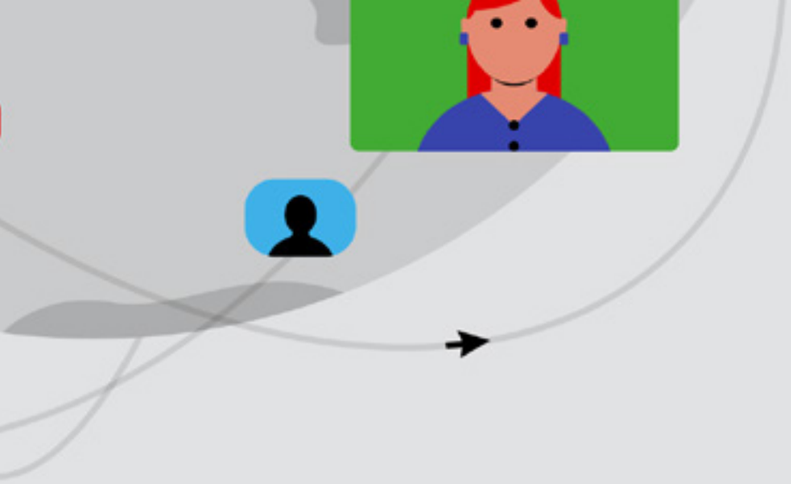
Young Persons' World Lecture Competition

ONLINE FINAL 2023

WEDNESDAY 8 NOVEMBER 12.00 GMT

#YPWLC2023

bit.ly/YPWLC2023final



ORGANISING COMMITTEE

Efi Fragkou
Event organiser

Sophie McDonald
Design

Lara Collins
Design

Mike Rolph
Communications

SUPPORTED BY

George Ho
Hong Kong

Nor Akmal Fadil
Malaysia

Wendy Knott-Craig
South Africa

Andrew Spowage
China

WELCOME

Welcome to the 2023 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

I·M3 Institute of Materials, Minerals & Mining

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

I·M3 SEC

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 Ilija Rasovic MIMMM
Event Co-ordinator

Vice-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.

Mr Martyn Jones
CEng MIMMM

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 Aimee Goodall
CEng CSci MIMMM

Chair, Student & Early Career Committee

Aimee is currently the Through Chain Value Manager for Tata Steel UK. Previous work experience includes working for 4 years as a Process Technology Specialist on the galvanising line in Llanwern, South Wales.

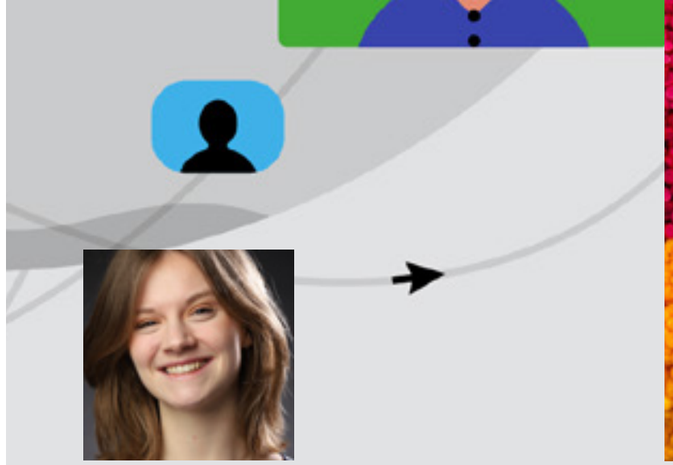
Aimee studied for a Forensic Science undergraduate degree at De Montfort University, Leicester. During the degree she realised her interest for material science. Aimee then carried out a 3-month summer placement at the Corby, Tata Steel site. She gained a PhD in the Phase Transformation and Microstructural Modelling Group at the University of Birmingham looking at the heat treatment of high strength low alloyed steel.

In her spare time, Aimee is a keen reader, swimmer and is part of a musical show choir.

PROGRAMME

12:00	Login
12:10	Welcome & introductions
12:15	Stimuli-responsive polymers as self-healing materials Georgina Burgoyne Morris, UK
12:35	How does thermal shock affect rocks? Zihan Liu, Hong Kong
12:55	Novel energy absorption structure base on 3D printed polymer blend system Chuan Yu, China
13:15	Break
13:25	Band aids for blood vessels: Co-electrospinning of polyurethane/chitosan & polyvinyl alcohol/elastin for vascular patch development Kugambikai Vangetaraman, Malaysia
13:45	Cyclic potentiodynamic polarization testing of TIG welded 316L stainless steel for characterization of pitting corrosion Lodewikus Vorster
14:05	Networking, Q&A with the finalists
14:30	Results
14:45	End

* time zone = GMT



GEORGINA BURGOYNE MORRIS
UNITED KINGDOM

Georgie is a first year PhD student at the Department of Materials Science & Metallurgy at the University of Cambridge, where she stayed having completed her undergraduate degree in Natural Sciences, specialising in Materials Science. Her research, within the Photoactive Materials group, surrounds the development of self-healing polymeric hosts for triplet-triplet annihilation upconversion – a process by which the efficiency of solar cells could be boosted through the ability to usefully harvest sub-bandgap photons.

