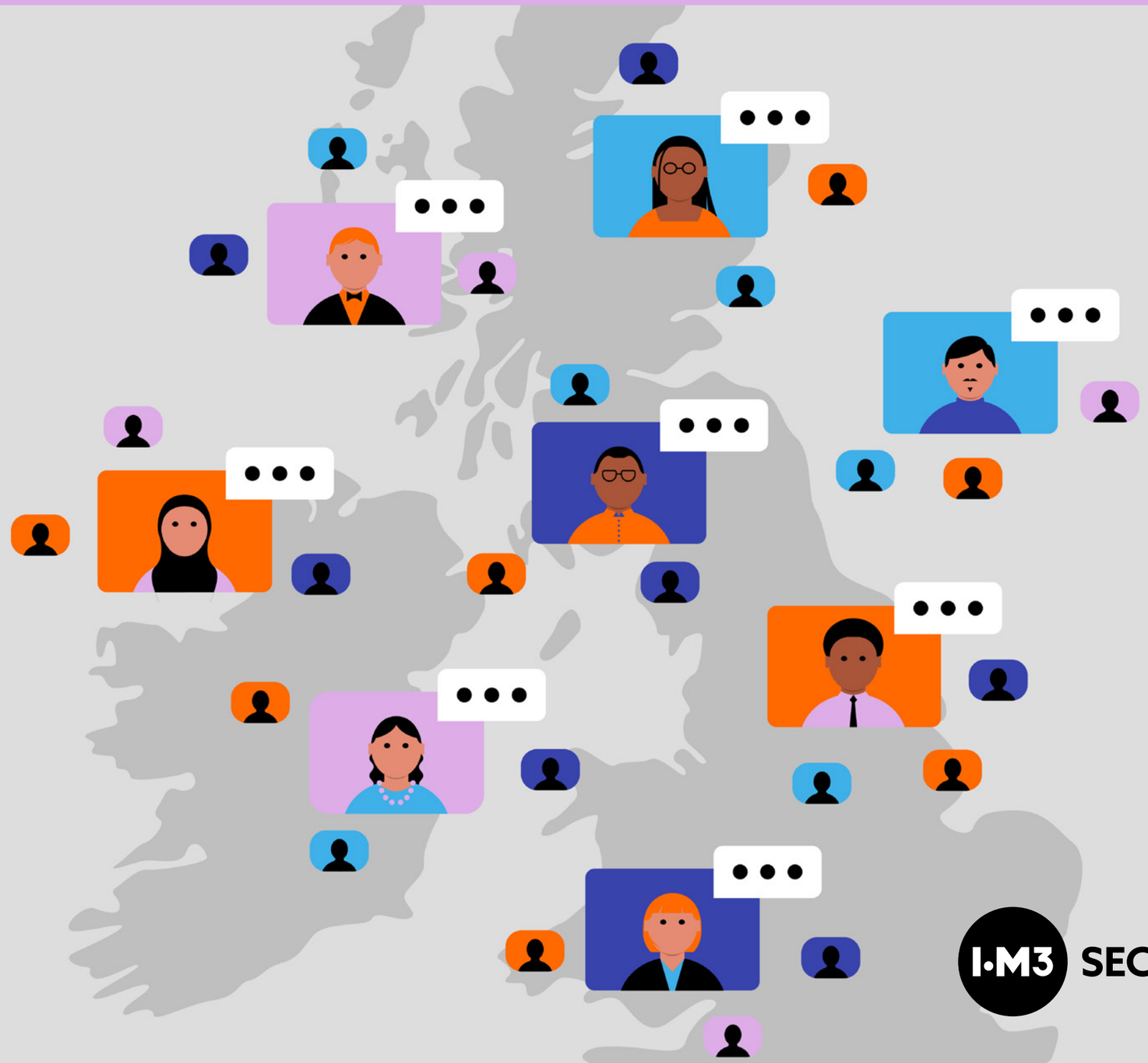
Young Persons' Lecture Competition

NATIONAL FINAL 2021

WEDNESDAY 5 MAY 2021
17.00 BST



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EMMS East Midlands Materials Society

