HENRY ROYCE INSTITUTE

the BRAGG centre FOR MATERIALS RESEARCH

UNIVERSITY OF LEEDS

the BRAGG exchange

TIME TO **BRAGG** ABOUT MATERIALS

23rd - 24th January 2024

Delegate Guide

Sponsored by:

Quantum Design UK AND IRELAND

MSDE

Materials Horizons

Soft Matter

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Event code of conduct

The Bragg Centre wants everyone to enjoy the event and feel able to contribute.

We expect all participants (speakers, chairs, organisers and attendees) to treat others with dignity and respect and to conduct themselves in a proper and professional manner. Remember that harassment and sexist, racist, homophobic, or transphobic comments and exclusionary jokes are not appropriate.

Please refer to speakers, the chair, or attendees by the pronouns that they state. If not stated, please politely ask before using pronouns to refer to someone. Please do not assume someone's pronouns.

Anyone who violates the Code of Conduct may be asked to leave the event. Repeated violations may result in attendance at future events being restricted.

Unacceptable behaviour can be reported confidentially by speaking to one of the organisers or by emailing BraggCentre@leeds.ac.uk.

The Bragg Centre reserves the right to escalate any complaints to human resources following the procedures laid out in the University's Policy on Dignity and Mutual Respect.

General Information

Venues

The Bragg Exchange will take place across two venues on the University of Leeds campus.

Location: **Esther Simpson Building, Lecture Theatre LG.08**
Activity: Registration, Talks and Refreshments
Locate on Campus Map

Location: **The Refectory**
Activity: Poster Session, Lunch, Drinks Reception
Locate on Campus Map

Toilet Facilities

Toilets are located on lower ground floor near the lecture theatre. Please ask a member of the organising team to direct you.

Step Free Access

Step free access is available at both venues, please ask a member of the support team for guidance.

Fire Alarm

The fire alarm is tested every Wednesday morning at 08:15, which is prior to the event starting on the second day. If the alarm sounds during the event then this is not a test and you must evacuate the building.

Please leave the building following the green escape signs, the assembly point is on the main grass area outside the main entrance to Esther Simpson.

First Aid

If First Aid is required, please alert one of the organising team and they will contact the Emergency Services.

Asking Questions

The session chair will moderate all questions and remote microphones will be used within the audience, please wait to receive a microphone before you begin to ask your question.

Live Broadcast

Please be aware that the main talk sessions, including audience participation during Q & A, will be broadcast live to a public audience on YouTube. Although the focus of the broadcast is the speakers and talks, it is highly likely that audience members will be identifiable in the recorded footage.

If you have any concerns, please make the Bragg Team aware as soon as possible.

Poster Prizes

Prizes:
The Bragg Exchange 2024 poster prizes are graciously sponsored by the Royal Society of Chemistry (RSC).

1st Place = £100 Amazon voucher & 1 year RSC membership,
2x Runner Up = £50 Amazon voucher & 1 year RSC membership

Process:
Posters will be judged by a peer voting system. Each delegate has a voting card attached to their lanyard and may cast one vote following the instructions on the card.

Voting will take place across three poster sessions (during both lunches and the Tuesday evening drinks reception), with votes being collated in the afternoon of the second day. Prizes will be awarded in the closing remarks on the second day (Wednesday 24th January).

If you are presenting a poster, please ensure you are available to answer questions about your poster during these sessions.

Catering

Refreshments

A selection of hot and cold drinks will be available during registration on the ground floor foyer of the Esther Simpson building.

Lunch

Hot food will be served for lunch on both days alongside posters in the Refectory. The events team will help guide you over at the appropriate time.

The menu consists of (allergens are listed in red):

- Creamy chicken stroganoff with saffron rice and garlic crostini MILK,GLUTEN
- Winter vegetable risotto with crispy halloumi pieces and chilli oil (Vegetarian) MILK
- Beef bourguignon with mixed herb dumpling S02, GLUTEN
- Cantonese style broccoli and mushrooms with hot and sour sauce and non-prawn cracker (Vegan) S02

Drinks Reception

A selection of beer, wine, soft drinks and nibbles will be provided in the Refectory alongside posters between 16:00 – 18:30 on day 1 (Tuesday 23rd January)

Get In Touch

Feedback

We hope you enjoy the Bragg Exchange and we would love to hear about your experience. Please use our feedback form to let us know your thoughts and any suggestions that you may have to help us improve our events in the future.

You can access the feedback form by clicking HERE

Talk to the Team

Throughout the event there will be several members of the Bragg Centre team on site, alongside several members of the events team. If you require assistance, please let us know and we will do our best to support you.

