Welcome

There are now three new Nobel Laureates in Physics, three in Chemistry, one in Physiology or Medicine, one in Literature, one in Peace and two new Laureates in Economic Sciences. Rigaku extendes a warm and heartfelt congratulations to these amazing individuals for their exemplary contributions to the benefit of all humanity. We also wish to give special recognition to two of these new Nobel Laureates whose labs employ Rigaku instrumentation.

The Nobel Prize in Physiology or Medicine 2016 was awarded to Professor Yoshinori Ohsumi, professor at Tokyo Institute of Technology's Institute of Innovative Research, for his discoveries of mechanisms for autophagy. Prof. Ohsumi's group used a Rigaku XRD system equipped with a MicroMax-007 X-ray source and R-AXIS detector. The Nobel Prize in Chemistry was awarded jointly to Jean-Pierre Sauvage, Sir J. Fraser Stoddart and Bernard L. Feringa for the design and synthesis of molecular machines. Sir James Fraser Stoddart, Board of Trustees Professor of Chemistry and head of the Stoddart Mechanostereochemistry Group in the Department of Chemistry at Northwestern University, owns a MiniFlex.

Please come visit Rigaku in November at the following major events: American Association of Pharmaceutical Scientists (Denver), Eastern Analytical Symposium (Somerset, NY), Materials Research Society (Boston) and AsCA (Hanoi, Vietnam). We wish to thank all who attended the recent materials characterization workshops produced by Paralab, our distributor in Portugal. A detailed report on these events is included (*herein*).

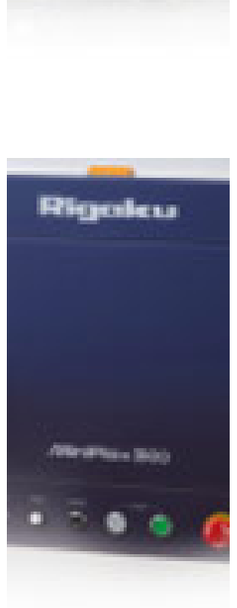
Presentations at Paralab XRD Workshop in Portugal

This month we continue the new serialized *Basic Principles of WDXRF* articles with "Instrument Parameters (Part 2)." Our featured XRD and WDXRF Application Notes this month cover the "MiniFlex300/600 Variable knife edge features" and "Quantitative Analysis of Blast Furnace Slag by the Pressed Powder Method on ZSX Primus III+." Additional application papers include EDXRF and Raman technologies.

The video topic continues the new series exploring technologies of the future. This month we look at projects that are under way around Japan's coast to develop offshore wind power. Check out the news and papers sections at the bottom of the page for the latest developments in materials science.

Enjoy the newsletter.

R.C. Tisdale, Ph.D. – Editor

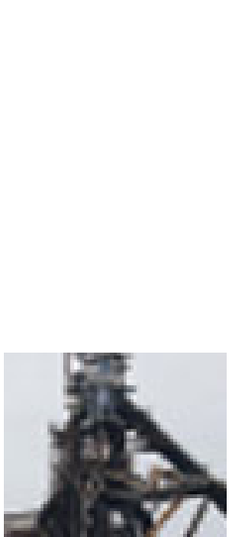


Featured XRF Article – Basic Principles of WDXRF

Instrument Parameters (Part 2)

By Pol De Pape, XRF Application Scientist, Rigaku Latin America

In the previous article, we learned about the basics of X-ray fluorescence as a spectroscopic analysis technique. We saw that it is a technique that has been established for many decades and has a wide range of applications. It also explained the basic principles or physics of X-rays. In this article, we will apply those principles to the hardware and, in particular, to the X-ray tube of an (wavelength dispersive) X-ray spectrometer. **For full article >**

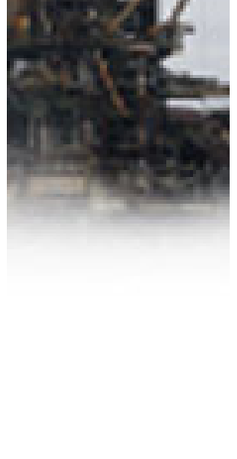


Paralab XRD Solutions Seminar

Report on Rigaku - Paralab XRD Workshops in Portugal

Reported by Yurika Takumi, Office of the President, Rigaku Corporation

In September 2016, three workshops were held in Portugal. The first was held in Porto and from there two more in Coimbra and Lisbon. More than 150 people joined and discussed Rigaku's unique XRD solutions. **For full report >**



