ISSUE 3 / 2013

PANalytical

X'PRESS

The customers' voice

SHARING KNOWLEDGE

be open

10 years

WIMIC FACULTY OF MATERIALS SCIENCE AND CERAMICS AGH UNIVERSITY OF SCIENCE AND TECHNOLOGY

XIV OPTICS

OBLF

The Analytical X-ray Company

Sharing knowledge – be open

I wish you a warm welcome to this latest issue of X'Press.

The research and engineering of new materials today is becoming increasingly more complicated and frequently involves delving into the smallest details of a material composition or structure, often at nanoscale. For this kind of research highly specialized knowledge and experience are indispensable, yet it is also impossible without dedicated and often expensive equipment. A common scientific remedy to cope with this problem is sharing knowledge and resources and cooperating in larger, often international groups.

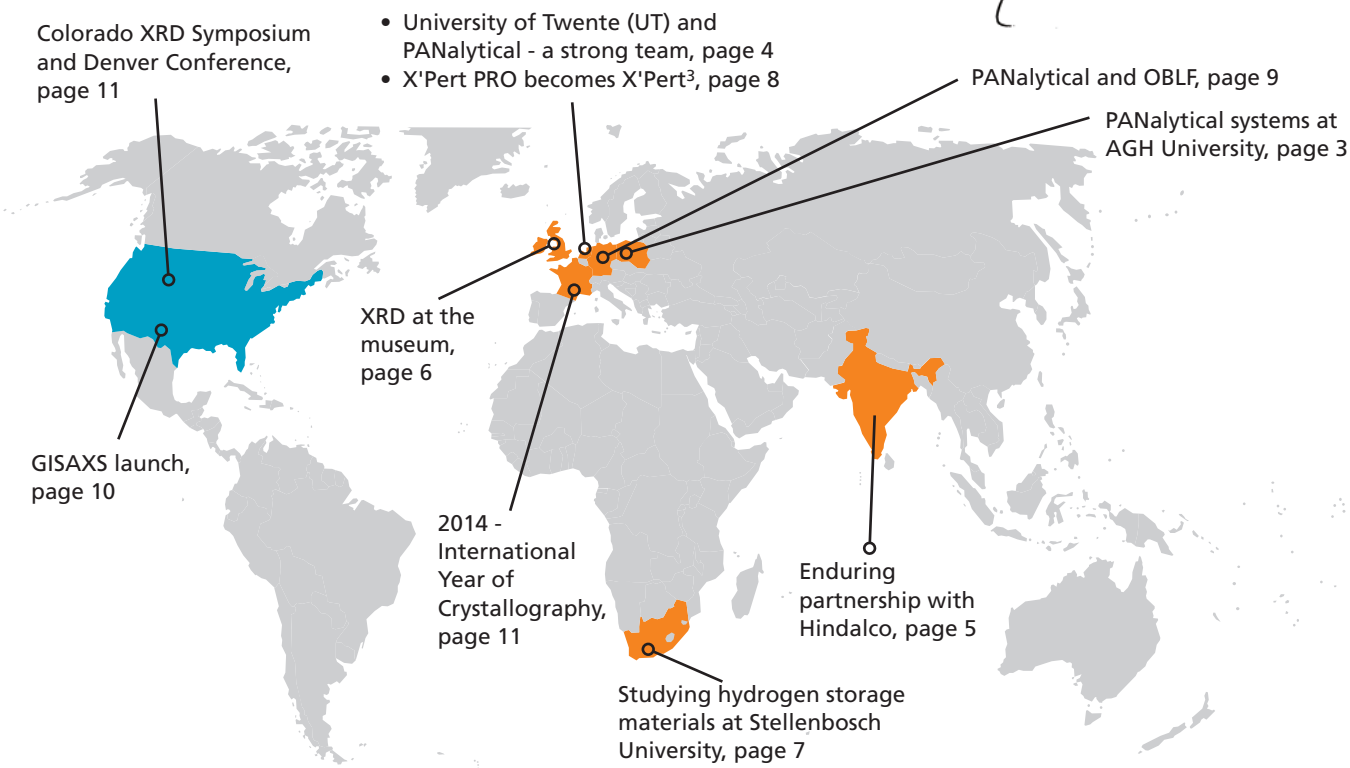
This is where PANalytical enters the stage. Referring to our long standing motto 'Winning by Sharing', we have traditionally committed ourselves to collaborations with (among others) leading academic research groups. With our collaborations we strive to achieve a multitude of goals, an important one the research and development of new, often breakthrough, technologies for our own instruments and applications. An example is the Medipix2 collaboration, the fruit of which is the range of new PIXcel detectors enabling new areas of analysis on one multipurpose XRD platform. Our close cooperation with Sodern, as another example, is enabling us to provide the cement and mining industry with proven solutions for online materials analysis.

