



## Upcoming Rigaku XRD Forum



### Coatings & Thin Films XRD

Join us February 11th – 13th for a three-day Coatings & Thin Films XRD Forum at our Rigaku Europe office located in Neu-Isenburg, Germany (Frankfurt area). Learn about the latest developments in thin film XRD and discuss your research with recognized XRD scientists. This event is intended to allow an open discussion on classical XRD topics as well as advanced X-ray scattering techniques. **For more info >**

### Powder diffraction, thin film diffraction, SAXS, in-plane scattering



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## Welcome

December is at the peak of the holiday season for many around the globe, but was nevertheless, an active month for Rigaku.



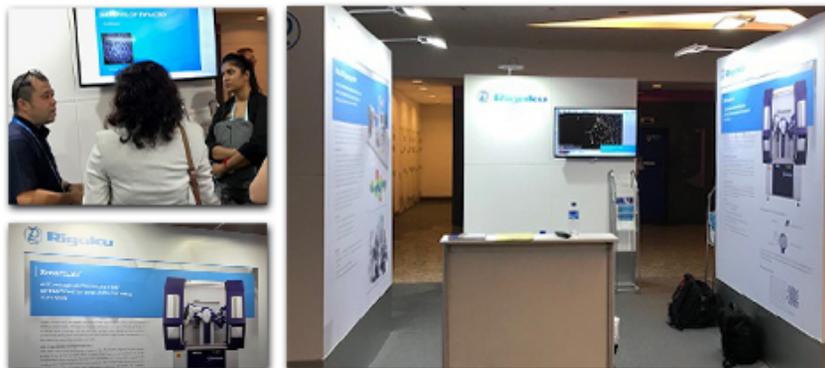
*Wishing you and your family health and prosperity for the New Year! We look forward to working with you in 2020.*

The [2019 MRS Fall Meeting](#) was held December 1–6, in Boston, Massachusetts. The MRS meeting is the international scientific gathering for materials research, showcasing leading interdisciplinary research in both fundamental and applied areas presented by scientists from around the world. Rigaku, a “gold” partner of the MRS, was in attendance highlighting its instrumentation for [materials analysis](#).

Thank you to all who attended the 16th Conference of the Asian Crystallographic Association ([AsCA 2019](#)) — December 16-20 in Singapore, showcasing the latest developments in crystallography in the Asia-Pacific region, where Rigaku presented an informative workshop on the latest techniques in single crystal and powder diffraction.

high-resolution X-ray diffractometer available today. Perhaps its most novel feature is the SmartLab Guidance software, which provides you with an intelligent interface that guides you through the intricacies of each experiment. It is like having an expert standing by your side.

**For more >**



*Rigaku at the 16th Conference of the Asian Crystallographic Association, National University of Singapore*

### 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 [email copy](#) to the editor.

### WDXRF for quantitative elemental analysis with mapping and multi-point analysis

This month's issue also contains application notes for XRD, TXRF WDXRF, and EDXRF.

This month's featured XRD technical note discusses quantification the taste of salt by DD (Direct Derivation) method, identifying mineral compounds in salt in addition to NaCl.

The TXRF application note discusses analysis of trace elements in wine. One advantage of the TXRF (total reflection X-ray fluorescence) method compared with ICP or AAS is the simple sample preparation.

With the WDXRF Application Note, Rigaku introduces the Application Packages "Refractory" series with a method for fused bead analysis. Application Packages are designed to enable less experienced users to easily start up quantitative analysis.

The EDXRF application note highlights the he Rigaku Auto Cats-Pak, demonstrating the measurement of precious metals in recycled automotive catalytic converters using Fundamental Parameters (FP) approach and pre-installed starter Matching Library.

Be sure to view the video from The Royal Swedish Academy of Sciences featuring the 2019 Nobel Lectures in Chemistry. As always, an aggregation news reports and recent scientific papers presenting the latest developments in materials science is included.

Happy Holidays!



#### XRD Application Note

##### Quantification the taste of salt by DD (Direct Derivation) method

*Rigaku Corporation*

In addition to NaCl, salt contains mineral compounds having specific tastes. The taste of salt changes depending on the amount of these mineral compounds, and increasing certain mineral components has an influence on digestion and can interfere with the absorption of other nutrients. Quantitative analysis of the mineral compounds contained in salt is, therefore, a necessary task in food productions to maintain well-balanced flavor, well-being, and functionality. **For more >**



#### TXRF Application Note

##### Analysis of trace elements in wine

*Rigaku Corporation*

Wine contains small or trace amounts of K, Ca, Fe, Mn, and Cu. Component analysis of wine is important from the viewpoints of dietary intake of minerals and identification to prevent improper locality and brand camouflage. One advantage of the total reflection X-ray fluorescence (TXRF) method compared with ICP or AAS is the simple sample preparation. **For more >**

#### WDXRF Application Note



### ZSX Primus IV

As a tube-above sequential wavelength dispersive X-ray fluorescence (WDXRF) spectrometer, the Rigaku ZSX Primus IV delivers rapid quantitative determination of major and minor atomic elements, from beryllium (Be) through uranium (U), in a wide variety of sample types — with minimal standards.

