



# Centre for Advanced Structural Ceramics (CASC)

Imperial College  
London

A UK centre for structural ceramics research and teaching, which is world-leading in this key area and is developing links with leading industrial and academic groups.

December 2017

12<sup>th</sup> Newsletter

CASC continues its activities supported by the **Industrial Consortium** formed by Morgan Advanced Materials, Asahi Glass, Reaction Engines, SAFRAN and John Crane. More than 30 students and postdoctoral researchers are working on projects funded by a variety of sources including EPSRC, EU and Industry.



REACTION ENGINES

## Ceramics Summer School

The eight edition of CASC Summer School on Ceramics took place from the **13<sup>th</sup> to the 15<sup>th</sup> of September** at Imperial College.

The programme for the three days consisted on a talk from **Professor Eduardo Saiz** on *Ceramic Shaping*, **Dr Andre Prette** (Lucideon) talked about *Flash sintering of ceramics-from concept to commercialisation* and the first day finished with a talk by **Dr Finn Giuliani** on *Introduction to mechanical properties*.

The second day started with the presentation of **Dr Fabrice Rossignol** (University of Limoges) on *Additive manufacturing of ceramics at the University of Limoges* and after a coffee break we had **Dr Nasrin Al Nasiri** (Imperial College) talking about her work on *Oxidation of ceramic matrix composites in dry and wet environments*, and to finish the day we had two amazing lab sessions on 3D printing and ceramic shaping.

The last day we had the visit of **Dr Alan McLelland** (Morgan Advanced Materials) who presented the *Future Challenges and applications of ceramics* and to close the School we had **Dr Esther Garcia Tunon** (Liverpool University) talking about *Complex fluids in ceramic processing: tuning rheology for additive manufacturing*.

The School also included two social dinners, where the guests had the chance to network and get to know each other and their work.

This year we had attendees from Morgan, Rolls Royce, Saint Gobain, ETH, Queen Mary University and an independent consultant.

Feedback from the attendees was that they would all recommend the school to a colleague as it was a great occasion to get a good insight on advancements on ceramic engineering and especially to expand their networks.



The **ninth edition of CASC Summer School** will most likely take place from the 12<sup>th</sup> to 14<sup>th</sup> of September 2018, but the date will be decided early next year.



## 2017 Sir Richard Brook Prize Award

Nominations are open for the **2017 Sir Richard Brook Prize** for the best ceramics science or engineering PhD in the UK in 2017.

For nominations, the PhD supervisor should submit to Prof Saiz ([e.saiz@imperial.ac.uk](mailto:e.saiz@imperial.ac.uk)) the following information:

- Copy of the award certificate
- Copy of resulting publications or presentation
- Abstract of the nominee's thesis
- Supporting statement

The 2017 nomination will remain open until the **15<sup>th</sup> of January 2018**, for additional information contact: Eduardo Saiz ([e.saiz@imperial.ac.uk](mailto:e.saiz@imperial.ac.uk)) or Alba Matas ([a.matas-adams@imperial.ac.uk](mailto:a.matas-adams@imperial.ac.uk)).



## CASC Goodbyes

These past few months we have had to say goodbye to:

- **Dr Laura Larrimbe Bergera**, she left her job as Research Associate at CASC in August to work as a R&D Engineer-Materials Scientist at Sandvik in Barcelona, Spain.
- **Dr Claudio Ferraro**. He left his job as Research Associate at CASC in September to go and work at Beiersdorf as Materials Engineer in Hamburg, Germany.
- **Mr Ezra Feilden Irving** (now Dr Feilden Irving) finished his PhD at CASC, sponsored by the Industrial Consortium, and moved to work at Meggitt as Graduate Engineer.
- **Dr Na Ni** left her position as EPSRC Junior Research Fellow and started in November as Associate Professor in the School of Mechanical Engineering at Shanghai Jiao Tong University.
- **Dr Cyril Besnard** left his position as Research Assistant in CASC in November.

We wish all of them the best of luck!

## CASC New Appointees

- **Dr Dan Glymond** joined the EPSRC project *Transpiration Cooling Systems for Jet Engine Turbines and Hypersonic Flight* until August 2018.
- **Iuliia Elizarova** joined CASC at the beginning of December as a Research Associate for the *Manufacture using Advanced Powder Processes (MAPP)* EPSRC project.
- **Justine Delage** joined CASC at the beginning of December to do her PhD under the supervision of Dr Nasrin Al Nasiri and Prof Eduardo Saiz. Her project, titled "*Development and Evaluation of in-plane Fracture Toughness of SiC Based Ceramic Matrix Composites*", will be funded by Rolls-Royce.
- **Ben Currie** joined CASC to do his PhD under the supervision of Dr Luc Vandeperre and Dr Sam Humphry Baker. His project is titled "*Next generation ceramic composites for extreme environments in nuclear fusion power reactors*".
- **Stuart Aberdeen** is doing his PhD with Dr Luc Vandeperre and Prof Mary Ryan on "*Magnetic nanoparticles for water cleaning*".

