



NEW CT Lab GX series



Computed tomography (CT) for materials science

Rigaku recently introduced an ultra-high-speed, high-resolution 3D X-ray micro CT imager into the industrial CT market. The new "CT Lab GX" incorporates the "Sample-Stationary Method" and achieves CT scan in 8 seconds at top speed and minimum resolution of 4.5 μm . **For more >**

nano3DX – Microtomography of large samples at high resolution



X-ray microscope

Rigaku nano3DX is a true X-ray microscope (XRM) with the ability to deliver 3D computed tomography (CT) images of relatively large samples at high resolution. This is accomplished by using a high-powered rotating anode X-ray source and a high-resolution CCD detector. The rotating anode provides for fast data acquisition and the ability to switch anode materials easily to optimize contrast for specific sample types. **For more >**

Video of the Month



Cosmos Carl Sagan Episode – 01 – The Shores of the Cosmic Ocean

For those who missed this fantastic series in 1980, Carl Sagan opens the program with a description of the cosmos and a "Spaceship of the Imagination" (shaped like a dandelion seed). The ship journeys through the universe's hundred billion galaxies, the Local Group, the Andromeda Galaxy, the Milky Way, the Orion Nebula, our Solar System, and finally the planet Earth. Eratosthenes' successful calculation of the circumference of Earth leads to a description of the ancient Library of Alexandria. Finally, the "Ages of Science" are described, before pulling back to the full span of the Cosmic Calendar. Note: the revised version of the series adds an introduction by Ann Druyan to this episode, recorded after Sagan's death, in which she discusses some of the changes that occurred in the years after his broadcast. **Watch the video >**

Conferences and Workshops



Join Rigaku at future meetings

Rigaku will be sponsoring, attending or exhibiting at the following conferences and trade shows:

- PITTCON**
Atlanta, GA, USA
March 6 – 10, 2016
 - ACS – Spring**
San Diego, CA, USA
March 13 – 17, 2016
 - APS American Physical Society**
Baltimore, MD, USA
March 14 – 18, 2016
- See the complete list >**

Useful link of the Month



XLENS® DIFFRACTION SOFTWARE

At the Science Materials Institute of Barcelona (ICMAB – CSIC) they have developed these X-ray diffraction software packages, for Windows and Linux platforms: Intensity extraction and space group determination (DAJUST_Software); Crystal structure solution (Powder data: XLENS_PD6; Single crystal data: XLENS_v1); Crystal structure solution from Powder data using Direct-Space Methods (TALP) and Crystal structure refinement from Powder data (RIBOLS). **For more >**

Planning to Submit a Grant?



Rigaku is happy to assist

If you are planning on submitting an instrument grant proposal, Rigaku will be happy to assist you. We can help you determine the correct instrument and configuration best suited for your analytical needs. **Start the process >**

Rigaku's Materials Analysis eNewsletter, The Bridge



Join us

Each month, Rigaku distributes two eNewsletters: *The Bridge*, which focuses on Materials Analysis, and *Crystallography Times*, which concentrates on life sciences. **Join us >**

Welcome

2016 sees *The Bridge* marking the beginning of our fourth calendar year of publication. We remain committed to bringing our readers a substantive eNewsletter, one that helps the community stay abreast of the latest developments in X-ray based materials science.

Last month, Rigaku attended Pacificchem 2015, the seventh in the series of successful cosponsored scientific conferences of Pacific Basin Chemical Societies. Founded in 1984, these conferences have been held in Honolulu, Hawaii about every five years. This year, one of our visitors was Prof. Ei-ichi Negishi (pictured below), who was one of the 2010 Nobel laureates in chemistry for palladium-catalyzed cross couplings in organic synthesis. Prof. Negishi usually uses NMR for his research; however, as he was familiar with Rigaku and X-ray techniques, we enjoyed talking about our X-ray instruments with him. In the coming months, Rigaku will attend many major international events. A [listing of Rigaku events](#) may be found on our web site.



For your continuing education, we offer the sixth installment of our new series "Introduction to single crystal X-ray analysis," entitled "About CIFs – Alerts and how to handle them." Our featured technical paper is a primer on "X-ray Thin-film Measurement Techniques: III. High resolution X-ray diffractometry."

To reminisce about the work of a great scientist, this month's video is the [first episode of Prof. Carl Sagan's seminal TV series "Cosmos: A Personal Voyage."](#) For those who did not see it in 1980 on PBS, it is worth watching even if the information is a bit dated. It won two Emmys and a Peabody Award, and has since been broadcast in more than 60 countries and seen by over 500 million people.

