ISSUE 3 / 2014

X'PRESS

HOW TO IMPROVE?

PANalytical
get insight

Welcome to this issue of our **X'Press magazine**

Pieter de Groot
Corporate marketing director

We are looking back on a challenging year 2014 with numerous crises around the world tampering the most needed economical growth in many geographies. To remain economically healthy as an enterprise it is important to ensure that your industrial processes are as sustainable and cost-effective as possible. PANalytical aims at providing tools to help our customers to improve their processes, hence the theme of this edition 'How to improve'.

A fine example is the South African Rand Refinery showing how their CubiX^3 Minerals has helped them to better control several aspects of their smelting process and save energy at the same time. Improvement starts at the source and that's why we at PANalytical continuously strive to improve data quality. Our two new and revolutionary XRD detectors, GaliPIX^{3D} and PIXcel^{3D} with Medipix3 technology, provide even more superior data than their predecessors.

Besides developing new products we also exploit ever more possibilities of existing ones. Two of these new applications of known devices are described on page 12. Our Bragg-Brentano^{HD} module proves to be useful not only in research but also for the mining industry. The Deben 300N tensile stage (well-known in electron microscopy) can be employed to measure stress and strain *in situ* by X-ray diffraction while applying computer-controlled external stress/strain.

As announced in the last issue, we further introduce to you our latest addition to the PANalytical family: Claisse, the First and Finest in Fusion. The combination of both companies' expertise provides you with an even more complete offering from sample preparation to final analysis resulting in an optimal end result of your analysis. Last but not least our managing director, Peter van Velzen, reflects on our current theme 'How to improve' in an interview with the editor.

I hope you enjoy reading our choice of articles in this X'Press and I wish you a good start of 2015.

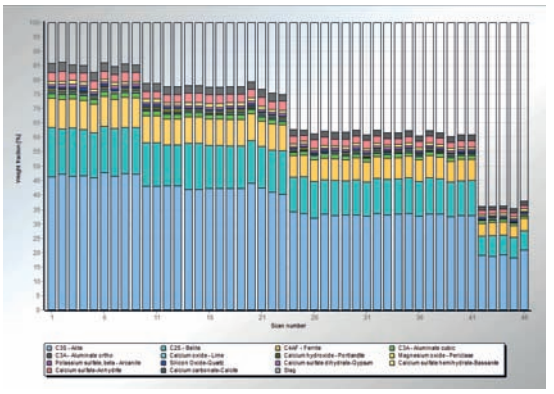
Kind regards,
Pieter de Groot

LATEST NEWS

HighScore version 4.1 released in October 2014

A new minor version 4.1 of HighScore, the Plus option and of RoboRiet was released in October 2014. This is essentially a bugfix release and available free-of-charge to all version 4.0 users.

Version 4.1 of this proven powder diffraction analysis software starts faster and uses memory and multi-cores better on modern PCs. Many bugs have been fixed and some new functions are available. The example shows the presentation of the phase quantities of many scans together in a multi-column chart.



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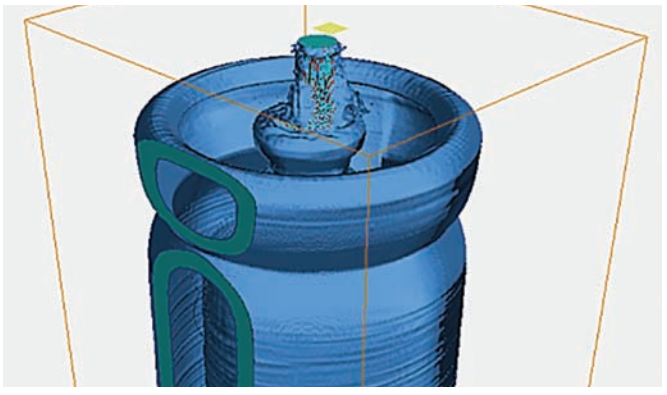

