



MiniFlex – qualitative and quantitative analysis of polycrystalline materials



Benchtop X-ray diffraction (XRD) instrument

Ideally suited for today's fast-paced XRD analyses, the fifth generation MiniFlex delivers speed and sensitivity through innovative technology enhancements such as the optional D/teX high speed detector coupled with a 600 W X-ray source. Whether used for teaching X-ray diffraction at the college and university level, or routine industrial quality assurance, the MiniFlex delivers both performance and value. **For more >**

nano3DX – Microtomography of relatively large samples at high resolution



X-ray microscope

Rigaku nano3DX is a true X-ray microscope (XRM) with the ability to deliver 3D computed tomography (CT) images of relatively large samples at high resolution. This is accomplished by using a high-powered rotating anode X-ray source and a high-resolution CCD detector. The rotating anode provides for fast data acquisition and the ability to switch anode materials easily to optimize contrast for specific sample types. **For more >**

Video of the Month



The PHD Movie 2 OFFICIAL TRAILER

The PHD Movie 2 – OFFICIAL TRAILER. COMING THIS FALL! To arrange a screening at your University or Research Center, visit <http://phdcomics.com/movie>. **Watch the video >**

Conferences and Workshops



Join Rigaku at future meetings

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

(GSA) Geological Society of America
Baltimore, MD, USA
November 1 – 4, 2015

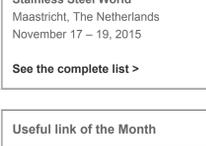
FABTECH
Chicago, IL, USA
November 9 – 12, 2015

Aluminum USA
Detroit, MI, USA
November 11 – 12, 2015

Stainless Steel World
Maastricht, The Netherlands
November 17 – 19, 2015

See the complete list >

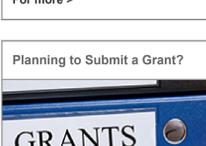
Useful link of the Month



PyMca Toolkit

For the developer, the PyMca Toolkit is a collection of Python tools for visualization and analysis of energy dispersive X-ray fluorescence data. It builds its graphic interface and plotting routines on top of the C++ libraries Qt and Qwt through their respective Python bindings PyQt and PyQwt. Nevertheless, the data analysis routines can be used independently of any graphical interface. PyMca follows the dual licensing model of Riverbank's PyQt. Basically that means you can use, modify and distribute the modified code under the terms of the GPL license. **For more >**

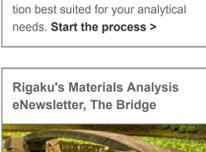
Planning to Submit a Grant?



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 life sciences. **Register >**

Welcome

November is always a busy month for Rigaku, with our various divisions participating in a variety of conferences and other events. I invite everyone who can come to visit us at one of our exhibits during the first week in November at: the Geological Society of America annual conference in Baltimore, the MRL Biological Conference on the University of Illinois at Urbana-Champaign Campus or the joint regional American Chemical Society meeting in Memphis. A complete listing of Rigaku events may be found on our [web site](http://www.rigaku.com).

For your continuing education, we offer the third installment of our new series "Introduction to single crystal X-ray analysis," entitled "Obtaining Quality Data from a Microcrystal." Our featured technical paper is a primer on the use of the Rigaku nano3DX high-resolution X-ray microscope. Check out the news and papers sections at the bottom of the page for the latest developments in materials science. Enjoy the newsletter.

R.C. Tisdale, Ph.D. – Editor



Introduction to single crystal X-ray analysis III

Obtaining quality data from a microcrystal
Rigaku Corporation

In this month's article, techniques and tools to measure diffraction data out of a microcrystal are introduced. **For more >**



Featured Rigaku Journal Article

A primer on the use of the nano3DX high-resolution X-ray microscope
Rigaku Corporation

The nano3DX is an X-ray microscope with submicron spatial resolution, employing a quasi-parallel beam, near-detector system comprised of a unique high-intensity X-ray source and a high-resolution X-ray detector. By selecting the X-ray energy that is most appropriate for the sample, the instrument is capable of observing the microstructure of various samples in either 2D or 3D modalities. **For more >**



Featured RIGAKU Journal Article

Analysis of trace impurities in pharmaceutical products using polarized EDXRF spectrometer NEX CG
Rigaku Corporation

