

ISSUE 1 / 2014



PANalytical

X'PRESS

The customers' voice

Dedicated analysis



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get insight

Dedicated analysis

Welcome to this first edition of X'Press in 2014

As you were able to read in previous issues of this magazine, UNESCO has defined 2014 as the International Year of Crystallography (IYCr), commemorating the centennial of X-ray diffraction. In 1912 Max von Laue and his coworkers Walter Friedrich and Paul Knipping discussed the possible interaction of the then recently discovered X-radiation with a crystal lattice. They tested their hypothesis by directing X-rays towards a crystal of copper sulfate and were able to record the first X-ray diffraction pattern. This laid the foundation for today's advanced technology enabling materials characterization by means of X-rays, and in 1914 Max von Laue was awarded the Nobel Prize for Physics for his research.

As so often in science, the general public tends not to know that crystallography plays a vital part in industries as diverse as agrifood, pharmaceuticals, aeronautics, new materials and mining. In his presentation at the IYCr Opening Ceremony in Paris, PANalytical's product marketing manager Martijn Fransen presented a few illustrative examples (see page 11) of crystallography in daily life, which made this science more accessible for the many UNESCO ambassadors present and thus making the importance of X-ray analysis more tangible.

The discovery of X-ray diffraction has led to many possibilities to get insight in materials and a large number of dedicated methods for materials analysis has been developed during these last 100 years. Since its foundation in 1948 PANalytical has continuously contributed to the development of new methods and instruments both for X-ray diffraction and X-ray fluorescence.

With these new technologies we have arrived today at a point where this science can, without compromising analytical versatility breadth and results, be applied by an increasing

number of non-specialist users. In this issue of X'Press we would like to present you a number of those examples: customers who routinely use PANalytical systems and standards to solve their analytical problems such as Aurubis and Borealis (on pages 3 and 4 respectively), and also our latest developments in dedicated software and hardware allowing for very easy application of advanced analytical technology.

It remains fascinating to see where the discovery of X-ray diffraction has led to. And we are not at the end: I am convinced ever more technology and applications will be discovered and developed, thereby addressing the growing need for process efficiency and compliance with environmental and product safety, which are of rapidly increasing importance to our environment and sustaining our way of life. This is the core of our mission. We will continue to contribute with our know-how and commitment to understanding your requirements and needs every day, all the time. In line with this we launched a new tagline to our logo: 'get insight'. In the next edition of the X'Press I will elaborate further on this, but if you are curious please visit our website.

I hope you enjoy reading this issue of X'Press and I am looking forward to your reactions via www.panalytical.com.



Kind regards,
Peter van Velzen



Copper is our metal

Aurubis is the leading integrated copper group and the world's largest copper recycler. About 6,500 employees work at several production facilities in Europe and in the US and in sales and service throughout Europe, Asia and North America. Their largest production site and headquarters are located in Hamburg (Germany), employing more than 2000 people. It was here that the Norddeutsche Affinerie AG was founded in 1866 and has developed through the years into today's Aurubis group. Nowadays the Hamburg site is one of the most modern and environmentally friendly copper smelters worldwide.

Aurubis receives a large variety of raw material (copper concentrates and copper scrap which contain numerous metals in widely varying concentrations) from mines and recyclers worldwide. Precise analysis of the metals' concentrations is essential for an energetically and environmentally advantageous mixture of raw materials as a starting point for refinement. Via a number of production steps (smelting and converting) copper anodes (99% copper) are produced and subsequently further refined by electrolysis, resulting in 99.99% pure copper cathodes.

The Hamburg site houses the company's main analytical laboratory. Here, more than 80,000 samples per year are analyzed by X-ray fluorescence (XRF) spectrometry containing almost all metals in concentration ranges from 100 % to ppm.

The main tasks of the lab are:

- Inspection of incoming copper concentrates and of secondary raw materials like electronic scrap, circuit boards, muds and dust
- Production control of metals, slags, stones, acids and more
- End control of metals (copper, silver, gold) and metal leaches

Until 2012 a MagiX PRO and two PW2400 spectrometers from PANalytical performed all XRF analyses at Aurubis' Hamburg lab. The continuously increasing number of samples, however, demanded an increase of analytical power resulting in Aurubis ordering three high-end PANalytical Axios^{mAX} systems as replacement for the two PW2400 spectrometers. Due to the high number of calibrations to be transferred to the new spectrometers these have gradually been delivered within the last two years with the final one being installed a few weeks ago.

