

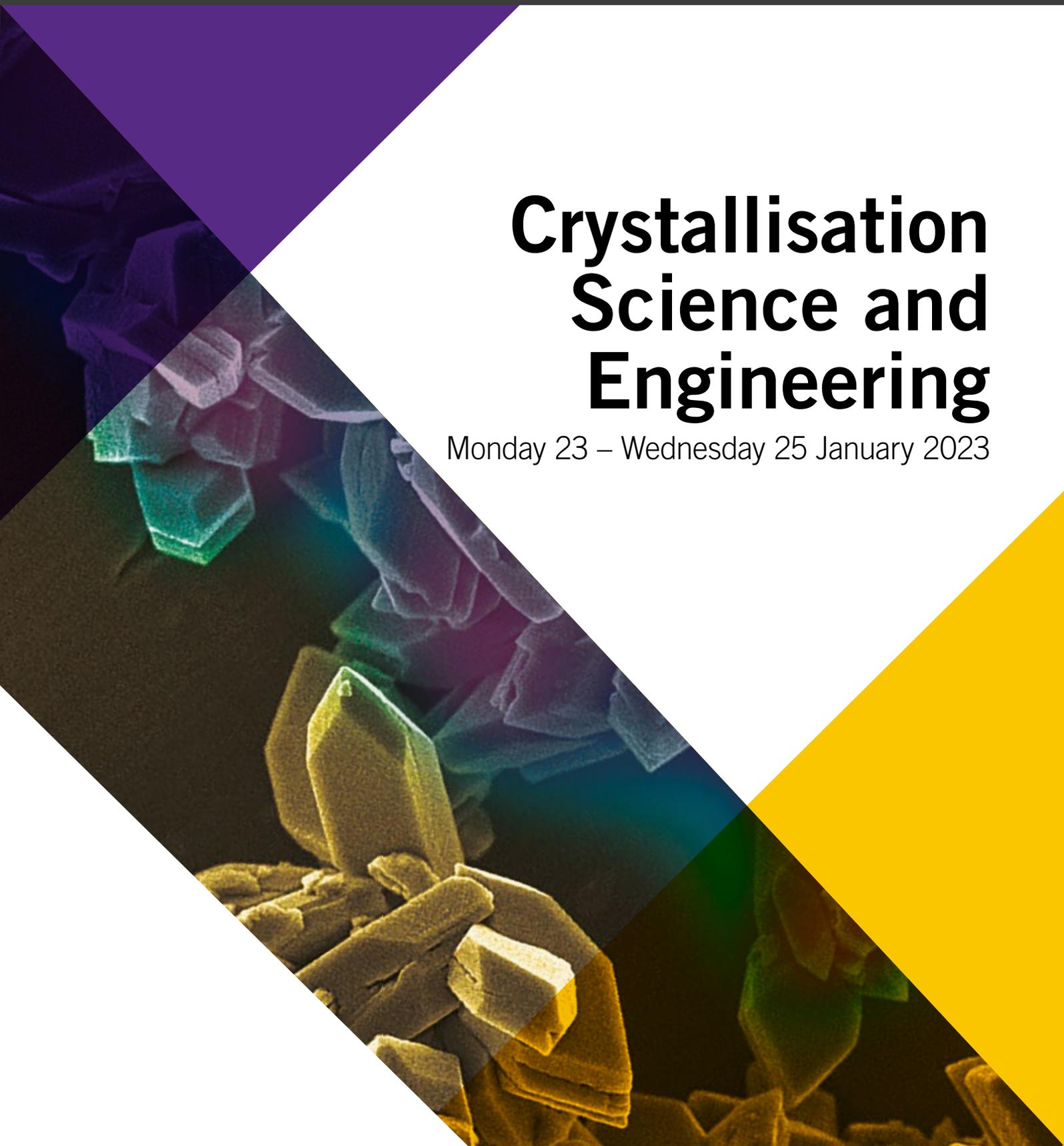
Faculty of Engineering  
and Physical Sciences



