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Welcome

As featured in the [News](#) section (below), we wish to congratulate John B. Goodenough, M. Stanley Whittingham, and Akira Yoshino for winning the 2019 Nobel Prize in Chemistry. Their research, focused on improving battery technology, culminated in the development of lithium-ion batteries. In honor of this achievement, two X-ray diffraction application notes on Li-ion batteries are featured this month.



Dr. Kiyoshi Ogata (Rigaku Corporation), spoke at the Gala Dinner for ESSDERC/ESSCIRC in Kraków, Poland. Rigaku was the Diamond Sponsor for this event held September 23 – 26.

For those in the metals and alloys arena, please come visit us at [FABTECH](#) (Nov. 11 – 14, Chicago, McCormick Place, booth A5005). Also, the American Chemical Society is hosting the [SWRM/RMRM](#) regional conference in El Paso, Texas (Nov. 13 – 16). Another highlight is the [Eastern Analytical Symposium](#) (Nov. 18 – 20, Plainsboro, NJ, booth M1). A complete list of all upcoming events can be found [here](#).

Other Application Notes and Technical Articles for the month feature *Local Structure Analysis of Non-Crystalline Materials based on PDFs (XRD)*, *Chlorine Analysis of Aluminosilicate for Fluid Catalytic Cracking Catalyst by WDXRF* and *Palladium Catalyst in Pharmaceuticals (EDXRF)*.

The two book reviews cover *The Physics of Everyday Things: The Extraordinary Science Behind an Ordinary Day* by James Kakalios and *How To: Absurd Scientific Advice for Common Real-World Problems* by Randall Munroe. Our video covers *The Secrets of Light and Energy | Quantum Physics*, a 2019 BBC science documentary. 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

XRD Application Note – 1

[Operando measurement of Li ion battery positive electrode using 2D detector](#)

Rigaku Corporation

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 total reflection X-ray Fluorescence (TXRF) spectrometer



NANO HUNTER II

The new, next generation Rigaku NANO HUNTER II benchtop total reflection X-ray fluorescence (TXRF) spectrometer enables high-sensitivity ultra-trace elemental analysis of liquids down to parts-per-billion (ppb) concentrations. Total reflection X-ray fluorescence spectroscopy is a method by which an incident beam of X-rays just grazes the sample, delivering low-background noise, high-sensitivity measurement of ultra-trace elements. **For more >**

Video of the Month



The Secrets of Light and



Lithium ion secondary batteries are widely used in small portable devices such as mobile phones. Research and development of lithium ion batteries for use in automobiles and larger machines is an active field. To develop lithium ion secondary batteries with high capacity, high stability and long life, it is essential to evaluate the stability of the positive electrode material during the charge/discharge process. **For more >**



XRD Application Note – 2

[Operando measurement of laminated lithium ion battery using 2D detector](#)
Rigaku Corporation

To develop lithium ion secondary batteries with high capacity, high reliability, and long life, it is essential to evaluate the stability of the electrode materials during the charge/discharge process. The laminate cell attachment enables the reproduction of a high-speed charge/discharge process while keeping the sample temperature constant, and simultaneously allows the collection of transmission X-ray diffraction images. **For more >**



Featured Article

[Local Structure Analysis of Non-Crystalline Materials based on PDFs](#)
Rigaku Corporation

Using the SmartLab system, we obtained high-quality scattering patterns for PDF analysis. We used a high-power PhotonMax 9 kW rotating anode X-ray source with Ag target and CBO-E elliptical multilayer mirror for Ag radiation to condition a high-resolution focusing beam. A scattering protector and a 2.5-deg Soller slit were used in the receiving optics to eliminate parasitic scattering from the incident optics and air. **For more >**



WDXRF Application Note

[Chlorine Analysis of Aluminosilicate for Fluid Catalytic Cracking Catalyst](#)
Rigaku Corporation

It is important to control the chlorine content of FCC catalyst to guard against the formation of hazardous organo-chloride compounds such as dioxins and to prevent degradation of catalytic activity. This application note documents the performance of a Rigaku ZSX Primus series spectrometer for analysis of chlorine in FCC aluminosilicate catalyst. **For more >**



EDXRF Application Note

[Palladium Catalyst in Pharmaceuticals](#)
Applied Rigaku Technologies

Palladium is a common catalyst in the manufacturing of pharmaceuticals. Pills and tablets are ground to homogeneous powder to test for any retained spent Pd as well as other heavy metals such as unwanted Cd, Pb, Hg and Br as part of the quality control process. The Pd is also monitored during the recovery of the catalysts material. Cellulose is a common medium for pharmaceuticals and testing is often done in pills ground to powder or cellulose powder itself. **For more >**

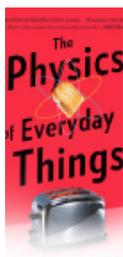
Book Reviews

[How To: Absurd Scientific Advice for Common Real-World Problems](#)
By Randall Munroe

Energy | Quantum Physics BBC Science Documentary 2019

This BBC science documentary on the secrets of light and energy quantum physics, highlights the formation, transference and storage of energy as well as how light is reflected and “created”.

