



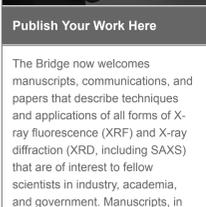
**Elemental analysis of solids, liquids, powders, alloys and thin films**



**Supermini200**

As the world's only high-power benchtop sequential wavelength dispersive X-ray fluorescence (WDXRF) spectrometer for elemental analysis of oxygen (O) through uranium (U) of almost any material, the Rigaku Supermini200 uniquely delivers low cost-of-ownership (COO) with high resolution and lower limits-of-detection (LLD). **For more >**

**Interested in publishing your work in The Bridge?**



**Publish Your Work Here**

The Bridge now welcomes manuscripts, communications, and papers that describe techniques and applications of all forms of X-ray fluorescence (XRF) and X-ray diffraction (XRD, including SAXS) that are of interest to fellow scientists in industry, academia, and government. Manuscripts, in PDF format, are only accepted with the understanding that they are not commercial in nature. Authors are responsible for all statements made in their work. If illustrations or other material in a manuscript have been published previously, the author is responsible for obtaining permission to republish. Please send copy to the editor at [Rigaku.newsletter@Rigaku.com](mailto:Rigaku.newsletter@Rigaku.com)

**Benchtop chemical crystallography system for 3D small molecule structure determination**



**XtaLAB mini II**

The Rigaku XtaLAB mini II benchtop X-ray crystallography system is a compact single crystal X-ray diffractometer designed to produce publication-quality 3D structures. The perfect addition to any synthetic chemistry laboratory, the XtaLAB mini II will enhance research productivity by offering affordable structure analysis capability without the necessity of relying on a departmental facility. With the XtaLAB mini II, you no longer have to wait in line to determine your structures. Instead your research group can rapidly analyze new compounds as they are synthesized in the lab. **For more >**

**Video of the Month**



**SACLA Magnifies World's Smallest Object – X-ray Free Electron Laser**

SACLA, pronounced (Sa-Ku-Ra), is the free-electron laser, or X-FEL in Japan, embedded in the SPring-8 accelerator and synchrotron complex. Operational since 2011, it is the brightest X-ray source of the world.

This video introduces the 700 meter long X-ray laser facility SACLA, where things that are a billionth of a millimeter become visible. This feat is made possible with a powerful X-ray laser. The electrons are drastically accelerated until a light that is a hundred million times brighter than sunlight is produced. This makes it possible for scientists to observe things that were once limited to speculation. A collection of Japan's original and sophisticated technologies was used to create SACLA, a giant microscope that can reveal objects on the atomic level. **Watch video >**

**Conferences and Workshops**



**Join Rigaku at future meetings**

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

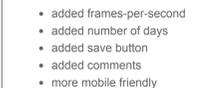
**PITTCON 2017**  
Chicago, Illinois, USA  
March 5 – 9, 2017

**AWPA 2017**  
Las Vegas, Nevada, USA  
April 9 – 11, 2017

**MRO Americas 2017**  
Orlando, Florida, USA  
April 25 – 27, 2017

**See the complete list >**

**Useful link of the Month**



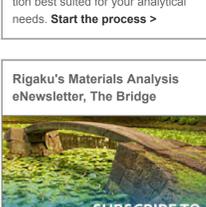
**Time Calculator**

Time Calculator is perfect for video or presentations. Functions include: time (orig), time\_2, time diff, date/time diff, date/time card, interval, splits and pace. Recent updates:

- added frames-per-second
- added number of days
- added save button
- added comments
- more mobile friendly

**For more calculator >**

**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**

The leading U.S.-based scientific instrumentation conference runs from March 5th to 9th at McCormick Place in Chicago.

While formally called "The Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy," most people now simply call it PITTCON. Please come by our booth #3512 and see the latest X-ray Fluorescence (XRF) and X-ray Diffraction (XRD) products.

Our featured *Rigaku Journal* article the month covers the winner of the 2016 Nobel Prize in Physiology or Medicine. The laureate is Professor Yoshinori Osumi of the Tokyo Institute of Technology, who received the award for the discovery of autophagy.



Scenic images from Harvard Parker State Forest in Andover, MA are a quick drive from Rigaku Analytical Devices located in Wilmington, MA. Pictures by Kenichi Yaota.

A special report on the Australian X-Ray Analytical Association (AXAA) 2017 workshop is included for your edification. Application papers are included for XRD, WDXRF, EDXRF and RAMAN techniques.

