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UK-based consortium established to develop prototype solid-state batteries

MOU signed between Johnson Matthey, Faraday Institution, Britishvolt, Oxford University, UK Battery Industrialisation Centre, Emerson & Renwick and University of Warwick

HARWELL, UK (19 August 2021) A consortium of seven UK-based organisations has signed a memorandum of understanding to combine ambitions to develop world-leading prototype solid-state battery technology, targeting automotive applications.

Solid-state batteries offer significant potential advantages over conventional lithium-ion batteries and could be transformational in meeting the UK's net zero commitments through the electrification of transport. The successful outcome of the collaboration would be to harness and industrialise UK academic capability to produce cells using highly scalable manufacturing techniques that leapfrog the cost-effectiveness and performance achieved elsewhere.

The consortium comprises the following world-leading organisations in battery research, development and manufacturing:

- Faraday Institution – the UK's independent institute for electrochemical energy storage research, which has led the consortium's formation and will lead its development.
- Britishvolt – the UK-based Gigaplant developer, with a site in NE England.
- E+R (Emerson & Renwick) – a world leading designer of manufacturing equipment.
- Johnson Matthey – a global leader in sustainable technologies and the UK's leading battery materials business.
- Oxford University – that leads the Faraday Institution's solid-state battery project (SOLBAT) and provides the necessary scientific understanding to the consortium.
- UK Battery Industrialisation Centre – the pioneering battery manufacturing development facility to enable UK battery manufacturing scale-up and facilitate upskilling in the battery sector.
- WMG, University of Warwick – leaders in battery R&D and initial scale-up capability, as well as academic and apprenticeship skills development.

The preliminary design for a prototyping facility has been developed. Sources of funding are currently being sought.

Minister for Investment Lord Grimstone said: "Collaboration between industry, government and our world-leading academic institutions is putting the UK at the forefront of global efforts to develop innovative automotive technologies, such as solid-state batteries.

"It is the work of our internationally-renowned research and development base, like those brought together by this consortium, that will give us the tools needed to forge a strong and sustainable future for the automotive sector and increase our contribution to combatting climate change."

“I am delighted to be able to announce the formation of this unique consortium for the advancement of solid-state battery prototyping that includes leading UK-based organisations at many stages in the value chain,” said Professor Pam Thomas, CEO of Faraday Institution. “Our leadership in this venture signals a move towards a role that the Faraday Institution will increasingly play as a trusted convener of significant partnerships between UK industry and academia as a route to commercialise breakthrough science emerging from our research programmes to maximise UK economic value.”

Solid-state batteries (SSBs) offer significant potential advantages over existing lithium-ion battery technologies, including the ability to hold more charge for a given volume (leading to increased electric vehicle (EV) range) and reduced costs of safety-management. Early deployment of SSBs is likely to be in consumer electronics, niche automotive applications and unmanned aerospace, before being used in broader EV markets. The Faraday Institution forecasts that, in 2030, SSBs are likely to take a 7% share of the global consumer electronics battery market and a 4% share of the EV battery market¹. Global SSB revenues from sales to EV manufacturers are expected to reach \$8 billion by 2030² and then grow rapidly to 2040 and 2050 when the market is expected to become extensive.

However, there are fundamental scientific challenges that need to be addressed before high power SSBs with commercially relevant performance can be realised. The Faraday Institution’s SOLBAT project has made considerable progress in addressing these challenges over the last three years.

The construction of the one-of-a-kind facility being developed by the collaboration will enable SSB technology to emerge from UK university laboratories. It will allow larger cells to be produced using scalable manufacturing techniques that will be improved iteratively through deep investigation of the causes of problems that emerge during manufacture and testing of prototype batteries. This will leverage the collective knowledge of Faraday Institution SSB researchers and the industrial partners.

Christian Gunther, CEO, Battery Materials at Johnson Matthey comments, “The realisation of a prototype solid-state battery cell will be a great achievement for the UK battery industry, and this consortium will be a critical enabler for delivering this milestone. Delivering enhanced range and safety over traditional lithium-ion battery technologies will be a key driver for battery electric vehicle adoption, supporting the transition to a net zero future.”

