



**High-power Benchtop Sequential WDXRF Spectrometer**



**Supermini200 – Elemental analysis of solids, liquids, powders, alloys and thin films**

As the world's only high-power benchtop sequential wavelength dispersive X-ray fluorescence (WDXRF) spectrometer for elemental analysis of oxygen (O) through uranium (U) of almost any material, the Rigaku Supermini200 uniquely delivers low cost-of-ownership (COO) with high resolution and lower limits-of-detection (LLD). **For more >**

**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 send copy to the editor at [Rigaku.newsletter@Rigaku.com](mailto:Rigaku.newsletter@Rigaku.com)

**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 >**

**Video of the Month – Part I**



**2001: A Space Odyssey Official Re-Release Trailer (2014)**

Stanley Kubrick's spectacular, transcendent epic has been the touchstone for all science-fiction cinema since its original 1968 release. This landmark film returned to cinema screens in 2014. With a screenplay co-written by Kubrick and Arthur C. Clarke and developed concurrently alongside Clarke's novel of the same name, *2001: A Space Odyssey* is widely regarded as one of the greatest films ever made. **Watch video >**

**Video of the Month – Part II**



**Stanley Kubrick | 2001 A Space Odyssey (1968) | Making of a Myth**

The documentary *2001: The Making of a Myth* is introduced by James Cameron, who looks at the stories behind *2001: A Space Odyssey*, examining why the film has endured and why it still generates such interest. With contributions from Arthur C. Clarke, Keir Dullea, Elvis Mitchell, and Douglas Trumbull. **Watch video >**

**Conferences and Workshops**



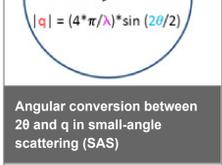
**Join Rigaku at future meetings**

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

- Bureau of International Conference on Coordination Chemistry**  
Brest, France  
July 3 – 8, 2016
- Aluminum China**  
Shanghai, China  
July 12 – 14, 2016
- Semicon West 2016**  
San Francisco, CA, USA  
July 12 – 14, 2016
- Metals Recycling Event**  
Derby, UK  
July 13 – 14, 2016

**See the complete list >**

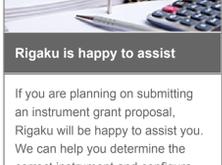
**Useful link of the Month**



**Angular conversion between 2θ and q in small-angle scattering (SAS)**

Select either conversion from 'q (or d)' to '2θ' or '2θ to q (or d)', the range of conversion and the wavelength. The angular units of 2θ are in degrees (0-180) and q has the same (but reciprocal) unit as the wavelength, d has the same unit as the wavelength. So if the wavelength is given in nm, q will be in inverse nm (or d will be also in nm), q is in reciprocal units, d in real-space units (d = 2\*PI/q). **For more >**

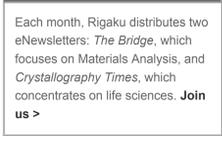
**Planning to Submit a Grant?**



**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. **Join us >**

**Welcome**

We want to thank everyone who visited Rigaku at EPDIC15 in Bari, Italy. The European powder diffraction conference celebrated 2016 as a landmark year for powder diffraction history: almost a century has passed since the pioneering works and experiments of Debye, Scherrer, and Hull, and fifty years have passed since the first publication of the Rietveld method. The images below capture the essence of this lively event.



EPDIC 2016

Please come and see us at the following scientific events in July: 16th (ICCBM) International Conf on the Crystallization of Biological Macromolecules (Prague), Semicon West 2016 (San Francisco), American Crystallographic Association 2016 (Denver) and M&M Microscopy & Microanalysis (Columbus, OH). We promise to have new and interesting things to discuss.

Our featured technical paper covers the "Determination of Crystalline Phase and Amorphous Phase in Refractory Material by X-ray Diffraction Analysis Using the Rietveld Refinement."

The second serious science fiction movie, and clearly the most important and influential movie of its ilk, is the video topic this month. *2001: A Space Odyssey* was the 1968 epic science fiction film produced and directed by the late Stanley Kubrick. Many of us, who were around at the time, were scientifically inspired by watching this in ultra wide angle 70mm Cinerama® format on a curved screen with six-track surround sound (about like the state-of-the-art today). It was an unforgettable experience that inspired many scientific careers.