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ORGANISED BY

I·M3 Institute of Materials, Minerals & Mining

THE INSTITUTE OF MATERIALS, MINERALS AND MINING

The Institute of Materials, Minerals and Mining (IOM3) is the professional body for the international materials, minerals and mining community. It promotes all aspects of materials science and engineering, as well as geology, mining, extraction metallurgy, minerals and petroleum engineering.

IOM3 plays an important role in the professional development of engineers and scientists. It provides information and library services, events and publications, and promotes the materials discipline to younger generations through various educational resources. IOM3 has strong links with other professional bodies and makes important contributions at Government and international levels in areas such as education and training, standards, test procedures, research programmes and environmental issues.

www.iom3.org

ON BEHALF OF

I·M3 SECC

SECC – STUDENT & EARLY CAREER COMMITTEE

The SECC represents the views of student, younger and early career* members to the Institute's Executive Boards and Advisory Council. We aim to represent the diverse range of members by ensuring Council representatives cover the different disciplines, regions and career pathways of student and early career members.

Since the Committee was founded in 1967 (as the Younger Members' Committee), we have developed a range of events to encourage networking and early career members' involvement with IOM3. Our greatest successes to date include the Young Persons' Lecture Competition, Matopoly, Professional Development events and Future Materials Conference. While we have been successful in the past, we aim to provide more events in the future. These include regular informal networking opportunities, along with new skills seminars, conferences and regional events.

* The Institute defines 'early career' as meaning someone who is, as of 1 September 2020 (and allows for career breaks, e.g. parental leave):

1. within 10 years of the start of their first employment (or self-employment) in a materials, minerals or mining related role, or

2. within 6 years of completing their PhD (in a relevant subject), whichever is sooner.

Note - the 10 years from the start of first employment would not normally include any apprenticeships (or equivalent training scheme).

www.iom3.org/secc

CHAIRMAN

Mr Dave Evetts CEng FIMMM
Chair, IOM3 Local Affairs Committee

JUDGES

Dr Phil Bischler CEng CSci FIMMM
Chair, Members' Board

Dr David Stanley
Training & Skills Manager, The Henry Royce Institute

Stewart Bullock CEng FIMMM
Vice-President, Midland Institute of Mining Engineers

Dr Aimee Goodall MIMMM
Vice-Chair, Student & Early Career Committee

PRIZES

1st - £750 plus The Worshipful Company of Armourers and Brasiers Medal

2nd - £400

3rd - £200

All participants receive a £150 prize, sponsored by The Worshipful Company of Armourers and Brasiers, in recognition of their selection as a regional finalist.

Further Information

efi.fragkou@iom3.org or visit **www.iom3.org/yplc**

PRESIDENT'S ADDRESS

Welcome to the 2021 UK final of the Institute of Materials, Minerals and Mining Young Persons' Lecture Competition.

The Young Persons' Lecture competition is always a highlight of the IOM3 Annual calendar. Tonight, contestants from all over the country will take part to win, not only the prestigious national award, but also the exciting opportunity to represent the UK in the Young Persons' World Lecture Competition final to be held virtually in November.

As in previous years, we will be hearing from the finest young speakers from the IOM3 community around the UK. Just to be here, the speakers have already won their local and regional finals, a considerable achievement in itself, and I would like to congratulate them all for making it this far and wish them the best of luck.