Other collaborations, such as with the University of Stellenbosch described in this issue of our magazine, have helped to understand scientific interrelationships: the university lab is very well equipped for the safe handling of hazardous gases, whereas Anton Paar and PANalytical contributed their leading-edge equipment (the high-pressure chamber) and specialized know-how, resulting in a better understanding of the reversible hydrogen cycling reaction mechanism.
The increasing collaboration with our 'neighbors', the University of Twente/MESA+, supports the move of a new research group to Enschede, provides equipment and will stimulate their research of nanomaterials. Generally PANalytical strives at being not just a supplier of instruments but at being a partner for scientific discussions and for the solution of application problems.

The International Year of Crystallography 2014, organized by the UNESCO to stimulate education and scientific cooperation, is another form of sharing and PANalytical is proud to contribute with our know-how and equipment. And last but not least we have developed the PANalytical Award, meant to support an exceptional young scientist who has used X-rays in novel challenging applications to realize his scientific goals and as such to stimulate further use of X-rays in the academic world.

I hope you enjoy reading these and more articles in this current X'Press. As always we are open to proposals for cooperation to further science and engineering in new territories.

With best regards,
Peter van Velzen



The AGH University's range of PANalytical systems

The AGH University of Science and Technology (AGH UST) in Kraków, Poland is one of the best and most renowned modern Polish universities. Established in 1919 and until 1949 known as Academy of Mining, it now serves science and industry through educating students, developing of academic staff and research and development. Various labs at AGH UST use in total 14 PANalytical systems (of which seven are Empyrean X-ray diffractometers).

The Faculty of Materials Science and Ceramics has a strong technological and chemical background, which is traditionally associated with the manufacturing of ceramics, glass, building materials and refractories. Their comprehensive engineering knowledge comprises research and design, processing and characterization of novel materials for specific applications in different branches of modern industry (e.g. electronics, energy production, aircraft or automobile industry), materials for medicine and environmental protection as well as analytics and quality control.

Recently, the faculty was modernized by the European Regional Development Fund supported by additional funds from the National Centre for Research and Development. The new Ceramics Centre was built, providing outstanding conditions for research as well as the education in materials science and chemistry for all academic levels (engineer, master, doctoral and post graduate). This center is home to the X-ray Diffraction and Fluorescence Laboratory (XDFL), which has been equipped with two X-ray diffractometers (Empyrean and X'Pert Powder) and an Axios^{mAX} wavelength dispersive X-ray fluorescence (WDXRF) system.

Ceramics Center, Faculty of Materials Science and Ceramics at Kraków's AGH University of Science and Technology

"The support of the PANalytical branch in Poland has been invaluable. Their rapid response to technical problems and their laboratory assistance is commendable. As a result, laboratory work runs continuously and the system provides so many possibilities that two people can hardly exploit them fully."

The complementary configurations of the diffractometers enable many measurements such as: qualitative and quantitative phase analysis (with support from the ICDD PDF4+ database) at room temperature as well as in elevated temperatures up to 1400°C, grain and pore size distribution based on SAXS (small-angle X-ray scattering) and thin film analysis (grazing incidence diffraction, X-ray reflectivity, reciprocal space mapping and rocking curves).

The Axios WDXRF spectrometer, equipped with six analyzing crystals, provides elemental analysis in the range from boron up to uranium. Using PANalytical's Omnian software it delivers semi-quantitative standardless analysis. XDFL's main goal is the analysis of samples delivered from all faculty laboratories and subsequent expertise for the interpretation of the results. Furthermore XDFL conducts its own research on polyhedral oligomeric silsesquioxane (POSS) thin films.

In addition to scientific research, more than 200 students per year take classes at the XDFL in basics of crystallography and X-ray diffraction in four courses at different levels. Student courses are supported by the computer lab which is a part of XDFL. Close collaboration with industry and with other departments and universities is also a priority of the laboratory.

X-ray Diffraction and Fluorescence Laboratory, Dr. Bartosz Handke - head of laboratory (left) and M.Sc. Łukasz Klita - researcher

University of Twente (UT) and PANalytical - a strong team

Research institute MESA+, the Netherlands' largest research institute for nanotechnology and located in the University of Twente (Enschede, the Netherlands), has used PANalytical systems for many years. With the arrival of a new research group and the purchase of an X'Pert Powder and an X'Pert PRO MRD system the collaboration has reached a new dimension. Dr. ir. Gertjan Koster of the Inorganic Materials Science group and Prof. Fred Bijkerk of the XUV Focus Group are very satisfied with the intensified collaboration. "PANalytical is much more than just a manufacturer of equipment".

