



ULTRAWIRE 2022 WORKSHOP

Conductive Materials Solutions Workshop & EXPO

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Post Event Report v1.1

29 & 30 June 2022

Murray Edwards College, Cambridge - Hybrid



Organised by:



CAMBRIDGE
NANOMATERIALS
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Summary

The **UltraWire Workshop 2022** “*Conductive Materials Solutions Workshop*”. (<http://ultrawire.eu/workshops/>), took place on the 29th and 30th June 2022, as a hybrid meeting. The in-person event took place at the Murray Edwards College (Cambridge), with a dinner on the 29th June, at Sidney Sussex College (Cambridge).

The **UltraWire Workshop 2022** and EXPO (www.ultrawire.eu) (2day meeting), was organised in order to support commercialisation of new technologies providing conductive materials solutions, including nano-carbon and metal-based composite materials for several 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 2022 Workshop** was an opportunity to learn about progress in the development of nano-carbon wire technologies for improving electrical conductivity properties.

This was also an opportunity to link the workshop with other activities related to applications of graphene and nano-carbon materials and composites (**GRAPHENEXPO & Conference-** www.graphenexpo.net).

Around 22 participated on this workshop. they came from leading organisations, research centres and universities such as: **Graphenea, Avanzare Innovación Tecnológica, Versarien, TMBK Partners, CodiKoat LTD, Soongsil University, Nanografi Nano Teknoloji Anonim Şirketi, W.L. Gore & Associates, ADVISE Deta, Brunel Composites Center and Johnson Matthey.**





Agenda UltraWire 2022 Workshop

Date 1

Date: 29th June 2022

Venue: Conference Room,
Paula Browne House, **Murray Edwards College**,
Cambridge (in person venue) –

ZOOM

Dinner Venue: The Old Library
Sidney Sussex College, Cambridge

10:00 Arrival, registration, and networking

10:30 *Online session - opening & testing*

10:45 **Dr Bojan Boskovic**, CEO, Cambridge Nanomaterials Technology Ltd

Welcome and Introduction to the UltraWire Workshop 2022 & GRAPHENEXPO 2022 Conference

11:00 **Dr George Maistros**, ADVISE-DETA Ltd., UK

Title: Sensors for quality control of nano-reinforced structures

Interdigital sensors with impedance spectroscopy are used to evaluate the degree of dispersion of nanoparticles in polymers or in aqueous solutions. The sensors can be introduced to the solution at the time of dispersion of nanoparticles and the impedance measurement hardware performs scans over a wide frequency range. The sensors produce a fringing electric field over their surface and the response of the solution is recorded as impedance spectrum. The spectrum can be analysed with the help of equivalent electrical circuit models where the circuit elements can represent physical processes in the dispersion of nanoparticles. The time evolution of the values of the electrical circuit components is correlated to the changes in the size and interactions of the nanoparticles in the solution.

The same technique has been used in composite materials manufacturing to monitor in situ and in real time the progress of the cure reaction of the resin and provide a means of on-line quality control in production

11:30 **Akram Zitoun**, Brunel University, UK

Title: Graphene-based strain sensing in composites for structural and health monitoring applications

Graphene is well known for its excellent physical properties. The presentation covers the use of graphene-based strain sensors systems for the assessment of the health of composite structures. The graphene sensor was applied on the composite structure through different scenarios. It was attached on CFRP and GFRP coupons either on the surface or embedded. The work focused on composite structure as they are more interest across different industrial sectors due to their mechanical properties.

12:00 Dr Julio Gomez, Avanzare, Spain

Title: Use of graphene materials in low resistivity inks and composites

The use of different graphene materials (GRMs) allows to obtain low impedance inks and composites for their use in indifferent applications such as flexible electronics.

