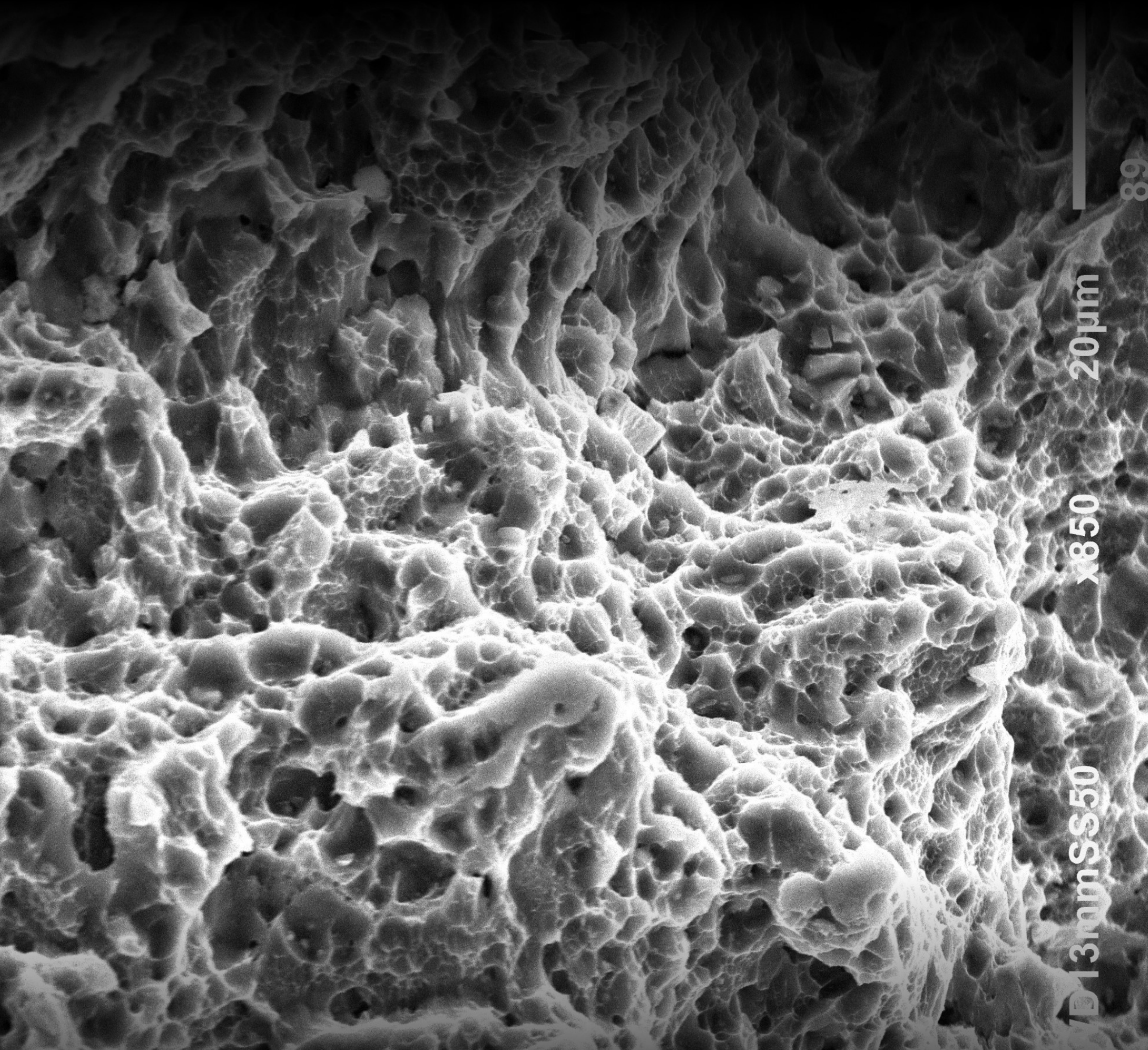
MatSocMagazine

Summer2018



IMPERIAL MATERIALS

Est. 1851

The Materials Society (MatSoc) is a student run organisation which aims to enhance the experience of students studying in this department at Imperial College London, and to promote Materials Science and Engineering both at university and in industry. We achieve this goal through collaborative events, social functions, extra-curricular lecture series, and industrial visits to engage with Materials Science beyond an academic environment.

Our society currently has 695 members, including undergraduate and postgraduate Materials Science students at Imperial, as well as other students studying other subjects who are interested in Materials Science and working in related areas upon graduation.

Image owned by Imperial College London

Photographer: Christian Richters

Contents

IMPERIAL MATERIALS Est. 1851

Welcome to the MatSoc Magazine:

Editors Foreword and Introductions

Amy Tall (Magazine Officer) and Harriet Frier (President) introduce the MatSoc Magazine, the new MatSoc committee for 2018/2019 and say farewell to the committee of 2017/2018.

Welcome to the 2018 Summer edition of the MatSoc Magazine!

Producing the magazine in the Summer term, when exams are everyone's priority, was undoubtedly a challenge. However, despite my fears of struggling to fill the page quota (32 pages for a printed booklet), It feels as though I have been playing the worlds longest and most intense game of Tetris to fit everything in. Once again, the magazine includes a varied range of high quality articles about internal and external events and I am truly confident this edition contains an article of interest to every individual.

To the "freshers" who will be reading this at the beginning of the 2018/2019 academic year, welcome to Imperial, the Royal School of Mines and the Department of Materials. Articles of particular interest to you likely include: 'MatSoc on Tour', 'MatSoc Socially' and 'YPLC London Heats'. I hope you find some time to have a read in your busy first few weeks!

Additionally, I would direct third and fourth years to 'A Career with TTP', an informative feature about preparing for life after your degree. Furthermore, I would like to highlight 'Bauerman Prize Lecture 2018' and 'Molly Stevens Inaugural Lecture'. It is worth noting that both of these lectures were given by influential women in STEM and these features are a must read for anyone with an interest in biomaterials!

Finally, I would like to thank all those who contributed and I encourage anyone who wants to try their hand at journalism to contact me. Enjoy!

Amy Tall
Magazine Officer

Hello everyone, and welcome to the summer edition of the MatSoc Magazine! I hope you find it an exciting read, and maybe it will even inspire you to write something for the next edition! Thank you to everyone who has contributed - without you there would be no magazine.

It has been an absolute pleasure to lead MatSoc this year, and though I am biased, I really do think that this has been the best year for materials yet! We've had a fantastic year that has been absolutely jam-packed with events, both social and academic (often a mixture of both!), and we wouldn't have been able to do any of it without the support of the department and the consistent hard work from the committee. From a successful careers fair, to a series of tasty dinners, and a brilliant tour to Germany, this year really couldn't have been any better. So it just leaves me to thank the department for their support, and the committee for all their incredible work this year. They have given up so much of their time to improve the lives of our students and I am unbelievably proud of what we have achieved.

I'd like to take this opportunity to wish next year's committee the best of luck with everything. I know I will be leaving MatSoc in good hands, and I cannot wait to hear about all the amazing things you will achieve. Finally, I'd like to congratulate everyone on making it to the end of the year! Each year of your degree is difficult in its own way, and I'm sure you have all learnt a lot more than you realise, both academically and personally, so well done!

Best of luck for the next academic year!

Harriet Frier
President 2017/2018

Hello, I'm Abigael and I'm thrilled to be your MatSoc President for the coming year!

Your university experience is vastly shaped by the community you're a part of – ours is awesomely diverse and talented. MatSoc's aim is to create events that help you; whether that's providing chances to get to know students across all years, or helping you to attain commercial awareness and internship/graduate opportunities.

As President, I'll be working with the committee to continue to expand upon our current offerings; mums and dads, socials, lectures, trips and the Careers Fair. In addition to ensuring MatSoc collaborates with more companies that offer visa sponsorship, I'm aiming to introduce new social events including our first Formal Dinner!

Abigael Bamgboye
President 2018/2019

Hey, I'm George and I'm the incoming Vice President of MatSoc.

My job is to strengthen our strong links with industry and help to showcase the talent and diversity of students in the department. Whether this is by a careers fair, trips to industry sites or an international tour, MatSoc will continue to offer the very best opportunities to help you stay motivated and ready for the future!

George Grant
Vice President 2018/2019

Hi I'm Susannah and I will be the Treasurer for MatSoc 2018/19.

I am excited about being part of the MatSoc committee and particularly managing the financial side. I am aiming to set out a clear budget for the year to suitably subsidise events, but also ensure that there is money to roll over to next year's committee.

Susannah Lea
Junior Treasurer 2018/2019

I'm Sam and I will be the Web Officer for 2018/19.

