...a very challenging and productive year...
Recruited total 14 PhD students and 5 RAs

17 academic staff involved

Hosted 9 visiting academics this year

8 research topics underway

10 journal papers published

2 sets of six monthly reports produced

1 workshop organised

7 PhDs graduated

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4 Structure of the Centre
5 Development plan of the Centre
5 List of research projects
6 Testimonials
7 Research project descriptions
13 Key equipment used by the Centre
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The management and governance arrangements for the Centre are as follows.

### Directors of the Centre

- Professor John Dear – Director, Professor Jianguo Lin FREng – Executive Co-Director
- Prof Fionn Dunne FREng, Prof Kamran Nikbin, Dr Ben Britton – Co-Director

### Steering Committee

<table>
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<tr>
<th>Membership</th>
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<tbody>
<tr>
<td>Professor Shaoyang Chen, Senior Vice President of AECC</td>
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<td>Professor Jun Ding, General Director of Quality, Science and Technology, AECC</td>
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<td>Professor Shenglong Dai, President of BIAM</td>
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<td>Professor Yajun Wang, Executive Vice President of BIAM</td>
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### Management Committee

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<tr>
<td>Ms Hui Luo, Division Director in Quality, Science and Technology, AECC</td>
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<tr>
<td>Professor Feng Lu, Vice Chief Engineer of BIAM</td>
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<tr>
<td>Mr Xiaochang Xie, Deputy Director of International Cooperation Department, BIAM</td>
</tr>
<tr>
<td>Ms. Tian Tian, Project Manager, International Cooperation Department, BIAM</td>
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### Other associated academic staff

- Professor Mike Lowe FREng, Professor Maria Charalambides, Professor Tony Kinloch FRS FREng, Dr Stephen Garwood FREng, Dr Liliang Wang, Prof Gordon Williams FRS FREng, Dr Bamber Blackman, Dr Gregory Offer, Dr Zhusheng Shi, Dr Jun Jiang, Dr Minh-Son Pham, Dr Xiaoyu Xi

### RAs and PhDs

- Dr Jiaying Jiang – Powder processing technology – Professor Jianguo Lin & Dr Zhusheng Shi
- Yan Zhao – All solid state thin film lithium battery – Dr Gregory Offer & Professor John Dear
- Sze Ki Ng – Fracture and fatigue studies on transparent polymers for aircraft cockpit applications – Dr Bamber Blackman & Professor John Dear
- Ming Huang – Ultrasound characterisation of microstructure of polycrystals – Professor Michael Lowe
- Xianyan Zhou – Fracture mechanisms of central damage in cross wedge rolling – Dr Jun Jiang & Professor Jianguo Lin
- Mei-Chun Pang – Modelling solid state lithium batteries – Dr Gregory Offer & Professor John Dear
- Alessandro Piglione – Microstructures and fatigue damage of Ni crystals – Dr Minh-Son Pham & Professor Fionn Dunne
- Xiaochun Lu – Welding process in differential velocity sideways extrusion – Prof Jianguo Lin & Dr Zhusheng Shi
- Tom Bellamy – Computational and Experimental Investigation of Pores in Single Crystal Nickel Fatigue – Prof Fionn Dunne

