

Young Persons'
World Lecture
Competition

ONLINE FINAL 2024

THURSDAY
28 NOVEMBER
13.00 GMT

#YPWLC2024

[BIT.LY/2024YPWLC](https://bit.ly/2024YPWLC)





ORGANISING COMMITTEE

Efi Fragkou
Event organiser

Tolu Dada
Design

Lara Collins
Design

Mike Rolph
Communications

SUPPORTED BY

George Ho
Hong Kong

Abdul Hakim Md Yusop
Malaysia

Wendy Knott-Craig
South Africa

Andrew Spowage
China



WELCOME

Welcome to the 2024 online final of the Institute of Materials, Minerals & Mining (IOM3) Young Persons' World Lecture Competition.

This flagship event is a personal highlight for me of the IOM3 annual calendar. I enjoy learning from the finest young speakers from 5 countries around the world who have the chance to showcase their skills and knowledge on a global scale. To be presenting today each of the competitors have already won local, regional and national stage competitions. As such I would like to congratulate them all on behalf of IOM3 for their success so far and wish them the best of luck in this final stage of the competition. Though there can ultimately be only one winner, each of them should be proud of their impressive achievement in reaching this final and the skills they have honed and demonstrated along the way. I am confident we will all enjoy a series of high quality and entertaining presentations and leave feeling both better informed in a range of fascinating topics and confident in the capability of the next generation of materials, minerals and mining professionals.

Although the content of the talks will no doubt be of the highest technical quality, we should not forget that the competition is predominantly conceived as a way of encouraging young materials, minerals and mining scientists and engineers to develop their communication and presentation abilities. The ability to break down complex technical information into an easily understandable message is an important and often overlooked skill. This skill will be needed more than ever to help fight off the growing misinformation we see on so many topics in our industries nowadays.

Today's competition is the seventeenth international event and the fourth to take place virtually, with previous in-person finals having taken place in the UK, Singapore, USA, South Africa, Malaysia, Brazil, Hong Kong, Ireland and Australia. While there were advantages to our in-person competitions the ability to present virtually is a growing and much needed skill for this generation of scientists and engineers. I look forward to seeing how they convey their presentations through this format.

I'd like to thank everyone who has been involved in making this competition so successful. All those who voluntarily gave their time to organise heats and national finals, the IOM3 team who have co-ordinated the competition and brought us together for this final.

Finally, I would like to thank our competitors, our judges and of course our audience. If you wish to have a go at scoring yourself, to compare with the decisions of the judges, then a simplified marking sheet has been included for you within this programme.

Good luck to all our competitors, I hope you are each able to perform to the very best of your abilities.

Dr Kate Thornton CEng, CSci, FIMMM, FWES
IOM3 President

ORGANISED BY



THE INSTITUTE OF MATERIALS, MINERALS & 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



STUDENT & EARLY CAREER GROUP

The Student & Early Career Group (SEC) represents the views of student, younger and early career* members to the IOM3 Executive Board and Advisory Council. We aim to represent the diverse range of members by ensuring Advisory Council representatives cover the different disciplines, regions and career pathways of student and early career* members.

Since the Group 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, Art Lecture, Road to Chartership and Professional Development events, Future Materials Conference and Materially Challenged. 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.

We also want to ensure that we are raising with Executive Board the major issues affecting younger members. To do this successfully, we need to communicate more with members and obtain feedback from events.

* The Institute defines 'early career' as meaning someone who is, as of 1 September 2024 (and allows for career breaks, e.g. parental leave):

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

JUDGING PANEL

Dr Kate Thornton
CEng CSci FIMMM, IOM3 President
Chair, Judging Panel



Kate works as a Lead Research Scientist at Croda in Widnes and her work is focused on sustainable biopolymers.

Kate studied Biomedical Material Science for her undergraduate degree at the University of Manchester. She then went on to complete her PhD in self-assembled peptide hydrogels for the three-dimensional culture of embryonic stem cells at the same university.

Kate first became involved with IOM3 as a student in the Younger Members' Committee (now the Student & Early Career Group) in 2008 and will succeed Neil Glover as President in January 2023.

Dr Michael Kenyon MIMMM
Vice-Chair, Student & Early Career Committee



Michael works for Innoval Technology as a Materials Engineer. Innoval provide consultancy to the global aluminium industry, with expertise in materials characterisation and process improvement across all sectors. Day to day, Michael has two roles, as a physical metallurgist and as a sustainability analyst. As a metallurgist, Michael examines microstructures of numerous aluminium series within the automotive, aerospace and packaging sectors. Michael particularly enjoys characterising aluminium structures by utilising optical, scanning and transmission electron microscopes. In addition to client work, Michael is heavily involved with publicly funded projects, providing metallurgical development and characterisation support. Michael finds collaborative projects incredibly rewarding, working alongside universities and commercial partners, contributing to projects that will increase the awareness and usage of sustainable aluminium for future materials.

