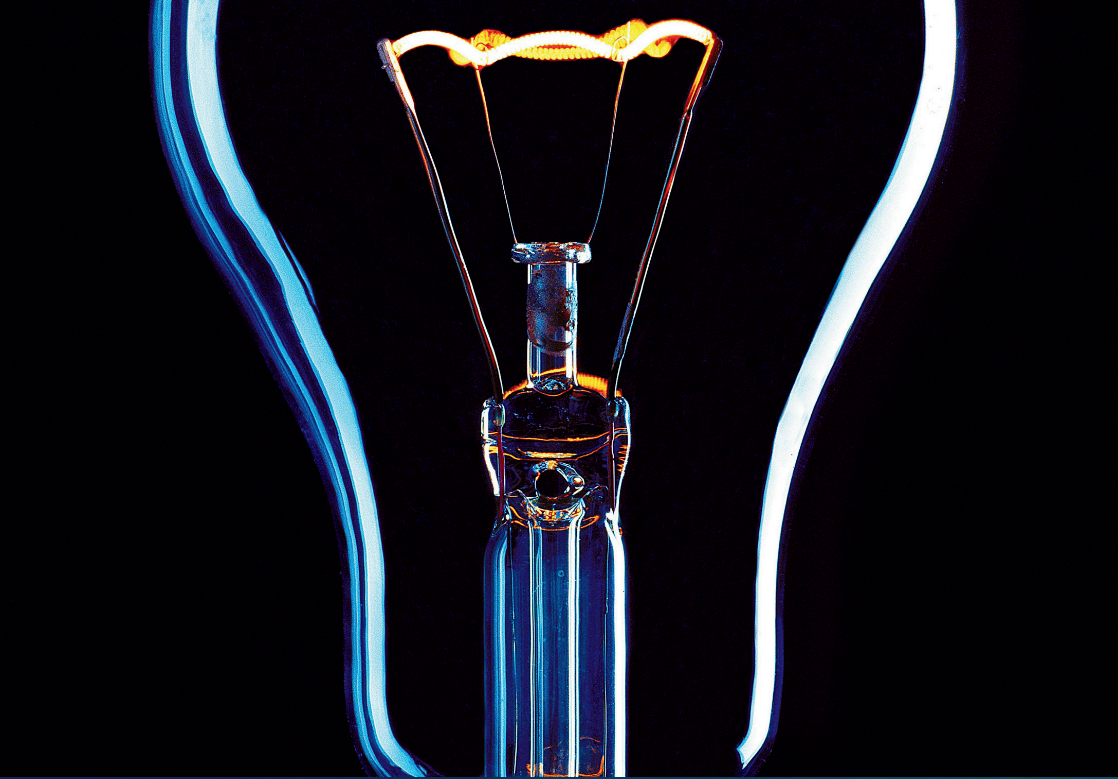

ELECTROCHEMISTRY FOR A SUSTAINABLE FUTURE

WORKSHOP PROGRAMME

15 -16 JUNE 2026

UNIVERSITY OF SURREY

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INTRODUCTION

Electrochemistry plays a vital role in addressing some of the most pressing global challenges of our time. From enabling clean energy generation and storage to advancing water purification, sustainable chemical manufacturing, and next-generation sensing technologies for health and environmental monitoring, electrochemical science is central to building a more sustainable future. Progress in these areas will be essential for achieving net-zero ambitions and supporting the United Nations Sustainable Development Goals.

The University of Surrey is home to a vibrant and rapidly growing multidisciplinary electrochemistry community, bringing together expertise from chemistry, biology, engineering, materials science, and related disciplines. This two-day international workshop, Electrochemistry for a Sustainable Future, showcases this strength while fostering new connections between researchers from academia, industry, and national laboratories.

The workshop is organised around four strategic research themes: Energy Conversion, Energy Storage, Water Treatment and Sensing, and Electrosynthesis and Catalysis. Together, these areas highlight the breadth of electrochemical research and its potential to deliver transformative solutions for a sustainable society.

By bridging traditional disciplinary boundaries and encouraging collaboration across sectors, this event aims to accelerate innovation, share emerging discoveries, and strengthen the partnerships needed to address global sustainability challenges through electrochemical science.

