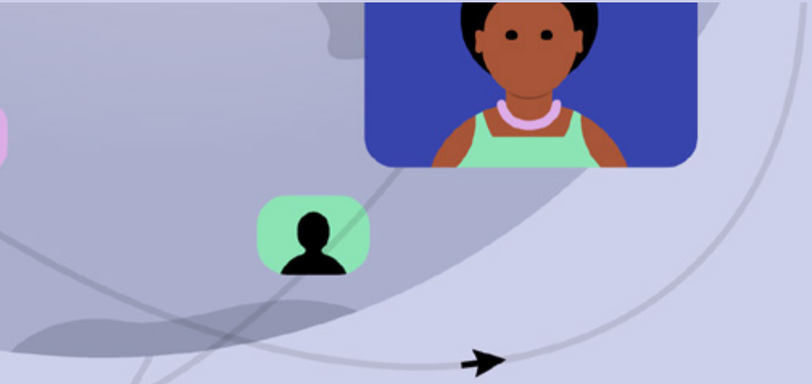
Young Persons' World Lecture Competition

ONLINE FINAL 2021

11 NOVEMBER 12.00 GMT

BIT.LY/YPWLC2021
#YPWLC2021



ORGANISING COMMITTEE

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WELCOME

On behalf of the Institute of Materials, Minerals and Mining (IOM3), I would like to welcome you to the 2021 final of the Young Persons' World Lecture Competition. This annual final has become a flagship event for the Institute. The final is the culmination of many local, regional and national heats held in 7 countries and territories around the world. Each competitor today has won their respective final and on behalf of the Institute I would like to congratulate each of them for this achievement.

Again, this year's competition has had to be very different to previous years due to the global pandemic. Most heats and finals have had to take place online, which has added new skill sets to both the competition organisers and competitors. Also the normal YPWLC final event, where all international competitors take part in a week-long series of talks, tours and visits in one of the competing countries, could not take place. I feel particularly sad about this as we don't have the opportunity to meet and network with each other as we normally do.

The YPWLC competition began in the UK as a way of encouraging young materials scientists and engineers to develop their communication and presentation skills. The ability to convey complex technical information in an enthusiastic and understandable way to a non-specialist audience has become an essential requirement in today's rapidly changing world. The competition today is the seventeenth international event, with previous finals having taken place in the UK, Singapore, USA, South Africa, Malaysia, Brazil, Hong Kong, Ireland and Australia.

I would like to thank all the local society and academic members, both within the UK and abroad, for their help in co-ordinating all the heats and finals. May I also add my personal thanks to the IOM3 organising team, who have worked so hard, under the present difficult circumstances to ensure that this world final takes place.

Finally, I would like to thank you, our audience, for taking the time to support this event. I am sure you will find all the presentations both entertaining and informative. A simplified marking sheet has been included within this programme for you to have a go at scoring each of the candidates.

I wish all the candidates the very best of luck for the competition and hope they perform at the best of their abilities. Your efforts will enable everyone involved in this competition to learn something new, either about ourselves or the ever expanding world of materials, minerals and mining.

Dr Phil Bischler CEng FIMMM APM
Chair of the judging panel

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).

bit.ly/IOM3_SECC

JUDGING PANEL

Dr Philip Bischler
CEng CSci FIMMM

Chair of Judging Panel

Phil Bischler is the Senior Consultant in the Customer and Solutions Department of Magnox where he acts as Portfolio Development Manager for a number of nuclear reactor sites. Other duties involve Strategy Analyst, Intelligent Customer and Design Authority roles in a number of large company projects. In the past, he has worked for Alcan International, British Steel, the Royal Aircraft Establishment and Oxford University. He has also set up and operated a small biomedical consultancy company. He is a member of the IOM3 Council, Managing Board and chairs the Local Affairs Board. He has helped to organise and judge the UK Young Persons' Lecture Competition for over 20 years and has chaired the judging panel for the world event since 2006.

