BCA IG Newsletter

January 2009

Notes from the Chair

2009 promises to be a busy year for the Industrial Group. We have some really interesting talks planned for the Spring Meeting. Our sessions include pharmaceutical applications and also a joint session with the British Association of Crystal Growth (BACG). The biennial XRF strand will run over the three days of the meeting; the XRF program includes trace analysis, environmental applications, and even portable instruments. For the third year running, the IG is sponsoring a prize for the best talk given at the Young Crystallographers (YC) session, and the winner will have the opportunity to give their talk in one of our sessions.

I'd like to remind those who are providing posters for the Spring Meeting that the 20th February is the poster abstract deadline, with a template and details of submission on the meeting web page.

The Autumn IG meeting is in its early stages of planning; it will be held at Pilkington's Research centre in Lancashire.

Continued on Page 2.

Forthcoming Events

- 24th Feb 2009 **BSSM Residual Stress Workshop The University of Manchester**
- 21st to 23rd April 2009 **BCA Spring Meeting 2009** University of Loughborough
- 4th to 7th May 2009 Glasgow PPXRD-8 **The 8th Pharmaceutical Powder X-ray Diffraction Symposium**
- 5th November 2009 Pilkington Group Limited, Lancashire **Autumn Meeting** – including a Young Crystallographers Meeting

XRF Newsletter 8 published electronically in January 2009. View a copy on the web.

Industrial Group

BCA

Charity Registration Number: 284718

World Wide Web addresses:
BCA http://www.crystallography.org.uk
IG http://bca.cryst.bbk.ac.uk/bca/ig/ig.htm
Tip Google BCA IG (with a space) to find us!

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http://www.bruker-axs.co.uk/

Apart from an opportunity to hear some great talks, the tour of Pilkington's glass exhibition is not to be missed.

Looking back to last Autumn, we had a very successful Pharmaceutical Special Interest Group Meeting, held at AstraZeneca, Charnwood. For the second time, the IG offered free places to students, and 13 of these were taken up. Thanks to both AstraZeneca and Pilkington for the free use of their facilities. The great quality of the programs and the positive remarks we get from attendees are a tribute to the hard work that goes in to planning and contributing to these meetings. I'd like to extend my thanks to all those involved, whether as organisers, speakers, or venue providers.

Anne Kavanagh - AstraZeneca

EDITORIAL

Welcome to this edition of the BCA Industrial Group's Newsletter. It contains a report of the Pharmaceutical Special Interest Group Meeting which was held at AstraZeneca on the 5th November. Thanks goes to Matthew Johnson (GSK) and Brett Cooper (Merck) for providing the report and to Talbir Austin (AZ) for the photograph. For those interested in Residual Stress measurements using XRD, the University of Manchester is organising a meeting on the 24th Feb. See page 9 for more information.

The programme for the BCA Spring Meeting at Loughborough University is now in place. The Industrial Group has organised a number of sessions covering both XRD and XRF. The IG session contents are shown on pages 6 to 8. Further information about the Spring Meeting can be found on the BCA web-site and the Industrial Group's web-site at: http://bca.cryst.bbk.ac.uk/bca/ig/ig.htm

Enclosed with the paper version of the Newsletter you will find an A5 promotional leaflet for the Industrial Group. The IG committee would like to encourage new members to join the Group in 2009. Could you please display the leaflet on a suitable notice board at your place of work. Feel free to photocopy it so that more people can be reached.

Sad Loss

In September, we heard the sad news that Dr Andy Parkin, from the University of Glasgow, had passed away following a short illness. He was one of the founder members of the Young Crystallographers' group and was extremely active within the BCA. His enthusiasm for crystallography and his gentle sense of humour will be very sadly missed. It is tragic that he was taken at such a young age. Our thoughts continue to be with his wife and family.