XRD Application Note

MiniFlex300/600 Variable knife edge features

Rigaku Corporation

Powder X-ray diffractometers are used in many fields of industry and research, for substances ranging from inorganic materials such as ceramics and minerals, to pharmaceuticals and other organic materials. The MiniFlex300/600 can be equipped with the D/teX Ultra high-speed 1-dimensional detector to obtain greater intensity. This detector has a broad detection surface and can efficiently count diffraction X-rays from a sample. As a result, it is possible to obtain intensities from a few tens to roughly 100 times greater than a scintillation counter. Background can also be reduced using the fluorescent X-ray reduction mode, or knife edge. **For more >**

WDXRF Application Note

Quantitative Analysis of Blast Furnace Slag by the Pressed Powder Method on ZSX Primus III+

Rigaku Corporation

The blast furnace slag is formed when iron ore or iron pellet, coke and flux are melted in a blast furnace of iron foundry. The rapid chemical analysis of blast furnace slag is important task to control a blast furnace. X-ray fluorescence spectrometers are the most common analysis tools to analyze powder samples in iron and steel making process. This application note describes blast furnace slag analysis using ZSX Primus III+. **For more >**

EDXRF Application Note

MgO and P_2O_5 in Phosphate Rock

Applied Rigaku Technologies

Phos rock (phosphate rock, rock phosphate, phosphorite) is mined from high phosphorous clay deposits and processed to be used in fertilizers. During mining and processing it is critical to measure and monitor the levels of P_2O_5 and MgO, as well as the other major oxides CaO, Al_2O_3, SiO_2 and Fe_2O_3 to ensure proper product quality of the physical and chemical properties desired. To meet this industry need Rigaku offers NEX QC+ EDXRF analyzer. The self-contained unit with touch screen operation is ideal for at-line quality checks by non-technical operators, as well as in the QA/QC lab. **For more >**

Raman White Paper

Detection of Methanol in Methanol/Ethanol Mixtures

Rigaku Analytical Devices

A study was performed for the detection of methanol in methanol-ethanol mixtures. The scope of the study was to determine at what level methanol can be detected and what the characteristics are of the methanol-ethanol mixtures. The study was undertaken based on the requirement that contamination of ethanol by methanol can be quickly and effectively detected based on the common adulteration levels. The contamination of methanol in ethanol poses a health risk, especially in the case of alcohol adulteration for liquor sales and off-vendor sales, and also for safety checks in reliable vendors. This study was done to assess the best levels for detection of methanol by using pure methanol and ethanol solutions and looking for characteristic spectral qualities. In addition to assessing the ability of Progeny ResQ handheld Raman to detect and identify the components of the mixtures. **For more >**

Material Analysis in the News

News for October 2016

October 1, 2016. Textbook illustrations and museum dioramas could soon be even more accurate in their depiction of the rich color of long-extinct animals like dinosaurs. An international team of scientists used advanced X-ray imaging techniques to map out elements related to pigmentation in modern birds of prey, which they will use to reconstruct the likely color patterns of fossil specimens.

October 3, 2016. Researchers in Japan developed a silicon fluorescent material that is very low in toxicity and high in luminescence efficiency, compared to conventional materials. Under near-infrared radiation (NIR) at wavelengths of 650 to 1,000 nm – the range known as the "biological optical window" – that is capable of passing through living systems, the joint group succeeded in bioimaging using this new material.

October 3, 2016. Nobel Prize in Medicine was awarded to Fukuoka, Japan-born scientist Yoshinori Ohsumi. He illuminated a cellular process called autophagy, or "self-eating," in which cells take unneeded or damaged material, including entire organelles, and transport them to a recycling compartment of sorts – in yeast cells, this compartment is called the lisosome, while vacuoles serve a similar purpose in human cells.

October 4, 2016. To strengthen their collaboration in materials science and engineering, the CNRS, Université de Lyon, and Tohoku University launched an international joint unit (UMI) based in Sendai, Japan, on October 4, 2016. Named Engineering Science Lyon – Tohoku for Materials and Systems under Extreme Conditions (ELyTMaX), this new laboratory studies the behavior of materials subject to extreme and complex stress.

October 4, 2016. Three British scientists behind ground-breaking research into exotic matter in the quantum world were jointly awarded the Nobel Prize in physics. Awarding the prize in two parts, the Royal Swedish Academy of Sciences handed one half to David J. Thouless of the University of Washington and the second half to F. Duncan M. Haldane of Princeton University and J. Michael Kosterlitz of Brown University.