The ability and the possibility to produce graphene materials by using different production methods, give the ability to modulate the final properties of the inks and composites

12:30 Discussion

13:00 *Lunch break and networking*

Visit our virtual expo; www.graphenexpo.net and www.ultrawire.eu/expo

14:30 Dr Amaia Zurutuza, Graphenea, Spain

Title: Developing a Graphene Industry

Graphene is a relatively new nanomaterial with outstanding properties that could potentially be applied in many different fields. However, in order to integrate a new material into well-established industries such as the semiconductor industry, there are many challenges that will need to be overcome. During this talk, I will explain industrially viable ways to produce graphene and cover some of its potential applications.

15:00 Dr Vahid Javan Kouzegaran, Nanografi Nano Technology, Turkey

Title: Graphene Oxide Frameworks (GOFs) as Advanced Materials for Applications in Energy Storage & DNA-based Molecular Junctions

The expansion of 2D graphene oxide (GO) sheets by the cross-sectional solvothermal reaction of organic linkers as pillaring agents with the functional oxygen groups leads to a porous largely interlayered structures referred to as graphene oxide frameworks (GOFs) with the restored electrical conductivity and improved thermal stability. The solvent-free activated GOFs with highly increased surface area and porosity could be considered as promising candidates for applications in energy storage as electrode materials in various battery technologies and supercapacitors as well as molecular junctions. Theoretical and computational investigations demonstrate that electronic transport properties in GOFs are governed by quasiresonant and tunneling regimes. The covalent reaction of organic linkers with active sites of GO establishes through-molecule conductivity that can be tuned depending upon the chemical composition and length of the linking molecules.

15:30 coffee break

16:00 discussion

16:30 End of day one

19:00 Dinner at the Old Library in Sidney Sussex College, Cambridge

Date 2

Date: 30th June 2022

Venue: Conference Room,
Paula Browne House, **Murray Edwards College**,
Cambridge (in person venue) –
ZOOM

10:00 Delegates arrival and registration

10:15 *Online session - opening & testing*

10:30 **Dr Bojan Boskovic**, CEO, Cambridge Nanomaterials Technology Ltd

Welcome and Introduction to the UltraWire Workshop 2022 & GRAPHENEXPO 2022 Conference

11:00 **Prof. Anna Boczkowska**, TMBK Partners, Poland

Title: Ultralight CNT-doped veils for the modification of composite' properties.

Ultralight CNT-doped veils are based on thermoplastic polymers, carbon nanotubes and other fillers whose introduction into the composites' structure improves the electrical, mechanical and thermal properties. They can be used in the aviation, automotive, construction, machine, defence, and electronics industries for electromagnetic shielding and electrical discharge. Strengthening the laminates with nonwovens improves their electrical and mechanical properties, increasing their impact strength and limiting delamination, while minimising weight and manufacturing costs. The CNT-doped veils are intermediate products in composite material production, used as surface finishing or interleaves between fabrics or prepregs. They are easy in handling and safe during production of composites with common techniques such as RTM, infusion, Autoclave or Out of Autoclave. Pilot plant for manufacturing of CNT-doped veils was established in TMBK Partners Sp. z o.o. (Warsaw, Poland) in 2017

11:30 **Prof. Park Joung-hu**, Songsil University, South Korea

Title: CNTFs-based Wires for Mega-Hertz Wireless Power Transfer

This presentation shows an example of CNTF wire application to investigate a planar spiral transformer suitable for WPT charging systems. Efficiency of the transformer is investigated theoretically and experimentally over several MHz frequencies and ampere currents. The CNTFs-based wireless transformer operation was compared with copper (Cu) based wireless transformer fabricated with similar dimensions and DC resistance values. The AC resistance of both transformers is calculated using the conventional model of solid round conductor and the FEM simulation. It is found that the calculated and the FEM AC resistance values are matched in case of Cu transformer with 4194A Impedance/Gain-Phase Analyzer measurements while

they are mismatched in case of CNTFs one. Therefore, a correction factor for the AC resistance of CNTFs wire is proposed to match the calculated AC resistance with the measured one. Furthermore, both transformers were tested experimentally within 50 W/6.78 MHz WPT charging systems at different ampere currents.