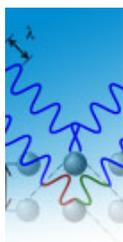
Light energy is a kind of kinetic energy with the ability to make types of light visible to the human eye. Light is defined as a form of electromagnetic radiation emitted by hot objects like lasers, bulbs, and the sun. Light contains photons which are minute packets of energy. **For more >**



[The Physics of Everyday Things: The Extraordinary Science Behind an Ordinary Day](#)

By James Kakalios

James Kakalios' newest book is a delightful endeavor into the physics of everyday life. Kakalios does not take the time explain the basic concepts of physics, but rather the basic physics (or not-so-basic physics) of mundane mechanisms. These range from alarm clocks and toasters to car engines and airplanes—all things that we largely take for granted in our everyday lives. **Read reviews >**



Material Analysis in the News

[News for October 2019](#)

October 1, 2019. In ground-breaking research, an international team of astronomers led by the National Astronomical Observatory of Japan and including Imperial College London researchers, have [discovered a new "protocluster" that is being touted as the oldest galaxy clusters of the universe](#). According to the study, the 13-billion-year-old cluster was already in the making during the nascent years of the universe and continues to form hundreds of galaxies.

October 2, 2019. The World Intellectual Property Organization (WIPO), in collaboration with the African Regional Intellectual Property Organization (ARIPO), has launched a pilot project on the use and application of intellectual property (IP). With the support of the [Japan Patent Office](#), the [WIPO-ARIPO Guidelines on Developing Intellectual Property Policy](#) and strategy were launched at Kenya's Jomo Kenyatta University of Agriculture and Technology (JKUAT).

October 2, 2019. A team of scientists has made the strongest silver ever, 42% stronger than the previous world record. It's part of a discovery of a new mechanism at the nanoscale that can create metals much stronger than any ever made before, while not losing electrical conductivity. By mixing a trace amount of copper into the silver, the team showed it can [transform two types of inherent nanoscale defects into a powerful internal structure](#).

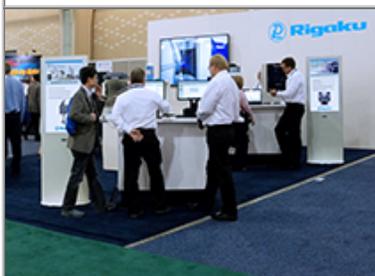
October 3, 2019. Japan's [Hayabusa2 spacecraft released a small rover](#) that will land on the surface of an asteroid as part its final mission before heading back to Earth, Japan's space agency said. The Minerva-II2 rover began a slow descent to the asteroid Ryugu. Hayabusa2 is to start its yearlong return trip to Earth later this year.

October 4, 2019. An international team of scientists claims to have developed [perovskite solar cells with an efficiency of 18.1%](#) by using a new configuration of cesium lead iodide perovskite CsPbI₃, which has the narrowest band gap – 1.73 eV – of all inorganic lead halide perovskites. Researchers from Okinawa Institute of Science and Technology Graduate University, Shanghai Jiao Tong University and Ecole Polytechnique Fédérale de Lausanne studied CsPbI₃ crystals in their more stable beta phase.

October 7, 2019. [Pressure improves the ability of materials to turn heat into electricity](#) and could potentially be used to create clean generators, according to new work from a team that includes Carnegie's Alexander Goncharov and Viktor Struzhkin published in *Nature Materials*.

October 7, 2019. The [2019 Nobel Prize in Physiology or Medicine](#) was awarded to National Institutes of Health grantees Gregg L. Semenza, M.D., Ph.D., of Johns Hopkins University, Baltimore, and William G. Kaelin Jr., M.D., of Dana-Farber Cancer Institute, Boston, who share the prize with Sir Peter J. Ratcliffe, M.D., of the University of Oxford, England, and Francis Crick Institute, London, for their discoveries of how cells sense and adapt to oxygen availability.