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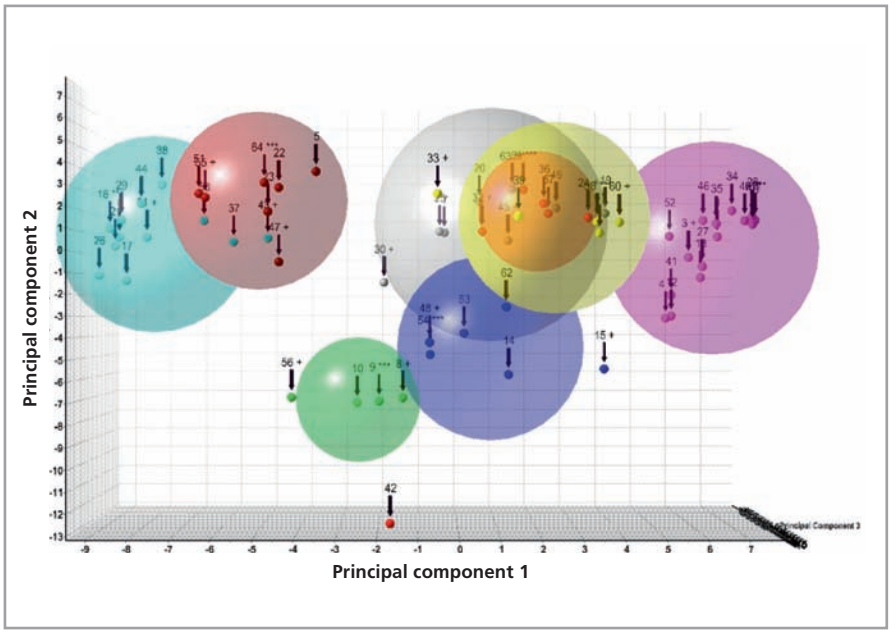
Rand Refinery
Refinement towards perfection

Since its establishment in 1920, Rand Refinery (close to Johannesburg, South Africa) has refined nearly 50,000 tons of gold – almost one third of all the gold mined worldwide. Also silver is refined to the same high benchmark standards. The refinement process starts at the smelter, which currently processes over 70 different types of material, including by-products from the mining industry, electronic waste, carbon fines and sludge. Here, all low-grade materials are concentrated into a semi-pure product that is further refined into the pure elements at the main refinery.

The smelter works with additional reactants to compensate for impurities in the incoming material. In order to achieve the most efficient and cost-effective process, the charge make-up for each deposit needs to be perfected, requiring detailed knowledge of each deposit's mineral composition. To gain this insight, Rand Refinery purchased a PANalytical CubiX³ Minerals industrial X-ray diffractometer in 2012. This article presents a few of the many applications for this system at the company.

Determination of magnetite/hematite concentrations

One of the components of the incoming material is iron bound in the minerals magnetite (Fe_3O_4) and hematite (Fe_2O_3), which require different amounts of reactant. Where elemental analysis previously only revealed the concentration of iron, X-ray diffraction can now easily determine the amounts of both phases. With this knowledge furnace conditions can be optimized, resulting in energy saving.



Clusters for mill concentrates received from different customers. Each colored circle represents a different deposit. The outlier '42' (at the bottom) is a mill concentrate from a new customer which does not fit the routine material composition.

Continuous slag analysis

Previously slag analysis was only done after completion of the melting process. Rand Refinery now uses continuous slag analysis, where XRD can determine crystalline phases and amorphous content. This better control considerably improves the effectiveness of the melt.

Elimination of impurities

CubiX³ Minerals proved it's value in quality control by identifying silicon carbide and graphite in surface markings on the 1 kg gold cast bars. Tracing these materials back to their sources in the crucible and the casting moulds, enabled Rand Refinery to better control their ingot production process.

Cluster analysis

The deposits Rand Refinery receives are varying in composition, meaning that there is not one routine smelter charge make-up for mill concentrates. Here, cluster analysis proves very useful:

- All datasets are automatically sorted into closely related classes
- The most representative scan of each class is identified
- The two most different scans of each class are identified
- Outliers not fitting into any class are identified

Rand Refinery originally purchased the XRD system in 2012 to gain better control over its smelter processes. Quickly these expectations have been exceeded and Rand Refinery is now in the process of expanding the use of their CubiX³ Minerals from the smelter to the refinery.

RAND REFINERY

Established by the Chamber of Mines of South Africa in 1920, Rand Refinery is now the largest integrated single-site precious metals refining and smelting complex in the world. Products extend across the precious metals value chain, from world-class smelting to refining and recovery of precious metals. A variety of products for investment and industrial use, luxury products, and retail products are fabricated.

The Rand Refinery mark - synonymous with integrity and quality - can be found on cast bars, minted bars, minted coins, coin blanks and medallions. One of Rand Refinery's top investment products is the internationally acclaimed Krugerrand, the world's premium bullion coin with over 60 million in circulation.

Peter van Velzen,
CEO of PANalytical

Peter van Velzen obtained his PhD at the University of Leiden (the Netherlands), pioneering novel analytical techniques for the study of gas phase organic chemistry.
He joined Philips Research in 1981 working on the forefront of the application of time-of-flight secondary ion mass spectrometry (TOF-SIMS) for advanced surface analysis and applying the technique to many industrial applications in the Philips group.
In 1991 he joined the Philips X-ray business where he held various positions and gained extensive experience in the field of analytical instrumentation and applications. Peter has been the CEO of the company since 1999.