You can also reach out to the Bragg Team via Microsoft Teams Chat throughout the event by clicking HERE

Agenda

Day 1 (Tuesday 23rd January)

Welcome

10:30 – 11:15 **Registration & Coffee**

11:15 – 11:30 **Welcome & Housekeeping**
Dr Andrew Lee – Bragg Centre Manager,
Prof. Nick Plant – Deputy Vice Chancellor: Research & Innovation,
Prof. Edmund Linfield – Bragg Centre Director,

Session 1: Analytical Science

Chair: Prof. Rik Dummond-Brydson

11:30 – 12:00 **Prof. Melanie Bailey,** *Surrey Ion Beam Centre, University of Surrey*
From semiconductors to organelles: exciting opportunities to exploit new analytical tools at the University of Surrey

12:00 – 12:20 **Dr George Heath**, *School of Physics & Astronomy*
Advances in high-speed atomic force microscopy methods to observe dynamics of single-molecules

12:20 – 12:30 **Dr Stephanie Foster,** *School of Chemical & Process Engineering*
Investigating the Carbonation of $Ca(OH)_2$ Using Cryo- and Liquid Cell TEM

12:30 – 13:45 Lunch, Posters & Exhibition

Session 2: Functional Surfaces

Chair: Dr Liuquan Yang

13:45 – 14:15 **Dr Gareth Hinds,** *National Physical Laboratory*
Towards more representative corrosion testing of fuel cell and electrolyser bipolar plate materials

14:15 – 14:35 **Dr Frederick Pessu,** *School of Mechanical Engineering*
Understanding Corrosion Interactions in Systems Designed to Deliver Clean Energy and Net Zero Targets

14:35 – 14:45 **Dr Jamie Mannering,** *School of Chemistry*
High Entropy Alloy Nanocatalysts within Ordered 3D Graphene Architectures

Session 3: Soft Matter

Chair: Prof. Giles Davies

15:00 – 15:30 **Dr Lorenzo Di Michele,** *University of Cambridge*
Synthetic cells from smart nucleic-acid condensates

15:30 – 15:50 **Prof. Lorna Dougan,** *School of Physics & Astronomy*
Understand and exploiting the translation of mechanical properties of proteins across length scales

15:50 – 16:00 **Ashley Victoria,** *School of Chemical Process & Engineering*
Design of experiments in the optimisation of all cellulose composites

Drinks Reception, Posters & Exhibition

Including Cleanroom VR Experience

16:00 – 18:30 **Venue: The Refectory**

Day 2 (Wednesday 24th January)

Welcome

10:30 – 11:15 **Registration & Coffee**

Session 4: Electronic and Photonic Materials

Chair: Prof. Chris Marrows

11:15 – 11:45 **Prof. Serena Cussen,** *University of Sheffield*
Title TBC

11:45– 12:05 **Prof. Gordon Love,** *School of Computing*
Liquid Crystal Physics and its applications in optics & vision science

12:05 – 12:15 **Md Golam Hafiz,** *School of Physics & Astronomy*
Effect of Electric field on structural and interfacial magnetic properties

12:15 – 13:30 Lunch, Posters & Exhibition

Session 5: Multiscale Materials

Chair: Prof. Fiona Meldrum

13:30 – 14:00 **Prof. Kevin Paine,** *University of Bath*
Self-Healing Concrete and other Bacterial Innovations in Infrastructure

14:00 – 14:20 **Dr Boyue Chen,** *School of Design*
Printed sensors and generators for engineering and wearable applications

14:20 – 14:30 **Robert Mackay,** *School of Physics & Astronomy*
Phase Field Modelling of Magnetoelasticity in Antiferromagnets

Session 6: Bionanotechnology

Chair: Prof. Christoph Wälti

14:45 – 15:15 **Dr Linda Pravinata,** *Marlow Ingredients*
Championing Food Sustainability via Biotechnology and Colloid Sciences in Fungal Fermentation

15:15 – 15:35 **Dr Paolo Actis,** *School of Electronic & Electrical Engineering*
A story about stupidity in nanopore research (and how a laxative could explain it all)

15:35 – 15:45 **Dr Delanyo Kpeglo,** School of Physics & Astronomy
A microfluidic cell culture model of the biophysical barriers to drug delivery in pancreatic ductal adenocarcinoma for testing better therapeutics

Close

15:45 – 16:00 Prize Giving & Concluding remarks
Dr Andrew Lee – Bragg Centre Manager,
Prof. Edmund Linfield – Bragg Centre Director
Prof. Rob Hardeman – Chair EAB

Abstracts

External Speakers

Prof. Melanie Bailey, *Surrey Ion Beam Centre, University of Surrey*
From semiconductors to organelles: exciting opportunities to exploit new analytical tools at the University of Surrey

The University of Surrey is the lead site for the UK National Ion Beam Centre, which has been an EPSRC National Facility for over 40 years, providing materials modification and analysis service for the benefit of industry and academia across the UK. Historically, we have provided 3D elemental analysis of materials at the sub-micron scale. More recently, we have expanded this to chemical characterisation using spatially resolved mass spectrometry and biological mass spectrometry. This has resulted in the BBSRC providing funding for a new national facility for spatially resolved single and sub-cellular "omics", SEISMIC , which enables the analysis of single, living cells or their sub-cellular compartments under microscope observation. These tools are open to UK academics and industry –feel free to come along to learn how these new and established analytical approaches could help your research.

