, networking & virtual exhibition

14:00 George Maistros, GRAPHOSITE Project Coordinator, Technical Director, ADVISE-DETA Ltd, UK.

Title: GRAPHOSITE - Graphene sensors for strain measurement and defect detection in composite materials

GRAPHOSITE offers a technological solution that addresses a significant challenge to composite materials – defect detection. It aims to apply graphene to a customised substrate to achieve enhanced defect sensing and predictive maintenance with increased sensitivity. The sensor will be embedded with the composite during manufacturing and will have high flexibility properties. A unique feature of the novel technology is that graphene will serve as the sensing element and act as the gate through which the electric current passes. Being an embedded part of the composite at manufacture, condition monitoring will therefore be continuous and in real-time.

14:20 George Maistros, GRAPHOSITE Project Coordinator, Technical Director, ADVISE-DETA Ltd, UK

Title: Sensors for in-line quality assessment of composite materials

The current activities of ADVISE-DETA are focusing on the application of quality assessment (in-process and in-service) for composite materials. There is a variety of sensors ranging from electrical to interdigital and ultrasound. The company has developed all the components of a complete quality assessment system, DETA SCOPE™, linked to the sensing system and equipped with material science models for the evaluation of quality. The readings from the sensors are translated to actual material properties or state (i.e. viscosity, degree of cure, strain, condition). There are variants of DETA SCOPE in the form of Defect Detection System or Process Performance Monitoring System. The operation of the system helps to improve efficiency of composites production and detection of defects and poor condition of composite

structures. The core technology development within ADVISE-DETA lies with sensors in the form of interdigital electrodes. They are sensing elements with custom design circuit in the form of grid of 'fingers'. To facilitate evaluation of material state, the company has developed several modelling tools on the electric field analysis of the sensor structures and on signal interpretation.

14:40 Matthew Thornton, UK Site and Innovation Director, Haydale, UK

Title: Next-Generation Advanced Materials using Functionalised Nanomaterials

Next generation products will rely on advanced materials to deliver performance whilst minimising weight and increasing efficiency. The use of nanomaterials will be crucial to meeting the performance and efficiency targets set by manufacturers of next generation products and technologies. Through the deployment of functionalised nanomaterials, Haydale have developed a range of technically advanced next generation materials with improved mechanical performance, increased thermal conductivity and market-leading electrical conductivity for wide ranging applications.

15:10 Natalia Garban, TWI, UK

Title: Overview of Condition Monitoring technologies at TWI

TWI has experience in working in a range of different industries and applications. The non-destructive evaluation expertise can offer a range of different Monitoring services and provide consultancy on appropriate monitoring strategy, implementation, data analysis and evaluation. Monitoring gives the indicator that there is a problem and inspection is used to give a more in-depth assessment of the problem. Some key applications are development Monitoring, in-service Monitoring and process Monitoring, also covering the Data Handling, Processing and Analysis. TWI is uniquely positioned to provide expertise in NDE, Materials, Asset integrity, Modelling and Joining to provide a full rounded assessment.

15:40 Akram Zitoun, Brunel Composites Centre (BCC), UK

Title: Overview of composite materials research areas at the Brunel Composites Centre

The Brunel Composites Centre (BCC) creates shared research and technology capabilities, specializing in novel composites processing and joining technologies and developing innovative methods for composites related technologies applied to different industries such as the aerospace and the automotive industries.

BCC provides expertise in non-destructive testing, structural health monitoring and multiple digital solutions for composite industry such as algorithm development, machine learning and artificial intelligence implementation for composite inspection as well as composite in-service inspection and monitoring.

16:10 Discussion

Facilitated by **Bojan Boskovic**, CEO, Cambridge Nanomaterials Technology Ltd

16:30 Concluding remarks

Note It is planned that all presentations would be followed by Q&A discussion. The organisers reserve the right to change the programme, speakers or venue should circumstances require. *For any further enquires please do not hesitate to contact directly Dr Bojan Boskovic on Bojan.Boskovic@CNT-Ltd.co.uk or on his mobile phone +447780874335.*

UltraWire 2021 Workshop – Speakers



Dr Atif Aziz (*Speaker*)
Senior Research Associate
The Nanoscience Centre
University of Cambridge
UK

Dr Atif Aziz is a senior research associate at the Nanoscience Centre, University of Cambridge. His area of research is studying the physical, electrical and mechanical properties of nano materials and nanoscale devices. At present he is working on Carbon Nanotubes and metal composites in particular copper and functional nanofibers. He did his PhD from Cavendish Lab, University of Cambridge and had been working as a research associate at the Materials Science Department, University of Cambridge. Before his current job, he was an experimental office at the Lancaster University, where he setup a nanofabrication facility for Quantum Technology Centre and had been a manager of the Cambridge Graphene Centre.



