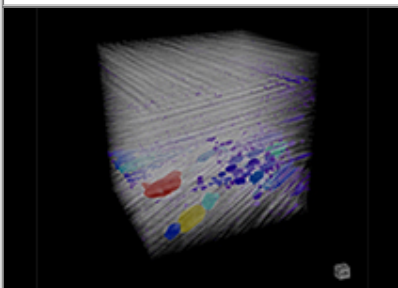




Upcoming Webinar



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 >

NEX DE – High-resolution elemental analysis of sodium (Na) through uranium (U)



Fast Silicon Drift Detector (SDD) EDXRF spectrometer

Welcome

May is a big month for Rigaku with about 17 events planned around the globe. Just to highlight a few, we will be at Ceramics Expo 2019 (Cleveland, Booth 838), Control 2019 (Stuttgart, Booth 4313-1), AAPG (San Antonio, Booth 1224) and PEFTEC 2019 (Rotterdam, Booth 62 & 63). 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. Well known in the medical arena, X-ray Computed Tomography and the technology behind it has advanced rapidly, putting the analysis of all types of materials within easy reach. Register today to learn more about this technique and its potential applications.

The featured *Rigaku Journal* article this month introduces the new CT Lab HX, a high-performance benchtop X-ray micro CT system with the most powerful X-ray source in its class (130 kV, 39W). This month's featured XRD technical note discusses the limit of quantification (LOQ) of trace impurities in active pharmaceutical ingredients (APIs). The WDXRF application note explores semi-quantitative analysis of recycled solid fuel. The EDXRF brief covers the analysis of nickel laterite ore.

The book review covers *The Big Nine: How the Tech Titans and Their Thinking Machines Could Warp Humanity* by Amy Webb. Check out the interesting video about the newly imaged black hole at the center of a galaxy called M87. 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

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Featured Rigaku Journal Article

3D X-ray micro CT – CT Lab HX

Rigaku Corporation



Recently, products development, failure analysis of electronic devices and quality control requirements have increased demand for X-ray CT 3D imaging. Powerful CPUs and GPUs have greatly improved computer processing throughput for this technique. The CT Lab HX is a high-performance benchtop X-ray micro CT system with the most powerful X-ray source in its class (130 kV, 39W). This compact yet powerful micro CT system can provide three dimensional X-ray images of a wide variety of samples such as printed circuit boards (PCB's), batteries, food, drugs, medical device, bones, minerals, ceramics, and light metals. **Full article >**

XRD Application Note

Limit of Quantification (LOQ) of Trace Impurities in Active Pharmaceutical Ingredients (APIs) via the Direct Derivation Method

As a premium high-performance benchtop EDXRF elemental analyzer, the Rigaku NEX DE delivers wide elemental coverage with an easy-to-learn Windows®-based QuantEZ software. Non-destructively analyze from Na through U in almost any matrix, from solids and alloys to powders, liquids and slurries. **For more >**

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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 small molecule structure determination



Rigaku Corporation

Quantification of a trace amount of polymorphic impurities is critical especially in the quality control of APIs. Conventional quantitative analysis by XRD requires calibration curve preparation, reference intensity ratio (RIR) or crystal structure (Crystallographic Information File, CIF). However, the materials of APIs are often missing from the database. Therefore, their quantification is not straightforward. Rigaku has developed a novel quantitative analysis method called "Direct Derivation (DD)." **For more >**



WDXRF Application Note

Semi-quantitative Analysis of Recycled Solid Fuel with Benchtop WDXRF "Supermini200"

Rigaku Corporation

Recycling has become a term that cannot be ignored in the industrial world. New technologies utilizing fly ash of urban refuse as cement material (chemical recycling) and converting urban refuse into solid fuel (thermal recycling) have attracted a lot of attention. This application note demonstrates analysis results of refuse derived fuel (RDF) by the semi-quantitative analysis program "SQX" with the benchtop WDXRF spectrometer, Supermini200. **For more >**



EDXRF Application Note

The Analysis of Nickel Laterite Ore

Applied Rigaku Technologies

Laterite ore is the source of 70% of the global supply of nickel. During mining a fast and simple means of determining and monitoring oxide and elemental composition of the ore material is important for grading and preparing feedstock for further processing. Applied Rigaku technologies offers EDXRF systems ideally suited for analyzing elemental and oxide composition throughout mining operations and processing operations. **For more >**