Mark Farnworth – Pilkington Group Limited
Editor

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Pharmaceutical Special Interest Group - Report

5th November 2008 AstraZeneca, Charnwood

Speakers: Left to Right are - Matt Tucker (ISIS), Graeme Day (University of Cambridge), Xue Wang (University of Leeds), Robert Docherty (Pfizer), Claire Thompson (GSK), Frank Leusen (IPI, University of Bradford), Amy Robertson (AstraZeneca), Matthew Johnson (GSK), Talbir Austin (AstraZeneca)

The Pharmaceutical Special Interest Group held its Autumn meeting on the 5th November 2008 at Astra Zeneca, Charnwood. Seven speakers presented an excellent range of topics including computational techniques such as polymorph prediction, Process Analytical Technology (PAT) focusing particularly on in-situ monitoring of crystal growth and finally techniques for characterising amorphous materials in the pharmaceutical industry, introducing Pair-wise Distribution Functions (PDF) for the understanding of amorphous structure at a molecular level. The chairs for the morning and afternoon sessions were **Matthew Johnson** (GSK) and **Brett Cooper** (MSD) respectively.

Bob Docherty (Pfizer) started the morning session with a review of the Pfizer vision for computational techniques within the pharmaceutical pipeline, highlighting a molecule to market approach which starts at the molecular level and builds up with each stage of development through formulation to manufacture and launch. Computational techniques, he explained, linked the crystal structure of the drug product to the physical properties of the drug, its surface characteristics and therefore the interaction characteristics of that surface to other materials, which will directly influence such processes as milling, drying and formulation. By utilising computational techniques he believes it will be possible to produce a stable drug product faster and cheaper than ever before.

Graham Day (University of Cambridge) followed Bob's review by focusing on polymorph prediction and the benefits this could have on the pipeline. Polymorph prediction can be used to generate subsequently unknown crystal structures of a molecule and rank them by energy to determine the most stable polymorph.

This has obvious benefits to the pipeline in that allows more focused screening to be developed to crystallise, via certain solvent combinations, the stable polymorph. He presented the case study of Carbamazepine, a combination of experimental and computational approaches, where he identified that Form 2 could only be stabilised during crystallisation by the addition of toluene in the channels of the crystal structure. This was independently confirmed by Fabbiani et al in 2007 by the collection of the single crystal structure containing channel toluene.

Frank Leusen (IPI, University of Bradford) followed on from Graham on the topic of polymorph prediction, summarising the CCDC blind tests from 1999-2007, particular highlighting the large Dutch movement in this field! Frank described the new approach and results obtained by himself and Marcus Neumann of Avant-garde Materials Simulation. In the 2007 CCDC blind test they predicted four out of four structures, with each of the structures being ranked as the first structure prediction. This talk really highlighted the level of complexity involved in polymorph prediction, but also showed the current state of the art and the potential for the future.

Moving away from computational chemistry **Xue Wang** (University of Leeds) gave an excellent talk summarising the use of PAT for morphological population balance modelling and 2D/3D on-line monitoring of crystal growth. The case studies he presented demonstrated the effect of size and shape on bioavailability and processing and that once defined it is possible to control these variables on large scale (e.g. 200L reactors) by completing the suggested simulations to produce an optimised cooling regime.

In the first presentation after lunch **Amy Robertson** (Astra Zeneca) gave a fascinating overview of how AZ applies PAT to really understand the crystallisation process. She highlighted the importance of monitoring the crystallisation process to ensure the correct particle size and morphology, which are key to the final product performance within the Quality by Design framework. She described the application of Focus Beam Reflectance Measurement (FBRM) and Particle Vision Monitoring (PVM) to show how crystal size, shape and growth could be monitored during the process. Finally, she described the use of FTIR and Raman probes to demonstrate how form turnovers could be monitored and how processing could be controlled to ensure delivery of the correct form with the desired properties.

In the second afternoon presentation **Claire Thompson** (GSK) highlighted the importance of monitoring how much amorphous material was present in batches of API, especially when developing inhalation formulations. She highlighted how amorphous material can form during milling and what could happen to the particle size distribution should the amorphous material crystallise and fuse together particles of API. Claire then highlighted the "Plethora" of analytical techniques that could be used to study amorphous content. She discussed their relative sensitivities and discussed the approaches for quantifying amorphous content in the API batches.

In the last talk of the afternoon session **Matt Tucker** (ISIS) highlighted the benefits of total scattering or PDF method. Matt described how synchrotron X-ray or neutron data could be normalised to an absolute scale to provide information on local, medium and long range atomic structure. He then went on to describe how this could be applied to monitor pressure induced amorphisation in the negative thermal expansion of ZrW2O8 at the molecular level, identifying the structure of the nano-zones of amorphous. Finally he challenged the Pharma audience to think of ways this technique could be applied to the challenges faced during pharmaceutical development.