Dr Amaia Zurutuza (*Speaker*)
Scientific Director
Graphenea
Paseo Mikeletegi 83,
20009 - San Sebastián
Spain

Dr Amaia Zurutuza received her Ph.D. degree in polymer chemistry from the University of Strathclyde (Glasgow, UK) in 2002. From 2001 to 2003, she was a Postdoctoral Research Fellow working in two European projects related to molecularly imprinted polymers. In 2004, she joined Ferring Pharmaceuticals (previously Controlled Therapeutics) where she worked in the research of new controlled drug delivery systems as a Senior Polymer Scientist. Her contribution led to the granting of three patents in novel biodegradable and biostable polymers for the controlled release of active compounds. In 2010, she became the Scientific Director of Graphenea. At Graphenea, she leads the research and development activities on graphene-based materials. Since joining Graphenea, she has so far filed for eleven patents and published more than 68 publications in peer reviewed journals, including Nature and Science. Principal Investigator in 21 EU FP7/H2020 funded research projects, 16 collaborative projects including the Graphene Flagship and 3 people training network projects. In addition, she has also given more than 48 invited talks in international conferences. Her research interests include the synthesis, characterization, and future industrial applications of graphene.



Prof. Park Joung-hu (*Speaker*)
Department of Electrical Engineering
Soongsil University
Seoul, Korea

Joung-Hu Park (S'02 - M'06 – SM'13) received his B.S., M.S., and Ph.D. from the Department of Electrical Engineering and Computer Science of Seoul National University, Seoul, Korea, in 1999, 2001 and 2006, respectively. He is currently a Professor at Soongsil University, Seoul, Korea. From August 2004 to August 2005, he was a visiting scholar at Virginia Tech. Blacksburg, VA, USA, and from July 2015 to June 2016, he was a visiting assistant professor at University of British Columbia, Vancouver, Canada. His current research interests include the analysis of high frequency switching converters and renewable energy applications.



Dr Ashraf Ahmed (*Speaker*)
Department of Electrical Engineering
Soongsil University
Seoul, Korea

Ashraf Ahmed (M'09) received the B.Sc. and M.Sc. degrees in electrical engineering from Assiut University-Egypt, Cairo University-Egypt in 1999 and 2005 respectively. He received the Ph.D. degree from University of Durham - UK in 2011, in the field of renewable energy control and power electronics. He is currently an Associate Professor at Soongsil University, Seoul, Korea. His research interests include the analysis and design of switching power converters for renewable energy applications.



Ronald Tellas (*Speaker*)
Technology and Applications Manager,
Enterprise Networks, Belden
401 Pennsylvania Parway STE 200
46280
USA

Ronald Tellas joined Belden in 2016 to help define the roadmap of technology and applications in the enterprise. Prior to this, he developed cables and connectivity for Panduit and Andrew Corporation. Ron Tellas is a subject-matter expert in RF design and Electromagnetic Propagation. He represents Belden in the ISO WG3 committee, TIA TR42 Premises Cabling Standards and IEEE 802.3 Ethernet Working Group and is a committee member of NFPA 70 Code-Making Panel 3. Ron is the inventor of 16 US patents. He has a Bachelor of Science degree in Electrical Engineering from Purdue University, a Master of Science degree in Electrical Engineering from Illinois Institute of Technology, and a Master of Business Administration from Purdue University.