October 6, 2016. A team of scientists headed by Lawrence Berkeley National Laboratory researcher Prof. Ali Javey has used carbon nanotubes and a compound called molybdenum disulfide to create a transistor with a working 1-nm (nanometer) gate.

October 11, 2016. Clive Randall, professor of materials science and engineering at Penn State, has developed a new technology called cold sintering. It advances the ability to combine incompatible materials, such as ceramics and plastics, into new, useful compound materials–and to lower the energy cost of many types of manufacturing.

October 12, 2016. Hiroshi Funakubo and co-workers at the Tokyo Institute of Technology, in collaboration with researchers across Japan, have conducted experiments to determine the ferroelectric properties of an inorganic compound called hafnium oxide (HfO_2) for the first time. Crucially, the crystal structure of HfO_2 allows it to be deposited in ultra-thin films, meaning it may prove invaluable for next-generation technologies.

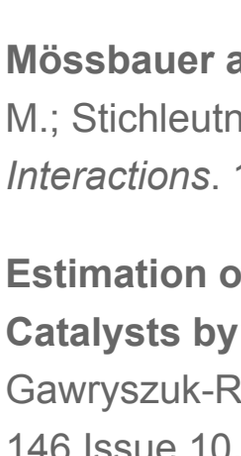
October 14, 2016. A new Apple research and development facility is coming to Japan. A spokesperson representing Japanese Prime Minister Shinzo Abe said during a press conference in Tokyo that Apple plans to finish construction of a new development center in Japan's second largest city Yokohama

October 17, 2016. Scientists from 16 countries were in Pokhara to discuss about latest researches and studies on material science and engineering. The Kathmandu Symposia on Advanced Material Science was organised by Nepal Polymer Institute with the support from the Nepal Academy of Science and Technology, the Pokhara University and German-based Institute of Polymer Research (IPW).

October 20, 2016. Researchers at Stanford and Oxford have created a new type of solar cell that replaces silicon with a crystal called perovskite. This design converts sunlight to electricity at efficiencies similar to current technology but at much lower cost.

October 21, 2016. A nonsensical academic paper on nuclear physics written only by iOS autocomplete has been accepted for a scientific conference. Christoph Bartneck, an associate professor at the Human Interface Technology laboratory at the University of Canterbury in New Zealand, started a sentence with 'atomic' or 'nuclear' and then randomly hit the autocomplete suggestions. He submitted the paper under a fake identity using a biography that featured contradictory gender pronouns.

October 24, 2016. A new study demonstrates how the ultrafast light-induced modulation of the atomic positions in a material can control its magnetization. An international research team led by Andrea Cavalleri from the Max Planck Institute for the Structure and Dynamics of Matter at CFEL in Hamburg used terahertz light pulses to excite pairs of lattice vibrations in a magnetic crystal.



Recent Scientific Papers of Interest

Papers for October 2016

Recent Scientific Papers of Interest is a monthly compilation of material analysis papers appearing in recently released journals and publications. *See below*

Quantitative XRD study of amorphous phase in alkali activated low calcium siliceous fly ash. Bhagath Singh, G.V.P.; Subramaniam, Kolluru V.L. *Construction & Building Materials.* Oct2016, Vol. 124, p139-147. 9p. DOI: 10.1016/j.conbuildmat.2016.07.081.

Structure determination of electrodeposited zinc-nickel alloys: thermal stability and quantification using XRD and potentiodynamic dissolution. Fedi, B.; Gigandet, M.P.; Hihn, J-Y; Mierzejewski, S. *Electrochimica Acta*. Oct2016, Vol. 215, p652-666. 15p. DOI: 10.1016/j.electacta.2016.08.141.

XRF Characterization Of 18th Century Piedmontese Porcelains From The Palazzo Madama Museum (Torino, Italy) . Turco, F.; Davit, P.; Maritano, C.; Operti, L.; Fenoglio, G.; Agostino, A. *Archaeometry*. Oct2016, Vol. 58 Issue 5, p765-778. 14p. DOI: 10.1111/arcm.12186.

Mössbauer and XRD study of hot dip galvanized alloy. Kuzmann, E.; Speakman, R.; El-Sharif, M.; Stichleutner, S.; Homonnay, Z.; Klencsár, Z.; Sziráki, L.; Chisholm, C.; Lak, Gy. *Hyperfine Interactions*. 10/10/2016, Vol. 237 Issue 1, p1-9. 9p. DOI: 10.1007/s10751-016-1362-x.

