



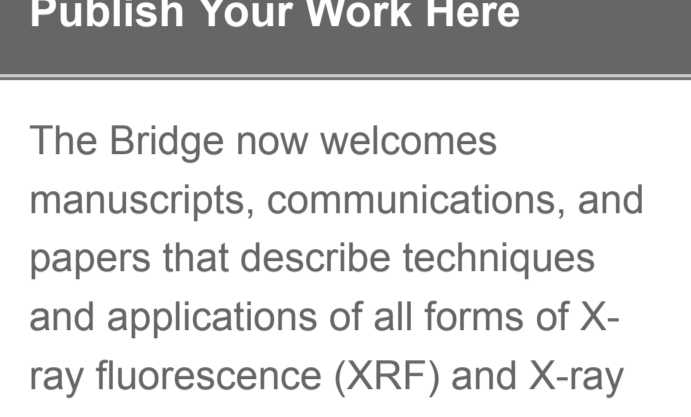
Non-destructive measurement of particle size and size distribution



NANOPIX mini

Rigaku NANOPIX mini is the world's first benchtop small angle X-ray scattering (SAXS) system that is engineered to deliver automatic nanoparticle size distribution analysis for both quality control (QC) and research and development (R&D) applications. Nanoparticle size, size distribution, and particle shape are the key pieces of information obtained from SAXS. Samples may range from solutions, suspensions or slurries to solid plastics, rubbers or polymers. **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 send copy to the editor at Rigaku.newsletter@Rigaku.com

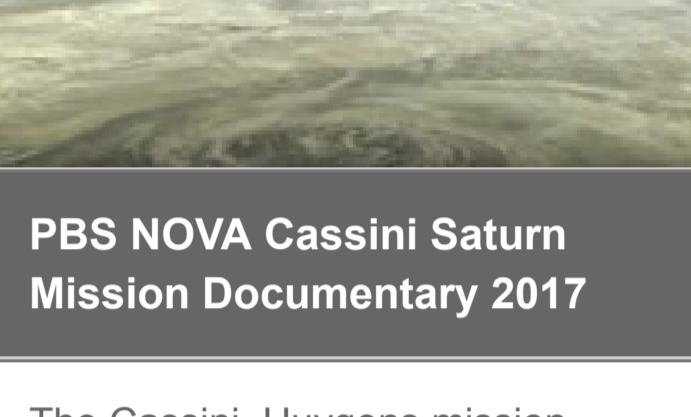
NEX DE – High-resolution elemental analysis of sodium (Na) through uranium (U)



Fast Silicon Drift Detector (SDD) EDXRF spectrometer

As a premium high-performance benchtop EDXRF elemental analyzer, the new 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 >**

Video of the Month



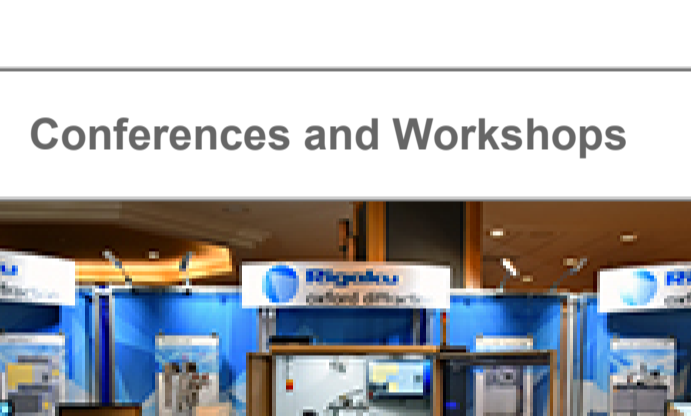
PBS NOVA Cassini Saturn Mission Documentary 2017

The Cassini-Huygens mission, commonly called Cassini, was a collaboration between NASA, the European Space Agency (ESA), and the Italian Space Agency (ASI) to send a probe to study the planet Saturn and its system, including its rings and natural satellites. The Flagship-class unmanned robotic spacecraft comprised both NASA's Cassini probe, and ESA's Huygens lander, which would be landed on Saturn's largest moon, Titan. Cassini was the fourth space probe to visit Saturn and the first to enter its orbit. The craft were named after astronomers Giovanni Cassini and Christiaan Huygens.