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



Lab in the Spotlight

Dr. Hiroshi Abe, National Defense Academy of Japan, School of Electronics and Communication, Department of Materials Science and Engineering

In this month's issue of *The Bridge*, we feature the work of Associate Professor Hiroshi Abe at the National Defense Academy of Japan. His research into the unusual behaviors of ionic liquids have been aided by the [simultaneous measurement of XRD and DSC](#). Ionic liquids are regarded as the third most important liquid following water and organic solvents due to their high electrical conductivity. This month, his latest paper regarding research into ionic liquid behavior using a Rigaku SmartLab + X-ray DSC was published: "[Two-length scale description of hydrophobic room-temperature ionic liquid – alcohol systems.](#)" **For more >**



Introduction to Single Crystal X-ray Analysis VI

About CIFs—Alerts and how to handle them—

Rigaku Corporation

This article discusses the purpose of and background behind the adoption of CIFs, alerts which frequently appear when checking using checkCIF/PLATON and how to handle them, details on judgment criteria, and vrf's (validation reply/response forms). **For more >**



Featured XRD Rigaku Journal Article

X-ray Thin-film Measurement Techniques III

Rigaku Corporation

Recently, there are a very large number of electric devices developed in the high-tech industry. Semi-conductor material is one of the basic components for these electronic devices. For example, III-V compounds (GaN, GaAs, etc.) are often used to produce optical devices because the band gap range of these compounds are close to the visible light range. These compounds can coordinate band gap making a solid solution with another III-V compound. **For more >**



XRD Application Note

MiniFlex300/600 — Differences in intensity/resolution due to differences in X-ray tubes.

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 MiniFlex Series is a line of benchtop instruments – with 1/20 the volume, and 1/10 the weight, of stand-alone powder X-ray diffractometers – that can operate with power from an AC 100 V outlet. **For more >**



WDXRF Application Note

Multiple Element Determination for Nickel Sulfide Ores by Pressed Powder Method on Simulix14

Rigaku Corporation

Nickel is one of the essential base metals in modern industries. About 60% of nickel is used to make stainless steel. In the recent years, market price of nickel metal and volume of primary nickel production and ore production have been increasing. Therefore, demand for accurate and fast analysis in laboratory to determine multiple metal elements in ores is growing. **For more >**



EDXRF Application Note

Co, Br, Mn in TPA and PTA

Applied Rigaku Technologies

On-line measurement of cobalt (Co), bromine (Br) and manganese (Mn) in terephthalic acid (TPA) is demonstrated in this Application Note. **For more >**

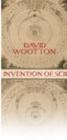


Raman Application Note

Regulation of Raw Material Identification in Cosmetics

Rigaku Analytical Devices

The safety of cosmetic products is an important issue for manufacturers, suppliers, and regulators. The EC Cosmetic Regulation 1233/2009 of the European Parliament and Council requires all cosmetic products in the EU market to be manufactured according to Good Manufacturing Practices (GMP) described by the ISO 22716 standard. In addition, the International Cooperation on Cosmetic Regulation (ICCR) – a joint effort by the US, EU, Japan, and Canada – agreed to implement ISO 22716 in their respective regions, wherever possible. **For more >**



Scientific Book Review

The Invention of Science: A New History of the Scientific Revolution

By David Wootton

We often think of invention as the product of scientific inquiry, but it doesn't seem as intuitively obvious to think of science itself as something that was invented. Yet that is exactly how David Wootton presents the history of the Scientific Revolution in his new book, *The Invention of Science: A History of the Scientific Revolution*. **For more >**



Material Analysis in the News

News for January 2016

January 5, 2016. X-ray fluorescence remote sensing technique plays a significant role in the chemical compositions research of the Moon. The data analysis method for China's Chang'E-2 X-ray spectrometer (CE2XRS) provided the first global Mg/Si and Al/Si maps on the lunar surface. Al/Si ratio shows a reverse relationship with the map of Mg/Si ratio.

January 5, 2016. Forbes Magazine's latest list of entrepreneurs under 30 includes a few Texans among those to watch bringing changes to the energy industry. **NUD Geochemical, based out of Austin, have created a service that uses X-ray fluorescence and high-resolution scanning to determine the mineral makeup of rock layers encountered by a driller.**

January 7, 2016. A student-built experiment aboard NASA's Origins, Spectral Interpretation, Resource Identification, Security-Regolith Explorer (OSIRIS-REx) mission has been integrated onto the spacecraft. The **Regolith X-ray Imaging Spectrometer (REXIS) will determine elemental abundances on the surface of asteroid Bennu**, complementing the mineral and chemical mapping capabilities provided by two other instruments on the spacecraft.

January 11, 2016. Multiple X-ray approaches to discriminate the origin of liquefied sand erupted during the 2012 Emilia Romagna earthquake. Geochemical, mineralogical and sedimentological analyses were performed by wavelength dispersive X-ray fluorescence, X-ray powder diffraction and Sedigraph and Settling tube, respectively.

