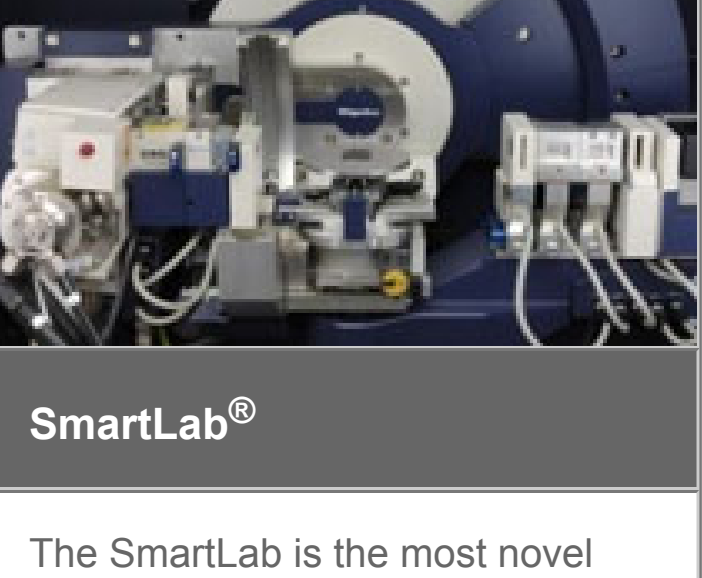




橋 THE BRIDGE

MATERIALS ANALYSIS eNEWSLETTER
JULY 2018, ISSUE 61

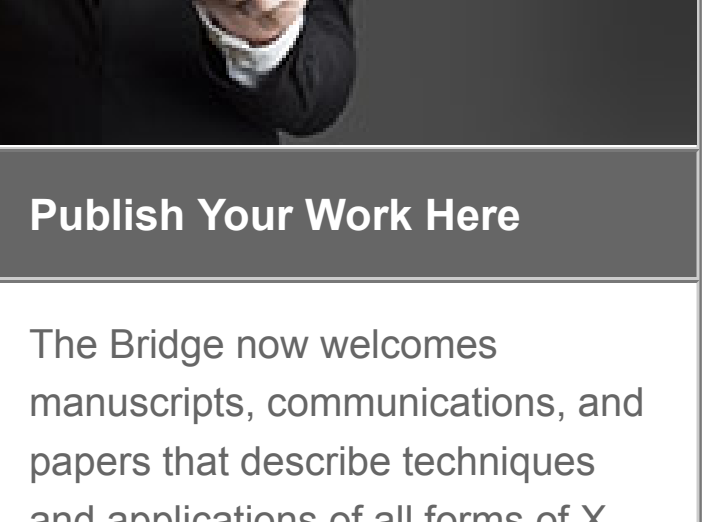
Powder diffraction, thin film diffraction, SAXS, in-plane scattering



SmartLab®

The SmartLab is the most novel 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.
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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

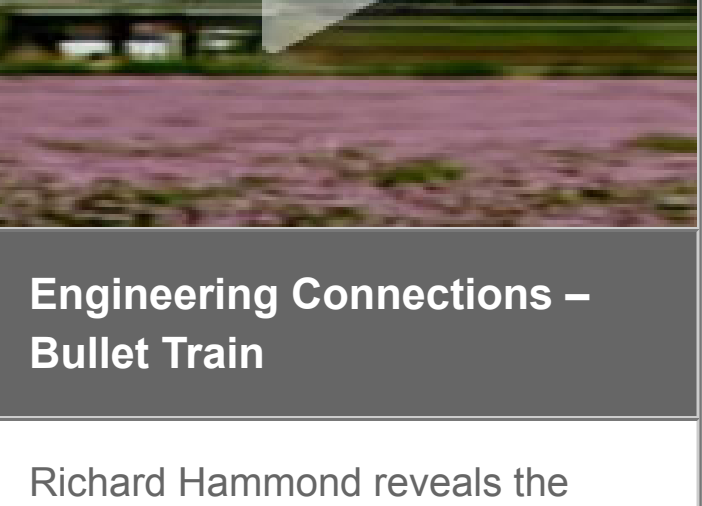
Micro-Z ULS – Measure ultra-low sulfur (ULS) in petroleum fuels by ASTM D2622-10



