



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

**Supermini200**

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 >**

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

**Benchtop chemical crystallography system for 3D small molecule structure determination**

**XtaLAB mini II**

The Rigaku XtaLAB mini II benchtop X-ray crystallography system is a compact single crystal X-ray diffractometer designed to produce publication-quality 3D structures. The perfect addition to any synthetic chemistry laboratory, the XtaLAB mini II will enhance research productivity by offering affordable structure analysis capability without the necessity of relying on a departmental facility. With the XtaLAB mini II, you no longer have to wait in line to determine your structures. Instead your research group can rapidly analyze new compounds as they are synthesized in the lab. **For more >**

**Video of the Month**

**Free Electron Lasers**

Thorsten Hellert studied Physics in Darmstadt, Singapore and Hamburg and made his Ph.D. in particle accelerator physics at the Deutsches Elektronen-Synchrotron (DESY) in Hamburg. He discusses the latest and biggest of the new 4th synchrotron radiation sources which was built is the European XFEL. A one billion Euro 'free electron laser', based on a superconducting accelerator technology and spread out 3km beneath the city of Hamburg. The produced X-ray pulses allow pictures, for example from proteins, with sub-atomic resolution and an exposure time short enough to enable in-situ studies of chemical reactions. **Watch video >**

**Conferences and Workshops**

**Join Rigaku at future meetings**

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

**Ceramics Expo 2018**  
Cleveland, OH, USA  
May 1 – 3, 2018

**2018 Midwest Haz Mat Conference (RAD)**  
Northbrook, IL, USA  
May 4 – 5, 2018

**IFAT 2018**  
Munich, Germany  
May 14 – 18, 2018

**See the complete list >**

**Useful Link of the Month**

**NASA Apps For Smartphones, Tablets and Digital Media Players**

Come explore with NASA and discover the latest images, videos, mission information, news, feature stories, tweets, NASA TV and featured content with the NASA app. **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**

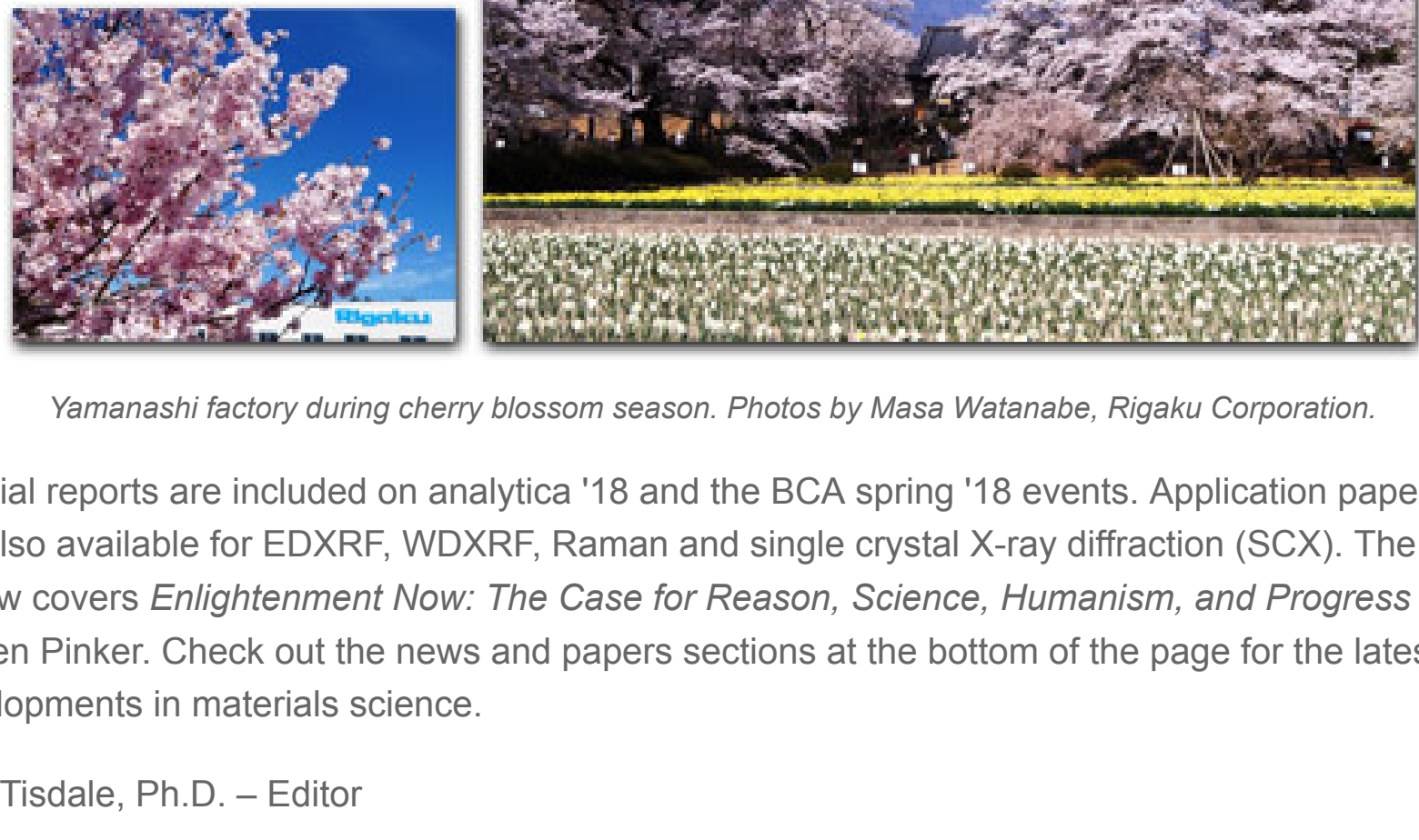
Each month, Rigaku distributes two eNewsletters: *The Bridge*, which focuses on Materials Analysis, and *Crystallography Times*, which concentrates on X-ray crystallography. **Join us >**