Prof. Dr Mehmet Ertugrul (*Speaker*)
Ataturk University
Engineering Faculty
25100
Turkey

Prof. Dr. Mehmet Ertugrul was born in Trabzon, Turkey, in 1966. He received the B.Sc. degree from the Department of Physics, in 1986, and the M.Sc. and Ph.D. degrees in physics, in 1990 and 1994, respectively. From 1994 to 1996, 1996 to 2001, and 2001—2002, he was, respectively, an Assistant Professor, an Associate Professor, and a Full Professor at the Department of Physics, Ataturk University, where he has been a Full Professor at the Department of Electrical and Electronics Engineering since 2003. He is the author or co-author of more than 200 papers published in international journals and over 200 publications in national and international conference proceedings. His current research interests include carbon nanostructures and composites, energy storage systems employing 2D structures such as graphene, dichalcogenides and MXenes, biomedical and gas sensors, ultraconducting and superconducting cables, composites, radar absorber materials, superconducting and semiconducting devices. He worked as a visiting scientist at Oak Ridge National Laboratory between 2001-2003, 2005-2006, and 2008-2009. He has been working as a visiting professor at University Putra Malaysia (UPM) since 2019. Prof. Ertugrul has received several awards such as Encouragement award by The Scientific and Research Council of Turkey (TUBITAK), The Successful Young Scientists Award by the Turkish Academy of Sciences, and the best project award. He was also awarded with NATO-C scholarship in 2001 and TUBITAK scholarship in 2009. He has served as a supervisor to many

masters and PhD students. He has worked for several committees such as the Higher Education Council, The Scientific and Research Council, The Ministry of Science, Technology and Industry of Turkey.



Dr George Maistros, (*Speaker*)

ADVISE-DETA
34 Castle Rd.
Bedford MK40 3PJ
UK

Dr George Maistros is the Technical Director of ADVISE-DETA. He is a Chemical Engineer from National Technical University of Athens in 1988 and received his PhD in Advanced Materials from Cranfield University in 1991, focusing on the dielectric cure monitoring of thermoset resin systems. He has over 20 years of experience in promoting dielectric sensing systems to all kinds of material processes, such as composites processing, repair of structures, nano-membranes operation and engine exhaust fumes characterization. He has authored 15 publications in scientific journals and 1 chapter in book. He has coordinated 3 Aeronautics FP6 (COMPROME, SENARIO, NOESIS) programs on applications of dielectric technology on composites manufacturing processes.



Dr Matthew Thornton (*Speaker*)

UK Site and Innovation Director
Haydale Composite Solutions
Unit 10, Charnwood Business Park,
North Road, Loughborough,
LE11 1QJ, UK

Dr Matthew Thornton is the Head of Innovation at Haydale and has over 15 years' industrial experience in the polymers, composites, elastomers, and nanomaterials sectors. He has a BSc (Hons) in Chemistry with Chemical Engineering from the University of Huddersfield and a PhD in Materials Science and Engineering from the University of Nottingham which investigated the use of carbon nanotubes for the rapid manufacture of aircraft brake discs; this was sponsored by Meggitt Aircraft Braking Systems. Matthew is responsible for the management of a range of nanocomposite materials innovation, research, development, and manufacturing programmes in both the commercial and grant funded sectors and has managed several successful collaborative R&D projects that commercialised nanomaterial enhanced products.



Natalia Garban (*Speaker*)

TWI
U Granta Park, Great Abington
CB21 6ALK Cambridge

Natalia Garban is a Chartered Engineer and Project Leader at TWI in the Condition and Structural Health Monitoring team. She leads the development and application of advanced innovative inspection, assessment and risk management solutions for the Energy industry and Oil & Gas sector. Natalia is experienced in project planning, control and monitoring, milestones and resources management, product optimisation integrity management. Prior to joining TWI, she worked in Venezuela, on business development projects as the Head of strategic planning, control and budgeting of construction and renovation projects, as well as maintenance of equipment. She has a MEng in Materials Engineering and an MSc in Structural Integrity.



Akram Zitoun (Speaker)
Brunel Composites Centre
U Granta Park, Great Abington
CB21 6ALK Cambridge

Akram Zitoun is a Research Fellow at the Brunel Composites Centre (BCC). His current work includes design, modelling and development of technologies with relation to quality evaluation of composite either after manufacturing or during service life. His expertise lies within different non-destructive methods and structural health monitoring systems. He has expertise in designing and developing systems, develop machine learning algorithms for autonomous extraction of signal of interest and applying technical knowledge to evaluation the health of structures.

Akram gathered valuable experience by working on developing innovative systems of evaluation and assessment of aircraft composite structures and he currently is working on different projects such as GRAHOSITE. He in charge of developing the technical solutions and project management.