Phil is a Fellow of the Institute, a Chartered Engineer, a Chartered Scientist and a member of the Association for Project Management. In his spare time he is a keen international mountaineer, marathon/mountain marathon runner who likes mountain biking, power kiting and travel. He also actively supports and raises funds for a number of charitable organisations.

Mr Neil Glover
FREng CEng FIMMM

President, IOM3

Neil Glover FREng CEng FIMMM is Head of Materials Research in the Central Technology and Strategy group at Rolls-Royce where he has worked for more than 25 years in materials for the aerospace and marine sectors. He studied Natural Sciences (Materials Science) at the University of Cambridge, UK. Neil has worked on the development, application and through life management of a wide range of materials from light alloys and composites to high temperature superalloys within the organisation.

He first became involved in IOM3 as a student as an opportunity to network with others and learn. He has been involved in local society committees including the East Midlands Metallurgical Society; Secretary of the High Temperature Materials Committee. Neil is a Chartered Engineer and Fellow of IOM3.

Dr Ilija Rasovic
MIMMM

Student & Early Career Committee

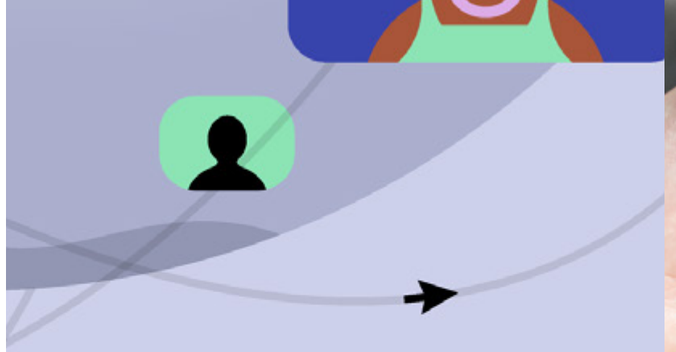
Ilija is a Lecturer at the University of Birmingham. He earned his MEng in Materials Science from Corpus Christi College, Oxford, followed by a DPhil in Materials from St Cross College, Oxford. His primary research interests focus on fullerenes and supramolecular systems with particular application in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

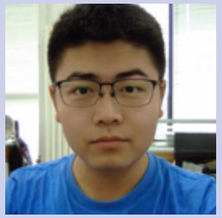
Ilija is an award-winning science communicator, having won IOM3's international Literature Review Prize in 2016 and finishing second in the Young Persons' World Lecture Competition in 2017, amongst receiving other best talk prizes at international conferences and scientific meetings. He is also currently 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

12.00pm	Login
12.10	Welcome & Introductions
12.15	Juncheng Fan, China *Polydopamine-based Antibacterial Coatings: Mussel-inspired Smart and Versatile Platforms for Orthopaedic Implants*
12.35	Mia Maric, UK How do Hexagonal Materials Recrystallise?
12.55	Shane De Beer, South Africa *Computational methods to investigate photocatalysis in metal-organic frameworks*
1.15	Dio Brian Billi, Hong Kong *Design of Edible bi-wax coating on nanocellulose-added bagasse paper for Green and Waste-reducing Food Packaging*
1.35	Break
1.45	Hannah Ramsay, Canada *Silver Clusters: Small Material, Big Potential*
2.05	Ivan Perepletkin, Russia *Integrated geophysical approach to clarify near-surface geological model in the permafrost zone*
2.25	Farah Hannah Abd Nasir, Malaysia *Traps in Organic Semiconductors*
2.45	Networking, Q&A with the finalists
3.15	Results, Q&A with the finalists
3.30	End





JUNCHENG FAN
CHINA

Juncheng Fan is a graduate of BEng in Polymer Materials Science and Engineering from Queen Mary University of London and an incoming MPhil student in Micro and Nanotechnology Enterprise at the University of Cambridge. Juncheng has been participating in many research projects during his undergraduate years, focusing on improving people's health and supporting environmental protection, including developing new materials for medical devices to improve their performance and durability. He designed a bioactive coating for orthopaedic implants that can facilitate bone regeneration and can exhibit antimicrobial ability if given certain stimuli during his undergraduate final-year project.