**Welcome**

Thanks to everyone who took the time to come and talk to us at analytica 2018 in Munich. As always, it was good to see everyone and have a chance to catch up. In May, Rigaku will attend about a dozen events worldwide (see full list). Of particular note is Ceramics Expo 2018 in Cleveland (booth #4113).

April 1, 2018 marked the introduction of the new [SmartLab multi-purpose X-ray diffractometer](#) system. A highly versatile automated X-ray diffraction (XRD) system, the newest SmartLab diffractometer offers continued refinement of the ease-of-use features that enabled the original SmartLab diffractometer to receive the coveted R&D 100 Award, such as automatic alignment, component recognition, Cross Beam Optics and a 2D detector.

This month's issue contains three *Rigaku Journal* articles. The first is Part X in a series exploring single crystal X-ray diffraction (XRD), while the second discusses principles and applications of multilayer mirror optics for X-ray diffraction. The final article covers the Micro-Z ULS wavelength dispersive XRF for ultra-low sulfur analysis by the D2622 method.



Yamanashi factory during cherry blossom season. Photos by Masa Watanabe, Rigaku Corporation.

Special reports are included on analytica '18 and the BCA spring '18 events. Application papers are also available for EDXRF, WDXRF, Raman and single crystal X-ray diffraction (SCX). The book review covers *Enlightenment Now: The Case for Reason, Science, Humanism, and Progress* by Steven Pinker. 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**  
*Introduction to single crystal X-ray analysis*  
*X-Protein expression for X-ray structure analysis*  
By Takashi Matsumoto, Rigaku Corporation

In order to elucidate various biological phenomena occurring in vivo, it is essential to determine the structure of proteins. This article focuses on expression of proteins for X-ray analysis. **Full article >**

**Featured Rigaku Journal Article**  
*Principles and applications of multilayer mirror optics for X-ray diffraction measurements — CBO series for SmartLab*  
By Takeshi Osakabe, Rigaku Corporation

In this article, we introduce the features and applications of each member of the CBO unit series to help SmartLab users achieve effective XRD measurements and high-quality data acquisitions for precise analyses. **Full article >**