Dr Bojan Boskovic (Speaker and Organiser)
CEO, Cambridge Nanomaterials Technology
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 and nTRACK. Also in UK Government InnovateUK funded projects, such as UltraMAT and GRAPHOSITE He is also a leader of two private membership based consortiums: Nano-Carbon Enhanced Materials (NCEM) and Advanced Materials for Additive Manufacturing (AMAM).

UltraWire 2021 Workshop – Organisers

Cambridge Nanomaterials Technology Ltd (CNT)

Web: www.cnt-ltd.co.uk



The **Cambridge Nanomaterials Technology** Ltd (CNT Ltd) is an innovation management and nanotechnology consulting company based in Cambridge. 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 membership-based consortiums: Nano-Carbon Enhanced Materials (NCEM) and the new Advanced Materials for Additive Manufacturing (AMAM) with members coming from leading multinational companies and research institutions.

CNT Innovation



Web: www.cnt-innovation.com

The **CNT Innovation SPRL/BVBA** is an innovation management and technology consulting company based in Brussels (Belgium company registration number: 0723.767.874). The company was opened in March 2019, with an aim to create support and provide better services for our European customers and complement the work of its sister company, Cambridge Nanomaterials Technology Ltd. (based in Cambridge, UK). CNT Innovation is providing services related to support in research and development, technological innovation (especially in the field of nanotechnology, advanced materials and biotechnology), intellectual property rights, market research and strategy, organising conferences, seminars, workshops, training courses.

UltraWire 2021 Workshop - Speaker & Delegate Organisations

Prysmian Group



Web: www.prysmiangroup.com

Prysmian Group is world leader in the energy and telecom cables and systems industry. With nearly 140 years of experience, sales of over €7.5 billion in 2016, 21,000 employees across 50 countries and 82 plants, the Group is strongly positioned in high-tech markets and offers the widest possible range of products, services, technologies and know-how. It operates in the businesses of underground and submarine cables and systems for power transmission and distribution, of special cables for applications in many different industries and of medium and low voltage cables for the construction and infrastructure sectors. For the telecommunications industry, the Group manufactures cables and accessories for voice, video and data transmission, offering a comprehensive range of optical fibres, optical and copper cables and connectivity systems. Prysmian is a public company, listed on the Italian Stock Exchange in the FTSE MIB index.

Airbus Group Innovations

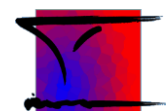
Web: www.airbus.com



Airbus is a global leader in aeronautics, space and related services. In 2020, it generated revenues of €49.9 billion and employed a workforce of around 130,000. Airbus offers the most comprehensive range of passenger airliners. Airbus is also a European leader providing tanker, combat, transport and mission aircraft, as well as one of the world's leading space companies. In helicopters, Airbus provides the most efficient civil and military rotorcraft solutions worldwide. Airbus is an international pioneer in the aerospace industry and a leader in designing, manufacturing and delivering aerospace products, services and solutions to customers on a global scale. We believe that it's not just what we make, but how we make it that counts; promoting responsible, sustainable and inclusive business practices and acting with integrity. Our people work with passion and determination to make the world a more connected, safer and smarter place, on the ground, in the sky and in space.

The Nanoscience Centre

Cambridge University nanofabrication and characterisation facility
Web: <https://www.nanoscience.cam.ac.uk>



The **Nanoscience Centre** is an 1800m² research facility completed in January 2003 and located at the north east corner of the University's West Cambridge Site. The Centre provides open access to over 300 researchers from a variety of University Departments to the nanofabrication and characterisation facilities housed in a combination of Clean Rooms and low noise laboratories. Office space is primarily home to the Department of Engineering's Nanoscience Group, technical and administrative staff and members of other research groups who require long term access to facilities.

ADVISE-DETA

Web: www.advise-deta.com/en/



ADVISE-DETA is a recently formed SME that specialises in implementing advanced sensors to a wide range of material transformation processes, including polymer processing, composite materials manufacturing, mixing of chemicals and repair of structures. To this end, the company owns the IP (through transfer from ADVISE, Greece) of the dielectric monitoring system, which includes dielectric sensors, electronic measurement hardware and intelligent process monitoring software. The system has been installed in several industrial sites of advanced composites manufacturing. The business goal is to market the existing technology and establish new applications in modern manufacturing processes. The company's laboratory includes process characterisation methods (viscometer, optical microscope), dielectric measurement systems (frequency analyser, dielectric cure monitoring systems, material state based control prototype, temperature controlled sample holders) and software programming and modelling tools (LabView, Matlab).