Co-Chairs of the Surrey Electrochemistry Network:
Dr Daniel Commandeur & Dr Hui Luo

Organised by the Surrey Electrochemistry Network Members:
Professor John Varcoe, Professor Carol Crean, Professor Adrian Dobbs, Dr David Watson, Professor Qiong Cai, Dr Siddarth Gadkari, Professor Bob Slade, Dr Marco Sacchi, Dr Kai Yang, Professor Jin Xuan, Professor Claudio Avignone Rossa, Dr Marina Ramirez Moreno, Professor Angela Danil de Namor, Dr Vlad Stolojan, Professor Tao Chen, Dr Lei Xing, Dr Bahman Amini Horri and Dr Ian Riddlestone

Administrative support:
Linda Bennett, University of Surrey & Louise Jones, Institute of Advanced Studies, University of Surrey

PROGRAMME

MONDAY 15 JUNE: ENERGY CONVERSION AND STORAGE INNOVATION FOR HEALTH BUILDING, ROOM 02 IFH 01

(BST)	
09.00 – 09.50	Arrival & Registration
09.50 – 10.00	**Introduction and Welcome**
10.00 – 10.50	**Keynote: Energy Conversion** Professor Yannis Ieropoulos, University of Southampton
10.50 – 11.10	**Energy Conversion** Professor John Varcoe, University of Surrey
11.10 - 11.40	Coffee Break
11.40 - 12.00	**Energy Conversion** Dr Lei Xing, University of Surrey
12.00 - 12.30	**Emerging Leader: Energy Conversion** Dr Mengnan Wang, University of Swansea
12.30 - 13.00	**Industrial Sponsors**
13.00 - 14.00	Lunch Break
14.00 - 14.50	**Keynote: Energy Storage** Professor Emma Kendrick, University of Birmingham
14.50 - 15.10	**Energy Storage** Professor Qiong Cai, University of Surrey
15.10 - 15.40	Coffee Break

15.40 - 16.00	**Energy Storage** Dr Kai Yang, University of Surrey
16.00 - 16.30	**Emerging Leader: Energy Storage** Dr Zhen Xu, University of Manchester
16.30 – 17.00	**Keynote: Energy Conversion/Storage** Professor Gareth Hinds, National Physical Laboratory

TUESDAY 16 JUNE: WATER TREATMENT AND SENSING, ELECTROSYNTHESIS AND CATALYSIS

09.00 – 09.50	Arrival & Registration
09.50 – 10.00	**Introduction and Welcome**
10.00 – 10.50	**Keynote: Water Treatment and Sensing** Professor Zhugen Yang, Cranfield University
10.50 – 11.10	**Water Treatment and Sensing** Dr Marina Ramirez Moreno, University of Surrey
11.10 - 11.40	Coffee Break
11.40 - 12.00	**Water Treatment and Sensing** Kyriakos Almpanidis, University of Surrey
12.00 - 12.30	**Emerging Leader: Water Treatment and Sensing** Dr Lingcong Meng, University of Edinburgh
12.30 - 13.00	**Industrial Sponsors**
13.00 - 14.00	Lunch Break
14.00 - 14.50	**Keynote: Electrosynthesis and Catalysis** Dr Reshma Rao, Imperial College

14.50 - 15.10	**Electrosynthesis and Catalysis** Dr Hui Luo, University of Surrey
15.10 - 15.40	Coffee Break
15.40 - 16.00	**Electrosynthesis and Catalysis** James Scanlon, University of Surrey
16.00 - 16.30	**Electrosynthesis and Catalysis** Dr Zeliha Ertekin, University of Glasgow
16.30 – 16.50	**Closing Perspective** Dr Daniel Commandeur

SPEAKER & ORGANISER BIOGRAPHIES

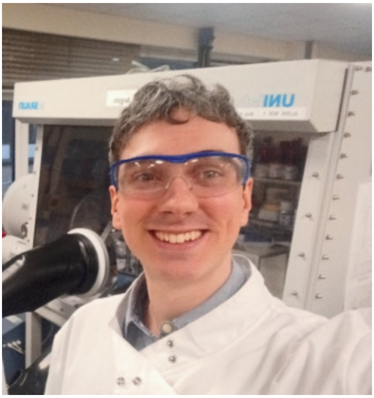
KYRIAKOS ALMPANIDIS

Kyriakos Almpanidis is a PhD researcher at the Advanced Technology Institute (ATI), University of Surrey, under the supervision of Dr Vlad Stolojan and Professor S. Ravi P. Silva. He received his Integrated Master (M.Eng.) in Electrical and Computer Engineering from Aristotle University of Thessaloniki (AUTh), Greece, where he completed his master's thesis on surgical robotics under the supervision of Professor Zoe Doulgeri. He has also been awarded Turing Scheme funding for a research placement at the Nara Institute of Science and Technology (NAIST), Japan. His research interests include smart wearables, electrochemistry, biosensors, and electrospinning.