**For more >**

### Video of the Month



### Nobel Lectures in Chemistry

From The Royal Swedish Academy of Sciences, watch the 2019 Nobel Lectures in Chemistry. This prize was awarded to John Goodenough, M. Stanley Whittingham and Akira Yoshino for the development of lithium-ion batteries. **See video >**

### Conferences and Workshops



### Fused Bead Analysis for Refractories Using Application Package "Refractory" Series

Rigaku Corporation

XRF analysis is widely used in a number of fields, including quality control and research & development, due to its high degree of accuracy and extremely simple sample preparation. Quantitative analysis with XRF spectrometry requires reference materials in order to generate calibration curves. The fusion method in XRF analysis is an effective sample preparation technique for getting accurate analysis results of powder samples, since the technique eliminates heterogeneity due to grain size and mineralogical differences. Rigaku provides analysis solution for various refractories by the fusion method. **For more >**

### EDXRF Application Note

Pt, Pd, Rh in Recycled Automotive Catalysts

Applied Rigaku Technologies

The measurement of Pt, Rh and Pd in recycled automotive catalytic converters is demonstrated using Fundamental Parameters (FP) approach and pre-installed starter Matching Library as the Rigaku Auto Cats-Pak. **For more >**

### Material Analysis in the News

News for December 2019

**December 3, 2019.** Our use of battery-operated devices and appliances has been increasing steadily, bringing with it the need for safe, efficient, and high-performing power sources. To this end, a type of electrical energy storage device called the supercapacitor has recently begun to be considered as an alternative to conventional energy-storage devices such as Li-ion batteries. In a recent study, Dr. Takeshi Kondo and group from the Tokyo University of Science and Daicel Corporation in Japan explored the possibility of using a novel material, the [boron-doped nanodiamond, as electrode in the supercapacitors](#).

**December 6, 2019.** Gels are a soft elastic material consisting of a three-dimensional polymer network with nanometer-sized pores and are used in a variety of applications. However, gel networks typically have a substantial level of defects because the network formation reaction proceeds stochastically. In a new study, a [general scheme to fabricate gels with extremely low levels of defects](#) by applying geometric constraints into pregel solution based on the "bond percolation" concept is presented.

**December 11, 2019.** Elemental kinds, composition ratios, effective atomic number ( $Z_{eff}$ ), and spatial distributions are the most basic information on materials and determine the physical and chemical properties of materials. X-ray fluorescence analysis has conventionally been used for elemental mapping, however maps on deep internal areas cannot be obtained because the escape depth of fluorescence X-rays is limited to a few mm from the surface of samples. Here, [a novel  \$Z\_{eff}\$  imaging method that uses back-scattered X-rays](#) is presented.

**December 11, 2019.** [Plastic electronic materials and related science and technology](#) was the topic of discussion at Tokyo Institute of Technology last month during the third such exchange workshop between the Plastic Electronics Centre for Doctoral Training at Imperial College London and Tokyo Institute of Technology.

**December 17, 2019.** Simulating the conditions 2,700 kilometers deep underground, scientists have studied [an important transformation of the most](#)

## Join Rigaku at future meetings

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

### **Florida State University Rigaku Symposium and Workshop on X-ray Crystallography and Diffraction**

Tallahassee, FL, USA  
January 24 – 25, 2020

### **Thin Film XRD Forum**

Neu-Isenburg, Germany  
February 10 – 13, 2020

### **AWA Global Release Liner Industry Conference & Exhibition**

Amsterdam, Netherlands  
February 27 – 28, 2020

**See the complete list >**

## Useful Link of the Month



**Quora: A place to share knowledge and better understand the world**

Have a question and do not know who to ask? Quora is a platform where users can ask questions and connect with other users who provide knowledgeable insights and quality answers. **For more >**

## Planning to submit a grant?

[abundant mineral on Earth, bridgmanite](#). The results from the Extreme Conditions Beamline at DESY's X-ray light source PETRA III reveal how bridgmanite turns into a structure known as post-perovskite, a transformation that affects the dynamics of Earth's lower mantle, including the spreading of seismic waves.