Launched aboard a Titan IVB/Centaur on October 15, 1997, Cassini was active in space for more than 19 years, with 13 years spent orbiting Saturn, studying the planet and its system, including its rings and its system, entering orbit on July 1, 2004. The voyage to Saturn included flybys of Venus (April 1998 and July 1999), Earth (August 1999), the asteroid 2685 Masursky, and Jupiter (December 2000). Its mission ended on September 15, 2017.

Watch video >

Conferences and Workshops



Join Rigaku at future meetings

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

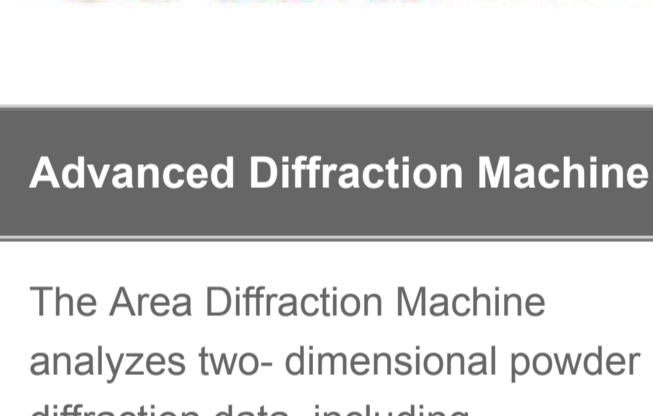
Materials Science & Technology (MS&T17)
Pittsburgh, PA, USA
October 8 – 12, 2017

GSA 2017
Seattle, WA, USA
October 22 – 25, 2017

European Conference on Metal-Organic Frameworks and Porous Polymers
Delft, The Netherlands
October 29 – November 1, 2017

See the complete list >

Useful Link of the Month



Advanced Diffraction Machine

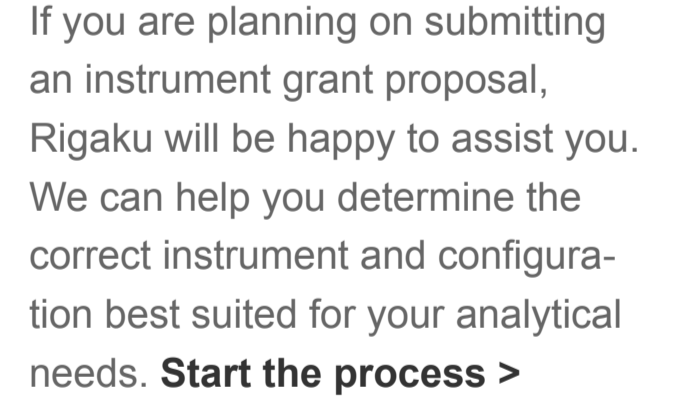
The Area Diffraction Machine analyzes two-dimensional powder diffraction data, including calibration, visualization, polarization corrections, and integration. It supports recalculating parameters for internal calibrants as well as a macro mode for processing large numbers of data files.

The ADM was developed by Joshua Lande as a summer project by a summer intern student at SSRL in conjunction with Sam Webb and Apurva Mehta.

The program is hosted by GitHub and is free open source software. It is still in development so check back frequently for updates.