January 11, 2016. Return of incandescent light bulbs as MIT makes them more efficient than LEDs. Researchers at MIT have shown that by surrounding the filament with a special crystal structure they can bounce back the energy which is usually lost.

January 13, 2016. In a recent experiment, Argonne battery scientists Jun Lu, Larry Curtiss and Khalil Amine, along with American and Korean collaborators, were able to produce stable crystallized lithium superoxide (LiO₂) instead of lithium peroxide during battery discharging. Unlike lithium peroxide, lithium superoxide can easily dissociate into lithium and oxygen, leading to high efficiency and good cycle life.

January 13, 2016. X-ray computed tomography (CT), Raman spectrometry and powder X-ray diffraction (PXRD), can provide valuable insights when testing for substandard or counterfeit medicines, say Japanese researchers. The team tested six brands of the cholesterol-lowering drug atorvastatin calcium bought over the Internet from Japanese language websites – including the originator brand Lipitor and various generics – and tested them for their drug content and how quickly they dissolved a release their active ingredient.

January 18, 2016. The research group of University of Tokyo Graduate School of Information Science and Technology of Professor Isao Shimoyama, Graduate School of Science Professor Makoto Gonokami (currently University President), and the Graduate School of Information Science and Technology Assistant Professor Tetsuo Kan, and Graduate School of Science Assistant Professor Kuniaki Konishi developed a terahertz metamaterial device to dynamically switch the polarization state of terahertz waves.



Recent Scientific Papers of Interest

Papers for January 2016

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

Artificial aging paper to assess long-term effects of conservative treatment. Monitoring by infrared spectroscopy (ATR-FTIR), X-ray diffraction (XRD), and energy dispersive X-ray fluorescence (EDXRF). Hattji, Latifa; Boukir, Abdellatif; Assouik, Jamal; Pessanha, Sofia; Figueirinhas, João Luis; Carvalho, Maria Luisa. *Microchemical Journal*. Jan2016, Vol. 124, p646-656. 11p. DOI: [10.1016/j.microc.2015.10.015](#).

Comparative analysis of ex-situ and operando X-ray diffraction experiments for lithium insertion materials. Brant, William R.; Li, Dan; Gu, Qinfen; Schmid, Siegfert. *Journal of Power Sources*. Jan2016, Vol. 302, p126-134. 9p. DOI: [10.1016/j.jpowsour.2015.10.015](#).

Hybrid-angle energy dispersive low-power X-ray diffraction and fluorescence portable system for non-invasive study: Peak identification and object positioning corrections. Mendoza Cuevas, Ariadna; Fernández-de-Cossio Dorta-Duque, Jorge. *Microchemical Journal*. Jan2016, Vol. 124, p435-240. 6p. DOI: [10.1016/j.microc.2015.08.006](#).

CO₂ capture and positional disorder in Cu₃(1,3,5-benzenetricarboxylate): An in situ laboratory X-ray powder diffraction study. Wong-Ng, W.; Levin, I.; Kaduk, J.A.; Espinal, L.; Wu, H. *Journal of Alloys & Compounds*. Jan2016, Vol. 656, p200-205. 6p. DOI: [10.1016/j.jallcom.2015.09.078](#).

Effect of short and long range order on crystal structure interpretation: Raman and powder X-ray diffraction of LiPF₆. Lekgoathi, M.D.S.; Kock, L.D. *Spectrochimica Acta Part A: Molecular & Biomolecular Spectroscopy*. Jan2016, Vol. 153, p651-654. 4p. DOI: [10.1016/j.saa.2015.09.025](#).

Study of Phase Transformation in BaTe₂O₆ by in Situ High-Pressure X-ray Diffraction, Raman Spectroscopy, and First-Principles Calculations. Mishra, K. K.; Achary, S. Nagabhusan; Chandra, Sharat; Ravindran, T. R.; Pandey, K. K.; Thyagi, Avesh K.; Sharma, Surinder M. *Inorganic Chemistry*. 1/4/2016, Vol. 55 Issue 1, p227-238. 12p. DOI: [10.1021/acs.inorgchem.5b02174](#).

An in situ X-ray diffraction study of phase separation in Cu–Ta alloy thin films. Müller, Claudia M.; Spolenak, Ralph. *Thin Solid Films*. Jan2016, Vol. 598, p276-288. 13p. DOI: [10.1016/j.tsf.2015.12.028](#).

In-situ X-ray μ Lae diffraction study of copper through-silicon vias. Sanchez, Dario Ferreira; Reboh, Shay; Weleuela, Monica Larissa Djomeni; Micha, Jean-Sébastien; Robach, Odile; Mourier, Thierry; Gergaud, Patrice; Bleu, Pierre. *Microelectronics Reliability*. Jan2016, Vol. 56, p78-84. 7p. DOI: [10.1016/j.microrel.2015.10.008](#).