Dr Allan Paterson, Chief Technology Officer, Britishvolt comments, “Solid-state is the holy grail of battery solutions. Solid-state batteries have the potential to increase energy density significantly over battery technology available today and could dramatically, and positively, change the world of electric vehicles. Britishvolt will be at the forefront of commercialising this step change over the coming years. This collaboration, which includes major global industrial leaders such as Johnson Matthey and academic leadership from University of Oxford, underscores another key objective in our technology roadmap – home grown intellectual property.”

Professor Peter Bruce, Principal Investigator of SOLBAT, comments: “It’s fantastic to see the culmination of combined UK academic strength in solid-state battery research come to fruition. I’m proud that the work of the Faraday Institution SOLBAT project, led by Oxford University, will make a significant contribution to the UK’s green energy revolution.”

¹ [Faraday Insight 5](#), 2020

² [IDTechEx](#), June 2021

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Ian Whiting, Commercial Director at UKBIC added: “Our newly opened national battery manufacturing scale up facility is already contracted to scale new cells and battery packs by companies basing their manufacturing centres in the UK. It’s a really exciting time for this fast-growing industry. We’re scaling technologies that will be the core products of the UK’s emergent Gigafactories. But we need to think even further ahead and solid-state battery technology is going to be a big part of that. This collaboration is what is needed to give the UK the edge it needs in creating a centre of excellence for solid-state batteries and we’re excited to be part of it. The bringing together of academic and industrial know how in this space is key to unlocking Britain’s electrified potential.”

David Greenwood, Professor of Advanced Propulsion Systems, and CEO of WMG High Value Manufacturing Catapult comments: “Early forms of solid-state battery are already around us, but we have yet to see solutions which are both mass-manufacturable and meet the performance and cost targets for future transport applications. There remains huge opportunity for innovation in this space, and this initiative will provide the route for the UK to fast-track candidate technologies to industrialisation.”

Andrew C Jack, Sales Director, E&R Group comments, “E&R Group are delighted to be contributing our world renowned engineering expertise working in partnership Faraday and the wider consortium on this exciting development for next generation battery production for the UK.”

For more information on the Faraday Institution, visit www.faraday.ac.uk and follow [@FaradayInst](https://twitter.com/FaradayInst) on twitter.

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Notes to Editors

About the Faraday Institution

The Faraday Institution is the UK's independent institute for electrochemical energy storage research, skills development, market analysis, and early-stage commercialisation. Bringing together expertise from universities and industry, the Faraday Institution endeavours to make the UK the go-to place for the research and development of new electrical storage technologies for both the automotive and wider relevant sectors.

The Faraday Institution is funded by the Engineering and Physical Sciences Research Council (EPSRC) as part of UK Research and Innovation. Headquartered at the Harwell Science and Innovation Campus, the Faraday Institution is a registered charity with an independent board of trustees.

The **Faraday Battery Challenge** aim is to develop and manufacture batteries for the electrification of vehicles to help UK businesses seize the opportunities presented by the move to a low carbon economy. The challenge is split into three elements: research, innovation, and scale-up.

The EPSRC is part of **UK Research and Innovation**, a non-departmental public body funded by a grant-in-aid from the UK government.

EPSRC is the main funding body for engineering and physical sciences research in the UK. By investing in research and postgraduate training, we are building the knowledge and skills base needed to address the scientific and technological challenges facing the nation.

Our portfolio covers a vast range of fields from healthcare technologies to structural engineering, manufacturing to mathematics, advanced materials to chemistry. The research we fund has impact across all sectors. It provides a platform for future UK prosperity by contributing to a healthy, connected, resilient, productive nation.

UK Research and Innovation (UKRI) is the largest public funder of research and innovation in the UK, with a budget of around £8bn. It is composed of seven disciplinary research councils, Innovate UK and Research England.

We operate across the whole country and work with our many partners in higher education, research organisations businesses, government, and charities.

Our **vision** is for an outstanding research and innovation system in the UK that gives everyone the opportunity to contribute and to benefit, enriching lives locally, nationally and internationally.

