AXAA e-newsletter

Issue 3, 2016 **Australian X-ray Analytical Association**

President's Address

Dear AXAA Members and Friends,

AXAA-2017 is almost upon us! Only two months to go before our triennial meeting, which brings together leading developers and appliers of advanced X-ray and related techniques of analysis from Australia and across the globe. The Workshops and Conference Programme is developing very nicely, and registrations are coming in steadily although if you know someone who really *should* attend but hasn't yet signed up, please encourage them to register and participate in what's going to be a fantastic five days of all things X-ray. I'm particularly looking forward to our double-header Public Lecture session featuring Dr Helen Maynard-Casely from ANSTO and Michael Varcoe-Cocks from the National Gallery of Victoria, and our Careers Panel Discussion which is a new and exciting addition to the AXAA conference line-up. Sponsorship opportunities are still available and if you would like to investigate this option, check out the AXAA-2017 sponsorship prospectus.

I'd like also to draw your attention to a post-AXAA-2017 workshop on Line Profile and Microstructure Analysis using Powder Diffraction, to be held at the Australian Synchrotron the day after AXAA-2017 concludes. The workshop is to be given by Professor Matteo Leoni from the University of Trento, the current Chair of the ICDD. Those who sign up for this free workshop and who haven't yet registered for AXAA-2017 but do so will receive a 20% discount on their AXAA-2017 registration by entering the code **LPM20**. Contact Justin Kimpton at the Australian Synchrotron for more details on the content of the Line Profile workshop.

The General Meeting at AXAA-2017 will see the election of a new AXAA National Council, and I'd like to thank the outgoing Council which comprises Vanessa Peterson (Vice-President), Natasha Wright (Secretary), Gordon Thorogood (Treasurer) and Mark Styles (Newsletter Editor) for all of their dedication and efforts over the last three years. I'd also like to make special mention of Jessica Hamilton from Monash University who has brought AXAA into the 21st century through her ownership of the AXAA Twitter account @axaa_org, and who has initiated our "Day in the Life of an X-ray Scientist" blog series which is attracting attention within the community. Our Rules of Association state that the outgoing Council has the opportunity to make three nominations to be taken to the election of the new AXAA National Council, and our nominations appear later on in this Newsletter. I'd like to encourage anyone who is hardworking and has an interest in being intimately involved in leading the evolution of AXAA into the future to consider nominating for a role on Council. Please read on for details of the nomination process.

For now, I wish everyone and your families a happy and safe festive season, and looking forward to seeing you at AXAA-2017 in Melbourne in February.

Nathan Webster
AXAA President

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Innovation from X-ray Characterisation in Materials and Energy Research

One of the keys to innovation in materials and energy research is understanding how materials are formed, and how they are then transformed through secondary processing and/or during operation. *In situ* and *in operando* X-ray scattering techniques, particularly using synchrotron light sources, provide insights into the structure and behaviour of materials under non-ambient and/or non-equilibrium conditions.

Example 1: CO_2 capture materials

Lime-based materials show great promise for cost- and energy-efficient CO_2 capture from flue gases produced in power generation. The so-called 'Ca looping' scheme can be made even more efficient if the lime sorbent is first hydrated to $Ca(OH)_2$. X-ray diffraction patterns were collected from $Ca(OH)_2$ powder during heating runs in N_2 and CO_2 gas streams. Under N_2, the material converted to CaO after 30 minutes at 450°C; while under CO_2 there was partial conversion to $CaCO_3$, although $Ca(OH)_2$ was still present even at temperatures up to 520°C (Fig. 1). Upon switching the gas stream from CO_2 to N_2, the remaining $Ca(OH)_2$ converted to CaO – a phenomenon called 'superheated dehydration'. Detailed X-ray diffraction analysis enabled the mechanisms of dehydration, carbonation, and superheating of $Ca(OH)_2$ to be unravelled (Materić, Ingham, Holt; *CrystEngComm* 2015, 17, 7306).

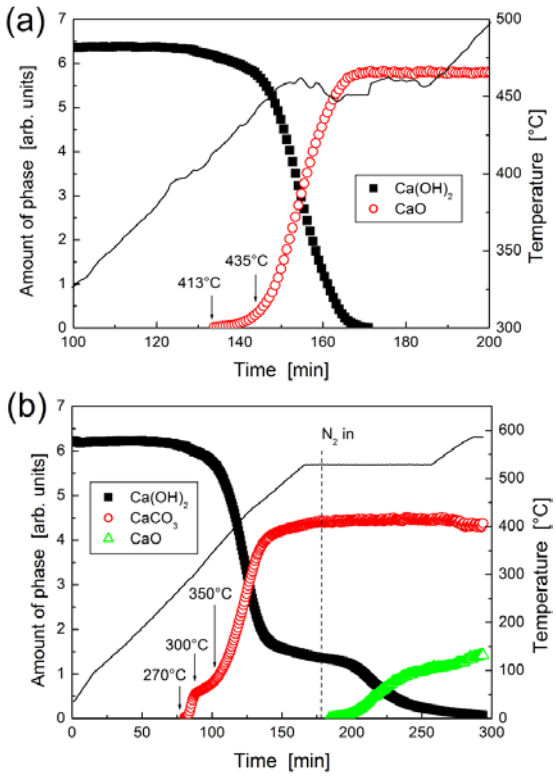

Figure 1. Phase transformations of crystalline species during the (a) dehydration in N_2 and (b) superheating in CO_2, of $Ca(OH)_2$. Reproduced from Materić, Ingham, Holt; *CrystEngComm* 2015, 17, 7306.