PROFESSOR QIONG CAI

Qiong Cai (FRSC) is a Professor in Sustainable Energy and Materials at the University of Surrey. Her research focuses on multi-scale materials design for sustainable energy conversion and storage applications including batteries, electrolytic hydrogen production, and chemical conversion. Her research has been funded by EPSRC, the H2FC SUERGEN Hub, the Faraday Institution, the Royal Society, the Henry Royce Institute, and Horizon Europe. She has supervised 12 postdocs and 26 PhD students to successful completion and published >160 peer-reviewed papers. She is an associate editor for a few energy journals and sits on the Strategic Advisory Board of GW-SHIFT and FULL-MAP.

DR DANIEL COMMANDEUR



Dr Daniel Commandeur is a Lecturer researching Sustainable Energy Storage at the University of Surrey. His research focuses on the development of next-generation electrochemical energy storage systems, including sodium-ion batteries, aqueous batteries, and dual-functional technologies for desalination and carbon capture. His work combines advanced materials synthesis, high-throughput experimentation, electrochemical characterisation, and data-driven approaches to accelerate materials discovery. He has particular interests in sustainable battery chemistries based on earth-abundant elements and the integration of automation and machine learning into battery research. His research aims to develop scalable energy storage technologies that support the global transition to net-zero energy systems.

DR ZELIHA ERTEKIN

Dr Zeliha Ertekin was previously an Assistant Professor in Analytical Chemistry at Hacettepe University, Turkey, where she awarded competitive funding (TUBITAK 2219 postdoctoral fellowship) that supported her move to the University of Glasgow in 2021. She is currently a Research Fellow in the School of Chemistry at Glasgow and manages a large electrochemistry research group, serving as day-to-day supervisor for Professor Symes' group. Her research focuses on electrocatalysis, CO_2 reduction and decoupled water electrolysis. She has contributed to major international projects, including EPSRC UK-HyRES, holds a patent from EU Horizon 2020 work, and has authored over 26 publications, contributed to two book chapters, and delivered 30+ international presentations.

PROFESSOR GARETH HINDS

Gareth Hinds is Senior NPL Fellow and Science Area Leader in the Electrochemistry Group at the National Physical Laboratory in Teddington, United Kingdom. His primary expertise is in the development of novel in situ diagnostic techniques and standard test methods for assessment of corrosion and material degradation in energy applications. Gareth is a Fellow of the Royal Academy of Engineering and holds visiting professorships at UCL, the University of Strathclyde, Harbin Institute of Technology and the Institute of Corrosion Science & Technology, Guangzhou. He is the author of over 200 publications and is currently President of the European Federation of Corrosion and Immediate Past President of the World Corrosion Organization.

PROFESSOR YANNIS IEROPOULOS

Yannis Ieropoulos is the Head of Department for Civil, Maritime & Environmental Engineering at the University of Southampton. He brings 24 years of experience in self-sustainable systems (EcoBots, PEE POWER®, powered by microbial fuel cells. Yannis has been a UKRI-EPSRC Career Acceleration Fellow, a Gates Foundation grantee, advancing Bioelectrochemical Systems for sanitation in LMICs. He is Chair of the EU COST Innovators Grant commercialising Microbial Fuel Cells and PI on the European Innovation Council project Mi-Hy. He is Editor-in-Chief for SETA.

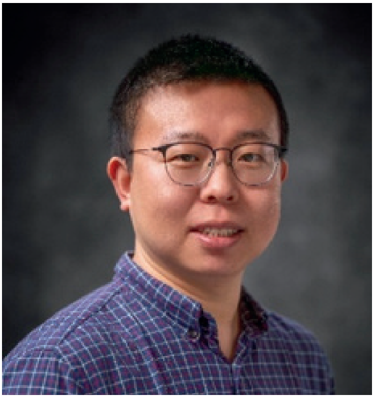
PROFESSOR EMMA KENDRICK

Professor Emma Kendrick, CChem FRSC FIMMM Professor of Energy Materials, University of Birmingham and co-lead of the Energy Materials Group (EMG). Her research focuses on the design and development of sustainable battery technologies and chemistries, materials, manufacturing and recycling. Before academia, she worked in the battery industry, as Chief Technologist in Energy Storage at SHARP Laboratories of Europe Ltd (SLE) and as Lead Scientist of two lithium-ion battery SMEs, Fife Batteries Ltd and Surion Energy Ltd. Her work on battery parameterisation was spun out into a company, About: Energy, in 2021. She has been recognised for her research in sustainable batteries, including, as part of RELIB, the 2024 RSC Horizon Prize for work in battery recycling. and (RSC) 2021 Environment, Sustainability and Energy Division Mid-Career Award

DR HUI LUO

Dr Hui Luo (MRSC, MIMMM, FHEA) is an RAEng research fellow and Senior Lecturer in the School of Engineering, and part of the Surrey Circular Economy Group at the University of Surrey. She leads the Catalysis for Chemical Circularity group (C4CC), and her research interests include developing and up-scaling efficient mechanocatalytic and electrolysis technologies to convert biomass and plastic wastes into green hydrogen and high-value commodity chemicals.