Dr Gareth Hinds, *National Physical Laboratory*
Towards more representative corrosion testing of fuel cell and electrolyser bipolar plate materials

Polymer electrolyte membrane (PEM) electrolysers and fuel cells are promising candidates for large scale generation and end use of green hydrogen. A significant fraction of the cost of these devices arises from the bipolar plate components, which are used to pass the electrical current to the electrodes. *Ex situ* testing of candidate bipolar plate materials typically involves electrochemical polarization of the specimen in a three electrode cell. Relatively high potentials of between 1.5 V and 2.0 V vs RHE are commonly applied during such tests due to the widely held assumption that, during both start-up/shutdown and normal operation, the bipolar plate experiences the same potential as that of the nearest electrode. This talk will present experimental and modelling evidence demonstrating that the bipolar plate in an operating PEM fuel cell or electrolyser actually sits at its natural open circuit potential due to the high resistivity of the aqueous phase, which effectively shields the material from the elevated potential at the electrode. The implications for more representative *ex situ* testing of such materials will be discussed.

Dr Lorenzo Di Michele, *University of Cambridge*
Synthetic cells from smart nucleic-acid condensates

Bottom-up synthetic biology aims to build synthetic cells (SCs), micro-robots constructed *de novo* to replicate behaviours typically associated with biological cellular life. If endowed with sufficiently advanced cell-like responses, SCs could underpin game-changing solutions in healthcare and biosynthesis. Like biological cells, SCs require micro-compartmentalised architectures to regulate transport and establish internal heterogeneity. While membrane-based SC scaffolds are common, membrane-less implementations relying on hydrogels or coacervate droplets are becoming increasingly popular due to their robustness and programmability. In this talk, I will discuss the use of nucleic acid condensates as scaffolds for building SCs. I will show that condensates self-assembling from synthetic nucleic acid constructs can host a variety of biomimetic functionalities, including regulated transport, cargo capture/release, triggered assembly and disassembly, and the in-situ synthesis of functional RNA. To recapitulate the internal compartmentalisation seen in biological cells, I will discuss how reaction-diffusion processes and micro-phase separation can be used to create distinct, chemically addressable domains within the SCs, allowing spatial engineering of functionalities and localised morphological responses.

Prof. Serena Cussen, *University of Sheffield*
Title TBC

Prof. Kevin Paine, *University of Bath*
Self-Healing Concrete and other Bacterial Innovations in Infrastructure

Degradation of concrete buildings and infrastructure is inevitable and consequently regular maintenance is required to mitigate against failure during the service-life. See, for example recent issues with recycled autoclaved aerated concrete. However, understanding and knowledge of composites is now leading to the creation of concretes with autonomic self-healing capabilities. This development will transform our infrastructure by embedding self-immunity and resilience, such that manual repair may become unnecessary. This presentation delves into the cutting-edge developments in these technologies, concentrating on recent strides in harnessing bacteria to create these self-healing structures through better understanding of the underlying concrete technology and microbiology. Furthermore, this new understanding creates an exciting possibility to use bacteria to form cementitious compounds, potentially replacing traditional cement and paving the way for innovative, low-carbon concrete solutions.

Dr Linda Pravinata, *Marlow Ingredients*
Championing Food Sustainability via Biotechnology and Colloid Sciences in Fungal Fermentation

Usage of microbial proteins for food production has been one of the promising solutions for the current high demand of non-animal-derived proteins. Marlow Foods has been the pioneer in fungal fermentation leaning on over 40 years of experience in mining mycoprotein's unique properties for meat analogue and dairy applications. The aim of this presentation is to provide an overview of the joined forces between biotechnology and food colloids in creating positive impact in sustainability and health aspects. An end-to-end processing steps from fermentation to freeze-texturization will be outlined to demonstrate the interplay of hyphae morphology and ice crystals in defining architectural structure of the meat-analogue to create texture. Moreover, the importance of structural design at multiple length scales in formulating colloidal foods such as vegan cheese and yogurt will also be discussed. To conclude, various research findings about mycoprotein will be disseminated to spark opened innovations and collaborations in joining Marlow Foods' mission to tackle global challenges in food sustainability and accelerate alternative protein transition.

Bragg Centre Speakers

Dr George Heath, *School of Physics & Astronomy*
Advances in high-speed atomic force microscopy methods to observe dynamics of single-molecules

Dynamics are fundamental to the functions of biomolecules and can occur on a wide range of time and length scales. Many bulk techniques average out important events such as transient states, real-time dynamics, and heterogeneity. Here, I will present new high-speed atomic force microscopy (AFM) methods that push the temporal and spatial resolution achievable by any technique for studying single molecules. Additionally, I will introduce NanoLocz, a versatile AFM and high-speed AFM analysis platform that facilitates a variety of high-throughput AFM analysis workflows.