Wavelength dispersive X-ray fluorescence sulfur (S) analyzer

Designed for ultra-low level sulfur analysis of diesel, petrol (gasoline) and other fuels, the Rigaku Micro-Z ULS wavelength dispersive X-ray fluorescence (WDXRF) instrument features a novel design that measures both the sulfur peak and the background intensity. The ability to measure and correct for changes in background intensity delivers a better net peak intensity measurement, resulting in superior calibrations and enhanced real world precision. **For more >**

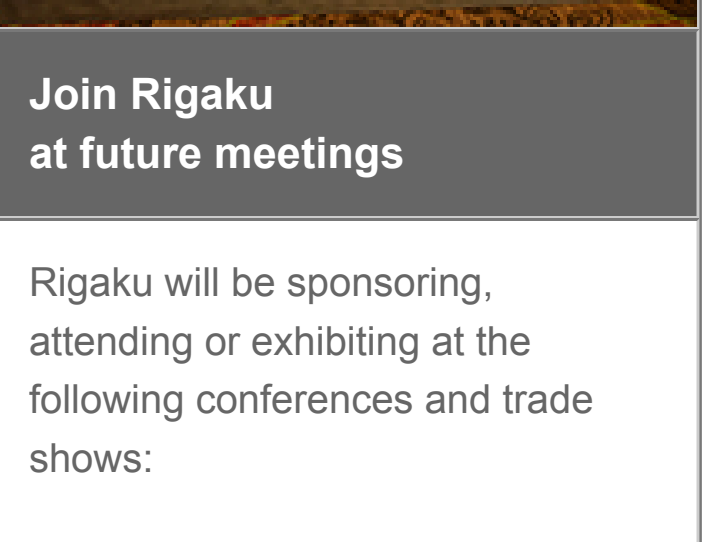
Video of the Month



Engineering Connections – Bullet Train

Richard Hammond reveals the surprising engineering connections between Japan's Bullet Train, the world's first high-speed train, and ancient charioteers, a crowbar, a medieval clock, the electric telegraph and a 19th-century luxury racing car. **Watch video >**

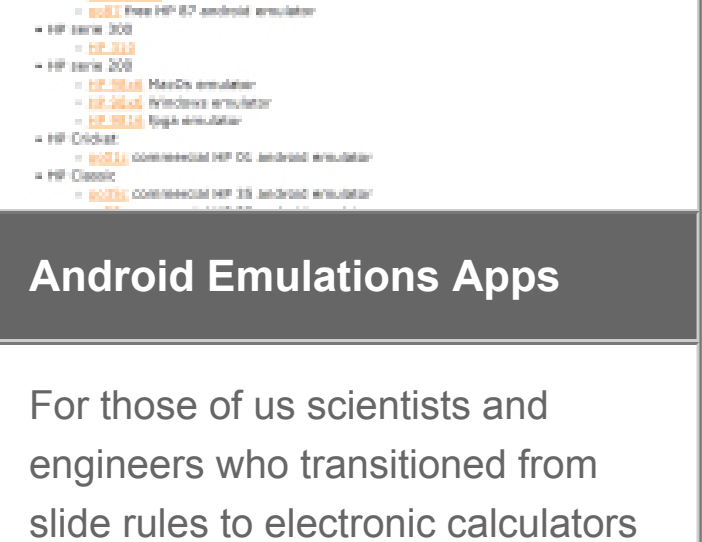
Conferences and Workshops



Join Rigaku at future meetings

- Rigaku will be sponsoring, attending or exhibiting at the following conferences and trade shows:
- Microscopy & Microanalysis 2018**
Baltimore, MD, USA
August 6 – 9, 2018
 - Denver X-ray Conference**
Westminster, CO, USA
August 6 – 10, 2018
 - Fire Rescue International**
Dallas, TX, USA
August 8 – 11, 2018
- See the complete list >**

