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X'PRESS

HOW TO INVEST

PANalytical
get insight

Investing in a new company

Paolo Carmassi
President 'Malvern PANalytical'

The start of this new year marked a special moment in the history of PANalytical: From 1 January 2017 we have merged our activities with Malvern Instruments (see also our latest news in X'Press 3/2016). The new company was officially launched with a large 'kick off' event on 9th and 10th January where many members of both companies met each other and also the new leadership team. They were two exciting and inspiring days with many enthusiastic people sharing their ideas of the future and showing me that this merger has many of the key ingredients to deliver growth and success, in a way which will be challenging for our competitors to duplicate.

The new company, with the preliminary name 'Malvern PANalytical', is built on the two strongest pillars within the Materials Analysis segment of Spectris plc. With this legacy as a foundation, we will be able to understand our customers' pains and needs and, thanks to our large combined portfolio of know-how and technologies, provide them with tangible economic impact.

In the future, we must move away from purely transactional business. Our customers around the world are asking more from their suppliers. We want to be seen as a valued partner that helps them on the their path to success, we'll understand your processes and your problems and needs. Together, we will define and agree an approach to your challenges. Our solution will comprise not just an instrument but the relevant software, application knowledge and service. This will be installed and tested according to the requirements defined at the beginning of the process. In this way, we want to ensure that our customers are getting the most value from their investments with us.

At a time when industries becoming increasingly demanding we are convinced that we have chosen the right moment for this merger. For the new company we must reach for the highest shelf when solving compelling problems in the most innovative way, striving for excellence in all key aspects. An ambition, which will most certainly differentiate us from others.

During the next months this new company will take shape and our ideas will continuously be refined to make sure that we will reach our goal. I am very much looking forward to this exciting process during which we will keep you up to date on a regular base.

Saluting to our new partnership,

Paolo Carmassi

LATEST NEWS

Acquisition of Pixirad

On 8 February 2017 PANalytical announced that its parent company Spectris plc has acquired Pixirad Srl., an Italian technology company that develops and distributes high-performance X-ray detectors. The business will be integrated into PANalytical within Spectris' Materials Analysis division.

Pixirad was established in 2012 under the spin-off programme of the Istituto Nazionale di Fisica Nucleare (INFN).

PANalytical sells the Pixirad detectors as a top-of-the-range option for its Empyrean X-ray diffraction (XRD) instrument, used for various materials analysis applications.

The combination of Pixirad's know-how with PANalytical's expertise in solutions utilising advanced X-ray detectors will result in rapid expansion of the range of applications addressed by existing and future instruments.

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Prof. Shao Jianping from DICP (left) and regional product manager XRF Xue Shilei from PANalytical

Dalian Institute **invests** in **analytical equipment**

A leading research institution in China, the renowned Dalian Institute of Chemical Physics (DICP), has been a long-term user of PANalytical instruments since September 2000. With a focus on energy research, DICP collaborates with both public and private institutions such as international oil giant BP and China BAK Battery, Inc, the world's leading lithium battery manufacturer and electric energy solution provider, to support industrial production and development process.

Over the past 15 years, DICP has purchased close to 20 X-ray diffraction (XRD) and X-ray fluorescence (XRF) instruments for the institute, including PANalytical's X'Pert^3 Powder and Empyrean diffractometers.
Led by Professor Shao Jianping, the Public Test Center within the institute manages a great number of large analysis instruments. These are employed to support many different users with a wide variety of applications, including material characterization, materials composition analysis and phase structure analysis of catalysts, functional nanomaterials, minerals and many more.

"Among the published papers produced by our institute, at least a hundred of them can present data and graphs from PANalytical's XRD analysis", says Professor Jianping.

The lab's latest acquirement is PANalytical's Zetium XRF spectrometer, which allows them to meet the most demanding applications, with its small spot analysis with mapping capabilities and the high sample throughput.