"Standstill is a decline"

Peter van Velzen, CEO PANalytical, about 'How to improve'

As CEO of PANalytical Peter van Velzen is regularly visiting our customers and our company's local organizations around the world. In his meetings with customers and colleagues he not only discusses product news but he also introduces PANalytical's new mission and teaches the code of business ethics PANalytical is adhering to. X'Press was lucky to find him at his desk one day in October and seized the opportunity to ask Peter a few questions about his view on our current theme 'How to improve'.

Peter, can you explain what is meant by this theme? What is to be improved?
PANalytical's obsession is to improve every day because it's our conviction that 'standstill is in fact a decline, a deterioration'. Of course this motto is not only our guiding principle in defining new and better products for our customers but it is also driving improvements in our own business processes. The statement is central in our thinking and guides our actions.

Can you give us some examples?
It's obvious that we invest substantially in better technology and better products. but also in improving all our processes. We are currently implementing Lean Six Sigma in our company and many of our employees have recently finished extensive training. We do this because we believe that better internal business processes will lead to better quality of services and products for our customers. Secondly we strive to make best-in-class analytical solutions and technologies aimed at providing the means to improve your business. By employing these products and technologies our customers will be able to improve their process efficiency, their process control, their product quality or cost price. They will be able to reduce waste, to control pollution, or perform groundbreaking research into new materials and new material applications.

"Employing our products will enable our customers to improve their process efficiency, their process control, their product quality or cost price; in short - their business".
- ***Peter van Velzen***,
CEO of PANalytical

This is our way to translate 'How to improve' into tangible benefits to all our customers. And this is why we are in business 'to enhance the productivity of our customers'.

PANalytical recently acquired Claisse who are introduced in this issue of X'Press. How can this company contribute to any improvements?
The acquisition of Claisse, 'the First and Finest in Fusion', has been a logical step for us because we can now provide even more complete solutions and expertise to our customers. XRF users will confirm that the quality of their analysis is heavily depending on the quality of sample preparation and with Claisse we have added a large range of sophisticated best-in-class solutions to our portfolio. That means that we can now even better support analyses from the start up to the end.

Last but not least: this is the last X'Press issue of 2014. Can you summarize the past year for our readers and could you give us a glimpse of 2015?
We are proud to have launched more than 10 new products to the market in 2014 and I am talking not only hardware but also software including important new functionality and improved navigation and human interfaces. I think this clearly demonstrates that we live our conviction that innovation in products, technology and processes is key to improve your and our business.

We are firmly determined to make 2015 another year of such continuous and game-changing PANalytical innovations aimed at making the world a better place. We will strive to provide guidance in and support to 'How to improve' every occasion, every time. This we do in the framework of a thoroughly socially responsible and ethical company.
I am looking forward to the challenges of next year. As always, in 2015 and beyond we will continue serving you in the best possible way, a partner for life. Stay tuned for more exciting news to come.

Welcome to Claisse. A new member of the PANalytical family

Corporation Scientifique Claisse Inc. ('Claisse') is a global market leader in inorganic sample preparation by fusion for XRF, AA, ICP and wet chemistry analysis. The last issue of X'Press contained a short announcement about PANalytical's acquisition of Claisse and now, in this issue, it is time to introduce the company.

Claisse products comprise not only fusion instruments but also consumables (such as fluxes, chemicals to monitor the fusion process and platinumware), services (assistance with the start-up, prefused discs and consultation) and profound expertise, all based on solid research & development. This makes Claisse the perfect PANalytical center of expertise for fusion.

Fusion is a widely used technique to prepare samples for X-ray fluorescence (XRF) analysis. A ground solid sample is homogeneously dissolved into a borate flux in a platinum crucible. It is then cast and cooled to result in homogeneous glass disks to be analyzed. This eliminates mineralogy and particle size effects and allows the use of synthetic standards to facilitate the preparation of calibration curves.

Claisse's electric fusion instruments **LeNeo®** (1 position) and **TheOx®** (6 positions) prepare glass disks for XRF analysis and also borate and peroxide solutions for ICP and AA analysis. The fully automatic procedure ensures superior homogenization of the melt and highly reproducible and accurate results.

M4™ with 3 positions and the **Peroxide Fluxer™** with 6 positions use gas for heating the sample and are mainly used to prepare solutions.

TheAnt®, a high-precision flux weigher and dispenser, and the **rFusion®** automated modular system complete the portfolio of flexible and reliable products with low operating costs.

CLAISSE
THE FIRST AND FINEST IN FUSION®

Claisse was founded in 1976 in Quebec (Canada) when the first automatic fusion instrument was invented. Over the following years the company went on to develop the first fused fluxes with integrated non-wetting agents. The current products, designed for unprecedented analytical accuracy and repeatability, make Claisse 'The First and Finest in Fusion®'. With headquarters at Quebec (Canada), Claisse is represented by local agents in 70 countries worldwide.

"Partnering two world leaders in their fields will considerably enhance and complement both our capabilities and the combination of our commercial networks will increase accessibility for our customers worldwide. We are looking forward to our cooperation".