The analysis of pharmaceutical products for metal impurities, such as harmful elements contained in the raw materials and residual catalysts in the manufacturing process is important for the risk assessment in actual large scale production. **For more >**



XRD Application Note – 1

Crystal orientation measurements of samples containing coarse grains
Rigaku Corporation

Pole figure measurement is an important technique for determining the crystal orientation of a sample or calculating the volume fraction of the orientation. Especially for the latter, it is crucial that the measured intensities are equal to the true intensities. Some reduction in intensity due to defocus can be compensated for using defocus corrections, but for samples containing coarse grains, the further development of measurement techniques is necessary. **For more >**



XRD Application Note – 2

Difference between quantitative results using the WPPF method and the RIR method
Rigaku Corporation

In quantitative analysis using X-ray diffractometry, different quantification methods are used depending on factors such as the state of the sample and concentration of the measured components. The method using calibration curves is complicated by the need to procure standard samples, or prepare and measure samples, and thus, at present, there is a switch toward analysis using the WPPF (Whole Powder Pattern Fitting) method and the RIR (Reference Intensity Ratio) method. **For more >**



WDXRF Application Note

Cement Analysis by the Pressed Powder Method on Benchtop WDXRF Supermini200 According to ASTM C114-11
Rigaku Corporation

Cement is one of the most important materials for construction. Many kinds of hydraulic cements, including Portland cement, with various physical properties are produced by changing the composition of clinker minerals; therefore, it is important to control the chemical composition of cement products and interim products. **For more >**



EDXRF Application Note

Chemical Bath for Copper Foil Surface Treatment
Applied Rigaku Technologies

Surface treating is an important part in the manufacture of copper foil for the electronics industry. Surface treatments are used to clean the copper foil, to create roughing and heat resistance treatments, and to make single or multiple layer thin film coatings to prevent oxidation or enhance the electro-chemical properties of the copper foil. The chemical baths must be constantly monitored to ensure the highest quality surface treatments. **For more >**



Raman Application Note

On-site Detection of Counterfeit Medicines & Healthcare Products with Handheld Raman
Rigaku Corporation

Counterfeit pharmaceuticals and other health care products are a global problem and include not only products containing potentially harmful substances, but also products that contain no or diluted amounts of active pharmaceutical ingredients. Because of this growing problem, the need for fast and easy screening techniques in the field has become increasingly urgent. **For more >**



Lab in the Spotlight

ZSX Primus II at American National Carbide in Tomball, Texas, USA

Located in Tomball, Texas, about 25 miles north of Houston, American National Carbide (ANC) is a company that manufactures cemented tungsten carbide (WC), the hardest man-made material. **For more >**



Scientific Book Review

Alan Turing: The Enigma
By Andrew Hodges

Even though Andrew Hodges' *Alan Turing: The Enigma* is now thirty-two years old, it is still regarded as one of the best-researched biographies of Alan Turing. Its relevance prevails despite its age, and the book was the inspiration for the Academy Award-winning film, *The Imitation Game* (which, ironically enough, was heavily criticized for its manifold historical inaccuracies that in no way came from the book that supposedly inspired it). Despite *The Imitation Game's* particular failures, the film's impending release led to a re-release of Hodges' book. The new "movie-tie-in" edition's cover is a scene from the movie, showing Benedict Cumberbatch as Turing from behind, facing his famed Enigma decryption machine. That was about the extent to which the book tied in to the movie. **For more >**



Material Analysis in the News

News for October 2015

October 1, 2015. Susan Trolier-McKinstry, Professor of Ceramic Science and Engineering and Professor of Electrical Engineering at The Pennsylvania State University, will serve as **vice president of the Materials Research Society beginning Jan. 1, 2016, and president in 2017**. Her three-year term will continue in 2018 as immediate past president.

October 1, 2015. Researchers at the University of Texas at Dallas, in collaboration with an international team of engineers and scientists, have uncovered a phenomenon that could have major implications for the development of nanoelectronic circuits and devices. Researchers describe how **grown and stacked atomically thin materials can exhibit a unique transport effect, called negative differential resistance, or NDR, at room temperature**. NDR is a phenomenon in which electrons, due to their wave nature, tunnel through thin materials with varying resistance.