### Academic visitors in current year

- Dr Jiqian Zhao – Effects of voids on the fatigue properties of single crystal superalloy – Minh-Son Pham, Prof Fionn Dunne, July 2017 (6 months)
- Dr Jichun Xiong – Modelling of micropores in single crystal nickel alloy – Professor Fionn Dunne, August 2017 (6 months)
- Dr Zhusheng Li – Damage tolerance properties study on BOPMMA – Dr Bamber Blackman, Prof John Dear, December 2017 (12 months)
- Dr Jiang Yu – Effects of voids on the fatigue properties of single crystal superalloy – Dr Minh-Son Pham, Prof Fionn Dunne, May 2018 (6 months)
- Dr Xinyu Ren – Microstructure and mechanical properties of vacuum brazed TiAl and Ni-based superalloy – Dr Jun Jiang, Prof Jianguo Lin, October 2018 (6 months)
- Ms Yuting Ding – Damage tolerance design of modern aircraft transparency – Dr Bamber Blackman, Prof John Dear, November 2018 (12 months)
- Dr Xiaoyu Li – Damage tolerance design of modern aircraft transparency – Dr Bamber Blackman, Prof John Dear, November 2018 (6 months)
- Dr Youxiu Wei – Parameterisation and electrochemical simulation of solid film battery – Dr Greg Offer, Prof John Dear, November 2018 (6 months)
- Dr Rongyu Qin – Laser additive manufacturing nickel-base alloys – Dr Jun Jiang, Prof Jianguo Lin, December 2018 (6 months)
The plan is to provide for the research needs of BIAM. The main research interests of BIAM are centred on the development of materials, manufacturing processes and the in-service maintenance methods for aircraft structures. The procedure used in the planning of future research in the Centre is for BIAM staff to provide a brief on the specific research requirement. Visiting researchers from BIAM will be assigned to do research the BIAM Centre, and each researcher will be involved in a specific research topic. The BIAM centre will allocate funding for a PhD or postdoctoral researcher to initiate and perform the research and to work in association with the visiting academic from BIAM. This mode of operation works well as it means that all BIAM visitors working in the Centre will have a PhD or post doctorate staff within College to research alongside, and this connection will continue when the visiting academic has returned to BIAM. The academic supervisor for the PhDs and post doctorates is also the academic supervisor for the visiting academic. Examples of research topics are given below:

- Characterisation of all solid-state thin film lithium battery and battery thermal runaway modelling – Imperial: Mr Yan Zhao, Ms Mei-Chin Pang; Academic visitors: Dr Xiaofeng Zhang, Dr Mu Chen, Dr Hongyan Liu, Dr Weiming Liu; Supervisors: Dr Gregory Offer, Professor John Dear, Professor Yue Yan

- Damage tolerance design of the modern aircraft transparencies – Imperial: Ms Sze Ki Ng, Academic visitors: Dr Xuan Zhang, Dr Jingyun Zhao, Dr Zhisheng Li; Supervisors: Dr Bamber Blackman, Professor John Dear, Professor Yue Yan

- Experimental characterisation and crystal plasticity modelling of fatigue behaviour of single crystal Nickel superalloy – Imperial: Mr Alessandro Piglione, Mr Tom Bellamy, Dr Yi Guo; Academic visitors: Dr Jinqian Zhao, Dr Jichun Xiong, Dr Jian Yu; Supervisors: Dr Minh-Son Pham, Dr Ben Britton, Professor Fionn Dunne

- Ultrasound characterisation of microstructure of polycrystals — Imperial: Mr Ming Huang, Supervisor: Professor Michael Lowe

- Fracture mechanisms of central damage in cross wedge rolling – Imperial: Ms Xianyan Zhou; Supervisor: Dr Jun Jiang

List of research projects:

1. Characterisation and degradation of all solid-state thin film lithium battery
2. Fracture and fatigue studies on transparent polymers for aircraft cockpit applications
3. Fracture mechanisms of central damage in cross wedge rolling
4. Experimental characterisation and crystal plasticity modelling of fatigue behaviour of single crystal nickel superalloy
5. Ultrasound characterisation of microstructure of polycrystals
6. Plastic deformation and fatigue crack initiation near cylindrical notches in a single crystal nickel superalloy
7. Microstructure and mechanical properties of vacuum brazed TiAl and Ni-based superalloy
8. Laser additive manufacturing nickel-base alloys
Testimonials

Personal statement from research staff and students currently involved within the Centre