The Dalian Institute of Chemical Physics (DICP), an affiliate of the Chinese Academy of Sciences, is located in Dalian, China. In the past half century, research at DICP has closely reflected the economic and scientific needs of China. The institute has built up an impressive portfolio of achievements, principally in the fields of catalysis, chemical engineering, chemical lasers, molecular reaction dynamics, organic synthesis, and chromatography for modern analytic chemistry and biotechnology.

Illuminating the past:

Scientific analysis of historic illuminated manuscripts

An illuminated manuscript is a manuscript in which the text is supplemented by the addition of decoration or illustration, such as decorated initials, borders and miniatures. Illuminated, from the Latin illuminare (to light up), denotes the glow created by the radiant colors of the illustrations, as well as by real gold and silver. Illumination was costly and complex and was therefore usually reserved for special books like an altar Bible. Wealthy people often had richly illuminated 'books of hours', which set down prayers for various times during the liturgical day.

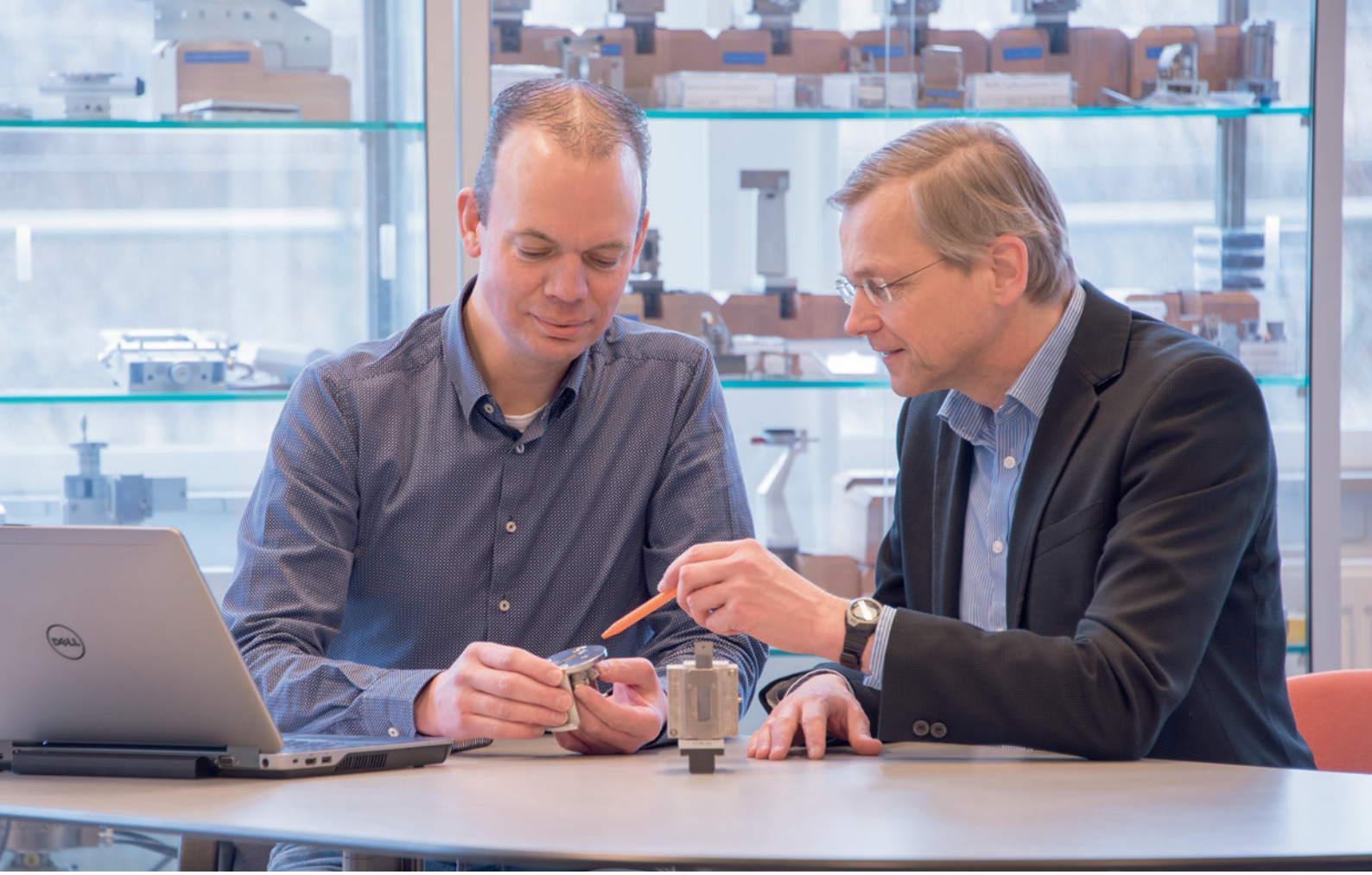
Illuminated manuscripts are artistically significant and maintain historic text documents by preserving their informative value. Researchers can distinguish between artists by analyzing which materials they used and how they employed them and it helps them to learn more about the technical know-how that these artists possessed[1]. Identifying the ways in which artists used the same materials in different media, or transferred materials and techniques across media, offers a whole new way of looking at art[1].
Because illuminated manuscripts are delicate and contain very thin layers of pigment they can be seriously compromised by taking samples[1]. In order to gather evidence on how the manuscripts were made, non-invasive techniques are required[1], which need to keep the document safe but should be sensitive enough to get accurate results.