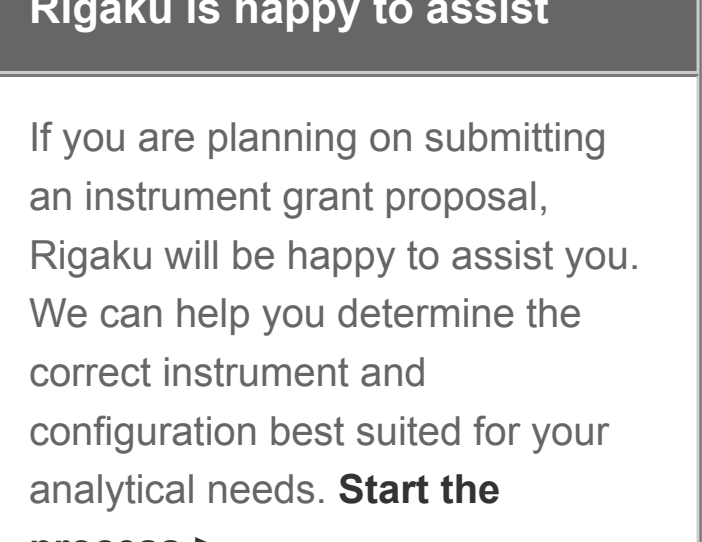
Useful Link of the Month



Android Emulations Apps

For those of us scientists and engineers who transitioned from slide rules to electronic calculators in the early 1970s, this link is a suite of Android Emulations for your phone. Not only a blast from the past, but also really fun and useful. Brings back fond memories. Enjoy! **For more >**

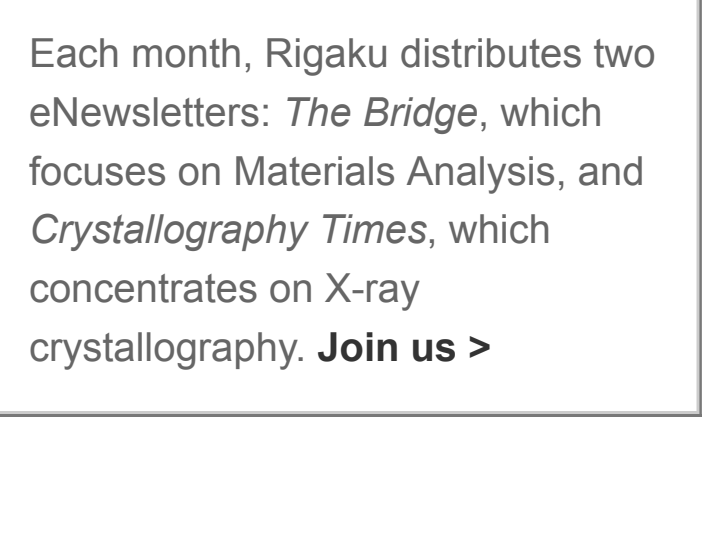
Planning to submit a grant?



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 >**

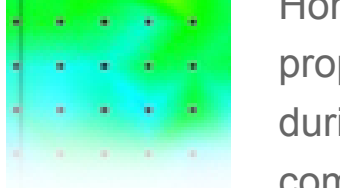
Welcome

As always, thanks to everyone who took the time to come and talk to us at the ACA, EPDIC and SEMICON West events (to mention just a few) that we attended in July. Rigaku will attend many events worldwide (see [full list](#)) in August. Of particular note are the [Microscopy & Microanalysis 2018](#) exhibit in Baltimore (Aug. 5 – 9), the [Denver X-ray Conference](#) in Westminster, CO (Aug. 6 – 10), the ACS Fall Meeting in Boston (Aug. 19 – 23), the [14th International Conference on X-ray Microscopy](#) in Saskatoon (Aug. 19 -24) and the [European Crystallographic Meeting](#) in Oviedo, Spain (Aug. 22 – 27).

This month's issue contains two featured articles. They discuss data visualization in XRD and the newest member of the XtaLAB Synergy series.

Application papers are also available for XRD, WDXRF, and EDXRF. The book review covers *Everybody Lies: Big Data, New Data, and What the Internet Can Tell Us About Who We Really Are* by Seth Stephens-Davidowitz. The link of the month opens an interesting and potentially useful window into Android App emulations of legacy HP calculators. Check out the news and papers sections at the end of the page for the latest developments in materials science.

R.C. Tisdale, Ph.D. – Editor

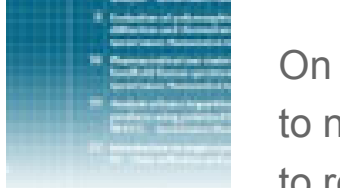


Featured Article

SmartLab Studio II: Data Visualization plugin #1 – XY mapping.