Aurum rubrum = red gold

Aurubis produces more than 1 million tons of copper cathodes each year and from these a variety of copper products such as continuous cast wire rod, shapes, rolled products and strip and specialty wire made of copper and copper alloys. Precious metals and a number of other products, such as sulfuric acid and iron silicate, complete the product portfolio.

Aurubis' customers include companies in the copper semis industry, electrical engineering, electronics and chemical industries as well as suppliers for the renewable energies, construction and automotive sectors.



Casting of copper anodes in the casting carousel

In order to prevent interruptions, the PCs of all spectrometers share a common network allowing evaluation of the results of all systems on any PC, using PANalytical's Omnian and SuperQ software.

The company has used PANalytical XRF spectrometers for about 40 years and considers itself a very critical customer. Aurubis requires very precise and reproducible analysis and maximum uptime.

"The high reliability and availability of the PANalytical systems is the main reason all Aurubis labs are equipped with PANalytical spectrometers. We can be sure that any maintenance issue will be solved within 24 hours," says Mr. Harald Florek, manager of the XRF analytical lab and he continues: "This is crucial for continuous materials control".



Harald Florek (Aurubis lab manager), Mathias Schäfer, Jürgen Wess and Sören Brunke (all PANalytical) during the official handover of the latest Axios system

Beyond the hardware



PANalytical develops total solution for polyolefine analysis at Borealis

Borealis is a leading provider of innovative solutions in the fields of polyolefins, base chemicals and fertilizers. Their polyolefins, mainly polyethylene (PE) and polypropylene (PP), are manufactured in about 15 plants worldwide. X-ray fluorescence (XRF) spectrometry for quality control has been used for many years at Borealis, enabling the company to provide the highest quality products. With multiple laboratories at different Borealis sites it became increasingly important to produce standardized and comparable results. In order to achieve this, PANalytical was asked for a joint project, which has now been successfully completed.

The major challenge of this project, driven by the operational excellence program in Borealis, was the availability of proper reference materials. These need to contain specific elements in various and uncorrelated concentration ranges in order to enable good line-overlap corrections. Additionally it is critical to achieve the best possible homogeneity in the samples without degrading the polymer material. PANalytical was able to provide these unique reference materials. After several extrusion steps, samples with uncorrelated concentrations of the various requested elements (Mg, Al, Si, P, S, Ca, Ti, Zn) were obtained as pressed pellets.

These concentrations were subsequently validated according to modern quality standards and guidelines. XRF spectrometry, inductively coupled plasma mass-spectrometry (ICP-MS) and Instrumental Neutron Activation

Analysis (INAA) were applied, followed by statistical evaluation. PE and PP samples were measured at one single calibration line with XRF. The different polymer matrices did not deliver measurable differences for any of the investigated elements. Additionally an application has been developed that takes all critical parameters such as limited sample thickness, line overlaps and matrix effects into consideration.

Early this year Borealis received a turn-key application, delivered in a case together with monitor samples. This new standard suite will be used at all of Borealis' laboratory sites and will ensure precise and perfectly comparable analysis results. The next step will be the development of a full standard operating procedure (SOP). The benefit for Borealis is to deliver the same high quality on every site and minimize variations in production and therefore save costs.

Dr. Thomas Steindl, head of Quality Control says:

"The excellent and open collaboration with PANalytical led to reference materials that perfectly suit the increased quality aim we have in mind."

Borealis has over 50 years of heritage in polyethylene and polypropylene production. The company is headquartered in Vienna (Austria). Around 6,200 employees provide services and products to a wide range of industries in more than 120 countries worldwide.

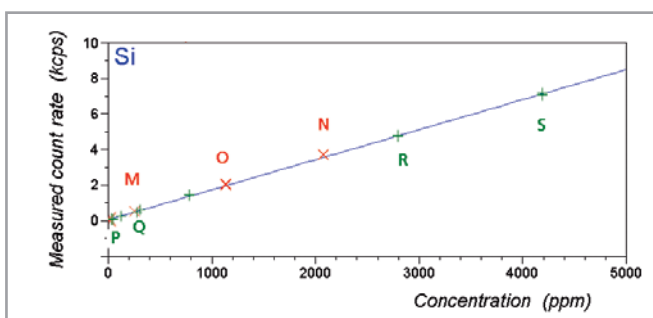
Borealis is committed to the principles of Responsible Care®, an initiative to improve safety performance within the chemical industry.