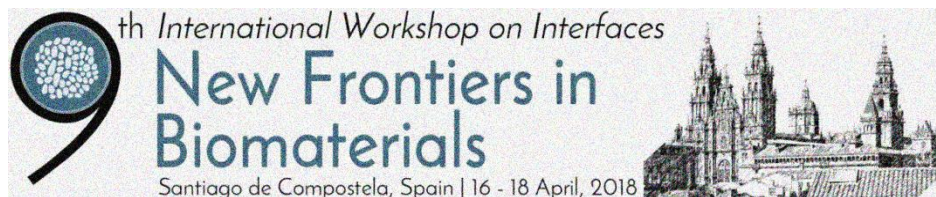
## CASC new doctors

In the last six months we have had the following PhD defense in CASC:

- **Dr Cyril Besnard** defended his PhD work titled: "*Silicon doped boron carbide for armour*" under the supervision of Dr Giuliani and Dr Vandeperre.
- **Dr Ezra Feilden Irving** defended his PhD work titled: "*Additive Manufacturing of ceramics and composites via robocasting*" under the supervision of Prof Saiz, Dr Vandeperre and Dr Giuliani.

**Further information:** [www.imperial.ac.uk/structural-ceramics](http://www.imperial.ac.uk/structural-ceramics) or +44 20 7594 2053

## 9<sup>th</sup> International Workshop on Interfaces



Abstract submission for the 9<sup>th</sup> edition of the Workshop on Interfaces. New Frontiers in Biomaterials, has been extended until the 15<sup>th</sup> of December. The meeting will take place in **Santiago de Compostela, Spain**, from the **16<sup>th</sup> to 18<sup>th</sup> of April 2018**, and it is being organised by members of Imperial College, Tampere University of Technology, McGill University, University of Manchester and Keramat and endorsed by the European Society for Biomaterials (ESB)

This workshop follows on from merging the past **International Workshops on Interfaces** and the first **Biobone Symposium** in 2015.

It is becoming increasingly recognized that understanding the role of structure at multiple length scales is the key for the future development of biomaterials and bio-inspired structures for functional and structural applications. In this respect, the growing diversity in processing and characterization techniques creates unique opportunities but also new challenges. Here they aim to merge the boundaries between these fields and open a platform for learning and dissemination of the latest advances.

The full programme will be available soon, even though, 5 keynote speakers (**Prof Joanna Aizenber, Prof Peter Fratzl, Prof André R Studart, Prof Helmut Cölfen and Prof Justin Cobb**) and 14 invited speakers (**Prof Marc Bohner, Prof Chiara Vitale Brovarone, Prof Jérôme Chevalier, Prof Liam Grover, Dr Gowsihan Poologasundarampillai, Prof Qunfeng Cheng, Prof Maria-Pau Ginebra, Prof Brian Derby, Prof Akiko Obata, Prof Mauro Alini, Prof Fabrice Rossignol, Prof Paul Hatton and Prof Horst Fischer**) have already been confirmed.

**Registration** will remain open until the 16<sup>th</sup> of March 2018 and includes access to all talks and poster sessions, as well as coffee break, lunches and the Gala dinner.

For additional information contact: Dr Francesca Tallia ([f.tallia@imperial.ac.uk](mailto:f.tallia@imperial.ac.uk)) or Dr Alba Matas Adams ([a.matas-adams@imperial.ac.uk](mailto:a.matas-adams@imperial.ac.uk)).



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## CASC Diary

- 12<sup>th</sup> January 2018 ➤ **CASC Industry Day**, London, UK.
- 21-26<sup>th</sup> January 2018 ➤ **42<sup>nd</sup> International Conference and Expo on Advanced Ceramics and Composites (ICACC'18)**, Daytona Beach, USA.
- 30-31<sup>st</sup> January 2018 ➤ **MAPP 1<sup>st</sup> International Conference**, Sheffield, UK.
- 16-18<sup>th</sup> April 2018 ➤ **9<sup>th</sup> International Workshop on Interfaces. New Frontiers in Biomaterials**, Santiago de Compostela, Spain.