By Dr. Akito Sasaki, Rigaku Corporation

Homogeneity/inhomogeneity often has a major influence on a material's physical properties. Therefore, it is very important to control homogeneity/inhomogeneity during the development of these materials. X-ray analysis provides information on composition, layer thickness, residual stress, etc. of the adjacent surface of a sample, and evaluates homogeneity/inhomogeneity by moving the X-ray irradiation position on the sample surface. **Full article >**

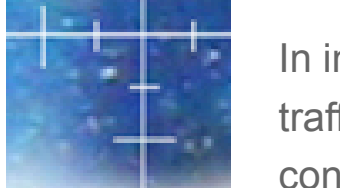


Featured Rigaku Journal Article

XtaLAB Synergy-DW: X-ray diffractometer system with dual wavelength X-ray source

Rigaku Corporation

On average, laboratories look to replace their diffractometers every ten years due to new technology becoming available, research taking a new direction or the need to replace aging parts. Starting your own research group—or setting up a central facilities laboratory—often requires a diffractometer that will ensure that your highest quality publications are supported with the gold standard of analytical techniques: a single crystal X-ray structure. **Full article >**



XRD Application Note

Measurement of ultra-small samples using D/MAX-RAPID II

Rigaku Corporation

In investigations that rely on information gained from evidence left at the scene of a traffic accident, evidence is often limited in the amount available for testing or consists of microscopic traces, which made it difficult to acquire sufficient results with conventional XRD systems. The D/MAX-RAPID II, equipped with a confocal mirror, combines high-brilliance incident X-rays with a large active-area 2D detector, allowing for rapid micro area measurements of several 10 µm in just about 10 minutes. **For more >**



WDXRF Application Note

Mapping and Small Spot Analysis with a General-Purpose XRF Spectrometer

Rigaku Corporation

One of the features of X-ray fluorescence (XRF) spectrometry is that a large area, such as 30 mm in diameter, can be measured on the surface of a specimen, which appropriately represents an analysis sample. This application note demonstrates point and mapping analysis function of ZSX Primus I/Primus by analyzing a granite rock chip. **For more >**



EDXRF Application Note

Phosphorus on steel

Applied Rigaku Technologies

Aluminum and steel are often coated with a protective conversion coating, also called passivate or passivation coating, to prevent oxidation and corrosion of the base metal. **For more >**



Book Reviews

Everybody Lies: Big Data, New Data, and What the Internet Can Tell Us About Who We Really Are. by Seth Stephens-Davidowitz, HarperCollins, New York, 2017. 352 pages, ISBN-13: 978-0062390851.

Review by Joseph Ferrara, Deputy Director, X-ray Research Laboratory, Rigaku

Seth Stephens-Davidowitz is a former Google data scientist and currently a lecturer at the Wharton School. He hypothesizes that surveys and Facebook do not reflect our true inner selves. The answers we provide in surveys and what we put on Facebook reflect what we want other people to think, not what we actually think. **Read reviews >**



Material Analysis in the News

News for July 2018

July 1, 2018. Jincheng Du, a material science professor at University of North Texas, and a team of researchers working to develop a new glass to store nuclear waste have found that [gel layer formation on a new glass surface](#), after coming in contact with water, may potentially provide clues for the superior long-term storage of radioactive waste.

July 1, 2018. Researchers at Penn State have created a [nanocomposite of ceramics](#) and a two-dimensional material by employing a new cold sintering process (CSP), opening the door for new designs of nanocomposites with such applications as solid-state batteries, thermoelectrics, varistors, catalysts, chemical sensors and much more.

July 3, 2018. Environmentally friendly building trends have boosted the popularity of heat reflecting window coatings. They have also inspired scientists and engineers to create thin, see-through solar cells to turn windows into miniature electricity generators. Researchers have gone a step further and [combined these two functions into one](#) window-compatible material that could double the energy efficiency of an average household.

July 6, 2018. Chemists at Johannes Gutenberg University Mainz (JGU) and at the Université de Montréal in Canada have developed a [molecular system capable of very precise optical pressure measurements](#). This molecular system has potential applications in the fields of materials sciences, homogeneous and heterogeneous catalysis, and all conceivable fields where pressure changes need to be monitored.

July 9, 2018. New work from a team led by Carnegie's Alexander Goncharov confirms that nitrogen, the dominant gas in Earth's atmosphere, becomes a [metallic fluid when subjected to the extreme pressure and temperature](#) conditions found deep inside the Earth and other planets.