The ability to talk to a non-specialist audience, clearly, concisely and with enthusiasm has never been more important. The Young Persons' Lecture Competition is all about developing these skills in the next generation of materials, minerals and mining professionals. I am sure we will be hearing about a range of fascinating subjects and learning a great deal, but it is important to realise that this competition is about recognising and celebrating the communication skills of the presenters rather than their undoubted technical ability. Each speaker will talk on a subject of their own choice for 15 minutes before answering questions from our panel of judges. This year the challenge is made all the greater as for the second time we are hosting the event virtually. I'm confident that our speakers will demonstrate to us all how to make best use the virtual platforms that have come to dominate our lives over the last twelve months.

Finally, I would like to thank everyone who makes this competition possible – the contestants themselves, our panel of judges, the team at IOM3 and importantly our sponsors. This year we are fortunate to be again generously supported by our long term sponsors The Worshipful Company of Armourers and Brasiers, The Midland Institute of Mining Engineers and The East Midlands Metallurgical Society and also to welcome our newest sponsor The Henry Royce Institute.

Neil Glover CEng FIMMM
President, Institute of Materials, Minerals and Mining

HENRY ROYCE INSTITUTE

The Henry Royce Institute is proud to partner with IOM3 in supporting the Young Person's Lecture Competition. Royce shares with IOM3 a passion not only for developing the next generation of materials, but also the next generation of materials scientists. Prior to winning both the national and global Young Person's Lecture Competition in 2020, PhD student Morgan Lowther was awarded a grant to access some of Royce's world-class imaging equipment to support his research into 3D printed medical implants.

The Henry Royce Institute is the UK's national institute for advanced materials research and innovation. Royce was established to ensure the UK can exploit its world-leading expertise in advanced materials and accelerate innovation from discovery to application. With investment of over £330 million from the Engineering and Physical Sciences Research Council (EPSRC), Royce is ensuring that both the UK academic and industrial materials community have access to world-class research capabilities, infrastructure, expertise, and skills development.

From future cities and their energy supplies, to computing, manufacturing and medicine, the research and innovation facilitated by Royce has the potential to significantly impact peoples' lives. With its Hub in Manchester and with capability distributed across nine founding Partners, Royce works collaboratively to create real solutions and make a fundamental difference to the UK economy.

Through a variety of access grants, Royce offers students, academics, and industry world-class equipment, expertise and training, to support their advanced materials research.

David Knowles
CEO, Henry Royce Institute

admin@royce.ac.uk
www.royce.ac.uk

THE WORSHIPFUL COMPANY OF ARMOURERS AND BRASIERS

The Armourers & Brasiers' Company is one of the largest private sponsors of education and research in Materials Science in the UK. It is a livery company of the City of London, tracing its origins back to 1322. The Company's home, Armourers' Hall, has occupied the same site since 1346. The Armourers & Brasiers were engaged in the control and development of the armour and brass trades in London from medieval times until the industrial revolution, ensuring quality control, supporting the training of apprentices and encouraging manufacturing innovation. From its beginnings the Company engaged in philanthropy. In earlier centuries this was largely for the welfare of its members and their dependents but since Victorian times it has increasingly targeted its charitable giving towards science education and research, with a particular focus on Materials Science. Currently it gives over £220,000 each year for this purpose, mainly in small grants to numerous beneficiaries ranging from primary schools through to universities. In July 2020 the Company through its charitable arm the Gauntlet Trust, gave its largest ever gift to established the Armourers & Brasiers Chair in Materials Science at Imperial College to mark its 700th Anniversary in 2022.

Mike Goulette FREng CEng FIMMM
Master, the Armourers & Brasiers' Company

www.armourershall.co.uk

MIDLAND INSTITUTE OF MINING ENGINEERS (MIME)

The Midland Institute of Mining Engineers was formed on the 7 June 1857 in Barnsley South Yorkshire. The first meeting was of fourteen prominent mining engineers for the purpose of discussing the formation of an Association having for its objects 'the more general diffusion of practical and scientific knowledge for the working and ventilation of coal mines'.

This association was known as 'The South Yorkshire Viewers Association' and it was not until 1868 that the name of Midland Institute of Mining Engineers was first used to reflect the changing and more broadly based requirements of the expanding coal industry.