Conferences and Workshops



Join Rigaku at future meetings

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

[Ohio Hazmat Conference](#)

Solon, OH, USA

November 1, 2019

[AAPS PharmSci 360 2019](#)

San Antonio, TX, USA

November 3 – 6, 2019

[Japanese Association Forensic Science Conference](#)

Tokyo, Japan

November 7 – 8, 2019

See the complete list >

Useful Link of the Month



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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 >**

October 9, 2019. The [2019 Nobel Prize in Chemistry](#) was awarded to John B. Goodenough (University of Texas at Austin), M. Stanley Whittingham (State University of New York at Binghamton), and Akira Yoshino (Meijo University) for their work on "the development of lithium ion batteries," according to the Nobel committee. "Lithium ion batteries have revolutionized our lives and are used in everything from mobile phones to laptops and electric vehicles," tweeted the committee. "Through their work, this year's Chemistry Laureates have laid the foundation of a wireless, fossil fuel-free society," it added. The three winners will share a prize of 9 million Swedish kroner (\$910,000).

October 12, 2019. Scientists from Tokyo Metropolitan University have [created a new layered superconducting material](#) with a conducting layer made of bismuth, silver, tin, sulfur and selenium. The conducting layer features four distinct sublayers; by introducing more elements, they were able to achieve unparalleled customizability and a higher "critical temperature."

October 14, 2019. A [new refrigeration technology based on the twisting and untwisting of fibres](#) has been demonstrated by a team led by Zunfeng Liu at Nankai University in China and Ray Baughman at the University of Texas at Dallas. As the demand for refrigeration expands worldwide, their work could lead to the development of new cooling systems that do not employ gases that are harmful to the environment.

October 15, 2019. Scientists at Kyoto University have come up with an innovative way to try and counter the massive amounts of carbon dioxide we're still pumping into the air. The [newly developed method sucks CO₂ molecules out of the air](#), without expending much energy in the process. The material can then potentially be turned into an ingredient for packaging or clothing. The invention is a porous coordination polymer (PCP) made up of zinc metal ions.

October 23, 2019. [Japan has its eyes on the moon, with two new partnerships](#) designed to advance the country's lunar goals. The nation signed on as a partner to NASA's Artemis program, although the details of that partnership have not yet been specified. A representative of the Japan Aerospace Exploration Agency (JAXA) also spoke at the International Astronautical Congress, on Oct. 22, about a potential partnership with India's space agency on another lunar mission.

October 23, 2019. Alphabet Inc.'s Google said its [quantum computer has performed a calculation in about three minutes](#), compared with the 10,000 years it would have taken the world's fastest conventional supercomputer. The calculation involves a progressively difficult random number-sampling task and the research was published in the science journal *Nature*.



Recent Scientific Papers of Interest

Papers for September 2019

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

A comparative determination of major components in coal power plant wastes by wavelength dispersive X-ray fluorescence using pellet and fused bead specimens.

Chuparina, Elena V.; Chubarov, Victor M.; Paradina, Ludmila Ph. *Applied Radiation & Isotopes*. Oct2019, Vol. 152, p162-167. 6p. DOI: [10.1016/j.apradiso.2019.06.040](https://doi.org/10.1016/j.apradiso.2019.06.040).

Determination of gold leaf thickness using X-ray fluorescence spectrometry: Accuracy comparison using analytical methodology and Monte Carlo simulations. Pessanha, Sofia; Queralt, Ignasi; Carvalho, Maria Luisa; Sampaio, Jorge Miguel. *Applied Radiation & Isotopes*.

MCR-ALS analysis of IR spectroscopy and XRD for the investigation of ibuprofen – nicotinamide cocrystal formation. Ishihara, Sae; Hattori, Yusuke; Otsuka, Makoto.

Spectrochimica Acta Part A: Molecular & Biomolecular Spectroscopy. Oct2019, Vol. 221, p117142-117142. 1p. DOI: [10.1016/j.saa.2019.117142](https://doi.org/10.1016/j.saa.2019.117142).

Shooting distance estimation based on gunshot residues analyzed by XRD and multivariate analysis. Miranda, Karla Leiva; Ortega-Ojeda, Fernando E.; García-Ruiz, Carmen; Martínez,

Pedro Sáez. *Chemometrics & Intelligent Laboratory Systems*. Oct2019, Vol. 193, pN.PAG-N.PAG. 1p. DOI: [10.1016/j.chemolab.2019.103831](https://doi.org/10.1016/j.chemolab.2019.103831).