Miss Sze ki Ng, PhD since October 2016 – Fracture and Fatigue Studies on Transparent Polymers for Aircraft Cockpit Applications – Dr Bamber Blackman & Prof John Dear

“I was honoured to be one of the recipients of the BIAM Centre’s studentship in the Mechanical Engineering department at Imperial College London. My PhD focused on the fracture and fatigue studies on transparent polymers for aircraft cockpit applications. Throughout my time at Imperial, I had the privilege to work alongside many world-renowned researchers and talented individuals in a world-class research institute. My constant work with various polymers has taught me through experimentation cutting-edge techniques to characterise materials as well as using computational simulations to confirm such results to be able to predict material failures. During my PhD, I also attended a conference to present and publish my work. This proved to be a great experience where I took the opportunity to network with those in the same field and it also greatly refined my presentation skill. I can now say, without a doubt, with all the skillsets I have accumulated throughout my PhD that I am now palpably in good stead for transition and growth in the academic and professional sphere. And thus, I wholeheartedly thank you, BIAM and my supervisors for this wonderful opportunity.”

Dr Jian Yu, Academic visitor since May 2018 - Effects of voids on the fatigue properties of single crystal superalloy – Dr Minh-Son Pham

“It started my PhD study on lithium ion cell thermal performance from 2015 with funding support from BIAM-Imperial Centre for Materials Characterisation, Processing and Modelling. For three year, I focused on understanding lithium cell performance and degradation under complex thermal conditions and developed models for optimising cell design for longer lifetime, all of which would not be possible without the support from the centre. However, the support of the centre goes beyond just for PhD work. Aside from my core research, I had pleasure to work with researchers and engineers from BIAM on a promising next-gen battery chemistry, solid state battery. With the funding support, I was also able to spend a month-long research exchange at one of the best battery research in Europe (Institute of Electrical Energy Storage, Technical University of Munich) as an Imperial-TUM global fellow. All of these has resulted in a fruitful and enjoyable three years. I sincerely hope the centre continue to support future research at Imperial and promote collaboration between Chinese and British researchers and beyond. Keep up the good work!”

Yan Zhao, PhD since October 2015 – Fracture and Fatigue Studies on Transparent Polymers for Aircraft Cockpit Applications – Dr Gregory Offer & Prof John Dear

“It is my great honour to have the opportunity to spend six months to study in the BIAM-Imperial Centre. During this time, I had studied in Dr Minh-Son Pham’s research group. My project is about experimental and computational studies on fatigue behavior of microporosity in a single crystal superalloy. Dr Minh-Son Pham has a wealth of research experience and achievements in the fatigue research. Thanks to the help of Dr Minh-Son Pham and other members of the research group, I learned a lot of knowledge and skills in the research of single crystal superalloy with EBSD and found more interesting thing about the carbide and the crack tip of micropores in the single crystal superalloy during LCF fatigue. I also enjoy the scientific atmosphere and academic environment here, because there are many seminars and group meetings in the college. In a word, the six-months’ stay has greatly helped me both in professional research and communication ability. At last, I would like to express my sincere gratitude to BIAM-Imperial Centre for offering me this research opportunity.”

Dr Zhisheng Li, Academic visitor since December 2018 – Characterisation of PMMA edge joint – Dr Bamber Blackman

“It is a great honour to have the opportunity to study in BIAM-Imperial Centre for a year. I studied in Dr Bamber’s group working on the topic of characterisation of PMMA edge joint. Dr Bamber has a wealth of research experience in fracture mechanics of structural adhesive joints. Since the mechanical behaviours of adhesive joints are complicated, digital image correlation (DIC) method was adopted in our research. DIC technique is widely applied for its full field capability, wide range of sensitivity, easy implementation and flexible application. Through the overview of published works concerning the investigation of adhesive joints using DIC, I have got a good comprehension on the technique. The failure process of PMMA edge joint was recorded with DIC. The fracture behaviour of dacron fibre reinforced composite used in PMMA edge joint was also characterised with the assistance of DIC. Furthermore, the strain distribution in the joint was simulated with finite element modelling based on Abaqus. Through the achievements of above work, the mechanical behaviour of PMMA edge joint was well characterised. The experience here broadened my view in mechanical engineering field. Not only the valuable experimental result, but also the learned new techniques will be helpful in my future work.”
Research Projects