Gertjan Koster develops and investigates new 'intelligent' materials for various applications. "Our and collaborating research groups have been using PANalytical systems for years to determine the structural properties of materials. Our new lab has again been equipped with two PANalytical systems because these best meet our specifications and our expectations". Koster especially appreciates the user-friendliness and specific technical details of these X'Pert Powder and X'Pert PRO MRD systems.

"PANalytical is not only a supplier for us but a real partner. We regularly meet their specialists and discuss problems and possible solutions for our applications. An additional bonus is the short distance between the UT and PANalytical (about 30 km). On the other hand PANalytical is very interested in our wishes and experiences with their systems, which can be used for future product developments".

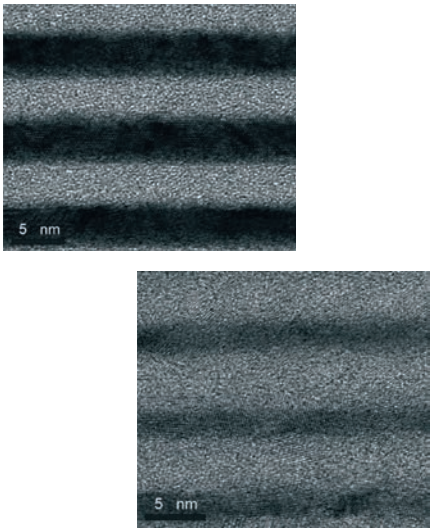


Figure 1: Electron microscopy pictures of a Mo/Si multilayer structure before (top) and after (bottom) thermal loading. EUV reflected wavelength, amplitude and phase all change due to thermally induced structural changes in the multilayer.

Recently the Industrial Focus Group XUV Optics under Prof. Fred Bijkerk has moved to MESA+ and is using PANalytical systems too. The group owns a new Empyrean XRD platform, which will be moved to MESA+ later this year. The XUV Optics group originates from the nanolayer Surface & Interface Physics division from the FOM Institute for fundamental energy research DIFFER in Nieuwegein. Their research is focused on multilayer mirrors for the very precise manipulation of extreme ultraviolet (XUV) radiation.

These mirrors are used in space telescopes and in advanced lithography for the creation of a new generation of computer chips and are thus very much in demand from the industry. A number of industrial partners such as PANalytical has now signed a collaboration contract with the XUV Optics group, supplying financial support during a joint 8-year research programme.

The mirrors consist of Mo/Si multilayers and other materials. Their properties, especially the reflectance, may change at exposure to higher temperatures due to a diffusion-driven formation of molybdenum silicides at the interfaces. Analysis by X-ray diffraction can help understanding the diffusion processes and their temperature- and time-dependences.

High-resolution *in situ* reflectometry studies were carried out at temperatures between 250 and 300 °C, using an Anton Paar domed hot stage on the PANalytical X'Pert PRO MRD system. These studies reveal thermally induced structural changes with a resolution as low as 0.01 Å, rivaling results obtained from synchrotron-based structural studies. Results of this research have been successfully used to improve the thermal stability of Mo/Si based multilayers.

MESA+
INSTITUTE FOR NANOTECHNOLOGY

Besides the long-lasting scientific partnership between UT and PANalytical their new and increased collaboration includes

- hosting the high-tech discovery route (1 June 2013) during the Dutch Technology Week (demonstration of PANalytical systems and their applications at MESA+);
- PANalytical's presence at the UT Open House on 5 October 2013;
- PANalytical's participation as industrial partner of the XUV Optics Industrial Focus Group.

From left to right: Joachim Woitok (PANalytical XRD product specialist), Gertjan Koster, Guus Rijnders (both MESA+), Nico Clemens (PANalytical sales engineer), Mark Huijben (MESA+)

Demonstration of PANalytical systems during the high-tech route

An enduring partnership in India with Hindalco

Hindalco Industries Limited, the metals flagship company of the Aditya Birla Group, is the world's largest aluminium rolling company and one of the biggest producers of primary aluminium in Asia. Their major products include standard and specialty grade aluminas and hydrates, aluminium ingots, billets, wire rods, flat rolled products, extrusions and foil. Earlier this year Hindalco installed an X'Pert Powder diffractometer at the Hindalco Innovation Centre in Belgaum, Karnataka, India.

Established in 1958, Hindalco commissioned their first aluminium facility at Renukoot in eastern Uttar Pradesh, India in 1962. Subsequent acquisitions and mergers with Indal, Birla Copper and the Nifty and Mt. Gordon copper mines in Australia, reinforced Hindalco's position as a major powerhouse in aluminium and copper. Further, the acquisition of Novelis Inc. in 2007 placed Hindalco among the top five aluminium majors worldwide and the largest vertically integrated aluminium company in India.

