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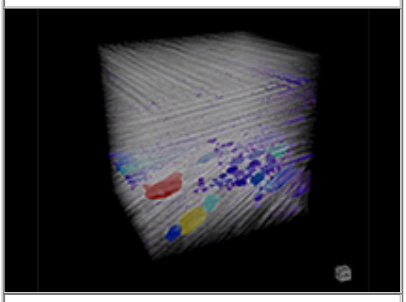
Rigaku
Leading With Innovation

X-ray Diffraction, Fluorescence & Imaging

Upcoming Webinar



X-ray Computed Tomography for Materials Science

Join us on June 26th for the second webinar on X-ray Computed Tomography for Materials Science. Learn about the principles of image segmentation and how it is applied to X-ray CT images. Find out how to extract quantitative values such as volume percentage, particle size or coating thickness distribution from segmented three-dimensional images of various materials.
For more information >

Wavelength dispersive X-ray fluorescence spectrometer

Welcome

June is another busy month for Rigaku with about 23 events planned around the globe. Just to highlight a few, we will be at Canadian Chemistry Conference (Quebec, Booth 212), ACS Central – CERM 2019 (Midland, MI), ACS NW – NORM 2019 (Portland, OR) and ACS NE – NERM 2019 (Saratoga Springs, NY). A complete list of all upcoming events can be found here.

In late June, we invite you to join us for the second in a series of Webinars on X-ray CT for Materials Science. The second webinar will focus on image processing of CT data and how specific methods can be used to better extract quantitative information for materials science applications. Traditional thresholding, as well as machine and deep leaning artificial intelligence methods will be presented. Register today to learn more about these techniques and potential applications.

The featured article this month discusses the SQL database within the SmartLab Studio II software suite. This month's featured XRD technical note covers phase identification and orientation analysis for a thin film SOFC material using a 2D detector. The TXRF application note explores analysis of toxic trace elements in wastewater. The WDXRF brief describes analysis of used automobile catalysts while the EDXRF brief details analysis of lead in gasoline.

The book review covers *Mama's Last Hug: Animal Emotions and What They Tell Us about Ourselves* by Frans de Waal. Check out the interesting symposium video about the future of Japanese science. And, as always, the news and papers sections are at the bottom of the page for a taste of the latest developments in materials science.

R.C. Tisdale, Ph.D. – Editor

Featured Article

Do you still save your data as a file?
Rigaku Corporation

The Rigaku SQL database provided with the SmartLab Studio II software, makes data management much easier! The Rigaku SQL DB centralizes all your measurement and analysis result data. You simply have to save all your data in the Rigaku SQL DB. You can extract data from the database as needed. You can, of course, create folders to group data in the Rigaku SQL DB. **Full article >**

XRD Application Note

Phase identification and orientation analysis for a thin film SOFC material using a 2D detector

ZSX Primus / SSLS

Rigaku's Smart Sample Loading System (SSLS) adds a new dimension of flexibility to the ZSX Primus WDXRF spectrometer. For sample types that are amenable to such a process, a vacuum chuck can be used to load samples into pre-loaded sample holders. This sample loading system has two important consequences: time is saved by the operator since they are no longer required to manually load each sample in a sample cup and the number of samples that can be held on the sample deck is increased significantly. **For more >**

Interested in publishing your work in The Bridge?

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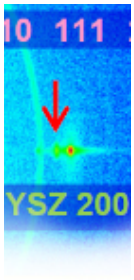
The Bridge now welcomes manuscripts, communications, and papers that describe techniques and applications of all forms of X-ray fluorescence (XRF) and X-ray diffraction (XRD, including SAXS) that are of interest to fellow scientists in industry, academia, and government. Manuscripts, in PDF format, are 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 email copy to the editor.