Example 2: Pipeline corrosion

The corrosion of oil and gas pipelines is a major industrial challenge. In situ X-ray diffraction studies of pipeline steel in CO_2-saturated aqueous solutions under electrochemical control have provided critical information regarding the formation of protective $FeCO_3$ scales and how they can be modified through solution conditions. For example, the presence of chromium in the steel or added to the solution shows profound effects on the supersaturation of $FeCO_3$, which governs the nucleation and growth kinetics of the scale (Ko, Ingham, Laycock, Williams; *Corr. Sci.* 2014, 80, 237). The steel microstructure can also produce localised effects that alter the corrosion and scale formation processes (Ko, Ingham, Laycock, Williams; *Corr. Sci.* 2015, 90, 192).

Example 3: Nanoparticle formation

It is widely known that the size and shape of a nanoparticle can have profound effects on its physical properties. *In situ* synchrotron X-ray diffraction and small-angle X-ray scattering have been widely used to understand the formation mechanisms of metal nanoparticles of different sizes and shapes. One example is Pt, which can form compact nanocubes or highly branched particles depending on the precursor concentration in a solution synthesis. *In situ* synchrotron X-ray diffraction revealed a multi-stage formation mechanism of the highly branched particles that form when higher precursor concentrations are used (Fig. 2). During the initial stage they formed compact nanocubes. At a critical point, the cubes started to dissolve on their {100} faces while continuing to grow from the corners. This ultimately led to the branched structures observed (Cheong, Watt, Ingham, Toney, Tilley; *J. Am. Chem. Soc.* 2009, 131, 14590).

Bridget Ingham
Callaghan Innovation, Lower Hutt, New Zealand

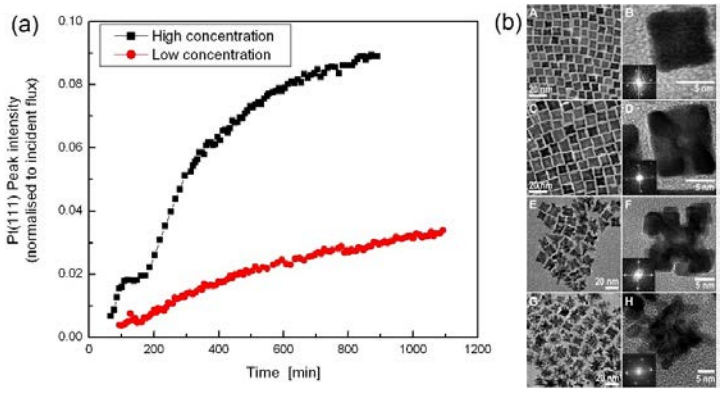

Figure 2. (a) X-ray diffraction intensities of Pt nanoparticles during formation. The high concentration experiment shows multiple stages, illustrated by transmission electron microscopy images in (b), recorded after (A, B) 75 min, (C, D) 120 min, (E, F) 240 min, (G, H) 500 min. Adapted from Cheong, Watt, Ingham, Toney, Tilley; *J. Am. Chem. Soc.* 2009, 131, 14590.

New Career Path Panel Session at AXAA-2017

We're surrounded by talented and successful scientists, and it's easy to wonder how they got there. For AXAA-2017 we have introduced a new addition to the program; a discussion panel on career paths and progression in X-ray and neutron related science. The panel will be composed of five members with a range of backgrounds - for example, "classical" career in industry, "classical" research career, time in industry followed by transition to research and vice versa, synchrotron/neutron beamline scientist - and a range of experience. This will be of particular value to students and ECRs, but will be of interest to all AXAA-2017 attendees. The session will begin with short introductions from members of the panel, followed by an open Q & A session – pre-submitted questions will be invited from attendees to kick start the session.

Panel members:

- **Dr Kathy Ehrig**, Principal Geometallurgist, BHP-Billiton
- **Professor Vanessa Peterson**, Principal Research and Neutron Instrument Scientist, Australian Centre for Neutron Scattering, Australian Nuclear Science and Technology Organisation
- **Dr Martin Duriska**, Technical Sales Specialist XRD/SC-XRD/SAXS, Bruker Pty Ltd
- **Dr Malisja De Vries**, Team Leader, CSIRO Manufacturing
- **Associate Professor Brian Abbey**, ARC Centre of Excellence in Advanced Molecular Imaging, La Trobe Institute for Molecular Sciences, La Trobe University

This session aims to deconstruct career pathways and discuss the challenges and opportunities that contribute to a career in X-ray and neutron sciences. Integral to this session will be discussion of life experiences outside of what ends up on a CV. It will provide an opportunity to explore personal experiences of expectations, promotion, work culture and lifestyle, and transitions between fields. For instance, how can you juggle a family while maintaining career progression? Career breaks are becoming more accepted, but how does one go about getting back on track? What are the biggest challenges in making the transition from industry to academia or vice versa? Are there set expectations for timeframes and sequences of progression, or is it up to you to chase the next role? How are issues around bias managed in different industries and what support exists?