With his sustainability hat on, Michael conducts studies for clients including Life Cycle Assessments to better understand and improve the footprint of their products and processes. Michael previously studied for a PhD in Advanced Metallic Systems at the University of Manchester, investigating the evolution of dispersoids in Al-Mg-Si based automotive alloys with varying impurity levels; a project sponsored by Novelis. Outside of work, you'll find Michael with a camera in his hand, focusing on landscape, animal and astrophotography. Michael has been a keen Table Tennis player for many years, playing across the country.

Mr Martyn Jones
CEng FIMMM
Chair, Members' Board

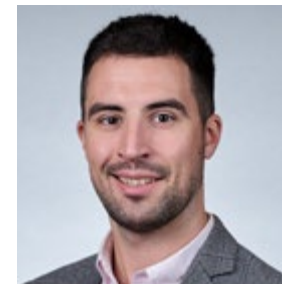


Martyn is currently working for Rolls-Royce plc in Repair Technology, where his role is to develop strategic repair technologies and to support current repair capability acquisition programmes. He is also reading for his PhD with the University of Sheffield which is part-time and industrially based. Prior to working for Rolls-Royce plc he graduated from the University of Sheffield with a first class honours degree in Aerospace Materials, which included a 5-month internship which was completed with Rolls-Royce. It was following this placement that he gained a place on the Rolls-Royce plc graduate scheme. During his time on the graduate scheme, he became a STEM ambassador, leading a project aimed at encouraging school children to go on to study STEM subjects by enthusing them about science and maths - one of his passions!

His other academic achievements include being awarded the Nesthill medal for work on physical metallurgy and the Armourers and Brasiers medal for greatest distinction shown by candidates reading for BEng (Level 3) or MEng (Level 4).

In his spare time he regularly officiates in grass roots football and also enjoys travelling.

Dr Ilija Rasovic MIMMM
Event Co-ordinator
Chair, Student & Early Career Committee



Ilija is Associate Professor at the University of Birmingham. He earned his MEng in Materials Science from Corpus Christi College, Oxford, followed by a DPhil in Materials from St Cross College, Oxford. His primary research interests focus on fullerenes and supramolecular systems with particular application in biomedical contexts.

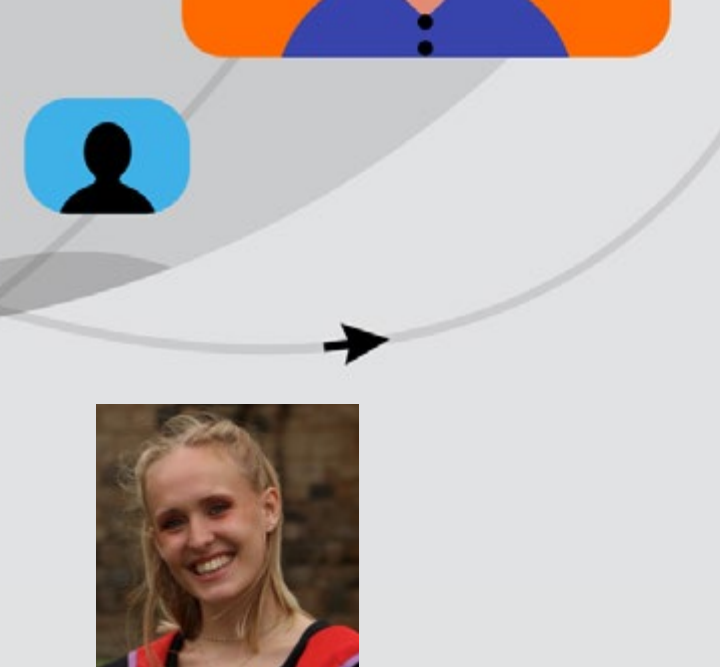
Ilija is an award-winning science communicator, having won IOM3's international Literature Review Prize in 2016 and finishing second in the Young Persons' World Lecture Competition in 2017, amongst receiving other best talk prizes at international conferences and scientific meetings. He is also currently Advanced Materials Engineer at P1 Graphene Solutions, having previously worked on placement at Jaguar Land Rover and as a CNC miller for Lesk Engineers.