Borealis Borstar® polypropylene plant



By offering expertise and know-how beyond just selling equipment, PANalytical has been able to provide a dedicated total analysis solution to enhance the customer's effectiveness and productivity.



Calibration for silicium.
Letters indicate different samples.

XRF for the environment

Rapid, multi-elemental analysis of sediments and curative mud

Thanks to favorable geological characteristics, Estonia has a variety of important deposits of peat, lake and marine muds (sediment with high organic matter content). These have been recognized for their curative properties for several centuries. However, at present, the mud resources are much less utilized than during the early 20th century, when Estonian spas were a tourist destination for the whole region. One of the important constraints that hinders a revival of public and commercial utilization of mud is a lack of understanding the sediment composition, material properties and potential contamination risks. Tallinn University Haapsalu College's new analytical laboratory will now perform detailed analyses of these muds.

For this task the Haapsalu College team has acquired a PANalytical Epsilon 3 XL X-ray fluorescence (XRF) spectrometer. This will be used first to characterize the organic and inorganic compositional matrix of mud in detail, with special focus on healing substances (clay, decomposed organic matter, antioxidants) and potentially toxic compounds, such as cyanobacterial toxins or heavy metal pollution.

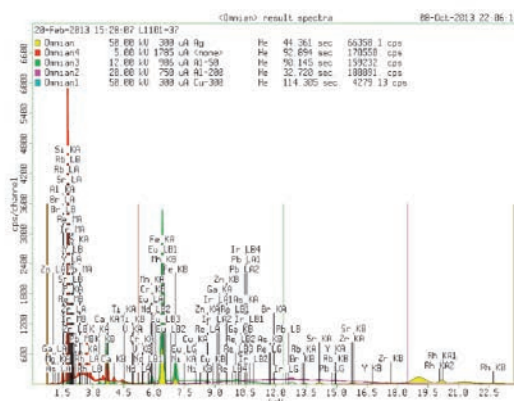
Secondly, the spatial characterization of the mud deposits will be investigated. This includes the variability of the composition within the site, a comparison of sites, and the investigation of new sites for mud extraction. In order to contribute to a more sustainable management of

natural resources, the project will not only technically describe the mud and assess the potential yield in the deposits, but it will also explore its broader environmental context.

Therefore, the obtained chemical data will be interpreted in the context of the sedimentological and ecological expertise and will serve for understanding the mud formation processes, its ecological functions and dynamics. Additionally, since the element composition of sediment reflects the environmental conditions under which sediment was formed, the element ratios can serve as good environmental indicators (Cohen, 2003; Boyle, 2002).

The main challenges of such analyses are the highly variable matrix, the lack of suitable standards and the need to analyze a large number of compounds in highly variable quantities. The Epsilon 3 XL spectrometer is a perfect tool for this project because it can simultaneously measure a broad range of elements (from Na to U) directly from pressed or loose dry sediment powder and thus optimizes the demand on labor, expertise and lab equipment.

Typical XRF spectrum of a powder mud sample from Haapsalu Bay



Haapsalu College is a regional college and campus of Tallinn University. It is situated on the Western coast of Estonia at the Haapsalu Bay of the Baltic Sea, one of the best-known curative mud deposits in the Baltic region. The College is also a successful education and competence center that specializes in research for health promotion and rehabilitation.



Investing in your future



European Union
Regional Development Fund

In 2013, with support from a European Regional Development Fund, a new analytical laboratory was opened which focuses on the chemical characterization of Estonian curative muds as well as mapping of the mud deposit resources.



Training at the Epsilon 3. Left to right: Jakob Noreland (PANalytical specialist), Agata Marzecova and Galina Kapanen (Haapsalu College)

References:

- Boyle, J. F. "Inorganic geochemical methods in palaeolimnology." Tracking environmental change using lake sediments. Springer Netherlands, 2002. 83-141.
- Cohen, Andrew S. *Paleolimnology: the history and evolution of lake systems*. Oxford: Oxford University Press, 2003.

EasySAXS version 2.1 – for nanomaterials analysis

As of April 2014 a new version of PANalytical's EasySAXS data analysis software will become available. In particular, advanced small-angle X-ray scattering (SAXS) users and experts will appreciate the access to additional SAXS analysis options and the possibility to apply optimized measurement strategies.