A low-cost portable system for elemental mapping by XRF aiming in situ analyses. Campos, P.H.O.V.; Appoloni, C.R.; Rizzutto, M.A.; Leite, A.R.; Assis, R.F.; Santos, H.C.; Silva, T.F.; Rodrigues, C.L.; Tabacniks, M.H.; Added, N. *Applied Radiation & Isotopes*. Oct2019, Vol. 152, p78-85. 8p. DOI: [10.1016/j.apradiso.2019.06.018](https://doi.org/10.1016/j.apradiso.2019.06.018).

Insight into the adsorption mechanisms of aqueous hexavalent chromium by EDTA intercalated layered double hydroxides: XRD, FTIR, XPS, and zeta potential studies. Li, Jing;

Yan, Lianguo; Yang, Yanting; Zhang, Xue; Zhu, Rixin; Yu, Haiqin. *New Journal of Chemistry*. 10/28/2019, Vol. 43 Issue 40, p15915-15923. 9p. DOI: [10.1039/c9nj03479j](https://doi.org/10.1039/c9nj03479j).

FTIR, CHNS and XRD analyses define mechanism of glyphosate herbicide removal by electrocoagulation. Danial, Rabiatuladawiyah; Sobri, Shafreeza; Abdullah, Luqman Chuah; Mobarekeh, Mohsen Nourouzi. *Chemosphere*. Oct2019, Vol. 233, p559-569. 11p. DOI: [10.1016/j.chemosphere.2019.06.010](https://doi.org/10.1016/j.chemosphere.2019.06.010).

Operando XAS/XRD and Raman Spectroscopic Study of Structural Changes of the Iron Molybdate Catalyst during Selective Oxidation of Methanol. Gaur, Abhijeet; Schumann, Max; Raun, Kristian Vieggaard; Stehle, Matthias; Beato, Pablo; Jensen, Anker Degn; Grunwaldt, Jan-Dierk; Høj, Martin. *ChemCatChem*. 10/7/2019, Vol. 11 Issue 19, p4871-4883. 13p. DOI: [10.1002/cctc.201901025](https://doi.org/10.1002/cctc.201901025).

In-situ High-Temperature XRD and FTIR for Calcite, Dolomite and Magnesite: Anharmonic Contribution to the Thermodynamic Properties. Wang, Xiang; Xu, Xiaoxiang; Ye, Yu; Wang, Chao; Liu, Dan; Shi, Xiaochao; Wang, Sha; Zhu, Xi. *Journal of Earth Science*. Oct2019, Vol. 30 Issue 5, p964-976. 13p. DOI: [10.1007/s12583-019-1236-7](https://doi.org/10.1007/s12583-019-1236-7).

An Inexpensive XRF Lab for Undergraduates and Other Educational Activities at Tarleton's Nuclear Laboratory. Marble, Daniel Keith. *AIP Conference Proceedings*. 2019, Vol. 2160 Issue 1, p050021-1-050021-7. 7p. DOI: [10.1063/1.5127713](https://doi.org/10.1063/1.5127713).

XRF (X-ray fluorescence) applied to characterization of unconventional Woodford Shale (Devonian, U.S.A.) lateral well heterogeneity. Zhang, Jing; Zeng, Yijin; Slatt, Roger. *Fuel*. Oct2019, Vol. 254, p115565-115565. 1p. DOI: [10.1016/j.fuel.2019.05.148](https://doi.org/10.1016/j.fuel.2019.05.148).

High-resolution SAXS setup with tuneable resolution in direct and reciprocal space: a new tool to study ordered nanostructures. Chumakov, Andrei P.; Napolskii, Kirill S.; Petukhov, Andrei V.; Snigirev, Anatoly A.; Snigireva, Irina I.; Roslyakov, Ilya V.; Grigoriev, Sergey V. *Journal of Applied Crystallography*. Oct2019, Vol. 52 Issue 5, p1095-1103. 9p. DOI: [10.1107/S1600576719011221](https://doi.org/10.1107/S1600576719011221).

Rapid multi-element characterization of microgreens via total-reflection X-ray fluorescence (TXRF) spectrometry. Allegretta, Ignazio; Gattullo, Concetta Eliana; Renna, Massimiliano; Paradiso, Vito Michele; Terzano, Roberto. *Food Chemistry*. Oct2019, Vol. 296, p86-93. 8p. DOI: [10.1016/j.foodchem.2019.05.187](https://doi.org/10.1016/j.foodchem.2019.05.187).

X-ray fluorescence and visible near infrared sensor fusion for predicting soil chromium content. Xu, Dongyun; Chen, Songchao; Viscarra Rossel, R.A.; Biswas, Asim; Li, Shuo; Zhou, Yin; Shi, Zhou. *Geoderma*. Oct2019, Vol. 352, p61-69. 9p. DOI: [10.1016/j.geoderma.2019.05.036](https://doi.org/10.1016/j.geoderma.2019.05.036).