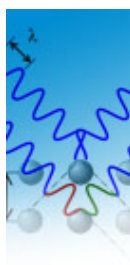


Book Review

The Big Nine: How the Tech Titans and Their Thinking Machines Could Warp Humanity

By Amy Webb

Forget Stephen King. If you want to read something nightmare-inducing, pick up Amy Webb's newest book, *The Big Nine*. Webb, a quantitative futurist and professor of strategic foresight at NYU's Stern School of Business, presents a vision of humanity's future that doesn't have much humanity in it. It is scary—real world scary, not vampires and haunted hotels scary. **Read review >**



Material Analysis in the News

News for April 2019

April 1, 2019. Scientists in Japan have developed a complex hydride lithium superionic conductor that could result in [all-solid-state batteries with the highest energy density to date](#). Researchers led by Professor Shin-ichi Orimo of Tohoku University, Japan, have developed a substance that exhibits high ionic conductivity and high stability against lithium metal, making it ideal for use in an all-solid-state battery.



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



What does a black hole look like?

“Black holes are by definition hard to photograph. Any depictions you’ve seen of black holes might as well be the stuff of science fiction films. But the Event Horizon Telescope has given us a real picture of a real black hole. It’s a supermassive black hole at the

April 3, 2019. Scientists from the RIKEN Cluster for Pioneering Research in Japan and collaborators have used simulations to show that the photons emitted by [long gamma-ray bursts – one of the most energetic events to take place in the universe](#) – originate in the photosphere, the visible portion of the "relativistic jet" that is emitted by exploding stars.

April 4, 2019. At the Institute of Space and Astronautical Science (ISAS) of Japan Aerospace Exploration Agency (JAXA), Kazuhisa Mitsuda showcases some of the [Japanese Space Agency's recent achievements in the field of X-ray spectroscopy](#) and looks towards an M pixel class X-ray integral field.

April 5, 2019. Japan's Hayabusa2 mission continued its unprecedented explorations by apparently [creating an artificial crater in an asteroid](#), a space exploration first. Officials confirmed that the operation to fire a projectile into asteroid Ryugu went smoothly, though they were still trying to confirm whether a crater had actually been formed.

April 5, 2019. Together with their colleagues from the Russian Academy of Sciences, Moscow State University, South Ural State (National Research) University and Japan's NIMS, researchers from the NUST MISIS have developed a [method to obtain prospective BiCuSeO \(bismuth-copper-selenium-oxygen\) oxyselenide-based thermoelectric materials](#).

April 10, 2019. "We have taken the [first picture of a black hole](#)," said EHT project director Sheperd S. Doeleman of the Center for Astrophysics | Harvard & Smithsonian. "This is an extraordinary scientific feat accomplished by a team of more than 200 researchers." The image reveals the black hole at the centre of Messier 87, a massive galaxy in the nearby Virgo galaxy cluster.

April 11, 2019. Scientists managed to capture the very first direct image of a black hole – and it was all thanks to a graduate at MIT. Three years ago Dr. Katie Bouman, now 29, created an [algorithm that collects data from telescopes across the world](#) to stitch together a photograph of the phenomenon which is 55 million light years away.

April 11, 2019. Researchers at Missouri S&T, led by Dr. Jay Switzer, the Donald L. Castleman/Foundation for Chemical Research Professor of Discovery in Chemistry, have found an [unprecedented, economical method for creating high-performance inorganic thin films](#), or “epitaxial” films, used in the manufacture of semiconductors for flexible electronics, LEDs and solar cells.

April 13, 2019. Researchers from Tokyo Metropolitan University, led by Prof. Yoshikazu Mizuguchi, have found that crystals of a recently discovered [superconducting material, a layered bismuth chalcogenide](#) with a four-fold symmetric structure, shows only two-fold symmetry in its superconductivity. The origin of superconductivity in these structures is not yet well understood; this finding suggests a connection with an enigmatic class of materials known as nematic superconductors and the extraordinary mechanisms by which superconductivity can emerge at easier-to-reach temperatures.