Today the coal mining industry in the area has unfortunately closed; however, the Midland Institute of Mining Engineers has developed to include a range of other Mining and Mineral related disciplines. It currently has round 800 members with a substantial number of these being Younger members and covers the areas of Yorkshire, Nottinghamshire and Derbyshire. The Midland Institute of Mining Engineers objectives are the advancement in the public interest of the engineering, science and practice of the extraction and processing of natural resources, and the education of those involved in such activities and of the general public."

It's aims are:

- To promote science and mineral extraction engineering
- To encourage and foster skills in mineral extraction engineers
- To provide a forum for discussion of mineral extraction related issues
- To arrange publication of papers and disseminate information
- To promote safe working practices within mineral extraction
- To enhance members appreciation of new practices and techniques

The Midland Institute of Mining Engineers has 3 trust funds:

- The Peake Fund – Travelling Scholarship no age limit to applicants
- The Webster Fund – Travelling Scholarship applicants up to age 35
- The AMCO Bursary – to aid members in short-term work-related training of students (placements)
- The 3 Trust Funds can also at times be used to make additional awards for student activities such as field trips, attending seminars and conferences, it encourages and pays the student membership fees for those students who join the MIME dependent on the course length and subject studied

These funds are also used to support the educational experience for younger members of the Institute of Material, Minerals and Mining in the form of this Young Persons' Lecture Competition.

The Midland Institute Promotes the YPLC running its own competition the J. F. Tunnicliffe paper competition – C. S. Littlewood memorial award

This competition also serves as a local heat of the IOM3 Young Persons' Lecture Competition.

The Midland Institute of Mining Engineers has a younger persons' section with its own chairperson. They organise field trips, mine visits underground and open pit, visits to manufacturers and joint meetings with other interested groups such as British Tunnelling Society.

Steve Straw FIMMM
Honorary Secretary, Midlands Institute of Mining Engineers

EAST MIDLANDS MATERIALS SOCIETY (EMMS)

East Midlands Materials Society are proud to continue to support the National final of the Young Person's Lecture Competition. We have run a local heat for well over fifteen years now, and our winners have had some success in the finals.

EMMS is a Local Society which has technical meetings in Derby, Leicester, Loughborough and Nottingham and has been in existence since 1950. We have also run successful conferences, currently one every three years. Our last, 'Energy and the Environment – Materials Making the Difference', was organised in conjunction with the Energy Materials Group of IOM3. It was well received and enjoyed a wide range of support. We are fortunate to receive support from Rolls-Royce and the Universities of Derby, Leicester, Loughborough Nottingham and Nottingham Trent. Our attendees include people from local industry, colleges and the universities. We do much to support our local students, sponsoring many of them to become IoM3 members. We also refund travel expenses for students travelling to meetings and give financial support for students to attend and present papers at conferences. We also support local schools, sponsoring the Loughborough University outreach programmes and Materials Matter in the past.

We are always looking at new initiatives. We have recently organised a local research seminar and promoted Women in Engineering and Women in Materials at a recent event. This season we have met the challenge of running virtual events and have had a very well attended series of technical meetings.

Most of our committee members have full-time careers, so we run the society with a minimum number of committee meetings, doing most of our business by electronic communication.

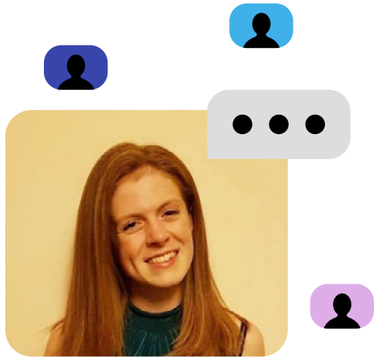
We are a lean, well run Local Society, making a significant contribution to the region.