Juncheng enjoys intercultural communication and has been a volunteer at Queen Mary University of London Language Centre helping Chinese language learners improve their speaking skills since February 2021. During his leisure time, he always explores different kinds of food and goes hiking, and he is a shutterbug!

POLYDOPAMINE-BASED ANTIBACTERIAL COATINGS: MUSSEL-INSPIRED SMART & VERSATILE PLATFORMS FOR ORTHOPAEDIC IMPLANTS

Titanium and its alloys are probably the most popular materials for orthopaedic implants. However, titanium orthopaedic implants are vulnerable to bacterial adhesion due to opportunistic pathogens and may end up with failure. In addition, the incidence of bacterial adhesion can be exacerbated by their poor integration with human tissues. Introducing bioactive coatings on their surfaces is an effective approach to improve implants' interactions with the human body and resistance to bacteria.

Inspired by mussels, polydopamine was found to be able to adhere to almost any solid surfaces. It possesses good antimicrobial activity and can bond a range of chemicals to achieve many purposes like facilitating the formation of bones. More interestingly, polydopamine exhibits responsive behaviours to many in vivo and in vitro stimuli, such as pH and light. Therefore, polydopamine can be utilised to design smart platforms for more effective infection prevention for the next generation of orthopaedic implants.

MIA MARIC
UK

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.

SHANE DE BEER
SOUTH AFRICA

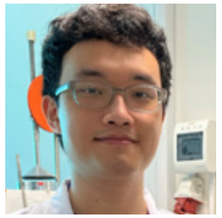
Shane is an aspiring academic in the field of theoretical chemistry. He is currently undertaking his PhD studies at Stellenbosch University after completing his BSc and MSc studies at the University of Pretoria. His research interests include investigating the quantum mechanical behaviours of materials. During his previous studies, he explored chemical bonding using a computational approach and is now seeking to apply similar insights on the bonding in solid state materials. During his PhD, he is also learning experimental spectroscopic techniques to complement the theoretical models on the solid state. Shane has presented his work at the International Symposium on Halogen Bonding and published in the Journal of Computational Chemistry. In future, he aspires to develop theories and techniques to further investigate the quantum behaviours of materials.

Over the weekend, Shane can be found in the world of a thriller novel or enjoying the company of his two dachshunds. Otherwise, he is trying his hand at a new recipe or a new language.

COMPUTATIONAL METHODS TO INVESTIGATE PHOTOCATALYSIS IN METAL-ORGANIC FRAMEWORKS

Metal-organic frameworks (MOFs) are an increasingly important class of compounds in modern research. MOFs are able to absorb CO2 and various other gasses leading to their applications in gas purification. However, MOFs can also be utilised as catalysts. Aromatic ligands are common in MOFs which make them exceptional candidates for photocatalysis. In order to reduce the cost and labour invested in searching for photoactive MOFs, a computational approach can be followed. DFT and TDDFT models allow excited states to be studied to determine whether certain MOFs with the associated guest molecules are viable for photocatalytic reactions.

The research here aims to develop the approach in order to identify host-guest pairs which are viable for photocatalysis. The hope is to provide a novel approach for designing reusable catalysts which can be applied to a wide range of reactions.



DIO BRIAN BILLI
HONG KONG

Dio Brian Billi is a Final Year Undergraduate student studying Materials Engineering at City University of Hong Kong. Originally from Indonesia, Dio has worked on several projects including developing project prototypes for smart city applications and sustainability in protecting the environment. During his 3-year study program, he was able to complete his Final Year Project in CityU to fabricate and innovate in the field of food and material science; a prototype that holds potential in replacing plastic inner-lining in food packaging.

Currently undergoing his own entrepreneurship journey through the CityU flagship HKTECH300 program for start-ups, Dio and his team at OceanVoice HK are looking to protect the ocean environment and safeguard marine ecosystems for the future.