**December 17, 2019.** Understanding the behavior of materials at their interfaces — where they connect to and interact with other materials — is central to engineering a variety of devices used to process, store and transfer information. Devices such as transistors, magnetic memory and lasers could all improve as researchers delve into the nature of these bonds, which affect the materials' properties of conductivity and magnetism. In this effort, Steven May, PhD, and his colleagues from Drexel University's College of Engineering, along with researchers from the University of Saskatchewan and Lawrence Berkeley, Brookhaven and Argonne National Labs have recently demonstrated [a new approach for examining — with atomic-layer precision — changes in the behavior of electrons at the interfaces between two materials](#).

**December 17, 2019.** Additive manufacturing (AM) — sometimes referred to as '3D printing' — applied to metals opens up new possibilities for the fabrication of alloys with tailored properties. Yet, alloys made by AM have characteristic microstructural features that are usually different from those of metallic compounds manufactured by traditional methods ('subtractive manufacturing'). A thorough understanding of the microstructures of AM-processed alloys, and how they influence their mechanical properties, is therefore needed. A 2017 review by Stéphane Gorsse and colleagues published in Science and Technology of Advanced Materials offers a comprehensive [overview of structure–property relationships for three important types of alloys](#) has now been awarded the 2019 STAM Journal's Best Paper Award.

**December 18, 2019.** Researchers at the National Institute for Materials Science in Japan are leading a study today to create [machines capable of thinking like a human brain](#). According to the research, published in the journal Scientific Reports, the device built, made of a tangle of silver nanowires, exhibited characteristics analogous to certain behaviors of the brain – learning, memorization, forgetting, wakefulness and sleep.

**December 18, 2019.** Ultrafast X-ray Optics Scientists have demonstrated a [new micro-electro-mechanical-system \(MEMS\) resonator](#). MEMS devices combine tiny electronic and mechanical components. By using this device with a hard (higher energy) X-ray, scientists can now control how long the X-ray pulses are, down to 300 picoseconds long. Picoseconds are one trillionth of a second long. Typical synchrotrons – a type of particle accelerator – produce X-rays that are about 100 picoseconds long, but don't have the ability to have fine control over the pulse length.

**December 19, 2019.** IBM and the University of Tokyo announced an agreement to partner to advance quantum computing and make it practical for the benefit of industry, science and society. [IBM and the University will form the Japan – IBM Quantum Partnership](#), a broad national partnership framework in which other universities, industry, and government can engage.

**December 19, 2019.** The so-called topological insulators are those materials that are insulators in bulk, i.e., those that do not allow electric currents in their volume, but that are conductors on their surfaces. So far, magnetic topological insulators had only been created by the so-called extrinsic route, which consists of doping nonmagnetic topological insulators with magnetic atoms. However, thanks to the efforts of a group of researchers from the Materials Physics Center (CFM, CSIC-UPV/EHU joint centre), Donostia International Physics Center (DIPC) and the University of the Basque Country (UPV/EHU), [it is now possible to grow an intrinsic magnetic topological insulator](#), that is, one that has magnetic properties by its own very nature.



### 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 >**

**December 19, 2019.** The smuggling of contraband, such as explosives and drugs, is a major threat in airport security. These risks have increased in modern times with the uptick in parcel delivery. Researchers at Tongji University and Zhejiang University City College propose a [new technique for the efficient security detection](#) of contraband items.

**December 20, 2019.** Researchers have shown [mechanical force can start chemical reactions](#), making them cheaper, more broadly applicable, and more environmentally friendly than conventional methods.



### Recent Scientific Papers of Interest

#### Papers for December 2019

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

**Density measurement for carbon nanotube film grown on flat substrates.** Omote, Kazuhiko; Hirose, Raita; Imayama, Naoya; Noda, Kei; Endoh, Ryo; Sugiyama, Naoyuki. *Applied Physics Express*. Dec2019, 13, 016501. DOI: [10.7567/1882-0786/ab5991](https://doi.org/10.7567/1882-0786/ab5991).

**Visible cellular distribution of cadmium and zinc in the hyperaccumulator *Arabidopsis halleri* ssp. *gemmifera* determined by 2-D X-ray fluorescence imaging using high-energy synchrotron radiation.** Fukuda, Naoki; Kitajima, Nobuyuki; Terada, Yasuko; Abe, Tomoko; Nakaia, Izumi; Hokura, Akiko. *Metallomics*. 2020, Advance Article. DOI: [10.1039/C9MT00243J](https://doi.org/10.1039/C9MT00243J).