DR LINGCONG MENG



Dr Lingcong Meng is a Lecturer in Bioanalytical and Biophysical Chemistry at the University of Edinburgh. He received his PhD in Chemistry from the University of Warwick in 2017, focusing on boron-doped diamond electrochemistry. He then worked as a Research Fellow in Electrochemistry at the University of Southampton before joining the University of Lincoln as a Lecturer in Analytical Chemistry. Since 2023, he has been working at Edinburgh's Institute for Regeneration and Repair (IRR) developing electrochemical platforms for nano-biointerface and disease biomarker detection.

DR MARINA RAMIREZ MORENO

Marina Ramirez Moreno is a postdoctoral researcher at the University of Surrey, where she has worked since 2023 in the laboratory of Professor Claudio Avignone-Rossa. Her research focuses on bioelectrochemical systems, mainly for metal recovery and PFAS bioremediation. She obtained her degree in Chemistry and a Master's degree in Fine Chemistry from the University of Alcalá. Her PhD research was carried out at the University of Alcalá and the IMDEA Water Institute within the Bioelectrogenesis group. Her work focused on sustainable desalination and wastewater treatment using microbial desalination cells as part of the Horizon 2020 programme.

DR RESHMA R RAO

Dr Reshma R. Rao obtained her PhD in 2019 from the Massachusetts Institute of Technology and her MEng from the University of Southampton in 2014. She is currently an Assistant Professor and Royal Academy of Engineering Research Fellow in the Department of Materials and the Grantham Institute – Climate Change and the Environment at Imperial College London, where she leads the Sustainable Electrochemical Technologies Group. Her research tackles a central challenge for the chemicals and energy industries: designing catalytic materials and processes that can efficiently, selectively, and scalably convert renewable electricity into fuels and chemicals. In addition to her research, she serves as the national research area lead for electrochemical systems at the Henry Royce Institute.

JAMES SCANLON

James Scanlon is a PhD candidate in the Department of Chemistry at the University of Surrey, conducting research under the supervision of Professor Adrian Dobbs. His doctoral work, titled 'Novel Electrochemical Methods for Functionalised Molecules', investigates a range of electro-organic procedures. As part of his research, James focuses on pulsed current Kolbe electrolysis as a versatile electrochemical tool for the dimerisation of functionalised aromatic and amine building blocks. The work serves as a proof of concept for expanding the synthetic scope of electrochemical methods, demonstrating their potential as accessible and sustainable alternatives to conventional synthetic approaches.

PROFESSOR JOHN VARCOE

Prof John Varcoe trained at the University of Exeter, receiving a BSc degree in 1995 and PhD in 2000 (proton-exchange membrane for fuel cells). He then held post-doctoral positions at the University of Surrey (1999-2006). He was appointed Lecturer at the University of Surrey in August 2006, Reader in April 2011 and Professor of Materials Chemistry in April 2013. He was awarded an EPSRC Leadership Fellowship (2010-2015). He is currently Associate Head of School for Research and Innovation for the School of Chemistry and Chemical Engineering. His research is focused on ion-exchange membranes for electrochemical applications.

DR MENGNAN WANG

Dr Mengnan Wang is a Senior Lecturer at the University of Exeter. Her research focuses on sustainable nanostructured carbon materials and electrocatalytic microenvironment engineering for electrochemical energy conversion. Her work spans oxygen reduction reaction in proton exchange membrane fuel cells, CO_2 reduction and nitrate reduction, with emphasis on how catalyst structure, carbon porosity, ionomer interactions and local mass transport govern activity, selectivity and stability. She received her PhD from Imperial College London, and her BEng and MSc from the National University of Singapore.

DR LEI XING

Dr Lei Xing specialises in the modelling and optimisation of circular-economy processes and systems within chemical engineering field. His research focuses on simulating and integrating chemical and electrochemical reactor processes, alongside data-driven modelling using machine learning and AI-enabled techno-economic and sustainability analysis. His work supports evidence-based decision-making and contributes to achieving net-zero carbon emissions in the future chemical industry.