Apart from hunting for Hong Kong's best dessert spots and playing sports during the weekends, Dio enjoys reading fiction novels and talking with his team at OceanVoice.

DESIGN OF EDIBLE BI-WAX COATING ON NANOCELLULOSE-ADDED BAGASSE PAPER FOR GREEN & WASTE-REDUCING FOOD PACKAGING

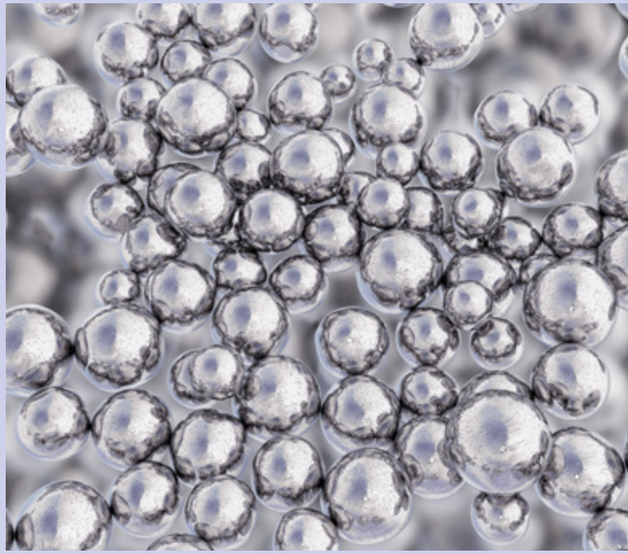
To solve issues regarding wide use of plastics and food packaging contamination during recycling, my project incorporates widely available and bio-degradable materials to create a lightweight and sturdy paper packaging. It is composed of bagasse fibres with nanocellulose fibre addition and lined with an inner coating made of beeswax and carnauba wax. The research yielded positive results; with incorporated nanocellulose improving the tensile and flexural strength of the paper substrate packaging, and the bi-wax mixture inducing super hydrophobicity for food waste reduction and anti-frosting properties for longer shelf life.

Using characterization methods such as water contact angle tests, the 'Lotus' state was induced onto the waxed surface, causing food matter to slide easily and reducing food loss and microbial contamination. With further tuning of fabrication parameters and experimentation, the project shows promise in achieving a frozen or liquid-slurry food-safe packaging prototype that is environmentally safe and easy to recycle.

HANNAH RAMSAY
CANADA

Hannah is currently an MD/PhD Candidate at Queen's University, studying Chemistry. Previously, she obtained her BSc in Life Sciences and BEd in Secondary Education, also at Queen's as part of the Concurrent Education program. Her research focuses on the applications of silver clusters, which are nanosized particles of silver that can be used for the combined diagnosis and treatment of disease. She is excited about helping realize the clinical applications of this material, and moving forward with this research in her role as a future clinician-scientist. Hannah's research is supported by the Alexander Graham Bell CGS Doctoral Award, and has been published in several scientific journals, including Nanoscale.

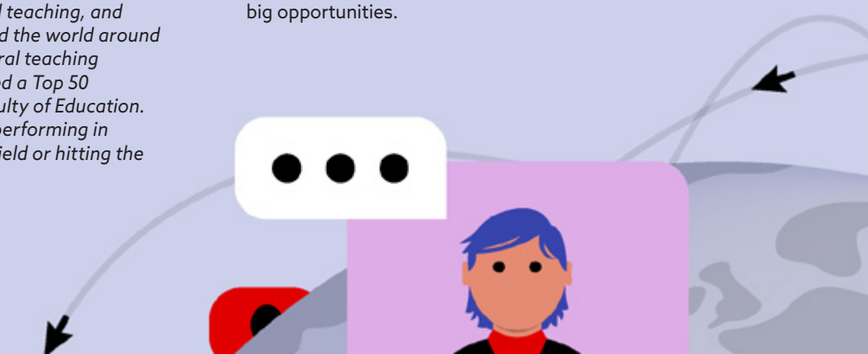
Hannah is passionate about science and teaching, and helping others use science to understand the world around them. This has been recognized by several teaching awards, and Hannah was recently named a Top 50 graduate in 50 years at the Queen's Faculty of Education. In her spare time, you can find Hannah performing in Chemistry magic shows, on the soccer field or hitting the ski slopes!