Dr Stephanie Foster, *School of Chemical & Process Engineering*
Investigating the Carbonation of $Ca(OH)_2$ Using Cryo- and Liquid Cell TEM

The carbonation of calcium hydroxide is a crucial reaction in the manufacture of calcium carbonate, cement aging processes and for the preservation of cultural heritage sites. In order to adequately control the reaction, an understanding of the underlying mechanism is required, and yet the exact reaction pathway is still highly debated. An excellent way of studying crystallisation processes is to use correlative transmission electron microscopy (TEM) techniques, which is particularly powerful when snapshot-style imaging of set reaction timepoints (e.g. dry and cryo-TEM) with is combined with dynamic in-situ analysis (e.g. liquid cell TEM). In this work, these techniques have been used to capture the dissolution of calcium hydroxide nanoplates, pseudomorphic precipitation of ACC, and the crystallisation of scalenohedral calcite. The underlying mechanism is deduced and the combined use of static and in-situ TEM techniques is highlighted as an ideal platform for studying complex reaction mechanisms.

Dr Frederick Pessu, *School of Mechanical Engineering*
Understanding Corrosion Interactions in Systems Designed to Deliver Clean Energy and Net Zero Targets

The need for clean energy and meeting net-zero targets by 2050 has inspired a two-pronged approach: energy transition, and "greening" of energy systems. Energy transition explores clean sources of energy; geothermal, solar – including industrial scale concentrated solar power (CSP) systems, and cocktail of next generation nuclear reactor designs - including molten salt reactors (MSRs). CSPs/MSRs uses high boiling point molten salts (MS) as heat transfer fluid (HTF), thermal energy storage (TES) and coolants (in the case of MSRs) and have shown great promise in the efforts to meet global climate change target. CO_2 Capture and Sequestration (CCS) into repurposed gas reservoirs has emerged as a key strategy in "greening" energy generation. This presentation discusses how the development of updated understanding of corrosion interactions in energy systems can help towards delivering net-zero targets. This is because long-term materials interactions with arduous corrosive environments in energy systems (including deep geological saline aquifers in the case of CCS) and their performance and resilience, have become critical for delivering low-carbon electricity, and achieving net-zero. The extreme conditions in CSPs/MSRs: high temperature (≥700°C) and aggressive corrosion media in MS systems, presence of H_2S gas and dissolved sulphide species, transition elements and high TDS in geothermal systems poses complex material degradation issues related to corrosion, chemical speciation kinetics, high temperature (HT) fatigue and irradiation induced creep.

Dr Jamie Mannering, *School of Chemistry*
High Entropy Alloy Nanocatalysts within Ordered 3D Graphene Architectures

High entropy alloy nanoparticles, composed of five or more atomically mixed metal elements, represent a ground-breaking area of exploration within multi-metallic catalytic systems. Conventional thermal conditions typically lead to phase separation in mixed metal nanoparticles due to thermodynamic processes. However, by leveraging the outstanding electrothermal properties of graphene foams, we can achieve rapid heating and cooling kinetics using an electrical heating approach and effectively inhibit phase separation. This unique thermal treatment method, combined with a structure-preserving sublimation-deposition technique, enables the through-volume functionalisation of HEAs onto centimetre-scale graphene foams. To demonstrate the successful formation of HEAs onto graphene foams, an array of cutting-edge microscopic, spectroscopic and tomographic characterisation methods are employed across multiple length scales from atomically-resolved AC-STEM-EDX imaging of the HEA nanoparticles to the tomographic microstructural imaging of the 3D graphene support architecture. This comprehensive approach provides fundamental insights into the physiochemical properties of these material forms and their diverse applications. The formation and activity of atomically mixed quinary nanoparticles comprised of five (electro)chemically important elements (Cu, Pd, Pt, Ru and Rh) is demonstrated through one of the first examples of graphene foam architectures within flow chemical catalysis for a pharmaceutically-important oxidative amidation reaction of tertiary amines.

Prof. Lorna Dougan, *School of Physics & Astronomy*
Understand and exploiting the translation of mechanical properties of proteins across length scales

A major challenge in the field of soft matter is to understand how the mechanical properties of an individual biopolymer translates to the collective response of a biopolymer network. By combining protein engineering, structural and mechanical characterisation and modelling we are developing a fundamental understanding of protein network formation and function. This approach is revealing a diversity of viscoelastic and structural properties that originate on both the nanoscale and the mesoscopic scale, providing powerful opportunities for engineering responsive and functional biomaterials. In this talk I will share our recent efforts to engineer protein aspect ratio and mechanical malleability and demonstrate its role in defining network architecture, mechanics and function. By modelling folded proteins as colloids, there are rich opportunities to explore network formation mechanisms, revealing an important crossover between diffusion and reaction limited cluster aggregation and the importance of the structure of the network at the percolation point. By taking an integrative small- and wide-angle scattering approach coupled with computational modeling we reveal the multiscale structure of hierarchically self-assembled proteins in aqueous solution. Finally, I will share our collaborative efforts to exploit these novel biomaterials for application in triggered drug delivery, as scaffolds for disease modelling and to understand the physics of living systems.