We expect the topics of discussion to be as diverse as the audience in attendance, and welcome any suggestions or comments about this new addition to the program. Details about pre-submission of questions to this session will be provided closer to AXAA-2017. We hope to see wide attendance of this session, as the wealth of our collective experience is most valuable when shared.

Jessica Hamilton
Monash University

Australian Synchrotron User Meeting 2016 Wrap-Up

The Australian Synchrotron User Meeting 2016 was a fantastic occasion to discuss the work being carried out at the facility and network with those involved. I thoroughly enjoyed seeing research that was outside of my primary area of expertise, as well as Synchrotron techniques I am not overly familiar with. My personal favourites were those presentations by Dr Anita Hill (CSIRO) on 'Tunable Materials and Materials Dynamics' and by Mr. David Child (ANSTO) on 'Radioactive particles as concentrated sources related to uptake and dose in mammals'. I found the User Meeting was also a great opportunity to catch up with colleagues, and funnily enough I got chatting with Dr Mark Hackett (Curtin University) who I have not seen since we studied undergraduate chemistry together in Perth. The User Meeting presented a range of engaging research, method development, industry and imaging work, as well as current activities and those which are planned for the Australian Synchrotron.

PhD student Anurag Parihar from Monash University explaining his research into the thermochemical conversion of low-rank fuels to bio-based products during the poster session.

The annual Stephen Wilkins Thesis Medal for the most outstanding PhD thesis involving work performed at the Australian Synchrotron or ANBF was also awarded at the user meeting. The winner for 2016 was Dr Wenchao Huang for his PhD research at Monash University into organic photovoltaic (OPV) devices, exploring how critical microstructural features evolve during the preparation of cutting-edge, clear and pliable solar panels, which are tipped to surpass older, silicon-based panels in value and performance over the next decade. Dr Huang provided a fascinating overview of his research via teleconference from the University of California, Los Angeles where he now works, explaining how his experiments on the Soft X-ray Spectroscopy (SXR) beamline at the Australian Synchrotron were crucial to achieving an optimal balance between light absorption and charge transfer in his OPV devices. Congratulations Wenchao on your remarkable achievement!

Anita D'Angelo
CSIRO Minerals Resources

AXAA Student Seminars

A key part of the lead-up to each AXAA conference is a series of AXAA student seminar days, where students get the opportunity to present their X-ray and neutron analysis results to a diverse audience of researchers and industry professionals in a friendly and relaxed atmosphere. 2016 was a bumper year, with outstanding presentations given at all the three events held in NSW, Victoria and WA. This year 8 prize winners received an all-expenses paid bursary to attend the AXAA-2017 conference in Melbourne, including PhD student Tyron Turnbull from the University of South Australia. All 8 students will be presenting their work at the AXAA-2017 conference, so be sure to look out for them! AXAA will be looking to expand the series in the future to include events in Queensland and SA, so stay tuned for announcements in the newsletter and on the website. Thanks to all who helped make the 2016 events a huge success!

VIC – "Something to Bragg About"

This year the AXAA student seminars kicked off in Victoria on the 20th of September with an event held at the CSIRO Laboratories in Clayton. Presentations were given by 9 honours and PhD students, on topics ranging from advanced high strength steels to novel catalyst materials. The standard of all of the talks was outstanding, with a diverse range of analysis techniques being used at a very high level. Prizes were awarded to Masrur Morshed Nahid, Jessica Hamilton and Connor Turvey for their presentations on charge transport in a high mobility *n*-type semiconducting polymer, accelerated mineral carbonation in mine tailings, and CO_2 sequestration in poorly crystalline geological phases, respectively.

NSW – "Scattering Matters"

The series continued in NSW with an event held on the 30th of September at the University of Sydney. A record equalling 11 students gave presentations which amazed the audience and judges alike. Topics included uranium oxides, piezoelectrics, sodium-ion batteries and recycled glass-ceramic materials. Prizes were awarded to Pierre Naeyaert, Julia Wind, Bowen Ding for their presentations on K doping of P2 $Na_xFe_{2/3}Mn_{1/3}O_2$ cathode materials, stabilization of the fast ion conducting delta phase of bismuth oxide, and electron transfer in metal organic frameworks, respectively.

WA – "Bright Scatterers"

Finally, the series wrapped-up in WA on the 5th of October with an event held at Curtin University. Although this event was smaller with only 4 presenters, the quality of science was excellent, making for a very enjoyable afternoon. Topics included hydrogen storage, solar-thermal energy and automated sample preparation for XRD analysis. The prize for best presentation at the WA even was awarded to Ehsan Mohammadpour for his talk on magnetron sputtered CrAlN coatings studied via *in situ* synchrotron XRD analysis.

AXAA National Council, 2017-2020

In accordance with the requirements of the AXAA-Inc constitution, the current National Council will vacate their positions at the next AGM, to be held during the AXAA-2017 conference.