This month's featured scientific paper, concerning sample preparation for X-ray fluorescence analysis, is entitled "Pulverizing methods of powder samples." Applications notes include XRD, WDXRF, EDXRF and RAMAN technologies. Check out the book review, 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



**Lab in the Spotlight**

**Introduction to Dr. Katsuhiko Inaba's paper on HRXRD analysis of thin films**

This month we are pleased to introduce Dr. Katsuhiko Inaba's paper on HRXRD analysis of thin films. The paper has been downloaded over 3300 times since it was first published in 2013, and offers helpful hints on the analysis of new functional thin films. It is available via the Open Access journal *Advances in Materials Physics and Chemistry*. **For more >**



**Featured XRF Rigaku Journal Article**

**Sample preparation for X-ray fluorescence analysis II. Pulverizing methods of powder samples**

Rigaku Corporation

In the XRF field, it may fairly be said that sample preparation can be the largest factor that cause analysis error. Especially for the analysis of powder samples, as mentioned in the previous edition [Sample preparation for X-ray Fluorescence Analysis I.], heterogeneity effects such as grain size effect, mineralogical effect and segregation can result in analysis error because of its effect on the X-ray Fluorescence intensity. When more precise analysis is required, it is recommended to analyze the sample after pulverization to eliminate the grain size effect and segregation as much as possible. **For more >**



**XRD Application Note**

**Quantitative analysis of a 4-component sample using a benchtop X-ray diffractometer**

Rigaku Corporation

Previous benchtop X-ray diffractometers needed a measurement time of roughly 1-2 hours to measure an X-ray diffraction pattern with the wide angular range and sufficient intensity necessary for quantitative analysis. However, with a benchtop X-ray diffractometer equipped with a high-speed 1-dimensional detector, it is possible to obtain an X-ray diffraction pattern suitable for quantitative analysis in about 10 minutes. **For more >**



**WDXRF Application Note**

**Determination of Chemical Composition of Nickel Laterite Ore by Fusion Method**

Rigaku Corporation

Nickel is one of the most important base metals for modern infrastructure. Over 60 percent of world nickel production (nickel metal based) is used for the making of stainless steel. There are mainly two types of resources for nickel mining – sulfide and laterite (oxide) ores. More than 70 percent of world nickel resources on land are found in laterite ores. **For more >**



**EDXRF Application Note**

**Complex Lube Oils**

Applied Rigaku Technologies

Quality control and quality assurance during the lube oil blending and manufacturing process is essential. Basic lube oil formulations containing only P, S, Ca and Zn are often augmented with additional elements and additives to create lubricating oils for specific needs. A fast, simple method of analyzing lube oils is important throughout the QC/QA process. Rigaku meets this industry need with a high performance low cost benchtop EDXRF system. **For more >**

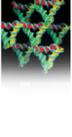


**Raman Application Note**

**Herbal Materials and Natural Foods Analysis with Handheld Raman**

Rigaku Analytical Devices

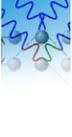
FDA guidelines for current Good Manufacturing Practices (c-GMP) in manufacturing, packaging, labeling, or holding operations for dietary supplements are described under 21 CFR part 111. Under these regulations, dietary supplement manufacturers are required to use at least one appropriate test method to verify the identity of any component or excipient used in the manufacturing of a dietary supplement. Manufacturers are also required to confirm identity of all components to determine if applicable specifications are met. **For more >**



**Scientific Book Review**

**Structural DNA Nanotechnology by Nadrian C. Seeman**

Nadrian C. Seeman has been at New York University since 1988, but wrote most of the book while on sabbatical in 2011 in San Francisco. Seeman is the founder of the field of DNA nanotechnology and has been given a number of awards, including the Feynman and Kavli Prizes, in recognition of his groundbreaking work. Seeman comments that he came up with the idea of making nanoscale structures with DNA in a bar in 1980, but he doesn't elaborate. I would have enjoyed the rest of that story. **For more >**



**Material Analysis in the News**

**News for June 2016**

June 1, 2016. Contrary to widespread expectation, **hydrogen atoms can be located very accurately using x-ray diffraction**, yielding bond lengths involving hydrogen within (Å-H) that are in agreement with results from neutron diffraction mostly within a single standard deviation.