UNIVERSITY OF LEEDS

# Crystallisation Science and Engineering

Monday 23 – Wednesday 25 January 2023



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## About the course

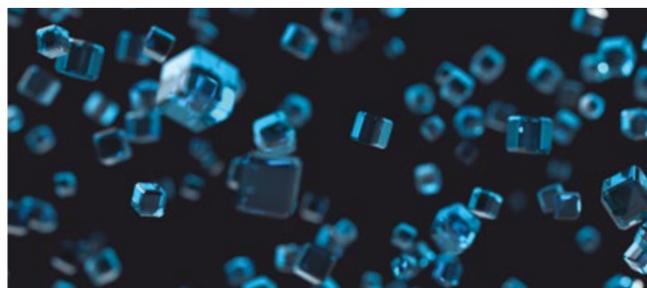
This 3-day short course will outline the fundamental science and engineering of crystallisation processes. The programme embraces digital transformation and weaves together the best experimental and computational workflows. The course will include laboratory experimental sessions to demonstrate crystallisation processes, application of advanced process analytical technologies (PATs) and particle characterisation techniques. The delegates will also have first-hand opportunities to use crystallisation modelling software. The course will be delivered by leading academic and industrial experts in the field and will include case studies.

## Course aims

Delegates will leave with core 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 and a knowledge framework to be able to better support company project teams and engage 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 areas of solid form selection, particle design and 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, Raman technique for multiple component crystallisation system characterisation, and in situ XRD for phase transformation investigation. He has also recently developed instrumentation of laser interferometry for visualising crystal growth interface and mass transfer in the boundary layer, and combined X-ray topography and multiple diffraction to characterise crystal defects 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.

## What our previous delegates say:

“Very good course, with right balance of speakers from industry and academia, on crystallisation processes and solid-state chemistry.”

“The course is perfect for anyone who wants to learn the fundamentals of crystallisation science and engineering.”

## Programme

### Monday 23 January 2023

08:45 Registration and coffee

09:10 Introduction

#### Crystallisation Fundamentals

**09:20 Crystallisation route map**

Professor Kevin Roberts,  
University of Leeds

**10:20 Solution properties and super saturation generation**

Dr Tom Turner, University of Leeds

11:05 Coffee

**11:20 Nucleation and crystal growth**

Dr Tom Turner

**12:05 Fundamentals of polymorphism**

Dr Robert Hammond,  
University of Leeds

12:50 Lunch

**13:35 Screening for polymorphs (solid form selection)**

Dr Bob Docherty, Visiting Professor,  
University of Leeds. Recently retired  
from Pfizer after 22 years having  
previously worked for ICI/Zeneca

**14:20 Solid-state analysis for the characterisation of polymorphs and hydrates**

Dr Bob Docherty

15:05 Tea

**15:20 Fundamentals of co-crystallisation and case studies of recent developments**

Professor Mingzhong Li,  
De Montford University  
Professor Anant Paradkar,  
University of Bradford