Dave Evetts

For more information: www.iom3.org/group/east-midlands-materials-society-emms.html

PROGRAMME

17.00	**Join**
17.10	**YPLC Welcome & Introductions** Neil Glover CEng FIMMM - President, IOM3 Mike Goulette FREng CEng FIMMM - Master, The Worshipful Company of Armourers & Brasiers Dave Evetts - Chair, Local Affairs Committee
17.20	**Catriona Breasley, Scotland** Deep-Sea Hydrothermal Manganese Deposition beneath the Arctic Ice Sheet
17.40	**Mia Maric, North West & North Wales** How do Hexagonal Materials Recrystallise?
18.00	**Alex Dickinson-Lomas, Midlands** Using Complementary Characterisation Techniques to Understand Radiation Damage in Nuclear Reactor Pressure Vessels
18.20	**Break**
18.30	**Camilla Hurst, South East** The role of materials and surfaces in the transmission of bacteria
18.50	**Alastair Houston, South West & South Wales** Finding Success in Failure
19.10	**Frances Livera, North East** Improving the Complementarity between Additive Manufacture and Brazing
19.30	**Networking / Q&A with the finalists**
19.50	**Young Persons' Lecture Competition UK Final Results** Announced by Dr Phil Bischler CEng CSci FIMMM, Chair of the Judging Panel

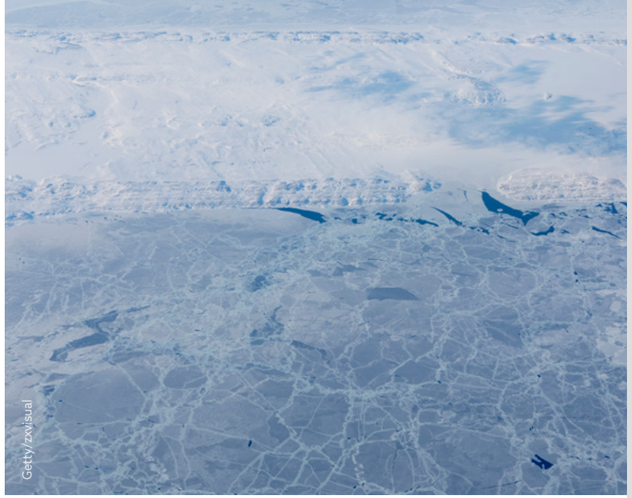


CATRIONA BREASLEY
SCOTLAND

Catriona is a fifth year MGeol student in the School of Earth and Environmental Science at the University of St Andrews. She is currently researching the formation of hydrothermal manganese deposits at mid ocean ridge spreading centres under the supervision of Dr Eva Stueken and Dr Michael Byrne for her MGeol thesis.

She undertook an exploration geology internship at Cornish Lithium Ltd. in the summer of 2019 which inspired her to continue into further study looking at lithium deposits. This year, Catriona will start a PhD under the supervision of Dr Lee Groat at the University of British Columbia looking at lithium rich pegmatites.

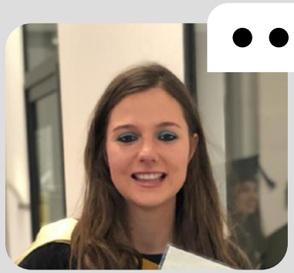
Outside of academia she is an avid hiker, tennis player and loves to collect plant fossils along the beautiful Fife Coastal Path.



DEEP-SEA HYDROTHERMAL MANGANESE DEPOSITION BENEATH THE ARCTIC ICE SHEET

Deep-sea hydrothermal manganese deposits are known to be significant sources of rare earth elements and other critical metals. Found in a variety of settings, these nodules, crusts and enriched sediments have the potential to be economic sources of metal exploration and extraction.