Possibilities and drawbacks of total reflection X-ray fluorescence spectrometry as a fast, simple and cost-effective technique for multielement analyses of cosmetics. Marguí, E.; Dalipi, R.; Borgese, L.; Depero, L.E.; Queralt, I. *Analytica Chimica Acta*. Oct2019, Vol. 1075, p27-37. 11p. DOI: [10.1016/j.aca.2019.05.005](https://doi.org/10.1016/j.aca.2019.05.005).

Mineral analysis of pollen by Total Reflection X-Ray Fluorescence. Basso, Inés M.; Lorenzo, Daniel S.; Mouteira, María C.; Custo, Graciela S. *Applied Radiation & Isotopes*. Oct2019, Vol. 152, p168-171. 4p. DOI: [10.1016/j.apradiso.2019.06.015](https://doi.org/10.1016/j.apradiso.2019.06.015).

In-situ Electrochemical X-ray Diffraction: A Rigorous Method to Navigate within Phase Diagrams Reveals β -Fe_{1+x}Se as Superconductor for All x. Rasche, Bertold; Yang, Minjun; Nikonow, Lothar; Cooper, Joshaniel F. K.; Murray, Claire A.; Day, Sarah J.; Kleiner, Karin; Clarke, Simon J.; Compton, Richard G. *Angewandte Chemie International Edition*. Oct2019, Vol. 58 Issue 43, p15401-15406. 6p. DOI: [10.1002/anie.201907426](https://doi.org/10.1002/anie.201907426).

Composition and morphology tuning during hydrothermal synthesis of Sr_xBa_{1-x}Nb₂O₆ tetragonal tungsten bronzes studied by *in situ* X-ray diffraction. Grendal, Ola G.; Blichfeld, Anders B.; Vu, Tuong D.; van Beek, Wouter; Selbach, Sverre M.; Grande, Tor; Einarsrud, Mari-Ann. *CrystEngComm*. 10/21/2019, Vol. 21 Issue 39, p5922-5930. 9p. DOI: [10.1039/c9ce01049a](https://doi.org/10.1039/c9ce01049a).

Characteristics of weathered mudstone with X-ray computed tomography scanning and X-ray diffraction analysis. Ohishi, Tomihiko; Terakawa, Masahiro. *Bulletin of Engineering Geology & the Environment*. Oct2019, Vol. 78 Issue 7, p5327-5343. 17p. DOI: [10.1007/s10064-018-1429-9](https://doi.org/10.1007/s10064-018-1429-9).

In situ reactor to image catalysts at work in three-dimensions by Bragg coherent X-ray diffraction. Rochet, Amélie; Suzana, Ana Flávia; Passos, Aline R.; Kaliile, Tiago; Berenguer, Felisa; Santilli, Celso V.; Pulcinelli, Sandra H.; Meneau, Florian. *Catalysis Today*. Oct2019, Vol. 336, p169-173. 5p. DOI: [10.1016/j.cattod.2018.12.020](https://doi.org/10.1016/j.cattod.2018.12.020).

Effects of annealing parameters on residual stress and piezoelectric performance of ZnO thin films studied by X-ray diffraction and atomic force microscopy. Shen, Jie-Nan; Zeng, Yi-Bo; Xu, Ma-Hui; Zhu, Lin-Hui; Liu, Bao-Lin; Guo, Hang. *Journal of Applied Crystallography*. Oct2019, Vol. 52 Issue 5, p951-959. 9p. DOI: [10.1107/S1600576719010124](https://doi.org/10.1107/S1600576719010124).

Unravelling the strain relaxation processes in silicon nanowire arrays by X-ray diffraction. Romanitan, Cosmin; Kusko, Mihaela; Popescu, Marian; Varasteanu, Pericle; Radoi, Antonio; Pachi, Cristina. *Journal of Applied Crystallography*. Oct2019, Vol. 52 Issue 5, p1077-1086. 10p. DOI: [10.1107/S1600576719010707](https://doi.org/10.1107/S1600576719010707).

Investigating temperature-induced structural changes of lead halide perovskites by in situ X-ray powder diffraction. Caliendo, Rocco; Altamura, Davide; Belviso, Benny Danilo; Rizzo, Aurora; Masi, Sofia; Giannini, Cinzia. *Journal of Applied Crystallography*. Oct2019, Vol. 52 Issue 5, p1104-1118. 15p. DOI: [10.1107/S160057671901166X](https://doi.org/10.1107/S160057671901166X).