My goal over the coming months is to overhaul the MatSoc website so it can better represent our society, while also adding features to improve functionality for current students such as event calendars and social media feeds.

Samuel Welton
Web Master 2018/2019

IMPERIAL MATERIALS Est. 1851

Hi I'm Schan and I will be acting as Secretary for the coming years MatSoc committee.

Most of what my role entails is behind the scenes. I'm involved in organising committee meetings and facilitating efficient communication between committee members as well as offering assistance for any tasks that might be too much for just one person. Regalia is also on my 'to-do' list and I hope to make sure every society member feels they have a say in designing and personalising their items so that we can all be proud to bear the MatSoc emblem!

Schan Perera
Honourary Secretary 2018/2019

Hey, I'm AJ and I'm excited to be your events officer over the next year.

I'll be working with the team to pack your social calendar with events such as bowling, parties, movie nights, academic events and races around London, culminating in a materials tour abroad. I'm also open to ideas and suggestions, so please don't hesitate to talk to me, so that I can make this year the best for you.

Arinjay Jadeja
Events Officer 2018/2019

My name is Edoardo "Edo" Italia and am honoured to have been elected Sponsorship Officer for the incoming 2018/2019 committee!

As sponsorship officer I am in charge of securing funding from external companies to finance events/trips that take place during the year. I will also be responsible for maintaining the relationship between MatSoc and eventual sponsors- effectively acting as industry liaison. Super excited!

My main aim is expanding the range, industry and nation-wise, of our current portfolio of sponsors.

Edoardo Italia
Sponsorship Officer 2018/2019

Hello, I'm Amy, MatSoc's returning Magazine Officer.

My role is to produce and edit the MatSoc magazine, a professional publication that contains reports of industry visits, reviews of materials related events, interviews with academics and sponsors and student reflections about summer placements and internships. I advertise events taking place throughout the year, commission the writing of features and compile these contributions, producing a magazine containing all things MatSoc! Please contact me if you would like to write an article!

Amy Tall
Magazine Officer 2018/2019

MatSoc on Tour:

Five Days in Stuttgart

A selection of students introduce the establishments they visited on tour, discuss what they learnt and consider how academic research and industry compliment one another.

The discipline of Materials Science and Engineering spans a wide spectrum, from fundamental research to cutting-edge applications. In our lecture halls and laboratories, we see one side of this. But through industrial trips and site visits we can see an entirely different facet.

Following the success of MatSoc's first international tour to Amsterdam in 2017, MatSoc embarked on its second international tour this June, to Stuttgart, Germany. Home to automotive giants, including Mercedes-Benz AMG and Porsche, the Baden-Wattenberg region of Germany is also the base of research institutions and organisations, making it a great place to explore a multitude of industrial applications.

This year's five day tour (with day 1 lost to travelling) featured visits to the **Fraunhofer Institute of Chemical Technology (ICT)**, **Karlsruhe Institute of Technology (KIT)**, the **German Aerospace Centre (DLR)** and a bonus trip to the **Mercedes-Benz Museum**.

By Abigael Bamgboye, 2nd year

As the first institution we visited in Germany, the Fraunhofer Institute of Chemical Technology (ICT) really surprised me. Partly because of its beautiful countryside view, but also because of the glimpse it gave of industrial Germany.

Dr. Stefan Troester, our guide, gave us an insight into some of the projects carried out within Fraunhofer. The Fraunhofer Institutes are a conglomerate of 72 institutes and research units, with over 25,000 staff who work with the aim of taking fundamental research from universities to industrial clients to improve their products. The ICT provided an interesting insight into how Materials Science and Engineering can be used to reduce environmental impact and increase sustainability. The projects that intrigued me the most involved their work on sustainable energy and plastics.

The over-production and poor disposal of plastics has had severe effects on the environment, especially on marine animals and ecosystems. Tonnes of plastic waste is floating on the sea where it is likely to be consumed by aquatic creatures and birds. This has resulted in an intensive effort to find a solution by making use of recycled plastics.

Tarmac produced using recycled plastic

Day 2: Tour attendees learning about sustainable technologies at Fraunhofer ICT

At Fraunhofer, Dr. Troester described how plastic was recycled in Tarmac, by mixing shredded plastic rubbish with bitumen. Beyond theoretically establishing the best formula for industry to manufacture this tarmac, Fraunhofer tested it in their own car park. The accompanying image displays a road with two different colours. The darker section was paved with recycled plastics and concrete, which gives a certain elasticity to the road, reducing the vibrations when vehicles pass over it. The tarmac has been there for over 10 years, but still functions perfectly.

As for sustainable energy, the Institute aims to be electrically independent and the site has a wind turbine which can supply power for several days.

ICT also tests energy storage technologies and we saw batteries based on Lithium ions and alternative systems being tested for large-scale energy storage. One system transformed wind energy to chemical energy by using the electricity to ionise a compound and store it underground.

As one of the largest applied research institutes, the Fraunhofer Institutes cooperate with Mercedes-Benz, Rolls-Royce and other large corporations to make new sustainable materials, reducing cost and damage to the environment, while also enhancing material performance.

As we saw from other visits during tour, The Fraunhofer Institutes are far from being the only applied research centre/group in Germany. At the German Aerospace Centre, we saw more fascinating work on batteries, hydrogen gas, cars, space shuttles and other things that will all significantly impact our future.

In my opinion, these research institutes will allow Germany to continue to lead as one of the most industrially forward thinking nations in the world. So, a questions arises: *what can Britain do to keep pace with Germany?* Should institutes and Universities keep their focus on theoretical work, or collaborate with industry more closely?

By Vivian (Bohan) Zhang, 1st year

Day 3: Energy technology at KIT

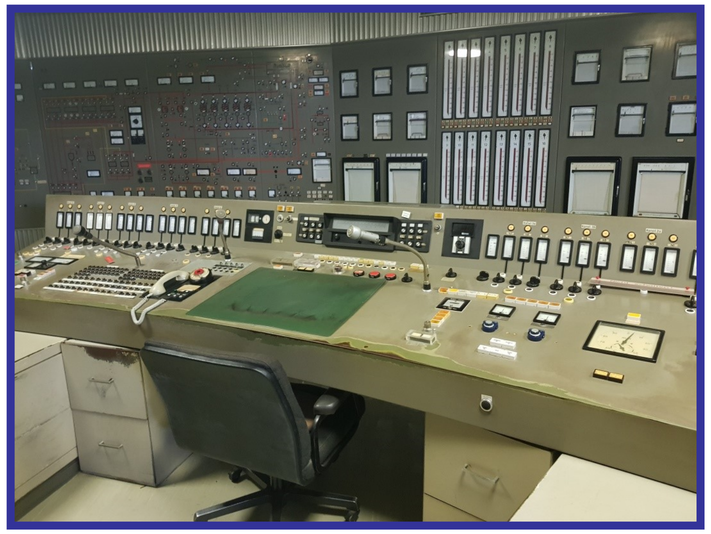
Karlsruhe Institute of Technology (KIT) was originally founded in 1825 as a public research university known as the "Fridericiana" and in 1956 it was merged with the Karlsruhe Research Centre, a national facility for nuclear research. Famous alumni include the physicist Heinrich Rudolf Hertz (1857-1894), who confirmed James Clerk Maxwell's theory of electromagnetic waves, and Karl Friedrich Benz (1844-1929), the German automobile engineer famous for designing the first practical vehicle to be propelled by an internal combustion engine. Nowadays, KIT prepares some 26,000 students to contribute to tackling global challenges in the fields of energy, mobility and information.

We were taken on a tour of KIT on a hydrogen fuel bus (a nice touch and very fitting). Our tour guide, Mika, was knowledgeable, witty and provided an excellent description of the political environment surrounding the energy industry in Germany and its relation to the multitude of projects running at the Institute. Technical pursuits at KIT are supported by research based on the social sciences, to improve and enhance the potential of chosen technologies.

"As a leading academic institution, KIT gave us a brilliant insight into German energy research, from nuclear to batteries and fuel cells"

-2nd year Materials student

Following the Fukushima Daiichi nuclear disaster, which sparked anti-nuclear protests in Germany, Merkel's government announced the closure of all nuclear power plants by 2022. This decision necessitated the development of efficient and renewable energies, topics with which KIT are heavily involved. With the view to tackling these challenges, KIT collaborates closely with key industry players, conducting research on several areas including: biomass from straw for gasoline production, nuclear fusion, risk assessment of hydrogen fuel systems and battery research.



Control room of Germany's first nuclear reactor

Additionally, KIT conducts elementary particle and astrophysics experiments, such as a project named operation KATRIN, which will attempt to determine the mass of the neutrino. Projects such as this require the development of numerous technologies such as superconductors and sensitive measurement systems.