- Christian Marcoux, general manager Claisse

The CNA family.
New configuration, new applications

With the recent release of the CNA³, PANalytical's CNA family has grown. The new configuration is designed to address coal, mining and other high-capacity operations. The CNA³, like its predecessor the CNA, provides real-time elemental analyses of material on a conveyor belt. The new configuration can be mounted completely under the belt, which simplifies both installation and maintenance and enables the analyzer to be installed over a wide range of belt widths and material sizes.

In the standard CNA configuration, the conveyor belt passes through the analyzer with the neutron tube below and the gamma detectors above. While this arrangement is ideal for layered belt loads, it limits both the belt width and top size of the material on the belt. In contrast, the CNA³ is designed with both the neutron tube and detector(s) in a single compact box. The box is mounted on rails and can be easily retracted from under the belt for maintenance or additional calibration and reinserted under the belt for analysis – all without interrupting production.

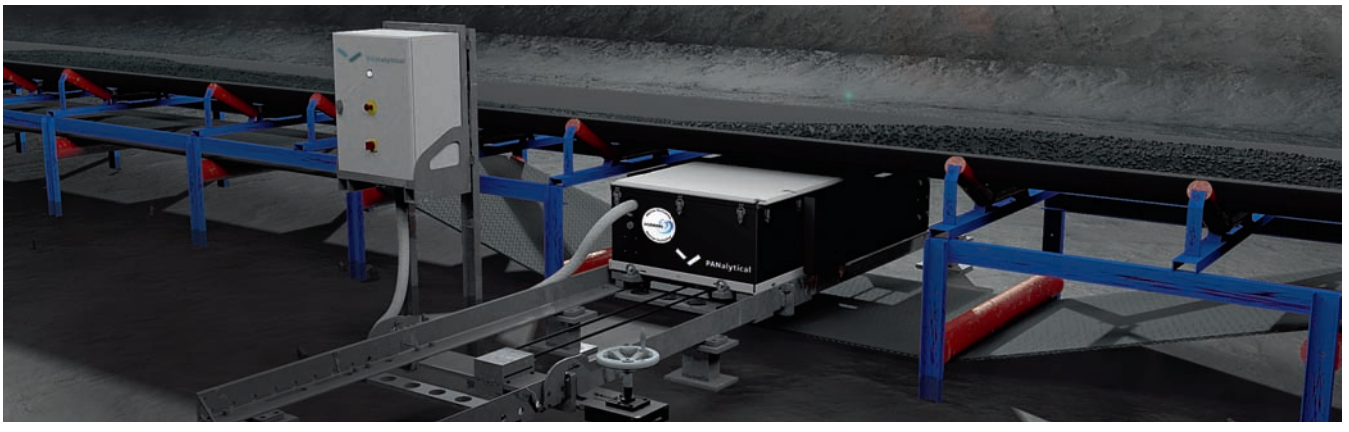
CNA³ (box on the right) in LKAB's iron ore mine, 815 m underground

The CNA³ is currently installed in two locations, both in underground mines and both providing real-time feedback on mining operations. The Swedish LKAB Minerals group has installed a CNA³ 815 m underground in their Malmberget iron ore mine (see X'Press 4/2013). Another unit is in service in an European underground copper ore mine and additional units are on order for limestone sorting and mine load out in Brazil and Australia, respectively.

The CNA³ is an ideal analyzer for coal applications. Mines, treatment plants, and end users can all benefit from the real-time analyses the units can provide, and the under-belt design simplifies installation and maintenance.

While the CNA³ provides many exciting possibilities, it does not replace the classical CNA design which remains the mainstay for cement and related applications, particularly those with layered materials. The Siam Cement Group, one of the leading business conglomerates in the ASEAN region, has recently purchased 3 CNA systems for two of their plants (limestone stockpile and raw mix). At Shree Cement, one of India's top cement manufacturers, multiple CNA units have been installed at their three plant locations to provide analyses for real-time monitoring and control.

All models of CNA analyzers feature proven Sodern neutron technology. The heart of the system is the Sodern neutron tube which provides a controlled neutron stream for improved analytical capabilities and unmatched safety. Ongoing improvements in the tube technology have resulted in continuously improved tube life. Operating life of recent models has exceeded 15,000 hours.



Curtains up for PANalytical's new **XRD detectors**

PANalytical has been pioneering solid-state X-ray detection technology for more than a decade and is continuously developing new detectors which exploit state-of-the-art technologies for X-ray applications. Our exclusive new 2D detectors for XRD, PIXcel^{3D} with Medipix3 inside and the brand-new GaliPIX^{3D} detector, stay true to this vision. These additions result from the world-leading expertise that has built up in the company since the first solid-state detector, X'Celerator, was launched in 2001.