For more >

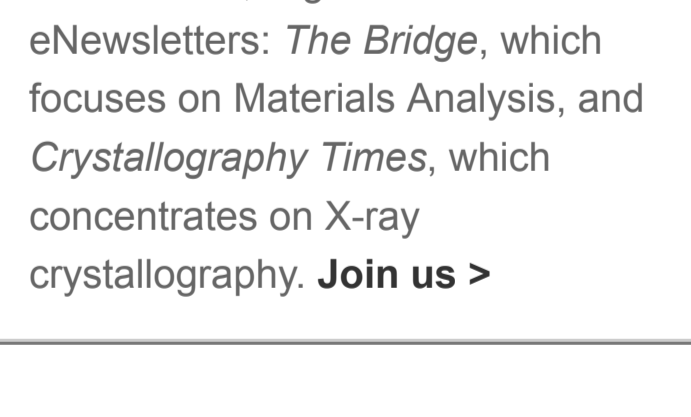
Planning to submit a grant?



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 >**

Welcome

September was an important month for Rigaku, with the annual Japan Analytical & Scientific Instruments Show (JASIS), where many new and current instruments were shown. For XRD, we featured the new SmartLab SE and sixth generation MiniFlex, along with the SmartLab 9KW. For XRF, the new NANO Hunter II TXRF was shown along with the Supermini200, ZSX Primus IV and NEX DE. Rigaku's nano3DX micro-CT imager was also displayed, along with various thermal analyzers, the Progeny handheld Raman spectrometer and the new NANOPIX mini benchtop SAXS instrument. Around 30,000 visitors attended JASIS 2017, the largest number ever.



Rigaku booth at JASIS 2017

In a featured report (below), Dr. Alex Stanley provides an overview of our participation at the recent 24th Congress and General Assembly of the International Union of Crystallography (IUCr). Upcoming events for October are listed below. Please come and visit, as we would love to show you our latest instrumentation.

This month's issue contains a *Rigaku Journal* article describing the investigation of fuel-cell structures with the multi-scale X-ray analysis high-temperature attachment for capillaries. In addition, Dr. Takashi Kikuchi provided a featured article on a symposium called "A Golden Age for Chemistry," hosted by the Stoddart group at Nottingham University.

To round out the month's eNewsletter, Dr. T. Arai provided a report on "Applications of Halal foods by thermal analysis." Application papers are also included for TXRF, WDXRF, and XRD. The book review this month concerns a potentially dystopian future enabled by CRISPR technology. This month's video celebrates the wildly successful Cassini Saturn Mission that just ended. Check out the news and papers sections at the bottom of the page for the latest developments in materials science.

R.C. Tisdale, Ph.D. – Editor

Featured Rigaku Journal Article

Investigation for fuel-cell structures with multi-scale X-ray analysis high-temperature attachment for capillaries

By Kazuhiko Omote, Tomoyuki Iwata, Yoshihiro Takeda and Joseph D. Ferrara

It is well known that X-rays have wavelengths comparable with interatomic distances and can be utilized for atomic-scale structural determination. In addition, X-rays can penetrate through opaque objects and show the internal structure without destroying the object. It is for these reasons that X-rays are widely used for atomic-scale structural analysis of various kinds of crystals including small molecules and large protein molecules, and in some cases providing accurate electron density information. **Full article >**

Featured Article

A Golden Age for Chemistry – A Tribute to Prof. J. Fraser Stoddart

By Dr. Takashi Kikuchi

On June 25 – 28, I attended a symposium called "A Golden Age for Chemistry" hosted by the Stoddart group at Nottingham University. The symposium was held to celebrate Prof. J. Fraser Stoddart's Nobel Prize for Chemistry, the 50th anniversary of the Stoddart group, and Prof. Stoddart's 75th birthday. **Full article >**

Featured Report

Applications to Halal Foods by Thermal Analysis

Reported by Dr. T. Arai, Thermal Analysis Division at Rigaku Corporation

Thailand Institute of Scientific and Technological Research, TISTR's "From Local to Global International Forum: Food Industry 4.0" was held on June 12 – 13, 2017 at the Centara Grand Hotel at Central Lad Phrao, Bangkok, Thailand. The food industry is one of the fastest growing sectors globally. Rigaku participated in the session "Food for Health and Safety: Trends in Food Safety Standards," with four representatives from member companies of JAIMA. Dr. T. Arai presented a talk entitled "Applications of Halal foods by thermal analysis." **Full report >**