June 7, 2016. Researchers at the Paul Scherrer Institute's Swiss Light Source in Villigen, Switzerland, have developed a **new design for X-ray spectrometers** that eschews a commonly utilized component to lowers overall production costs and increase the efficiency of x-ray flux, which may lead to faster acquisition times for sample imaging and increased efficiency for the system.

June 7, 2016. Researchers have **demonstrated calcium ion batteries (CIBs) using pigment electrodes** such as Prussian blue and its analogues. The CIBs showed excellent cyclability of discharge and charge in a calcium-based organic electrolyte.

June 10, 2016. Scientists have found that the **hair-like nanoscale filaments on some bacteria have electrical conductivity** comparable to that of copper, an advance that may lead to low-cost, non-toxic, biological components for light-weight electronics.

June 13, 2016. Utilizing the X-ray diffraction instrument on NASA's Curiosity rover, **researchers have found traces of the mineral tridymite** in a drill site in Gale crater. Tridymite is normally only associated with silica-rich volcanism that can have explosive and high-temperature eruptions similar to the volcanism seen in the Cascades on Earth.

June 14, 2016. Xenon, one of the noble gases, forms oxides that are not stable under ambient conditions, but are stable under very high pressure. In an effort to understand why the Earth's crust and atmosphere lacks the expected amount of xenon, researchers from institutions in France, the U.K. and Japan have **made two new xenon compounds under high pressure conditions**.

June 17, 2016. Revealing new insights into how the material can be "fatigued" and fail, an X-ray analysis technique clearly shows the culprit — rare, abnormally large crystalline regions. With repeated use, materials undergo a deformation process called fatigue.

June 19, 2016. **With just the change of an atom**, researchers using two U.S. Department of Energy synchrotron light sources, including the Advanced Photon Source (APS) at Argonne, have found it is possible to change a material's properties.

June 20, 2016. When it comes to X-ray analysis we normally think of techniques like XRD and XRF. However, another interesting technique exists that uses x-rays, namely residual stress analysis. A leading light in this field is scientist **Professor Liangchi Zhang at the University of New South Wales**, in the School of Mechanical and Manufacturing Engineering.



**Recent Scientific Papers of Interest**

**Papers for June 2016**

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

**Blombos Cave: Middle Stone Age ochre differentiation through FTIR, ICP OES, ED XRF and XRD.** Moyo, Stanley; Mphuthi, Dikeledi; Cukrowska, Ewa; Henshiwood, Christopher S.; van Niekerk, Karen; Chimuka, Luke. *Quaternary International*. Jun2016 Part B, Vol. 404, p20-29. 10p. DOI: [10.1016/j.quaint.2015.09.041](https://doi.org/10.1016/j.quaint.2015.09.041).

**Determination of the compressive yield strength for nano-grained YAG transparent ceramic by XRD analysis.** Wang, H.M.; Jiang, J.S.; Huang, Z.Y.; Chen, Y.; Liu, K.; Lu, Z.W.; Qi, J.Q.; Li, F.; He, D.W.; Lu, T.C.; Wang, Q.Y. *Journal of Alloys & Compounds*. Jun2016, Vol. 671, p527-531. 5p. DOI: [10.1016/j.jallcom.2016.02.112](https://doi.org/10.1016/j.jallcom.2016.02.112).

**Barite precipitation following celestite dissolution in a porous medium: A SEM/BSE and μ-XRD/XRF study.** Poonnoosamy, J.; Curti, E.; Kosakowski, G.; Grolmund, D.; Van Loon, L.R.; Mäder, U. *Geochimica et Cosmochimica Acta*. Jun2016, Vol. 182, p131-144. 14p. DOI: [10.1016/j.gca.2016.03.011](https://doi.org/10.1016/j.gca.2016.03.011).