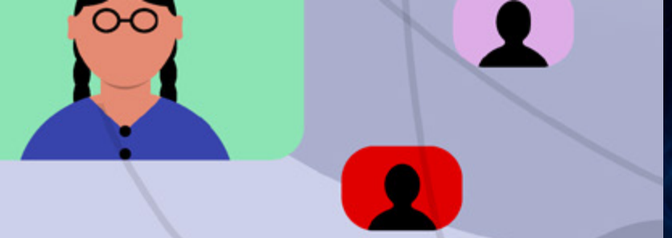


SILVER CLUSTERS: SMALL MATERIAL, BIG POTENTIAL

Silver has been used since prehistoric times- in fact, it is one of the first five metals discovered by humans! What we commonly recognize as silver, for instance the silver in our jewelry, has all the properties of a bulk metal; it is conductive, shiny and malleable. As we look at silver on a smaller and smaller scale, its properties actually change. At nanoscale sizes, silver starts to look red or even yellow in colour. We can use these tiny molecules of silver to do a ton of interesting things, from looking at new drug therapies, to biological imaging to producing solar energy. By controlling the exact size and composition of these molecules, you can target specific cells and binding sites in the body.

The goal of my research is to deeply understand this material and investigate how these really small particles can lead to big opportunities.





IVAN PEREPLETKIN
RUSSIA

Ivan Perepletkin is a graduate from Industrial University of Tyumen. Apart from studying, he is working as a specialist-geophysicist in the biggest scientific centre of 'Rosneft' Oil Company – Tyumen Petroleum Research Centre LLC, on the strategic project of geophysical exploration in North of Western Siberia (Gydan peninsula) at data interpretation direction. In his final thesis, he focused on electromagnetic methods integration together with seismic to refine the near-surface model in one of the gas-condensate fields in Eastern Siberia.

The technical aspects as well as practical results throughout the 3-year work on this project were presented in English at various scientific conferences, such as SPE Student Technical Congress (Aachen, Germany, 2019 and online, 2020), 7th SPE Annual Student Energy Congress (Zagreb, Croatia, 2020), EAGE Annual Conferences and Exhibitions (2018, 2020), XII SPE Scientific and Practical Congress 'Oil & Gas Horizons' (Moscow, 2020), and also published in peer-reviewed journals and proceedings. Apart from studying, since 2017, he has organized various international scientific events, such as conferences, workshops, field trips, etc. in the framework of the SEG Student Chapter team, where he used to be Vice-President and Scientific Committee Chair.

INTEGRATED GEOPHYSICAL APPROACH TO CLARIFY NEAR-SURFACE GEOLOGICAL MODEL IN THE PERMAFROST ZONE

The presentation actualizes a kinematic inversion problem and the most competent electromagnetic methods combination (transient EM sounding and ultra-wideband georadar radiometry) for its solution – refining seismic data in the heterogeneous subsurface zone.