The Fitzwilliam Museum's Paola Ricciardi analyzing an illuminated manuscript with ASD's FieldSpec instrument

Dr. Paola Ricciardi is a research associate in the Department of Manuscripts and Printed Books of the Fitzwilliam Museum, Cambridge and focuses on the use of non-invasive techniques like near-infrared (NIR) for the characterization of artist's materials. Paola uses ASD's FieldSpec® instrument and fiber optic reflectance spectroscopy (FORS) to map and identify artists' materials of pigments and paint binders in illuminated manuscripts. The technique allows Paola to determine the composition of pigments as well as reveal underdrawings and preparatory sketches[2] without damaging the valuable documents.

References:

1. *www.cam.ac.uk/research/features/illuminating-arts-history*
2. *www.cam.ac.uk/research/news/science-illuminating-art*



Wim Altena (left) and Hans te Nijenhuis (right), project leaders (technical and commercial, respectively) of PANalytical's Specials team XRD

Invest in customized solutions for X-ray diffraction

PANalytical's Empyrean and X'Pert³ X-ray diffraction (XRD) systems are true multipurpose instruments, designed to support a wide range of applications. Even so, our specialists often meet scientists and analysts working with PANalytical equipment who would like to extend the possibilities even further, in line with new ideas for their own research. We at PANalytical continuously aim at providing the best possible solutions for our customers' complex analytical problems or cost-effective production processes.

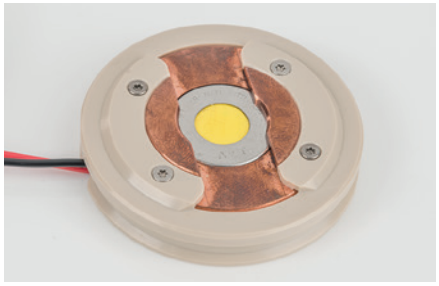
This means that we are always open to listen to our customers' ideas. If your research could profit from other than the usual sample holders and stages, optical modules or analytical techniques, you are welcome to discuss your requirements with your local PANalytical sales representative who will subsequently approach the PANalytical Specials Team XRD.
This team consists of a number of experienced and highly motivated researchers and specialists from PANalytical who meet on a regular basis to analyze all special customer wishes received. In most cases the team can offer a tailor-made solution for the challenge addressed, sometimes preceded by additional discussions with the customer.

Exactly these contacts with our users are an inspiring source for our innovative product developments, not only in the field of materials science, but also in more specialized areas as pharmaceuticals, building materials and semiconductor metrology. Together we can work on advanced solutions for new requirements, keeping pace with the latest developments in the world of science and research. Check out our examples and see what we can do for you.