Benchtop chemical crystallography system for 3D



Rigaku Corporation

Thin films formed on substrates show various crystal phase and orientations depending on the materials and manufacturing method. Therefore, phase identification is sometimes difficult by ordinary X-ray diffraction (XRD) measurement. The diffraction image using a 2D detector reveals the lattice constant and the orientation for each crystal phase readily because the diffraction intensity distribution in the 2θ direction and the distribution of the crystal orientation in the χ direction are observed simultaneously. **For more >**

TXRF Application Note

Analysis of Toxic Trace Elements in Wastewater

Rigaku Corporation

Toxic elements such as Cd, As, Pb are contained in the wastewater drained from industrial factories. Organic and inorganic components in wastewater cause physical interference in induced coupled plasma optical emission spectrometry (ICP-OES) analysis. Therefore, acid decomposition or desalting processes of matrix components in wastewater are needed in ICP-OES analysis. On the other hand, total reflection X-ray fluorescence (TXRF) analysis has an advantage in that there is less effect of matrix components compared to ICP-OES. In this report, the analysis of toxic trace elements in wastewater by TXRF is introduced. **For more >**

WDXRF Application Note

Pt, Rh and Pd Analysis of Used Automobile Catalyst

Rigaku Corporation

The number of automobiles in developing nations has increased dramatically in recent years, which has caused serious air pollution in those countries. In developed nations, tight control on exhaust emission is already being enforced while emission control standards in developing countries are still lax. In the future, emission control standards must become tighter throughout the world. This application note introduces XRF analysis of Pt, Rh and Pd in used automobile catalyst. **For more >**

EDXRF Application Note

The Analysis of Lead in Gasoline by ASTM D5059 Bi IS Method

Applied Rigaku Technologies

This application note details performance for the measurement of lead (Pb) in gasoline as per ASTM D5059 using the Bi internal standard method Part C (ultra-low lead for MoGas, motor gasoline) and Part A (high Pb for AvGas, aviation gasoline). As efforts continue to reduce and remove lead from gasoline fuels around the world, Applied Rigaku Technologies offers EDXRF analyzer NEX QC+ using direct excitation for the measurement of lead by ASTM D5059 as well as many other applications in the petroleum and fuel industries. **For more >**

Book Review

Mama's Last Hug: Animal Emotions and What They Tell Us about Ourselves

By Frans de Waal

Frans de Waal's latest book, *Mama's Last Hug*, derives its name from a singular event. In 2016, an elderly professor named Jan van Hoof visited a dying female chimpanzee named Mama at the Burgers' Zoo in the Netherlands. Van Hoof had

small molecule structure determination

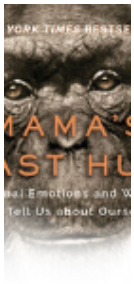
XtaLAB mini II

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

The Future of Japanese Science

2019 marks *Nature's* 150th anniversary. As part of the celebration, they held a symposium on April 4, 2019, at The University of Tokyo. Here is a sneak preview



known Mama for over forty years, having spent many of them studying her behavior and the behavior of her fellow chimpanzees in the zoo's colony.
Read review >

Material Analysis in the News

News for May 2019

May 1, 2019. Japan sent its Hayabusa probe to the asteroid known as Itokawa in 2003. Some seven years later it returned to Earth's surface with a sample of the space rock stowed inside. Those samples have been the subject of much interest in the scientific community, and now a new research paper reveals that the tiny specks of material contain something that could tell us a lot about our own planet: water.

May 1, 2019. A study published in *Nature Geoscience* suggests that the moon was forged from the fires of an ocean of magma sloshing over baby Earth's surface. If correct, this model may solve a longstanding paradox. The new research, led by Natsuki Hosono of the Japan Agency for Marine-Earth Science and Technology, adds what may be the recipe's missing ingredient.

May 3, 2019. What do catalytic converters, miniature explosives detectors, and scales for weighing nanoscale quantities have in common? These technologies are all enabled by MIT Professor Harry L. Tuller's pioneering research on electroceramics, which are complex materials that exhibit a distinctive variety of electrical, optical, magnetic, ionic, and electronic properties.

May 6, 2019. China has become ranked only second to the U.S. for the quality of its scientific research according to a survey by the Japan Science and Technology Agency (JST). In the study, which assesses countries by their volume of high-quality articles published in 151 science and technology fields between 2015 and 2017, China emerged at the top in 71 fields.

May 7, 2019. An international and interdisciplinary team, including several from the Earth-Life Science Institute (ELSI) at Tokyo Institute of Technology, and the ELSI Origins Network, have reported new estimates for the amount of carbon cycling on a global scale between Earth's crust and mantle. The new finding lowers estimates for the efficiency of carbon subduction by 20% and has important implications for understanding Earth's past and present climate.