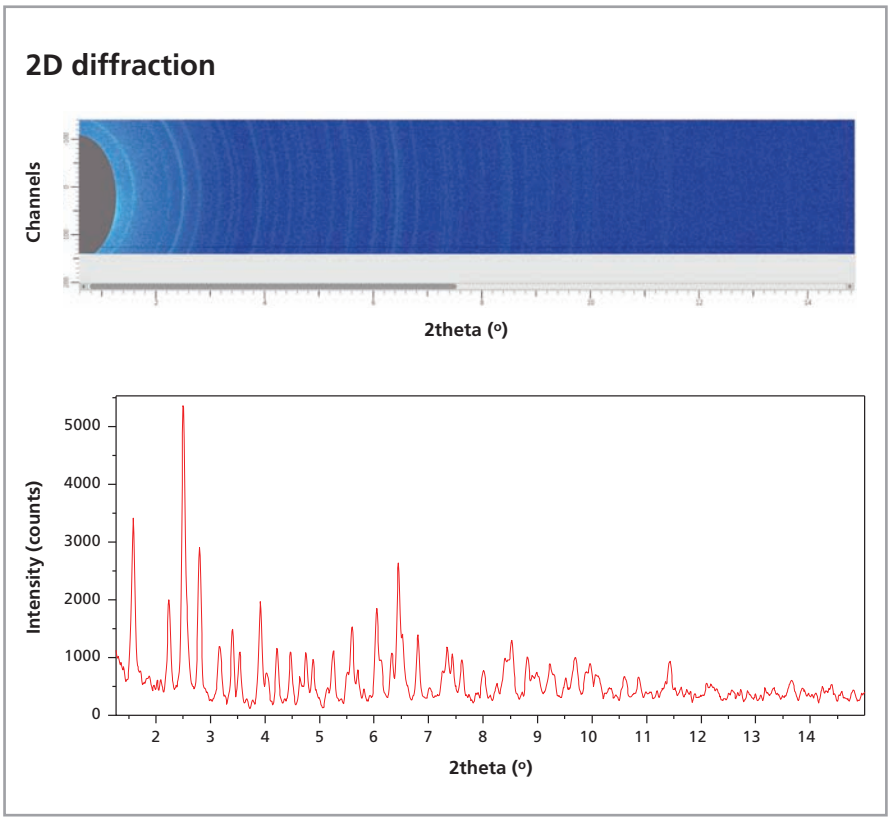
PIXcel^{3D} now incorporates the Medipix3 chip recently developed at CERN, the European Organization for Nuclear Research in Geneva (Switzerland). The first and immediate benefits for XRD detection are found in improved efficiencies for softer radiation (e.g. Cr, Co). Not only that, behind the scenes, developments in the analogue and digital electronic design bring step changes in signal processing.

GaliPIX^{3D} is PANalytical's newest and largest 2D pixel detector for XRD with a pixel area of 60 µm x 60 µm and overall sensor dimensions of 30.7 mm x 24.8 mm. The high-quality CdTe sensor providing an unrivalled stopping power for X-rays, is responsible for close to 100% efficiency even for higher energy radiation like Ag and Mo. GaliPIX^{3D} is now the detector of choice for computed tomography (CT) and pair distribution function (PDF) analysis on our Empyrean diffractometer.

We live in a visual age and this new generation of detectors is designed to provide the state-of-the-art in 2D images, data quality and flexibility. The design of PANalytical's 2D photon counting detectors allows users to switch seamlessly between 0D, 1D and 2D modes. Together with the evolutionary flexibility of instruments such as Empyrean, these provide total freedom in choice of XRD experimental methods with less changeover time.

2D mode offers pattern capture within seconds and the most rapid sample screening options. 1D mode enables rapid scanning with the highest sensitivity and angular resolution. In 0D mode, tried and trusted point-focus and high-resolution methods are performed with unrivalled high dynamic range.

GaliPIX^{3D}
Highest efficiency detector for hard radiation

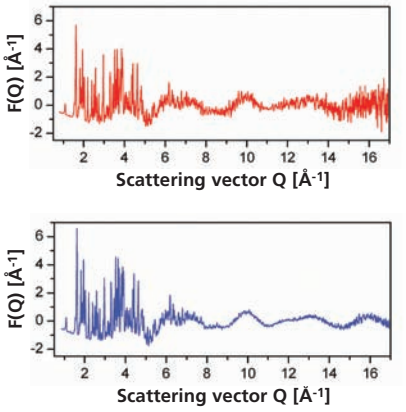


A 2D scan of hen egg white lysozyme shows minimal peak asymmetry at low angles. The top 2D scanned image is processed by integrating along the diffraction rings to give the line scan below. Note the high quality and symmetry of the first reflection already at 1° 2Θ.