Dr Xing's research bridges chemical engineering, energy systems, and data science, expanding the boundaries of traditional reactor modelling approaches. He has significantly accelerated the computation of large-scale complex models, offering innovative methodologies for system integration and dynamic optimisation. He has published over 168 research papers in areas of fuel cells, hydrogen production, carbon capture and utilisation (CCS), and holds five granted patents. His work has received more than 6,100 citations, with an h-index of 42. He consistently ranked among the top 2% of scientists worldwide (Stanford/Elsevier) in Enabling & Strategic Technologies (Energy as sub field) since 2020.

Dr Xing has led and participated in multiple UK and international research projects, including those funded by the EPSRC, EU Horizon, Royal Society, National Natural Science Foundation of China (NSFC), UGPN-RCF, and Daiwa Anglo-Japanese Foundation. Dr Xing is a Chartered Member and Registered Scientist of IChemE (Institution of Chemical Engineers, UK), a Senior Member of the International Association for Carbon Capture (IACC), Associate Editor of Carbon Capture Science & Technology, Canadian Journal of Chemical Engineering, Frontiers in Energy Research, Academic Editor of Fuel Cells, and editorial board members of Energy and AI etc. He also serves as a guest editor for international journals such as Journal of Energy Storage, Future Batteries, and Energies etc.

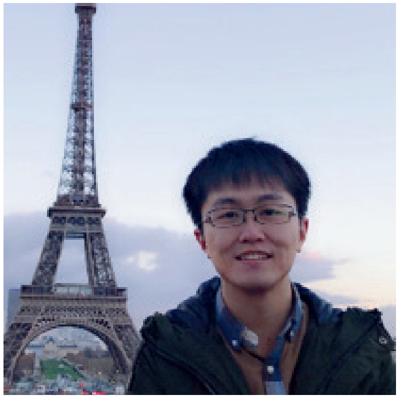
DR KAI YANG

Dr Kai Yang is a Lecturer in Energy Materials and Nanotechnology at the University of Surrey and leads the Electrochemical Characterization and Sensing Group. His research focuses on operando electrochemical characterization, high throughput microdevice platforms, intelligent battery sensing, and advanced energy storage technologies. His work combines real-time diagnostics, miniaturized electrochemical systems, and data-driven approaches to advance the understanding, performance, safety, and reliability of next-generation electrochemical energy systems.

PROFESSOR ZHUGEN YANG

Zhugen Yang is a Professor of Biosensing and Environmental Health at Cranfield University, leading the UKCRIC-funded Advanced Sensors Laboratory. He started the independent research group at the University of Glasgow in 2018 after being awarded a UKRI NERC Fellowship, substantially moved to Cranfield in 2019 and was promoted to Senior Lecturer in 2022 and Professor in 2023. He completed an EU Marie Curie Fellow at Bath University and a postdoc at the University of Cambridge, after receiving his PhD at the University of Lyon (Ecole Centrale) in France. He has received three prestigious Fellowships for different career stages, including a recent Leverhulme Trust Leadership Award. His group is developing low-cost and rapid sensors (e.g., paper microfluidic device) for biomedical diagnostics (e.g., infectious diseases and cancers), public health (e.g., wastewater-based epidemiology), and environmental science (e.g., microbial source tracking, antimicrobial resistance). He has published over 130 refereed articles (H=47, as of April 2026), including top-tier journals such as Nature Water, Nature Communications, Device, etc. He has received national and international awards such as the James J Morgan ACS ES&T Early Career Award-Honourable Mention. The origami sensor has been featured in Science and media coverages (e.g., BBC.) and the London National Science Museum. He serves as senior editor, associate editor and editorial advisory board member for multiple international journals (e.g., Water Research, NPG MINE) and has chaired three international conferences.

DR ZHEN XU



Dr Zhen Xu is a Dame Kathleen Ollerenshaw Fellow and Assistant Professor in the Department of Materials at the University of Manchester. He was previously a postdoc at University of Cambridge with Professor Alex Forse, where he was awarded a Leverhulme Early Career Fellowship. He completed his PhD at Imperial College London supervised by Professor Magda Titirici. His research focuses on the development of advanced carbon materials and electrochemical devices for CO2 capture and energy storage.