Application of micro X-ray diffraction to investigate the reaction products formed by the alkali-silica reaction in concrete structures. Dähn, R.; Arakcheeva, A.; Schaub, Ph.; Pattison, P.; Chapuis, G.; Grolmund, D.; Wieland, E.; Leemann, A. *Cement & Concrete Research*. Jan2016, Vol. 79, p49-56. 8p. DOI: [10.1016/j.cemconres.2015.07.012](#).

Ultrasonics determination of mercury in waters via photochemical vapor deposition onto quartz substrates coated with palladium nanoparticles followed by total reflection X-ray fluorescence analysis. Romero, Vanesa; Gryglicka, Magdalena; Calle, Inmaculada; Lavilla, Isela; Bendicho, Carlos. *Microchimica Acta*. Jan2016, Vol. 183 Issue 1, p141-148. 8p. DOI: [10.1007/s00604-015-1612-7](#).

A simple method for the multi-elemental analysis of organic fertilizer by slurry sampling and total reflection X-ray fluorescence. Resende, Luciene V.; Nascentes, Clésia C. *Talanta*. Jan2016, Vol. 147, p485-492. 8p. DOI: [10.1016/j.talanta.2015.10.007](#).

X-ray fluorescence analytical signal of elements with small atomic numbers as a function of the energy of primary photons. Pavlinskii, G. *Journal of Analytical Chemistry*. Jan2016, Vol. 71 Issue 1, p22-26. 5p. DOI: [10.1134/S106193481512014X](#).

Effectiveness of activated carbon disk for the analysis of iodine in water samples using wavelength dispersive X-ray fluorescence spectrometry. Lee, Junseok; An, Jinsung; Kim, Joo-Ae; Yoon, Hye-On. *Chemosphere*. Jan2016, Vol. 142, p72-76. 5p. DOI: [10.1016/j.chemosphere.2015.06.017](#).

Multi-elemental analysis of pharmaceuticals derived from plant seeds by energy dispersive X-ray fluorescence spectrometry. Al-Omari, S.; Mubarak, A. A.; Al-Noaimi, M.; Afaneh, F.; Aqili, A.; Hamarneh, I.; Mustapha, N. *Instrumentation Science & Technology*. 2016, Vol. 44 Issue 1, p98-113. 16p. DOI: [10.1080/10739149.2015.1057845](#).

Identification of pigments in different layers of illuminated manuscripts by X-ray fluorescence mapping and Raman spectroscopy. Mosca, S.; Frizzi, T.; Pontone, M.; Alberti, R.; Bombelli, L.; Capogrosso, V.; Nevin, A.; Valentini, G.; Comelli, D. *Microchemical Journal*. Jan2016, Vol. 124, p775-784. 10p. DOI: [10.1016/j.microc.2015.10.038](#).

Determination of sulfur in soil and plant media using wavelength dispersive X-ray fluorescence spectrometry as a tool for assessment of chemical spills. Kim, Youn-Tae; Lee, Junseok; Yoon, Hye-On; Woo, Nam-Chul. *Microchemical Journal*. Jan2016, Vol. 124, p594-599. 6p. DOI: [10.1016/j.microc.2015.09.010](#).

Calcium and Phosphorus Detection Using Benchtop Versus Handheld X-ray Fluorescence Spectrometers. Kuzel, Aaron R.; Christensen, Angi M.; Marvin, Susan M. *Journal of Forensic Sciences*. Jan2016 Supplement, Vol. 61, pS190-S192. 3p. DOI: [10.1111/1556-4029.12951](#).

X-ray micro-computed tomography (μ CT) for non-destructive characterisation of food microstructure. Schueto, Letitia; Williams, Paul; du Plessis, Anton; Manley, Marena. *Trends in Food Science & Technology*. Jan2016, Vol. 47, p10-24. 15p. DOI: [10.1016/j.tifs.2015.10.016](#).

Elemental analysis-aided Raman spectroscopic studies on Chinese cloisonné wares and painted enamels from the Imperial Palace. Su, Yan; Qu, Liang; Duan, Hongying; Tarcea, Nicolae; Shen, Aiguo; Popp, Jürgen; Hu, Jiming. *Spectrochimica Acta Part A: Molecular & Biomolecular Spectroscopy*. Jan2016, Vol. 153, p165-170. 6p. DOI: [10.1016/j.saa.2015.08.005](#).

An inverse routine to predict residual stress in sheet metal. Abvabi, A.; Rolfe, B.; Hodgson, P.D.; Weiss, M. *Materials Science & Engineering: A*. Jan2016, Vol. 652, p99-104. 6p. DOI: [10.1016/j.msea.2015.11.077](#).