Ilija is involved in numerous outreach and engagement activities as a STEM ambassador and is committed to both championing Materials Science as a subject and inspiring students of all backgrounds to pursue further study at university. He is a trustee of the newly formed charity, Break Off Labs, whose aim is to widen participation in STEM research.

PROGRAMME

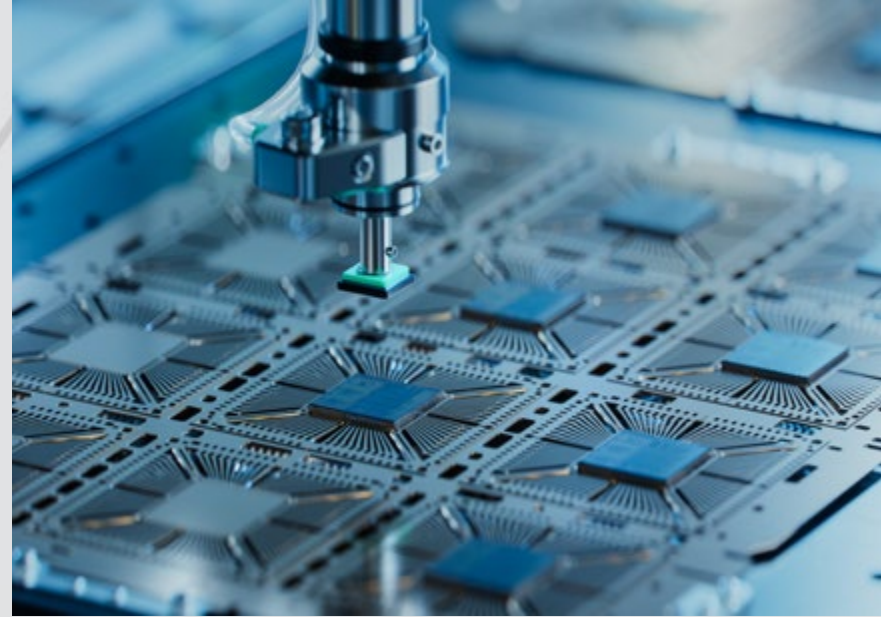
13:00	Login
13:10	Welcome & introductions
13:15	Why strained semiconductors are like crinkle-cut crisps Emilia Russell, UK
13:35	A deep learning-based framework for automatic rock core logging Sihao Yu, Hong Kong
13:55	Dislocation-based toughening and damage-tolerance in oxide ceramics Oliver Marian Preuß, FEMS
14:15	Biodegradable Mulch Biofilms Potential Environmentally Friendly Alternative for Agricultural Mulching Sebasa Theresa Ramahlare, South Africa
14:35	MXene: Pursuing Fast-Charging Battery Jerome Liew, Malaysia
14:55	Networking, Q&A with the finalists Update from IOM3 Student & Early Career Group (IOM3 SEC Group))
15:15	Results
15:30	End

* time zone = GMT



EMILIA RUSSELL UNITED KINGDOM

Emilia Russell is a 2nd year PhD student in the Department of Engineering at Durham University, currently investigating the impacts of mechanical strain on the electrical properties of 2-dimensional semiconductors. In her free time, she enjoys sailing and organising seminars from industry speakers with the Women's Engineering Society at Durham.



WHY STRAINED SEMICONDUCTORS ARE LIKE CRINKLE-CUT CRISPS

When applying strain to 2-dimensional transition metal dichalcogenides, it has been observed that the bandgap changes. The bandgap is the potential difference between the highest energy bounded (immobile) electrons and the delocalised (mobile) electrons.

Crinkle cut crisps taste better because they hold more salt, crinkle cut semiconductors insulate better because they hold more electrons.

This effect could be exploited in the next generation of synthetic skin. It could also be used to design flexible acetylene detectors to monitor food expiration, reducing food waste. To date, the relationship between mechanical strain and electronic properties has predominantly been shown through computational modelling. This research focuses on overcoming the issues that have hindered the realisation of these devices, such that the effects of strain on other semiconductor properties can be investigated. In turn, this will lead to a better understanding of the electrostatics and charge transport of these novel 2-D materials.



A DEEP LEARNING-BASED FRAMEWORK FOR AUTOMATIC ROCK CORE LOGGING

Rock core logging plays a crucial role in obtaining geological and geotechnical information such as lithology and Rock Quality Designation (RQD). However, traditional rock core logging procedures are often tedious and time-consuming, especially for highly fractured rock cores. Have you ever imagined that such domain-professional work could be aided by artificial intelligence? Prof Louis Wong and his research team at HKU have developed an autonomous framework for performing core logging that mimics human processes.