April 23, 2019. Understanding [nonequilibrium phenomena to effectively control them](#) is an outstanding challenge in science and engineering. In a recent study, Trond. I. Andersen and colleagues at the departments of physics, chemistry, materials science and engineering in the USA, Japan and Canada used electricity to drive ultraclean graphene devices out-of-equilibrium and observe the manifested

center of a galaxy called M87. In addition to filling in some blanks on the workings of black holes, this image will serve as yet another test of Einstein's general theory of relativity." (*Science News*, Published on April 10, 2019)

For more >

instability as enhanced current fluctuations and suppressed conductivity at microwave frequencies.



Recent Scientific Papers of Interest

Papers for April 2019

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

Conferences and Workshops



Join Rigaku at future meetings

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

AWA Global Release Liner Industry Conference & Exhibition 2019

Charlotte, NC, USA
May 1 – 3, 2019

Annual Conference of the German Ceramic Society (DKG)

Leoben, Austria
May 5 – 8, 2019

Control 2019

Stuttgart, Germany
May 7 – 10, 2019

See the complete list >

Indexing grazing-incidence X-ray diffraction patterns of thin films: lattices of higher symmetry. Simbrunner, Josef; Hofer, Sebastian; Schrode, Benedikt; Garmshausen, Yves; Hecht, Stefan; Resel, Roland; Salzmann, Ingo. *Journal of Applied Crystallography*. Apr2019, Vol. 52 Issue 2, p428-439. 12p. DOI: [10.1107/S1600576719003029](https://doi.org/10.1107/S1600576719003029).

Reducing the background of ultra-low-temperature X-ray diffraction data through new methods and advanced materials. McMonagle, Charles James; Probert, Michael Richard. *Journal of Applied Crystallography*. Apr2019, Vol. 52 Issue 2, p445-450. 6p. DOI: [10.1107/S1600576719003078](https://doi.org/10.1107/S1600576719003078).

X-Ray powder diffraction – A non-destructive and versatile approach for the identification of new psychoactive substances. Jurásek, Bronislav; Bartunek, Vilém; Huber, Štěpán; Kuchar, Martin. *Talanta*. Apr2019, Vol. 195, p414-418. 5p. DOI: [10.1016/j.talanta.2018.11.063](https://doi.org/10.1016/j.talanta.2018.11.063).

Primordial, thermal, and shock features of ordinary chondrites: Emulating bulk X-ray diffraction using in-plane rotation of polished thin sections. Imae, Naoya; Kimura, Makoto; Yamaguchi, Akira; Kojima, Hideyasu. *Meteoritics & Planetary Science*. Apr2019, Vol. 54 Issue 4, p919-937. 19p. DOI: [10.1111/maps.13257](https://doi.org/10.1111/maps.13257).

Synthesis and Characterization of PVP-Stabilized Palladium Nanoparticles by XRD, SAXS, SP-ICP-MS, and SEM. Walbrück, Katharina; Kuellmer, Fabian; Witzleben, Steffen; Guenther, Klaus. *Journal of Nanomaterials*. 4/17/2019, p1-7. 7p. DOI: [10.1155/2019/4758108](https://doi.org/10.1155/2019/4758108).

Investigating XRF parameters and valence electronic structure of the Co, Ni, and Cu spinel ferrites. Demir, Lütfü; Perisanoglu, Ufuk; Sahin, Mehmet. *Ceramics International*. Apr2019, Vol. 45 Issue 6, p7748-7753. 6p. DOI: [10.1016/j.ceramint.2019.01.078](https://doi.org/10.1016/j.ceramint.2019.01.078).

Multiscale structure of super insulation nano-fumed silicas studied by SAXS, tomography and porosimetry. Benane, Belynda; Baeza, Guilhem P.; Chal, Bruno; Roiban, Lucian; Meille, Sylvain; Olagnon, Christian; Yrieix, Bernard; Foray, Geneviève. *Acta Materialia*. Apr2019, Vol. 168, p401-410. 10p. DOI: [10.1016/j.actamat.2019.02.024](https://doi.org/10.1016/j.actamat.2019.02.024).

Petrographic and XRF analyses of andesitic cut stone blocks at Teotihuacan, Mexico: implications for the organization of urban construction. Murakami, Tatsuya; Boulanger, Matthew T.; Glascock, Michael D. *Archaeological & Anthropological Sciences*. Apr2019, Vol. 11 Issue 4, p1491-1518. 28p. DOI: [10.1007/s12520-018-0619-5](https://doi.org/10.1007/s12520-018-0619-5).