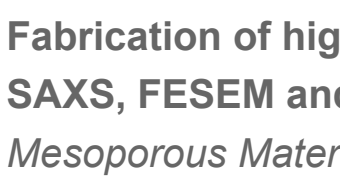
July 19, 2018. Working to address "hotspots" in computer chips that degrade their performance, researchers at the UCLA Samueli School of Engineering have developed a [new semiconductor material](#), defect-free boron arsenide, that is more effective at drawing and dissipating waste heat than any other known semiconductor or metal materials.

July 20, 2018. [Burton Richter, a Nobel Prize-winning particle physicist](#) who also exercised significant influence in scientific policy, died on 18 July. He was 87 years old. In 1974, Richter's key scientific discovery laid a cornerstone for physicists' standard model of fundamental particles and forces. He also led the Stanford Linear Accelerator Center from 1984 to 1999.

July 23, 2018. Researchers at Tufts University School of Engineering have developed magnetic elastomeric composites that [move in different ways when exposed to light](#), raising the possibility that these materials could enable a wide range of products that perform simple to complex movements, from tiny engines and valves to solar arrays that bend toward the sunlight.

July 25, 2018. The U.S. Department of Energy (DOE) announced \$30 million in funding for 10 projects to advance research in the important and [growing field of "ultrafast" science](#). The research efforts span both materials science and chemistry, and will take advantage of new and emerging capabilities to probe materials and chemical processes at time scales of a quadrillionth of a second or less.

July 25, 2018. A [newly identified group of materials could help recharge batteries faster](#), raising the possibility of smartphones that charge fully in minutes. Prof. Clare Grey and her team of researchers at the University of Cambridge have identified a group of materials called niobium tungsten oxides through which lithium ions can move at astonishingly high rates.



Recent Scientific Papers of Interest

Papers for July 2018

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

Fabrication of highly ordered nanoporous alumina membranes: Probing microstructures by SAXS, FESEM and AFM. Syed, R.; Sen, D.; Mani Krishna, K.V.; Ghosh, S.K. *Microscopy & Mesoporous Materials*. Jul2018, Vol. 264, p13-21. 9p. DOI: [10.1016/j.micmes.2017.12.034](#)

Structural properties of zirconia – in-situ high temperature XRD characterization. Kurpaska, Lukasz. *Journal of Molecular Structure*. Jul2018, Vol. 1163, p287-293. 7p. DOI: [10.1016/j.molstruc.2018.03.010](#)

Assessment of crystalline phase changes and glass formation by Rietveld-XRD method on ceramic lightweight aggregates sintered from mineral and polymeric wastes. Moreno-Maroto, José Manuel; González-Corrochano, Beatriz; Alonso-Azcárate, Jacinto; Rodríguez, Luis; Acosta, Anselmo. *Ceramics International*. Jul2018, Vol. 44 Issue 10, p11840-11851. 12p. DOI: [10.1016/j.ceramint.2018.03.274](#)

XRD, SEM, XPS studies of Sb doped ZnO films and electrical properties of its based Schottky diodes. Caglar, Yasin; Caglar, Mujdat; Ilıcın, Alihan. *Optik - International Journal for Light & Electron Optics*. Jul2018, Vol. 164, p424-432. 9p. DOI: [10.1016/j.jleo.2018.03.017](#)

Effects of a lysophosphatidylcholine and a phosphatidylcholine on the morphology of taurocholic acid-based mixed micelles as determined by small-angle X-ray scattering. Aizawa, Hideki; Ichikawa, Sosa; Kotake-Nara, Eichi; Nagao, Akihiko. *Journal of Dispersion Science & Technology*. 2018, Vol. 39 Issue 7, p1003-1009. 7p. 1 Chart, 3 Graphs. DOI: [10.1080/01932691.2017.1380529](#)

Relaxation of asymmetric crystallographic tilt: In situ x-ray diffraction studies of epitaxial electrodeposition of bismuth on GaAs (110). Huang, Xin; Plaza, Manuel; Ko, J. Y. Peter; Abruña, Héctor D.; Brock, Joel D. *Journal of Applied Physics*. 7/21/2018, Vol. 124 Issue 3, pN.PAG-N.PAG. 6p. DOI: [10.1063/1.5026630](#)