This presentation will showcase ongoing research to further improve automatic lithology classification and RQD estimation. A deep learning-based framework has been trained to classify rock cores into different categories. Moreover, this framework can also segment cores at a high accuracy, allowing the subsequent automatic RQD calculation. Upon further verification, the plan is to update the framework and integrate it into a publicly accessible website for widespread use.



SIHAO YU HONG KONG

Sihao is a 2nd year PhD student in the Department of Earth Sciences at the University of Hong Kong, under the supervision of Prof Louis Wong. He earned his BEng (2020) in Civil Engineering from Southeast University, China, followed by an MPhil (2023) in Geotechnical Engineering from Tongji University, China. His current research focuses on the application of artificial intelligence in geotechnical engineering practice, particularly advanced computer vision techniques.

In his spare time, Sihao enjoys outdoor activities like hiking and ball games.



OLIVER MARIAN PREÜß FEMS

Oliver studied Materials Science at the Technical University of Darmstadt, Germany. After investigating the mechanical properties of diamond coatings during his Bachelor's thesis, he did his Master's thesis in the field of dislocations in ceramics in 2021, under the supervision of Dr Xufei Fang. Continuing this topic, he started a PhD on dislocation-based toughening in ceramics co-supervised by Prof Dr Jürgen Rödel and Dr Xufei Fang.

Oliver attended 3 international (incl. USA and Japan) and 5 national conferences and was the winner of the 2024 FEMS Master Thesis Award. His first paper achieved 'Editor's Choice' by the American Ceramic Society and he also won three prizes in the ceramographic competition of the American Ceramic Society, including the Roland B Snow award for best-of-show. In his free-time, he practices luthiery and builds his own guitars.



DISLOCATION-BASED TOUGHENING AND DAMAGE-TOLERANCE IN OXIDE CERAMICS

The growing research interest in dislocation tuned functionality in ceramics is evident, with the most recent proofs of concept for enhanced ferroelectric properties, electrical conductivity, and superconductivity via dislocations. In this study, we focus on dislocation-tuned mechanical properties and demonstrate that, by engineering high dislocation densities (up to 10^{14} per m^2) into $KNbO_3$ at room temperature, the fracture toughness can be increased by a factor of 2.8 compared to the reference.

A strong interaction between the dislocations and the ferroelectric domains was found, whose effect on the toughness is ruled out by a high-temperature indentation experiment. By an improved deformation technique, the dislocation density in MgO can reach over 10^{15} per m^2 , which leads to full crack suppression.



BIODEGRADABLE MULCH BIOFILMS POTENTIAL ENVIRONMENTALLY FRIENDLY ALTERNATIVE FOR AGRICULTURAL MULCHING

Plastic mulching materials are used in agriculture, providing advantages to crop production. Conventional plastic mulch presents challenges with disposal, increasing pollution, and breakdown into microplastics, leading to ecological problems. The current materials are synthetic and nondegradable, raising environmental concerns. This work was conducted to develop biobased plastic materials from biopolymers and biomass waste residues. Local biomass was used to modify biodegradable polymers to tailor biodegradability to suit the mulching of different lifecycles.

The physical and chemical properties of the materials were studied. The optimized mulch plastics were taken for laboratory and agricultural field trials to test the value proposition and practicality of use. The results revealed good properties comparable to conventional nonbiodegradable mulch plastics, with the added advantage of 100% biodegradability. These offer a sustainable alternative to traditional plastic mulch, which reduces plastic pollution.



SEBASA THERESA RAMAHLARE SOUTH AFRICA

Sebasia is from Mohodi ga Manthata, a village in the Limpopo province, South Africa. She has a BSc in Chemical Engineering from the University of Witwatersrand and is currently working at the Council for Scientific and Industrial Research (CSIR) in the Pretoria Gauteng province. She is on a 3-year graduate-in-training programme in the Advanced Polymer and Composites (APC) group in the Chemicals cluster, currently working on a project titled 'Biodegradable films: Potential Environmentally Friendly Alternative for Agricultural Mulching'.

Sebasia hopes to pursue my postgraduate MSc in Chemical Engineering in 2025.



JEROME LIEW MALAYSIA

Jerome Liew is a PhD candidate at Universiti Malaya (UM) studying Doctor of Philosophy in Physical Science. He is zealous in his research in energy storage devices and has participated in numerous exhibitions, competitions, and conferences with awards. He won top 3 in Faculty of Science 3-Minute Thesis at UM twice consecutively, and actively took part in International Invention, Innovation & Technology Exhibition (ITEX'23 & ITEX'24).

