

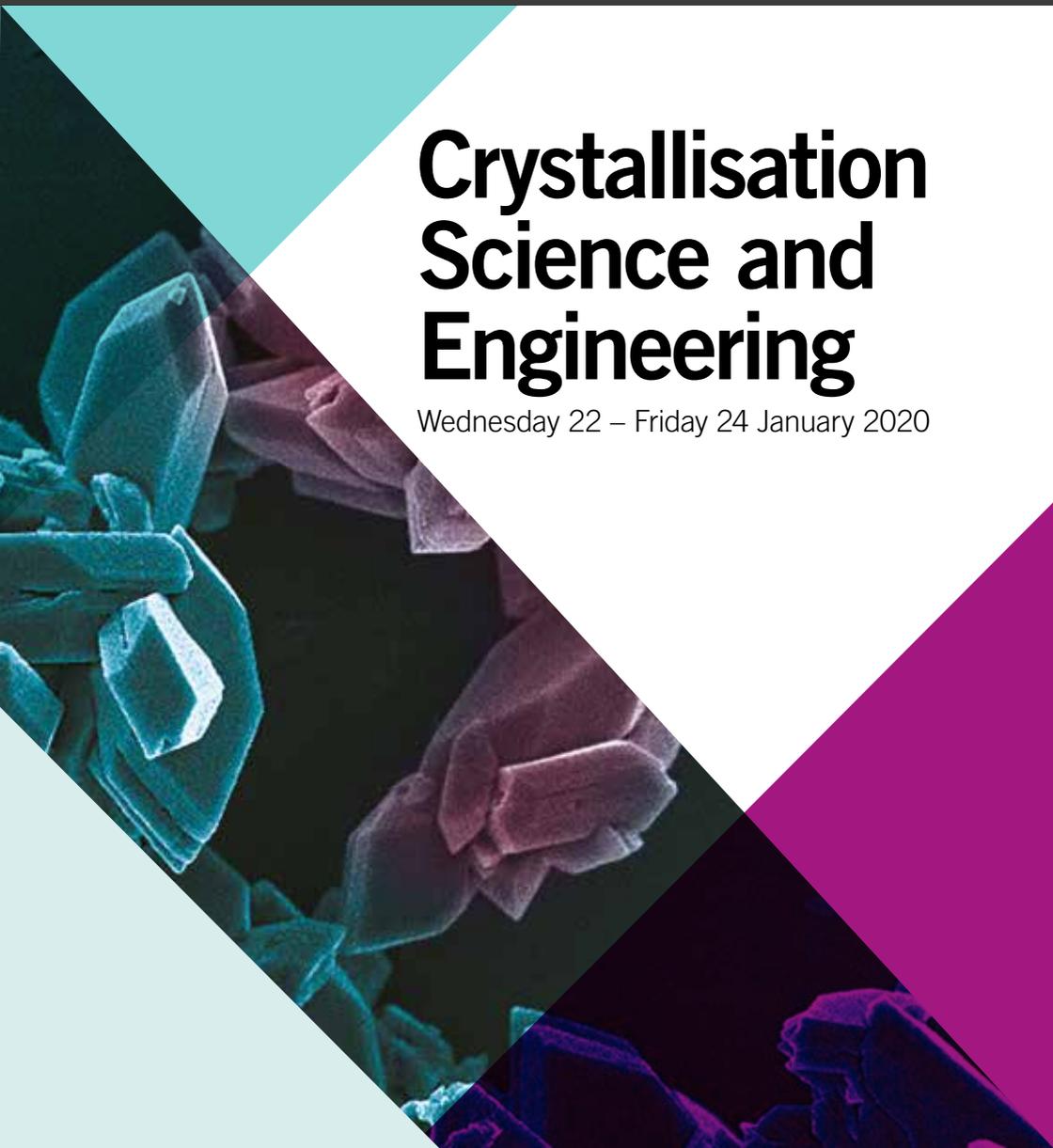
Faculty of Engineering  
and Physical Sciences



UNIVERSITY OF LEEDS

# Crystallisation Science and Engineering

Wednesday 22 – Friday 24 January 2020



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## About the course

This 3 day short course will outline the fundamental science and engineering of crystallisation processes. The course will also include laboratory experimental sessions to demonstrate crystallisation processes, application of advanced process analytical technologies (PATs) and particle characterisation techniques. The delegates will have hands-on opportunities to use crystallisation modelling software. The course will be delivered by academic and industrial experts in the field and will include case studies.

## Course aims

Delegates will leave with the basic knowledge that they can use in their industrial work and a deeper understanding of crystallisation science and technology to assist in process development and scale-up of the manufacture of crystals for desired properties. The course will also give delegates the tools to be able to better engage with experts when needed.