Gakkel Ridge represents one of the least studied hydrothermal ridge systems in the world. Located beneath the Arctic Ice sheet, exploration and sample analysis is logistically difficult and expensive. Using Ocean Parcels software, a manganese decay and deposition kernel is implemented and sensitivity tested to show areas of enrichment around well studied vent sites across the world. This model is implemented onto Gakkel Ridge where areas of enrichment are located, and likely deposit formations are hypothesised. This talk ultimately aims to explain factors influencing manganese deposit formation, assess the use of advection-based modelling to predict manganese deposit formation and finally discuss these implications for deep sea mining.



MIA MARIC
NORTH WEST

Mia is a third year international PhD student studying Materials Science at the University of Manchester. She completed her undergraduate degree at the University of New South Wales in Sydney Australia, where she won the university medal for the top performing student in Materials Science and Engineering. Mia conducted an internship at the Australian Nuclear Science and Technology organisation, where her passion for nuclear materials and their useability within the nuclear power industry was developed. During her studies, she has been thoroughly involved in an array of outreach activities particularly focusing on equity, diversity and inclusion work. Earlier in 2021, Mia was selected to attend the global young scientist symposium where her passion for encouraging females within science and technology to pursue and excel in research related careers was enhanced.

Outside of research, Mia enjoys playing hockey, running and hiking. When not doing sports, she can be found volunteering at the local cat shelter and trying to bake the perfect chocolate chip cookie.

HOW DO HEXAGONAL MATERIALS RECRYSTALLISE?

Recrystallisation of Hexagonal alloys is extensively utilised within both industrial and research applications as a means of microstructural development and mechanical property refinement. However, the multifaceted nature of this process has meant that the mechanistic drivers for the microstructural as well as textural evolution that occurs during heating is not yet understood. Here, a range of experiments combined with computational modelling techniques have been able to highlight that the deformation imparted onto the alloy prior to recrystallisation strongly dictates its behaviour during heating.

In this study we have developed a model to correlate the deformed microstructure to the strong orientation dependent texture change that is seen in hexagonal alloys during recrystallisation. Therefore, an understanding of the relationship between deformation and recrystallisation is essential if heat assisted texture control is to be utilised as a cost-effective method for mechanical property enhancement of hexagonal alloys.

ALEX DICKINSON-LOMAS
MIDLANDS

Alex is a PhD student in the School of Metallurgy & Materials at the University of Birmingham. She completed a BSc in Nuclear Science & Materials in 2018 and an MSc in Nuclear Decommissioning & Waste Management in 2019. After an MSc project based in the Cavendish Nuclear radiometric physics team, Alex stayed in the beautiful West Cumbria and started a role as a mechanical engineer for Arup in 2019. This gave brilliant insight into the decommissioning and engineering challenges faced by the aging nuclear sites in the UK and reignited an enthusiasm for understanding materials in a nuclear context. With a hankering for some more fundamental science Alex started a PhD project looking at radiation damage in nuclear materials under the supervision of Dr Yu-Lung Chiu and Professor Martin Freer in August 2020.

Outside of materials science she can often be found clinging to the sides of mountains, swimming in lakes or embarking on sewing projects.