**Porosity production in weathered rock: Where volumetric strain dominates over chemical mass loss.** Hayes, Jordan L.; Riebe, Clifford S.; Holbrook, W. Steven; Flinchum, Brady A.; Hartsough, Peter C. *Science Advances*. Sept2019, Vol. 5, No. 9, eaao0834. DOI: [10.1126/sciadv.aao0834](https://doi.org/10.1126/sciadv.aao0834).

**Macromolecular transformations for tectonically-deformed high volatile bituminous via HRTEM and XRD analyses.** Song, Yu; Jiang, Bo; Li, Ming; Hou, Chenliang; Mathews, Jonathan P. *Fuel*. Dec2019, Advance Article. DOI: [10.1016/j.fuel.2019.116756](https://doi.org/10.1016/j.fuel.2019.116756).

**Application of non-destructive integrated CT-XRD method to investigate alteration of cementitious materials subjected to high temperature and pure water.** Takahashi, Hayato; Sugiyama, Takafumi. *Construction and Building Materials*. April2019, Vol. 203, p579-588. DOI: [10.1016/j.conbuildmat.2019.01.128](https://doi.org/10.1016/j.conbuildmat.2019.01.128).

**XRF core scanning yields reliable semiquantitative data on the elemental composition of highly organic-rich sediments: Evidence from the Fürmoos peat bog (Southern Germany).** Kern, Oliver A.; Koutsodendris, Andreas; Mächtle, Bertil; Christanis, Kimon; Schukraft, Gerd; Scholz, Christian; Kotthoff, Ulrich; Pross, Jörg. *Science of The Total Environment*. Dec2019, Vol. 697, 134110. DOI: <https://doi.org/10.1016/j.scitotenv.2019.134110>.

**Triple-pulse LIBS: laser-induced breakdown spectroscopy signal enhancement by combination of pre-ablation and re-heating laser pulses.** Prochazka, David; Pořízka, Pavel; Novotný, Jan; Hrdlička, Aleš; Novotný, Karel; Šperka, Petr; Kaiser, Jozef. *J. Anal. At. Spectrom.* 2020, Advance Article. DOI: [10.1039/C9JA00323A](https://doi.org/10.1039/C9JA00323A).

**A direct and safe method for plutonium determination using total reflection X-ray fluorescence spectrometry.** Dhara, Sangita; Sanyal, Kaushik; Paul, Sumana; Misra, N.L. *J. Anal. At. Spectrom.* Dec2019, Vol. 34, p366-374. DOI: [10.1039/C8JA00351C](https://doi.org/10.1039/C8JA00351C).

**Development of an AES based analytical method for the determination of trace metallic impurities in uranium silicide dispersion fuel: from precursors to end products.** Sengupta, Arijit; B., Rajeswari; Kadam, R.M. *J. Anal. At. Spectrom.* 2020, Advance Article. DOI:

[10.1039/C9JA00321E](https://doi.org/10.1039/C9JA00321E).

**Investigation on 4-amino-5-substituent-1,2,4-triazole-3-thione Schiff bases as antifungal drug by characterization (spectroscopic, XRD), biological activities, molecular docking studies and electrostatic potential (ESP).** Wu, Shaojie; Zhang, Wenhui; Qi, Le; Ren, Yinghui; Ma, Haixia. *J. Mol. Struct.*. Dec2019, Vol. 1197, p171-182. DOI: [10.1016/j.molstruc.2019.07.013](https://doi.org/10.1016/j.molstruc.2019.07.013).

**Calibrating high resolution XRF core scanner data to obtain absolute metal concentrations in highly polluted marine deposits after two case studies off Portmán Bay and Barcelona, Spain.** Cerdà-Domènech, M.; Frigola, J.; Sanchez-Vidal, A.; Canals, M. *Science of The Total Environment*. Nov2019, Advance Article. DOI: [10.1016/j.scitotenv.2019.134778](https://doi.org/10.1016/j.scitotenv.2019.134778).

**Novel  $Z_{eff}$  imaging method for deep internal areas using back-scattered X-rays.** Yoneyama, Akio; Kawamoto, Masahide; Baba, Rika. *Sci. Rep.* Dec2019, 9(1), 18831. DOI: [10.1038/s41598-019-54907-3](https://doi.org/10.1038/s41598-019-54907-3).

**Synthesis of wollastonite from AlF<sub>3</sub>-rich silica gel and its hardening in the CO<sub>2</sub> atmosphere.** Gineika, A.; Siauciunas, R.; Baltakys, K. *Sci. Rep.* Dec2019, 9(1), 18063. DOI: [10.1038/s41598-019-54219-6](https://doi.org/10.1038/s41598-019-54219-6).