Recent highlights of PANalytical's specials

Sample holders for the analysis of batteries

Research on battery materials is currently one of the hottest topics in materials science. Since these materials



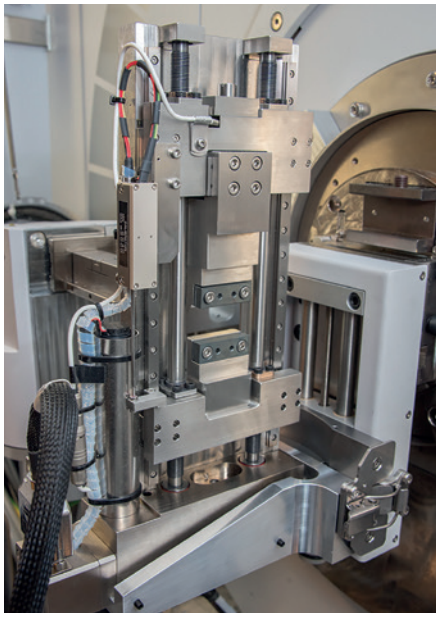
undergo a phase transition during charging and discharging cycles, XRD can provide a wealth of information on the condition of the battery in operando. PANalytical has developed a number of different sample holders for batteries to support this type of analysis.

A coin cell or button cell can be inserted in a special circular sample holder, that can be attached to a sample stage in a clamping holder.
Pouch cells can be mounted onto a diffractometer with a holder for thin solid samples for transmission analysis. A spring-loaded clamping mechanism ensures automatic positioning in the center of the goniometer.
Electrochemical test cells can be created in a special version of a commercially available test cell for the X-ray characterization of Li-ion battery materials. This special version is the result of a cooperation between the product specialists of EL-CELL (Hamburg, Germany) and PANalytical's Specials team XRD. Its wider X-ray window allows access to lower 2theta-angles than the standard version.

Analysis of materials under stress

How do materials behave under applied stresses? At which strain does plastic deformation start? When are cracks appearing?
The answers to these questions heavily depend on the microstructure of the material investigated.

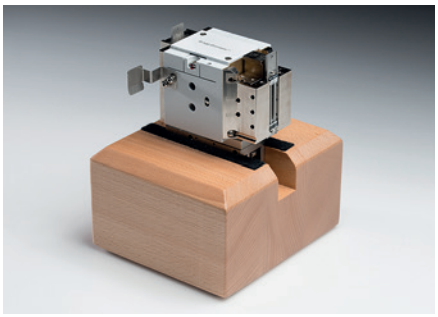
You can now follow changes in the microstructure of a sample under well-defined stress and strain conditions in reflection mode. Just mount one of the compact Deben tensile stages onto a three-axes cradle on your Empyrean diffractometer. The change in preferred orientation of the crystallites in the sample can then be determined by analyzing the measured X-ray pole figures.



Alternatively, you can obtain information on the elastic behavior of stretched polymer samples from 2D diffractograms, measured in transmission mode.

The Bragg-Brentano^{HD} family

PANalytical's Bragg-Brentano^{HD} is an optical module for the incident beam path that is designed to obtain high-quality powder diffraction data by Bragg-Brentano measurements. It delivers an improved peak-to-background ratio and excellent low-angle performances. This module has originally been developed for Cu $K\alpha$ radiation.



There are, however, analyses which profit from the use of a different wavelength. For example, Co $K\alpha$ radiation is typically used for the analysis of iron-containing samples whereas Mo $K\alpha$ radiation is preferred when a higher penetration depth into the sample is required.
To accommodate these needs, the Bragg-Brentano^{HD} family has now been extended with special versions for cobalt and molybdenum radiation, delivering the same superb data quality as for copper radiation.

"Our customers' challenges are the most inspiring source for many of our developments."

Hans te Nijenhuis, Commercial project leader of PANalytical's Specials Team XRD

Investing in **Services and Support**

At present, the demand for more speed in everything we do is almost daily increasing, especially in the business world. We at PANalytical are aware that our customers are constantly challenged to produce better results within shorter times. By delivering not only the equipment but also the technical and expertise support we believe we can contribute strongly to this challenge.