PANalytical has enjoyed an excellent, long-standing relationship with Hindalco and has consistently over the past three decades supplied them with a series of X-ray diffraction (XRD) and X-ray fluorescence (XRF) solutions in tandem with their expansionary and changing business needs.

Starting with the first potflux system (based on PW1710) in Hindalco Renukoot in the early 1980's, many other systems such as PW1404 (WDXRF), PW1800 and X'Pert APD and later, CubiX Potflux and MagiX PRO were installed at their unit in Renukoot and R&D center at Belgaum. More recent installations include Axios (2007) in their Muri works, the CubiX^3 Potflux and Axios^{mAX} for the Utkal alumina project (2012) and now an X'Pert Powder at their Hindalco Innovation Centre–Alumina in Belgaum, Karnataka. This center conducts research in the field of bauxite, the Bayer process and alumina.

Hindalco have been using XRF for the elemental analysis of Bayer process materials and for the semi-quantitative analysis of various materials.

"We use XRD to quantify the phases present in different grades of alumina. This is done by a calibration method with suitable standards using the Industry software provided by PANalytical," said Dr. G. Shankar, general manager (Measurement Sciences, Hindalco Innovation Centre–Alumina). Other applications include the characterization of carbon samples as well as qualitative phase analysis investigations of a number of different materials.

PANalytical's systems have been Hindalco's choice for years because of their ruggedness, speed, high-quality performance and the dedicated support throughout their growth. Dr. Shankar acknowledges: "We have been happy with the timely service rendered by PANalytical over the years".

On the inaugural day of X'Pert Powder, from right : Mr. H. Hebballi, Mr. J. Sagayanathan, Dr. G. Shankar, Mr. Shrikant Kulkarni (PANalytical), Mr. R. Srinivasan (PANalytical), Mr. S. Sankaranarayanan, Mr. K. Ravi, Mr. Ravi Mohare and Mr. T. Ramraj (PANalytical)

XRD in the museum (4/4)

Strontianite from the edge of the volcanic Ardnamurchan ring complex (West of Scotland)

The National Museum of Scotland in Edinburgh (UK) is fourth and last in a series in X'Press about museums in the United Kingdom who have recently invested in PANalytical X-ray diffraction systems to advance their research programs.

The National Museum of Scotland took delivery of their PANalytical X'Pert Powder diffractometer in early 2013. This new system replaced a long service XRD system based on Debye Scherrer cameras. Mr. Peter Davidson, Curator of Minerals and Meteorites in the museum, has many year's worth of films of mineral specimens including data on type specimens of some rare Scottish minerals. The X'Pert Powder will be used to re-examine some of these specimens to obtain sufficient quality data enabling their classification according to Dana's System of Mineralogy.

The XRD system is located in the Granton collection repository, away from the public-accessible museum in its Chambers Street home. The public galleries display a wide variety of Scottish natural world, science, technology and heritage. Scotland is renowned for hitting above its grade when it comes to scientific discovery and general contribution to our civilization. This small jewel in the crown (literally) of the UK, is also famous for the range and variation in its natural mineralogy. It is home to rocks from the earliest pre-Cambrian through to the stunning Tertiary volcanic complexes typified by Ardnamurchan, Mull, Arran and Skye.

Currently the museum has over 50,000 specimens, with an emphasis on agates and associated economic minerals from the numerous mining areas of Scotland.

They also pride themselves in their small but diverse meteorite collection. In Scotland it is not always easy to identify meteorite falls as there are rather a lot of rocks on the ground already!

Apart from the investigation of any newly acquired specimens and identification of specimens belonging to the public, the main use of the XRD is in aiding the correct classification of the important mineral collection according to the New Dana Classification. X-ray diffraction data alongside chemical analysis and visual petrology are needed to correctly assess and characterize mineral specimens. Equally this information can be used to determine a new species of mineral.

A large selection of sometimes unique minerals has been collected / acquired from mining areas in Scotland over the centuries and these need to be classified. Often it is inconvenient to grind down the crystal specimen to make a good powder sample, so the use of low background holders for small scrapings of powder is the routine technique.

Lanarkite from Leadhills, a village close to Wanlockhead; both situated in a lead mining area in the Scottish Uplands

Calcite from Wanlockhead (known as 'God's treasure house' due to its richness of mineral resources)

Mr. Peter Davidson, Curator of Minerals, has been a valued customer of Philips Analytical and now PANalytical for nearly 30 years. The X'Pert Powder is the 3rd generation of the museum's XRD systems.

We look forward to continuing this partnership long in the future.