Modelling the Effects of Thermal Gradients Induced by Tab and Surface Cooling on Lithium Ion Cell Performance

Start: July 2015
Expected end: April 2020
PhD: Mr Yan Zhao, Ms Mei-Chin Pang; BIAM: Dr Mu Chen

Lithium ion batteries are increasingly important in large scale applications where thermal management is critical for safety and lifetime. Yet, the effect of different thermal boundary conditions on the performance and lifetime is still not fully understood. This project develops a two-dimensional electro-thermal to simulate cell performance and internal states under complex thermal boundary conditions. Attention was paid to model, not only the electrode stack but also the non-core components (e.g. tab weld points) and thermal boundaries, but also the experiments required to parameterize the thermal model, and the reversible heat generation. The model is comprehensively validated and the performance of tab and surface cooling strategies was evaluated across a wide range of operating conditions. Surface cooling was shown to keep the cell at a lower average temperature, but with a large thermal gradient for high C rates. Tab cooling provided much smaller thermal gradients but higher average temperatures caused by lower heat removing ability. The thermal resistance between the current collectors and tabs was found to be the most significant heat transfer bottleneck and efforts to improve this could have significant positive impacts on the performance of li-ion batteries considering the other advantages of tab cooling.
Ultrasound characterisation of microstructure of polycrystals

PhD: Ming Huang
Start: January 2017
Expected end: May 2020

Many high performance safety-critical components are being made from large-grain polycrystalline materials. Grain size and shape have a significant effect on their mechanical behaviours, e.g. yield, fracture and fatigue strength, thus it is of great importance to measure these microstructure parameters to achieve quality control. Ultrasound scattering in polycrystalline materials carries bulk information about microstructure, and this linkage provides us with an opportunity to measure polycrystalline grain size and shape through the inversion of scattering-induced ultrasound behaviours, e.g. attenuation, dispersion and backscatter.

Current progress includes:
(1) Finite element models have been built to simulate ultrasound scattering in polycrystals with statistically equiaxed and elongated grains;
(2) The approximations of analytical models have been evaluated by comparing with finite element models;
(3) The effect of grain shape on ultrasound scattering has been investigated via finite element and analytical models.

Fig 1. Typical equiaxed and elongated models for simulating polycrystalline materials

Fig 2. Comparison of attenuation between finite element and analytical models for polycrystalline Aluminium

Fig 3. Dependence of attenuation and phase velocity on grain elongation
Fracture and Fatigue Studies on Transparent Polymers for Aircraft Cockpit Applications

Start: July 2015
Expected end: September 2019
PhD: Sze Ki Ng; Visiting Academics: Dr Xuan Zhang, Dr Jingyun Zhao, Dr Zhisheng Li

Transparent polymers are used in many engineering applications for civilian transportation such as passenger aircraft and automotive applications. The advancement in material technology has allowed high density, non-shatter proof glass to be replaced by the low density, shatter proof transparent polymers which provide a better fit for the applications. In the light of concerns about safety issues with transparent polymers, this research aims to gain a detailed understanding of the damage tolerance design of these materials in particular for bi-axially oriented Polymethyl Methacrylate (BOPMMA) used for aircraft cockpit applications.