The highlight of the visit was the unique experience of entering the first Nuclear Reactor built by Germany (Forschungsreaktor 2). I was interested to discover that this reactor was not used for energy production, but for materials research. Here, materials were irradiated and then taken through a range of mechanical tests such as tensile and hardness testing to explore the effects of radiation on material properties.

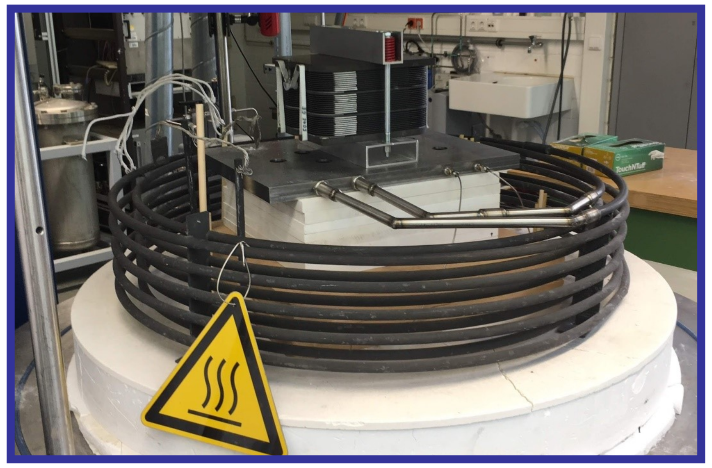
Overall, the tour of KIT provided a fascinating insight into the importance of the political environment to the successes or failures of energy technologies.

By George Grant, 2nd year

IMPERIAL MATERIALS Est. 1851

On Thursday the 14th of June (day 4) we visited the DLR Institute of Thermodynamics, otherwise known as the German Aerospace Centre, which is based at the University of Stuttgart. The German Aerospace Centre is Germany's space agency and comprises of a group of Institutes, whose research aims, as suggested by the title, are focused around space and transport.

On a whistle stop tour of their laboratories and facilities, we learnt about their research into electrochemical cells for aerospace applications, such as aircraft and satellites, which included work on solid-oxide fuel cells combined in stacks, as well as lithium-oxide fuel cells.



Solid-oxide fuel cell stacks ready to be tested at high temperatures

Next to the DLR Institute of Thermodynamics is the Institute of Vehicle Concepts. This department is looking into developing a non-water based heating/cooling system for cars. The prototype demonstration used a reversible hydrogen reaction that is endothermic in one direction and exothermic in the other, meaning that the reaction can also provide hydrogen for a hydrogen fuel cell engine.

At DLR, we also saw a plasma gun in action. The second years on the trip grinned eagerly and exchanged knowing glances with one another as they recalled the 206 plasma poster presentation they had delivered earlier in the year. A few of those attending had actually created a poster explaining how plasma could be used in plasma coating items such as turbine blade coatings. But why use a plasma gun for coating a component? The materials you would apply using a plasma gun are typically ceramics with very high melting temperatures. These would be difficult to melt with many other techniques, so plasma is used to heat ceramic particles into a mist that can be applied to a component. This mist is at incredibly high temperatures (10000K), but it cools rapidly when it comes into contact with the substrate, so the substrate does not melt. This type of coating is used in turbine blades because the engine in which the blades sit operates at temperatures higher than their alloy melting temperature; the coating acts as a thermal insulator, preventing the alloy from reaching such high temperatures.

We also observed research about the storage of solar thermal energy. Solar energy was used to heat water, which underwent a phase transformation to produce steam, which drove a turbine. This latent heat storage using the solid to liquid transformation of the material is also being modelled using computational fluid dynamics (CFD) to try and predict the movement of the particles as the solid melts.

Finally, in the afternoon, we visited a natural gas and hydrogen refueling centre to look at the institute's PEM (proton exchange membrane) electrolyser. This has been used as a test facility to develop new catalysts and study degradation mechanisms in developing hydrogen as a technology to link power generation, transport and industry.

By Susannah Lea, 1st year

As time flew by, our trip to Stuttgart was soon coming to an end. Since we had our last day free, some of us suggested visiting another city, but, as die-hard car aficionados, we realised that coming to Stuttgart without visiting the Mercedes museum would be the same as not enjoying a stein of beer in Germany.

In fact, the museum was the highlight of the trip. We definitely did not anticipate its grandeur nature and we were shocked that it was eight floors high! The museum was organised in chronological order from top to bottom. Descending the spiral staircase recounted a journey through history, from when Daimler built his first engine to Mercedes' modern innovation in the automotive industry. It was almost shocking to see the extent of how competition and wars instigated the monumental advance in technology in just less than 200 years. The detailed audio guides and bright displays were complemented by an assortment of interactive stations at each level, where we could watch short biopics and delve into the world of Mercedes-Benz.

Situated at the plateau of every level were full-scaled automobiles, a blessing to our photo addicts, and hanging from the ceiling were combustion and turbojet engines, a blessing to our inner engineers. No two floors looked the same. From German fighter jets parading the roof, panoramas of idyllic roads gracing the walls and the evolving styles of automobiles at each level, we saw that Mercedes-Benz was constantly changing and innovating throughout its history.

Descending into the penultimate level, we discovered a sublime view of a banked track littered with racing cars, utopia for our many F1 fans. We then wrapped up our visit with a thrilling race on a 'Need for Speed' style racing simulator, although many of us were already racing for the gift shop by then.

Our Friday in Stuttgart was enlightening and fascinating, even for those who wouldn't identify as 'petrolheads'. A fitting end to a fantastic tour!

By Steven Chen and Anton Le, 1st years

Day 5: A speedy end to tour at the Mercedes-Benz museum

Bauerman Prize Lecture 2018:

Printing Soft Matter in 3D

Susannah Lea reports on the annual Bauerman prize lecture, an event that brings the entire department together, and discusses the presentation given by Prof. Jennifer Lewis.

This year the annual Bauerman lecture was held on 21st February and given by Professor Jennifer Lewis, the Hansjörg Wyss Professor of Biologically Inspired Engineering at Harvard. Her lecture was entitled 'Printing Soft Matter in 3D' and demonstrated her research in the areas of soft electronics and robots, shape morphing architectures with the control of anisotropy and vascularised tissues. It touched on a wide range of disciplines within Materials, managing to appeal to the range of experience and interests of the whole department.

Initially Professor Lewis discussed the applications and demand for soft electronics in the modern day. For example, printing electronic components onto a soft matrix, such as a thermoelastic polymer, with conductive ink to create a strain sensor that could be worn and flex with the body's movement. Furthermore, she discussed the development of soft robotics using the example of the eight-legged, aptly named, 'Octobot'; the first untethered and completely soft robot. This has been achieved by a combination of techniques, including 3D printing of circuit components onto an elastomer, soft lithography and moulding. The battery was replaced with liquid hydrogen peroxide as a fuel, which reacts to form a gas that inflates bladders in the Octobot's legs causing alternate legs to pop up. The gas flow is controlled by a microfluidic logic circuit, creating an autonomous soft robot.

Professor Lewis then explained how her team had taken inspiration from nature to develop shape morphing architectures. For example, looking at the responses of flowers to changes in heat and light and how pine cones open and close depending on the presence of water. This led her team to suspend cellulose fibrils in hydrogen ink and use this for 3D printing. The cellulose fibrils gave the printed material a difference in stiffness in the longitudinal and transverse directions, which when

Prof. Jennifer Lewis explaining the applications of 3D printed soft matter

Prof. Peter Haynes, Prof. Jennifer Lewis and Prof. Molly Stevens following the presentation of the Bauerman Prize Medal

immersed in water, caused bending as the fibre swelled. This concept was used to create a biomimetic orchid that had petals which twisted and ruffled on contact with water. Looking forward Professor Lewis' team are developing predictive capability for this technology so that shapes can be programmed on demand by changing the external conditions, leading to numerous biomedical applications.

The final part of the lecture detailed Professor Lewis and her team's efforts to print vascularised tissue, which would also have a vast array of applications. For example, as a medium for testing drugs, giving the cost benefit of being able to screen out drugs at earlier stage, as well as for tissue replacement with particular focus on the kidney. This method essentially involves printing a vascular grid onto tissue with stem cells and a connective matrix, using fibroblast laden inks and a silicon border in the required shape. Nutrients and factors to differentiate stem cells can then be deposited into the vasculature and flowed through to generate the required tissues.

3D printed soft materials will undoubtedly play a huge role in the future, particularly in the medical and biomaterials sector and with the potential to programme shapes on demand. The possibility for fully soft circuitry will bring about new generations of sensors and monitors that can easily flex with movement, without the constraints of stiff circuit boards. Therefore, we are very thankful to Professor Lewis for giving us a taste of what is yet to come and look forward to further developments in this field.