Estimation of Average Crystallites Size of Active Phase in Ceria-Supported Cobalt-Based Catalysts by Hydrogen Chemisorption vs TEM and XRD Methods. Slowik, Grzegorz; Gawryszuk-Rzysko, Anna; Greluk, Magdalena; Machocki, Andrzej. *Catalysis Letters*. Oct2016, Vol. 146 Issue 10, p2173-2184. 12p. DOI: 10.1007/s10562-016-1843-1

Combined 1D, 2D and 3D micro-XRF techniques for the analysis of illuminated manuscripts. Lachmann, Tim; Van Der Snickt, Geert; Haschke, Michael; Mantouvalou, Ioanna. *JAAS (Journal of Analytical Atomic Spectrometry)*. Oct2016, Vol. 31 Issue 10, p1989-1997. 9p. DOI: 10.1039/c6ja00220j.

***In-situ* X-ray diffraction studies of slip and twinning in the presence of precipitates in AZ91 alloy.** Kada, Sitarama R.; Lynch, Peter A.; Kimpton, Justin A.; Barnett, Matthew R. *Acta Materialia*. Oct2016, Vol. 119, p145-156. 12p. DOI: 10.1016/j.actamat.2016.08.022.

Assessment of the U_3O_7 Crystal Structure by X-ray and Electron Diffraction. Leinders, Gregory; Delville, Rémi; Pakarinen, Janne; Cardinaels, Thomas; Binnemans, Koen; Verwerft, Marc. *Inorganic Chemistry*. 10/3/2016, Vol. 55 Issue 19, p9923-9936. 14p. DOI: 10.1021/acs.inorgchem.6b01941.

Aluminosilicate-based glasses structural investigation by high-energy X-ray diffraction. Bernasconi, Andrea; Dapiaggi, Monica; Bowron, Daniel; Ceola, Stefano; Maurina, Stefano. *Journal of Materials Science*. Oct2016, Vol. 51 Issue 19, p8845-8860. 16p. DOI: 10.1007/s10853-016-0132-0.

Phase-targeted X-ray diffraction. Hansford, G. M. *Journal of Applied Crystallography*. Oct2016, Vol. 49 Issue 5, p1561-1571. 10p. DOI: 10.1107/S1600576716011936.

A new method for quantitative phase analysis using X-ray powder diffraction: direct derivation of weight fractions from observed integrated intensities and chemical compositions of individual phases. Toraya, Hideo. *Journal of Applied Crystallography*. Oct2016, Vol. 49 Issue 5, p1508-1516. 8p. DOI: 10.1107/S1600576716010451.

***PyNX.Ptycho:* a computing library for X-ray coherent diffraction imaging of nanostructures.** Mandula, Ondrej; Burghammer, Manfred; Elzo Aizarna, Marta; Favre-Nicolin, Vincent; Eymery, Joël. *Journal of Applied Crystallography*. Oct2016, Vol. 49 Issue 5, p1842-1848. 6p. DOI: 10.1107/S1600576716012279.

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A comparative assessment of biomass ash preparation methods using X-ray fluorescence and wet chemical analysis. Xing, P.; Mason, P. E.; Chilton, S.; Lloyd, S.; Jones, J. M.; Williams, A.; Nimmo, W.; Pourkashanian, M. *Fuel*. Oct2016, Vol. 182, p161-165. 5p. DOI: 10.1016/j.fuel.2016.05.081.

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Common trends in elements? Within- and between-tree variations of wood-chemistry measured by X-ray fluorescence — A dendrochemical study. Scharnweber, Tobias; Hevia, Andrea; Buras, Allan; van der Maaten, Ernst; Wilmking, Martin. *Science of the Total Environment*. Oct2016, Vol. 566, p1245-1253. 9p. DOI: 10.1016/j.scitotenv.2016.05.182.

Total reflection x-ray fluorescence spectroscopy as a tool for evaluation of iron concentration in ferrofluids and yeast samples. Kulesh, N.A.; Novoselova, I.P.; Safronov, A.P.; Beketov, I.V.; Samatov, O.M.; Kurlyandskaya, G.V.; Morozova, M.; Denisova, T.P. *Journal of Magnetism & Magnetic Materials*. Oct2016, Vol. 415, p39-44. 6p. DOI: 10.1016/j.jmmm.2016.01.095.

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