**Featured Rigaku Journal Article**  
*Micro-Z ULS — WDXRF ultra low sulfur analyzer*  
*Excellent performance for ultra-low sulfur analysis in petroleum*  
Rigaku Corporation

The sulfur content in gasoline needs to be controlled in order to reduce air pollution, lengthen the lifetime of automobile catalysts, and improve engine reliability. For compliance verification, XRF spectrometry is the definitive analysis tool for use at distribution terminals and refineries, as well as mobile or stationary testing laboratories. In recent years, there has been an increasing need for an instrument which does not require the use of helium gas for situations where acquisition or delivery of helium to the analysis site is difficult. The Micro-Z ULS was designed to meet these trends. **Full article >**

**Featured Event**  
*analytica 2018*  
Reported by Rigaku Europe SE

analytica is a trade fair for laboratory technology, analysis and biotechnology that has been held at Messe München in Germany every two years since 1968. Its main exhibition sectors are the fields of analysis and quality control, biotechnology/life sciences/diagnostics and laboratory technology. Visitors who attend the fair are decision-makers and users from the chemicals, pharma, food and automobile industries, medicine, industry and government research. **Full report >**

**Featured Event**  
*British Crystallography Association Spring Meeting 2018*  
Reported by Reported by Dr. Fraser White, Rigaku Oxford Diffraction

This year, the annual British Crystallography Association Spring meeting was held in Warwick University in the science building. As usual, Rigaku Oxford Diffraction attended and we enjoyed chatting to those of you who stopped by our booth. **Full report >**

**WDXRF Application Note**  
*Quality and Process Control of Natural and Processed Iron Ores by Pressed Powder Method on Simultix14*  
Rigaku Corporation

For over 40 years, the Rigaku Simultix simultaneous WDXRF spectrometer system has been widely used as an elemental analytical tool for process control in industries that require high throughput and precision. This application note demonstrates the improved method to determine total iron in iron ores by pressed powder method, which covers crude iron ores (low and high content iron ores) and agglomerates (pellet and sinter). **For more >**

**Raman Application Note**  
*Presumptive field testing for narcotics, explosives and chemical warfare agents with Rigaku's Progeny ResQ Portable Raman Analyzer*  
Rigaku Analytical Devices

In safety and security environments, the use of portable Raman instruments has revolutionized the presumptive testing of narcotics and explosives. Overall, the use of portable Raman instruments has resulted in faster response times for on-site narcotics and explosives detection by first responders — helping them resolve potential hazardous situations rapidly and safely. **For more >**

**EDXRF Application Note**  
*Silicone Coating on Paper and Plastic*  
Applied Rigaku Technologies

In a clay coated paper the clay coating adds weight and adjusts various physical properties, such as paper glossiness and ink retention. During the coating process the amount of silicone coating, usually expressed as coat weight in g/m<sup>2</sup> or lbs/ream, must be periodically measured in order to ensure the proper physical properties of the product. When coating is too heavy silicone material is needlessly wasted, while too little coating may not meet the product specifications. In order to achieve reliable QA/QC, Rigaku offers the NEX QC<sup>®</sup> EDXRF analyzer. **For more >**

**Small Molecule Application Note**  
*Superior data quality achieved with the XtaLAB Synergy-i, micro-focus Mo source*  
Rigaku Oxford Diffraction

The XtaLAB Synergy-i is a cutting-edge diffractometer equipped with the latest technology detector, optimized for its small pixel size and sensitivity, and can be configured with up to two bright micro-focus sealed tube sources. The Mo micro-focus source has its own benefits and a typical data collection on an organometallic crystal is discussed herein. **For more >**

**Book Review**  
*Enlightenment Now: The Case for Reason, Science, Humanism, and Progress*  
Reviews by Review by Jeanette S. Ferrara, MA

Steven Pinker's latest work, *Enlightenment Now*, provides an optimistic outlook on the current state of world affairs. According to Pinker, all is not doom and gloom—and he spends 453 pages explaining why. **Full review >**

**Material Analysis in the News**  
*News for April 2018*

**April 2, 2018.** A team at the University of Maryland have pioneered a [wood densification technique to develop a material that is 10 times as tough as natural wood](#), and 12 times as strong. The lead author of the research and associate professor of materials science and engineering, Dr. Liangbing Hu, has high hopes for the material, and believes that it can be used to replace steel in any construction application.