In the book review this month, acclaimed author Brian Christian and cognitive scientist Tom Griffiths show how the simple, precise algorithms used by computers can also untangle very human questions. The video topic returns to tech in Japan, with a spotlight on the SACLA free-electron laser, or X-FEL. 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 Rigaku Journal Article**

**The 2016 Nobel Prize in Physiology or Medicine**

Akihito Yamano and Joseph D. Ferrara, *Rigaku Corporation and Rigaku Americas Corporation*

The Nobel Prize in Physiology or Medicine was awarded to a Japanese scientist for the second year in a row for 2016. The laureate is Professor Yoshinori Osumi of the Tokyo Institute of Technology who received the award for the discovery of autophagy. Generally speaking, knowledge of autophagy is limited to researchers in biology related fields, therefore the achievement of Professor Osumi may not be understood immediately as compared to the work by Professor Satoshi Omura discovering Ivermectin which prevents blindness in over 300,000 people every year. **For more >**

**Australian X-Ray Analytical Association**

**Report on AXAA 2017**

Reported by Dr. Cameron Chai, Marketing Communications Manager, AXT

The Australian X-Ray Analytical Association Workshop, Conference and Exhibition is the premiere event for the analytical X-ray community in the region. It is held every two years and hence it is imperative that we are well represented at this event. AXT, in conjunction with Rigaku and Rigaku Oxford Diffraction, took out a gold sponsorship package and were well represented throughout the entire event, which also served as the launching pad for "The Unfair Advantage" marketing program. **Full report >**

**XRD Application Note**

**X-Ray Diffraction Analysis of Abrasives in Household Cleaning Products**

AXT Pty Ltd (AXT)

Household cleaning products come in different forms, from aerosols to gels and creams through to pastes. They may contain a plethora of chemicals designed to tackle various tasks from disinfecting to removing stains and grease, as well as chemicals such as surfactants, polishes and detergents. In this study we examined three common household cleaning products using X-ray diffraction to determine what crystalline materials (if any) were present. **For more >**

**Application of Integrated X-ray Powder Diffraction Software: PDXL**

**Solid-State Photodimerization of Methoxyazachalcone**

Rigaku Corporation

The solid state photodimerization of alkenes has attracted considerable attention in synthetic organic photochemistry because it can afford products unobtainable in solution reactions. Despite its significant synthetic potential, controlling crystal packing modes is generally a difficult issue. **For more >**

**WDXRF Application Note**

**Sulfur Analysis in Petroleum Products by WDXRF According to ASTM D2622-10**

Rigaku Corporation

Crude oil contains sulfur in concentration from 0.5 mass% to 5.0 mass% typically, and control of the level of sulfur in refinery intermediates and final products is critical in the refinery. Sulfur in petroleum-based fuels contributes to atmospheric pollution; therefore, sulfur content in fuels, especially in automobile fuels, is strictly controlled. Sulfur also causes damage to facilities such as catalysts in refinery processes. Therefore, control of sulfur content is very important in the petroleum industry from the standpoints of both environment and production cost. **For more >**

**EDXRF Application Note**

**Academia & Teaching**

Applied Rigaku Technologies

XRF has become a popular analytical technique in industry around the world, as well as in academia for teaching and basic research. The technique is simple, fast and non-destructive. Use Rigaku EDXRF systems from Applied Rigaku Technologies in Austin, Texas in such disciplines as chemistry, material sciences, physics and geology. Rigaku EDXRF systems are also valuable tools in basic research for elemental spectroscopic analysis, as well as industrial process control. **For more >**

**Raman Featured Article**

**Detection of counterfeit stevia products using a handheld Raman spectrometer**

Rigaku Analytical Devices

Stevia is rapidly gaining popularity, partially because it is a safer sweetener alternative for diabetic patients. Therefore, counterfeit stevia production has increased and continues to be a concern. Handheld Raman spectroscopy is a proven technique for identification of a variety of substances. The results of this study demonstrate that handheld Raman spectroscopy can be used to accurately identify counterfeit stevia. **For more >**