Studying hydrogen storage materials at Stellenbosch University

The Supramolecular Chemistry laboratory led by Prof. Leonard Barbour in Stellenbosch University (Republic of South Africa) is home to a large group of students, post-docs and international visitors doing research on gas-solid interactions. In December 2012 a team of PANalytical (from Almelo and South Africa) and Anton Paar (Graz, Austria) spent a full week at the university to study the behavior of hydrogen storage materials.

Nowadays a lot of the scientific and technological research is focussed on finding more sustainable energy sources to replace the currently used fossil fuel. The sorption processes for hydrogen (to be used in fuel cells) and carbon dioxide (to be safely confined) are here of considerable and growing interest. Many suitable materials are crystalline and undergo reversible structural modifications during the uptake and release of hydrogen and carbon dioxide. These processes can be conveniently followed by *in situ* X-ray diffraction.

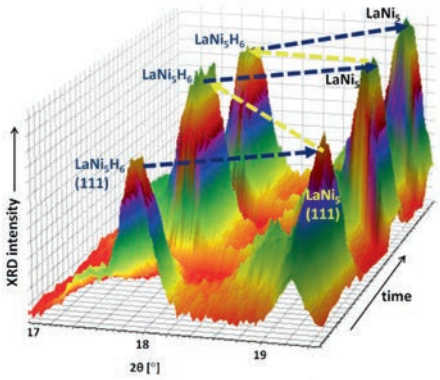
The materials analysis laboratory of the Supramolecular Chemistry group is an active and well equipped research facility focussed on building an understanding of the interaction between porous materials and gases, particularly H_2 and CO_2. It was an excellent place for PANalytical and Anton Paar to perform *in situ* experiments at high hydrogen pressures as it is fully equipped with the infrastructure for safe use of hazardous gases at high pressures.
This ensures safe handling of air-sensitive and flammable samples (like the ones needed for hydrogen storage). Last but not least, a multipurpose powder diffractometer X'Pert PRO MPD with fast X'Celerator line detector was available for data collection.

Christian Resch (Anton Paar, right) and Vincent Smith (PANalytical, left) enjoying their collaboration.

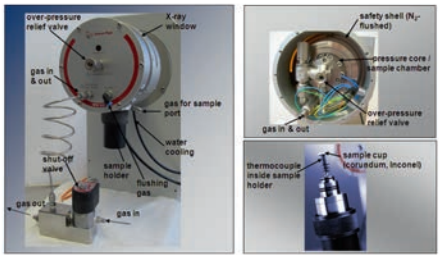
The first week of December 2012 was dedicated to the setup of the *in situ* experiments. The studies comprised the reversible hydrogen cycling in lanthanum pentanickel ($LaNi_5$), and the H_2 desorption during decomposition of ammonia borane (NH_3BH_3).

The experiments successfully demonstrated the suitability of a multipurpose diffractometer, equipped with a rapid X-ray detector and an Anton Paar High-Pressure Chamber for *in situ* X-ray diffraction experiments. This setup offers a unique perspective for studying structural modifications and reaction mechanisms that occur when gas and solid interact.

The HPC 900 remained installed in Stellenbosch for the following four months for the use of Prof. Barbour and his research group. Their feedback about the usability and versatility of the stage has been very positive.



A 3D representation of the in situ *XRD data during the cycles of dehydrogenation of $LaNi_5H_6$ (in vacuum) and hydrogenation of $LaNi_5$ (at 5 bar), at 50 °C*



Details of the High-Pressure Chamber HPC 900, connections and sample holder

The data generated during this cooperative week were presented by PANalytical's Marco Sommariva at the 2013 spring edition of the Material Research Society Symposium and will be published in an application note (available on the PANalytical website).

Jan Gertenbach (PANalytical XRD specialist) established the perfect link between his previous employer in Stellenbosch, PANalytical and Anton Paar. A team consisting of 7 specialists from both companies organized everything in detail, from the shipping of the molybdenum tube needed for the experiments and the HPC 900 itself, to the air-sensitive samples.

A success story continues: X'Pert PRO becomes X'Pert³

PANalytical recently introduced the next generation of multipurpose X-ray diffractometers, the X'Pert³ family. X'Pert³ continues the long successful history of X'Pert systems. Users can now enjoy improved performance and reliability in powder diffraction (X'Pert³ Powder) and thin film metrology (X'Pert³ MRD and X'Pert³ MRD XL) by innovations proven on our latest Empyrean platform. This state-of-the-art XRD technology guarantees the X'Pert³ family to be ready for the future.

The X'Pert³ family now uses the patented corrosion-resistant incident smart beam path (CRISP) technology. CRISP prevents X-ray-induced corrosion on any of the incident beam path components, from the X–ray tube, tube housing to incident beam optics, thus maximizing the uptime of your equipment. Toxic wastes, such as lead oxides and beryllium oxides are prevented. In combination with the lead-free tube tower and PANalytical's eco-friendly tube disposal policy this guarantees 'green' operation.