**April 3, 2018.** Researchers at MIT have found that an [ultrathin layer of aluminum oxide forms a protective coating for metals](#) in that it can deform as if it were a liquid, filling any cracks and gaps as they form. The thin coating layer should be especially useful to prevent leakage of tiny molecules that can penetrate through most materials, such as hydrogen gas that could be used to power fuel-cell cars.

**April 5, 2018.** Experiments carried out on a [complex arrangement of magnetic particles have identified a completely new state of matter](#), and it can only be explained if scientists turn to quantum physics. Physicists from the US carried out their research on the geometrical arrangements of particles in a weird material known as spin ice. The researchers focussed on one particular structure called a Shakti geometry, and measured how its magnetic arrangements fluctuated with changes in temperature.

**April 6, 2018.** Researchers have seen [exotic superconductivity that relies on highly unusual electron interactions](#). While predicted to occur in other non-material systems, this type of behavior has remained elusive. The team's research reveals effects that are profoundly different from anything that has been seen before with superconductivity.

**April 10, 2018.** A newly discovered structure of a [sodium-based material allows the materials to be used as an electrolyte in solid-state batteries](#), according to researchers. The team is fine-tuning the material using an iterative design approach that they hope will shave years off the time from research to everyday use.

**April 10, 2018.** An extensive [experimental database of inorganic thin-film materials](#) that organizes a decade's worth of research at the Department of Energy's National Renewable Energy Laboratory (NREL) is now publicly available. The High Throughput Experimental Materials (HTEM) Database contains more than 140,000 sample entries collected by NREL scientists investigating inorganic materials for use in advanced energy applications, such as thin-film solar cells.

**April 10, 2018.** A new material that harnesses the [power of ambient light to produce bacteria-killing molecules](#) could help stem the spread of hospital infections, including those with drug-resistant bacteria. It is made of polyurethane embedded with tiny quantum dots and particles of crystal violet dye. When the quantum dots absorb ambient light, they transfer some of that energy to nearby dye particles, causing the crystal violet to release a kind of high-energy oxygen molecule that kills microbes.

**April 12, 2018.** A team led by César Moreno and Aitor Mugarza of the Catalan Institute of Nanoscience & Nanotechnology and Diego Peña of the University of Santiago de Compostela [created nanoporous graphene](#) starting from diphenyl-10,10'-dibromo-9,9'-bianthracene, or DP-DBBA. The researchers polymerize DP-DBBA onto a gold substrate under ultrahigh vacuum, where it polymerizes at about 200°C. Further heating to 400°C makes the resulting polymer cyclize and dehydrogenate to form graphene nanoribbons with jagged polymer edges.

**April 12, 2018.** In a step towards grime-proof screens, countertops, and other everyday items, University of Michigan researchers have demonstrated a [smooth, durable, clean omniphobic coat — a material that will repel any liquid](#) before it can stain. The new material, developed in the lab of Anish Tuteja, an associate professor of materials science and engineering, repels liquids before they have the chance to do any damage.

**Recent Scientific Papers of Interest**  
*Papers for April 2018*

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

**Polymer Inclusion Membrane as an Effective Sorbent To Facilitate Mercury Storage and Detection by X-ray Fluorescence in Natural Waters.** Elias, Gemma; Margul, Eva; Diez, Sergi; Fontàs, Clàudia. *Analytical Chemistry*. 4/3/2018, Vol. 90 Issue 7, p4756-4763. 8p. DOI: [10.1021/acs.analchem.7b05430](https://doi.org/10.1021/acs.analchem.7b05430).

**Elemental analysis of teas, herbs and their infusions by means of total reflection X-ray fluorescence.** Dalipi, Rogerta; Borgese, Laura; Tsuji, Kouichi; Bontempi, Elza; Depero, Laura E. *Journal of Food Composition & Analysis*. Apr2018, Vol. 67, p128-134. 7p. DOI: [10.1016/j.jfca.2018.01.010](https://doi.org/10.1016/j.jfca.2018.01.010).