Investigating Industry:

Visit to Zotefoams

Connor McCraith, a second year student, reviews an educational trip to the Croydon site and describes Zotefoams' unique process for the production of foamed polymers.

As one of our silver sponsors, Zotefoams were keen to collaborate with MatSoc and an industrial visit trip was organised. Zotefoams are the world's largest manufacturer of block, cross-linked polyethylene foams and produce a range of foamed products, generally from simple and commonly used polymers. As the company has been running since 1921, they are in a unique position among many manufacturers in Britain, as the UK site is located in Croydon and has excellent transport links. The company also operates another factory in Kentucky, USA.

The day was packed with varying activities. Initially, we were given an informative briefing about the company and the technical theory behind the main products it offers. Following this, we visited the manufacturing plant where our graduate guides explained the foaming process and the need for in house testing facilities. Finally, we reassembled for a Q&A session with leading members of the management team.

It was explained to us that the company focused on two main categories of products: the Azote and the Zotek ranges. Azote products are the standard line of foams offered, whilst Zotek products are of higher quality and can be tailored to suit a client's direct needs. The main differences in product performance are due to the use of higher quality raw materials and customisation of the foaming process. Despite the differences in both physical and mechanical properties, the fundamental processes involved in the production of the two foams are very similar.

Zotefoams utilise a four stage, nitrogen expansion manufacturing process:

1. ***Initial extrusion of feedstock granules into plastic sheets***
2. ***Crosslinking of the polymer chains***
3. ***Nitrogen saturation in a high-pressure autoclave***
4. ***Unconstrained expansion in a lower pressure autoclave***

The first process involves mixing the polymer feedstock granules using a screw conveyor whilst they are melted using heating elements and extruded into sheets or slabs using a metal funnel which can be adjusted to different widths and thicknesses. The polymers used in the feedstock varied widely depending on specific foam required and they were also mixed with binding agents, colouring agents, peroxides and other additives depending on the crosslinking method to be used. The extrusion process is continuous for the Azote products and batch for the Zotek range. From here there are two different methods of crosslinking the polymer sheets. If the foam does not require specialist properties then it will have had peroxides added to its feedstock and will be placed into an oven and baked. This causes the peroxides to react

Connor and other trip participants prior to a tour of the manufacturing plant

with the polymer chains and removes hydrogen from the backbones. If the foam is to be used in specialist applications, such as Aerospace, cobalt 60 Gamma radiation or high energy electron beams can be used to create free radicals within the sheets which can then grow and react. The crosslinked plastic sheets are then placed into an exceptionally high-pressure autoclave rated at pressures up to 670 bar. The air is removed to create a vacuum and an atmosphere of nitrogen is added. Pressure and temperature are increased until the soak pressure is reached. This defines the pressure and temperature dictating the amount of nitrogen that diffuses into the sheets in a given time. This is continued for 7-17 hours whilst the nitrogen levels increase until nitrogen absorption reaches equilibrium. Following this, the autoclave is rapidly depressurised causing the nucleation of bubbles within the material, however, pressure is kept constant while the sheets cool to prevent expansion at this stage. The nitrogen loaded slabs are placed into a lower-pressure autoclave where the material is again heated above its softening temperature under 20 bar gas pressure. When this pressure is removed the nitrogen expands, foaming the soft plastic in a uniform manner.

This several stage, high pressure foaming process is unique to Zotefoams and brings several advantages over conventional foaming processes. Normal processes require a chemical blowing agent which react with heat to produce gas causing the expansion of the foam. This results in residue left within the structure of the foam which can affect the desired properties but also reduces the quantity of beneficial additives that can be included in the foam. Additionally, this process allows certain plastics to be foamed which otherwise could not, for example, high-density polyethylene (HDPE).

This allows novel and innovative solutions to be investigated by eliminating manufacturing restrictions. The resulting cellular structure is more consistent than those produced from other methods, which enhances mechanical properties, resulting in a strong, light and flexible range of products.

Applications of Zotefoams' products are widespread as the advancing polymer technology replaces traditional materials in many fields. The low mass of foams compared to the original solid polymer make them ideal for applications with weight cost penalties. Great energy absorption allows for use in impact protection in sporting equipment but also for reusable transportation of delicate products. Thermal and acoustic insulation make it applicable in the construction, aerospace, and automotive industries. The foams are also odourless, water and chemical resistant because of the purity of the foams compared to others made using chemical gas expansion leaving contaminants. The company are not only manufacturing products for traditional markets but produce foams specific to industries ranging from the creative industry (foams for puppets, props and costumes) to the biotechnology sector where foams for clean rooms and tubing insulation.

Overall, the trip proved to be informative both in terms of the technical knowledge of producing crosslinked polymer foams and what it would be like to work for a medium sized, world leading company in the materials industry.

A lunchtime lecture conducted by Zotefoams employees explaining the science behind their foaming process and available student opportunities

MatSoc Socially:

An Eventful Academic Year

Marta Wolinska, second year student and MatSoc Events Officer 2017/2018, summarises the varied range of educational and social events organised by MatSoc in the past year.

The year began with an event organised via cooperation with the department: The 'Mums and Dads' Pizza Lunch. 'Mums and Dads' is an Imperial wide scheme where older students pair up and take several incoming students under their wings acting as 'college parents'. This event is the first chance for most 'families' to meet in person, as some 'parents' may have already contacted their 'children' via social media to help them before arriving at Imperial. The introductions began even before the event started with the unfortunate early birds helping me out with rearranging the room and bringing in extra chairs. Then, when it came to receiving the 50 pizzas, everyone was keen to help. Over plenty of pizza and initial awkward conversation, friendships were forged and (hopefully useful) advice exchanged.

"I've loved having Materials children this year. I would absolutely recommend the Mums and Dads scheme; not only is it a great way to make new friends but it's an ideal opportunity to go to Nando's for family dinners! "

-2nd year Materials student

The next MatSoc Freshers' Fortnight event of choice was bowling, where we mingled and had a great time without breaking the bank; the issue of expense being a common complaint following freshers fortnight. On the second Tuesday of term we trekked to Acton (to the delight of Woodward residents) to enjoy a relaxed evening with very questionable bowling skills.

First term was packed with industrial visits and lunch time lectures, providing insight into industry and departmental research, leaving little space for extra social events. As the end of term grew nearer we organised two events: a movie night and an end of term meal.

"I have a great relationship with my college Dads! It was great to immediately have someone to turn to and they are also a great help academically."

-1st year Materials student

The Christmas Movie Night, thanks to the generosity of the department, was hosted in our brand new common room. After some rearranging the common space fulfilled the role of cinema perfectly. With snacks and pizza provided and term coming to an end we had an excellent turn out. We shortlisted two winter classics; Die Hard and Love Actually. The deciding Facebook poll kept everyone guessing and despite my predictions, Love Actually was victorious.

Soon after Movie Night it was time for our annual staple: The Christmas Curry. First term can be busy and at times doesn't allow much time for exploring London so I decided to take our members all the way to Brick Lane. The biggest event of the year did not disappoint; with a starter, main, naan and rice on the menu our spirits were very festive. Many toasts were made to those who forgot to wear Christmas outfits, to the fantastic committee and of course to the end of term.

MatSoc has very close ties with the student societies from the Earth Sciences Department: De La Bêche (Geology) and Geophysics societies. Between the three societies we organise an annual competition, 'The Hill Cup', which is a series of events where we compete against each other. MatSoc organised a trip to go paintballing. This year, sadly, we tied with the other department, but hopefully we'll have more luck next year! As part of 'Hill Cup Week' we also hosted an Arts and Crafts session in collaboration with the RSMU.

Second term had a slow start with many events organised by the RSMU, but spur of the moment I found tickets for the longest running play in London: Agatha Christie's Mousetrap. Being a brand new event, I kept it small, however, it was in fact extremely popular with all tickets being sold in 30 minutes. An event definitely worth scaling up and repeating next year! Having never organised a trip like this I didn't know exactly what to expect. It turned out that our seats were so high above the stage I feared whether I should have put a disclaimer for members with a fear of heights! Regardless, the play was excellent and an absolute steal.