Environmental stress cracking (ESC) is commonly found in polymers when submerged in an environment under applied stress. In such conditions, a crack may initiate and propagate from a material defect until it reaches a critical size and causes catastrophic failure. It is known that materials with a denser molecular structure are less prone to ESC, hence amorphous polymers often suffer greatly from this effect. A fracture mechanics approach was employed to investigate the fracture mechanism and crack growth in both air and environment. Two different grades of PMMA (amorphous and biaxially stretched PMMA) were tested in solvents with similar solubility parameters as this is known to hasten crazing. Time for crack initiation and crack speed were obtained and plotted against their corresponding fracture toughness. Thus, the ESC resistance of each material can be compared and component life expectancy can also be predicted.

Fig 1. Propagation G vs crack speed for amorphous PMMA (left) and BOPMMA (right).
Research Projects

Fracture Mechanisms of Central Damage in Cross Wedge Rolling

Start: April 2017
Expected end: October 2020
PhD: Xianyan Zhou

Cross wedge rolling (CWR) is an innovative roll forming process, used widely in the automotive industry, having the advantages of a high fraction of material usage, significant level of productivity efficiency and consistent quality of its products. However, understanding the central cracks formation in the workpiece is a key problem prohibiting CWR from entering the conservative, safety-critical aerospace components market. This project aims to understanding the fracture mechanisms of central crack formation in CWR and developing a proper fracture criterion for predicting the crack formation, and then manufacture high quality products without central cracks through implementing the fracture criterion in FE software. The following progress has been made:

- An FE model of CWR with damage subroutines in QForm has been established;
- The stress strain states on the workpiece during CWR have been analysed;
- The fracture mechanisms of central crack formation on both transvers and longitudinal directions have been revealed;
- A fracture criterion has been proposed and verified by comparing the results of 27 cases in literature. Fig. 1 shows the prediction results by the proposed fracture criterion compared with the experimental results in literature;
- To further verify this criterion, an experimental equipment has been setup and a novel specimen is designed.

Fig. 1 Damage value of (Left): various damage models and crack dimensions; (Right): damage prediction of the proposed fracture criterion with experimental results
Research Projects

Experimental characterisation and crystal plasticity modelling of fatigue behaviour of Nickel single crystal superalloy

Ni-based superalloys have played a crucial role in the development of modern jet engines and are nowadays widely employed in both aircraft and rocket engines. Together with creep damage and high temperature corrosion, fatigue damage represents the major threat to the integrity of single-crystal (SX) turbine blades. Blades experience both low cycle fatigue (LCF), mostly due to severe thermal gradients and abrupt changes in loads during engine start-up and shut-down, and high cycle fatigue (HCF), mostly due to pressure fluctuations and mechanical vibrations in the engine.

This project is aimed at studying the deformation mechanisms in Ni-based single-crystal (SX) superalloys during cyclic loading, and consequently investigate the accumulation of fatigue damage. A particular focus lies in the evaluation of the influence of circular surface notches on the fatigue performance of SX superalloys at different temperatures and in different loading conditions. Such notches act as stress concentrators and therefore provide preferential sites for early fatigue crack initiation, inducing a significant reduction in the components’ fatigue lives. Notches are used to study the response of the alloy to the stress concentrations induced by material heterogeneities such as casting pores, by the design of parts (e.g., by the cooling channels in turbine blades) or by real-life notches formed during operation.

Recent progress includes:

- Performed strain-controlled tension-compression fatigue tests at elevated temperatures (800°C and 980°C) on circular-notched round samples, to understand the development of fatigue damage and its dependence on the test temperature
- Thoroughly analysed mechanical data to characterise the development of fatigue damage (Fig. 1)
- Performed extensive microstructural investigations (SEM and EDX), both on the γ/γ' structure (Fig. 2) and on heterogeneities, such as carbides (Fig. 3)
- Performed FIB lift-outs in the regions of the fracture surfaces surrounding notches and subsequent TEM investigations to characterise local plasticity around stress concentrations (Fig. 4)
- Performed extensive TEM investigations on thin foils prepared by twin-jet electro-polishing on fatigue specimens previously tested at room temperature (Fig. 5)