**Algorithm to Live By**

**Scientific Book Review**

**Algorithms to Live By: The Computer Science of Human Decisions: Brian Christian and Tom Griffiths**

I came across this title in the list of books Amazon thought I might like. It sat in my "to read" pile for a couple of months until I finally read it over the holidays. It is the most fun self-help book I have read in quite a while. The authors, Brian Christian and Tom Griffiths, are both experts in cognitive science. Christian has published articles in *The Wall Street Journal*, *The Atlantic*, *Gizmodo*, and *Cognitive Science*, to name a few places. Griffiths is the director of the Computational Cognitive Science Lab at UC Berkeley. **Read full review >**

**Material Analysis in the News**

**News for February 2017**

**February 2, 2017.** Takayuki Iwasaki, Mutsuko Hatano and colleagues at the Tokyo Institute of Technology, the Japan Science and Technology Agency (JST) and Toshiharu Makino at the National Institute of Advanced Industrial Science and Technology (AIST) report a **new method for sensing electric fields at the interior of operating semiconductor** devices. The technique exploits the response of an artificially induced single electron spin to variations in its surrounding electric field.

**February 2, 2017.** US scientists who analysed the energy spectrum of X-rays gathered by NASA's Chandra satellite claim that a small but distinctive signal in X-rays from the Milky Way could be key to **proving the existence of dark matter**.

**February 6, 2017.** A giant **black hole ripped apart a nearby star** and then continued to feed off its remains for close to a decade, according to research. This black hole meal is more than 10 times longer than any other previous episode of a star's death.

**February 7, 2017.** An international team led by researchers at Nagoya University has **identified a new type of solar event and dated it to the year 5480 BC**; they did this by measuring carbon-14 levels in tree rings, which reflect the effects of cosmic radiation on the atmosphere at the time. They have also proposed causes of this event, thereby extending knowledge of how the sun behaves.

**February 7, 2017.** NASA scientist William Zhang has created and proven a technique for manufacturing lightweight, high-resolution X-ray mirrors using silicon – a material commonly associated with computer chips. Data shows that **single-crystal silicon works exceptionally well as an X-ray optic**.

**February 8, 2017.** Layered ruthenate Ca<sub>2</sub>RuO<sub>4-y</sub> **ceramic shrinks by a record-breaking 6.7% when heated**. Japanese researchers based at Nagoya University discovered this ceramic material that contracts on heating by more than twice the previous record-holding material.

**February 10, 2017.** Scientists have invented a new kind of **thin material that can cool a surface** against the heat of the sun without using energy or typical air conditioning. The glass-polymer hybrid material measures just 50 µm thick—slightly more than aluminum foil—and can be manufactured cheaply.

**February 14, 2017.** Following a false alarm in 2004, two groups report what could be the first observation of **supersolids**, a theoretically predicted state of matter that is both a superfluid and a solid at the same time.

**February 20, 2017.** Drops of a **water–alcohol mixture exploding** into millions of tiny droplets have been observed by Etienne Reyssat and colleagues at the Institute of Industrial Physics and Chemistry in Paris. The explosions occur when the liquid is placed on a layer of oil. The physicists say that the process is driven by a combination of evaporation, surface tension and fluid flow.

**February 21, 2017.** Researchers at Berkeley Lab for NASA Ames Research Center are exploring next-generation **spacecraft materials at the microscale using an X-ray technique that produces 3-D images**. This work could help ensure future spacecraft survive the rigors of otherworldly atmospheres.

**February 21, 2017.** International **scientific collaboration more than doubled worldwide between 1990 and 2015**, according to new research led by Caroline Wagner, an Ohio State University science and technology policy professor. Her work revealed that the number of country author scientific papers with collaborators from more than one country rocketed from 10% to 25% during those 15 years.

**February 22, 2017.** Scientists at the Earth-Life Science Institute at the Tokyo Institute of Technology report **unexpected discoveries about the Earth's core**. The findings include insights into the source of energy driving the Earth's magnetic field, factors governing the cooling of the core and its chemical composition, and conditions that existed during the formation of the Earth.

**Recent Scientific Papers of Interest**

**Papers for February 2017**

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

**Characterization of Nanocellulose Using Small-Angle X-ray, and Dynamic Light Scattering Techniques.**

Yimin Mao; Kai Liu; Chengbo Zhan; Lihong Geng; and Benjamin Chu; Hsiao, Benjamin S. *Journal of Physical Chemistry B*. 2/16/2017, Vol. 121 Issue 6, p1340-1351. 12p. DOI: 10.1021/acs.jpcc.6b11425.