We seek nominations for the 2017-2020 National Council, comprising six members, with three being nominated by the retiring Council and three being nominated by the AXAA members. The retiring AXAA National Council announces our three Council nominees who have accepted their nominations:

- **Nathan Webster** (nominated for President)
- **Vanessa Peterson** (nominated for Vice-President)
- **Mark Styles** (nominated for Secretary)

We request that AXAA members forward their nominations for any National Council position, including President, Vice-President, Secretary, Treasurer, Newsletter Editor and General Council, to the current AXAA Secretary Natasha Wright (Natasha.Wright@csiro.au).

Closing Date for Nominations: 3rd February 2017

Upcoming Events

ISEB23

24-29 September 2017
Palm Cove, Tropical North Queensland, Australia

The International Society of Environmental Biogeochemistry's 23rd Symposium (ISEB23) will take place in Australia for the first time in 2017. The Symposium will be held in Palm Cove, Tropical North Queensland, Australia from 24 September to 29 September 2017. This international five-day Symposium will provide an excellent opportunity for international and local environmental biogeochemists to meet and discuss the most recent developments in their fields of research.

For more information:
Email: iseb23@pco.com.au
Website: http://www.iseb23.info

AXAA Website and Contacts

Please visit our website, www.axaa.org, for further information, or follow us on Twitter @axaa_org.

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The next issue of the AXAA Newsletter will be distributed in early 2017 following the conference. Please feel free to send contributions for the newsletter to Mark Styles at any time. Any comments or feedback about the Newsletter are welcome.

AXAA Membership

All registered participants of the AXAA-2014 conference are automatically granted AXAA membership for 3 years. Alternatively, new memberships can be obtained free of charge, by making an application to the National Council. Candidates should provide their CV and a short statement about how they intend to contribute to the organisation. Please send these to the National Council Secretary Natasha Wright (see AXAA contacts) if you would like to apply.

Company News and Advertising

PANalytical
X'press Updates

PANalytical and Malvern to merge effective 1 January 2017

Malvern and PANalytical are pleased to announce that effective 1 January 2017 they will be merging their activities. Both companies are owned by parent company Spectris plc and are operating companies within the Materials Analysis segment of Spectris.

Both companies are world leading suppliers of analytical instrumentation, PANalytical for X-ray instrumentation and software for the purpose of materials analysis and Malvern Instruments for materials and biophysical characterization technology. The combined entity is a strong player in the materials characterization market and will be able to leverage the strengths of the individual companies in their end markets ranging from building materials to pharmaceuticals and from metals and mining to nanomaterials.

The merger is based on the belief that there are clear benefits through this more collaborative relationship, leveraging the very strong brands and highly-skilled employees of the two companies, in order to deliver a more complete range of products, solutions and services to a broader set of markets and customers.

The companies will be working together to ensure a smooth and effective integration guaranteeing our usual high level of support to all our customers. The combined group will continue to develop and invest in the Malvern and PANalytical technologies and the highly-talented workforce.

Eoghan O'Lionaird, Business Group Director responsible for the Materials Analysis segment within Spectris, says: "This is an exciting time for Malvern and PANalytical. Joining the two companies will enable us to leverage new resources to further grow our service offering and add even more value to our clients and customers. We are committed to ensuring a smooth integration process and will be actively engaging with our customers on how the combined entity can better serve their needs."

PANalytical launches Aeris, the world's first automatable benchtop

PANalytical, world's leading supplier of analytical X-ray instrumentation and software, announces the launch of Aeris, their new X-ray powder diffraction (XRD) benchtop instrument. Ease of use and maximum benefits for the user have been the key aspects of this newly developed system, which provides fast and precise phase information of the materials analyzed.

Aeris is accessible for everyone – its built-in touch screen with the intuitive interface directly displays all results. At the same time Aeris is designed for low cost of ownership – it only requires a single-phase power outlet and neither needs cooling water nor compressed air. Nevertheless, as the instrument incorporates many technologies proven on PANalytical's high-end systems, its performance is exceeding typical benchtop X-ray diffractometer performance. Data quality and speed of data acquisition have so far only been observed on full-power systems. Additionally, Aeris is the first benchtop XRD system that is fully automatable and can easily be incorporated in industrial production control.

As many industries have specific demands for their materials' analysis, Aeris editions are available, which have been tailored to the specific needs of the cement, mining and metals industries. They provide fast and precise mineralogical phase information, which can be used for control and optimization of the production process. The Research edition of Aeris, on the other hand, is designed for quick XRD scans in any laboratory and is easily accessible for students. Especially with its unique 2D option it also serves as an ideal instrument for teaching XRD.

Harald van Weeren, product manager at PANalytical says: "We at PANalytical are proud that we have succeeded in developing an XRD instrument that is so easy to use and at same time delivers such excellent data quality so quickly. This makes Aeris the ideal instrument for everyday X-ray diffraction analysis for everyone."