Since last year's launch of PANalytical's ScatterX⁷⁸ SAXS/WAXS module (see article in X'Press 1/2013), high-quality SAXS data can be acquired on the Empyrean platform even on very weakly scattering materials, such as dilute samples of surfactants, polymer dispersions, biomacromolecules and other soft matter.

In order to obtain the best possible data from such types of delicate samples within reasonable data acquisition times, optimized measurement strategies are required. EasySAXS 2.1 now fully supports such approaches, e.g. by enabling the summation of repeated short measurements, to merge high- and low-concentration data, and by supporting quick static measurements e.g. with the PIXcel^{3D} 2x2 detector.

Furthermore, EasySAXS 2.1 can export data in a format, that is compatible with several publicly available software packages for small-angle scattering data analysis, thus allowing users to access additional, dedicated analysis options. In particular, data can be transferred to the popular ATSAS package from the European Molecular Biology Laboratory (EMBL), which offers in-depth interpretation of scattering data acquired from biological macromolecules (bioSAXS). The data are also compatible e.g. with the Irena package developed at the Argonne National Laboratory (IL, USA).

The graphical user interface was improved for better data display and additional plotting options, as well as for more ease of use. Finally, performance enhancements and more flexibility were added to model fitting, background subtraction, as well as data smoothing and desmearing.

EasySAXS is complemented by other PANalytical software packages, namely PANviewer for displaying 2D SAXS data and XRD2Dscan for 2D image processing (e.g. radial averaging). HighScore (Plus) is available for WAXS data analysis, including the identification of crystalline phases and the determination of nanocrystallite size.

PANalytical's SAXS/WAXS solutions are introduced by on-demand webinars, which can be accessed via <http://www.panalytical.com/webinars>

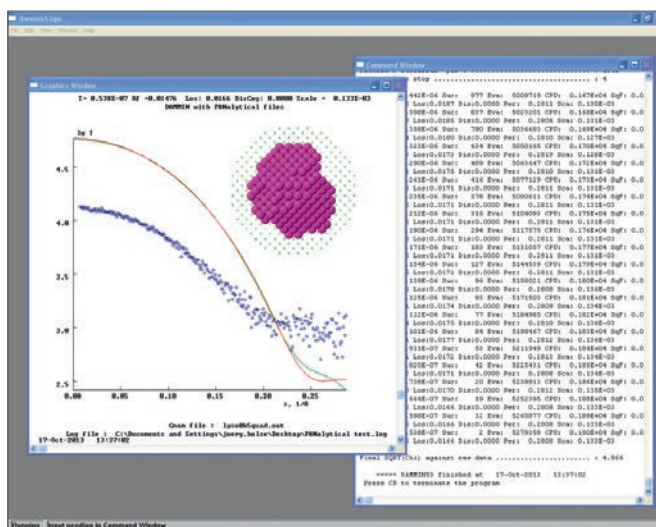
New software releases for de



EasySAXS is an advanced, user-friendly software package for the analysis of small-angle X-ray scattering (SAXS) data. It provides information on nanoscale structures and dimensions, nanoparticle shapes and surface areas.

EasySAXS offers advanced algorithms, a complete data analysis toolbox, automation options and reporting. The toolbox includes data reduction, Guinier and Porod analyses, least-squares fitting and model simulations.

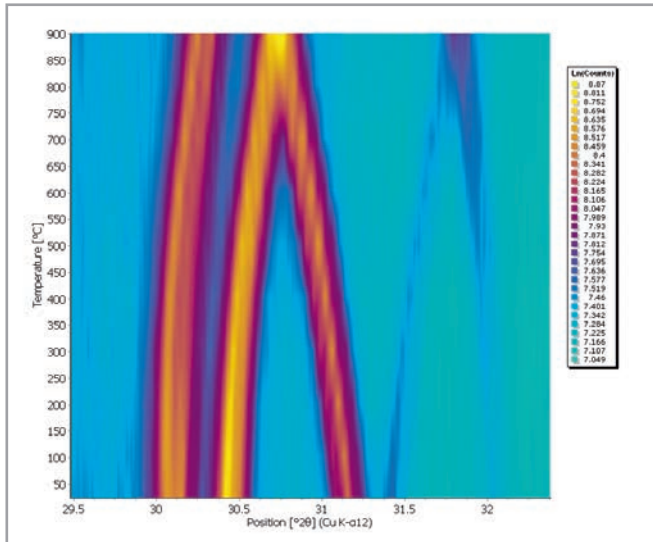
A collaboration with world-class scientists at EMBL
The EasySAXS interface provides convenient access to advanced data analysis options. Some of the underlying algorithms are based on codes from the renowned ATSAS software suite developed by Dr. D. Svergun and his team at the European Molecular Biology Laboratory (EMBL) in Hamburg, Germany. These include pair distribution function and particle size distribution analyses enabled by indirect Fourier transformation calculations.