PANalytical's current Customer Support and Expertise infrastructure is unmatched in the market with multi-tier support hubs (our Customer Care Centers or CCC's) being available on local and on central level, just to make sure that we can swiftly respond to your needs.

With our philosophy to first provide a remote assessment (where possible) before travelling on site, we are able to solve issues quicker and much more cost-effective. Naturally, our customer support engineers are continuously trained to be able to provide service in the best possible way.

Our latest investment is in Shanghai (China) where our Xpertise Lab serves as a local training ground for our customer support engineers. Here they receive thorough instructions and gain practical experience in diagnosing potential problems and servicing PANalytical's X-ray fluorescence (XRF) instruments.

Education at the Xpertise Lab is also complementary to the rigorous training that customer support engineers undergo at PANalytical's supply center/ headquarters in the Netherlands. By cross-training our engineers, they are able to learn from each other as well as improve their first-time-fix rate, which is an ongoing Lean 6 Sigma project in all of PANalytical's regions.

So far, four courses have been given on XRF basic techniques, namely for the Axios and Zetium XRF spectrometers. The training has been designed in close cooperation with the specialists from the supply center. Emphasis not only lies on product knowledge but also on preventive maintenance and basic troubleshooting.

Additionally, we have completed a training program for Epsilon 3 for both customer support engineers and agents through local courses. A local basic XRD training is in the pipeline for India, which will mark a significant increase in the total number of seats for local courses.

"We're investing in these resources to ensure that our clients enjoy a first-time fix. This is of utmost importance, especially for clients in remote areas. Not only will this translate into greater productivity and cost savings for our customers but also PANalytical will be able to increase the available resources for a wider coverage of customer support", says Gianmario Bini, regional customer support director for the Asia Pacific region. "These investments are also visible in our newest Remote Assistance Suite for Axios and Zetium. It enables us to address a problem that can't wait, or assist customers who are located a little farther away from the rest of the world."

PANalytical offers remote assistance through our Customer Care Centers, which are manned by our most experienced and skilled support engineers. This way immediate access to our expertise and troubleshooting is just a phone call away. Our network of CCCs is growing with the one in China being the latest addition to others in Japan, USA, Brazil, India, Australia and at our headquarters in the Netherlands.

The Australian Customer Support team undergoing training on troubleshooting and maintenance for benchtop X-ray fluorescence spectrometers

The China CCC team with Anna Yao, Zhiqiang Ding and manager Wu ShiHai (from left to right)

"Our investments will translate into greater productivity and cost savings for our customers."

Wu ShiHai, customer support manager, PANalytical China

John Oude Egbrink (left) and Huub Smit (right)

Customers first

How can a PANalytical engineer master the challenge of maintaining the large variety of complex and high-tech instruments in our product portfolio? How can a user be sure that he makes optimal use of his PANalytical instrument? X'Press asked John Oude Egbrink, PANalytical's global customer support director, and Huub Smit, Application Competence Center (ACC) manager, to share their view on the latest investments for a successful support to our customers.

John could you tell us about the challenges for a PANalytical customer support engineer (CSE)?
At PANalytical, a CSE signs up for a life of learning based on the multitude of challenges he or she can be faced with: from mastering all of PANalytical's technologies to being the company's ambassador in front of our customers.

The most important aspect in case a customer needs support, is to insure that all services are provided professionally and in the quickest possible way. Here, the engineer relies on everything he has learned from his training but also on his skills to manage the various moving 'parts' of the process (e.g organizing spare parts shipments, cross check with customer support specialists on the diagnosis etc.) to achieve his or her responsibility of meeting the customers' expectations and securing their satisfaction.

Besides the intrinsic challenges of his own profession, geographical location is often a challenge in itself because PANalytical's customers can be located in the most remote places imaginable and just getting there will impact the system's uptime. In the end, whether remote or not, excellent preparation is key to serving our customers the first time right.
The challenges can basically be summarized by two of our five values: Customer Focus and High Performance.