USING COMPLEMENTARY CHARACTERISATION TECHNIQUES TO UNDERSTAND RADIATION DAMAGE IN NUCLEAR REACTOR PRESSURE VESSELS

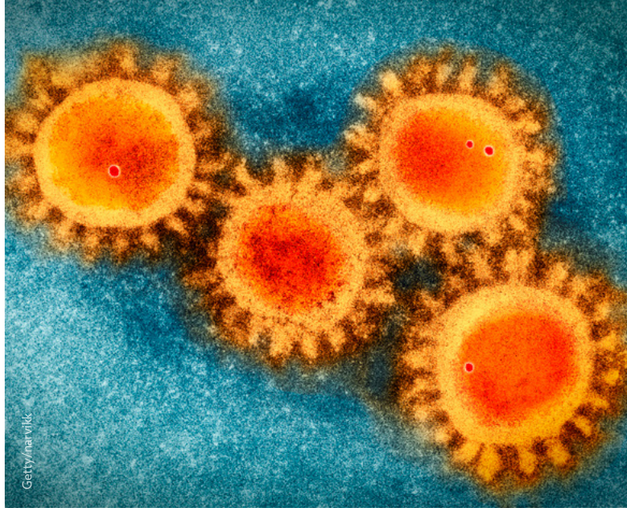
Extending the lifetime of nuclear reactors to improve sustainability is essential for the global future of energy generation. The critical component, the reactor pressure vessel (RPV), is subjected to extreme radiation conditions for over 50 years and must maintain structural integrity to ensure safe and secure reactor operation. Understanding the mechanisms and changes in microstructure and mechanical properties of RPV steels will enable more accurate prediction of lifelong performance. Combining a wide range of complementary characterisation techniques holds the key to understanding how these materials change in harsh environments and how we can create better predictive models for their behaviour.

This talk will briefly explain how combining techniques such as mechanical testing, transmission electron microscopy, atom probe tomography and small angle neutron scattering, is not only useful but necessary to underpin predictions and understand material behaviour.

CAMILLA HURST
SOUTH EAST

Camilla is a 3rd year undergraduate reading Materials Science at Corpus Christi College, University of Oxford. Her interest in materials science has stemmed from extracurricular research projects she carried out in high school. These projects have won her prizes internationally, including at the EU Contest for Young Scientist (EUCYS) and the Intel International Science & Engineering Fair (Intel ISEF). She has also been selected to participate in various scientific programs, namely the London International Youth Science Forum and the Weizmann Institute of Science International Summer Science Institute in Israel.

Outside of materials science, Camilla enjoys broadening her knowledge in areas from climate change to female representation in science. She believes in promoting science to the youth, and so has repeatedly volunteered at national young scientist contests. Camilla otherwise likes to spend her time running and painting.



THE ROLE OF MATERIALS AND SURFACES IN THE TRANSMISSION OF BACTERIA

Covid-19 has highlighted the issue of viral transmission not only by particulates, but also via fomite surfaces. This will continue to be a critical issue if we are to prevent other pandemics and problems from antimicrobial resistance. We will see that materials can have an important role in solving this issue.

In my presentation I will discuss which surfaces are problematic in public places by drawing on evidence from a school study. This study shows the types of bacteria that are present as well as the different bacteria survival rates on a variety of materials. Interestingly, the bacterial death rate is highest on some natural woods. This is due to the chemicals involved in the natural defence mechanism of trees. Therefore, we should promote this sustainable material for use on fomite surfaces as much as possible.

ALASTAIR HOUSTON
SOUTH WEST & SOUTH WALES

Alastair is currently working for Minton Treharne and Davies as a Consultant Materials Scientist, where his role is to perform investigations involving materials identification, mechanical testing, and failure analysis for the marine, cargo, and construction industries.

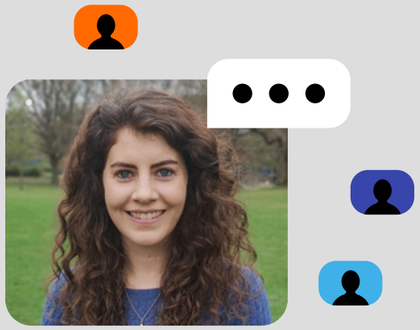
He studied Natural Sciences at the University of Cambridge, specialising in materials science, during which time he researched laser welding, protective coatings and compositional variations in jet engine turbine blades, and the production of new materials used for low-level nuclear waste storage. He continued his passion for materials science by completing a PhD in the Composites and Coatings Group, University of Cambridge, where his research focussed on the development of novel diesel particulate filters containing fine ceramic fibres. During his PhD, Alastair was heavily involved in the teaching of undergraduate students and spreading the joy of materials science through various outreach events.