Amidst the blur of second term MatSoc also hosted a University Challenge evening, where our common room again proved to be the perfect venue. An element essential to any quiz night are the buzzers - it had never occurred to me that the battery compartments could be screwed in rather than easily removable! Yet, our MatSoc team spirit truly came into play with several freshers and second years trying to unscrew those tiny compartments with anything from ID cards, to room keys, to nails. Here a special shout out must go to Luca, who jogged over to Eastside to get his screw driver to aid our efforts. Additionally, we now know how many engineers it takes to change a battery! Once successful, we commenced the 'trial rounds'. First, teams tested their knowledge with real University Challenge questions with themes ranging from fictional book authors to cafes. Then, we moved on to pub quiz style questions resulting in many more correct answers. The final was a true David versus Goliath battle as the seasoned fourth years stood against a team of freshers. Even though the latter were on good form, the fourth years were victorious. We also had three bonus rounds on the Olympics, Disney and flags knowledge, where all teams competed against each other. This wasn't too much of a problem until it came to the 'flags' round, where everyone knew the answer immediately! If there's two things this event has demonstrated it's that our members have truly diverse interests and that vexillology is everyone's strength.

As the term started coming to an end we had another movie night, this time hosted in G20, the lecture theatre featured in 'Kingsman: The Secret Service'. Thus, the movie choice was obvious and unanimous. A week later we had our end of term meal, which brought our members together in Wildwood, an Italian restaurant in Gloucester Road for a final goodbye before the Easter break.

Summer (exam) term contained few events due to the impending exams and the focussed revision of our members. However, their was a much anticipated event to look forward to: MatSoc's International Tour! To celebrate the completion of another academic year, MatSoc organised a tour to Stuttgart, Germany. With a limited number of highly subsidised tickets, the event sold out in a record breaking 17 minutes. The lucky attendees enjoyed a week of German culture and visited a varied range of institutions. Discover what they learnt by turning to pages 7-11!

A messy battle for the 'Hill Cup' required lab coats to be exchanged for overalls

Tour goers enjoying the sun outside the PEM electrolyser site

IOM3 Women in Materials:

Successful Women and their Careers

Anuja Sharma, a first year student, attended the IOM3 Women in Materials Seminar held on the 18th of April. She reflects on the inspiring messages conveyed by the speakers.

After attending the IOM3 Women In Materials seminar in Bristol, I immediately thought of a poem by Rupi Kaur (see below). The event consisted of a series of talks given by truly inspiring women, each of whom spoke about their career journeys and the importance of encouraging female engineers to aspire for leadership roles. Therefore, I believe this poem perfectly describes the essence of the event.

> ***"What's the greatest lesson a woman should learn?***
>
> ***that since day one. she's already had everything she needs within herself.***
>
> ***it's the world that convinced her she did not."***
>
> ***Rupi Kaur***

Three personal stories were shared, each of which enforced three important messages. The first message, given by one of our very own, Fiona Robinson: ***"Sometimes it's necessary to be stubborn."*** Just like us, Fiona began her engineering career at Imperial. After completing the Metallurgy and Materials Science course, she then went on to pursue a PhD at the University of Liverpool which focused on process development for the application of high temperature corrosion resistant glassy coatings. Fiona began her industrial career with British Steel in 1991 and since then has remained in industry, working for several other companies such as Corus, Tata Steel and Cogent Power. With 27 years of industrial experience, one would think that this woman was impressive enough, but it doesn't stop there. In fact, it's how her career kick-started which makes her accomplishments that much more profound. Fiona began her talk by mentioning that she had taken the standard A-levels expected of any engineering student. She then further elaborated on this seemingly mundane statement to reveal the appalling and sadly unsurprising behaviour she had to face as a consequence of doing something that would be considered normal for a boy. Not only was she told to choose humanities subjects by her head-master at school but was also asked during a university interview as to why she had not applied for a social science degree instead. Despite the several narrow-minded comments thrown her way, she has successfully achieved what she had set out to be.

Second message: ***"Take every opportunity that comes your way."*** - Hamideh Khanbareh. Hamideh grew up in Iran and attended the University of Tehran where she read Materials Engineering. Upon finishing her degree, she obtained an internship at a tech company in Russia. Two years later she joined an international research group in Delft University of Technology, Netherlands, to work on projects including Fracture Surface Analysis and Fractal Analysis of Grain Boundaries. She then joined Tata Steel to experience working in industry, however, 3 months in, she realised academia was her preference and went on to join research teams at

Attendees of the IOM3 Women in Materials Seminar hosted at Rolls-Royce Filton

the Max Planck Institute for Polymer Research and then at Virginia Tech, USA. She is now a Prize Fellow in Mechanical Engineering at University of Bath. So far, she has had seventeen journal publications and her research has oriented around Functional materials, Sensing and energy materials, processing, characterization and modelling. And as if her career development wasn't extraordinary enough, then the fact that she is only thirty should do the trick.

Finally, the third message, given by the host herself: ***"You are in control of your own career; if you don't like something, change it."***- Ellie Clarke, Rolls-Royce plc. Ellie excelled in her undergraduate Materials Science and Engineering degree at Swansea University, and immediately pursued a PhD on 'Internal Stresses and Dislocation Densities in Steel' for which she received several awards. Having spent seven years in academia, Ellie got onto Rolls-Royce's graduate training programme and as a result discovered that a career in industry was what she enjoyed most. From then onwards she worked her way up to the position of Engineering Manager for Bristol Materials, Rolls-Royce. As she spoke of her professional journey, the underlying message she continually stressed was the importance of constantly communicating across your personal career goals to your boss and to not settle for work that you're not enjoying.

This event has proven to be the perfect push I needed to start familiarising myself with the support system of wonderful women who, in the future, I'm sure will help me to flourish in my own scientific career. Events such as these, which promote gender equality in engineering, provide great examples of the sort of environment that should be present in every work place.

A Career with TTP:

2017/2018 Gold Sponsor

Karthik Chellappan, an imperial graduate and current employee at TTP, advises students on determining the best job environment and sector for them.

Whether it's the nature of the course or life in London, before you know it the final year of your engineering degree at Imperial will be upon you, and in all likelihood you won't have spent much time reflecting what the right job would be for you. When we embark on our studies, few of us think about what kind of work precisely we will be doing after graduation. After all, three to four incredible years lie before us – seemingly ample time to figure out what we want to do.

Yet, knowing what kind of job is right for us is surprisingly difficult. Placements are a good way to try out various jobs, but ultimately, I believe every engineer needs to think about what's important to them. I am lucky that, at TTP, I have found an employer that gives me the opportunity to grow as a consulting engineer, as well as the freedom of an internal start-up culture to develop projects that have the potential to have a much broader impact.

Most people I spoke to during my time at Imperial said that they wanted a job that was varied, technical, intellectually stimulating and thus rewarding. While all these things are achievable, you also need to carefully consider how the various aspects of the job balance and the time frame within which projects and activities happen. Working in industry will help you to understand the subtler aspects of working life beyond the buzzwords, and one's student years are the ideal time to try out multiple placements in a variety of sectors.

As a mechanical engineer, I worked in power engineering, aerospace, academia and start-ups during my undergrad years. From visiting 132,000 V substations and modelling cooling of power lines, to testing high-pressure fuel system components for the latest turbofan designs, there's no shortage of interesting work for engineers and scientists. Good grades, prestigious universities and companies on your resume certainly help you land a job – but does the job have what it takes to keep you motivated beyond a summer or a year-long placement?

To answer this question, we need to consider what is truly important to us. During the second half of my degree I started asking myself whether I was satisfied with my impact at the level of society and individually. I was not. As an engineer, I had to work out how to use the engineering subjects that I was truly interested in, while balancing technical depth, variety and positive impact. I also concluded, rather pragmatically, that I could only tolerate bureaucratic, top-down management structures to the extent that they wouldn't significantly impede my ability to balance my priorities. In my case, this led me to focus my final year applications in the healthcare sector, and in particular on medical device development consultancies.

I now work for the medical devices group at TTP, a product and technology development organisation near Cambridge. Since graduating from Imperial one and a half years ago, I have worked on the development of a diverse range of devices, from novel breath-actuated inhalers to insulin infusion

The popular Beyond University Lecture (BUL) hosted by TTP on the 30th of January

and wound infection detection systems that help people to better manage conditions such as asthma, diabetes and chronic wounds. During my time at TTP, I have planned project costs and timescales, acquired new technical and modelling skills from hands-on and often lab-based work, negotiated project terms with clients, conducted Intellectual Property assessments and worked with moulding suppliers to take products from concept through to prototype testing and manufacture.

In addition to providing services for clients, TTP offers its engineers the rather unique opportunity to propose and secure funding for work on internal projects to develop novel concepts or improve existing ones for specific applications. Successful past examples range from low-cost gas sensors and low-pulsatility pumps based on fundamental acoustic physics to vibrating mesh technologies that underpin the aerosol engines of inhalers. To secure internal backing, these novel concepts need to be underpinned by validated studies of user and economic needs, though the technology in question may not be proven to the point where corporations are willing to adopt the technology and work with TTP. It's an internal start up culture with little hierarchy where aspects of selling, negotiation and influencing opinion – both internally and externally – are critical. These elements are combined with technical excellence to ensure success, a skillset that I continue to learn, and which involves working in the wide region between blue sky university research and product commercialisation.