How does PANalytical tackle these challenges?
We invest heavily in the training of our CSEs with a wide array of basic and advanced training for all our technologies. Our training centers are across the globe (see also page 9 in this X'Press). There we start with the basic training of X-ray fluorescence (XRF) and X-ray diffraction (XRD): installation, executing preventive maintenance and generic trouble shooting. Typically, after 6 to 12 months in the field, the CSE is ready for the advanced training in the Supply Center in Almelo, the Netherlands.

For some technologies we offer an even more in-depth training, for example for small-angle scattering (SAXS). Our instruments for the semiconductor industry, Semyos and the 2830 ZT Wafer Analyzer, need a specially designed training for a group of CS specialists. All CSEs are certified after successfully having passed the training.
With safety being of utmost importance, frequent on-line rehearsal trainings are mandatory in addition to hands-on training.

Speed is of essence for our customers and therefore we strive for world-class performance on minimum-time-to-repair and a 100% first-time-fix. If additional support is required, a CSE can always count on our CCC network with local presence in Australia, China, Japan, India, USA and Brazil and on our third-tier CCC based in Almelo.

Customers increasingly value the possibilities to get support remotely through the internet. In this case we can run diagnostics locally. After retrieving and analyzing the data in one of our CCCs we can provide a solution. Alternatively we execute a real-time session in the CCC with a CSE on site.

Information sharing is crucial in our high-tech environment. All information on the specific instrument is at hand for any CSE through our customer database and all service manuals and other relevant service information are available through our library. This library is updated every week to share the latest information, created by the CS specialist group in the supply center.

Huub, could you tell our readers what Expertise resides in the ACC?
Our application specialists play a key role in defining the solution that adds value to our customers' processes or activities. When a customer is in the process of investing in a PANalytical system, (s)he wants to be sure that all analytical requirements are fulfilled by the proposed solution. This feasibility is proven by studying customer samples. Additionally, our specialists show the solution and possible extensions during a live demonstration.

Building on their knowledge of the customer's industry or research, they deliver their Expertise by customizing the application and train the user, such that after installation and commissioning the important process parameters can be monitored or efficient and result-oriented research can be conveyed.

Application specialists also conduct application courses in all our main competence centers worldwide. The course schedule on our website (www.panalytical.com/courses) lists the numerous courses we organize during the year.

Could you give us some examples of Expertise?
In the fast changing world with many new materials and applications, the development of new solutions and applications of new products bring daily challenges for our application specialists.
Recently we developed analytical solutions to monitor air pollution in China with XRF, to measure nanomaterials for the growing number of applications with (utra-) small-angle scattering ((U)SAXS) and to enhance material research with fast small spot XRF mapping analysis (Zetium). Customers also embraced new applications like pair distribution function analysis and computed tomography.

How does the fusion with Malvern influence PANalytical's renowned customer support organization?
John: I think that the integration of the two renowned organizations will not only double the footprint but will accelerate the sharing of the best practices of both companies and add more value for our customers. Imagine that the same CSE will service a Malvern Mastersizer and a PANalytical Aeris - thus minimizing overhead costs and maximizing the uptime of both instruments.

Huub: There is an obvious overlap of the research areas and of the industries that both companies serve. This holds in pharmaceuticals, academia, material research, mining, cement, bio-science, metals and chemical, to name a few. With the combined groups of application specialists we will be able to better understand these industries, research questions and analytical requirements, and therefore our solutions will add even more value for our customers.

John Oude Egbrink studied Industrial Engineering and Production Engineering at the University of Twente. He joined Philips Analytical in 1997 and started as production manager XRF. After holding positions in Operations management, Supply Chain management, Spare Part management and Purchasing he combined these fields and was Director of Operations for more than 5 years. In 2009 he became Global Customer Support Director for PANalytical.

Huub Smit studied Physics at the University of Leiden. He started at Philips Analytical in 1988 as XRF product application specialist. After several functions including product manager in France, manager of the Automation Business Unit and general manager in the supply center in Waterloo Canada, he became responsible for the Application Competence Center.