Featured Event

24th Congress and General Assembly of the International Union of Crystallography (IUCr2017)

Reported by Dr. Alex Stanley

Finally, the long awaited visit to India to attend the IUCr was upon us. The conference had a record number of local Indian scientists in attendance, and it was great to be able to meet these colleagues in person. Rigaku, being in the fortunate position to be the Diamond Sponsor, was able to showcase a number of our diffraction systems at the meeting. The XtalLAB Synergy-DW, a multi-functional, high-flux single crystal X-ray diffractometer, was a popular attraction alongside the newly launched SmartLab SE powder XRD. **Full report >**

TXRF Application Note

Benchtop TXRF spectrometer NANO Hunter II Elemental Analysis of Pharmaceutical Intermediates

Rigaku Corporation

XRF has been considered as a useful method for impurity analysis for its short measurement time and few spectral overlaps even for multi-element matrices. In addition, analysis by TXRF has the advantage that only a small amount of sample is required compared to other methods. The analysis of pharmaceutical products is carried out in both the development stage and quality control of the final products. In particular, in the development stage, rapid and simple analytical method such as the confirmation of active compound tags and residual catalysts has been required. TXRF can meet these requirements. **For more >**

WDXRF Application Note

Analysis of Low Concentration Sulfur in Petroleum-based Fuels by Benchtop WDXRF According to ASTM D2622-10

Rigaku Corporation

Sulfur in petroleum-based fuels contributes to atmospheric pollution. Sulfur content in fuels, especially in automobile fuels, is strictly controlled and regulations of sulfur content in fuel oil, such as diesel fuel and gasoline, have been tightened. Therefore, control of sulfur content is very important in refineries. **For more >**

EDXRF Application Note

Analysis of Silver and Copper in Ore

Applied Rigaku Technologies

Silver naturally occurs in various ore and minerals, often as sulfides or chlorides or in combination with arsenic or antimony. A main source of silver is found in copper ore, as well as in copper-nickel, gold, lead and lead-zinc ores. Silver and other precious metals are also reclaimed from tailing piles or other recycled ore materials that would previously be discarded. Therefore the silver must often be measured at relatively low levels, as low level silver can be considered profitable to extract. To meet the challenges of low level silver analysis in ore and ore materials Rigaku offers the NEX DE EDXRF analyzer with 60 kV excitation source and high throughput SDD detector capable of analyzing 500,000+ cps. Giving the analyst and technician alike a fast, simple, yet powerful means for measuring elemental composition. **For more >**

Micro Powder Diffraction Application Note

Rigaku Oxford Diffraction from a 3 µg Sample of CsAgCu(CN)3

Rigaku Oxford Diffraction

Traditionally, powder diffraction experiments are carried out on dedicated powder diffractometers using relatively large amounts of sample (> 20 mg) and long exposure times (for example 15 min). Data on samples from Drs. Ann Chippendale and Simon Hibble from the University of Reading were collected on a Gemini S Ultra single-crystal CCD diffractometer from Rigaku Oxford Diffraction. The Gemini systems uniquely have both molybdenum and copper X-ray sources co-mounted on the same platform, making them ideal for a range of applications including chemical/protein crystallography and powder diffraction. This particular system has the high intensity Enhance Ultra X-ray source which is ideally suited for the measurement of powder diffraction patterns of very small samples, weighing only a few 10s of a µg or less. **For more >**

Book Review

Crack in Creation: Gene Editing and the Unthinkable Power to Control Evolution by Jennifer Doudna and Samuel H. Sternberg

Review by Jeanette S. Ferrara, MA

CRISPR is one of the hottest buzzwords in the biotech world right now. The ability to edit genes directly in living things – plants, animals, and even, maybe one day soon, humans – is here. Jennifer Doudna is one of CRISPR's foremost pioneers. In her lab at Berkeley, she helped start the CRISPR revolution. Samuel Sternberg is one of her fellow researchers and co-author. Their book (according to the jacket cover, a favorite of *Star Wars* creator George Lucas) reads a bit like "CRISPR for Dummies" – but in the best possible way. **Full review >**

Material Analysis in the News

News for September 2017

September 1, 2017. The world's most powerful X-ray laser, the [European X-ray Free Electron Laser \(XFEL\)](#), began operating at a Hamburg facility where scientists will attempt to recreate the conditions deep inside the sun and produce film-like sequences of viruses and cells.