For more information please visit **XRDisEASY.com**

PANalytical
get insight

Rapid 10 minutes mineralogical analysis with PANalytical's Aeris benchtop XRD enables fast counteractions to process controls

Applications for mining and minerals

The exploitation of new iron ore deposits of lower ore grade requires accurate and frequent monitoring of the mined material during mine planning and ore beneficiation. The presence of minerals such as clays, carbonates or silicates influence the properties and the grade of an iron ore. Resolving the mineralogical composition of the mined material by X-ray diffraction (XRD) is essential for optimizing operational efficiency of the mining and the beneficiation process of iron ore. The Minerals edition of Aeris is the first benchtop X-ray diffractometer designed for process control and geometallurgical characterization in the mining industry. In this data sheet we show a typical example of the fast and precise analysis of mineralogical ore compositions with Aeris.

Experimental

In order to demonstrate the flexibility and determination limits of the Minerals edition of Aeris, samples from two iron ore deposits with different mineralogy were analyzed. The presented data were measured using cobalt radiation, which is especially suited for geological materials with higher iron contents, as it produces high-resolution data without creating excessive sample fluorescence. The measurement time for each sample was less than 11 minutes followed by automated data evaluation using standardless full-pattern Rietveld quantification [1] to determine the quantitative mineral composition of the samples. In addition to the crystalline phases, the amorphouscontent was determined using the external standard approach, [2]. α-Al $_2O_3$ (>99.9% pure) was used as external standard.

Result and discussion

Figure 1 illustrates an example for a full-pattern Rietveld quantification of a lateritic iron ore sample. Main ore minerals are goethite (FeOOH) and hematite (Fe $_2O_3$). Minor phases present are magnetite (Fe $_2O_4$), rutile (TiO_2), anatase (TiO_2), clay minerals, carbonates, quartz (SiO_2) and an amorphous fraction. The comparison of seven lateritic iron ore samples shows variations in the iron-containing minerals, the impurities and the amorphous content. A correlation between the goethite and the amorphous phase is visible.

The results of the analysis of the samples from a banded iron formation is shown in Figure 2. More than 97% of all samples is hematite. Impurities of magnetite, silicates and carbonates could be detected and analyzed. The detection limits for the minor minerals such as magnetite in the banded iron ores depend on the measurement time per sample. For the presented 10 minutes measurements on an Aeris Minerals edition diffractometer, detection limits of 0.1-0.2% for all minerals present were found. Knowledge of the mineralogical composition of iron ore samples also allows the calculation of the Fe^{2+}/Fe^{3+} ratio from the known stoichiometry of the minerals.Other statistical tools such as cluster analysis or direct monitoring of process-relevant parameters with partial least squares regression (PLSR) can be easily applied to track iron ore grades in all stages of the mining and beneficiation process.

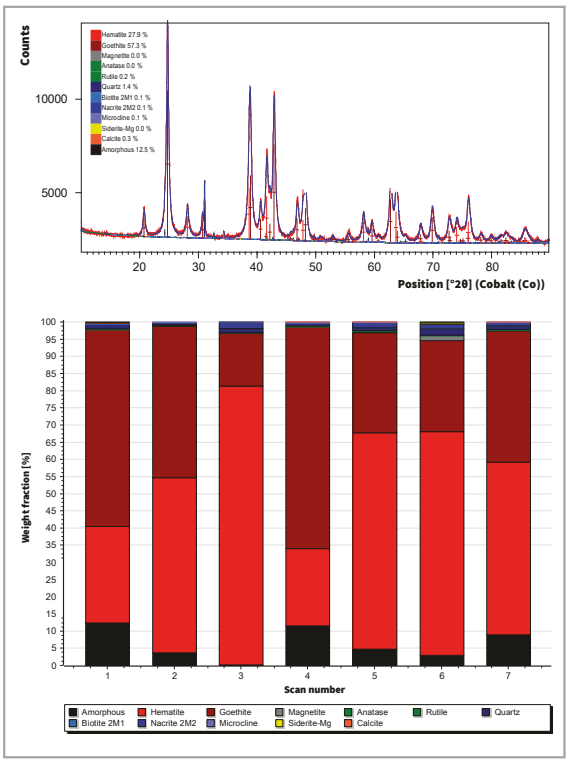

Figure 1. Quantitative Rietveld results of a typical lateritic Fe ore mainly consisting of goethite and hematite with the presence of minor amounts of quartz and an amorphous content of >10 wt.%

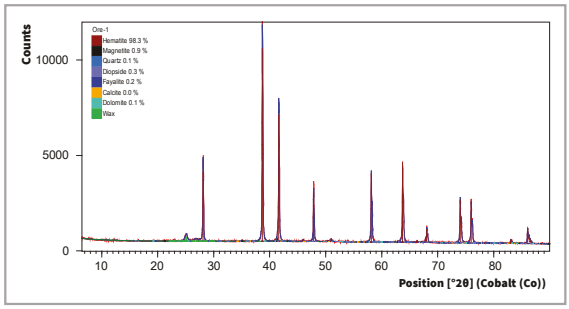

Figure 2. Quantitative Rietveld results of a typical banded Fe ore mainly consisting of hematite and magnetite with the presence of minor amounts of silicates and carbonates

Table 1. Quantitative results of 9 ores from a banded iron formation

Sample	1	2	3	4	5	6	7	8	9
Hematite %	98.3	99.1	97.6	97.7	98.5	98.1	98.4	98.3	98.2
Magnetite %	0.9	0.1	1.5	1.5	0.8	1.1	1.0	1.0	1.1
Quartz %	0.1	0.3	0.1	0.0	0.1	0.2	0.1	0.2	0.2
Diopside %	0.3	0.2	0.3	0.3	0.3	0.3	0.4	0.2	0.2
Fayalite %	0.2	0.3	0.1	0.2	0.2	0.3	0.2	0.1	0.2
Calcite %	0.0	0.0	0.3	0.2	0.1	0.1	0.0	0.1	0.1
Dolomite %	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.1	0.1

[1] Rietveld, HM (1969): A *profile refinement method for nuclear and magnetic structures*. J.Appl.Crys. 2, p. 65-71.