ABSTRACTS

Bioelectrochemistry for a Sustainable Future

Professor Yannis Ieropoulos, University of Southampton

Microbial fuel cells (MFCs) is a platform technology for a range of applications. MFCs work on anaerobic/electroactive microbial metabolism, which results in electricity production whilst organic matter (consumed as fuel) is being treated. MFCs usually consist of two half-cells, separated by an ion exchange membrane and electrons flow from the bacterial (negative) half-cell to the positive half-cell, through a circuit. Amongst many organic waste products and materials tested in MFCs, human urine is quite effective as fuel for electricity generation. Urine is responsible for 10% of organics, 75% of nitrogen and 50% of phosphorous found in domestic wastewater, and yet volumetrically, only constitutes less than 5% at municipal level. It is therefore significantly advantageous if waste separation was implemented at source, for more efficient downstream wastewater treatment. This talk will present results from the practical implementation perspective of MFCs in a range of applications, thereby making the case for a platform technology that can be used in off-grid and citywide inclusive environments. The talk will show the chronological development of the technology, from the early robotics implementation to the most recent application in sanitation. Work from the Urine-tricity programme that has been running for 14 years, showing the potential of MFCs in treating human urine will be presented. Different MFC designs, including ceramic-based with power generation and organics degradation are being discussed. When ceramics are appropriately exploited, this results in the generation of an electrochemically activated solution, known as the catholyte, which is a valuable by-product that can be used as a disinfectant. This catholyte is an alkaline, high in salt (thus high in conductivity) liquid that is produced due to the electro-osmotic drag and has been shown to achieve pathogen killing. MFCs can also be generally used as a biosensor to monitor the organics in an aqueous medium, through the analogue signal produced. The MFC technology has also been successfully scaled up and implemented as a power source for lighting, in remote, previously unsafe toilet environments, and for this reason, has been named Pee Power®. More recently, emphasis has been given on the pathogen killing properties of MFCs and bio-fertiliser production, whilst generating electricity. The talk concludes with the case for microbial fuel cells as a platform technology for a range of environments including energy storage, sanitation, renewable energy generation, production of value-added products via elemental recycling and wastewater treatment.

Radiation-Grafted Anion-Exchange Membranes for Electrochemical Technologies
Professor John Varcoe, University of Surrey

Artificial Intelligence for Fuel Cells and Water Electrolysis: From Surrogate Models to Autonomous Energy Systems
Dr Lei Xing, University of Surrey

Porosity Engineered Carbon Architectures for Electrocatalysis Microenvironment Control
Dr Mengnan Wang, University of Exeter

Porosity in catalyst layers governs far more than surface area. In gas phase electrochemical energy conversion systems, pore size distribution and connectivity directly control ionomer distribution, reactant access and local reaction environments at active sites. In this talk, I will discuss how rational control of carbon porosity enables the optimisation of catalyst layer microenvironments for proton exchange membrane fuel cells. First, I will present our recent work on Pt/C catalysts supported on carbons with contrasting pore architectures, including low surface area Vulcan, high surface area Ketjenblack and highly ordered mesoporous carbon. Using operando X ray absorption spectroscopy combined with gas sorption analysis, we show how mesoporous confinement regulates ionomer interactions at the catalyst surface, balancing proton accessibility with oxygen transport and improving oxygen reduction reaction performance under gas diffusion electrode conditions. Building on this understanding, I will then introduce our biomass derived carbon catalyst layer developed through a dual templating strategy. This hierarchical architecture creates interconnected micro, meso and macropore networks, improving gas transport and catalyst utilisation under device relevant conditions. Together, these studies show how porosity can be used as a tunable design parameter to connect nanoscale electrocatalytic environments with macroscopic fuel cell performance.

Sustainable Battery Technologies

Professor Emma Kendrick, University of Birmingham

Realising the full potential of sodium-ion batteries (SIBs) as a sustainable energy storage technology demands progress across the entire cell lifetime, from the synthesis and stabilisation of electrode materials, through full-cell engineering, to end-of-life recovery and the broader critical materials context in which SIBs must be justified. This talk presents an integrated view of these challenges, drawing on recent work from cathode particle engineering, full-cell lifetime optimisation, and novel electrode recycling strategies. On cathode materials, we present a boron-oxide-assisted particle engineering strategy for O3-type layered oxide cathodes. Acting simultaneously as a flux and structural modifier during sintering, boron oxide directs the growth of well-defined faceted particle morphologies that mitigate the irreversible phase transitions, lattice strain, and sluggish Na^+ transport that conventionally limit O3 cathode cycling and rate performance. The resulting materials break the durability–power trade-off characteristic of this cathode class, delivering improved rate capability without sacrificing long-term capacity retention, addressing the core structural instability that arises from high-voltage phase evolution. Closing the materials loop, we introduce ice-stripping, a novel sub-zero electrode delamination technique that achieves over 90% recovery of electrode coatings from both manufacturing scrap and end-of-life cells. Water is applied to the electrode surface and frozen at sub-zero temperature; the volumetric expansion of ice and its stronger adhesion to the electrode coating relative to the current collector enables clean, damage-free delamination without thermal treatment, organic solvents, or acids. The technique is binder-agnostic and has been demonstrated across both PVDF-NMP and CMC-SBR systems. Direct recycling case studies for Prussian white cathodes and hard carbon anodes demonstrate that recovered materials retain electrochemical functionality suitable for reintroduction into the manufacturing process. These material-level advances are contextualised within the critical materials landscape for batteries. SIBs decouple cell performance from lithium and cobalt supply chains by utilising sodium, manganese, iron, and hard carbon, elements with substantially lower geopolitical concentration risk and environmental extraction burden. Together, the results present a coherent pathway from particle-level engineering to scalable, circular sodium-ion battery technology.