September 4, 2017. An enormous black hole one hundred thousand times more massive than the sun has been found hiding in a toxic gas cloud wafting around near the heart of the Milky Way. [Astronomers in Japan found evidence for the new object](#) when they turned a powerful telescope in the Atacama desert in Chile towards the gas cloud in the hope of understanding the strange movement of its gases.

September 5, 2017. The [National Museum of Nature and Science](#) added Sony Corp.'s Trinitron color television and HRP-2 Promet, a humanoid robot made in 2003 to a list of Essential Historical Materials for Science and Technology.

September 5, 2017. An international team of researchers, including scientists from Shinshu University (Japan) and the director of Penn State's ATOMICS Center, has developed a [graphene-based coating for desalination membranes](#) that is more robust and scalable than current nanofiltration membrane technologies.

September 13, 2017. Fuel-cell cars may get a much needed cost reduction if new technology from Nissinbho Holdings leads to platinum-free catalysts becoming widely available for the first time. The use of solid-state ionics originated in Europe, but [Japanese scientists have significantly advanced it over the past 70 years, according to a review](#) in the journal *Science and Technology of Advanced Materials* (STAM).

September 14, 2017. [India and Japan inked 15 agreements to further broad-based their strategic partnership](#) and agreed to strengthen cooperation in the Indo-Pacific region, including advancing cooperation in the fields of energy, smart cities, information and communication technology, space, science and technology, biotechnology, pharmaceuticals and health.

September 15, 2017. [Japanese manufacturers are applying ultrafast quantum computing](#) to product and service development, with autotasks maker Denso aiming to unclog traffic and chemical company JSR looking to speed up the design process for new materials.

September 18, 2017. [Organic solar cells that are waterproof and stretchable](#) could someday be sewn into washable electronic clothing. Researchers in Japan, led by Takao Someya at the RIKEN Center for Emergent Matter Science in Saitama, say such cells could be used in health monitors woven into a patient's clothing to analyze their heartbeat and body temperature, and help spot early warning signs of medical problems.

September 25, 2017. Researchers from the Joint Physics Unit CNRS/Thales, the Nanosciences and Nanotechnologies Centre (CNRS/Université Paris Sud), in collaboration with American and Japanese researchers, have developed the world's [first artificial nano-neuron with the ability to recognise numbers spoken by different individuals](#).

Recent Scientific Papers of Interest

Papers for September 2017

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

Combining XRD and XRF analysis in one Rietveld-like fitting. Bortolotti, M.; Luterotti, L.; Pepponi, G. *Powder Diffraction*. Sep2017 Supplement1, Vol. 32, pS225-S230. 1p. DOI: [10.1017/S0885715617000278](https://doi.org/10.1017/S0885715617000278).

AUSPEX: a graphical tool for X-ray diffraction data analysis. Thorn, Andrea; Parkhurst, James; Emsley, Paul; Nicholls, Robert A.; Vollmar, Melanie; Evans, Gwynad; Murshudov, Garib N. *Acta Crystallographica Section D: Structural Biology*. Sep2017, Vol. 73 Issue 9, p729-737. 8p. DOI: [10.1107/S205979831700969X](https://doi.org/10.1107/S205979831700969X).

XRD and ToF-SIMS study of intermetallic void formation in Cu-Sn micro-connects. Ross, G.; Vuorinen, V.; Krause, W. M.; Reissaus, S.; Petzold, M.; Paulasto-Krockel, M. *Microelectronics Reliability*. Sep2017, Vol. 76, p390-394. 5p. DOI: [10.1016/j.microrel.2017.07.044](https://doi.org/10.1016/j.microrel.2017.07.044).