**Residual stress state in an induction hardened steel bar determined by synchrotron- and neutron diffraction compared to results from lab-XRD.** Holmberg, Jonas; Steuwer, Axel; Stormvinter, Albin; Kristoffersen, Hans; Haakainen, Merja; Berglund, Johan. *Materials Science & Engineering: A*. Jun2016, Vol. 667, p199-207. 9p. DOI: [10.1016/j.msea.2016.04.075](https://doi.org/10.1016/j.msea.2016.04.075).

**Quantitative analysis of trace nanoscale contamination in solution using electrochemical X-ray fluorescence (EC-XRF).** Ayres, Zoë J.; Newton, Mark E.; Macpherson, Julie V. *Analyst*. 6/7/2016, Vol. 141 Issue 11, p3349-3357. 9p. DOI: [10.1039/c6an00340k](https://doi.org/10.1039/c6an00340k).

**XRF-measured blood lead (Pb) as a biometric for Pb exposure and toxicity among children diagnosed with Pb poisoning.** Spieth, Aaron J.; Lin, Yanfen; Weisskopf, Marc; Yan, Chonghui; Hu, Howard; Xu, Jiao; Nie, Linda H. *Biomarkers*. Jun2016, Vol. 21 Issue 4, p347-352. 6p. DOI: [10.3109/1354750X.2016.1139183](https://doi.org/10.3109/1354750X.2016.1139183).

**SUNBIM: a package for X-ray imaging of nano- and biomaterials using SAXS, WAXS, GISAXS and GIWAXS techniques.** Siliqi, Dritan; De Caro, Liberato; Ladisa, Massimo; Scattarella, Francesco; Mazzone, Annamaria; Altamura, Davide; Spillito, Teresa; Giannini, Cinzia. *Journal of Applied Crystallography*. Jun2016, Vol. 49 Issue 3, p1107-1114. 7p. DOI: [10.1107/S1600576716006932](https://doi.org/10.1107/S1600576716006932).

**Fabrication and Characterization of CuCr2O4 Nanocomposites by XRD, FESEM, FTIR, and DRS.** Habibi, Mohammad Hossein; Fakhri, Fatemeh. *Synthesis & Reactivity in Inorganic, Metal-Organic, & Nano-Metal Chemistry*. 2016, Vol. 46 Issue 6, p847-851. 5p. DOI: [10.1080/15533174.2014.989591](https://doi.org/10.1080/15533174.2014.989591).

**Comparative SAXS, DSC and FT-IR Spectra of Polyurethane Coatings Filled with Hexagonal and Sword-like Zinc Oxide.** Srisathikul, Chitnaron; Pholnag, Chat; Chareonsuk, Thanida; Pancharawat, Pornsak; Rugmai, Supagorn. *Arabian Journal for Science & Engineering*. Jun2016, Vol. 41 Issue 6, p2339-2344. 6p. DOI: [10.1007/s13399-015-1948-7](https://doi.org/10.1007/s13399-015-1948-7).

**Deterioration of hardened cement paste under combined sulphate-chloride attack investigated by synchrotron XRD.** Stroh, J.; Meng, B.; Emmerling, F. *Solid State Sciences*. Jun2016, Vol. 56, p29-44. 16p. DOI: [10.1016/j.solidstatesciences.2016.04.002](https://doi.org/10.1016/j.solidstatesciences.2016.04.002).

**Raman-Mössbauer-XRD studies of selected samples from "Los Azulejos" outcrop: A possible analogue for assessing the alteration processes on Mars.** Laila, E.A.; Sanz-Arnanz, A.; Lopez-Reyes, G.; Sansano, A.; Medina, J.; Schmanke, D.; Klingelhofer, G.; Rodriguez-Losada, J.A.; Martinez-Frías, J.; Rull, F. *Advances in Space Research*. Jun2016, Vol. 57 Issue 11, p2385-2395. 11p. DOI: [10.1016/j.asr.2016.03.014](https://doi.org/10.1016/j.asr.2016.03.014).

**Geochemical exploration for tin deposits in Cornwall, England: recent developments using portable XRF for large scale surveys and Tellus SW regional surveys.** Moon, Charlie. *Applied Earth Science: Transactions of the Institution of Mining & Metallurgy, Section B*. Jun2016, Vol. 125 Issue 2, p92-92. 1p. DOI: [10.1080/03717453.2016.1166656](https://doi.org/10.1080/03717453.2016.1166656).