12:00 Dr Ana Bankovic Cassidy, Cambridge Nanomaterials Technology Ltd (CNT), UK

Title: 3D Printing Graphene micro-fluidic medical devices

An overview of current patenting and market trends in the field of microfluidics, 3D printing and nanocarbon medical devices will be given including key players and ongoing projects. The importance of innovation management and modern exploitation tools will be introduced, as they are having an essential role in supporting the exploitation of cutting-age interdisciplinary technologies, such as 3D printed nanocarbon microfluidic medical devices. The introduction of nanocarbon materials such as graphene for 3D printed lab on chip (LoC) medical applications required stakeholders to understand and apply innovation management tools to secure translation from excellence of science, scaling-up of manufacturing processes and establishment of an industrial nanomedicine sector. An example of the European H2020 project M3DLoC (www.m3dloc.eu) would be given.

12:30 Lunch break & networking

Visit our virtual expo; www.graphenexpo.net and www.ultrawire.eu/expo

14:00 End of session

UltraWire 2022 Workshop – Speakers



Dr Julio Gomez Cordon (*Speaker*)
CEO
Avanzare
Spain

Dr Julio Gomez is the President of the Board of Directors of Avanzare. B.S. degree in Chemistry from Universidad Complutense de Madrid (1995) receiving the best B.S. degree in Chemistry in 1995. Ph.D. in Chemistry (2000) from University of La Rioja, best PhD degree in Science and Technology award from the years 1999-2000. Postdoctoral researcher position in the Laboratoire de Synthèse Organique, University of Nantes-CNRS. He has received the National Award Entrepreneur of the year 2008 in Spain by the ministry of industry. Best SME from La Rioja in 2019, NANOAWARDS 2008 (USA). F&S best practices award in innovation 2013 (UK) for graphene composites. Finalist of the National Awards in Excellence 2013 and finalist of Innovation in SME awards 2018. Member of the Executive board of the Chamber of Commerce from La Rioja from 2010. President of the Innovation Committee of the Chamber of commerce, from 2010 to 2018, President of the Education and employment Committee of the Chamber of commerce from 2013. He is member of the Social Council of La Rioja University elected by the Regional Parliament from 2012. He is member of La Rioja region R&D committee from 2010.

Member of FEDER committee from 2013. Member of the Secondary Education Committee from La Rioja region from 2013. He is the president of the Spanish Graphene Alliance. Inventor in 12 patents all of them under exploitation or licenced. Author of 71 papers and 7 books.



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.



Dr George Maistros, (*Speaker*)
Technical Director
ADVISE-DETA
34 Castle Rd.
Bedford MK40 3PJ, UK

Dr George Maistros is the Technical Director of ADVISE-DETA and he is responsible for the innovation activities of the company. He is a Chemical Engineer from National Technical University of Athens and has received his PhD in Advanced Materials from Cranfield University in 1991, focusing on the dielectric cure monitoring of thermoset resin systems. He has over 25 years of experience in researching and promoting dielectric sensing systems for a wide range of materials and processes. He has coordinated five European industrial R&D projects on applications of dielectric technology on composites manufacturing processes. Through ADVISE-DETA he has coordinated the Innovate UK funded project GRAPHOSITE leading a consortium of 6 organisations.



Akram Zitoun, (*Speaker*)
Research Fellow
Brunel University London
Brunel Composites Centre
Cambridge, UK

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. He in charge of developing the technical solutions and project management.



Dr Vahid Javan Kouzegaran, (*Speaker*)
Principal Investigator at Production & Development
Department
Nanografi Nano Technology
Turkey

Dr Vahid Javan Kouzegaran received his Ph.D. in Analytical Chemistry with his research project on the application of porous materials (MOFs) as fluorescent biosensing platform for the detection of biomolecules and nucleic acid structures. He started to work as a researcher at Nanografi in the area of the application of porous as well as carbon materials as electrode materials for energy storage purposes, specifically Hybrid Supercapacitors & Metal-air batteries. He is serving as the project manager and main technical person in two Horizon Europe project calls for developing Supercapacitors and Metal-air batteries and is in charge of the industrial scale synthesis and production of Graphene Oxide, Reduced Graphene Oxide and a range of Nanostructured materials and dispersions.