**Quantifying covalent interactions with resonant inelastic soft X-ray scattering: Case study of Ni<sup>2+</sup> aqua complex.**

Kunnsk, K.; Josefsson, I.; Schreck, S.; Quevedo, W.; Miedema, P.S.; Teichert, S.; de Groot, F.M.F.; Föhlisch, A.; Odellius, M.; Wernet, Ph. *Chemical Physics Letters*. Feb2017, Vol. 669, p196-201. 6p. DOI: 10.1016/j.cpl.2016.12.046.

**In situ observation of γ-ZrH<sub>2</sub> formation by X-ray diffraction.**

Maimaitiyili, T.; Bjerkén, C.; Steurer, A.; Wang, Z.; Daniels, J.; Andrieux, J.; Blomqvist, J.; Zanellato, O. *Journal of Alloys & Compounds*. Feb2017, Vol. 695, p3124-3130. 7p. DOI: 10.1016/j.jallcom.2016.11.337.

**Monte Carlo modeling of neutron diffraction results and partial radial distribution functions from computer simulations.**

Steininger, Zsuzsanna; Jovánki, Pál; Pusztai, László. *Journal of Molecular Liquids*. Feb2017, Vol. 228, p19-24. 6p. DOI: 10.1016/j.molliq.2016.09.068.

**X-ray diffraction analysis of residual stresses in textured ZnO thin films.**

Dobročka, E.; Novák, P.; Bůc, D.; Harmatha, L.; Murin, J. *Applied Surface Science*. Feb2017, Vol. 395, p16-23. 8p. DOI: 10.1016/j.apsusc.2016.06.060.

**An X-ray diffraction and Raman spectroscopy investigation of AlGaIn epi-layers with high Al composition.**

Wang, Shuchang; Zhang, Xiong; Dai, Qian; Feng, Zhe; Chuan; Cui, Yiping. *Optik - International Journal for Light & Electron Optics*. Feb2017, Vol. 131, p201-206. 6p. DOI: 10.1016/j.ijleo.2016.11.079.

**Application of the particle swarm optimization method for the analysis of wide-angle X-ray diffraction curves of semicrystalline polymers.**

Rabiej, Malgorzata. *Journal of Applied Crystallography*. Feb2017, Vol. 250 Issue 1, p221-230. 9p. DOI: 10.1107/S160057671601983X.

**Nondestructive separation of residual stress and composition gradients in thin films by angle- and energy-dispersive X-ray diffraction. I. Theoretical concepts.**

Klaus, Manuela; Genzel, Christian. *Journal of Applied Crystallography*. Feb2017, Vol. 250 Issue 1, p252-264. 12p. DOI: 10.1107/S1600576716020598.

**Modelling of glass-like lead carbon structure and its experimental verification by neutron and X-ray diffraction.**

Jurkiewicz, K.; Duber, S.; Fischer, H. E.; Borian, A. *Journal of Applied Crystallography*. Feb2017, Vol. 250 Issue 1, p36-48. 12p. DOI: 10.1107/S1600576716017660.

**CADEM: calculate X-ray diffraction of epitaxial multilayers.**

Komar, Paulina; Jakob, Gerhard. *Journal of Applied Crystallography*. Feb2017, Vol. 250 Issue 1, p288-292. 4p. DOI: 10.1107/S1600576716018379.

**The ammonium ion in a silicate under compression: infrared spectroscopy and powder X-ray diffraction of NH<sub>4</sub>AlSi<sub>3</sub>O<sub>9</sub>-buddingtonite to 30 GPa.**

Vennari, Cara; O'Bannon, Earl; Williams, Quentin. *Physics & Chemistry of Minerals*. Feb2017, Vol. 44 Issue 2, p149-161. 13p. DOI: 10.1007/s00269-016-0844-3.

**Order of <sup>163</sup>Tm<sup>4+</sup> in a Ti-rich calcium amphibole from Kaersut, Greenland: a combined X-ray and neutron diffraction study.**

Diego Gatta, G.; McIntyre, Garry; Oberti, Roberta; Hawthorne, Frank. *Physics & Chemistry of Minerals*. Feb2017, Vol. 44 Issue 2, p83-94. 12p. DOI: 10.1007/s00269-016-0839-0.

**A solid-state NMR and X-ray powder diffraction investigation of the binding mechanism for self-healing cementitious materials design: The assessment of the reactivity of sodium silicate based systems.**

Irico, S.; Bovio, A. G.; Paul, G.; Boccaleri, E.; Gastaldi, D.; Marchese, L.; Buzzzi, L.; Canonico, F. *amp*. Feb2017, Vol. 76, p57-63. 7p. DOI: 10.1016/j.cemconcomp.2016.11.006.