Brunel Composite Centre

Web: www.twi-innovation-network.com/innovation-centres/brunel-composites-innovation-centre



Brunel Composite Centre is part of the Institute of Materials and Manufacturing of Brunel University. The principal mission of BCC is to establish a world class research centre offering high quality research in phenomena that take place at the interface of composites to other materials. The physicochemical processes studies include processing of composites, embedding of smart structures in composites and joining of composites with other materials. BCC operates with the aim of developing a financially sustainable research facility, drawing on Brunel University's existing strengths, to complement and underpin the applied research and development activities of TWI.

DZP Technologies

Web: www.dzptechnologies.com/



DZP Technologies is a leading developer of specialty materials, formulations, and technologies for emerging industries. We work closely with our customers to create innovative materials for a range of markets, from consumer electronics and wearables, to 3D-printing and renewable energy. Founded in 2008, we work with forward-thinking businesses and enterprises to fast-track scientific discoveries and create advanced technologies for a wide range of markets. We are happy to take on the toughest technical challenges, using our expertise to help our customers develop innovative, sustainable products which offer a true differentiator in competitive markets.

Haydale Composite Solutions Ltd

Web: www.haydale.com



HAYDALE Composite Solutions is an independent research and development company based in Loughborough, UK specialising in the development of advanced composites and nanomaterial enhanced composites and their applications. The company employs highly qualified engineers with mechanical engineering and material science backgrounds. The company has extensive knowledge of both thermosetting and thermoplastic based composites, manufacturing processes, structural design and applications across a broad range of industries. The company utilise the latest in computer aided

design systems and have access to its own prototyping workshops. We are a global technology solutions company passionate about creating the next generation of advanced materials. We bring together cutting-edge technology with engineering know-how to enhance the performance of products and materials thus delivering business value for our customers.

TWI



Web: 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.

Belden



Web: www.belden.com

Belden Incorporated is an American manufacturer of networking, connectivity, and cable products. The company designs, manufactures, and markets signal transmission products for demanding applications. These products serve the industrial automation, enterprise, security, transportation, infrastructure, and residential markets. Belden is one of the largest U.S.-based manufacturers of high-speed electronic cables primarily used in industrial, enterprise, and broadcast markets.

SAFRAN



Web: www.safran-group.com

Safran is an international high-technology group, operating in the aviation (propulsion, equipment and interiors), defense and space markets. Its core purpose is to contribute to a safer, more sustainable world, where air transport is more environmentally friendly, comfortable and accessible. Safran has a global presence, with 79,000 employees and sales of 16.5 billion euros in 2020 and holds, alone or in partnership, world or regional leadership positions in its core markets. Safran undertakes research and development programs to maintain the environmental priorities of its R&T and Innovation roadmap.

Graphenea



Web: www.graphenea.com

Graphenea, a technology company founded in 2010, is a world leading graphene producer. The 25 employees in Graphenea work on contributing to the successful development of Graphene applications of our customers, in a wide range of sectors and in more than 60 countries in the world. Through research and innovation, we support our customers with our portfolio consisting of: CVD Graphene films, Graphene Field-Effect-Transistors chips (GFETs), Graphene Foundry Services (GFAB) and Graphene Oxides. Graphenea's facilities are located in Spain (San Sebastián) and USA (Boston)

Conductores Monterrey, SA de CV

Web: www.viakable.com



Viakable is the Cables Division of Grupo Xignux, which integrates all the companies dedicated to the manufacture and sale of electrical conductors within the group itself.

Viakon is a **Viakable** brand, a company of the Xignux Group, dedicated to the manufacture and marketing of electrical conductors. We are a world-class company that has the most advanced technology for the manufacture and testing of our products. We offer the market reliable, safe, efficient and long-service electric conductors. We have ISO-9001 and ISO-14001 certifications in all operations, which guarantees our world-class quality.

Soongsil University

Web: <https://eng.ssu.ac.kr/>



Soongsil University's roots trace back to 1897, when Dr. W. M. Baird, an American missionary started teaching from his residence in Pyongyang. Soongsil was then given the title of the first university in Korea. Later during the Japanese occupation when Korea lost its sovereignty, Soongsil University made national liberalization its top priority and took the lead in the national independence movement. In 1938, the school even decided to close itself down in protest against forced worship at Japanese shrines. Even throughout Korea's tumultuous history, Soongsil has always striven to be the first.