October 2, 2015. 125 years after his death, conservators at the Van Gogh Museum in Amsterdam in the Netherlands are working with scientists at AkzoNobel to reverse the effects of time, and reveal Van Gogh's paintings as they appeared when he first painted them. To help with this, they are using chemical clues from **X-ray fluorescence analysis conducted on the painting**, which reveals the elemental composition of each individual pixel.

October 2, 2015. Morris E. Fine, the **Walter P. Murphy Professor Emeritus** of Materials Science and Engineering and the Technological Institute Professor Emeritus of Materials Science and Engineering at Northwestern University, died at age 97. A member of Northwestern's faculty since 1954 and co-founder of the world's first department of materials science, Fine was well-regarded in the field of materials science, at both the national and international levels.

October 5, 2015. The U.S. Department of Energy (DOE) has announced \$12 million in funding over the next four years for a new **Center for Computational Design of Functional Strongly Correlated Materials and Theoretical Spectroscopy** at Brookhaven National Laboratory and Rutgers University. The center will be led by Gabriel Kotliar, a physicist at Rutgers who holds a part-time position at Brookhaven Lab.

October 19, 2015. UCLA geochemists have found evidence that **life likely existed on Earth at least 4.1 billion years ago** — 300 million years earlier than previous research suggested. The discovery indicates that life may have begun shortly after the planet formed 4.54 billion years ago.

October 19, 2015. The National Science Foundation (NSF) is pleased to announce 24 new awardees for the **NSF Research Traineeship (NRT)** program, designed to encourage the development and implementation of bold, new, potentially transformative models for graduate education in the fields of science, technology, engineering and mathematics (STEM).

October 20, 2015. Researchers at the Harvard John A. Paulson School of Engineering and Applied Sciences (SEAS) have announced a way to make steel stronger, safer and more durable. Their **new surface coating, made from rough nanoporous tungsten oxide**, is the most durable anti-fouling and anti-corrosive material to date. The new material joins the portfolio of other non-stick, anti-fouling materials developed in the lab of Joanna Aizenberg, the Amy Smith Berylson Professor of Materials Science.

October 21, 2015. The **Micron Foundation's gift of \$25 million — the largest it has ever made — covers nearly half the cost of the \$55 million center in Boise State University's materials science program**, which started in 2002. Micron's donation is one in a string of gifts the company and its foundation has made to launch Boise State's materials science program, which now has 177 students.

October 22, 2015. NASA's OSIRIS-REx spacecraft has completed assembly operations at its Lockheed Martin construction site in Denver, Colorado. OSIRIS-REx, slated to become the first asteroid sample return mission for the U.S. space agency, To accomplish the mission's scientific objectives, OSIRIS-REx is fitted with six scientific instruments, including the **Regolith X-ray Imaging Spectrometer (REXIS)**.



Recent Scientific Papers of Interest

Papers for October 2015

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

X-Ray Diffraction: Instrumentation and Applications. Bunaciu, Andrei A.; Udriștioiu, Elena Gabriela; Aboul-Enin, Hassan Y. *Critical Reviews in Analytical Chemistry*. Oct2015, Vol. 45 Issue 4, p289-299. 11p. DOI: [10.1080/10408347.2014.949616](https://doi.org/10.1080/10408347.2014.949616).

X-ray scattering characterisation of nanoparticles. Ingham, Bridget. *Crystallography Reviews*. Oct2015, Vol. 21 Issue 4, p229-303. 75p. DOI: [10.1080/0889311X.2015.1024114](https://doi.org/10.1080/0889311X.2015.1024114).

Development of a method for direct elemental analysis of lithium ion battery degradation products by means of total reflectance X-ray fluorescence. Evertz, Marco; Lürenbaum, Constantin; Vortmann, Britta; Wipf, Martin; Nowak, Sascha. *Spectrochimica Acta Part B*. Oct2015, Vol. 112, p34-39. 6p. DOI: [10.1016/j.sab.2015.08.005](https://doi.org/10.1016/j.sab.2015.08.005).

The Copper CHARM Set: A New Set of Certified Reference Materials for the Standardization of Quantitative X-Ray Fluorescence Analysis of Heritage Copper Alloys. Hegginham, A.; Bassett, J.; Bourgarit, D.; Eveleigh, C.; Glinzman, L.; Hook, D.; Smith, D.; Speakman, R. J.; Shugar, A.; Van Langh, R. *Archaeometry*. Oct2015, Vol. 57 Issue 5, p856-868. 13p. DOI: [10.1111/arc.12117](https://doi.org/10.1111/arc.12117).