Structural analysis of sulfuric acid solutions containing Ti and Mn using x-ray diffraction, x-ray absorption fine structure, and molecular dynamics simulation. Tokuda, Kazuya; Iihara, Junji; Saito, Yoshihiro; Masuno, Atsunobu; Inoue, Hiroyuki. *Journal of Chemical Physics*. 7/2/2018, Vol. 149 Issue 1, pN.PAG-N.PAG. 7p. 1 Diagram, 5 Charts, 7 Graphs. DOI: [10.1063/1.5024950](#)

Elemental fingerprinting of mineral species in iron-fortified milk: anomalous small-angle X-ray scattering and resonant soft X-ray scattering studies. Ingham, Bridget; Kirby, Nigel; Wang, Cheng; Brady, Mike; Carr, Alistair. *Journal of Synchrotron Radiation*. Jul2018, Vol. 25 Issue 4, p1106-1112. 6p. DOI: [10.1107/S1600577518000774](#)

Measuring femtometer lattice displacements driven by free carrier diffusion in a polycrystalline semiconductor using time-resolved x-ray scattering. Jo, Wonhyuk; Landahl, Eric C.; DiChiara, Anthony D.; Walk, Donald A.; Lee, Soohyong. *Applied Physics Letters*. 7/16/2018, Vol. 113 Issue 3, pN.PAG-N.PAG. 4p. DOI: [10.1063/1.5039582](#)

Spectral weight of resonant inelastic X-ray scattering in doped cuprates: Effect of core-hole lifetime. Tohyama, Takami; Tsutsui, Kenji. *International Journal of Modern Physics B: Condensed Matter Physics: Statistical Physics; Applied Physics*. Jul2018, Vol. 32 Issue 17, p-1. 6p. 3 Graphs. DOI: [10.1142/S0217979218400179](#)

Structural analyses of sphere- and cylinder-forming triblock copolymer thin films near the free surface by atomic force microscopy, X-ray photoelectron spectroscopy, and grazing-incidence small-angle X-ray scattering. Hanafy Bayomi; Igarashi, Noriyuki; Asaki, Takashi; Shimojima, Takuma; Takagi, Hideaki; Shimizu, Nobutaka; Raghava, Hanay; Aoki, Sono; Sakurai, Shinichi. *Polymer*. Jul2018, Vol. 147, p202-212. 11p. DOI: [10.1016/j.polymer.2018.05.074](#)

Local structures of titanium-ion complexes in redox flow battery electrolytes as revealed by XRD scattering with difference analysis. Tsurumura, Tatsuya; Tanaka, Toru; Yagi, Kazunori; Morita, Masayuki; Kameda, Yasuo; Fujii, Kenta. *Journal of Molecular Liquids*. Jul2018, Vol. 261, p468-472. 5p. DOI: [10.1016/j.molliq.2018.04.074](#)

Shape Anisotropy of Magnetic Nanoparticles in (Co₉Nb₁₂Ta₂)_x(SiO₂)_{1-x} Composite Films Revealed by Grazing-Incidence Small-Angle X-Ray Scattering. Uklejev, V. *Journal of Superconductivity & Novel Magnetism*. Jul2018, Vol. 31 Issue 7, p2099-2102. 4p. DOI: [10.1007/s10948-017-4459-9](#)

Elastic squared form factor and binding effect of carbon dioxide studied by the high resolution X-ray scattering. Huang, Xin-Chao; Xu, Long-Quan; Ni, Dong-Dong; Liu, Ya-Wei; Peng, Yi-Geng; Yang, Ke; Hiraoka, Nozomu; Tsui, Ku-Ding; Zhu, Lin-Fan. *Journal of Electron Spectroscopy & Related Phenomena*. Jul2018, Vol. 226, p41-44. 4p. DOI: [10.1016/j.elspec.2018.05.006](#)

Elemental Analysis of Copper-Zinc Ores by Total Reflection X-Ray Fluorescence using Nonaqueous Suspensions. Alov, Nikolai; Sharanov, Pavel. *Analytical Letters*. 2018, Vol. 51 Issue 11, p1789-1795. 7p. 1 Diagram, 1 Chart, 2 Graphs. DOI: [10.1080/00032719.2017.1390758](#)

Comparison of wavelength-dispersive X-ray fluorescence spectrometry and inductively coupled plasma optical emission spectrometry for the elementary determination in plants through the accuracy profile method. Masson, Pierre; Dalix, Thierry; Daujeu, Guillaume; Souté, Patrice. *XRS: X-ray Spectrometry*. Jul/Aug2018, Vol. 47 Issue 4, p287-293. 7p. DOI: [10.1002/xrs.2840](#)