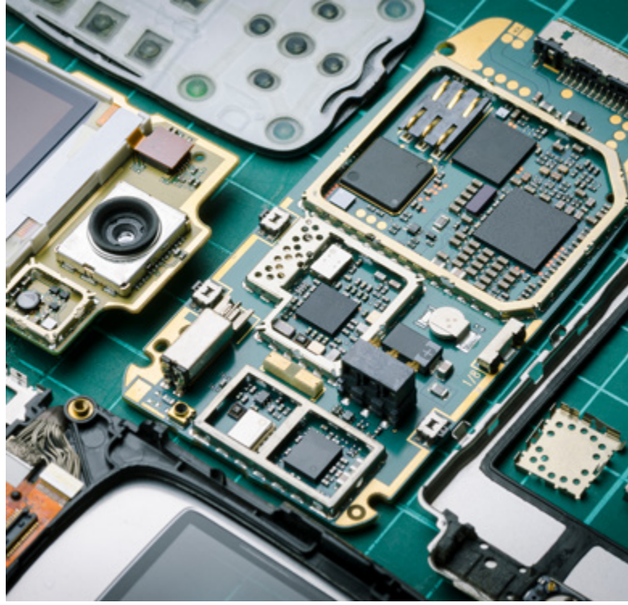
Given detailed theoretical review and empirical interconnections between analyzing parameters shows the complexing rationality. Considered examples of complexing sTEM with seismic data taken from Western and Eastern Siberia with different near-surface zone structure show the saturation forecast increase and correlation sTEM data with the well logging. Method has high horizontal resolution, but gives only averaged resistivity value vertically in particular horizon. Introducing the ultra-wideband GPR radiometry into a single set of methods allows neutralizing this problem and also expanding the studied electromagnetic parameters amount.

These arguments confirmed by the experimental realization while engineering-geological works. Recent technological breakthrough in ultra-wideband georadar radiometry allows already data quality increase in methods' integrated use already in oil and gas fields' areas introduction.

FARAH HANNAN ABD NASIR
MALAYSIA

Farah Hannan Abd Nasir graduated with a Bachelor of Science (Hons) Applied Chemistry from International Islamic University Malaysia (IIUM) in 2017. She is currently a Graduate Research Assistant pursuing her doctoral studies at the Low Dimensional Materials Research Centre (LDMRC) at the Faculty of Science, Universiti Malaya. Her research interests include organic electronics particularly organic light-emitting diodes (OLEDs), computational and theoretical chemistry and doping mechanisms in organic semiconductors. She is also interested to incorporate machine learning and artificial intelligence as an application to design more efficient organic light-emitting diodes.

In her spare time, she likes baking, playing indie video games, learning to code, playing the viola (not the violin!) and the piano. She thinks that science communication is an important skill to have, particularly now with the impending rise of fake news and misinformation.



TRAPS IN ORGANIC SEMICONDUCTORS

Organic semiconductors are organic (carbon-based) materials that can conduct electricity. Their ability to sustain deformation without affecting its conductivity makes them the ideal choice for flexible electronics, thus enabling seamless human-device design interface, opening up various applications in healthcare, the internet of things, and information processing. However, despite their potential, the performance of these organic electronics is still not on par with devices made of inorganic semiconductors.

In this lecture, we introduce some organic electronic materials, as well as their benefits and their current limitations. One such drawback is the prevalent presence of charge carrier traps, which is virtually unavoidable in organic semiconductors. Traps can capture and retain charge carriers, preventing them from being involved in the conduction of electricity, thus acting as a hindrance to an efficient charge carrier transport. We attempt to remedy this issue by adding dopants to the material, thereby filling the trap states. The addition of dopants has been shown to lead to a higher electron current for our chosen material. We believe this increase in electron current will lead to the fabrication of more efficient organic electronic devices.

I·M3 Awards

Nominations are now invited for the

2022 IOM3 Awards & Prizes

Full details and online nominations:
www.iom3.org/awards

Deadline for nominations:
31 January 2022 17.00 GMT

I·M3 SECC

Future Materials Conference

UNIVERSITY OF BIRMINGHAM

#FUTUREMATERIALS

13 DECEMBER 2021

YPWLC WINNERS

London 2006
Andrew Tarpey
(UK)

Structural adhesive use in lightweight vehicle architecture

Singapore 2007
Mary Donnabelle L Balela
(Malaysia)

Cobalt nanoparticles: Synthesis, properties and applications

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

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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

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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

SCORECARD

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

Judging criteria	Max mark	China	UK	South Africa	Hong Kong	Canada	Russia	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								

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