In his spare time, Alastair enjoys spending time in the great outdoors, and can often be found hillwalking or cycling, as well as honing his juggling skills.

FINDING SUCCESS IN FAILURE

Why did it fail? When did it happen? Who is responsible? — Commonly asked questions in the field of materials failure investigations. Materials will degrade from the moment they are put into service, for example through wear of moving components, corrosion in a harsh environment, or fatigue cracking through repeated motions. Recognising this, materials intended for critical applications are carefully selected to withstand their particular service environment. However, sometimes their expected lifetime can be cut short by an unexpected and catastrophic failure, often with a large price tag for damages and litigation.

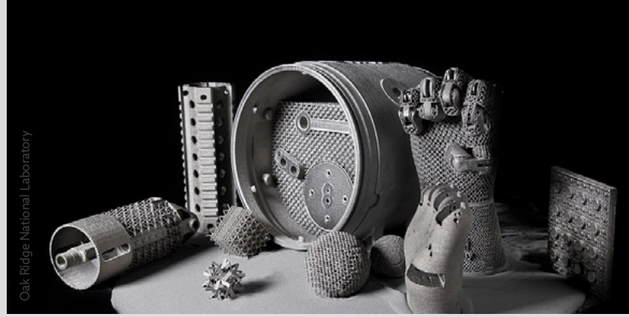
Once the dust settles following such an incident, it becomes necessary to answer the above questions. Through forensic study of failed materials, an investigator must piece together the evidence to find the nature of the failure. This presentation outlines the process of materials failure investigation with recent case studies on corrosion, fatigue and overload.



FRANCES LIVERA
NORTH EAST

Frances is a first year PhD student in Materials Science & Engineering at the University of Sheffield and part of the Advanced Metallic Systems Centre for Doctoral Training. She completed her MChem in Chemistry at the University of York in 2019, and took particular interest in Materials Science during her course. Frances completed her final undergraduate year in industry, working full time at Unilever whilst completing her Masters. The Steel City was calling though, and she began her PhD in 2019, sponsored by the Culham Centre for Fusion Energy. Her research aims to improve the complementarity between Additive Manufacturing and Brazing, under the supervision of Prof. Russell Goodall and Prof. Iain Todd. She is involved in undergraduate teaching, will be hosting a Nuffield Research Placement and takes pride in being a STEM Ambassador, helping to inspire the next generation to pursue careers in STEM.

Aside from academic study, Frances can be found exploring and climbing in the Peak District, playing hockey, or baking up a storm. She has had an international upbringing spanning three continents, and enjoys experiencing different cultures and new places.



IMPROVING THE COMPLEMENTARITY BETWEEN ADDITIVE MANUFACTURE AND BRAZING

Additive Manufacture (AM) and brazing have seen significant research interest individually, but their combination has not been widely investigated. AM is a layer-upon-layer building technique that can produce complex, three-dimensional parts in shorter time frames than traditional manufacturing, but is limited by build size for metal part production. Brazing uses a molten filler metal to create a joint between two materials. Combining the geometrical freedom of AM with brazing could produce complex part geometries and reduce lead-times. The disparity between the surface finish of AM and the smoother roughness requirements for a brazed joint is the main challenge in combining the techniques. An AM surface may be tailored by implementing a topographical structure, to aid braze alloy wettability and control flow direction. The applications of this research are considerable due to the freedom of AM and its increasing popularity as a manufacturing technique in aerospace, medicine and the nuclear industry.

SCORECARD

Please feel free to use the score sheet to compare your assessment with that of the judges

Judging criteria	Max mark	Scotland	North West & North Wales	Midlands	South East	South West & South Wales	North East
Abstract	10						
Structure of lecture	25						
Standard of presentation	25						
Visual aids and physical examples	10						
Technical content	15						
Handling questions	15						
Total							
Lecture time (mins/sec)							
Penalty > 17/19 mins Penalty < 12/13 mins	-5/-10						
Final Score							

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