In conclusion, **I suggest that every engineer continuously assess the impact of their work on human progress.** It's the only way to do justice to the stellar education we receive at Imperial. The process of finding a job that suits you, makes you happy and satisfied while aligning with your overall goals and beliefs in life is difficult, not to mention that your priorities may change over time. **I wish I had paid more attention to these questions during my early years at university, but I was lucky that, in TTP, I have found an employer that gives me the opportunity to grow as an engineer, as well as the freedom to develop projects that have the potential to have a much broader impact.** I hope that everyone reading this embarks on this quest even before they apply for their first "proper" job.

Faraday Prize Lecture 2017/2018:

Mark Miodownik on why 'Stuff Matters'

Helen Money-Kyrle, currently a second year student, reviews the lecture given by Mark Miodownik as the Faraday Prize winner of 2017.

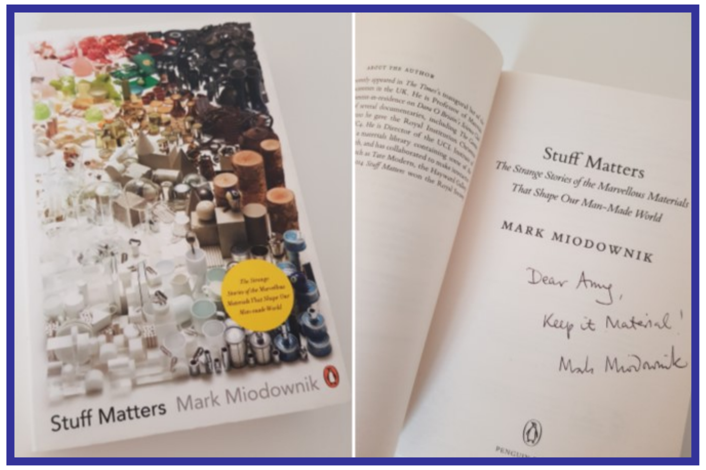
Michael Faraday was a highly influential British scientist, who contributed significantly to the field of electromagnetism and electrochemistry, and who was known to be an outstanding lecturer. Now, the annual Royal Society Michael Faraday Prize and Lecture is awarded to a scientist or engineer in recognition for their talent in communicating scientific ideas to the general public. This year, the lecture was given by Professor Mark Miodownik, whose book, 'Stuff Matters', is suggested reading for any student of Materials Science and Engineering.

Arriving, late, I just managed to get a seat in the overflow room at the Royal Society. Looking around I saw many familiar faces from across the department, with lots of excited students happy to be out in London on a Tuesday evening. Wearing one of his famously floral shirts, Miodownik delivered a fantastic lecture; taking us through the history of materials, describing some underlying principles of materials science and successfully convincing us that a deeper understanding of materials will be critical for the 21st century.

Going back in time, we see that materials have given their names to periods of history, describing our technological progress as we move from the Stone Age, to the Bronze Age, to the Iron Age. As we move through time we focus on the history of glass; from the development of glassblowing and invention of the window in Roman times, through the popular use of stained glass windows during the Dark Ages in Europe (which consequently were anything but dark), to the development of lenses. Not only could lenses correct eyesight, but they could be put together to magnify the world around us. From the microscopically small, to the incredibly far away, suddenly we could observe the world around us quite literally through a different lens. The properties of glass as a clear and chemically inert solid, with a coefficient of expansion of zero, made it very useful for experiments and also for cooking, thus dramatically changing both the laboratory and the kitchen.

Moving onto some of the more fundamental properties of materials, Miodownik asks us to consider, "what is a glass?" A glass is an amorphous brittle solid (as Prof. Julian Jones will also teach you in second year), most often based on molecules of silicon and oxygen which form a connected network of silica tetrahedrons. To find out more about the structure of glass, Miodownik takes a Prince Rupert's Drop, which is formed by dropping glass in a bucket of water. The outside cools very quickly, causing compressive stress at the surface, but the inside cools more slowly, forming a tensile stress at the centre which exactly cancels out the compressive stress. However, if we disrupt the equilibrium, the brittle glass will shatter into a pile of tiny shards, which Miodownik shows in a satisfyingly entertaining demonstration.

"But then," we ask, "if glass is brittle, why are other materials ductile?" Take, for example, a lead bell. The lead is made up of grains or little crystals which contain defects, which can move and interact with each other. When you hit a ductile metal, you move defects, absorbing most of the energy that is not lost as thermal energy. Consequently, very little energy is lost as sound, meaning that a lead bell does not ring very well. However, if you cool the bell by putting it in liquid nitrogen, you make the metal more brittle as a result of reducing the ability of the dislocations to move. Now, if you hit the lead bell it rings bright and clear: "Hear ye, hear ye. Dislocations exist!"



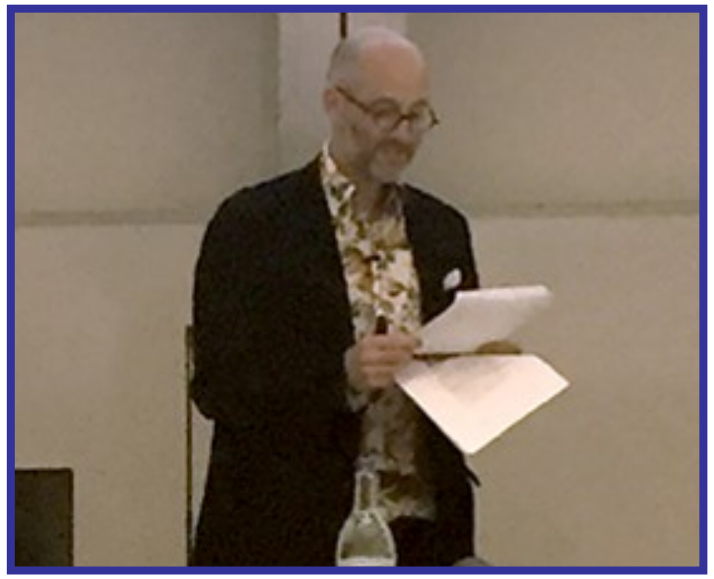
The Magazine Officer's cherished signed copy of 'Stuff Matters'

We marvel at chocolate. Highly engineered and utterly delicious, chocolate is designed to melt in your mouth, releasing all of the fruity esters, and hundreds of other compounds contained within the cacao, whose bitter theobromines are balanced with just the right amount of sweetness, encapsulated in a smooth and creamy cacao butter. Miodownik delights us with chocolate, before encouraging us to think about the future of synthetic foods, such as the rather topical 'lab grown' or synthetic meat. It's topical for a reason; if we all went vegetarian, we could have a massive impact on our global energy consumption, meaning that a competitive, environmentally-friendly, and tasty alternative to meat could have a huge impact.

We also discuss the future of plastic. With our prolific use of plastic packaging, our rivers and oceans are sadly becoming increasingly polluted. We can recycle some packaging, but certainly not all, and even recycling requires time and energy. How can we better use our limited natural resources? We are presented with The Mark Miodownik Fruit Container made out of a material such as glass that can protect food and display it during transport and sales, and which is designed to be reused rather than recycled. Miodownik acknowledges that his standardised fruit container feels slightly farfetched at the moment, but the idea that a simple change by supermarkets could have such an effect on our environmental impact certainly gives me food for thought.

Leaving the Royal Society, I found it hard not to share Miodownik's enthusiasm. The 21st Century brings with it some difficult technical challenges, from mitigating the effects of climate change and depleting natural resources, to storing energy and meeting the global demand for food. And yet, having wondered at the technological achievements and development of materials so far, I am left optimistic that a deeper understanding of and appreciation for materials can help us rise to meet these challenges.

Ask me now if materials science can save us from ourselves, and I would be inclined to agree with Miodownik in answering, "yes, it can".