Atomic-Scale Design of the Anode-Electrolyte Interfaces for Next Generation Batteries
Professor Qiong Cai, University of Surrey

Seeing Inside Electrochemical Systems: Operando Characterization and Intelligent Sensing for a Sustainable Future
Dr Kai Yang, University of Surrey

Transforming Electrochemical Capacitors for Next-Generation Carbon Capture
Dr Zhen Xu, University of Manchester

Electrochemical CO2 capture is an emerging class of carbon capture technologies driven by electricity. In this talk, I will present our recent progress in transforming conventional electrochemical capacitors into functional platforms for electrochemical CO2 capture. By integrating materials design with electrochemical engineering, this approach enables reversible, low-energy CO2 capture and opens new opportunities for coupling carbon capture with energy storage technologies.

Electrochemical Energy Conversion and Storage Research at NPL
Professor Gareth Hinds, National Physical Laboratory

Electrochemical energy conversion and storage devices are a key component of the global energy transition, facilitating large-scale storage of intermittent renewable energy and decarbonisation of hard-to-abate sectors such as industrial processes, heating and transport. The National Physical Laboratory (NPL) is working closely with academia, research institutes and industry to support widespread commercialisation of these technologies through the development of standard test methods, independent validation of performance, provision of reference materials and calibration artefacts, dissemination of best practice in measurement and testing, and the establishment of predictive models and curated databases. The primary focus is on enabling the generation of more reliable and reproducible test data to accelerate innovation and provide greater confidence for manufacturers, investors, regulators and end users.

Origami-Paper Microfluidic Devices for Point-of-Care Testing

Professor Zhugen Yang, Cranfield University

Pathogen detection is critical across multiple fields, including biomedical diagnostics for infectious disease management, environmental health monitoring for microbial contamination, and public health infrastructure for pandemic preparedness. Rapid, affordable, and deployable diagnostic tools are urgently needed, particularly in low-resource settings where conventional laboratory infrastructure is unavailable. This talk presents a low-cost paper microfluidics biosensor platform for rapid, field-deployable testing of pathogens for both clinical diagnosis and public health surveillance. Drawing on the principles of origami-inspired paper folding, these devices offer multiplexed detection capabilities within a compact, portable format that requires no specialist equipment or trained laboratory personnel. We demonstrate their application in low-resource settings across India and Africa, where field testing has validated both their analytical performance and practical usability under challenging environmental conditions. A key application of this platform has been the detection and source-tracing of SARS-CoV-2 in wastewater, developed as part of the UK national wastewater epidemiology surveillance programme for COVID-19. Field deployment at a quarantine hotel in London demonstrated real-time early warning capability for community-level infection trends ahead of clinical case reporting. Beyond COVID-19, the platform has been extended to the simultaneous detection of influenza virus, bacterial pathogens, and broader public health targets, including microbial viability testing and antimicrobial resistance profiling within a One Health framework integrating human, animal, and environmental health monitoring within a single, scalable biosensor architecture.

Microbial Desalination Cells: From Sustainable Desalination to Lithium Recovery

Dr Marina Ramirez Moreno, University of Surrey

Electrochemical Biosensing Technologies for Next-Generation Personalised Healthcare