In-situ XRD study of actuation mechanisms in BiFeO₃-K_{0.5}Bi_{0.5}TiO₃-PbTiO₃ ceramics. Li, Yizhe; Chen, Ying; Zhang, Zhenbo; Kleppe, Annette; Hall, David A. *Acta Materialia*. Apr2019, Vol. 168, p411-425. 15p. DOI: [10.1016/j.actamat.2019.02.026](https://doi.org/10.1016/j.actamat.2019.02.026).

Glass-ceramic nanoparticles in the Ag₂O-TeO₂-V₂O₅ system: Antibacterial and bactericidal potential, their structural and extended XRD analysis by using Williamson-Smallman approach. Shahmoradi, Yazdan; Souri, Dariush; Khorshidi, Mehdi. *Ceramics International*. Apr2019, Vol. 45 Issue 5, p6459-6466. 8p. DOI: [10.1016/j.ceramint.2018.12.133](https://doi.org/10.1016/j.ceramint.2018.12.133).

Useful Link of the Month

PreDICT

PreDICT (Phase DICT Tool) is a graphical user interface for the powder diffraction pattern indexing program DCPD 1.0, an implementation of the DCPD 1.0 software for the indexing method.

System Requirements: Windows XP or later, Java Runtime Environment 1.6.0 or higher.

© 2008 and 2009 by RIGAKU, Inc. "None better combination powder diffraction pattern indexing with the indexing method." (Powder 2008, 39, Suppl. 3, pp. S1-S10, DOI: 10.1107/S0022-3748/0800000000000000)

© 2008 and 2009 by RIGAKU, Inc. "Indexing pattern indexing with the indexing method." (*J. Appl. Crystallogr.* 41, 2008, 11, 2172-2173, DOI: 10.1107/S0021-8896/0800000000000000)

© 2008 and 2009 by RIGAKU, Inc. "Indexing powder pattern indexing with the indexing method." (*J. Appl. Crystallogr.* 41, 2008, 11, 2172-2173, DOI: 10.1107/S0021-8896/0800000000000000)

Download .zip

PreDICT

PreDICT (Premier DICvol Tool) is a graphical user interface for the powder diffraction pattern indexing program DICVOL14, an updated version of DICVOL04 based on the dichotomy method. System Requirements are Windows XP or later and Java Runtime Environment (JRE) 8 or higher.

For more >

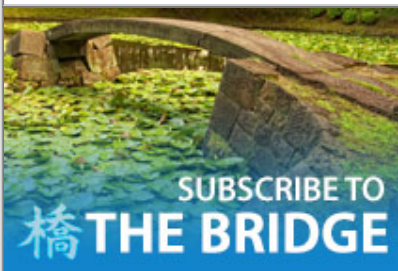
Planning to submit a grant?



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 X-ray crystallography. **Join us >**

Using powder XRD and pair distribution function to determine anisotropic atomic displacement parameters of orthorhombic tridymite and tetragonal cristobalite. Lee, Seungyeol; Xu, Huifang. *Acta Crystallographica: Section B, Structural Science, Crystal Engineering & Materials*. Apr2019, Vol. 75 Issue 2, p160-167. 8p. DOI: [10.1107/S2052520619000933](https://doi.org/10.1107/S2052520619000933).

Quantitative *in situ* XRD measurement of shock metamorphism in Martian meteorites using lattice strain and strain-related mosaicity in olivine. Jenkins, Laura E.; Flemming, Roberta L.; McCausland, Phil J. A. *Meteoritics & Planetary Science*. Apr2019, Vol. 54 Issue 4, p902-918. 17p. DOI: [10.1111/maps.13245](https://doi.org/10.1111/maps.13245).

Effects of drying temperature in solution coating process on microphase-separated structures in coated layers of pressure-sensitive adhesive composed of di- and triblock copolymer blends as revealed by small-angle X-ray scattering. Doi, Takahiro; Takagi, Hideaki; Shimizu, Nobutaka; Igarashi, Noriyuki; Sakurai, Shinichi. *Polymer*. Apr2019, Vol. 170, p211-221. 11p. DOI: [10.1016/j.polymer.2019.02.052](https://doi.org/10.1016/j.polymer.2019.02.052).