**Fig 1. Experimental results and numerical prediction for bonding time under the forging condition of 1150 degrees**
Research Projects

Plastic Deformation and Fatigue Crack Initiation near Cylindrical Notches in a Single Crystal Nickel Superalloy

Start: January 2018
Expected end: May 2021
PhD: Tom Bellamy

The high temperature stability of nickel based superalloys have allowed gas turbine engines to increase their efficiency levels and ultimately reduce the running costs associated. High safety factors are imposed on the most critical components, the turbine blades, due to a lack of understanding on the mechanisms of plastic deformation and mechanistic drivers for fatigue crack nucleation. This research aims to address this issue, focussing with intent on the role of notches to represent both internal casting defects and surface damage; this is being conducted using crystal plasticity modelling and provided experimental data for verification.

An overview of the current progress includes:

- The development of an accurate model of a notched dogbone sample, including a reduced geometry model to lower computational time of simulations.
- A detailed convergence study to determine a reasonable number of elements and element size local to the regions of interest.
- Completed strain rate sensitivity studies to provide justification for material and model parameters.
- An investigation into the local stored energy for single crystal nickel superalloys around cylindrical notches; this includes the development of the accumulated local stored energy with each cycle and the development of the rate of energy stored with each cycle.
- A brief study into the effects of orientation of a single crystal with respect to the loading axis has also been completed.

From the research completed, the next challenges are to perform an in depth study into the local stored energy with each increasing cycle, for various loading conditions. From this, a two-phase crystal plasticity model capable of accounting for both the gamma matrix phase, and the ordered gamma prime precipitate phase will be created. This will greatly improve accuracy of simulations, and has applications beyond the scope of this research.

Fig 1. (Top) Full geometry of dogbone samples being modelled; (Left) a section of the reduced model centred around the notch, image shows stress field around 0.2mm notch; (Right) accumulated stored energy at the base of notches sizing 0.2, 0.3, 0.4, and 0.5mm; note the increasing energy values with increasing notch sizes.
Equipment

An extensive range of equipment is available to the researchers within the Centre

Heavy Testing Machines
A 250 Tonne hydraulic forming press and 100 Tonne high-speed (up to 1.6 m/s) hydraulic forming press are available. These machines can act in tension and compression and can be used for three-point bending tests and forging tests. The 100 Tonne high-speed press can also be used for large scale fatigue tests.

High-rate Testing Machines
There are 25 Tonne (up to 5 m/s) and 2 Tonne (up to 25 m/s) testing machines available for high strain rate tests. These machines are important for studying strain-rate dependent effects such as work hardening and can be used for impact research.

Gleeble Thermo-Mechanical Simulator
The Gleeble 3800 is a fully integrated digital closed loop thermal and mechanical testing system. Specimens can be heated at rates up to a maximum 10,000 °C/s by resistance heating, or can be held at constant temperature. It is capable of exerting up to 20 tonnes of static force in compression or 10 tonnes in tension, with applied displacement rates up to 2 m/s. Feedback consists of linear variable differential transformers, load cells or non-contact laser extensometry.

Optical Strain Mapping
The optical techniques available within the Centre include Digital Image Correlation (including Speckle and Grid Patterning), Electronic Speckle Pattern Interferometry and Moiré Interferometry. Digital Image Correlation provides 3D deformation mapping.

X-ray Diffraction
A wide range of X-ray diffraction techniques are available within Imperial College for the investigation of polycrystalline materials, single crystal and thin films. Samples may be examined in either bulk or powdered form. There are currently 2 PANalytical MRDs, 2 PANalytical MPDs and a Bruker D2 desk-top instrument for rapid data collection. There is also a high temperature X-ray diffraction facility. X-ray diffraction measurements can be performed at elevated temperatures up to 1000 °C using a combination of direct and indirect heating. This allows the investigation of the thermal behaviour of lattice parameters, crystallisation studies, and the detection and characterisation of high temperature phases. The high temperature chamber is fitted with a system to allow measurements to be made in controlled atmospheres (including oxidative) so that structural changes related to sample-gas interactions can be studied.