Kyriakos Almpanidis, University of Surrey

Electrochemical Sensing at Nano-Interfaces

Dr Lingcong Meng, University of Edinburgh

Electrochemical technologies offer unique opportunities to interrogate biological systems with high sensitivity, temporal resolution and compatibility with miniaturised devices. However, selective molecular detection in complex biological environments remains challenging because of coexisting electroactive species, biofouling and poorly controlled transport at electrode interfaces.
In the first part of this talk, I will discuss our work on engineering microporous electrochemical interfaces using polymers of intrinsic microporosity (PIMs) integrated with boron-doped diamond electrodes. These materials provide chemically tunable pore environments that regulate molecular partitioning, intrapore transport and protein exclusion. By controlling the balance between molecular enrichment and diffusion resistance, PIM-modified interfaces can selectively enhance or suppress electrochemical responses depending on analyte structure, hydrophobicity and interaction with the pore chemistry. This work highlights molecular transport control as a design principle for robust electrochemical sensing in complex biological media. The second part of the talk will focus on our current nanopore work for extracellular vesicle (EV) analysis in ovarian cancer. EVs are promising biomarkers because they carry disease-relevant surface proteins and molecular cargo, but their nanoscale size and heterogeneity make them difficult to analyse using conventional bulk methods. We are developing nanopipette based sensing platforms to detect ovarian cancer-associated EVs through their surface protein signatures at the single-vesicle level. By combining nanoscale confinement, surface functionalisation and electrochemical/ionic readout, this approach aims to improve the molecular characterisation of EV heterogeneity and support more sensitive, label-free cancer biomarker analysis.

Electrocatalysis for the production of green hydrogen and beyond – Materials and Mechanisms

Dr Reshma Rao, Imperial College

The efficiency, lifetime and resilience of emerging green electrochemical energy conversion and storage, chemical synthesis, and pollution control technologies relies on atomic-level processes occurring at complex catalytic interfaces. As an example, low temperature water electrolysis that limits green hydrogen production at scale is limited by the slow kinetics of the water oxidation reaction at the anode.

Even the best catalysts have large reaction barriers and are reliant on precious metals such as iridium, which limit their scalability and global access. The challenge is further exacerbated when coupling green hydrogen production with biomass oxidation to value added chemicals at the anode, where, in addition to activity, selectivity of the catalysts to high-value products remains a key bottleneck. To guide the discovery of sustainable, resilient and earth-abundant catalytic materials, we need experimental probes that can shed light on the underlying physical and chemical processes occurring at these dynamic interfaces, at the nanometer scale. In this talk, I will demonstrate how a combination of operando spectroscopic techniques (optical, X-ray and vibrational) can be used to determine the evolution of catalytic interfaces under applied potential and identify key reaction active sites and mechanisms. I will demonstrate how these techniques can be applied to water oxidation for green hydrogen production and biomass oxidation for synthesis of value-added chemicals. Through mechanistic understanding of the atomic-level factors limiting the reaction, I will elucidate how catalyst materials discovery can be accelerated.

Tuning Reaction Selectivity in Ethylene Glycol Electrolysis Through Interface Engineering
Dr Hui Luo, University of Surrey

Pulsed Current Kolbe Electrolysis of Aromatic and Amine Building Blocks
James Scanlon, University of Surrey

Electrogenerated Polyoxometalates as Redox Mediators for Organic Synthesis
Dr Zeliha Ertekin, University of Glasgow

Polyoxometalates (POMs) are a diverse group of molecular metal oxides recognized for their exceptional ability to store and transfer electrons, often referred to as “electron reservoirs” or “electron sponges”. This unique redox behavior makes them highly effective as soluble mediators in energy storage and electrocatalytic applications. In addition, reduced and protonated forms of POMs can act as hydrogenation agents, offering new possibilities for organic transformations under mild conditions. Among polyoxometalates, silicotungstic acid ($H_4SiW_{12}O_{40}$) stands out due to its high stability, well-defined redox potentials, and ability to undergo multi-electron reduction, making it highly effective for electron transfer processes. It can be electrochemically reduced to a two-electron reduced form ($H_6SiW_{12}O_{40}$), which is stable and can be repeatedly cycled between reduced and oxidized states. This reversibility allows it to function effectively as a redox mediator in various processes. However, more deeply reduced forms of silicotungstic acid have been rarely explored, as deeper reduction requires more negative potentials, which can lead to the formation of highly reduced tungsten blue and brown species that are not readily re-oxidized to their original forms. Under such conditions, electrode surface modification and promotion of the hydrogen evolution reaction can also occur, further complicating controlled multi-electron reduction. Herein, we have shown that by carefully controlling electrochemical conditions, silicotungstic acid can be reduced beyond two-electron, suggesting that the four-electron reduced form is a more effective hydrogenation agent. In this talk, I will discuss how electrochemically generated polyoxometalate (POM) mediators can serve as efficient and tunable multi-electron redox mediators for the selective hydrogenation of substrates. This approach is simple and potentially more sustainable than traditional routes, as it avoids the use of hydrogen gas, elevated temperatures, precious metal co-catalysts, and sacrificial reagents. Instead, the reactions occur in aqueous solution at room temperature. Moreover, because the POM mediator is recoverable and recyclable, the process becomes reusable and more sustainable.

Electrochemistry for a Sustainable Future: Closing Perspective
Dr Daniel Commandeur

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