Data pre-processed in EasySAXS are compatible with several publicly available SAXS data analysis packages. As an example, the screenshot shows the result of a 3D protein shape reconstruction that was performed with DAMMIN (from the EMBL ATSAS software suite) applied on scattering data from a protein solution that were acquired with ScatterX⁷⁸ on the Empyrean platform.

Dedicated analysis

HighScore (Plus) version 4.0 – for all XRD powder applications



Isolines view: Detail of albite phase transitions between room temperature and 900 °C

HighScore software – dedicated to detailed analysis of X-ray powder diffraction data

Some of the obvious benefits are:

- No limits for the number of atoms, peaks, phases or data points
- No limit for overlapping peaks; use of a bigger peak base width is possible
- Split-peaks possibility to fit asymmetric peaks
- Possibility to mix structure fits and profile fits in one refinement
- Better support of HKL phases and automatic fitting batches
- Very fast and stable profile fit

The new features of HighScore 4.0 were introduced in a webinar, which can be followed on demand via www.panalytical.com/webinars. Additionally, a number of webinars, planned for the coming months, will discuss various applications of the software.

For many years PANalytical's HighScore has been the proven powder diffraction analysis software. It covers qualitative and quantitative XRD phase determinations, crystallographic analysis, all kinds of profile and phase fits, up to charge flipping structure analysis, as well as statistical methods to evaluate very large numbers of scans. An important change to HighScore is now ready and being released.

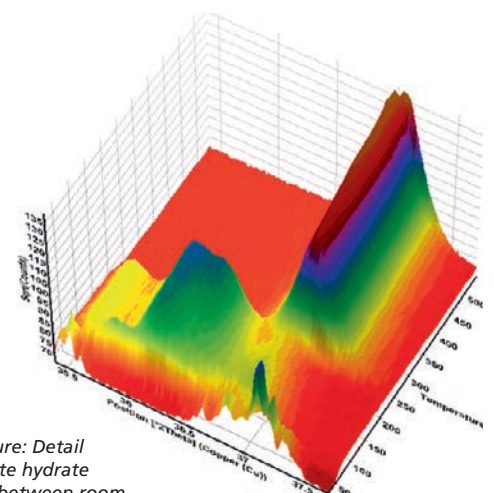
The software displays the familiar user interface, which has only been changed in details. Customers, however, can now enjoy a couple of brand-new functions:

- Partial least squares (PLS) regression to predict data from observed scan variations (data mining)
- Calculation of element or oxide concentrations from phase quantities
- Use of spherical harmonics to describe complex preferred orientations
- Unique bitmap-to-scan converter
- Unrivalled scripting functionality

"The biggest changes are barely visible", explains the longstanding HighScore team. *"We have changed the engine (the Rietveld kernel) and rebuilt it from scratch in a modern programming language, while keeping the car running".* Being more challenging and laborious than expected, this major development effort was necessary to allow further extensions of the code in the years to come.

PANalytical is already evaluating new XRD applications based on the new version 4.0 software functions. Product marketing manager XRD Martijn Fransen says: *"With this new kernel, we are prepared for the future. Together with our development team we are eager to set the next steps towards more ease of use and higher calculation speed, using the latest advances in computer technology."*

The former HighScore Plus functionality is now available as 'Plus'-option on top of the more basic HighScore package.



Pseudo-3D picture: Detail of copper acetate hydrate decomposition between room temperature and 550 °C

NIR for the mining industry



Near-infrared spectroscopy (NIR) is a fast, non-destructive technique that measures light reflectance to determine various materials or identify compounds. NIR is widely applied and is used to measure food quality, validate pharmaceutical constituents, research climate change effects, identify counterfeit products, monitor agricultural crops, identify and even quantify mined minerals, just to give a few examples.

Late in 2012, PANalytical acquired ASD, Inc., based in Boulder, CO (USA), a leading NIR spectrometer manufacturer. After two decades of manufacturing spectrometers for the remote sensing and mining markets, ASD Inc. (now known as PANalytical Boulder) is a recognized leader in NIR.