## Out and about

- 9-13 July 2017 ➤ **Prof Saiz** gave a talk at *ECerS 2017* about “*Ceramic-based composites with complex architectures*”, **Prof Lee** gave a talk titled “*A personal perspective of ceramic research collaborations with industry*” and **Dr Al Nasiri** talked about “*Environmental barrier coatings (EBC) for silicon-based ceramic composites*”. **Dr Zapata Solvas** also presented his work titled “*A study on the feasibility of  $Zr_{n+1}AlC_n$  and  $Zr_{n+1}SiC_n$  MAX phases for future fission environments*”. Finally, **Wirat Lerdprom** talked about “*Impact of field assisted sintering on porcelain microstructure*”.
- 29-31<sup>st</sup> August 2017 ➤ **Prof Saiz** attended *China Nano* where he gave a talk at the *Bioinspired Interfacial Materials and Devices* symposium.
- 17-20<sup>th</sup> September 2017 ➤ **Dr Vandeperre** attended the *Ultra-High Temperature Ceramics: Materials for Extreme Environment Applications IV* where he talked about “*Porous ZrB<sub>2</sub> manufacturing for transpiration cooling systems for hypersonic flights*”.
- 1-6<sup>th</sup> October 2017 ➤ **Dr Vandeperre** gave a lecture in honour of Professor Omer Van der Biest at the *6th International Conference on Electrophoretic Deposition: Fundamentals and Applications*, South Korea.
- 10-11<sup>th</sup> October 2017 ➤ **Prof Saiz** gave a talk at the *Interfaces, Grain Boundaries and Surfaces from Atomistic and Macroscopic Approaches – Structure and Chemistry of Interfaces* symposium at *MS&T 17* where **Ms Jindaporn Juthapakdeeprasert** talked about “*Cerium-added Alumina and Cerium-added Zircon as High Emissivity Coatings for Cement Rotary Kilns*” and **Mr Garry Stakalls** attended the Exhibits session.
- 4-7<sup>th</sup> November 2017 ➤ **Dr Vandeperre, Dr Giuliani and Prof Lee** attended the *Tenth International Conference on High-Performance Ceramics* in Nanchang, China. Dr Vandeperre gave an invited talk on “*Porous UHTC'S for transpiration cooling*”, Prof Lee also gave an invited talk on “*MAX phases and other carbides for severe environments*” and finally Dr Giuliani talked about “*In situ fracture tests of ceramic grain boundaries*”.
- 26<sup>th</sup> November-1<sup>st</sup> December 2017 ➤ **Dr Giuliani** gave a lecture at the *2017 MRS Fall Meeting* on “*In Situ Stable Fracture of Ceramics and Metal Ceramic Interfaces on the Micron Scale*”

## Prizes and Publications

- Several members of CASC participated at the **Imperial Material's Postdoc symposium**, that took place the 8<sup>th</sup> of September. **Dr Laura Larrimbe** and **Dr Eleonora D'Elia** were part of the organising committee.
  - **Dr Eleonora D'Elia** also talked about “*Smart adaptive materials with sensing, healing and self-shaping capabilities*”.
  - **Dr Claudio Ferraro** presented an image of his work to the image competition, he also presented a poster for which he won the **Best Design for a Poster Prize**.
  - **Dr Eleonora D'Elia** won the second prize for the **Best Picture** competition.
- In the past few months, CASC has published different papers in high impact factor journals. Some examples are:
  - *3D Printing Bioinspired Ceramic Composites* by Ezra Feilden, Claudio Ferraro, Qinghua Zhang, Esther Garcia-Tuñon, Eleonora D'Elia, Finn Giuliani, Luc Vandeperre and Eduardo Saiz. This paper was published in **Scientific Reports** in October.
  - *Graphene Oxide: An All-in-One Processing Additive for 3D Printing* by Esther Garcia-Tuñon, Ezra Feilden, Han Zheng, Eleonora D'Elia, Alan Leong and Eduardo Saiz. This paper was published in **ACS Applied Materials and Interfaces** in September.
  - *In Situ Stable Crack Growth at the Micron Scale* by Giorgio Sernicola, Tommaso Giovannini, Punit Patel, James R. Kermode, Daniel S. Balint, T. Ben Britton and Finn Giuliani. This paper has been published in **Nature Communications** in July.
  - *Spontaneous Solid-State Foaming of Nanocrystalline Thermoelectric Compounds at Elevated Temperatures* by Samuel A. Humphry-Baker and Christopher A. Schuh. This paper was published in **Nano Energy** in June.
  - *Using Graphene Networks to Build Bioinspired Self-Monitoring Ceramics* by Olivier T. Picot, Victoria G. Rocha, Claudio Ferraro, Na Ni, Eleonora D'Elia, Sylvain Meille, Jerome Chevalier, Theo Saunders, Ton Peijs, Mike J. Reece and Eduardo Saiz. This paper was published in **Nature Communications** in February.

## Visitors

- **Amin M'Barki** (Saint Gobain) visited CASC in October for two weeks as part of the AMITIE programme.
- **Dr Adam Stevenson** (Saint Gobain) visited CASC in October.