[2] O'Connor, B.H. & Raven, M.D. (1988): *Application of the Rietveld refinement procedure in assaying powdered mixtures*. Powder diffraction, 3, 2-6.

Bruker Australia / New Zealand News Dec 2016

In this update:

- The New IμS 3.0
- The New D8 ADVANCE Plus





The New IμS 3.0 - Bright. Brighter. Unique

At the AsCA meeting 2015, Incoatec launched the new generation of the Incoatec Microfocus Source - the IμS 3.0. This outstanding X-ray source for crystallography is available in the Bruker D8 VENTURE and QUEST Second Generation. It delivers a minimum of 30% more intensity, far more than the best microfocus sealed tube solutions to date.

Since its launch in 2006, the Incoatec Microfocus Source IμS has been regarded as the superior X-ray source for single crystal diffractometry in the home-lab. More than 700 sources sold within less than 10 years are proof for outstanding performance and reliability with best value for money. The IμS changed the rules of the game completely.

With the launch of the IμS High Brilliance in 2011, the photon flux was increased by at least another 30%. A technological limit seemed to have been achieved.

Now the story continues. Incoatec is proud to announce the 3rd generation of the IμS - the IμS 3.0 - with a further increase in intensity of 30% and more, and available for Cu, Mo and Ag radiation! By designing a new tube – Incoatec X-ray Tube IXT - we have set a new benchmark. This tube gives Incoatec the exclusive opportunity to offer the IμS with specifications that are not achievable with any other sealed tubes on the market.

Moreover, IμS 3.0 is not only a tube story. The mechanics, electronics and beam path have also been optimized. The mechanical separation of tube and optics enables easy alignment; tube and optics changes can be carried out without realigning the whole instrument; a vacuum pump is no longer needed because of the new He-filled and sealed optics housing - to name only a few advantages.



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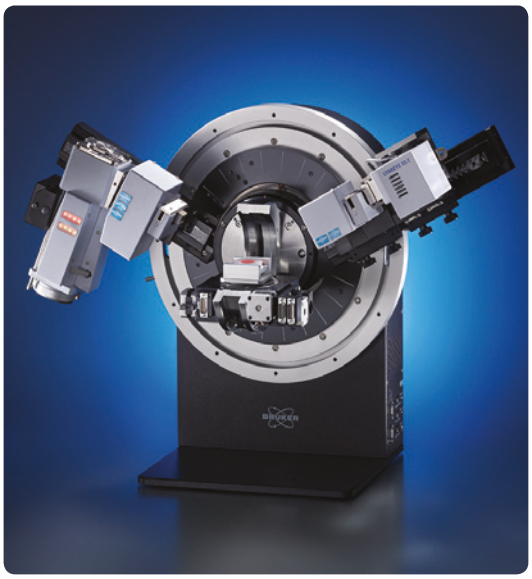
A New Member in the D8 ADVANCE Family - the D8 ADVANCE Plus™



Bruker AXS introduces the D8 ADVANCE Plus™ as the newest member of the D8 ADVANCE family of X-ray diffraction (XRD) solutions. The D8 ADVANCE Plus combines unparalleled ease-of-use with maximum flexibility. It is designed to investigate epitaxial or polycrystalline thin films, large or oddly shaped bulk specimens, and micro- to macro-amounts of powder samples under ambient and non-ambient conditions.

The newly introduced TRIO™ optic is the key component of the new D8 ADVANCE Plus, meeting the specific demands on the instrument resolution of the three most commonly used X-ray diffraction geometries in one single optic:

- Divergent beam for conventional powder diffraction (XRPD)
- High intensity parallel beam for capillary experiments, height insensitive measurements, surface sensitive grazing incidence geometry (GID), coating thickness determination (XRR) and micro-diffraction (uXRD)
- Pure Cu-Kα1 parallel beam for high-resolution diffraction (HRXRD) of epitaxial thin films and low symmetry powder samples

With maximum user convenience in mind, the TRIO optic features motorized switching between the three primary beam geometries and fully software-controlled instrument alignment without manual user intervention via unrivalled SmartCalib™ intelligence.

The D8 ADVANCE Plus is the latest extension to the well-established D8 ADVANCE Multipurpose Solutions™ family, joining the D8 ADVANCE Eco™ for full-sized goniometer powder diffraction and the D8 ADVANCE Twin™ for maximum performance on polycrystalline powder and layered samples. All three Multipurpose Solutions are optimized for ease-of-use to let the user fully concentrate on results instead of bothering with instrumentation, saving time and increasing accuracy.