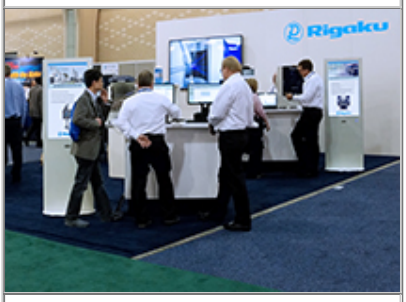
May 7, 2019. Using a molybdenum-based catalyst with samarium as an electron source, researchers in Japan have created a process that produces ammonia more efficiently than the conventional Haber-Bosch process. To improve the efficiency of ammonia production, researchers led by Professor Yoshiaki Nishibayashi at the University of Tokyo, Japan, created a new catalytic method which they called the Samarium-Water Ammonia Production (SWAP) process.

May 8, 2019. Nata de coco may be a delicious dessert, but researchers in Japan have found a way to turn it into a material for optical displays. A team at Osaka University, Japan, has determined the optical parameters of cellulose molecules with unprecedented precision and that cellulose's intrinsic birefringence is powerful enough to be used in optical displays.

of this full-day program.

Japan is a nation with a long tradition of scientific discovery. Building on this tradition, Japan has the opportunity to reinvigorate its primary research and tap into the true potential of its early career researchers. Now is the time for Japanese science and technology to look into the future and focus on building a sustainable and equitable society. By prioritizing the future of humanity and the planet, Japan has the opportunity to become a leading model in the global community and play a key part in advancing Sustainable Development Goals (SDGs). **For more >**

Conferences and Workshops



Join Rigaku at future meetings

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

Canadian Chemistry Conference
Quebec, PQ
June 3 – 7, 2019

ICDD Summer School
Newtown Square, PA, USA
June 3 – 7, 2019

USBTA Technology Training
Virginia Beach, VA, USA
June 4 – 6, 2019

See the complete list >

Useful Link of the Month

May 10, 2019. Predicting when a material will fail under mechanical stress is tricky business. Hence, scientists at the University of Fribourg, Switzerland, and Japan's Hokkaido University sought to develop stress-indicating molecules that can be integrated into polymers and signal damages or excessive mechanical loads optically.

May 14, 2019. Japanese space agency JAXA has been given the all clear from COSPAR to attempt the MMX mission: landing on Mars' largest moon, drill into it, and bring a sample back to Earth without an Andromeda Strain incident. The COSPAR [Committee on Space Research] Planetary Protection Panel recommended to the COSPAR Bureau that the inbound Earth return portion be classified as Planetary Protection Category V, unrestricted Earth Return, and the outbound portion of the MMX mission be classified Planetary Protection Category III.

May 16, 2019. Engineers at the University of Tokyo continually pioneer new ways to improve battery technology. Professor Atsuo Yamada and his team recently developed a material which could significantly extend the life of batteries and afford them higher capacities as well. The work demonstrated a model material – oxygen redox-layered oxide (Na_2RuO_3).

May 16, 2019. Shogo Tachibana, a professor at the University of Tokyo/Japan Aerospace Exploration Agency (JAXA), and his team analyzed the ALMA (Atacama Large Millimeter/submillimeter Array) data for Orion KL Source I, a young massive protostar, and found distinctive radio emissions from aluminum oxide (AlO) molecules. This is the first unambiguous detection of AlO around a young star.

Recent Scientific Papers of Interest

Papers for May 2019

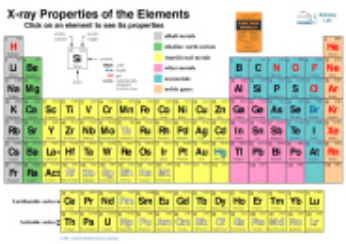
Recent Scientific Papers of Interest is a monthly compilation of material analysis papers appearing in recently released journals and publications. *See below*

Monitoring of Portland cement chemical reaction and quantification of the hydrated products by XRD and TG in function of the stoppage hydration technique. Maciel, Marcel Hark; Soares, Gabriela Simões; Romano, Roberto Cesar de Oliveira; Cincotto, Maria Alba. *Journal of Thermal Analysis & Calorimetry*. May2019, Vol. 136 Issue 3, p1269-1284. 16p. DOI: 10.1007/s10973-018-7734-5.

Thermal reaction studies and prediction of stoichiometry of pyrotechnic compositions using DSC and XRD methods. K, Harisivasri Phanindra; S P, Sivapirakasam; Soni, Pramod; M, Surianarayanan; K R, Balasubramanian. *Thermochimica Acta*. May2019, Vol. 675, p100-106. 7p. DOI: 10.1016/j.tca.2019.03.009.