**Studying the measurement by X-ray diffraction of residual stresses in TiAl<sub>3</sub>V titanium alloy.** Moussaoui, K.; Segonds, S.; Rubio, W.; Mousseigne, M. *Materials Science & Engineering: A*. Jun2016, Vol. 667, p340-348. 9p. DOI: [10.1016/j.msea.2016.03.130](https://doi.org/10.1016/j.msea.2016.03.130).

**Mapping of residual strains around a shear band in bulk metallic glass by nanobeam X-ray diffraction.** Shakur Shahabi, Hamed; Scudino, Sergio; Kaban, Ivan; Stoica, Mihai; Escher, Benjamin; Menzel, Siegfried; B.M. Vaughan, Gavin; Kühn, Uta; Eckert, Jürgen. *Acta Materialia*. Jun2016, Vol. 111, p187-193. 7p. DOI: [10.1016/j.actamat.2016.03.035](https://doi.org/10.1016/j.actamat.2016.03.035).

**Asymmetric skew X-ray diffraction at fixed incidence angle: application to semiconductor nano-objects.** Grigoriev, D.; Lazarev, S.; Schrott, P.; Minkevic, A.A.; Köhl, M.; Slobodskyy, T.; Helfrich, M.; Schaadt, D.M.; Aschenbrenner, T.; Hommel, D.; Baumbach, T. *Journal of Applied Crystallography*. Jun2016, Vol. 49 Issue 3, p961-967. 6p. DOI: [10.1107/S1600576716006385](https://doi.org/10.1107/S1600576716006385).

**Assessment of firing conditions in old fired-clay bricks: The contribution of X-ray powder diffraction with the Rietveld method and small angle neutron scattering.** Vianari, Alberto; Sotiriadis, Konstantinos; Len, Adél; Šašek, Petr; Ševčík, Radek. *Materials Characterization*. Jun2016, Vol. 116, p33-43. 11p. DOI: [10.1016/j.matchar.2016.04.003](https://doi.org/10.1016/j.matchar.2016.04.003).

**In-situ high-pressure x-ray diffraction study of zinc ferrite nanoparticles.** Ferrari, S.; Kumar, R.S.; Griblat, F.; Aphesteguy, J.C.; Gräfe, J.L.; Noseworthy, M.D.; Chettle, D.R. *Applied Radiation & Isotopes*. Jun2016, Vol. 112, p103-109. 7p. DOI: [10.1016/j.apradiso.2016.03.021](https://doi.org/10.1016/j.apradiso.2016.03.021).

**Ex-situ X-ray diffraction analysis of electrode strain at TiO<sub>2</sub> atomic layer deposition/α-MoO<sub>3</sub> interface in a novel aqueous potassium ion battery.** Schuppert, Nicholas David; Mukherjee, Santanu; Bates, Alex M.; Son, Eun-Jin; Choi, Moon Jong; Park, Sam. *Journal of Power Sources*. Jun2016, Vol. 316, p160-169. 10p. DOI: [10.1016/j.jpowsour.2016.03.064](https://doi.org/10.1016/j.jpowsour.2016.03.064).

**A phantom-based feasibility study for detection of gadolinium in bone in-vivo using X-ray fluorescence.** Lord, M.L.; McNeill, F.E.; Gräfe, J.L.; Noseworthy, M.D.; Chettle, D.R. *Applied Radiation & Isotopes*. Jun2016, Vol. 112, p103-109. 7p. DOI: [10.1016/j.apradiso.2016.03.021](https://doi.org/10.1016/j.apradiso.2016.03.021).

**X-ray fluorescence determination of the surface density of thin chromium and iron films using reference samples of elements with close atomic numbers.** Mashin, N.; Chernyaeva, E.; Tumanova, A.; Ershov, A. *Journal of Analytical Chemistry*. Jun2016, Vol. 71 Issue 6, p569-572. 4p. DOI: [10.1134/S1061934816060095](https://doi.org/10.1134/S1061934816060095).