Pharmaceutical Special Interest Group - Report

5th November 2008 AstraZeneca, Charnwood

We would like to thank **Anne Kavanagh** (Astra Zeneca) and **Tal Austin** (Astra Zeneca) for all their help organising the event at Astra Zeneca, Charnwood.

Conference Feedback

When asked about the meeting overall, the content, organisation and the venue the rating assigned by responders was "Excellent". When asked if they would attend future Pharma meetings or the BCA Spring meeting the majority of responders said "definitely" or "probably".

When asked how far people had come or where they prefer to have meetings, it seemed clear that the Midlands to the South would be the best location to hold meetings. When asked what they would like to see at future meetings the majority of responses were "more of the same please". So we will try to do our best next year.

Matthew Johnson (GSK) and Brett Cooper (Merck)

NOTE: The report on the web has links to PDF copies of some of the meeting presentations.

Industrial Group AGM

The 26th ANNUAL GENERAL MEETING of the Industrial Group will be held at Loughborough on 22thApril 2009 at 11:45

Nominations are sought to fill vacancies for Vice Chair and committee members to serve for three years from April 2009.

Nominations, which shall be proposed by not less than two members of the Group and shall be accompanied by the written consent of the nominee, shall be sent to reach the Honorary Secretary of the Group not later than seven days before the Annual General Meeting.

Approval will be sought for the following *addition* to item 11 of the constitution:

11 COMMITTEE. The affairs of the Group shall be managed by a Committee consisting of the Officers of the Group together with no more than six Ordinary Members of Committee. The BCA representative to the ICDD shall be a member of the committee ex officio.

There shall be a representative of the Young Crystallographers Group who shall be a member of the committee ex officio. Additional members may be co-opted from time to time under Rule 13. The Committee shall be broadly based, with no one field, discipline or type of institution unduly favoured. Only members of the Group shall be eligible for Membership of the committee.

2009 Spring Meeting University of Loughborough
Industrial Group Related Sessions (XRD)

Plenary

Wednesday 22nd April 2009, 09:00-09:45
Chair: Anne Kavanagh
Environmental Analysis with XRF and XRD Nick Marsh (Leicester)

Joint XRF and XRD session on Environmental Analysis

Wednesday 22nd April 2009, 10:15-11:45
Chair: Richard Morris

10:15 New applications in the use of X-ray diffraction at the Health and safety Laboratory: - A case study using XRD to assess emissions across construction sites
Peter Stacey, Health and Safety Laboratory.

10:45 Heavy metals in sediments of the canal network in the Black Country.
Clive Roberts, Wolverhampton University.

11:15 Matching XRF and XRD Solutions with Analytical needs for cleaner, safer and healthier environment.
Ravi Yellepeddi, Thermo Fisher Scientific.

11:45 Industrial Group AGM

Joint IG/BACG Session 1: Monitoring crystals, crystallization and transformations

Wednesday 22nd April 2009, 13:30-15:00
Chair: Nick Blagden (BACG)

13:30 Monitoring nucleation of cocrystals: a solution chemistry perspective.
Roger Davey, University of Manchester.

14:00 Opportunities for observing the synthesis and behaviour of functional materials using synchrotron X-Ray diffraction.
Paul Barnes, Birkbeck College.

14:30 Application of Process Analytical Techniques in Monitoring and Controlling the Crystallization of Fine Chemical Products.
Kevin Roberts, University of Leeds.

Joint IG/BACG Session 2: Monitoring crystals, crystallization and transformations - including the IG YC prize talk

Wednesday 22nd April 2009, 15:30-17:00
Chair: Alison Burke (IG)

15:30 2009 Industrial Group Young Crystallographer prize talk
To be announced at the meeting

16:00 Exploring Crystallisation Phase Space - Expect the Unexpected?
Chick Wilson, University of Glasgow.

16:30 A Retrospective of the Time-Resolved in-situ EDXRD Data we Collected at the SRS.
Dermot O'Hare, University of Oxford.

Foundation Lecture "Method Validation to Achieve ISO 17025 Accreditation"
Thursday 23rd April 2009, 09:00-09:45
David Lowe, United Kingdom Accreditation Service (UKAS).

This XRF Foundation Lecture will be of interest to a wide range of delegates, and especially those who work in a standards based environment.