Ashley Victoria, *School of Chemical Process & Engineering*
Design of experiments in the optimisation of all cellulose composites

There has been a growth of interest in the field of all-cellulose composites (ACCs) as sustainable alternatives to petroleum-derived materials. Unlike traditional multi-component composites, both matrix and reinforcing components of ACCs comprise of cellulose, a renewable biopolymer found abundantly in nature. ACCs with enhanced interlaminar adhesion can be produced using a combination of textile reinforcement and interleaved films. This partial dissolution process allows sufficient matrix to be produced whilst preserving fibre fraction, decreasing the likelihood of common failure mechanisms such as delamination to occur. Here, statistical design of experiments (DoE) is applied to the processing of ACCs, where the effects of dissolution temperature, pressure and time on ACC mechanical properties are explored through a full factorial design, and later optimised using Response Surface Methodology (RSM). The underlying relationship between Young's modulus and processing conditions was revealed through the experimental design, and optimum temperature and time settings of 101 °C and 96.8 minutes respectively were identified, predicting a Young's modulus of 3.3 GPa. Samples produced under these conditions gave an average Young's modulus of 3.4 ± 0.2 GPa, validating the derived predictive model. Furthermore, the optimised samples had excellent consolidation within the material microstructure and favourable density, resulting in an average tensile strength and peel strength of 72 ± 2 MPa and 811 ± 160 N/m respectively. This work highlights the potential of DoE for ACC processing and optimisation.

Prof. Gordon Love, *School of Computing*
Liquid Crystal Physics: and its applications in optics & vision science

Liquid crystal devices have been used in a whole range of non-display applications based on their flexible ability to modulate both the phase and polarization of light. In this talk I will review some of the work I have done on creating non-display liquid crystal devices, and summary some of the interdisciplinary applications across optics, vision science and computer science.

Md Golam Hafiz, *School of Physics & Astronomy*
Effect of Electric field on structural and interfacial magnetic properties

Recent investigation of reversible oxygen ion migration in hafnia (HfO_2)-based nanostructures is providing a potential route to reducing the power consumption of future memory devices. These observations have renewed attention in memory architectures that use ionic-liquid gating (ILG) to electrically controlling magnetism in nanostructures. Here, oxygen ion migration is now being characterised with X-ray photoelectron spectroscopy (XPS). To date, XPS measurements have hinted at possible changes in the electronic structure of gated and ungated CoB layers, where the Oxygen is observed to migrate only to the CoB surface and may form an additional CoO secondary phase. This control of oxygens position within the nanostructure is hypothesised to modify the magnetic properties and might be suitable for modelling reconfigurable spintronics devices.

Dr Boyue Chen, *School of Design*
Printed sensors and generators for engineering and wearable applications

This presentation will start with an introduction on the development of a screen-printed P(VDF-TrFE)/$BaTiO_3$ piezoelectric composites as generators for energy harvesting. The energy harvesting performance of the generators was studied in conjunction with laminated composites and a nonlinear Duffing oscillator. In the case of laminated composites-based harvesters, the harvested energy was demonstrated to power a commercial accelerometer via a power management interface. Another part of the presentation will concentrate on the screen-printed piezoresistive sensors for pressure and temperature sensing. The pressure sensor was based on multi-walled carbon nanotubes/PDMS and the temperature sensors were printed with silver paste. A read-out circuit for the sensors was designed and printed. And it was demonstrated that the designed read-out circuit could successfully interface with Arduino.

Robert Mackay, *School of Physics & Astronomy*
Phase Field Modelling of Magnetoelasticity in Antiferromagnets

Conventional ferromagnetic data storage devices are fast approaching the lower limit of their minimum individual bit sizes. Antiferromagnetic spintronic devices have the potential to surpass this limit due to their inherent resistance to stray magnetic fields and THz order spin dynamics which means that denser packing of bits is possible as well as fast read/write times. To date, the formation and dynamics of these magnetic domains remain relatively unexplored at device level, despite experimental observation of their existence. It is currently thought that these domains are magnetoelastic in origin. To explain these observations, we explore the domain formation and dynamics using a phase field modelling approach which allows exploration of the domain formation and dynamics at a device-level length scale. To demonstrate our model, we look at a thin film of the antiferromagnet NiO grown on a substrate of MgO. In NiO we have two antiferromagnetically coupled magnetic sublattices. Since NiO and MgO have different lattice constants, we get a “mismatch” strain in both materials, which we separate into two components, the spontaneous strain (from magnetoelastic coupling in the antiferromagnet) and the elastic strain (from strain coupling between magnet and substrate). Using this “mismatch” strain together with the magnetoelastic coupling and other relevant free energy terms this scenario was input into our phase field model. Antiferromagnetic domains were observed, vindicating our model, and giving us a future base on which to improve our model further.