Prof. Miodownik introducing the Molly Stevens inaugural lecture (pages 28-31)

YPLC London Heats:

Seif Mehenna on Blue LED's

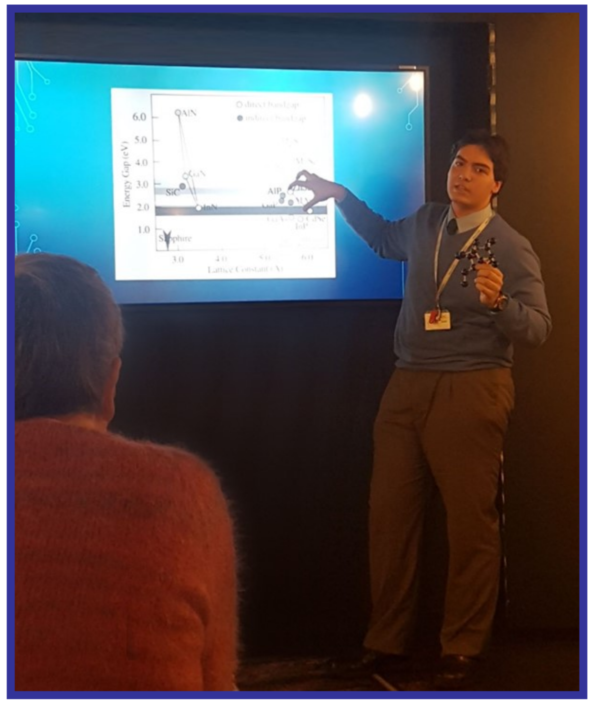
Seif Mehenna, currently a first year student, participated in IOM3's Young Persons Lecture Competition. He reflects on his experience and discusses his chosen subject: Blue LED's.

Have you ever wanted to be like one of your lecturers and give your peers a lecture on a topic you are extremely passionate about? Well, you do have the opportunity! On the 1st of February, I partook in the Institute of Materials, Minerals and Mining's (IOM3) Young Persons' Lecture Competition (YPLC).

We were tasked with making presentations, in the format of a short lecture, regarding one topic related to either materials, minerals, or one of their various offshoots. These presentations also needed an abstract, and were judged on things such as technical content, style, and structure. These presentations were aimed to be around 15 minutes, with a 5 minute question session with a panel of judges.

Our local materials society, the London Materials Society, held its heat, which was the sub-regional round, over at IOM3 Headquarters on Euston Road. The winner, Sabina Alexandra Nicolae of Queen Mary's, went on to the South-East Regionals (In London), and if she wins, she will go on to the national (Still in London), and perhaps even international round (In, you guessed it, South Africa). With a chance to tour the world and win a large cash prize, it's obvious why anyone would participate.

I came in third place, with a presentation on the invention of the blue LED. The blue LED was a very interesting topic for me, not only because of my interest in optoelectronics and semiconductors, but also because it illustrates one of the more practical



Seif Mehenna presenting at the competition

uses of quantum mechanics, a subject matter commonly seen as dry and esoteric. The blue LED is so important, that it was in fact the reason why Shuji Nakamura, Hiroshi Amano, and Isamu Akasaki won the 2014 Nobel Prize in Physics "for the invention of efficient blue light-emitting diodes which has enabled bright and energy-saving white light sources" (Nobel Prize Committee, 2014).

The LED itself was first invented in the 1920s by Oleg Vladimirovich Losev in the then USSR, and it emitted yellow-ish light using SiC. However, the first LEDs that were of commercial use were invented in 1962 by Nick Holonyak in the USA. While red LEDs made

with gallium arsenide, and green LEDs made with gallium phosphide were tiny steps in advancement, the blue LED proved to be an issue. Blue LEDs, with their high frequencies, require a larger bandgap and processing materials with the correct bandgap was challenging.

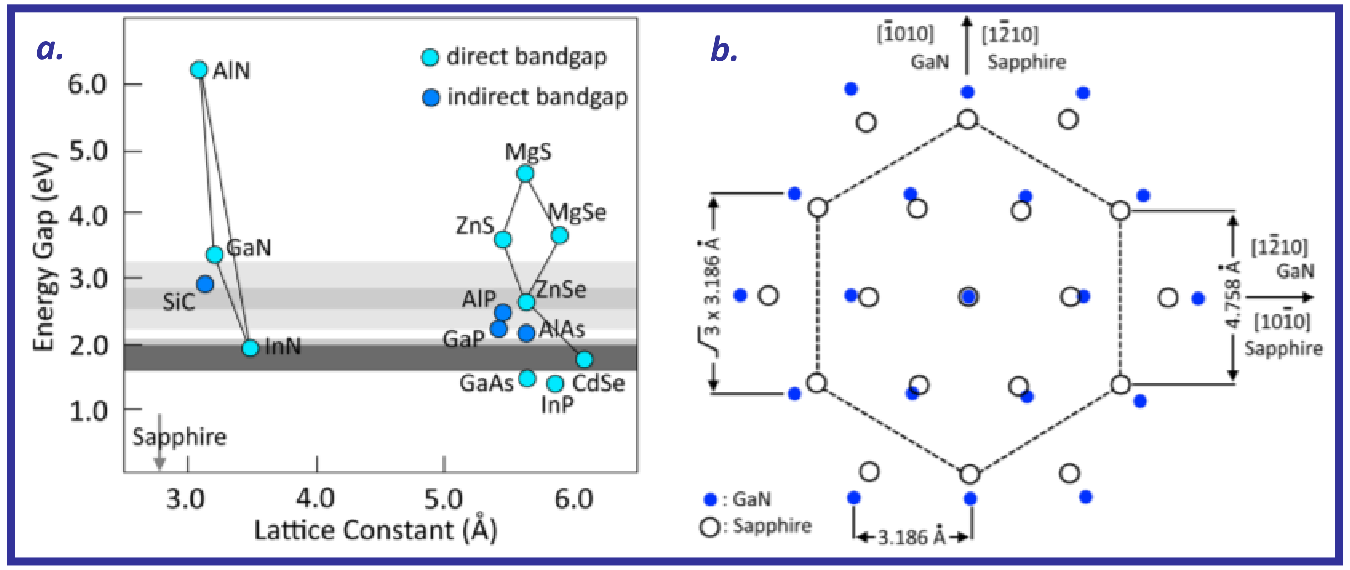
The first issue was the choice of materials. Two main candidates emerged at the beginning, the first being SiC. Now, one might stop and pause here, recalling the last paragraph in which I stated that SiC produces a yellowish light. Well, both parts are true, as hexagonal SiC has the correct bandgap for blue light, while cubic SiC results in yellow light. The issue is that SiC has an indirect bandgap and is therefore less energy efficient. So research shifted towards Type II-VI semiconductors, but they broke after an hour of use, thus not being suitable.

The 2014 Nobel Prize winners found the solution in GaN, which still needed to be processed correctly and with high purities. However, there was not suitable substrate for growth, with the closest match being sapphire, but a mismatch of nearly 1 Å meant that the layers would grow with a tremendous amount of strain, and that the first few layers were riddled with dislocations. The solution: Just keep growing more of it by MOVPE (Metalorganic Vapour Phase Epitaxy, which is a method of chemically based deposition) until the mismatch between layers from the strain became negligible. Voilà! You now have a lasting semiconductor, and some decent crystals of it.

Now one can create what is one of the most important inventions of our era: the RGB LED. The entirety of the colour spectrum is now under your control, and you can make everything from LED screens, to cheap white-light bulbs. That was the real reason why this whole fiasco, which only ended in 1992, is so important: Without it, most modern optoelectronics would be worthless.

I would like to thank **Dr. Mark Oxborrow** for helping me navigate the forest of differential equations required to understand the intricate quantum physics behind these optoelectronic marvels and I hope my explanation has done them justice.

I strongly encourage everyone who is deeply interested in a materials topic to enter, and learn something new about our deep and broad subject.



a. Band gaps and lattice constants of various semiconductor compounds. b. The basal plane of hexagonal SiC grown on sapphire

Created using diagrams from: Nakamura, S., Pearton, S. & Fasol, G., 2000. The Blue Laser Diode The Complete Story. 2nd ed. s.l.: Springer Science & Business Media.

Molly Stevens Inaugural Lecture:

Tissue Repair, Disease Detection and More

Schan Perera, 2nd year, reviews and summarises the popular inaugural lecture given by Prof. Molly Stevens on the 25th of May, 10 years after she was given the title 'Professor'.

A common symptom of exam fatigue is questioning your decision to study your chosen degree. I attended Prof. Molly Stevens inaugural lecture after a long week of exams and I can safely say that it was just what I needed to remind me why I chose to study materials. Her lecture, which really was an event In itself, attracted students, professors and even members of the House of Lords. But what we all had in common was that by the end of what seemed much shorter than an hour Prof. Stevens had brought out the wide eyed young scientist in all of us and had us on the edge of our seats.

Following a light hearted introduction from UCL professor and author of 'Stuff Matters', Mark Miodownik (yes the same one from your personal statement and pages 24-25) Prof. Stevens began her story. Weaving in jokes and anecdotes about the challenges involved in balancing family life and heading her interdisciplinary research group, she crafted a well structured story about how her group grew from success to success.