When she's not in the lab, Georgie enjoys cooking, playing music, and going to pub quizzes.

STIMULI-RESPONSIVE POLYMERS AS SELF-HEALING MATERIALS

The ability to autonomously repair damage can lead to significant improvements in lifetime and recyclability of polymeric materials, reducing both waste and production costs. This may be achieved either extrinsically, through the release of healing agents encapsulated in the polymer matrix, or intrinsically, as a result of dynamic interactions between the polymer chains themselves. The latter systems have the advantage that their healing ability is not reliant upon the presence of a secondary reactive species, giving potential to repair more extensive or repeated damage.

This talk will discuss how, through tuning their chemistry, polymers can be made to intrinsically self-heal under ambient conditions, or in response to external stimuli such as heat or light. It will also explore the variety of applications for these materials, from healable protective coatings to recyclable thermoset resins.

ZIHAN LIU
HONG KONG

Zihan is a 2nd year PhD student in the Department of Earth Sciences at the University of Hong Kong, under the supervision of Dr Louis N Y Wong. He completed a BEng (2019) and MPhil (2022) in Civil Engineering at China University of Geosciences and Shanghai Jiao Tong University, respectively. His research mainly focuses on rock mechanics. His works have been published in journals like Rock Mechanics and Rock Engineering. Zihan tries to understand the complex thermal response of rock materials through experimental and numerical methods. He believes this fundamental research can further expand the knowledge of geotechnical engineering disciplines and promote the development of deep underground space and energy.

In his spare time, Zihan likes playing basketball, running, and swimming. He also enjoys travelling, where he can learn and experience different cultures and lives.

HOW DOES THERMAL SHOCK AFFECT ROCKS?

Have you ever wondered how ancient civilizations break giant rocks without drilling tools or explosives? They harnessed the power of thermal shock by heating rocks first and then cooling them rapidly. Rocks are composed of various minerals with different thermal expansion coefficients and thermal conductivity. When rocks experience rapid heating or cooling, temperature change-induced thermal deformation differs among adjacent mineral grains and thus creates intragranular and intergranular microcracks. Thermal shock sometimes changes the microstructure of rocks and thus permanently alters the physico-mechanical properties of rocks.

Through theoretical and experimental investigation, the mechanical response of rocks under thermal shock loading and influencing factors of thermal shock can be comprehended. Thermal shock has been applied in thermal spallation drilling for excavation and thermal stimulation for reservoir penetration enhancement.

This presentation will provide an overview of the mechanism, influencing factors, and applications of thermal shock in civil engineering.

CHUAN YU
CHINA

Chuan is a graduate of Queen Mary Engineering School where he obtained his bachelor's degree in Polymer Materials and Engineering. Under the supervision of Dr. Han Zhang and Prof. Guangcheng Zhang, his final year project focused on the 3D Printing of polymer composite and its application in energy absorption structure design. After completing his undergraduate program, Chuan is now pursuing a Master's degree in the School of Biomedical Engineering at McMaster University where he studies the application of polymer material in health-related fields.

In his personal life, Chuan enjoys reading, baking and doing outdoor sports. He also likes music and is often found relaxing himself with Blues or light music.

NOVEL ENERGY ABSORPTION STRUCTURE BASED ON 3D PRINTED POLYMER BLEND SYSTEM

Energy Absorption Structure (EAS) is a type of material system designed to absorb high kinetic mechanical energy through irreversible deformation, which is widely used in many applications. This research project selected Fused Deposition Modelling (FDM) method to build up different EAS with a TPU-PVDF polymer blend system. Totally, there are two design strategies used in this project: the gradient configuration design where the EAS is given a gradient structure and the hierarchical design where multi-scale pores are introduced into the EAS.

The success of the two designs in this project strongly depends on the application of FDM 3D printing method whose specific processing procedure will be given in this presentation, together with the performance of the EAS created to evaluate the design strategies used.

KUGAMBIKAI VANGETARAMAN
MALAYSIA

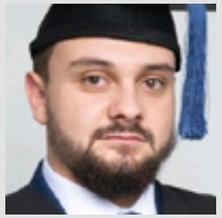
Kugam is currently pursuing her fast-track doctorate programme in Biomedical Engineering upon completion of her degree programme with first class honours in the year 2022. Kugam's passion in research works instigated her to further improve on her degree project in developing vascular patch. Her research interest covers biomaterials and mainly focuses on electrospinning of polymers. Kugam had shared her research innovation during the IJN-UTM Research Convention 2023 and secured third place in the Innopitch Competition held during the 5th International Innovation Day 2023 in UTM. She sincerely envisions making healthcare accessible to all and believes research and innovation is one of the medium to achieve so.

Besides research, her side interests would be weightlifting, yoga and she enjoys witticism.