Computed tomography

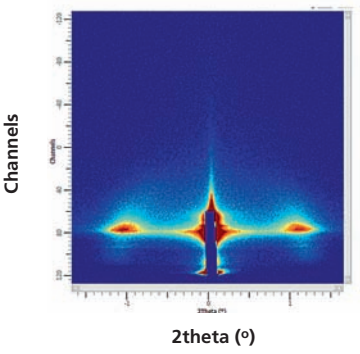
Computed tomography with the GaliPIX^{3D} detector and Ag radiation. All details of the interior of a capacitor (left) are clearly visible in the 3D reconstruction (right).

Pair distribution function



The new GaliPIX^{3D} detector offers much higher sensitivity for pair distribution function (PDF) measurements over previous detectors (top graph). The bottom graph shows the considerably improved data especially at high Q.

GISAXS scatter



GISAXS scatter from cobalt nanowires, taken by the new PIXcel^{3D} detector with Medipix3 inside, using Co radiation. Because GISAXS scatter is inherently weak and requires high resolution, 2D GISAXS images such as this would not be possible without the extremely low noise and the high lateral resolution provided by the new PANalytical 2D solid-state detectors.

X-ray detectors

Technological insight

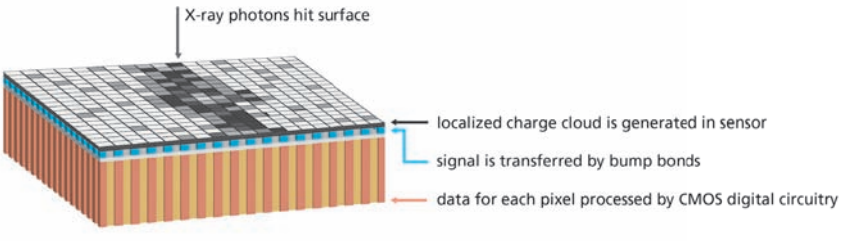
The previous decade has seen a move from gas filled detectors to the new solid-state technologies which offer photon counting, high saturation thresholds, uncompromised resolution and maintenance-free operation. PANalytical was first to introduce 2D pixel detectors with true photon counting. This together with advancements in integrated circuit manufacturing have meant that PANalytical's 2D detectors have the smallest pixel sizes (55 µm x 55 µm and 60 µm x 60 µm) and the highest spatial resolution available in the market.

Photon counting means that each X-ray photon arriving on the detector is measured as a discrete signal. Photon counting is enabled by the solid-state detection technology (namely the sensor p-n junction and the underlying electronics). The semiconductor sensor at the front of the detector is itself part of an analogue electronic circuit. Regularly spaced bump bonds at the rear of the sensor effectively divide the sensor into small regions called pixels. Each pixel has its own circuitry and can behave like a single detector. Incoming X-ray photons create charge pulses which are collected by the circuit within the pixel volume. The charge pulse in each pixel is measured, characterised and assigned an energy value which is transferred to the underlying digital logic circuits. The high-speed digital circuits, like an on-board computer, can be pre-programmed to process the signal according to its position, the time it was received and the requirements of the application. The circuitry is designed so that there is no residual noise from the detector electronics.

High resolution is provided by reducing the volume of interaction of the photons with the sensor and by locating the charge pulse at the point of its origin. Because the stopping power of semiconductor sensors is relatively high, they can be geometrically very thin. The result of this is that the charge is created in a very small volume precisely at the entry point of the incoming photon. Point spread function refers to the resolution to which the position of the charge pulse can be measured by the electronic circuitry. For these detectors every measured charge pulse can be allocated to one single pixel, meaning that the images are sharp and without blur.

The combination of flexible analogue and digital signal processing for each pixel allows an optimised energy window to be assigned for each X-ray wavelength. This reduces background in measured data and allows the detectors to be fine-tuned for different XRD applications and wavelengths.

The combination of these features, results in a detector with the best performance in detection sensitivity and resolution.



PRODUCT NEWS

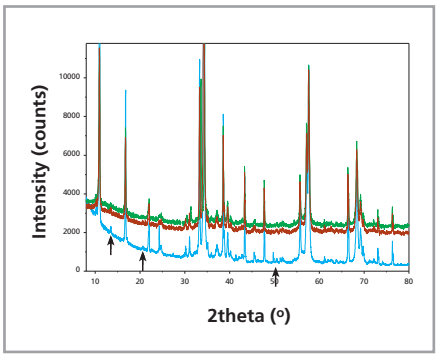
Bragg-Brentano^{HD} for mineralogical samples

This spring saw the launch of PANalytical's new Bragg-Brentano^{HD} X-ray diffraction PreFIX module. The first results demonstrated the impressive data quality obtained using this module with Cu radiation (see also X'Press 2/2014). Now PANalytical is pleased to demonstrate how Bragg-Brentano^{HD} can bring added benefits to metrology using Co radiation.