2009 Spring Meeting University of Loughborough
Industrial Group Related Sessions (XRD)

Understanding API Phase Transitions
Thursday 23rd April 2009, 10:15-11:45
Chair: Brett Cooper

10:15 The use of real-time variable temperature Raman microscopy to monitor temperature related API phase transitions.
Dr Paolo Avalle, Merck Sharp & Dohme Development Laboratories

10:45 Solid-solid phase transformations in channel hydrate during dehydration.
Ji Yi Khoo, Surfaces & Particle Engineering Laboratory (SPEL), Department of Chemical Engineering, Imperial College.

11:15 Identification of Driving Forces in High Pressure Phase Transitions Using the Pixel Method.
Russell Johnstone, School of Chemistry and CSEC, University of Edinburgh.

Crystallography in the Pharmaceutical pipeline
Thursday 23rd April 2009, 12:00-13:30
Chair: Matthew Johnson

12:00 Crystallography for Drug Development.
Cheryl Doherty, Pfizer.

12:30 The crystal structure is the gold standard for proof of structure of the API: What can be achieved for the drug product?
David England, Sanofi-Aventis Deutschland GmbH.

13:00 From the industrial via the academic laboratory to the court room: Cyclovirs – a pharmaceutical PXRD case study.
Jeremy K. Cockcroft, Department of Chemistry, UCL.

2009 Spring Meeting University of Loughborough
XRF Sessions (see web site for full details and up-to-date information)

Tuesday 21st April 2009

11:00 - 12:30 XRF: General Applications
David Beveridge is organiser and chair.

11:00 Calibration Maintenance: Food for Thought
Stephen Davies, PANalytical.

11:30 The 10 Micron Innovation - Applications in Micro-XRF. *Simon. FitzGerald, HORIBA Jobin Yvon Ltd.*

12:00 Micro Spot Analysis of Electronic Components using Polycapillary Lens in Standard WDXRF. *Y.Kataoka, Rigaku, Japan.*

13:30 - 15:00 XRF: General Applications
David Beveridge is organiser and chair.
See meeting web page for latest information.

Tuesday 21st April 2009

15:30 - 17:00 Portable Instruments.
Margaret West is organiser and chair.

15:30 Portable X-ray fluorescence analysis - new opportunities, new challenges.
Phil Potts, Open University.

16:00 Analysis of Limestone & Dolomite
Mark Ingham, British Geological Survey.

16:30 Penguins & Precious Metals, the use of the hand held XRF at Birmingham Museum & Art Gallery.
Deborah Cane and Duncan Slarke, Birmingham Museum and Art Gallery.

17:15 – 18:45 XRF Exhibitors Forum
Evening: Exhibition and posters buffet.

2009 Spring Meeting University of Loughborough
XRF Sessions cont. (see web site for full details and up-to-date information)

Wednesday 22nd April 2009

09:00 - 09:45 XRF / XRD Keynote - Environmental Applications.
Nick Marsh (Leicester)

10:15 - 11:45 XRF/XRD Joint session - Environmental Applications
Dave Taylor/Richard Morris are organisers.

10:15 New applications in the use of X-ray diffraction at the Health and safety Laboratory: - A case study using XRD to assess emissions across construction sites
Peter Stacey, Health and Safety Laboratory.

10:45 Heavy metals in sediments of the canal network in the Black Country.
Clive Roberts, Wolverhampton University.

11:15 Matching XRF and XRD Solutions with Analytical needs for cleaner, safer and healthier environment. *Ravi Yellepeddi, Thermo Fisher Scientific.*

13:30 - 15:00 XRF: Environmental Applications.
Dave Taylor is organiser and chair.

13:30 How XRF fits into RoHS analyses.
Christine Vanhoof, VITO - Environmental Analysis and Technology, Belgium.

14:00 Where There's Muck There's Brass and Iron and Lead and Chromium.... *Richard C. E. Morris, Morris Analytical X-ray Ltd.*

14:30 ItraX micro-XRF core scanner: just what the environmental sciences needed.
Ian Croudace, University of Southampton.

15:30 - 18:00 Trace Analysis
Mark Ingham is organiser and chair.
15:30 On Site Analytics: The Application of XRF to Contaminated Land Remediation
Jamie Cutting, Scott Wilson Ltd.

16:00 Determination of traces of heavy metals in water by XRF.
David Beveridge, HARMAN technology Ltd.