Soongsil University is pursuing global competitive power through specialization. As highly qualified faculty and unique educational programs are customized for each department with alliances between businesses and other universities worldwide, Soongsil is able to meet its goal of producing much needed global talents. It nurtures men and women of faith and ability by building on its long-standing strengths. Thus, it makes giant leaps towards a brighter future.

Ataturk University

Web: <https://atauni.edu.tr/en/index>



Atatürk University is a land-grant university established in 1957 in Erzurum, Turkey. The university consists of 23 faculties, 18 colleges, 8 institutes and 30 research centers. Atatürk University's main campus is in Erzurum city, Eastern Anatolia's largest city. It is now one of the city's most significant resources. Since its establishment in 1957, it has served as a hub of educational and cultural excellence for the eastern region.

Bronkhorst UK Ltd

Web: www.bronkhorst.com



Bronkhorst UK Limited is a wholly owned daughter company of Bronkhorst High-Tech BV of the Netherlands and offers local sales and after-sales support, calibration and service facilities, application engineering and user training courses. Product expertise includes gas and liquid mass flow measurement and control, pressure measurement and control, vapour production and control and primary calibration systems.

The UK Operation was established in 2002 and with quite outstanding success the result has been a 300% increase in both sales turn-over and staffing level. A specialist team has been formed that brings together Degree level education including flow theory, electronics, chemistry and materials engineering with time-served instrumentation placement and world-wide service application. This wealth of knowledge and experience is enhanced with business skills in contracts management and customer care to provide an overall service that is intended to be second to none. Above all else, however, is the commitment to a "can do" ethos that ensures our customers needs and expectations are always exceeded.

MBDA

Web: www.mbda-systems.com



MBDA is the only European group capable of designing and producing missiles and missile systems to meet the whole range of current and future needs of the three-armed forces.

A multi-national group with 10,000 employees working together across France, Germany, Italy, Spain and the United Kingdom. Offices also set up in USA. Jointly held by 3 prestigious shareholders: AIRBUS (37.5%), BAE Systems (37.5%) and Leonardo (25%).

Padar Tecnologie



Web: www.padar.it/HomePageEn.aspx

Founded in 1980 as Padar tecnologie, we are an independent company operating in high technology sectors. We support our partners in developing sales of equipment, materials and services by offering deep technical and marketing expertise.

We sell cutting edge manufacturing technologies mainly in Microelectronics, Power Electronics and Renewable Energies.

We are active in South Europe and North Africa. The fields of application are Industrial, Automotive, Telecommunications, Aerospace, Medical, Sensors and Renewable Energies.

Furukawa Electric Institute of Technology Ltd.



Web: www.feti.hu

Furukawa Electric Institute of Technology Ltd. is a wholly owned subsidiary of the Furukawa Electric Company (FEC) of Japan and was established in Budapest in 1991. Furukawa Electric is committed to research & development and has throughout its history been in the forefront of technological innovation.

University of Strathclyde (UOS)

Web: www.strath.ac.uk



The **University of Strathclyde** (UOS) is a top ranked university in the UK national Research Excellence Framework. The Centre for Precision Manufacturing (CPM) at UOS has over 40 researchers who conduct internationally leading researches in Precision-Forming and Micro-Manufacturing, Precision Engineering, and Light Metals Advanced Technology. The goal of CPM is to be a world-leading advanced manufacturing research centre delivering “total” precision manufacturing solutions for next generation high value-added products. With the accessibility to 40 million pounds worthy world-class manufacturing research facilities, the centre conducts cutting-edge researches in Micro-Manufacturing Technology, Precision Forming Techniques, Ultra-Precision Machining Techniques, Micro/Nano-Machining Technology, Ultra-Fine Grained Metal Technology, Light-Weight Metals Processing Techniques, Multiscale Modelling, and Manufacturing systems for Ultra-Precision and Micro/Nano-Manufacturing. The centre aims to facilitate collaborations across different manufacturing themes and disciplines. The CPM has engagement with worldwide industries and research communities (e.g. worked with more than 30 industry companies from 13 EU countries and currently working with more than 20 companies in various funded projects). The researchers of the group have generated a series of products, processes, tools and machinery designs, and analysis results respectively for material, electronic, automotive, aerospace, and machinery industries.