Neutron Diffraction
Imperial have been greatly successful in being awarded beam time at a number of research institutes including ISIS, UK; Helmholtz-Zentrum, Berlin; Institut Laue-Langevin, France; Heinz Maier-Leibnitz, Munich and The Paul Scherrer Institute, Switzerland. The highly penetrative neutron diffraction technique is well established for measuring 3D residual stresses deep within in a volume of material, non-destructively. Imperial have widely employed the technique to measure macro scale residual stresses and strains, typically in welded or non-uniformly plastic deformed components. These measurements have been valuable for the verification of finite element models to simulate the welding or deformation process and predict the residual stress fields. The method has also been employed to measure intergranular strains in alloys and used to develop and verify crystal plasticity models.

Gas Gun
A new gas gun has been installed in the lab. The gas gun has a fast launching mechanism allowing firing ice balls as well as rubber and gelatine projectiles. The gas gun can be connected to both compressed air and helium to the pressure up to 10 bar. The target area is designed with polycarbonate windows allowing the strain mapping of the sample under impact. The gun has 3 m long barrels in three different diameters including 10, 25 and 40 mm.

Multi-Point Forming Tooling
A modular flexible tool for the creep-age forming of extra-large panel components has been designed, built and patented. An integrated optimisation process for tool offsetting is demonstrated in published results. The method can be used to make flexible CAF tools with less than 1 mm error in the forming surface. In addition, this error can eventually be compensated and thus eliminated from the CAF-formed parts, by using the developed optimisation technique.

Materials Characterisation
The Harvey Flower Microstructural Characterisation Centre in the Department of Materials for electron microscopy provides modern facilities for advanced materials imaging and characterisation. The facilities include three scanning electron microscopes (SEMs) and three transmission electron microscopes (TEMs). This includes the state-of-the-art monochromated FEI TITAN 80/300 and FEI Helios NanoLab 600 DualBeam TEM.

Metal Additive Manufacturing Suite
The AM25 has a build rate of 5 cm³ - 20 cm³ per hour over an area of 250 x 250 up to 360mm high, the addition of 70 μm diameter powders can create complex shapes in stainless steel, inconel, titanium and aluminium.
A number of events have taken place to facilitate research interaction and deep dialogue regarding the Centre’s work and direction.

**BIAM Centre workshop in London**

**3 May 2018**

**BIAM:** Prof Yajun Wang, Prof Feng Lu, Prof Yue Yan, Prof Chengbo Xiao, Mr Biao Zhou, Ms Leimin Zhou, Dr Zhisheng Li  
**Imperial:** Prof John Dear, Dr Dimitris Sarantaridis, Prof Fionn Dunne, Dr Ben Britton, Dr Minh-Son Pham, Dr Catrin Davies, Dr Bamber Blackman, Prof Kamran Nikbin, Dr Zhusheng Shi, Dr Xiaoyu Xi, Dr Jun Jiang, Dr Jiaying Jiang and other researchers

**Visit of BIAM delegation**

**22 January 2018**

**BIAM:** Prof Yajun Wang, Mr Xiaochang Xie, Mr Xudong Wang, Mr Shaojiu Yan, Ms Jinhua Wang, Dr Zhisheng Li  
**Imperial:** Prof Jianguo Lin, Dr Zhusheng Shi, Dr Jiaying Jiang

**Visit to BIAM**

**27 April 2018**

**BIAM:** Prof Xingwu Li, Prof Feng Lu, Prof Yue Yan, Prof Yingying Lin, Prof Hai Lin, Prof Shuyun Wang, Mr Biao Zhou, Mr Xiaochang Xie, Dr Guodong Zhang, Dr Neng Li, Dr Jingqian Zhao, Dr Liu Chen, Dr Jian Yu, and other researchers  
**Imperial:** Dr Bamber Blackman, Dr Min-Son Pham, Dr Jun Jiang, Dr Zhusheng Shi, Dr Xiaoyu Xi