## Who should attend

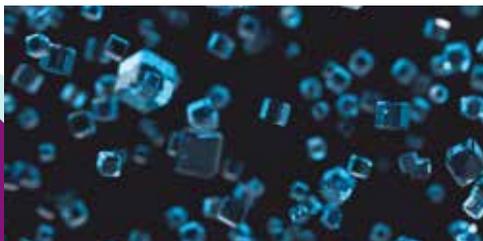
This course is aimed at engineers and scientists working in industries such as agrochemicals, biotechnology, food, fuels, personal care, pharmaceutical and speciality chemicals companies. It is relevant to those involved in crystallisation process development, scale-up, control and operations. It will also be of interest to post-graduates and post-docs involved in research in the general area of crystallisation.

## Course Directors

**Dr Tariq Mahmud** is an Associate Professor in Chemical Engineering. His expertise lies in industrial crystallisation process development, scale up and control. He also has extensive expertise in integrated CFD-process modelling encompassing development and validation of process models coupled with CFD of turbulent and multi-phase flow systems and nano-/micro-size particulate synthesis processes via crystallisation, reactive precipitation and spray drying. He has led a number of experimental and modelling projects in these areas, as Principal- or Co-investigator, funded by the UK EPSRC, Innovate UK and industry including AstraZeneca, GSK, Pfizer, P&G, NNL and Syngenta. Tariq is currently a member of the British Association for Crystal Growth (BACG) and jointly chaired their 45th and 47th Annual Conference held in July 2014 and June 2016 at Leeds, and a Council member of the European Network for Crystal Growth.



**Dr Xiaojun Lai** is a Lecturer in Chemical Engineering and has research interests in the application of process-related analytical and characterisation techniques to studies of crystallisation and precipitation processes. He has used reaction calorimetry for studying process thermodynamics, NIR spectroscopy and video microscopy for particle monitoring, Raman technique for multiple component crystallisation system characterisation, and in situ XRD for phase transformation investigation. He has also developed instrumentation for combined X-ray topography and multiple diffraction for the characterisation of lattice defects in crystals and made significant use of SR techniques, for in situ probing of crystal structure during practical processing and X-ray spectroscopy for probing impurity impact on crystal growth.



## Programme

### Wednesday 22 January 2020

08:45 Registration and coffee  
09:15 Introduction

### Crystallisation Fundamentals

**09:30 Crystallisation route map**  
Professor Kevin Roberts  
SCaPE, University of Leeds

**10:15 Nucleation and crystal growth**  
Dr Tom Turner  
SCaPE, University of Leeds

11:00 Coffee

**11:20 Crystal morphology and habit modification**  
Dr Ian Rosbottom  
Imperial College London

**12:05 Fundamentals of polymorphism**  
Dr Robert Hammond  
SCaPE, University of Leeds

12:50 Lunch

**13:35 Solid-state analysis**  
Dr Gerry Steele  
PharmaCryst Consulting Ltd

**14:20 Screening for polymorphs (solid form selection)**  
Dr Bob Docherty  
Pfizer, Sandwich

**15:05 Characterisation of pseudo polymorphs (TGA, DVS, IGC)**  
Dr Gerry Steele  
PharmaCryst Consulting Ltd

15:50 Tea

### Laboratory Demonstrations

**16:10 D1 – Nucleation kinetics**  
Dr Tom Turner and  
Dr Tariq Mahmud  
SCaPE, University of Leeds

**D2 – Growth kinetics**  
Muhammad Najib and  
Dr Xiaojun Lai  
SCaPE, University of Leeds

17:25 End of day one  
19:00 Course dinner

The full course details and online booking are now available from the course web page:  
[www.engineering.leeds.ac.uk/short-courses](http://www.engineering.leeds.ac.uk/short-courses)

### Thursday 23 January 2020

08:45 Coffee

**Crystallisation Processes**

**09:00 Batch crystallisation processes**  
Dr Elena Simone  
School of Food Science and Nutrition, University of Leeds

**09:50 Hydrodynamics, mixing and heat transfer in batch crystallisers**  
Dr Tariq Mahmud  
SCaPE, University of Leeds

10:40 Coffee

**11:00 Continuous crystallisation processes**  
Christian Melches  
GEA

**11:50 Solvent selection: properties and solubility**  
Professor John Blacker  
School of Chemistry, University of Leeds

12:35 Lunch

**13:20 Workflow for crystallisation process development – A case study**  
Dr Neil George  
Syngenta/SCaPE, University of Leeds