***In situ* X-ray Raman scattering spectroscopy of a graphite electrode for lithium-ion batteries.** Nonaka, Takamasa; Kawaura, Hiroyuki; Makimura, Yoshinari; Nishimura, Yusaku F.; Dohmae, Kazuhiko. *Journal of Power Sources*. Apr2019, Vol. 419, p203-207. 5p. DOI: [10.1016/j.jpowsour.2019.02.064](https://doi.org/10.1016/j.jpowsour.2019.02.064).

Experimental evidence for x-ray standing wave modulated surface scattering effect. Wu, Longlong; Wang, Xiao; Chen, Gang. *Applied Physics Letters*. 4/8/2019, Vol. 114 Issue 14, pN.PAG-N.PAG. 5p. 3 Color Photographs, 1 Graph. DOI: [10.1063/1.5085231](https://doi.org/10.1063/1.5085231).

Grazing-incidence X-ray scattering of lamellar thin films. Smilgies, Detlef-M. *Journal of Applied Crystallography*. Apr2019, Vol. 52 Issue 2, p247-251. 5p. DOI: [10.1107/S1600576719000402](https://doi.org/10.1107/S1600576719000402).

A dilute gold nanoparticle suspension as small-angle X-ray scattering standard for an absolute scale using an extended Guinier approximation. Mohammed, Ahmed S. A.; Carino, Agnese; Testino, Andrea; Andalibi, Mohammad Reza; Cervellino, Antonio. *Journal of Applied Crystallography*. Apr2019, Vol. 52 Issue 2, p344-350. 7p. DOI: [10.1107/S1600576719001109](https://doi.org/10.1107/S1600576719001109).

Inorganic analysis of falsified medical products using X-ray fluorescence spectroscopy and chemometrics. Rebiere, Hervé; Kermaïdic, Audrey; Ghyselinck, Céline; Brenier, Charlotte. *Talanta*. Apr2019, Vol. 195, p490-496. 7p. DOI: [10.1016/j.talanta.2018.11.051](https://doi.org/10.1016/j.talanta.2018.11.051).

Investigating water vapour sorption kinetics of aluminium MOFs by powder X-ray diffraction. Fröhlich, Dominik; Hügenell, Philipp; Reinsch, Helge. *CrystEngComm*. 4/21/2019, Vol. 21 Issue 15, p2551-2558. 8p. DOI: [10.1039/c9ce00132h](https://doi.org/10.1039/c9ce00132h).

Unraveling the Composition of Rembrandt's Impasto through the Identification of Unusual Plumbonacrite by Multimodal X-ray Diffraction Analysis. Gonzalez, Victor; Cotte, Marine; Wallez, Gilles; van Loon, Annelies; de Nolf, Wout; Eveno, Myriam; Keune, Katrien; Noble, Petria; Dik, Joris. *Angewandte Chemie*. 4/16/2019, Vol. 131 Issue 17, p5675-5678. 4p. DOI: [10.1002/ange.201813105](https://doi.org/10.1002/ange.201813105).

Direct *in situ* observation of electric field assisted densification of ZnO by energy dispersive X-ray diffraction. Bicer, Hulya; Beyoglu, Berra; Ozdemir, T. Ertugrul; Okasinski, John; Tsakalakos, Thomas. *Ceramics International*. Apr2019, Vol. 45 Issue 6, p7614-7618. 5p. DOI: [10.1016/j.ceramint.2019.01.057](https://doi.org/10.1016/j.ceramint.2019.01.057).

Crystallite size and lattice strain of lithiated spinel material for rechargeable battery by X-ray diffraction peak-broadening analysis. Al-Tabbakh, Ahmed A.; Karatepe, Nilgun; Al-Zubaidi, Aseel B.; Benchaabane, Aida; Mahmood, Natheer B. *International Journal of Energy Research*.

Apr2019, Vol. 43 Issue 5, p1903-1911. 9p. 1 Black and White Photograph, 2 Charts, 5 Graphs.
DOI: [10.1002/er.4390](https://doi.org/10.1002/er.4390).

d2Dplot: 2D X-ray diffraction data processing and analysis for through-the-substrate microdiffraction. Vallcorba, Oriol; Rius, Jordi. *Journal of Applied Crystallography*. Apr2019, Vol. 52 Issue 2, p478-484. 7p. DOI: [10.1107/S160057671900219X](https://doi.org/10.1107/S160057671900219X).

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