Real-time monitoring of liquids

Invest to reduce direct costs in your liquid-based production processes

Would you like your production process to be more efficient? Do you want to avoid using more reagents than needed or do you want to prevent producing waste by unnecessarily continuing a process? PANalytical will be able to help with the Epsilon Xflow, which is currently being developed. With this on-line liquid analyzer, to be introduced in spring 2017, you will be able to produce as cost-effectively as possible through the continuous analysis of the elemental composition of any liquid.

Industries are required to comply with increasingly stringent environmental norms and requirements for their products and production processes. On-line monitoring of these processes by continuously checking predefined conditions, will enable you to react immediately to any change in the process. It will result in more efficiency, enhance the use of resources and ensure product quality.

The analytical flexibility and superior performance will make the Epsilon Xflow a perfect addition to your process streams in a wide range of industries; e.g. mining, petrochemical, metal plating and food.

Contact us and find out how you can invest to save by real-time monitoring or keep an eye on www.panalytical.com/Xflow for the Epsilon Xflow.

Meeting the **pharmaceutical scientists** at **AAPS**

The American Association of Pharmaceutical Scientists took place in November 2016 in Denver, CO and was attended by scientists from pharmaceutics, biopharmaceutics, contract research organizations (CROs), universities and more. It was a great opportunity for PANalytical to share our newest solutions for pharmaceutical applications from elemental impurities in drug products, monitoring crystallization *in situ*, protein analysis on a laboratory X-ray scattering instrument, to studying stability of amorphous solid dispersions (ASDs).

The last topic was demonstrated by PANalytical's Detlef Beckers on his poster contribution, entitled 'Use of atomic pair distribution function (PDF) and X-ray scattering methods to assess the stability of amorphous organic compounds'. He showed how PDF analyses on spray-dried APIs performed on a PANalytical Empyrean diffractometer (using Mo and Ag sources and a GaliPIX^{3D} detector) compared well with data collected at Argonne National Laboratory on beam line 11-ID-B.

Besides showing that the sample is truly amorphous (absence of nanocrystalline domains) the patterns reveal that the amorphous drug did not possess ordering beyond 9-10 Ångströms. Further comparison of PDF data using cluster analysis demonstrated the ability to discern stable ASDs.

This work addressed both the need for reliable methods for structural characterization and fingerprinting of amorphous active pharmaceutical ingredients (APIs) as well as the means to assess process variations in amorphous drug preparation.

The poster can be downloaded from the PANalytical website: www.panalytical.com/pdfanalysis

Detlef Beckers at the AAPS

Synchrotron data

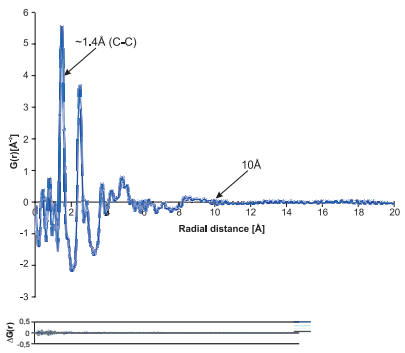


Figure 1: PDF patterns from synchrotron data

Laboratory data

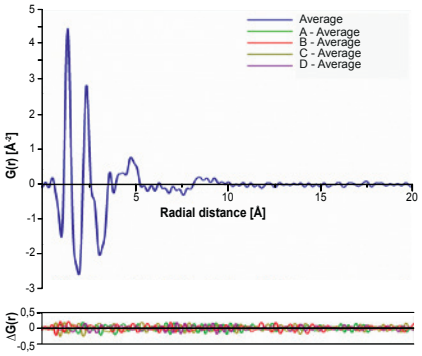


Figure 2: PDF patterns from laboratory data

Unrivalled analytical results for new non-wetting agent tablets

Do you often prepare samples for X-ray fluorescence analysis from molten mixtures? Are you sometimes having trouble with molten mixtures sticking to the platinumware? At Claisse®, we develop products with our customers' needs in mind. This is why we created a new non-wetting agent tablet that decreases the tendency of the molten mixture to stick to the platinumware.