He and his group won a Gold Award and a special award in 'Technology Reversing Climate Change' in ITEX'23. Recently, he received a scholarship to attend Green Chemistry Summer School in Venice, Italy. He aspires to make technological advancements in the field of energy storage devices and desires to bring breakthroughs in electrified vehicles in the advent of Electric Vehicles.



MXENE: PURSUING FAST-CHARGING BATTERY

The presentation exploits the properties of MXene in its incorporation with silicon-based anodes. Various MXene synthesis methods were examined for the best MXene without the direct usage of hydrofluoric acid. Silicon anode faces the issue of massive volumetric changes during charging and discharging that cause its pulverisation, limiting its practical applications.

By electrostatic assembly of MXene and silicon and the coating of the composite thereof, the exorbitant aspect ratio of MXene provides extra active sites for redox reaction, and the 3D matrix formed by MXene establishes electronic transport pathways and promotes carrier transfer, increasing rate performance. The matrix also provides mechanical integrity to the composite, confining silicon nanoparticles from pulverising, and improving the longevity of silicon anodes. This concurrently addresses the restacking phenomenon of MXene due to the intercalation of silicon nanoparticles, demonstrating the synergistic effects of the composite.





I.M3 ADM3

I.M3 EMM3

I.M3 PRIDE

I.M3 SEC

I.M3 WIM3

Join I.M3

No matter your career stage or level of experience, joining the IOM3 community can make a significant impact.

We are committed to connecting professionals across the materials, minerals, and mining sectors, and we support your growth every step of the way.

Find out more at
bit.ly/IOM3-Membership

IOM3 member networks bring together people who may be in an under-represented group in our profession

We have a number of groups within IOM3 focussed on advocating for members - from supporting members at the start of their career to those who identify as LGBTQ+.

Ably Different Member Group (ADM3) | Ethnic Minorities in Materials, Minerals & Mining (EMM3) | IOM3Pride Group | Student & Early Career Group (SEC) | Women in Materials, Minerals & Mining (WIM3)

Find out more at
bit.ly/iom3communities



#WeAreIOM3

Many disciplines. One community. Shaping the future.

I.M3

SEC Hub

**THE SEC
CONTENT &
RESOURCES
GATEWAY**

bit.ly/IOM3SEC_Hub

SCORECARD

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

Judging criteria	Max mark	United Kingdom	Hong Kong	FEMS	South Africa	Malaysia
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						

YPWLC WINNERS



South Africa 2009

Rochelle O'Hara
(UK)



Development of an injectable medical material for spinal repair



Malaysia 2010

Jason Mayers
(Florida)



Enhanced organic photovoltaic cell performance using transparent microlens arrays



Brazil 2011

Mitali Kakran
(Singapore)



Graphene: The new wonder material!



London 2012

Brian Weden
(California)



High performance impact-tolerant and abrasion-resistant materials: Lessons from nature



Hong Kong 2013

Cornelis van Niekerk
(South Africa)



Novel techniques for in-situ laser alloying of AISI 410L stainless steel with nitrogen during laser cladding



US 2014

Raphael Smith
(South Africa)



The design, construction and testing of a hermetically sealed breast platform for dual-modality mammography



Ireland 2015

Kevin Doherty
(Ireland)



New thermal control material systems for interplanetary and geosynchronous spaceflight



Brazil 2016

Li (Alan) Zhong
(Singapore)



Artificial corneal implants: A brighter future with advanced bioceramics



Australia 2017

Vidya Chamundeswari
Narasimhan (Singapore)



Biodegradable scaffold systems for musculoskeletal tissue regeneration with sustained release of multiple bio-molecules



South Africa 2018

Kyle Saltmarsh
(Australia)



Acoustic based condition monitoring in the resource industry



London 2019

Tamlyn Naidu
(South Africa)



Acid mine drainage remediation system using waste products from the steel manufacturing and sugar industries



London 2020

Morgan Lowther
(UK)

Head, shoulders, knees and microbes: 3D printing better implants



London 2021

Hannah Ramsay
(Canada)



Silver clusters: Small material, big potential



London 2022

Rathosivan Gopal
(Malaysia)



Immobilisation of factor VII through polydopamine grafting of polycaprolactone membrane for cardiac bleeding



London 2023

Lodewikus Vorster
(South Africa)



Cyclic potentiodynamic polarization testing of TIG welded 316L stainless steel for characterization of pitting corrosion

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