In mining, ASD's TerraSpec line of spectrometers are used by leading mining corporations in mines around the world to help them vector in on their deposits faster as well as characterize the geology and mineralogy at the mine site. NIR identifies many difficult alteration minerals such as various clay species, which are critical to proper characterization of the altered geology that surrounds an ore deposit.

While a valuable tool for miners, collecting NIR mineral spectra has historically been a cumbersome process. Exploration geologists would carry a briefcase-sized spectrometer in a backpack and collect mineral spectra by applying a probe to the rock's surface.

The probe connects to the spectrometer by an optical fiber and a wire, which collect and store the spectral files on a computer. The mineral is identified by feeding the files into a program that analyzes the spectra and compares it against a known mineral spectra library.

Last month, PANalytical Boulder released a breakthrough spectrometer for the mining market: the TerraSpec Halo. This instrument does everything above in one hand-held, phaser-style system weighing just over 2.5 kilograms.

A geologist simply needs to contact the instrument against a rock, pull the trigger and in 20 seconds or less the geologist will get a mineral result on the Halo screen. In an industry where costs have increased dramatically in the last few years, TerraSpec Halo will provide immediate results to miners that can be used for faster decision making and thus reducing operations and labor costs.

The TerraSpec Halo is a novel dedicated analysis tool for real-time mineral identification.



Ensuring milk powder safety

Powdered milk is a substance many of us have been in contact with during our lives, either consuming it as an infant or feeding it to children. Spray drying, drum drying or freeze drying are current methods to convert liquid milk into powdered milk, achieving a much longer shelf life than that of the liquid milk, without need for refrigeration.

Powdered milk is frequently used in the manufacture of infant formula, confectionery such as chocolate and caramel candy, and in various other sweets. It is also a common item in United Nations food aid supplies and shelters, and is widely used in developing countries because of the reduced weight and bulk. It contains all 21 standard amino acids (the building blocks of proteins) and a large number of soluble vitamins and minerals. These minerals are represented by a number of chemical elements. Major elements like sodium, magnesium, phosphorus, chlorine, potassium and calcium are normally present in the low percentage range while trace elements like manganese, iron, zinc and copper can be present in the mg/kg range.

Control and standardization of the elemental content are essential for product quality and consistency. They enable correction and prevention of nutritional deficiencies in the original milk and facilitate means to restore nutrient loss during processing. Checking the production process is essential to ensure milk powder is safe food in all respects.

To match the increasing demand and related production throughput for milk powders, manufacturers can now rely on PANalytical's new Epsilon 1 X-ray fluorescence (XRF) spectrometer for the fast and easy analysis of milk powder.



This new Epsilon 1 offers a complete pre-calibrated solution for milk powder analysis with XRF, and includes a built-in computer, user software and a sample preparation starting kit. The system is designed with a touch screen to provide ultimate ease of use, and delivers milk powder analysis in four simple steps with minimal sample preparation. Results are accurate, highly reproducible and very cost-effective. Epsilon 1 is fully compliant with international food industry standards, and an additional Enhanced Data Security software package can be purchased for FDA CFR 21 Part 11 compliance.

This release is the latest in PANalytical's range of Epsilon 1 systems dedicated to key applications, including mining, lubrication oils, sulfur in fuels and research and education - as already presented in the last issue of X'Press (issue 4/2013).



Potassium facilitates many reactions including protein synthesis, signal transmission in nerves and contraction of muscles.



Calcium is the principal constituent of bones and teeth and is involved in muscle contraction and relaxation, nerve function, blood clotting and blood pressure regulation.



Iron is essential for blood hemoglobin formation, it is part of muscle myoglobin and plays an essential role in energy utilization.



Zinc is essential for normal fetal development, vitamin A transport and wound healing. It is part of many enzymes, is present in insulin and is involved in sperm production.

"In the food industry, it is vital to have highly accurate, reliable results," commented Lieven Kempnaers, PANalytical product marketing manager XRF. "Epsilon 1 brings the power of XRF to milk testing, in a compact and ready-to-use format. The simple process ensures that non-specialists in XRF may use the Epsilon 1 with ease."