Supramolecular structure of methyl cellulose and lambda- and kappa-carragenan in water: SAXS study using the string-of-beads model. Dogsa, Itzok; Ceara, Jure; Jammik, Andrej; Tomšič, Matija. *Carbohydrate Polymers*. Sep2017, Vol. 172, p184-196. 13p. DOI: [10.1016/j.carbpol.2017.04.048](https://doi.org/10.1016/j.carbpol.2017.04.048).

CRF and micro-PIXE studies of inhomogeneity of Cu and silver alloys. Vasilescu, A.; Constantinou, B.; Stan, D.; Talmachi, G.; Ceccato, D. *Nuclear Instruments & Methods in Physics Research Section B*. Sep2017 Part A, Vol. 406, p302-308. 7p. DOI: [10.1016/j.nimb.2017.02.019](https://doi.org/10.1016/j.nimb.2017.02.019).

Combined analysis of aluminum oxane based by X-ray diffraction and X-ray fluorescence control. Piksina, Oksana; Andruschenko, Eugenie; Dubinin, Petr; Kirik, Sergey; Ruzhnikov, Sergey; Samoilov, Alexander; Yakimov, Igor; Zaloga, Alexandr. *XRS: X-ray Spectrometry*. Sep/Oct2017, Vol. 46 Issue 5, p474-482. 9p. DOI: [10.1002/xrs.2774](https://doi.org/10.1002/xrs.2774).

Elemental depth profiling in transparent conducting oxide thin film by X-ray reflectivity and grazing incidence X-ray fluorescence combined analysis. Rotella, H.; Caby, B.; Ménesguen, Y.; Mazel, Y.; Valla, A.; Ingerle, D.; Dettlefs, B.; Lépy, M.-C.; Novikova, A.; Rodriguez, G.; Strelci, C.; Nolot, E. *Spectrochimica Acta Part B*. Sep2017, Vol. 135, p22-28. 7p. DOI: [10.1016/j.sab.2017.06.011](https://doi.org/10.1016/j.sab.2017.06.011).

Archeological ceramic artifacts characterization through computed microtomography and X-ray fluorescence. Machado, A.S.; Oliveira, D.F.; Gama Filho, H.S.; Latini, R.; Bellido, A.V.B.; Assis, J.T.; Anjos, M.J.; Lopes, R.T. *XRS: X-ray Spectrometry*. Sep/Oct2017, Vol. 46 Issue 5, p427-434. 8p. DOI: [10.1002/xrs.2786](https://doi.org/10.1002/xrs.2786).

Characterization of microscopic deformation in Cu-Al-Mn superelastic alloy by in situ Laue diffraction study using white X-ray microbeam. Sato, M.; Kiwon, E.P.; Sato, S.; Fujiwara, S.; Shinoda, K.; Suzuki, S.; Kajiwara, K. *Materials Science & Engineering: A*. Sep2017, Vol. 705, p6-10. 5p. DOI: [10.1016/j.msea.2017.08.064](https://doi.org/10.1016/j.msea.2017.08.064).

Quantitative total reflection X-ray fluorescence analysis of directly collected aerosol samples. Prost, J.; Wobrauschek, P.; Strelli, C. *XRS: X-ray Spectrometry*. Sep/Oct2017, Vol. 46 Issue 5, p454-460. 7p. DOI: [10.1002/xrs.2752](https://doi.org/10.1002/xrs.2752).

In situ X-ray diffraction of Fischer-Tropsch catalysts—Effect of water on the reduction of cobalt oxides. Paterson, James; Peacock, Mark; Ferguson, Ewen; Ojeda, Manuel; Clarkson, Jay. *Applied Catalysis A: General*. Sep2017, Vol. 546, p103-110. 8p. DOI: [10.1016/j.apcata.2017.08.017](https://doi.org/10.1016/j.apcata.2017.08.017).