Prof. Park Joung-hu (*Speaker*)
Department of Electrical Engineering
Soongsil University
Sangdo-ro 369, Electrical Engineering
Dept. Soongsil University, Dongjak-gu, Seoul
06978 South 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.



Prof. Anna Boczkowska, (*Speaker*)
Scientific Director
TMBK Partners Sp. z o.o.
Poland

Prof. Anna Boczkowska has 30 years' academic and research experience at Warsaw University of Technology. She graduated from the Warsaw University of Technology, Faculty of Materials Science and Engineering, and received her PhD in 2000, D.Sc. in 2011, both at the same Faculty. Since 2018 she is full professor of technical sciences. Her professional experience is related to material sciences, especially composite materials, polymers, nanocomposites and smart materials. With TMBK Partners since 2013 as scientific director in several EU-funded projects on aeronautics and materials engineering performed under EU FP7 (ELECTRICAL, SARISTU), EU H2020 (PLATFORM, OASIS). Key competences: research and development of new materials, project management, extensive technical knowledge, international collaboration.



Dr Ana Bankovic Cassidy (M3DLoC Partner)
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.



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 2022 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.

UltraWire 2022 Workshop - Exhibitors & Participating organisations

Nanografi Nano Teknoloji Anonim Şirketi



Web: www.nanografi.com.tr

Nanografi Co was founded in 2011 as a nanotechnology startup that manufactures and creates a market for critical nanomaterials such as carbon nanotubes (CNTs) and graphene. After successfully producing various types of CNTs, we began to explore the applications of different nanomaterials such as metallic nanoparticles, metal oxides, carbides, and clay nanostructures. As a result of these research and production efforts, we launched a wide range of products to the local market in the second half of 2014. In 2015, the demand in the local market increased, and our company began to develop new applications of nanomaterials according to our customers' needs, from new-generation lightweight materials to high-performance composites for aircraft. At the same time, the miracle material "graphene" and its various derivatives were successfully launched on the market.

TMBK Partners Sp. z o.o.



Web: 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.

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)

ADVISE-DETA



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.

Avanzare Innovacion Tecnologica



Web: www.avanzarematerials.com

Avanzare Innovacion Tecnologica SL (AVAN) is a Spanish SME specialized in the production of nanomaterials, nanomaterials dispersions and nanotechnology-based solutions. The company is specialized in the development & commercialization of special additives, mainly for different matrices and industrial sectors: plastics, rubber, paints, paper, etc., with international presence in the automotive, aeronautic, fabric, plastic, rubber, paint and building industries, the wire & cable sector and manufacturers of household appliances and packaging wood, paper, among others. AVANZARE is the European leader in graphene and other artificial 2D nano-materials such as n-Mg(OH)₂, n-Zn(OH)₂ and LDHs (double layered hydroxide) among other materials. With 6,000 m² of facilities and more than



300 Tm of nanomaterials produced in 2018, AVAN has become one of the top 3 producers of nanomaterials in last decade.

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.

CodiKoat



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

Products made extraordinary with **CodiKoat** technology. Our nanoparticle-based tech coats any surface with world record speed and duration. GOVIROL is a self-cleaning and anti-viral adhesive film that is able to inactivate the coronavirus in seconds.

W.L. Gore & Associates



Web: www.gore.com

W. L. Gore & Associates is a global materials science company dedicated to transforming industries and improving lives. Since 1958, Gore has solved complex technical challenges in demanding environments – from outer space to the world's highest peaks to the inner workings of the human body. With more than 11,500 Associates and a strong, team-oriented culture, Gore generates annual revenues of \$3.8 billion.

Versarien™ plc



Web: www.versarien.com

At **Versarien** we utilise proprietary materials technology to create innovative engineering solutions that are capable of having game-changing impact in a broad variety of industry sectors. Founded in 2010, we have continued to develop advanced materials and processes to satisfy customer-specific applications whilst expanding our portfolio of intellectual property through acquisition. Our product offerings are capable of having a game-changing impact in a broad variety of industry sectors.