Superior light-element analysis – outperforming expectations

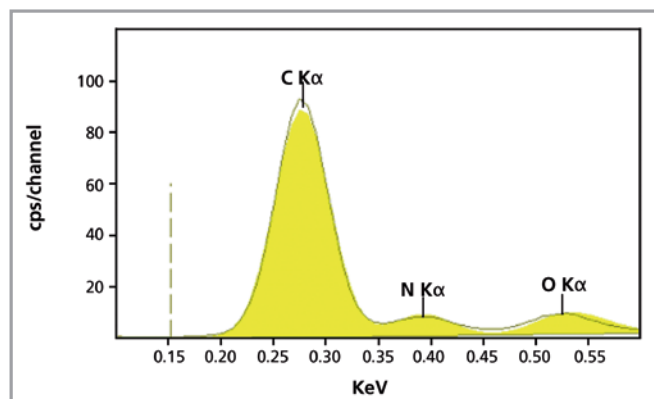
PANalytical's Epsilon 3 instruments are affordable and flexible benchtop X-ray fluorescence (XRF) spectrometers. They have been designed to deliver accurate, precise and reliable analyses through a very simple to operate interface. The first generation of Epsilon 3 spectrometers have already proven their performance at user sites all over the world (one example is described on page 4 of this X'Press). PANalytical has now upgraded the range with the introduction of the Epsilon 3^X and Epsilon 3^{XLE} with a focus on superior light-element analysis. These new spectrometers were presented to the public at AXAA 2014 (page 11).



The new benchtop spectrometers are equipped with latest excitation and detection technologies. This results in an analytical performance which matches, or even surpasses, that of larger, more powerful spectrometers. PANalytical's tube manufacturing facility has specially developed a high-performance metal-ceramic X-ray tube for the new spectrometers. A choice of anode materials (Rh, Ag or Mo), flexible voltage settings from 4.0 to 50 kV and a maximum current setting of 3.0 mA can be used to optimize instrument settings for specific applications and maintain a high level of performance across the periodic table.

Simon Milner, XRF product marketing manager, comments: "PANalytical's new Epsilon 3^X benchtop spectrometers are very reliable and simple to operate. They provide users with superior yet cost-effective analytical tools, which can be adapted easily to any user's needs. And wherever needed, PANalytical can offer expertise and support through our large worldwide service network."

Epsilon 3^X is equipped with the latest high-resolution silicon drift detector enabling analysis in the range from sodium up to americium. Whereas the Epsilon 3^{XLE} is configured with the SDD^{Ultra} silicon drift detector that enables the analysis of even ultra-light elements like carbon, nitrogen and oxygen. PANalytical's state-of-the-art correction and quantification algorithms are subsequently applied to the measured spectra, resulting in highly accurate and precise data.



Well-defined fluorescent peak from 85% carbon in a polymer sample. Ultra-thin windows on both X-ray tube and detector enable carbon, nitrogen, oxygen and fluorine analysis with Epsilon 3^{XLE}.

Additional software options are available for a number of applications:



OMNIA

Omnia
for advanced standardless analysis



OIL-TRACE

Oil-Trace
for analysis of oil and petrochemicals



STRATOS

Stratos
for analysis of coatings and (multi-)layers



FINGERPRINT

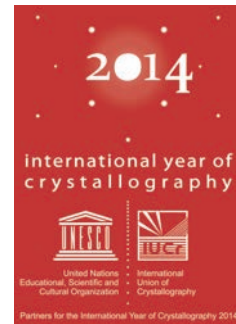
FingerPrint
for rapid identification



DATA SECURITY

Enhanced Data Security
for compliance with FDA CFR 21 Part 11 regulations

Celebrating the International Year of Crystallography (continuation)



On January 20-21, the International Year of Crystallography was officially opened, as declared by the United Nations during a ceremony held at the global headquarters of the United Nations' Educational, Scientific and Cultural Organization UNESCO in Paris.

UNESCO Director-General Irina Bokova introduced the subject to the audience by stating: *"Crystallography is essential to sustainable development, to tackling global challenges in food, in water, in the environment, in energy, in health. It is by understanding the basic forms of matter that we can transform it for the better, develop new materials, design new drugs against diseases, improve water quality."*

About 1000 people attended presentations about many different aspects of crystallography. PANalytical's product marketing manager XRD Martijn Fransen gave a talk about the importance of crystallography in our daily lives. He showed several practical examples of the complicated science behind materials we use on a daily basis.