For particular applications, such as texture, residual stress, or structure analysis, D8 ADVANCE Dedicated Solutions™ are the perfect tools, focused on a single analytical task with dedicated components optimized for leading-edge results.

The consistent implementation of DAVINCI Design™ in every member of the D8 ADVANCE family guarantees unlimited extension of capabilities to match all analytical needs - now and in the future.

The new D8 ADVANCE Plus – maximum flexibility meets unparalleled ease-of-use.

Visit our website for more information:
https://www.bruker.com/products/x-ray-diffraction-and-elemental-analysis/x-ray-diffraction/d8-advance/plus.html

For further details, contact Martin Duriska on 0487-800-317 or martin.duriska@bruker.com

AXT Brings Industry Leading Handheld XRF and LIBS Systems to Australia

AXT is proud to announce that they have teamed up with SciAps and will be distributing their range of industry leading handheld XRF's and LIBS devices. Their exciting range of instruments will give field engineers and scientists increased capabilities and allow them to carry out more accurate and faster analyses on site, increasing efficiency and reducing the number of samples that need to be brought back to the lab.

SciAps is based in Boston, USA with an ISO-certified manufacturing facility. Key members of the management and technical teams have had vast amounts of relevant experience having been responsible for the development and commercialisation of many of the Innov-X range of handheld XRF's.

The X-series next generation handheld XRFs from SciAps pick up where the others have left off. They feature the latest X-ray tube and detector technology which results in the fastest and most precise analyses with count rates far exceeding any other system. This means you can measure more samples per shift and increase productivity. Combine excellent ergonomics, light weight and shielded detectors to protect both the instrument and operator, and you get an instrument that simply can't be beaten.

SciAps also manufacture handheld LIBS (Laser Induced Breakdown Spectroscopy) systems that are suited to alloy sorting. Suitable for all types of alloys, their LIBS goes beyond the limits handheld XRF able to analyse aluminium and magnesium alloys as well as elements such as Li, Be, B and C. Using technologies such as argon purge and dual burn, the Z-series LIBS provide the most accurate results of any commercial handheld LIBS.

Both instruments use an Android operating system with a vibrant display that will instantly be familiar to anyone with a smartphone. This provides simple connectivity to computers and printers via wifi or Bluetooth. They also share batteries and battery chargers making them perfect partners for field use providing you with maximum portability and analytical power.

Richard Trett, Managing Director at AXT commented, "The SciAps handheld XRF and LIBS compliment our existing product ranges in our materials analysis, mining and non-destructive testing portfolios. We see great potential in these instruments and look forward to introducing them to the Australian market and empowering field engineers."

Andrew Somers, Managing Director of SciAps Australia replied, "while our products are relatively new to Australia, we know the technology and performance is industry leading. We are excited to be working with the team at AXT and see great opportunities in the areas of Positive Materials Identification (PMI) in particular light alloys and exploratory geology."

For more details about the SciAps handheld XRF and LIBS instruments and AXT's range of related products, please visit www.axt.com.au.

Posted November 16, 2016

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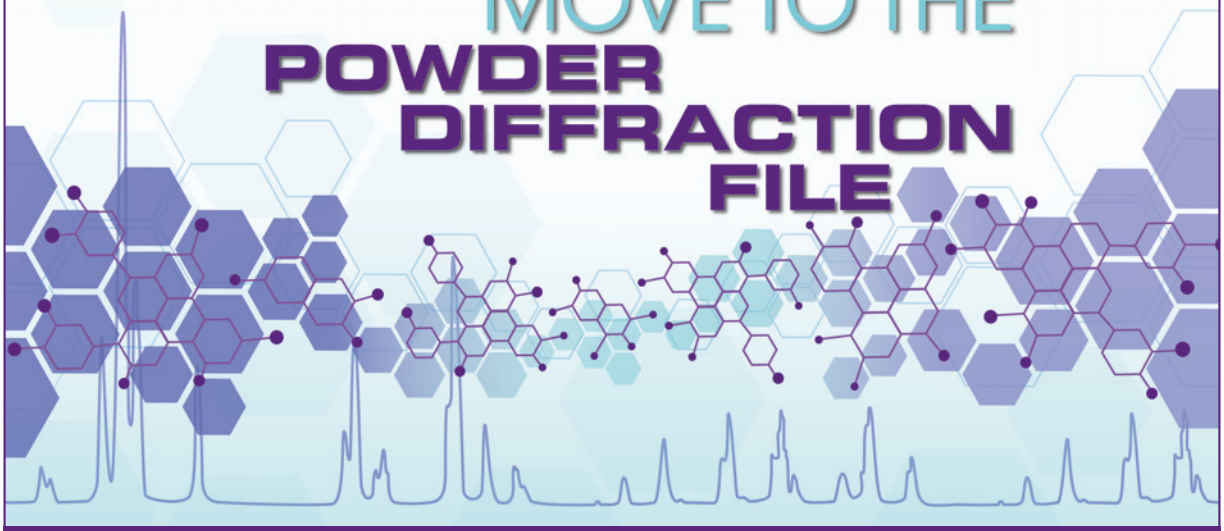

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ICDD 2016–2017 Product Summary