Generally, non-wetting agents are halides that can be pre-fused with fluxes or added as a solution. By reducing the surface tension of the molten mixture they prevent adhesion to the platinumware. The new non-wetting agent tablets from Claisse contain less organic matter than the original, thus ensuring superior analytical results.

Why don't you try our new non-wetting agent tablets and facilitate your work? No weighing is required and no more time needs to be spent unsticking precious platinumware. Our non-wetting agent pills come in a pack of 500, and they will be available soon.

Contact your Claisse representative for more information on how Claisse can make your work easier by providing you with a wide range of high-quality products for your fusion process.

Water for the **Cape Community School** in **Freetown, Sierra Leone**

Freetown is the capital of Sierra Leone, situated in the West of Africa at the Atlantic Ocean. Here, approximately 350 pupils from the poorest families in Freetown attend the Cape Community School, founded by Mr. Gabriel Scott. The school was established in 1999 and has educated thousands of children; some of them have even become teachers at this school. Besides education, the children get a decent meal once a week and some of them stay at school because their parents have died, or simply cannot raise their children.

Already in 2013, when PANalytical's Bas ter Mull visited the school for the first time, their biggest problem was the missing water supply due to the breakdown of water pumps, piping and the electrical installation. The children had to wash themselves and get drinking water along the road from leaking water pipes. In the following two years, Sierra Leone suffered badly from the Ebola virus but fortunately not the Cape Community School.

When Bas ter Mull visited again in 2015 he saw that the water supply had still not been fixed and he decided to take action. Together with a number of Dutch friends he managed to collect enough money to buy the necessary equipment. PANalytical agreed to take care of packing the material and to organize the transport of two wooden crates of 125 kg and 270 kg respectively. A transport company willing to deliver and clear the goods in Sierra Leone was found and the goods finally arrived at the Cape Community School in November 2016.

Within a few weeks the whole pumping system was installed and just before Christmas the school could fill all their water tanks.

Thanks to all people and companies who have supported this project, children and teachers have running water again!

Events calendar 2017

The list shows a selection of events during the next few months where you will find us. Please come by and visit us when you attend any of these events.

5 – 9 March	Pittcon	Chicago, IL, USA
20 – 22 March	Process Mineralogy '17	Cape Town, South Africa
28 – 30 March	Forum Labo & Biotech 2017	Paris, France
29 – 31 March	EUROLAB	Warsaw, Poland
10 – 13 April	BCA Spring	Lancaster, UK
18 – 21 April	Korea Lab 2017	Seoul, Korea
25 – 27 April	Ceramics Expo	Cleveland, OH, USA
15 – 19 May	Exponor	Antofagasta, Chile
31 May - 2 June	Philippines Chemistry Congress	Palawan, Philippines

www.panalytical.com/events

Peru - a giant in the global mining industry

3rd Ore and Mineral Analysis workshop (OMA) in Lima

The photograph shows two different copper ores from one deposit in Peru: a light green primary sulfidic ore and a blue green secondary oxidic ore. Because of the different mineralogy and distinct processing (flotation or leaching) it is of utmost importance to separate the ore types and waste rock as early as possible in the process. In order to achieve this separation in the most cost-effective way, various technologies and their combinations are available.

As Peru is one of the world's largest producers of copper it was only logical for PANalytical to organize the third edition of the OMA workshop together with Enviroequip in Lima, capital of Peru, right after the international GeoMet conference. More than 40 participants enjoyed presentations and live demonstrations of the large variety of PANalytical's solutions for efficient processing and increasing recovery rates. They also witnessed the introduction of the Minerals edition of Aeris, PANalytical's new benchtop X-ray diffraction (XRD) system for fast mineralogical analysis at every step in the mining process.

The 4th OMA workshop will be held in June 2017 together with the 'Open Laboratory' in Belém, Brazil. Another OMA workshop is planned for Mexico on 22 May 2017.

Colophon

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

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Training and education
Comprehensive application courses

Analytical services
And customized calibration materials

More information? Contact your local sales and service representative or visit our website www.panalytical.com