The technical focus of the lecture was on the Stevens Group main research areas; characterisation, tissue repair and disease detection. For each research area, Prof. Stevens began with a quick outline as to the relevance of each research area to keep fresh in the audiences minds the idea that this research is driven by applicability and the desire to help real people.

The importance of characterisation is relatively

Prof. Molly Stevens

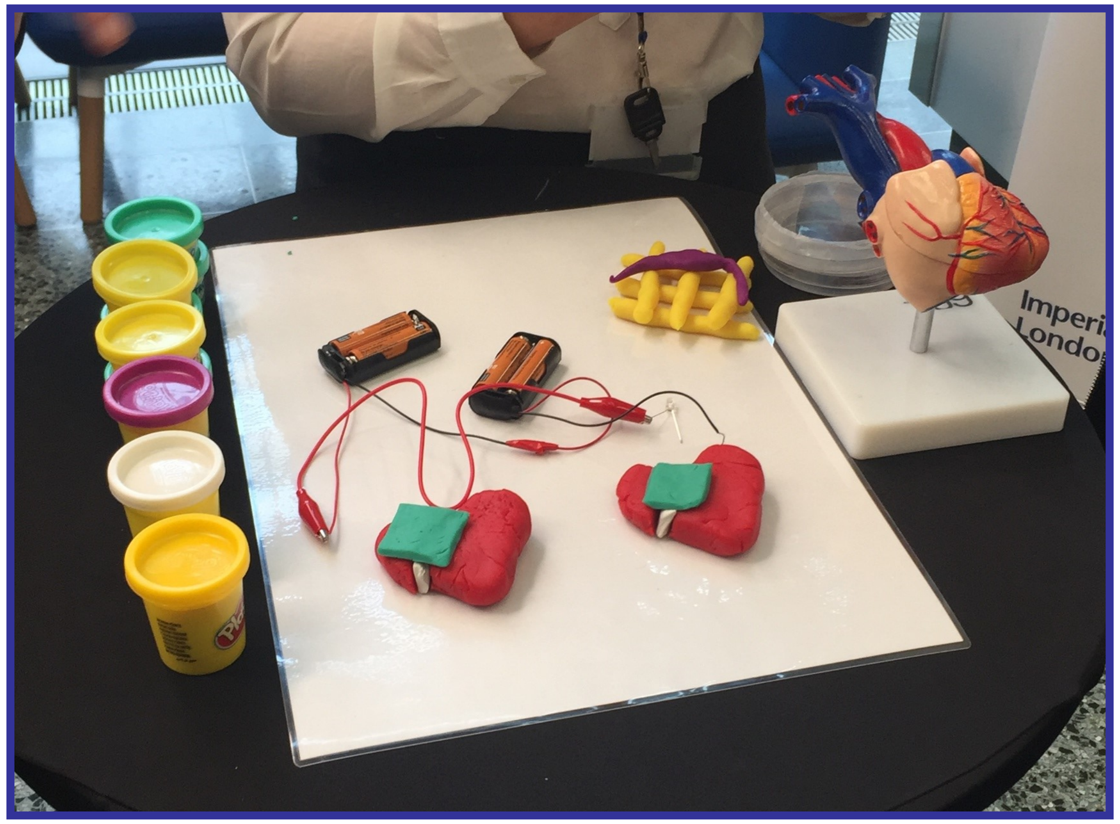
intuitive. To understand a problem you need to be able to know what materials are involved. Specific to cardiovascular calcification, a condition where a build-up of a mineral reduces tissue flexibility, the Stevens group developed a technique using electron microscopy to investigate the calcification process on a nano-scale. They found that the calcification process begins with the nucleation of tiny hydroxyapatite particles which has allowed us to better understand calcification related diseases.

Another interesting characterisation technique is live cell raman micro-spectroscopy. This is a technique that uses lasers to essentially take a biochemical

snapshot of living cells. The technique is non-invasive and shows huge promise for analysing cell processes such as differentiation.

Tissue repair is probably one of the major buzzwords when it comes to regenerative medicine. Everyone wants to live forever and science fiction has teased us with 'instant healing gels'. In reality these 'instant healing gels' aren't too far away and some of the research the Stevens Group are doing definitely looks like it could easily have come from the realm of science fiction. One of the techniques they are developing involves the growing and harvesting of new bone from what are essentially artificial bioreactors in your own body. Injection of a simple gel under the periosteum (membrane that covers the outer surface of most bones) creates space into which fresh, new bone can then easily grow. This newly grown bone can then be harvested and implanted elsewhere in the body. The underlying idea that Prof. Stevens was demonstrating was that if we want to repair human tissue, the best way involves letting the human body do its thing and facilitating ideal conditions for self-repair. We're not yet at a point where we can do a better job than our own bodies!

A personal highlight of the lecture came in the form of microcontact printing, essentially a way of patterning single cells into different shapes. Using the adorable analogy of the potato-shape stamping she had recently done with her son, Prof. Stevens explained how by stamping stem cells into different shapes you can control how these cells differentiate. For example a round cell might differentiate into a fat cell whereas a triangular cell (remember we're dealing with single cells so it's ok to assume 2D shapes) might differentiate into a bone cell. I can't be the only one who finds the simplicity of this to be awe inspiring and although the technicalities of how this actually works went way over my newly-blown mind I will always be reminded of potato art when I see this technique being applied in the future and it will undoubtedly bring a smile to my face.



Play-dough demonstration of conductive patch's designed to be placed on scarred heart tissue

As I mentioned earlier, this inaugural lecture was an event in itself and afterwards members of the Stevens Group were presenting live demos of some of the topics Prof. Stevens had presented in her talk. They were all clearly very passionate about their work and their enthusiasm for play-dough models was contagious.

Materials for interfacing with the human heart are an area of key interest. Most of us have hearts so it's fair to assume that keeping them beating as long as possible is in everyone's best interest. Heart attacks not only present an immediate threat but once you recover the heart is often left damaged and unable to pump blood. The Stevens Group created a material in the form of a patch which can be attached to the heart without stitches and can help propagate electrical signals over scarred heart tissue (which isn't usually conductive). These patches are made of a mixture of chitosan, polyaniline and phytic acid. As well as being conductive a key requirement for any material that interfaces with the heart is that it needs to be elastic in both directions to move with the beating of the heart. These are some of the materials challenges that are involved in biomedical applications.

On the topic of materials for interfacing with the body, the challenge of probing cells has also been one of the Stevens Groups recent challenges. Cells are quite delicate so probing / implanting chemicals into cells has traditionally been an inefficient process. Traditional techniques such as nano-biopsy and fluid force microscopy have made way for a new method developed by the Stevens Group involving something that Prof. Stevens assured us was less like 'cell torture' and more like 'cell massaging or light acupuncture'.

As scary as this looks, the silica based nanoneedles shown above interface very well with the content of individual cells and can provide means of intracellular sensing for cancer. By loading up the nanoneedles with fluorescent groups that are readily absorbed by cancer cells it's possible to create a 'map' of cancer cell activity.

Another play-dough model, this time demonstrating silica nanoneedles for probing cells

The final research area discussed by Prof. Stevens was the field of disease detection. The main example she used involved the use of coated nanomaterials which can be tailored using different bio sensing mechanisms to detect specific biomarkers, an exciting method which can be made qualitative using gold-nanoparticles to enable naked eye detection.

This has been my highlight review of the Prof. Molly Stevens Inaugural Lecture and I am not exaggerating when I say that it was all highlight worthy and that I could easily keep writing.

What really left an impression for me was how obvious it was that everyone involved in the Stevens Group loved what they do. The group is a testament to how successful multidisciplinary research can be and an inspiration to up and coming material scientists!

Members of the Stevens Group passionately explaining their research following the lecture

Left to right: Zack Jeanrenaud (Treasurer), Marta Wolinska (Events Officer), Abigael Bamgboye (Vice President), Dylan Hall (Sponsorship Officer), Harriet Frier (President) Amy Tall (Magazine Officer), Schan Perera (Publicity Officer)

The above photo of the 2017/2018 MatSoc Committee was taken at the Alumni Dinner and excludes Nikesh Patel (Secretary) and Christopher Keegan (Web Master) who unfortunately could not attend. The team worked efficiently and achieved an incredible amount. Well done and best of luck to all of the outgoing committee, working with all of you was a pleasure! Here's to another successful academic year for MatSoc!

IMPERIAL MATERIALS

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Cover Image:

SEM image captured in a second year laboratory exercise . The image displays the micro-voids that formed due to the ductile fracture of a piece of aluminium. This image contrasts from that used for the cover of the Winter 2017/2018 edition, which displayed the brittle fracture of zinc along distinct cleavage planes.