The atomic scale structure of graphene powder studied by neutron and X-ray diffraction. Woznica, Natalia; Hawelek, Lukasz; Fischer, Henry E.; Bobrinetskiy, Ivan; Burián, Andrzej. *Journal of Applied Crystallography*. Oct2015, Vol. 48 Issue 5, p1429-1436. 8p. DOI: [10.1107/S1600576715014053](https://doi.org/10.1107/S1600576715014053).

Combined Raman Scattering and X-ray Diffraction Study of Phase Transition of the Ionic Liquid [BMIM][TFSI] Under High Pressure. Wu, Jie; Zhu, Xiang; Li, Haining; Su, Lei; Yang, Kun; Cheng, Xueren; Yang, Guoqiang; Liu, Jing. *Journal of Solution Chemistry*. Oct2015, Vol. 44 Issue 10, p2106-2116. 11p. DOI: [10.1007/s10953-015-0393-2](https://doi.org/10.1007/s10953-015-0393-2).

Distribution of cations in Co_{1-x}Mn_xFe₂O₄ using XRD, magnetization and Mössbauer spectroscopy. Yadav, S.P.; Shinde, S.S.; Bhatt, Pramod; Meena, N.S.S.; Rajpuro, K.Y. *Journal of Alloys & Compounds*. Oct2015, Vol. 646, p550-556. 7p. DOI: [10.1016/j.jallcom.2015.05.270](https://doi.org/10.1016/j.jallcom.2015.05.270).

Complementary use of monochromatic and white-beam X-ray micro-diffraction for the investigation of ancient materials. Dejoie, Catherine; Tamura, Nobumichi; Kunz, Martin; Goudeau, Philippe; Sciau, Philippe. *Journal of Applied Crystallography*. Oct2015, Vol. 48 Issue 5, p1522-1533. 12p. DOI: [10.1107/S1600576715014983](https://doi.org/10.1107/S1600576715014983).

Welding residual stress measurement of an urban buried gas pipeline by X-ray diffraction method. Rubin, Gou; Wenjiao, Dan; Fei, Qiu; Min, Yu; Weigang, Zhang. *Insight: Non-Destructive Testing & Condition Monitoring*. Oct2015, Vol. 57 Issue 10, p556-561. 6p. DOI: [10.1784/insi.2015.57.10.556](https://doi.org/10.1784/insi.2015.57.10.556).

In situ x-ray diffraction study of crystal structure of Pd during hydrogen isotope loading by solid-state electrolysis at moderate temperatures 250-300 °C. Fukada, Yoshiaki; Hioki, Tatsumi; Motobiro, Tomoyoshi; Ohshima, Shigeaki. *Journal of Alloys & Compounds*. 10/25/2015, Vol. 647, p221-230. 10p. DOI: [10.1016/j.jallcom.2015.06.153](https://doi.org/10.1016/j.jallcom.2015.06.153).

Detecting rare, abnormally large grains by x-ray diffraction. Boyce, B.; Furnish, T.; Padilla, H.; Campen, D.; Mehta, A. *Journal of Materials Science*. Oct2015, Vol. 50 Issue 20, p6719-6729. 11p. DOI: [10.1007/s10853-015-9226-3](https://doi.org/10.1007/s10853-015-9226-3).

Analysis of mineral grades for metallurgy: Combined element-to-mineral conversion and quantitative X-ray diffraction. Parian, Mehdi; Lambert, Pelli; Mücke, Robert; Rosenkranz, Jan. *Minerals Engineering*. Oct2015, Vol. 82, p25-35. 11p. DOI: [10.1016/j.mineng.2015.04.023](https://doi.org/10.1016/j.mineng.2015.04.023).

Quantitative determination of two polymorphic forms of imatinib mesylate in a drug substance and tablet formulation by X-ray powder diffraction, infrared scanning calorimetry and attenuated total reflectance Fourier transform infrared spectroscopy. Bellur, Atico; Esen, Karliga; Bekir. *Journal of Pharmaceutical & Biomedical Analysis*. Oct2015, Vol. 114, p330-340. 11p. DOI: [10.1016/j.jpba.2015.06.011](https://doi.org/10.1016/j.jpba.2015.06.011).