16:30 Trace Analysis on Alternative Fuels by Polarised EDXF.
Phil Russell, PANalytical

Trace Analysis cont.
16:50 XRF - the new Trace Technique.
Mike Dobby, Bruker AXS

17:10 A simple and rapid method for Trace Element analysis of waters using Benchtop Polarized Edxrf Spectrometer. *Yoshiyuki Kataoka, Rigaku Corporation, Japan.*

17:30 Trace Analysis using a Geometrically Optimised Large Area Drift Detector (GOLDD) in Portable XRF. *Chris Calam, Thermo Fisher Scientific Niton Analyzers.*

17:50 Close
18:00 BCA AGM
Evening: Conference Dinner.

Thursday 23rd April 2009

09:00 - 09:45 Foundation Lecture **"Method Validation to Achieve ISO 17025 Accreditation"**
David Lowe, United Kingdom Accreditation Service (UKAS).

10:15 - 11:45 Method Validation.
Ros Schwarz is organiser and chair.
10:15 TBA
Debra Schofield, Oxford Instruments Analytical Ltd.

10:45 TBA
Eddie Birch, CIQ Audit.

11:15 TBA

12:00 - 13:30 New Developments in Instrumentation and TXRF
Margaret West is organiser and chair.

12:00 Developments in TXRF analysis
Prof Christina Streli, TU Wien, Atominstitut der Österreichischen Universitäten

12:30 Trace Element Analysis of Pharmacological, Medical and Biological Samples by TXRF *Armin Gross, Bruker AXS Microanalysis GmbH*

13:00 Energy Dispersive XRF - Its Diversity and Capabilities. *Malcolm Haigh, Spectro Analytical UK Ltd.*

X-RAY FLUORESCENCE (XRF) PAGE

Spring Meeting 21-23 April 2009
Loughborough: There is a full three day parallel XRF programme with sessions on: *"General Applications, New Developments in Instrumentation and TXRF, Environmental - including a plenary and joint XRF/XRD session, Trace Analysis, Method Validation and Portable Instruments".* There is also a commercial exhibition and Exhibitors Forum to update your product knowledge. Details of the programme are on pages 7 and 8 of this Newsletter or the latest information and how to register can be found on or from the XRF web pages. If the current economic climate means that you can only attend one meeting this year then this is the one to go for!
Posters: There is still time to present an XRF poster at this meeting. Submit your poster by 2nd February via links on the meeting web page.

WEB Newsletter: We are always on the look out for articles for the web and Newsletter, so if you have something to offer contact the editor. Don't forget that we need your help in expanding our **supplier pages** on the web to build it into a really useful guide for XRF users.

The main **BCA web pages** have been revamped to make it easier for more people to add content
http://www.crystallography.org.uk

Expect to see changes to the Group pages over the coming year as we migrate to a similar format. Your ideas and input for the revamp are welcomed.

May 2010 One day Meeting.
We are in the early planning stages for this meeting, so there is a chance for you to have some input. If you have some ideas on what we should cover at the meeting or even offer a talk, just contact any of the XRF committee members. (see back page).

A tribute to James Allan Smith
In 1959 a Hilger diffractometer on a Raymax 60 generator with a continuously-pumped X-ray tube was a wonderful way to learn about leaky vacuum systems. A few years later a combined PW1540/PW1050 XRF/XRD system and a Cambridge Instruments Microprobe were commissioned at Joseph Lucas Research in Birmingham. At this point Jim retired to the microprobe room where it was thought that he often studied the structure and composition of the back of his eyelids.

Some 20 years later this pipe smoking analyst recognised the value of co-ordinating information from the range of analytical equipment used in a steel works laboratory. A mountain of punch paper tape could be found on the lab floor and somewhere amongst it Jim would be muttering to himself. He managed to collate data from XRF and emission spectrometers and as paper transformed into magnetic tape; Winchesters were replaced by floppy discs, the analytical world appreciated the benefits of the Laboratory Information System. Jim could also be relied upon for guidance on steak houses after a hard day commissioning Philips software with the best providing both ice cream and custard with apple pie.

On leaving the Philips Analytical Department at Pye Unicam, Jim set up Cotswold Computers to concentrate on software support and development. There are laboratories, literally around the world, that have reaped the benefits of his computing skills.