**Non-destructive identification of unknown minor phases in polycrystalline bulk alloys using three-dimensional X-ray diffraction.**

Yang, Yiming; Xu, Liang; Wang, Yudan; Du, Guohao; Yang, Sam; Xiao, Tiejiao. *Materials Characterization*. Feb2017, Vol. 124, p206-214. 9p. DOI: 10.1016/j.matchar.2016.12.025.

**Depth sensitive X-ray diffraction as a probe of buried half-metallic inclusions.**

Burrows, C. W.; A. Hase, T. P.; Ashwin, M. J.; Mousley, P. J.; Bell, G. R. *Physica Status Solidi (B)*. Feb2017, Vol. 254 Issue 2, p/n/a-n/a. 6p. DOI: 10.1002/psb.201600543.

**Crystal structure of trirubidium citrate from laboratory X-ray powder diffraction data and DFT comparison.**

Rammohan, Alagappa; Kaduk, James A. *Acta Crystallographica: Section E*. Feb2017, Vol. 73 Issue 2, p250-253. 9p. DOI: 10.1107/S2056989017001086.

**Coherent 3D nanostructure of γ-Al<sub>2</sub>O<sub>3</sub>: Simulation of whole X-ray powder diffraction pattern.**

Pakharukova, V.P.; Yatsenko, D.A.; Gerasimov, E. Yu.; Shalygin, A.S.; Martynov, O.N.; Tsybulya, S.V. *Journal of Solid State Chemistry*. Feb2017, Vol. 246, p284-292. 9p. DOI: 10.1016/j.jssc.2016.11.032.

**Laboratory Setup for Scattering-Free Grazing Incidence X-ray Fluorescence.**

Baumann, J.; Herzog, C.; Spanier, M.; Grötzsch, D.; Lühl, L.; Witte, K.; Jonas, A.; Günther, S.; Förste, F.; Hartmann, R.; Huth, M.; Kolot, D.; Steigenhöfer, D.; Krämer, M.; Holz, T.; Dietsch, R.; Strüder, L.; Känggöser, B.; Mantouvalou, I. *Analytical Chemistry*. 2/7/2017, Vol. 89 Issue 3, p1965-1971. 7p. DOI: 10.1021/acs.analchem.6b04449.

**Polychromy in Africa Proconsularis: Investigating Roman statues using X-ray fluorescence spectroscopy.**

Kopczynski, Noémie; de Vigniere, Laurence; Neri, Elisabetta; Nasr, Nesrine; Walter, Philippe; Bejaoui, Fathi; Baratte, François. *Antiquity*. Feb2017, Vol. 91 Issue 355, p139-154. 16p. DOI: 10.15184/aaq.2016.250.

**George de Hevesy (1885-1966): discoverer of hafnium, founder of radioanalytical chemistry and X-ray fluorescence analysis and father of nuclear medicine.**

Niese, Siegfried. *Journal of Radioanalytical & Nuclear Chemistry*. Feb2017, Vol. 311 Issue 2, p1035-1041. 7p. DOI: 10.1007/s10967-016-4922-2.

**Elemental analysis of various biomass solid fractions in biorefineries by X-ray fluorescence spectrometry.**

Le, Duy Michael; Sørensen, Hanne R.; Meyer, Anne S. *Biomass & Bioenergy*. Feb2017, Vol. 97, p70-76. 7p. DOI: 10.1016/j.biombioe.2016.12.018.

**Spectrum reconstruction method based on the detector response model calibrated by x-ray fluorescence.**

Ruizhe Li; Liang Li; Zhiqiang Chen. *Physics in Medicine & Biology*. 2/7/2017, Vol. 62 Issue 3, p1-1p. DOI: 10.1088/1361-6560/62/3/1032.

**Spectrophotometric determination of gold(III) in forensic and pharmaceutical samples and results complemented with ICP AES and EDXRF analysis.**

Nagaraja, Vani; Kumar, M. Kiran; Giddappa, Nagendrapa. *Spectrochimica Acta Part A: Molecular & Biomolecular Spectroscopy*. Feb2017, Vol. 173, p407-417. 11p. DOI: 10.1016/j.saa.2016.09.045.