In the mining industry precise knowledge of the mineralogical composition of ores, concentrates and tailings is crucial for optimal recovery rates, an efficient process and thus considerable cost-savings. Here, measurements often employ cobalt instead of copper radiation.

Recent tests of the Bragg-Brentano^{HD} module with Co radiation show very good peak-to-background ratio, revealing peaks of minor phases much better than a conventional setup. Determination of impurities at concentration ranges of ca. 0.5 % can be performed with much higher accuracy.

"We are glad that the new Bragg-Brentano^{HD} module proves to be useful not only for research but for industrial applications too."
- Uwe König, PANalytical mining segment manager



*Determination of minor phases in Cu concentrate ($CuFeS_2$); arrows indicate well-resolved peaks of minor phases. **Green**: Programmable slits and incident-beam Fe filter; **Brown**: Programmable slits and diffracted-beam Fe filter; **Blue**: Bragg-Brentano^{HD}*

X-ray diffraction under external mechanical stresses

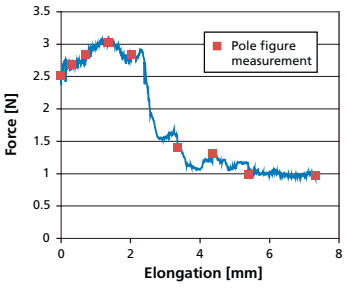
How do materials behave under applied stresses? At which strain does plastic deformation start? How do materials properties change with stress? The answers to these questions heavily depend on the microstructure of the material investigated.

With the Deben 300N tensile stage, well-known from electron microscopy, it is now possible to follow changes in the microstructure of a sample under well-defined strain and stress conditions, in X-ray diffraction reflection mode.

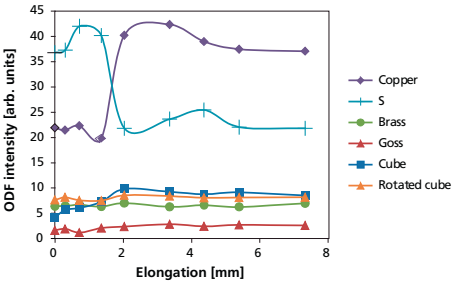
Due to the compact design of the Deben 300N tensile stage it can easily be placed on a three-axes cradle on PANalytical's Empyrean XRD platform. Samples are mounted horizontally, clamped to a pair of jaws and supported on stainless steel sliding bearings, enabling stress and texture measurements under externally applied, computer-controlled stresses or strains.

The resulting stress-strain curve can be recorded. The latest experiments showed that not only metals but also polymers (foils or fibers) are suitable candidates for these measurements.

A PANalytical webinar, held on 9 October 2014, discussed these applications in detail. It can be watched on demand at www.panalytical.com/webinars.



Typical stress-strain curve of the sample; the applied tensile force as a function of the elongation of the sample.



Intensity of the main components of the sample as function of the elongation of the sample (as derived from orientation distribution (ODF) functions)

Texture measurements of a rolled copper strip
Copper is a typical metal with high crystallographic symmetry and reveals the possibilities of the tensile stage. The results show that changes in preferred orientations as measured in situ can be related to the mechanical behavior of the sample.

Graduate student Charles Sinagra and high school summer student Amber Latona in the lab

The 2nd **DUPAN Symposium**

DUPAN – a collaboration between Duquesne University and PANalytical – was born out of a friendly conversation between PANalytical's US sales director Ron Amodeo and Dr. Jennifer Aitken of Duquesne University.

The 2nd annual DUPAN X-ray Powder Diffraction Symposium was held at Duquesne on June 25 and 26, 2014 to a growing audience of 70 participants from the Pittsburgh area. The event featured eight presentations on XRD applications and research, hands-on computer lab sessions, as well as 15 student posters on the subject of powder X-ray diffraction research.

Associate Professor Dr. Jennifer Aitken is very positive about the collaboration between PANalytical and Duquesne University's Department of Chemistry and Biochemistry. The entire faculty within the department fosters a collaborative environment with other universities by offering the use of the PANalytical X'Pert PRO MPD system to students in the greater Pittsburgh area. Jennifer states "at times samples will be sent for analysis, or a student or whole class will come into the lab to work with the instrument." Recent visitors include for example Chatham College, Washington and Jefferson College or the Indiana University of Pennsylvania.

Duquesne students that use the MPD are for the most part from the Integrated Laboratory Course where introduction to powder diffraction, sample preparation and simple phase identification are covered. They then expand on this by teaching quantitative methods and Rietveld refinement. Duquesne graduate students in forensics, law and pharmaceutical research use the MPD for class and research. In many cases the Duquesne students show the visiting students how to use the system, switching between configurations and generally share their knowledge of X-ray diffraction.