**16:20 Laboratory Demonstrations  
D1 – Nucleation kinetics  
D2 – Growth kinetics**

17:30 End of day one

19:00 Course dinner

### Tuesday 24 January 2023

08:45 Coffee

#### Crystallisation Process Engineering

**09:00 Hydrodynamics, mixing and heat transfer in batch crystallisers**

Dr Tariq Mahmud,  
University of Leeds

**09:45 Workflow for crystallisation process development – a case study**

Dr Neil George, Syngenta/  
University of Leeds

10:45 Coffee

**11:00 Continuous crystallisation processes**

Christian Melches, GEA,  
Duisburg, Germany

**11:45 Crystal morphology and habit modification**

Dr Hien Nguyen, University of Leeds

12:30 Lunch

**13:15 Post crystallisation unit operations: filtration and drying**

Dr Amgad Moussa,  
Syngenta, Switzerland

#### Measurements and control

**14:10 Process spectroscopic techniques (IR, UV-vis, Raman)**

Dr Xiaojun Lai, University of Leeds

14:55 Tea

**15:10 Control of crystallisation processes for PSD**

Dr Tariq Mahmud,  
University of Leeds

**15:55 Laboratory Demonstrations  
D3 – Particle characterisation  
D4 – Raman spectroscopy**

17:05 End of day two

### Wednesday 25 January 2023

08:45 Coffee

#### Measurements and control continued

**09:00 Particle size and shape measurements and characterisation**

Dr Umair Zafar,  
Novo Nordisk, Denmark

**09:45 Particle properties and performance**

Dr Richard Storey,  
AstraZeneca, Macclesfield

10:30 Coffee

#### Crystallisation modelling and software demonstrations

**10:45 Digital design: integrating computational and experimental crystallisation workflows to enable product design**

Dr Robert Hammond,  
University of Leeds

11:30 CFD

Speaker to be confirmed

**12:15 Digital design of crystallisation processes**

Dr Niall Mitchell, Siemens Process  
Systems Enterprise (SPSE), London

13:00 Lunch

**13:45 Panel discussion and troubleshooting – experimental practices and best digital tools**

14:30 Transfer to PC Cluster/log-in

**14:40 Software demonstration: VISUAL HABIT – enabling solid form and particle design**

Speaker to be confirmed,  
University of Leeds

15:25 Tea

**15:40 Software demonstration: Introduction to the crystallisation modules of gPROMS FormulatedProducts (Simulation & Global System Analysis)**

Dr Niall Mitchell, SPSE

**16:20 Wrap-up and feedback from delegates**

Dr Xiaojun Lai and Dr  
Tariq Mahmud

16:30 End of day three and course

**Please note**, although we remain devoted to the programme specified, we reserve the right to vary the programme in detail if required to do so by factors beyond our control.

View the full programme and book your place online at  
<http://eps.leeds.ac.uk/short-courses>

100% of respondents since 2017 have said the course met their aims

## Further information

### Course Fees

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

**£1075** – Monday 23 – Wednesday 25 January 2023

Discount available to full time PhD students

### Venue

The course venue will be within the Faculty of Engineering and Physical Sciences at the University of Leeds. The University campus is a 20 minute walk from Leeds city train station.

Please note, car parking for visitors is unavailable at the University. The nearest public car park is Woodhouse Lane (multi-storey) at LS1 3HQ.

### 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 be held at a Leeds city centre restaurant and is included in the course fee. This will take place on Monday evening and delegates are responsible for making their own way to and from the restaurant. The dress code is smart casual.

### How to Book

Please book your place for this course through our secure Online Store, using debit or credit card, following the instructions below:

1. Visit our Online Store at: <http://store.leeds.ac.uk>
2. Select Conferences and Events in the left-hand navigation bar and 'CPD Faculty of Engineering and Physical Sciences'
3. Select the relevant course, click on 'Book Event' and complete your booking details

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

## Get in touch

Helen Forsyth  
CPD, Conference and Events Unit  
Faculty of Engineering and Physical Sciences  
University of Leeds

T: +44 (0)113 343 8104

E: [cpd@engineering.leeds.ac.uk](mailto:cpd@engineering.leeds.ac.uk)

W: <https://eps.leeds.ac.uk/short-courses>

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University of Leeds](https://www.linkedin.com/company/CPD-Conference-and-Events-Unit-University-of-Leeds)

## Terms and conditions for booking

### Payment

Payment by debit/credit card should be made at the time of booking via the Online Store. If for exceptional reasons you are unable to book and pay online a purchase order document will be required to support a manual booking process. Our standard payment terms are 30 days from date of invoice however payment must be made prior to attendance. Attendance may be refused if payment has not been received.

### Changes made by the University of Leeds

The course programme 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 a 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.

### Where a delegate cancels a registration

For cancellations made within seven days of booking: a full refund is payable unless the course starts within the next seven days, in which case the full fee is payable and no refunds will be made.

For cancellations made after seven days of booking: written cancellations received up to 15 working days before the course will be subject to an administrative charge of 20% of the total fee. Within 15 working days of the course the full fee is payable and no refunds will be made.

For non-attendance: the full fee is payable and no refunds will be made. Appropriate course materials will be sent to the registered delegate.

In the event of cancellation, the University will not be held liable for or refund any incurred travel or accommodation expenses. Substitutions may be made at any time.

### Data/Privacy

Your right to privacy is important to us. We will only use your information to provide information on our CPD courses and relevant events. We will not pass your details on to any other organisations. The ways in which your personal data may be used when you provide it to us are defined in our Privacy Notice at <https://eps.leeds.ac.uk/privacy>.

If you have opted in to receive details of future CPD courses from us 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.



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