Another feature providing maximum uptime is the introduction of pneumatic shutters and beam attenuators. We have learned from the Empyrean that these type of actuators are the most reliable choice for these frequently operated system components. Smooth operation throughout the system's lifetime is thus guaranteed.

Also adopted from our latest Empyrean system is the 2nd generation PreFIX technology. Reconfiguring your XRD system and optics positioning are now easier and more accurate than ever. Naturally this 2nd generation PreFIX is compatible with the 1st generation, making any transition to a newer system very economical – your existing optics can just be reused. Additionally you can of course benefit from our latest and any future developments on optics, sample stages and solid-state detectors.

The X'Pert³'s new control electronics are now more powerful and network-enabled, offering improved service possibilities by remote monitoring of the complete instrument in the future.

Last but not least these new-generation systems comply with the latest safety standards.

All these innovations make the X'Pert³ systems supreme solutions for many applications of today and tomorrow.

X'Pert³ Powder

The cost-effective multipurpose system for:

- Crystallographic phase analysis (identification and quantification)
- Microdiffraction
- Small-angle scattering (SAXS)
- Pair distribution function (PDF)
- Stress analysis
- Thin film analysis
- Non-ambient XRD

X'Pert³ MRD (XL)

The standard in high-resolution analysis for:

- Thin films
- Reflectivity
- Rocking curve
- Reciprocal space mapping
- Texture analysis
- Stress analysis
- Wafer mapping

PANalytical and OBLF

As of December 2012, PANalytical is the proud representative for OBLF spark optical emission spectrometers in a large number of countries. Especially in the metals market segment, spark optical emission spectrometers (often abbreviated as OES) performs a complementary role to XRF in production control analysis.

OES and XRF combined
The strength of OES lies in analysis of low to ultra-low element concentrations (down to sub-ppm level) in solid metals samples including light elements such as boron, carbon, oxygen and nitrogen. Latest developments in optical emission spectrometry allow for the analysis of inclusions in a metal.

XRF is the non-destructive technique for the analysis of solid metallic and oxidic sample material (e.g. slags) in a wide range of concentrations - depending on the element, from ppm to 100% levels.
As the capabilities of both analytical techniques are complementary, they are very often applied next to each other.

A powerful partnership
The collaboration between PANalytical and OBLF is certainly not new. For more than two decades PANalytical and OBLF have been partners in building (fully) automated laboratories for the metals industries. This successful relationship has led to a closer partnership where PANalytical now distributes the OBLF systems also outside the scope of automated laboratories.

The philosophy of both companies shows a large similarity: full focus on developing and producing high-quality systems to provide the best value for money for their customers.

"The combination of OBLF's exceptional product line with PANalytical's unparalleled customer support promises an unsurpassed customer experience with optical emission spectrometry" says Dr. Peter van Velzen, CEO of PANalytical (left). Mr. Bringfried Overkamp, owner and CEO of OBLF (right), adds that *"he is delighted that this experience is now available to a greater part of the world".*

The product range of OBLF

- GS 1000-II, dedicated to foundries
- QSN 750-II for steel- and non-ferrous works with high analytical demands
- QSG 750-II for customers requiring ultimate in analytical capabilities and determination of inclusions in the metal
- VeOS, general and fully configurable instrument for research and development
- ASM1800, a grinding machine for sample preparation (mainly for Fe foundries)

GISAXS – a new option for Empyrean

GISAXS – Grazing incidence small-angle X-ray scattering is a surface-sensitive method for investigating nanostructure in thin films. It combines concepts from small-angle X-ray scattering (SAXS), X-ray reflectivity (XRR) and grazing incidence diffraction (GID). With GISAXS it is possible to obtain information about, for example, size, shape and ordering of nanomaterials on a surface.

At the Denver X-ray Conference (August 5-9, 2013) PANalytical showed results from its new lab-based GISAXS option for the multipurpose Empyrean X-ray diffraction platform. GISAXS enables the investigation of nanostructures in thin films. These thin film nanomaterials are an active research area in energy technologies, photovoltaic materials, semiconductor devices, photonics, acoustics, catalysis and bio-delivery systems to name a few. The addition of lab-scale GISAXS capabilities for nanomaterials processing research is both cost-effective and convenient.

GISAXS was once considered a method exclusive to synchrotron beam lines or dedicated systems. Now the Medipix2 detector with photon-counting technology enables PANalytical's PIXcel^{3D} detector to collect high-resolution, noise-free images, making good use of lab source intensities to obtain high-quality data on a multipurpose diffractometer. Lab-based systems are thus now presenting a viable alternative to a synchrotron beam line. Furthermore, at 55 microns, the uniquely small pixel size of the detector enables 2D GISAXS data with excellent sharpness to be collected on a standard-radius XRD system.