**Visit of BIAM and Beijing Municipal Science & Technology Commission delegation**

**13 May 2018**

**BMSTC:** Mr Qiang Xu, Mr Di Wei, Mr Xiaoyu Zhu, Ms Song Yang  
**BIAM:** Mr Xiaochang Xie, Mr Xudong Wang  
**Imperial:** Dr Xiaoyu Xi, Dr Zhusheng Shi

**Visit of BIAM delegation**

**31 October 2018**

**BIAM:** Prof Haifeng Jiang, Prof Feng Lu, Mr Zhiguo Zhang, Mr Yazhou Zhang, Ms Zhou Leimin, Prof Yan Wang, Prof Cheng Yang, Prof Zhaodong Fan, Dr Yingwei Fan  
**Imperial:** Prof. Jianguo Lin, Dr Jun Jiang, Dr Xiaoyu Xi, Dr Zhusheng Shi, Dr Jiaying Jiang and PhD students
IMPERIAL’S NEW PROVOST

Professor Walmsley, a world-renowned expert in ultrafast and quantum optics, took up his new role as Provost at Imperial in September. He joined from Oxford University, where as Pro-Vice-Chancellor he led the research and innovation strategy.

WE INNOVATE

Continuing the theme of diversity, the College celebrated the collective achievements of entrepreneurial women students, marking five year of WE Innovate (formerly known as the Althea-Imperial Programme).

Over its course, the programme has inspired a new generation of women entrepreneurs at Imperial and help them accelerate their startups. Some of these women spoke at a special event, including Olivia Ahn, founder of Polipop who won the competition in 2017. Her startup is developing zero-waste, flushable menstrual pads to tackle the environmental impact of disposable sanitary products.

PARTNERS AND FRIENDS

In January, Imperial announced a major new maths partnership with France’s National Center for Scientific Research (CNRS) to create a new joint laboratory. Meanwhile, in October the College signed a partnership with the Technical University of Munich in Germany to forge new research links in computer science and informatics, medicine and medical sciences, amongst other areas.

Importantly for Imperial’s global links, Professor Maggie Dallman became Imperial’s Vice President (International) in February and visited Ghana and Kenya in the Summer to strengthen collaborations and meet alumni. Indeed, Imperial and one of its most important partners in the US, MIT, subsequently launched a search for African research collaborators.

IMPERIAL’S AWARDS AND HONOURS

There are so many awards and honours at Imperial each month it can be hard to keep up with them all. But it was a seriously stellar year for two of Imperial’s top profs who attracted a litany of accolades. Professor Michele Dougherty CBE received an Institute of Physics Gold Medal for her research and leadership in space science, particularly during the Cassini missions to Saturn and its moons.

Meanwhile, following his bestselling book in 2017, Professor Jonathan Haskel received a CBE in the Queen’s Birthday Honours for public services to economics in June.

IMPERIAL WHITE CITY

The White City area of West London has seen a remarkable transformation over the past few years, and at its heart is the vision for Imperial’s own Campus, which has really come to life in 2018. One major milestone for the White City Campus this year was the completion of the Molecular Science Research Hub (MSRH) and the phased move of the College’s Department of Chemistry into the new building in the summer.

Meanwhile the College launched a £100 fundraising campaign to create a new School of Public Health at White City, which will pioneer new approaches to society’s most pressing healthcare challenges.
For all enquiries and further technical information please contact:

Imperial College London
Dr. Zhusheng Shi (zhusheng.shi@imperial.ac.uk) - Centre Manager
Prof. John Dear—Director
Prof. Jianguo Lin FREng—Executive Director
http://www.imperial.ac.uk/biam-imperial