BAND AIDS FOR BLOOD VESSELS: CO-ELECTROSPINNING OF POLYURETHANE/CHITOSAN & POLYVINYL ALCOHOL/ ELASTIN FOR VASCULAR PATCH DEVELOPMENT

Coronary heart diseases build up fatty deposits occluding blood vessels and restricting blood flow. Surgical treatment is required to substitute the defective tissues with vascular patches. However, current commercialized synthetic vascular patches are non-biodegradable and lead to thrombosis. Therefore, there is a need for biodegradable synthetic polymers such as polyurethane (PU) and polyvinyl alcohol (PVA) for the development of vascular patches. The blending of natural polymers such as chitosan (CS) and elastin (EL) in the matrix of biodegradable polymers strongly enhances the mechanical and biological properties. Electrospinning is a prominent technique for the fabrication of fibrous vascular patches, as it enables polymer to be blended in achieving the desired properties mimicking native vessels.

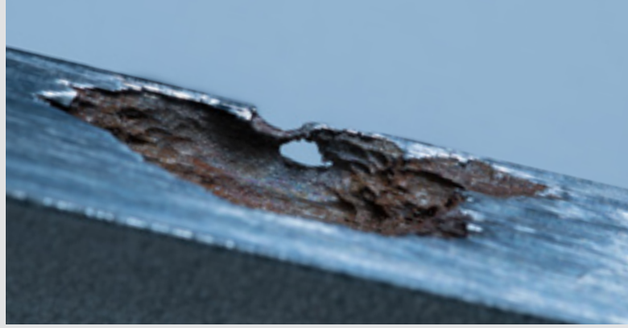
Thus, this lecture emphasizes the introduction of PU/CS and PVA/EL co-electrospun vascular patch, which exhibits biodegradability, elasticity and anti-thrombogenicity, besides being biocompatible and biofunctional to support its implementation as a vascular patch.



LODEWIKUS VORSTER
SOUTH AFRICA

Lodewikus is a first-year master's student in the field of physical chemistry and electrochemical analysis. In 2022, He achieved his honours degree, leaving an indelible mark with a project that sought to revitalize the green hydrogen production initiative in South Africa. This endeavour was about making clean energy solutions accessible to all by enhancing efficiency and reducing costs. In 2023, Lodewikus embarked on an exciting journey as a research student at eNtsa. This experience has been nothing short of transformative, igniting a fervent passion for the world of engineering and materials research.

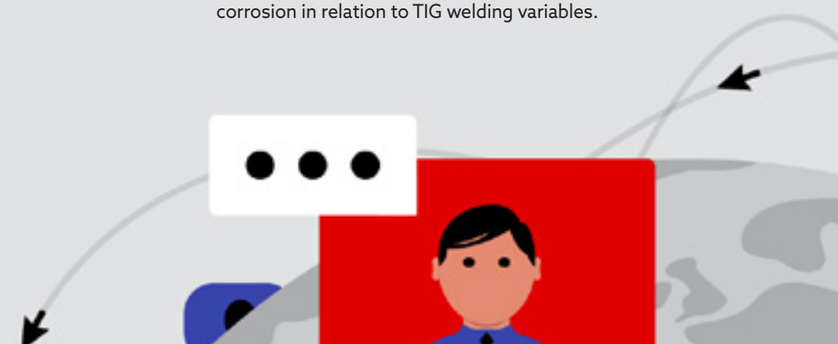
Beyond the laboratory, Lodewikus is an enthusiast of renewable energy and its possibility to improve the lives of everyone. His spare time is often spent expanding his skill set to enter industry where he can start making his mark.



CYCLIC POTENTIODYNAMIC POLARIZATION TESTING OF TIG WELDED 316L STAINLESS STEEL FOR CHARACTERIZATION OF PITTING CORROSION

This presentation focuses on the characterization of pitting corrosion in 316L stainless steel in response to Tungsten Inert Gas (TIG) welding parameters. The presentation will begin by providing a concise overview of pitting corrosion theory before introducing the results of the investigation. Cyclic potentiodynamic polarization testing was conducted to measure the susceptibility of the three different weld zones (base metal, heat affected zone, weld root) present in welded 316L stainless steel to pitting corrosion under different welding conditions.

The presentation will also discuss microstructure analyses of both heat-treated and untreated samples through Scanning Electron Microscopy / Energy Dispersive Spectroscopy (SEM-EDS), offering insights into the material's structural responses. The presentation will conclude with the introduction of a full factorial experimental setup designed to evaluate pitting corrosion in relation to TIG welding variables.



I·M3 SEC

Future Materials, Minerals & Mining Conference 2023

MTC, COVENTRY, UK

Sustainable future

12 DECEMBER 2023

I·M3

Student & Early Career Photo Competition

CLOSING DATE:
10 NOVEMBER 2023

YPWLC WINNERS

Florida 2008
Sinan Al Bermani
(UK)

Digital manufacture for medicine

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

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	China	Malaysia	South Africa
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						

ORGANISED BY

Institute of Materials, Minerals & Mining

ON BEHALF OF

SEC

Young Person's World Lecture Competition