Relative total L-subshell X-ray emission intensities and their impact on the fitting of complex X-ray fluorescence spectra. Ganly, Brianne; Van Haarlem, Yves; Tiekner, James. *XRS: X-ray Spectrometry*. Sep/Oct2017, Vol. 46 Issue 5, p336-340. 5p. DOI: [10.1002/xrs.2756](https://doi.org/10.1002/xrs.2756).

Towards a multi-element X-ray diffraction detector system for fluorescence spectroscopy in the soft X-ray regime. Bufon, Jérôme; Giancelloni, Alessandra; Ahangianabbari, Mahdi; Altissimo, Matteo; Belluti, Pierluigi; Giuseppe, Maria; Boghiesi, Roberto; Carraro, Sergio; Gautiero, Giuseppe; Ciuttin, Andres; Crespo, Giulia Liz; Fabbiani, Sergio; Gallardo, Massimo; Giacomini, Gabriele; Giuresi, Dario; Kourousias, George; Menk, Ralf Hendrik; Picciotto, Antonino; Piemonte, Claudio; Rachevski, Alexandre. *XRS: X-ray Spectrometry*. Sep/Oct2017, Vol. 46 Issue 5, p313-318. 6p. DOI: [10.1002/xrs.2766](https://doi.org/10.1002/xrs.2766).

Chemical Structures of Specific Sodium Ion Battery Components Determined by Operando Pair Distribution Function and X-ray Diffraction Computed Tomography. Soltmann, Jonas; Di Michiel, Marco; Fjellvåg, Helmer; Malavasi, Lorenzo; Margadonna, Serena; Vajeston, Ponniah; Vaughan, Gavin B. M.; Wragg, David S. *Angewandte Chemie International Edition*. 9/11/2017, Vol. 56 Issue 38, p11385-11389. 5p. DOI: [10.1002/anie.201704271](https://doi.org/10.1002/anie.201704271).

Crystal structure of radium sulfate: An X-ray powder diffraction and density functional theory study. Matyskin, Artem V.; Yimen, Rikard; Lagerkvist, Pettra; Rameabek, Henrik; Ekberg, Christian. *Journal of Solid State Chemistry*. Sep2017, Vol. 253, p15-20. 6p. DOI: [10.1016/j.jssc.2017.05.024](https://doi.org/10.1016/j.jssc.2017.05.024).

Direct analysis of marine macroalgae for determination of macro minerals. Korn, Maria Graças A. *Microchemical Journal*. Sep2017, Vol. 134, p35-40. 6p. DOI: [10.1016/j.microc.2017.05.001](https://doi.org/10.1016/j.microc.2017.05.001).

Crystalline microstructure of boehmites studied by multi-peak analysis of powder X-ray diffraction patterns. Pardo, Pablo; Kojdecki, Marek Andrej; Calatayud, José Miguel; Amigó, José María; Alarcón, Javier. *Powder Diffraction*. Sep2017 Supplement1, Vol. 32, pS87-S98. 1p. DOI: [10.1017/S0885715617000641](https://doi.org/10.1017/S0885715617000641).

Combined powder X-ray diffraction data and quantum-chemical calculations in EXPO2014. Altomare, Angela; Ciriaco, Fulvio; Cuocci, Corrado; Falicchio, Aurelia; Fanelli, Flavio. *Powder Diffraction*. Sep2017 Supplement1, Vol. 32, pS123-S128. 1p. DOI: [10.1017/S088571561700015X](https://doi.org/10.1017/S088571561700015X).

The feasibility of in vivo detection of lanthanum using a ²⁴¹Am K X-ray fluorescence system. Joanna Nguyen; Zaid Keldani; Eric Da Silva; Ana Pejović-Milić; James I. Gräfe. *Physiological Measurement*. Sep2017, Vol. 38 Issue 9, p1-1. 1p. DOI: [10.1088/1361-6579/aa82d8](https://doi.org/10.1088/1361-6579/aa82d8).