"Our relation has always been dependable, honest and genuine."

- Dr. Jennifer Aitken about PANalytical

DUQUESNE UNIVERSITY

PANALYTICAL ON THE ROAD

The **Denver X-ray Conference and Exhibit**

Big Sky Montana. July 28 - August 1, 2014

PANalytical's booth at this year's Denver Conference displayed an Empyrean XRD system, and Epsilon 1 and Epsilon 3^{XL} benchtop XRF systems. Over the course of the week visitors were not only treated to several conference talks but also entertained with lively discussions on X-ray diffraction and X-ray fluorescence at the booth.

Dr. Scott Speakman, XRD principal scientist at PANalytical in the US, participated as an instructor in the workshop 'Two-Dimensional Detectors'. This was the perfect venue to introduce the new GaliPIX^{3D} detector and also the PIXcel^{3D} with Medipix3 technology to the Denver X-ray Conference community. Both detectors drew interest for the significant advancement in 2D detector technology that they bring (page 10, this X'Press).

Visitors could take part in the 'Game of Stones', a new PANalytical Challenge where the player spins the wheel and is given an element. They were then shown a display of rocks and asked "Which rock contains the highest concentration of that element?" The rock was placed into the Epsilon 1 instrument and analyzed using Omnian semiquantitative software where the elemental results are plain to see, and the rank of that stone was revealed.

We were pleasantly surprised by the number of people that traveled to this out-of-the-way venue and we look forward to seeing everyone back in Westminster, CO in 2015!

23rd Congress and General Assembly of the **International Union of Crystallography** (IUCr)

The triennial conference was held this year in Montreal, Quebec, Canada on August 5-12. It was an important gathering of single crystal and powder diffractionists, as well as many people working at beam lines.

For PANalytical, it was a great networking opportunity toward the 2300 attendees. On display was not only the Empyrean XRD system, but also PANalytical's latest offerings in 2D detection – the brand-new GaliPIX^{3D} detector for hard radiation applications, and the PIXcel^{3D} with Medipix3 chip technology. These detectors drew quite a bit of attention due to their outstanding performance for applications such as pair distribution function (PDF) analysis, computed tomography (CT) on dense objects such as a meteorite sample, and transmission texture.

The next IUCr meeting will be in 2017 in Hyderabad, India.

XRD product manager for the Americas Julie Quinn demonstrates the Empyrean at IUCr.

Global XRD product marketing manager Martijn Fransen discusses the new 2D detectors.

Events calendar 2015

The list shows a selection of events during the year where you will find us. Please come and visit us if you attend any of these events. More information on www.panalytical.com/events

4–5 February	CBI Brazil and LATAM 2015	São Paulo, Brazil
15–18 February	SME Annual Conference	Denver, CO, USA
8–12 March	Pittcon	New Orleans, LA, USA
10-14 May	ICM 12	Karlsruhe, Germany
18-21 May	PPXRD-13	Bad Herrenalb, Germany

Workshop on X-rays Methods for Thin Film Characterization

Professor Václav Holý during his presentation on GISAXS

The 2-day workshop was organized by PANalytical together with Professor Václav Holý, one of the leading experts on X-ray scattering theories for thin films, from the Charles University in Prague. It aimed to provide a forum to stimulate discussions and to share experience amongst the 54 participants from across Europe.

Most attendees were PhD students, post docs or young researchers who were seeking detailed information and discussion on X-ray measurement strategies and scattering data interpretation. The mix of lectures, talks and posters provided the participants with sufficient opportunities to ask questions, to discuss analysis results and to exchange information. This was well appreciated and the majority of the attendees indicated that they received more information from the event than they had expected.

The workshop on X-rays methods for thin film characterization underlined PANalytical's ongoing commitment to the thin film community.

Colophon

Please send your contributions, suggestions and comments to the following address.

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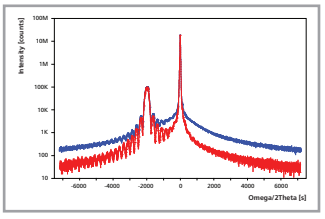

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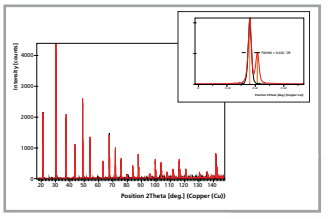

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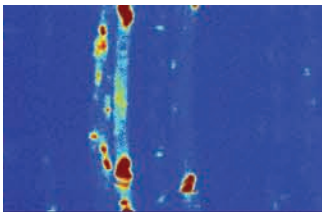

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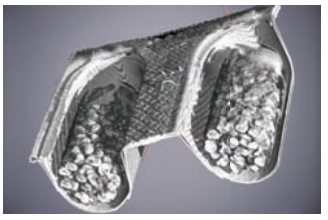

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