Dr Paolo Actis, *School of Electronic & Electrical Engineering*
A story about stupidity in nanopore research (and how a laxative could explain it all)

Nanopores come in many different shapes and size. The academic community is now particularly excited about using very fine glass needles as nanopores because they can be easily fabricated at the bench using some heat and a forceful pull. I will show how we can use these sharp needles to inject and analyse molecules, one at the time, inside the cytoplasm of living cells to develop the world's most precise microinjection setup. We discovered that the cytoplasm is a "special" place that enhance the single molecule sensitivity of the needles and I will explain how the world's most popular laxative (according to usnews.com) could explain this observation.

Dr Delanyo Kpeglo, School of Physics & Astronomy
A microfluidic cell culture model of the biophysical barriers to drug delivery in pancreatic ductal adenocarcinoma for testing better therapeutics

Pancreatic ductal adenocarcinoma (PDAC) is the most prevalent pancreatic cancer with poor prognosis. It is characterised by a rigid fibrotic stroma that blocks drug penetration, leading to treatment failure. High densities of cells and extracellular matrix proteins form a rigid mass and high interstitial pressure, leading to vasculature collapse and a mechanically stiff, collagen-dense, hypoxic stroma with reduced interstitial flow, which is critical for drug delivery to cells. There are currently inadequate culture models to assess promising new drugs and delivery methods against PDAC effectively. 3D microfluidic cell cultures allow disease-representative models, to mimic tumour biophysical features with physiological flow conditions, and the testing of new drugs and delivery approaches. Our culture model is a co-culture of the PDAC cell, PANC-1, and PSCs, the fibroblasts responsible for over-producing collagen for the rigid stroma and whose activity is increased with growth factors such as TGF-β1. Off-chip investigation of 3D PDAC cultures using oscillatory shear rheology found a 21-day culture was needed to mimic the stiff PDAC stroma (~1kPa). Translated on-chip, immunostaining found a collagenous matrix by day 21 of culture, leading to the mechanical rigidity measured, reduced interstitial flow, and a hypoxic environment. When the chemotherapeutic gemcitabine was delivered with ultrasound-activated micron-sized phospholipid-shelled gas bubbles on-chip, gemcitabine's effectiveness increased by ~15%. With the matrix-depleting drug losartan, which reduces collagen levels and mechanical stiffness, increasing hydraulic conductivity, on-chip culture viability with gemcitabine was ~24%. Currently, atomic force microscopy is being used to probe further the viscoelastic properties of 3D off-chip PDAC cultures.

Posters

Poster
No.

1. **Mae Jankowski**, *School of Chemical & Process Engineering*
   (x)BiFeO_3-(1-x)PbTiO_3 Thin Films Grown by Pulsed Laser Deposition

2. **Meg Coleman**, *School of Physics & Astronomy*
   3D Printed Liquid Crystal Elastomer Actuators

3. **Viola Huf**, *School of Physics & Astronomy*
   3D printed Liquid Crystal Elastomers

4. **Mohammed Al-Mosawi**, *School of Dentistry*
   A close-up look at dental enamel with transmission Kikuchi diffraction in the scanning electron microscope

5. **Oli France**, *School of Chemistry*
   Artificial Organelles Encapsulating Autocatalytic Enzyme Reactions For Application In Controlled Release

6. **Sudeshna Roy,** *School of Chemical & Process Engineering*
   Assessing process effects on recrystallisation of co-amorphous form products

7. **Xinyu Mao**, *School of Physics & Astronomy*
   Biodegradable gold nano-assemblies in the application of fluorescence guided surgery, photothermal and chemotherapy

8. **Rosa Catania**, *School of Chemistry*
   Biohybrids for renewable energy: Exploiting membrane enzymes in biotechnology

9. **Matt Hughes**, *School of Physics & Astronomy*
   Biology Exploits Geometry: Impact of Aspect Ratio on Protein Networks

10. **Gayathri Mohanan**, *School of Electronic & Electrical Engineering*
    Biomarker detection with affimer conjugated DNA origami using nanopipettes

11. **Isabelle Rogers**, *School of Physics & Astronomy*
    Cancer Cell-Specific Delivery of RNA Therapies using Fusogenic Silica Nanoparticles

12. **Emily Newcombe**, *School of Biology*
    Characterising Hemp and Tomato Lignocellulosic Wastes as Feedstocks for the Development of Sustainable Materials

13. **Emma Thompson**, *School of Chemical & Process Engineering*
    Characterising population heterogeneity and its impact on the physicochemical properties of hybrid lipid and block co-polymer vesicles

14. **Janine Preston**, *School of Chemical & Process Engineering*
    Characterising the interfacial behaviour of xanthone crystals and its influence on the Pickering stabilisation of foams and emulsions

15. **Katy Voisey**, *The University of Nottingham*
    Collaboration opportunities with Nottingham

16. **Thomas Moore**, *School of Chemistry*
    Controlling the microstructure of polymer foams via microfluidic templating