Mineralogical investigations of Jamaican hematite-rich and goethite-rich bauxites using XRD and solid state ^{27}Al and ^{31}P MAS NMR spectroscopy. Young, Nijole J.; Coley, Michael D.; Greenaway, Anthony M. *Journal for Geochemical Exploration*. May2019, Vol. 200, p54-76. 23p. DOI: 10.1016/j.gexplo.2019.01.010.

XRF-measured rubidium concentration is the best predictor variable for estimating the soil clay content and salinity of semi-humid soils in two catenas. Tóth, Tibor; Kovács, Zsófia Adrienn; Rékási, Márk. *Geoderma*. May2019, Vol. 342, p106-108. 3p. DOI: 10.1016/j.geoderma.2019.02.011.



X-ray Data Booklet

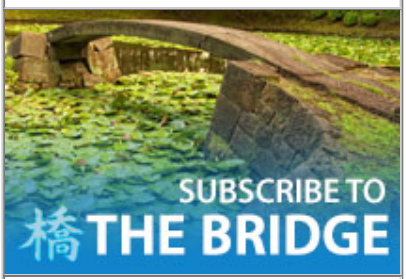
Center for X-ray Optics and Advanced Light Source, *Lawrence Berkeley National Laboratory.* **For more >**

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

Droplet Microfluidics XRD Identifies Effective Nucleating Agents for Calcium Carbonate. Levenstein, Mark A.; Anduix-Canto, Clara; Kim, Yi-Yeoun; Holden, Mark A.; González Niño, Carlos; Green, David C.; Foster, Stephanie E.; Kulak, Alexander N.; Govada, Lata; Chayen, Naomi E.; Day, Sarah J.; Tang, Chiu C.; Weinhausen, Britta; Burghammer, Manfred; Kapur, Nikil; Meldrum, Fiona C. *Advanced Functional Materials*. 5/9/2019, Vol. 29 Issue 19, pN.PAG-N.PAG. 1p. DOI: 10.1002/adfm.201808172.

A 3D free-standing lithiophilic silver nanowire aerogel for lithium metal batteries without lithium dendrites and volume expansion: *in operando* X-ray diffraction. Phattharasupakun, Nutthaphon; Wutthiprom, Juthaporn; Duangdangchote, Salatan; Sawangphruk, Montree. *Chemical Communications*. 5/18/2019, Vol. 55 Issue 40, p5689-5692. 4p. DOI: 10.1039/c9cc01528k.

Effects of phase transformation on properties of alumina ceramic membrane: A new assessment based on quantitative X-ray diffraction (QXRD). Lu, Xingwen; Yang, Jiani; Li, Xiaoyan; Sun, Feiyun; Wang, Fei; Chao, Yuanqing. *Chemical Engineering Science*. May2019, Vol. 199, p349-358. 10p. DOI: 10.1016/j.ces.2018.12.054.

Analysis of theoretical and experimental X-ray diffraction patterns for distinct mordenite frameworks. Sánchez-López, Perla; Antúnez-García, Joel; Fuentes-Moyado, Sergio; Galván, Donald H.; Petranovskii, Vitalii; Chávez-Rivas, Fernando. *Journal of Materials Science*. May2019, Vol. 54 Issue 10, p7745-7757. 13p. 3 Diagrams, 3 Charts, 4 Graphs. DOI: 10.1007/s10853-019-03407-w.

***In situ* high-temperature X-ray diffraction, FT-IR and thermal analysis studies of the reaction between natural hydroxyapatite and aluminum powder.** Mokhtari, A.; Belhouchet, H.; Guermat, A. *Journal of Thermal Analysis & Calorimetry*. May2019, Vol. 136 Issue 4, p1515-1526. 12p. DOI: 10.1007/s10973-018-7812-8.

Structure of the nearest surrounding of ions in aqueous solutions of iron(III) chloride by x-ray diffraction method. Smirnov, Pavel R.; Grechin, Oleg V. *Journal of Molecular Liquids*. May2019, Vol. 281, p385-388. 4p. DOI: 10.1016/j.molliq.2019.02.099.