**14:10 Post crystallisation unit operations: filtration and drying**  
Dr Amgad Moussa  
Syngenta

14:50 Tea

### Measurements and Control

**15:10 Particle size and shape measurements and characterisation**  
Umair Zafar  
Novartis/University of Leeds

**16:00 Control of crystallisation processes for PSD**  
Dr Tariq Mahmud  
SCaPE, University of Leeds

### Laboratory Demonstrations

**16:40 D3 – Particle characterisation**  
Dr Ben Douglas and  
Dr Tariq Mahmud  
SCaPE, University of Leeds

**D4 – Raman spectroscopy**  
Dr Tom Turner and  
Dr Xiaojun Lai  
SCaPE, University of Leeds

17:50 Poster and drinks reception followed by close of day two

### Friday 24 January 2020

08:45 Coffee

**Measurements and Control (cont.)**

**09:00 Process spectroscopic techniques (IR, UV-vis, Raman)**  
Dr Xiaojun Lai  
SCaPE, University of Leeds

**09:40 Particle properties and performance**  
Dr Richard Storey  
Astra Zeneca

**Co-Crystals**

**10:20 Fundamentals of co-crystallisation and case studies of recent developments**  
Dr Mingzhong Li  
De Montfort University  
Professor Anant Paradkar  
University of Bradford

11:10 Coffee

### Crystallisation Modelling and Software Demonstrations

**11:30 Molecular to crystal science modelling route map**  
Dr Robert Hammond  
SCaPE, University of Leeds

**12:15 Software demonstration: VISUAL HABIT**  
Dr Jonathan Pickering  
SCaPE, University of Leeds

12:45 Lunch

**13:30 Digital design of crystallisation processes**  
Niall Mitchell  
Process Systems Enterprise (PSE), London

**14:15 Software demonstration – Introduction to the crystallization modules of gPROMS Formulated Products (Simulation & Global System Analysis)**  
Dr Niall Mitchell  
PSE

**15:20 Wrap-up and feedback from delegates**  
Dr Xiaojun Lai  
Dr Tariq Mahmud

15:50 End of course

# Further Information

## Venue

The course venue will be within the Faculty of Engineering and Physical Sciences at The University of Leeds. Please note, car parking for visitors is unavailable at the University. The nearest public car park is Woodhouse Lane (multi storey) at LS1 3HQ.

## Course fees

The following course fees include the cost of tuition, course materials, refreshments, lunches and the course dinner:

**£1050** until 16 December 2019

**£1125** after 16 December 2019

Discount available to full time PhD students

## Accommodation

Delegates are responsible for their own accommodation, if required. A list of hotels close to the University will be sent out with the delegate joining instructions.

## Course dinner

The course dinner will take place at a Leeds city centre restaurant on Wednesday evening and is included in the course fee. The dress code is smart casual.

## Accessibility

Please let us know if you have any specific requirements including any access or dietary requirements in relation to this course.



## How to book

Booking for this course should be completed through our secure online store (via debit/credit card). To complete your booking please follow the instructions below:

## Online booking

1. Log on to our online store at <https://store.leeds.ac.uk>
2. Select Conferences and Events in the left-hand navigation bar.
3. Select CPD Faculty of Engineering and Physical Sciences
4. Select the course or event for which you wish to register and click on 'Book'
5. If you are a new user, please follow the instructions to register. If you already have an account log in as instructed.
6. Complete the application process as directed by the booking system.

You will receive an automatic confirmation email within 24 hours of your booking.

## For online booking queries and for all other enquiries please contact:

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University of Leeds

Front cover image courtesy of Jennifer N Haque,  
PhD student, 2006, University Of Leeds

## Terms and conditions for booking

Payment in full should accompany your booking. The course fee is exempt from VAT. Fees must be paid in full no later than 15 working days before the course commences. Failure to pay may result in attendance being refused. Registrations are accepted on the understanding that the printed programme is given in good faith but may have to be re-scheduled or the speakers changed for reasons outside our control. The University of Leeds reserves the right to cancel or postpone the course, in which case fees will be refunded in full. In the event of cancellation, the University will not be held liable for delegates travel or accommodation expenses. Delegates will receive a full refund for cancellations made within 7 days of online booking, except where the booking has been made for an event commencing within the next 7 days. Where a delegate wishes to cancel a registration after this 7 day period, written cancellations received up to 15 working days before the course will be subject to an administrative charge of 20% of the total remittance. After this date the full fee is chargeable and no refunds will be made, this also applies for non-attendance but copies of the course documents will be sent. Substitutions may be made at any time. If you are unable to complete your registration using the online booking system please contact the CPD, Conference & Events Unit to discuss alternative arrangements. The CPD Unit takes your privacy seriously and we will only use your details to provide information on our CPD courses and relevant engineering events. We will not pass your details to any other organisations. You can unsubscribe at any time by emailing us at [cpd@engineering.leeds.ac.uk](mailto:cpd@engineering.leeds.ac.uk) and your details will be removed from our database.