Variation of trace elements in snow during starting and ending of snowfall in Kyoto city measured by low power total reflection X-ray fluorescence spectrometry. Damdinsuren, Bolortuya; Kawai, Jun. *XRS: X-ray Spectrometry*. Jul/Aug2018, Vol. 47 Issue 4, p273-276. 4p. DOI: [10.1002/xrs.2838](#)

Potential and application of X-ray fluorescence spectrometry to estimate iron and zinc concentration in potato tubers. Sosa, Paola; Guild, Georgia; Burgos, Gabriela; Bonierbale, Merideth; zum Felde, Thomas. *Journal of Food Composition & Analysis*. Jul2018, Vol. 70, p22-27. 6p. DOI: [10.1016/j.jfca.2018.03.004](#)

Development of the Method of Calibration Equations for the X-Ray Fluorescence Analysis of Multicomponent Samples in the Presence of Undetectable Elements. Garmal, A. V.; Oskokol, K. V. *Journal of Analytical Chemistry*. Jul2018, Vol. 73 Issue 7, p631-640. 10p. DOI: [10.1134/S1061934818070055](#)

Migration of Sulfur in the X-Ray Fluorescence Analysis of Rocks. Borkhodev, V. Ya. *Journal of Analytical Chemistry*. Jul2018, Vol. 73 Issue 7, p627-630. 4p. DOI: [10.1134/S1061934818050052](#)

Analysis of coke beverages by total-reflection X-ray fluorescence. Fernández-Ruiz, Ramón; von Bohlen, Alex; Friedrich K. E. Josue; Redroja, M.J. *Spectrochimica Acta Part B*. Jul2018, Vol. 145, p99-106. 8p. DOI: [10.1016/j.sab.2018.04.013](#)

Comparative elemental analysis of fine particulate matter (PM_{2.5}) from industrial and residential areas in Greater Cairo-Egypt by means of a multi-secondary target energy dispersive X-ray fluorescence spectrometer. Shaltout, Abdallah A.; Hassan, Salwa K.; Karydas, Andreas G.; Zaki, Z.I.; Mostafa, Nasser Y.; Kregsamer, Peter; Wobruschek, Peter; Strelli, Christina. *Spectrochimica Acta Part B*. Jul2018, Vol. 145, p29-35. 7p. DOI: [10.1016/j.sab.2018.04.003](#)

Absolute Configuration of Pharmaceutical Research Compounds Determined by X-ray Powder Diffraction. Schlesinger, Carina; Tapmeyer, Lukas; Gumbert, Silke D.; Prill, Dragica; Bolte, Michael; Schmidt, Martin U.; Saal, Christoph. *Acta Crystallographica. Section A, Foundations & Advances*. 7/16/2018, Vol. 57 Issue 29, p9150-9153. 4p. DOI: [10.1002/anie.201713168](#)

Thermal stability of phase change GaSb/GeTe, SnSe/GeTe and GaSb/SnSe double stacked films revealed by X-ray reflectometry and X-ray diffraction. Velea, A.; Sava, F.; Socol, G.; Vlaicu, A.M.; Mihai, C.; Lorinczi, A.; Simandan, I.D. *Journal of Non-Crystalline Solids*. Jul2018, Vol. 492, p11-17. 7p. DOI: [10.1016/j.jnoncrysol.2018.02.033](#)

Indexing of grazing-incidence X-ray diffraction patterns: the case of fibre-textured thin films. Simbrunner, Josef; Simbrunner, Clemens; Schrode, Benedikt; Röthel, Christian; Bedoya-Martinez, Natalia; Salzmann, Ingo; Reisel, Roland. *Acta Crystallographica. Section A, Foundations & Advances*. Jul2018, Vol. 74 Issue 4, p373-387. 14p. DOI: [10.1107/S2053273318006629](#)

Estimation of degree of polymerization of polyacrylonitrile-kyeated carbon nanotubes using Guinier plot of small angle x-ray scattering. Hyyrynjoki Ch; Graeng Sik Jin; Jaenun Lee; Kun-Hong Lee. *Nanotechnology*. 7/6/2018, Vol. 29 Issue 27, p1-1. 1p. DOI: [10.1088/1361-6528/aabe5b](#)