Our **mission** is to convene, catalyse and invest in close collaboration with others to build a thriving, inclusive research and innovation system that connects discovery to prosperity and public good.

www.ukri.org

About Johnson Matthey

Johnson Matthey is a global leader in sustainable technologies that enable a cleaner and healthier world. With over 200 years of sustained commitment to innovation and technological breakthroughs, we improve the performance, function and safety of our customers' products. Our science has a global impact in areas such as low emission transport, pharmaceuticals, chemical processing and making the most efficient use of the planet's natural resources. Today about 15,000 Johnson Matthey professionals collaborate with our network of customers and partners to make a real difference to the world around us. For more information, visit www.matthey.com

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About Britishvolt

Britishvolt is Britain's foremost investor in battery cell technologies. It is dedicated to supporting the future of electrified transportation and sustainable energy storage, producing best-in-class, ethical, low-carbon, lithium-ion battery solutions.

Britishvolt's aim is to establish the UK as the leading force in battery technology, and associated ecosystem infrastructure. It is working with leading strategic partners/suppliers to achieve this, as it is of paramount importance to the future of the UK automotive industry and the overall economic and industrial health of the country.

The company believes that the UK is the right place for its investments because of the strength of its automotive and energy industry alongside its expertise and history in industrial and academic battery research and development.

Quarter four 2023 has been targeted as the start of production in Britain's first Gigaplant situated on the old coal stocking yard of the former Blyth Power Station in Cambois, Northumberland.

About E+R (Emerson & Renwick)

E+R is a world-leading equipment engineering company based in the UK. We have grown and developed across a number of market sectors including print, forming, vacuum and coating and we are proud to be a leading manufacturer of sophisticated roll-to-roll production machinery.

About Oxford University

Oxford University has been placed number 1 in the Times Higher Education World University Rankings for the fifth year running, and at the heart of this success is our ground-breaking research and innovation. Oxford is world-famous for research excellence and home to some of the most talented people from across the globe. Our work helps the lives of millions, solving real-world problems through a huge network of partnerships and collaborations. The breadth and interdisciplinary nature of our research sparks imaginative and inventive insights and solutions.

About UK Battery Industrialisation Centre

The UK Battery Industrialisation Centre (UKBIC), which was opened by the Prime Minister, the Rt Hon Boris Johnson in July 2021, is a pioneering concept in the race to develop battery technology for the transition to Net Zero. The battery manufacturing facility provides the missing link between battery technology, which has proved promising at laboratory or prototype scale, and successful mass production. Based in Coventry, the publicly-funded facility welcomes manufacturers, entrepreneurs, researchers and educators, and can be accessed by any organisation with existing or new battery technology – if that technology will bring green jobs and prosperity to the UK.

UKBIC is a key part of the Faraday Battery Challenge (FBC), a Government programme to fast track the commercialisation of cost-effective, high-performance, durable, safe, low-weight and recyclable batteries. In addition to funding from the FBC through UK Research and Innovation, UKBIC is also part-funded through the West Midlands Combined Authority. The project has been delivered through a consortium of Coventry City Council, Coventry and Warwickshire Local Enterprise Partnership and WMG, at the University of Warwick. UKBIC was created in 2018 following a competition led by the Advanced Propulsion Centre with support from Innovate UK.

About WMG, University of Warwick

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WMG is a world leading research and education group, transforming organisations and driving innovation through a unique combination of collaborative research and development, and pioneering education programmes.

As an international role model for successful partnerships between academia and the private and public sectors, WMG develops advancements nationally and globally, in applied science, technology and engineering, to deliver real impact to economic growth, society and the environment.

WMG has a track record of impact and collaborative R&D in batteries, through their Energy Innovation Centre. A unique UK facility which is capable of producing full-size prototype battery cells in sufficient quantities for industrial testing. The Centre is focused on identifying and demonstrating battery chemistries with higher energy densities and improved safety while achieving the cost criteria set by the automotive industry. This technology is transferred to other sectors including, aerospace, marine, rail and static energy storage for home applications.

WMG's education programmes focus on lifelong learning of the brightest talent, from the WMG Academies for Young Engineers, degree apprenticeships, undergraduate and postgraduate, through to professional programmes.

An academic department of the University of Warwick, and a centre for the HVM Catapult, WMG was founded by the late Professor Lord Kumar Bhattacharyya in 1980 to help reinvigorate UK manufacturing and improve competitiveness through innovation and skills development.