Figures 1 and 2 show examples of GISAXS measurements. In one case (Figure 1) GISAXS is being used to investigate the quality of the long-range ordering of mesopores in a silica thin film for applications in integrated circuit manufacturing.

In the other case (Figure 2) GISAXS is being used to provide information about interface quality in multilayer optical mirrors for applications in UV lithography.

GISAXS is the latest successful addition to the Empyrean multipurpose diffractometer platform and it follows hot on the heels of the ScatterX^{78} attachment. This new product, described in X'Press 1/2013, very significantly extends the SAXS/WAXS capabilities on the Empyrean platform. It allows for fast measurements and has good sensitivity even for weakly scattering samples. ScatterX^{78} also offers a 2D SAXS option.

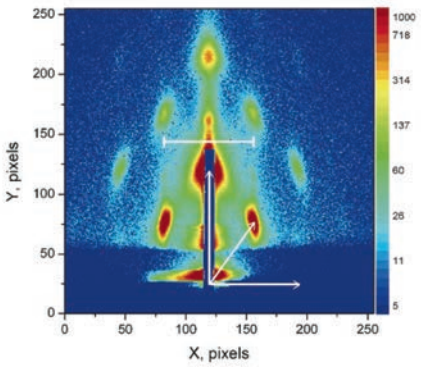


Figure 1. 2D GISAXS scattering image obtained on the Empyrean, one of several 2D images displayed at Denver 2013. The sample is a thin film of mesoporous amorphous SiO_2 supported on a Si wafer substrate [1]*. The regular GISAXS scattering pattern in the image shows the reciprocal lattice structure arising from long-range alignment and hexagonal close packing of the mesopores (sample courtesy of M. Morris, UCC, Ireland).*

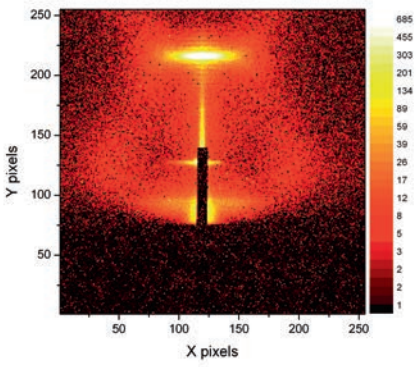


Figure 2. GISAXS measurement from a periodic multilayer structure. The sample is a thin film LaN/B_4C multilayer deposited on a Si wafer substrate. The multilayer is being studied as part of a program to develop optical mirrors for extreme ultraviolet (EUV) lithographic devices. In this case GISAXS is used to study the structure of interface roughness on the nm scale in order to appraise the quality of the multilayer structures [2] *(sample courtesy of FOM-DIFFER, the Netherlands).*

"GISAXS is another example of the versatility of PANalytical's diffraction platforms Empyrean and X'Pert^3", says Martijn Fransen, product marketing manager XRD. *"New options can be added and our customers can be confident that our products will be supported well into the future".*

"Our GISAXS option is accessible and user-friendly at the entry level. You don't have to be a GISAXS expert and you don't have to invest in a dedicated instrument, but instead you can use a configuration optimized for GISAXS on our multipurpose Empyrean."

[1] R. L. Rice, P. Kidd, J. D. Holmes, M. A. Morris, J. Mater. Chem., 2005, 15, 4032-4040

[2] I. A. Makhotkin, E. Zoethout, E. Louis, A. M. Yakunin, S. Mullender, F. Bijerk, J. Micro/Nanolith. MEMS MOEMS, 2012, 11, 4, 040501 (1-3)

2014 – International Year of Crystallography

2014 marks the centenary of the beginning of modern crystallography and the use of X-ray diffraction as the most powerful tool for structural determination of matter. To commorate this event the General Assembly of the United Nations has declared the year 2014 to be the International Year of Crystallography (IYCr2014).

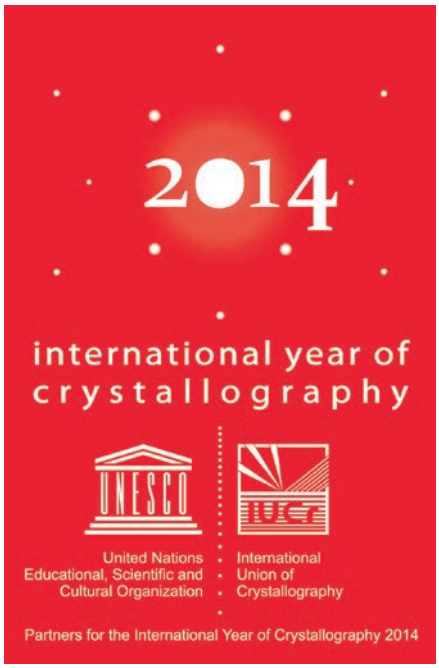
The International Year of Crystallography is organized by the United Nations Educational, Scientific and Cultural Organization (UNESCO) in conjunction with the International Union of Crystallography (IUCr), supported by manufacturers of scientific equipment for the analysis of crystals.