Jim was a great sportsman; particularly cricket, rugby, football and golf, reaching high levels of achievement as a left-arm fast bowler. On Thursday 27th November 2008, his many friends joined his wife Judy and family for a service to remember his life and achievements that was cut short following the diagnosis last summer of pancreatic cancer.

BSSM Workshop: The Measurement of Residual Stress using Diffraction Methods - 24th Feb 2009 University of Manchester

Residual stress is one of the most common causes of catastrophic and unexpected failures in engineering components. Today, engineers are developing tools and strategies for managing detrimental residual stresses and for introducing beneficial ones across component scales ranging from microelectronics through to aero-engine assemblies. This workshop is aimed at anyone who would like to know more about measuring residual stress using diffraction techniques.

It is suitable for beginners, as well as more experienced practitioners. The workshop aims to cover all diffraction methods, neutron, synchrotron and laboratory X-ray and consequently, will also be of interest to those who already have experience in one field and would like to extend their knowledge into others.
We will also cover sample preparation techniques as well as layer removal by electro polishing.

There will be an opportunity to make a measurement using two of Manchester's "state of the art" stress diffractometers. You can bring a sample if you wish; please let us know in advance.

This workshop will be run by Judith Shackleton, Dr Michael Preuss and Dr Jo Kelleher who are members of 'The Residual Stress and Damage Characterisation Unit' at The University of Manchester, School of Materials which is a centre of expertise for diffraction and many other methods.

Please check our web pages for a link to a BSSM web page to obtain further details, meeting registration and a PDF meeting flyer.

Programme

1. Introduction to the School of Materials

2. Basic Crystallography & Diffraction
(Judith Shackleton, Materials Science Centre, School of Materials,
University of Manchester)

3. Methods Using Laboratory X-rays, Specifically the Sin^2psi Method
(Judith Shackleton)
- Applications
- Strengths
- Limitations
- Instrumentation
- Practical applications
- Data processing
- Hints, tips, tricks of the trade

4. Sample Preparation, Considerations and Electro-Polishing
(Dr Jo Kelleher)
- Methods
- Recipes
- How to get good results

5. Neutron & Synchrotron Methods
(Dr Michael Preuss)
- Applications & advantages
- Differences from the laboratory based X-ray methods
- Main facilities

6. National Physical Laboratory, Good Practice Guide & the Residual
Stress Working Group
(Tony Fry, NPL)

7. Practical Demonstrations and a Chance to Have a Go

Contact:

See page 11

Forthcoming Meetings

BCA Spring Meeting 2009

University of Loughborough, 21-23rd April

Industrial Group Contributions

Plenary: ***Environmental Analysis with XRF and XRD*** Nick Marsh (Leicester)
Wed 22nd April
Chair: Anne Kavanagh

Joint XRF and XRD session on Environmental Analysis
Wed 22nd April
Chair: Richard Morris

Joint IG/BACG Session 1: Monitoring crystals, crystallization and transformations
Wed 22nd April
Chair: Nick Blagden (BACG)

Joint IG/BACG Session 2: Monitoring crystals, crystallization and transformations - including the IG YC prize talk
Wed 22nd April
Chair: Alison Burke

Understanding API Phase Transitions
Thu 23rd April
Chair: Brett Cooper

Crystallography in the Pharmaceutical pipeline
Thur 23rd April
Chair: Matthew Johnson

Industrial Group AGM
11:45 Wed 22nd April
The 26th ANNUAL GENERAL MEETING

The meeting also includes a full three days of XRF sessions. More information and details of other sessions is available on the BCA web-site meeting page.

BSSM Workshop: The Measurement of Residual Stress using Diffraction Methods

24th Feb 2009 University of Manchester

This workshop is aimed at anyone who would like to know more about measuring residual stress using diffraction techniques.

It is suitable for beginners, as well as more experienced practitioners.

Biana Gale, British Society for Strain Measurement, 7 Tythe Close, Flitwick, Beds, MK45 1LE

Telephone/Fax: 01525 712779
E-mail: bianagale@bssm.org

Autumn Meeting 2009

Pilkington Group Limited, Lathom, Lancashire, 5th November 2009

This meeting is in the early planning stage. It will include a Young Crystallographers (YC) morning session and a wide interest Crystallography in Industry Session in the afternoon.

Call for Papers - Please contact

John Kaniuka (YC session) or
Mark Farnworth (pm session)

with offers of talks at this meeting.

Local organiser:
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