- The complex crystallography of cement making and its importance for reducing CO₂ emissions,
- the use of X-ray diffraction to reduce the environmental impact of mining and increase the profitability of the mine owners,
- the importance of understanding and engineering crystal deformations to extend the life of essential components in airplanes and other machinery to prevent metal fatigue,
- polymorphism in pharmaceutical materials and the essential role of X-ray diffraction to create safe and reliable pharmaceuticals for the ageing world population, and distinguish genuine products from counterfeits,
- crystallography in soil sciences and fertilizer in order to optimize agricultural activities.



This simple story let the audience grasp the essentials of crystallography without having to understand scientific details. A number of ambassadors visited the PANalytical booth later on for more discussions.

During 2014 PANalytical will organize a number of Open Labs around the world. Details can be found on www.panalytical.com/IYCr2014.



AXAA 2014 – Workshops, Conference and Exhibition

The Australian X-ray Analytical Association (AXAA) 2014 Workshops, Conference and Exhibition held in Perth on 9 to 13 February was well attended by academics and industry professionals working and researching in the fields of laboratory X-ray fluorescence, X-ray diffraction, and in synchrotron, neutron and other scattering techniques.

A regular platinum sponsor of this significant event, PANalytical contributed a number of insightful lectures, covering a wide range of topics including XRD and XRF in mining, analysis of fluorine in different materials and characterization of nanoparticles.

At the exhibition front, PANalytical impressed visitors with an exciting array of XRD and XRF products at our booth, including the premier of the upgraded Epsilon 3X range, the latest benchtop EDXRF spectrometers that can rival the larger, more powerful spectrometers in ultra-light elements analysis and is also introduced on page 10 of this X'Press.

PANalytical's Christos Tsouris demonstrating the Empyrean diffractometer



Events calendar 2014, Q2 & Q3

The list below shows a selection of events where you will find us during the upcoming period. If you attend any of these events please come and visit us.

Date	Event	Location
2-4 April	X International Conference of Mining (EXPOMIN)	Chihuahua, Mexico
12-17 April	IEEE-IAD/PCA Cement Industry Technical Conference	Washington, DC, USA
21-25 April	MRS Spring 2014	San Francisco, CA, USA
4-9 May	VII National Congress of Crystallography	Tabasco, Mexico
10-13 June	COPHEX 2014	KINTEX, Korea
15-18 June	EPDIC 2014	Aarhus, Denmark
9-11 July	Semicon West / Intersolar	San Francisco, CA, USA
28 July-1 August	Denver Conference	Big Sky, MT, USA
4-12 August	IUCr	Montreal, Canada

Please visit www.panalytical.com/events for more information.

10th anniversary for Finnish mining seminar

On June 4–6, 2014 the Finnish city of Oulu will host the traditional mining seminar. The organizers, Suomen kaivosyrittäjät ry (SKY) and Oulu Mining School (OMS), have invited three PANalytical specialists to give presentations about laboratory automation, the use of near-infrared technology in the mining industry and X-ray diffraction applications for the mining industry.



Keep an eye on www.oulumining.fi for more information.

The PANalytical webinars

Encouraged by the popularity of the 2013 webinar series, PANalytical is pleased to announce a new series of webinars for 2014 on various aspects of materials analysis. These are presented by PANalytical specialists who are experts in their field. Each webinar lasts about 45 minutes and ends with a question-and-answer session, giving attendees the opportunity to ask questions directly at the source.

Titles of the next webinars will be:

- 10 April: Industrial minerals I: Maximize your efficiency with XRD
- 17 April: Qualitative phase analysis with HighScore
- 24 April: Blended cement: using XRD to cut CO₂
- 29 April: Introduction to the total scattering technique and PDF analysis on a multipurpose X-ray diffractometer
- 8 May: Optimize the properties of your steel using XRD

Please visit www.panalytical.com/webinars for more webinars and details. For those who have missed a live webinar, the recorded version is accessible around the clock in the 'webinar on demand' section on our website.

Colophon

PANalytical B.V.
Corporate Marketing and Communications Department
 Lelyweg 1, 7602 EA
 PO Box 13, 7600 AA
 Almelo
 The Netherlands
 T +31 (0) 546 534 386
 F +31 (0) 546 534 598
info@panalytical.com
www.panalytical.com

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

Regional sales offices Americas
 T +1 508 647 1100
 F +1 508 647 1115

Europe, Middle East, Africa
 T +31 546 834 444
 F +31 546 834 969

Asia Pacific
 T +65 6741 2868
 F +65 6741 2166

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