Effective piezoelectric coefficient measurement of BaTiO₃ thin films using the X-ray diffraction technique under electric field available in a standard laboratory. They, Virginie; Bayart, Alexandre; Blach, Jean-François; Roussel, Pascal; Saitzeq, Sébastien. *Applied Surface Science*. Oct2015, Vol. 351, p480-486. 7p. DOI: [10.1016/j.apsusc.2015.05.155](https://doi.org/10.1016/j.apsusc.2015.05.155).

Temperature dependence of helium-implantation-induced lattice swelling in polycrystalline tungsten: X-ray micro-diffraction and Eigenstrain modelling. de Broglie, I.; Beck, C.E.; Liu, W.; Hofmann, F. *Scripta Materialia*. Oct2015, Vol. 107, p96-99. 4p. DOI: [10.1016/j.scriptamat.2015.05.029](https://doi.org/10.1016/j.scriptamat.2015.05.029).

On-Site Identification of Early Böttger Red Stoneware Using Portable XRF/Raman Instruments: 2. Glaze & Gilding Analysis. Simsek, Gulsu; Colombari, Philippe; Casadio, Francesca; Bellot-Gurlet, Ludovic; Zelleke, Ghenele; Faber, Catherine T.; Milande, Véronique; Tiliard, Laurence. *Journal of the American Ceramic Society*. Oct2015, Vol. 98 Issue 10, p3006-3013. 8p. 2 Color Photographs, 1 Chart, 5 Graphs. DOI: [10.1111/jace.13720](https://doi.org/10.1111/jace.13720).

Combined XRD and XPS analysis of ex-situ and in-situ plasma magnetron magnetron sputtered Mg films. Milcius, D.; Grbović-Novaković, J.; Zostautienė, R.; Lelis, M.; Girždevičius, D.; Urbonavičius, M. *Journal of Alloys & Compounds*. 10/25/2015, Vol. 647, p790-796. 7p. DOI: [10.1016/j.jallcom.2015.05.151](https://doi.org/10.1016/j.jallcom.2015.05.151).

Determining the shape and periodicity of nanostructures using small-angle X-ray scattering. Sunday, Daniel F.; List, Scott; Chawla, Jasmeet S.; Kline, R. Joseph. *Journal of Applied Crystallography*. Oct2015, Vol. 48 Issue 5, p1355-1363. 9p. DOI: [10.1107/S1600576715013369](https://doi.org/10.1107/S1600576715013369).

Tuning the composition and magnetocrystalline structure of dysprosium iron garnets by Co-substitution: An XRD, FT-IR, XPS and VSM study. Tholkappiyar, R.; Vishista, K. *Applied Surface Science*. Oct2015, Vol. 351, p1016-1024. 9p. DOI: [10.1016/j.apsusc.2015.05.193](https://doi.org/10.1016/j.apsusc.2015.05.193).

In-situ STM and XRD studies on Nb-H films: Coherent and incoherent phase transitions. Burlaka, Vladimir; Wagner, Stefan; Pundt, Astrid. *Journal of Alloys & Compounds*. Oct2015 Supplement 1, Vol. 645, pS388-S391. 1p. DOI: [10.1016/j.jallcom.2014.12.103](https://doi.org/10.1016/j.jallcom.2014.12.103).

Structure of Bolaamphiphile Sphorolipid Micelles Characterized with SAXS, SANS, and MD Simulations. Manet, Sabine; Cuvier, Anne-Sophie; Valotteau, Claire; Fadda, Giulia C.; Perez, Javier; Karakas, Esra; Abel, Stéphane; Baccile, Niki. *Journal of Physical Chemistry B*. Oct2015, Vol. 119 Issue 41, p13113-13133. 21p. DOI: [10.1021/acs.jpcc.5b05374](https://doi.org/10.1021/acs.jpcc.5b05374).

A Comparison of Three Different Biodegradable Aliphatic Oligoesters (PGA, PLLA, and PCL) with Similar Linear Alkyl End Groups by DSC and SAXS. Báez, José E.; Marcos-Fernández, Ángel. *International Journal of Polymer Analysis & Characterization*. 2015, Vol. 20 Issue 7, p637-644. 8p. DOI: [10.1080/1023666X.2015.1054138](https://doi.org/10.1080/1023666X.2015.1054138).