17. **Ryan Abou-Shakra**, *School of Mechanical Engineering*
    Corrosion Inhibitor Persistency in Aqueous CO_2-Containing Environment

18. **Prof. Sandra Piazolo**, *School of Earth and Environment*
    Corrosion occurs by interface coupled replacement reactions: Insights from EBSD analysis, mineral and fluid chemistry

19. **Amber Sykes**, *School of Mechanical Engineering*
    Corrosion Product Characteristics in Geothermal Environments

20. **Niamh O'Donoghue**, *School of Food Science & Nutrition/School of Chemistry*
    Cytotoxicity of non-lamellar liquid crystalline nanoparticles

21. **Xinyu Ning**, *School of Chemistry*
    Developing a polyvalent multifunctional glycomimetic-gold nanoparticle probe for multivalent protein-glycan interactions

22. **Malika Zahedi**, *School of Molecular & Cellular Biology*
    Developing novel tools to uncover smooth and non-muscle myosin organisation in the smooth muscle of blood vessels

23. **Zijing Wu**, *School of Electronic & Electrical Engineering*
    Developing Skin-on-a-chip (SOC) and a bioreactor to recreate environmental conditions linked to Raynaud's disease onset

24. **Kieran Fagg**, *School of Physics & Astronomy*
    Dielectric Measurements in Ferroelectric Nematic Liquid Crystals

25. **Chao Sun**, *School of Chemical & Process Engineering*
    Droplet-based Millifluidic Synthesis of a Proton-conducting Sulfonate Metal-organic Coordination Polymer

26. Bianca Hazt, *School of Food Science & Nutrition*
Effect of thermal treatment on lactoferrin: unveiling insights for muco-adhesion

27. Marjan Homayoonfard, *School of Mechanical Engineering*
Effect of Tribological Conditions on Friction Reduction and Tribofilm Structure of Organic Friction Modifiers

28. Saud Alshammari, *School of Chemical & Process Engineering*
Enhancing the band gap and the surface of TiO2 NP by coupling with CdS NP

29. Sameena Kanakkayil, *School of Chemistry*
Exploiting Water as a Functional Surface to Create Inorganic Thin Films

30. Dimitra Katrantzi, *School of Chemical & Process Engineering*
Folded Protein Hydrogel Characterisation

31. **Will Ogle**, *School of Physics & Astronomy*
Green Solvents for Esterification Reactions

32. Reem Alqahtani, *School of Computing*
Hybrid Access Control Model based on Blockchain for Edge-IoT Environments

33. Hind Alluqmani, *School of Chemistry*
Impact of Cation Valence on Gelation and Viscoelastic Properties of Laponite Hydrogels

34. Luke Phillips, *School of Mechanical Engineering*
Innovative Approaches to Manufacture Terahertz Optical Devices with Additive Manufacturing: THz Characterisation of a Silica-Filled Photopolymer

35. Stephanie Foster, *School of Chemical & Process Engineering*
Investigating the Carbonation of $Ca(OH)_2$ using Advanced TEM Techniques

36. Daniel Williams, *School of Chemical & Process Engineering*
Investigations into the Toxicity of Metal Shell Microcapsules

37. Rahaf Bagbag, *School of Chemistry*
Laponite-Cellulose Composite Hydrogels as Artificial Soils for Sustainable Agriculture

38. Sandra Sanni, *School of Physics & Astronomy*
Liquid Crystal Switchable Prisms

39. Harry Godden, *School of Electronic & Electrical Engineering*
Liquid-Crystal-Based Optics for THz-Frequency Variable Attenuators

40. Deborah Oliveira, *School of Chemical & Process Engineering*
Machine learning models to map polymer property-performance correlations

41. **Ahmad Boroumand**, *School of Physics & Astronomy*
    Manipulation of protein hydrogels mesoscale architecture for controlled release and mechanics: A smart stimuli responsive drug delivery material

42. **Diana Nikolova**, *School of Physics & Astronomy*
    Measurements of Spontaneous Polarisation in Ferroelectric Nematic Liquid Crystals

43. **Bing Zhang**, *School of Mechanical Engineering*
    Multi-perspective management of the integrity of composite structures

44. **Sean Leggatt-Bulaitis**, *School of Chemistry*
    Nanocarbon Aerogels for Catalytic Flow Processes

45. **Rachel Bocking**, *School of Chemistry*
    Nanocarbon-modified microelectrode sensors for applications in reproductive medicine

46. **Emily Wynne**, *School of Chemical & Process Engineering*
    Nanoscale Structures of Alkane and Alcohol Wax Thin Films Crystallised From a Melt

47. **Prof. Megan Povey**, *School of Food Science & Nutrition*
    Non-cavitational acoustic control of crystallisation processes

48. **Tanveer Ahmed**, *School of Food Science & Nutrition*
    Nuclease enzymes action on 3D DNA origami nanostructures

49. **Emily Cooper**, *School of Physics & Astronomy*
    Optical Methods for Liquid Crystal Elastomers