The purpose of UNESCO is to pursue international peace through humanity's moral and intellectual solidarity, in particular by encouraging inter-cultural understanding through education and scientific cooperation. The aim of IYCr2014 is to raise the awareness of crystallography and the extent to which it underpins many technological developments in our modern society. The initiative represents an investment in our future and aims to inspire young people across the world, particularly those that are currently not very active in studying crystal structure. Ultimately it is anticipated that international scientific collaborations will also be facilitated by IYCr2014.

The IYCr2014 opening ceremony will be held in Paris on 20 and 21 January 2014 and will feature talks about topical aspects of crystallography. True to the objectives of the IYCr2014 many talks will be presented by young crystallographers from all over the world.

PANalytical's X'Press magazine will report the activities, especially those involving PANalytical and our customers.

All information about IYCr can be found on www.iycr2014.org.



The organizers have approached a number of manufacturers of diffractometer equipment for support. PANalytical has proudly agreed to participate by sharing our powder diffraction expertise and by using our extensive international networks to facilitate the reach of IYCr2014.

In particular, we anticipate that a number of diffraction workshops will be held across the globe that will utilize our equipment and knowledge. Proposals for PANalytical initiatives that further the goals of the IYCr2014 will be gladly accepted at info@panalytical.com.

Colorado XRD Symposium

On 2 August 2013, the Colorado Symposium on X-ray diffraction was hosted by PANalytical and sales engineer Damien Smith in Westminster, CO, USA. A full day of talks, presented by XRD product manager Brian Litteer and XRD application specialist Julie Quinn, resulted in fruitful discussions between the academic and industrial attendees.

Our next seminar which will be in Chicago,IL on September 17, 2013.

Denver X-ray Conference

The Denver X-ray Conference saw a large technical presence of PANalytical, with talks and posters on topics ranging from GISAXS of inorganic nanostructures, ambient and variable temperature PDF analysis, and diffracted beam collimators, to high precision analysis of iron ore by WDXRF.
The booth was an impressive sight with the Empyrean standing proudly at the center.

Within the booth 3 mini seminars were presented by Thomas Degen, highlighting the new capabilities in the soon to be released Highscore Plus version 4. Meanwhile at the other end of the booth, our X-ray fluorescence team gave demonstrations on Omnian, Stratos and FingerPrint software.
We hope to see you again at next year's Denver X-ray Conference in Big Sky Montana July 28 – August 1, 2014.

Events calendar 2013 Q3/Q4

You will find us at the following events during the upcoming period. If you attend any of these events, please pass by and visit us!

Date	Event	Location
16-17 September	4th Int. Conference on Nano Science and Technology	New Delhi, India
16 September	PERUMIN 31 Convención Minera	Arequipa, Peru
23-26 September	CMA 2013	Toronto, Canada
23-27 September	GALVATECH 2013	Beijing, China
24-27 September	ILMAC	Basel, Switzerland
24-26 September	Analitica Latin America 2013	São Paulo, Brazil
15-16 October	Gulf Coast Conference	Galveston, TX, USA
23-26 October	BCEIA	Beijing, China
2-6 November	Chemindix 2013	Al Manamah, Kingdom of Bahrain
11-14 November	AAPS Annual meeting and exposition	San Antonio, TX, USA

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

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FOR GROUND-BREAKING RESEARCH USING X-RAY TECHNIQUES

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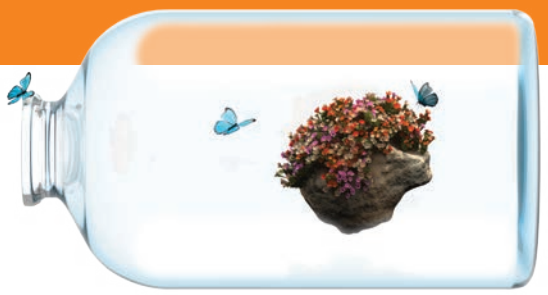
Promoting exceptional young scientists

PANalytical, the world's leading supplier of analytical instrumentation and software for X-ray diffraction and X-ray fluorescence spectrometry, continues to reward young scientists.



The PANalytical Award endorses an exceptional journal article dealing with the use of laboratory X-ray sources as the primary analytical technique.

No restrictions are placed on the manufacturer of the X-ray equipment that was used.

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