Data Entry Source	PDF-2 2016	PDF-4+ 2016 WebPDF-4+ 2016	PDF-4/ Minerals 2016	PDF-4/ Organics 2017
00- ICDD	115,066	115,066	12,031	39,395
01- FIZ	165,264	67,498	12,294	12,185
02- CCDC	0	0	0	431,359
03- NIST	10,067	2,960	216	281
04- MPDS	0	198,367	19,748	0
05- ICDD Crystal Data	722	722	52	32,785
Total No. of Data Sets	**291,119**	**384,613**	**44,341**	**516,054**
Subfile Distribution:				
Inorganic	258,130	351,612	44,285	33,943
Organic	41,386	42,229	701	505,530
New Entries	12,616	18,736	1,489	14,090
Rietveld—No. with atomic coordinates	0	271,449	33,574	96,825
Reference Intensity Ratio (RIR)—I/I_c	193,567	286,885	33,362	484,021
Experimental Digital Patterns	0	11,287	127	6,062
Pattern Fitting—Calculated Digital Patterns	0	384,613	44,341	516,054

All ICDD databases combine the power of both powder diffraction and crystal structure reference data. We are the only crystallographic database in the world with quality marks and quality review processes that are ISO certified. Each PDF database includes our integrated data mining software.

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WebPDF-4+ 2016

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Online XRF Analysis System with a Proven Track Record in the Coal Industry

IMP's Online XRF Analysis System is an online X-ray fluorescence spectrometer for the elemental analysis of bulk materials without any sampling or preparation.

It is typically mounted above main conveyor belts or at other feeding devices and continuously measures the elemental composition (Elements above atomic number 12) of the material. The XRF system offers immediate information 24/7 about the process without time consuming sampling and analysis in the laboratory.

Benefits and features of this system:

- The unit is suitable for belt speeds of up to 5 m/s and a particle size of up to 150 mm.
- It has a proven track record in the coal industry.
- Coal quality can be measured in real-time, assessing properties such as ash content, ash composition, and base/acid ratio.
- This makes it a valuable process control tool, but does not replace proper sampling and laboratory based analysis.
- The device is equipped with a rugged X-ray tube and an energy dispersive detector in a stainless-steel box.

The information acquired with the sensor is processed through custom software by an industrial PC which can be linked to the control system by standard interfaces. Flexible reporting options are available such as one click quality or end of shift reports.

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Online Pipe XRF Analysis System

IMP's Online Pipe XRF Analysis System is an online X-ray fluorescence device for the elemental analysis of slurries or suspensions without sampling.

It can be mounted directly on pipes and continuously analyses the elemental composition (Atomic number Z>12) of the material.

For steel pipes, it is typically mounted to a short section of pipe which is then added in to the actual process pipeline.

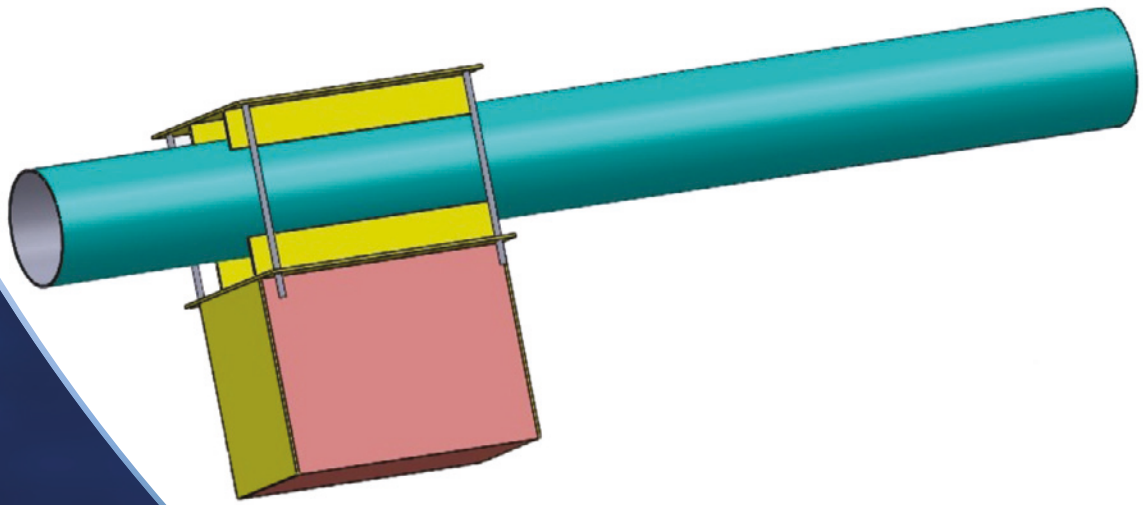
A bypass section can also be installed which allows routine maintenance to be performed without halting production.

In many cases the measurement can be performed straight through PE or PP pipes. Different window selections are available if the measurement must be performed on steel pipes.

These units have had great success in measuring nickel concentrations in solution during base metal refining.

All common interfaces for integration into the process control environment are available. The on-board industrial computer evaluates the spectra and computes the concentration of the elements of interest.

During the computational process, sophisticated algorithms take several parameters like temperature, correlations with other elements, and fluid density into account to increase the confidence level of the measurement.



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