50. **Manoj Rajankunte Mahadeshwa**ra, *School of Dentistry*
    Osteoarthritis in Articular Cartilage: Validating Bio-Tribological Properties through Structural Characterization

51. **Sharada Nagarkar**, *University of York*
    Photonic crystal assisted upconversion photoluminescence

52. **Sebastian Croft**, *School of Physics & Astronomy*
    Predicting glass transition temperature from monomer structure in PAEK polymers

53. **Darcey Ridgway-Brown**, *School of Chemistry*
    Product activation of enzymatic reactions in confinement

54. **Bence Solymosi**, *School of Chemistry*, *Institute of Process Research and Development*
    Promotion of true catalytic activity via acid oxidation of a catalyst support

55. **Callum Brennan-Rich**, *School of Physics & Astronomy*
    Properties of epitaxial Fe_3Sn_2

56. Oliver Ayre, *School of Chemistry*
Rationalising polymer guided inorganic crystal biomorph formation

57. Latifah Alsalem, *School of Computing*
Reinforcment Learning approach Based-Heterogeneous Task Scheduling in Edge Computing Environment

58. Joseph Thevakumar, *School of Mechanical Engineering*
Severity of Sulphuric Acid Corrosion in Geothermal Environments

59. Shudan Wei, *School of Chemical & Process Engineering*
Strategic Aluminum Dissipation Unlocking Exceptional Mbene MoB Supercapacitor Performance

60. Evi Paximada, *School of Food Science & Nutrition*
Sustainable materials for packaging applications

61. Chloe Loveless, *University of Manchester*
Sustainable Materials Innovation Hub

62. Abigail Bond, *School of Physics & Astronomy*
Towards the Liquid Crystal Chemical Sensor via Confinement Within a Stripe Pattern

63. Ellen Slay, *School of Molecular & Cellular Biology*
Using microparticles as a 3D scaffold in microfluidics to support cell growth

Exhibition & Sponsors

Bragg Centre Facilities

Experimental staff from the Bragg Centre research facilities will be on hand to discuss our capabilities and expertise throughout the Poster & Exhibition sessions. Come along to the exhibition table to find out how we can take your research to the next level.

Including;

- **Leeds Electron Microscopy & Spectroscopy (LEMAS) Facility**
- **Atomic Force Microscopy Facility**
- **X-Ray Diffraction (XRD) Facility**
- **Versatile X-ray Spectroscopy (XPS) Facility**
- **Physical Vapour Deposition Facility**
- **X-ray Computed Tomography (XCT) Facility**
- **The new SAXS/WAXS with *in situ Rheometry System***
- **The Royce Deposition System**

Quantum Design

Quantum Design UK and Ireland specialise in advanced scientific instruments for research in academic institutions, R&D departments, and company laboratories across the UK and Ireland. At the Bragg Exchange 2024, we will be on-hand to discuss the QD FusionScope, their X-Ray range, Zolix precision optical instruments and their imaging cameras range. Find out more about QD-UKI at www.qd-uki.co.uk

Cleanroom Virtual Reality Experience

Provided by Swansea University & Imersifi

Created by Swansea University & Imersifi, this virtual reality application has been created to help explain more about the semiconductor industry in a fun and engaging way.

It takes users on a journey from sand to silicon chip and then through realistic environments modelled on Swansea University's facilities, complete with a robot character guide, fun voiceover, and animation. The interactions are simple and intuitive, making the experience accessible for everyone.

Users will experience the be guided through a clean room gowning experience followed by an introduction to the lithography process (how device patterns are written on to a semiconductor wafer). This allows students to learn about how semiconductors are made and the important role they play in society.

Available during the drinks reception, 16:00 – 18:00, Day 1

The Royal Society of Chemistry

The Bragg Centre is grateful to the Royal Society of Chemistry for sponsoring the Bragg Exchange's poster prizes.

The Royal Society of Chemistry (RSC) publishes over 50 world-leading journals that span the core chemical sciences and related fields. Known for rigorous, fair peer review and fast publication times, our journals publish the best science, from original research articles to authoritative reviews**.** At the RSC, our mission is to advance excellence in the chemical sciences and our status as a society publisher allows us to focus on making that a reality. We re-invest all surplus back into the global scientific community, providing ongoing support for authors, researchers, and educators in every field of chemistry and related disciplines. You can find out more about what we do and the benefits of publishing with us.

Materials Horizons

Materials Horizons is a leading journal for the publication of exceptionally high quality, innovative materials science. The journal places an emphasis on original research that demonstrates a new concept or a new way of thinking.

Soft Matter

Soft Matter provides a unique forum for the communication of significant advances in interdisciplinary soft matter research. There is a particular focus on the interface between chemistry, physics, materials science, biology and chemical engineering.

MSDE

Molecular Systems Design & Engineering (MSDE) publishes work which establishes new understanding of molecular properties and behaviours, and uses this understanding to design and assemble better materials, systems, and processes to achieve specific functions.

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