Johnson Matthey



Web: <http://matthey.com>

Johnson Matthey (LSE: JMAT) is a British multinational speciality chemicals and sustainable technologies company headquartered in the United Kingdom.

It has five global divisions, each of one focussed on the development of high value added, high technology products and services. With 200-year commitment to innovation keeps them at the forefront of technological breakthroughs that make the world a better place.

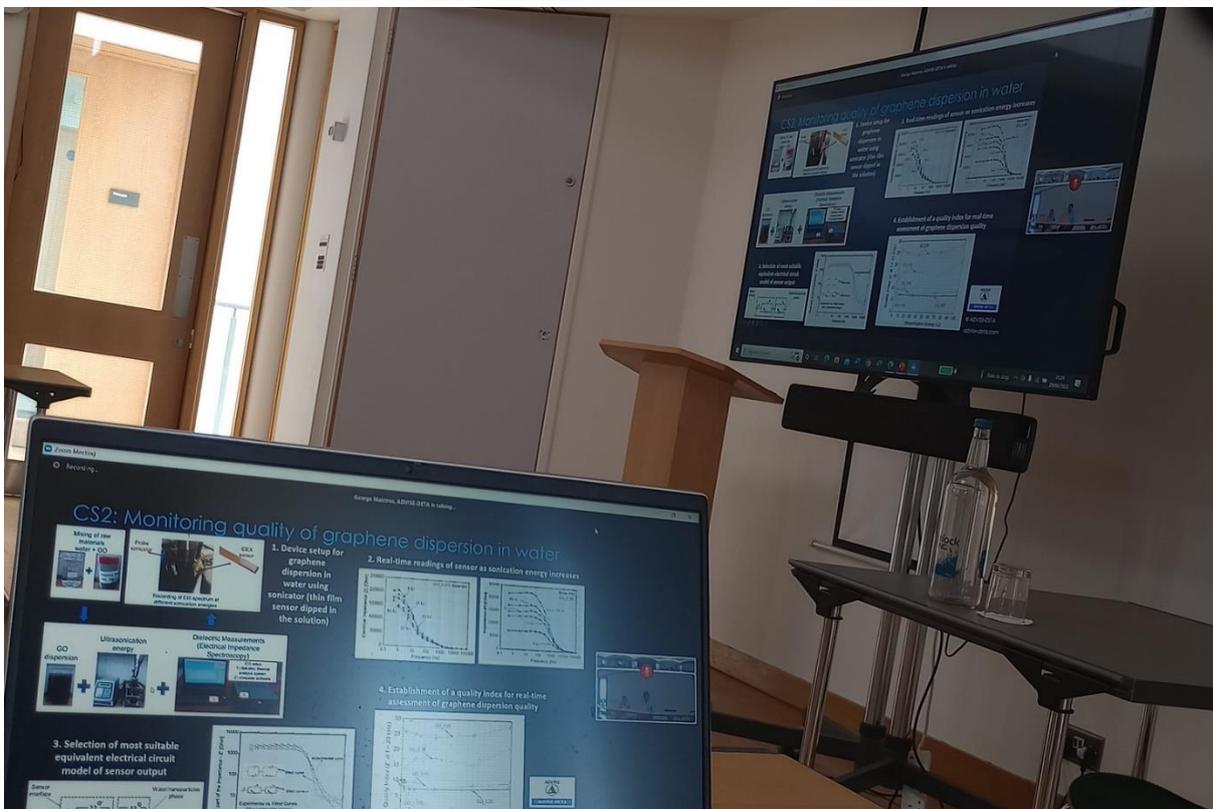
Enabled by their science, manufacturers across many industries, including automotive, petrochemicals and pharmaceuticals, apply their innovations to improve the function, performance and safety of their products at a lower environmental cost.

Annexes

Photos of event









Contact information

If you are interested in joining the **UltraWire** community and get more information, please contact us at:

info@ultrawire.eu

www.ultrawire.eu

www.ultrawire.eu/expo/

or

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