A new method to trace colloid transport pathways in macroporous soils using X-ray computed tomography and fluorescence macrophotography. Soto-Gómez, Diego; Pérez-Rodríguez, Paula; Vázquez Juíz, Laura; López-Periago, José E.; Paradelo Pérez, Marcos. *European Journal of Soil Science*. May2019, Vol. 70 Issue 3, p431-442. 12p. DOI: 10.1111/ejss.12783.

Energy dispersive X-ray fluorescence determination of Fe in solid powder samples: A quality improvement perspective. Chavan, Trupti A.; Ajith, Nicy; Periyamana Sankaran nampoothiri, Remya Devi; Swain, Kallola Kumar. *XRS: X-ray Spectrometry*. May/Jun2019, Vol. 48 Issue 3, p208-217. 10p. DOI: 10.1002/xrs.3023.

Detection and quantification of heavy metal elements in gallstones using X-ray fluorescence spectrometry. Jaswal, Brij Bir Singh; Rai, Pradeep Kumar; Singh, Tejbir; Zorba, Vassilia; Singh, Vivek Kumar. XRS: X-ray Spectrometry. May/Jun2019, Vol. 48 Issue 3, p178-187. 10p. DOI: 10.1002/xrs.3010.

Methods for the determination of silicon and aluminum in fuel oils and in crude oils by X-ray fluorescence spectrometry. Pedrozo-Peñafiel, Marlin J.; Doyle, Adriana; Mendes, Luiz André N.; Tristão, Maria Luiza B.; Saavedra, Álvaro; Aucelio, Ricardo Q. *Fuel*. May2019, Vol. 243, p493-500. 8p. DOI: 10.1016/j.fuel.2019.01.144.

Improved spectroscopic performance in compound semiconductor detectors for high rate X-ray and gamma-ray imaging applications: A novel depth of interaction correction technique. Veale, M.C.; Jones, L.L.; Thomas, B.; Seller, P.; Wilson, M.D.; Iniewski, K. *Nuclear*

Crystallography Times, which concentrates on X-ray crystallography. **Join us >**

Instruments & Methods in Physics Research Section A. May2019, Vol. 927, p37-45. 9p. DOI: 10.1016/j.nima.2019.01.045.

X-ray two-wave dynamical diffraction analogue of Talbot effect. M K Balyan. *Journal of Optics*. 5/5/2019, Vol. 21 Issue 5, p1-1. 1p. DOI: 10.1088/2040-8986/ab1409.

Visualizing and measuring gold leaf in fourteenth- and fifteenth-century Italian gold ground paintings using scanning macro X-ray fluorescence spectroscopy: a new tool for advancing art historical research. MacLennan, Douglas; Llewellyn, Laura; Delaney, John K.; Dooley, Kathryn A.; Patterson, Catherine Schmidt; Szafran, Yvonne; Trentelman, Karen. *Heritage Science*. 5/10/2019, Vol. 7 Issue 1, pN.PAG-N.PAG. 1p. DOI: 10.1186/s40494-019-0271-0.

X-ray Raman scattering: a building block for nonlinear spectroscopy. Rohringer, Nina. *Philosophical Transactions of the Royal Society A: Mathematical, Physical & Engineering Sciences*. 5/20/2019, Vol. 377 Issue 2145, p1-15. 15p. DOI: 10.1098/rsta.2017.0471.

Crude oil analysis by X-ray scattering technique. Oliveira, Davi F.; Silva, Ana Cecília; Figueiredo, Willians P.; Anjos, Marcelino J.; Lopes, Ricardo T. *XRS: X-ray Spectrometry*. May/Jun2019, Vol. 48 Issue 3, p195-201. 7p. DOI: 10.1002/xrs.3015.

Carbide derived carbons investigated by small angle X-ray scattering: Inner surface and porosity vs. graphitization. Härk, Eneli; Petzold, Albrecht; Goerigk, Günter; Risse, Sebastian; Tallo, Indrek; Härmas, Riinu; Lust, Enn; Ballauff, Matthias. *Carbon*. May2019, Vol. 146, p284-292. 9p. DOI: 10.1016/j.carbon.2019.01.076.

The structural relaxation study of Zr–Cu–Ni–Al metallic glass during heating by small-angle X-ray scattering. Liu, Yi; Pan, Jie; Li, Li; Cheng, Honghui. *Applied Physics A: Materials Science & Processing*. May2019, Vol. 125 Issue 5, pN.PAG-N.PAG. 1p. DOI: 10.1007/s00339-019-2611-z.

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