**Preliminary study on X-ray fluorescence computed tomography imaging of gold nanoparticles: Acceleration of data acquisition by multiple pinholes scheme.** Sasaya, Tenta; Sunaguchi, Naoki; Seo, Seung-Jum; Hyodo, Kazuyuki; Zeniya, Tsutomu; Kim, Jong-Ki; Yuasa, Tetsuya. *Nuclear Instruments & Methods in Physics Research Section A*. Apr2018, Vol. 886, p71-76. 6p. DOI: [10.1016/j.nima.2017.12.055](https://doi.org/10.1016/j.nima.2017.12.055).

**Microstructural characterisation of proton irradiated niobium using X-ray diffraction technique.** Dutta, Argha; Gayathri, N.; Neogy, S.; Mukherjee, P. *Philosophical Magazine*. Apr2018, Vol. 98 Issue 12, p1031-1052. 22p. DOI: [10.1080/14786435.2018.1425555](https://doi.org/10.1080/14786435.2018.1425555).

**Dislocation structure in textured zirconium tensile-deformed along rolling and transverse directions determined by X-ray diffraction line profile analysis.** Fan, Zhijian; Jóni, Bertalan; Xie, Lei; Ribárik, Gábor; Ungár, Tamás. *Journal of Nuclear Materials*. Apr2018, Vol. 502, p301-310. 10p. DOI: [10.1016/j.jnucmat.2018.02.026](https://doi.org/10.1016/j.jnucmat.2018.02.026).

**Implementation of UO<sub>2</sub> surface forensics using grazing-incidence x-ray diffraction: Measurements for nuclear forensics.** Tracy, Cameron L.; Chen, Chien-Hung; Park, Sulgiye; Davison, M. Lee; Ewing, Rodney C. *Journal of Nuclear Materials*. Apr2018, Vol. 502, p68-75. 8p. DOI: [10.1016/j.jnucmat.2018.01.052](https://doi.org/10.1016/j.jnucmat.2018.01.052).

**Stress determination by in situ X-ray diffraction — Influence of water vapour on the Zircaloy-4 oxidation at high temperature.** Buscail, H.; Rolland, R.; Issartel, C.; Perrier, S.; Latu-Romain, L. *Corrosion Science*. Apr2018, Vol. 134, p38-48. 11p. DOI: [10.1016/j.corsci.2018.02.002](https://doi.org/10.1016/j.corsci.2018.02.002).

**Computation of virtual X-ray diffraction patterns from discrete dislocation structures.** Bertin, Nicolas; Cai, Wei. *Computational Materials Science*. Apr2018, Vol. 146, p268-277. 10p. DOI: [10.1016/j.commatsci.2018.01.037](https://doi.org/10.1016/j.commatsci.2018.01.037).

**The effect of surface oxidation on hydrogen absorption in Ti-6Al-4V alloy studied by elastic recoil detection (ERD), X-ray diffraction and nanohardness measurements.** Topic, M.; Pichon, L.; Nsongurua, S.; Favaro, G.; Dubuisson, M.; Halindintwali, S.; Mazwi, S.; Sibanyoni, J.; Mtshali, C.; Corin, K. *Journal of Alloys & Compounds*. Apr2018, Vol. 740, p879-886. 8p. DOI: [10.1016/j.jallcom.2017.11.269](https://doi.org/10.1016/j.jallcom.2017.11.269).

**Pitfalls and reproducibility of in situ synchrotron powder X-ray diffraction studies of solvothermal nanoparticle formation.** Andersen, Henrik L.; Bjergsen, Espen D.; Birgisson, Steinar; Christensen, Mogens; Iversen, Bo B. *Journal of Applied Crystallography*. Apr2018, Vol. 51 Issue 2, p526-540. 14p. DOI: [10.1107/S1600576718003552](https://doi.org/10.1107/S1600576718003552).

**The integrals determining orientational order in liquid crystals by x-ray diffraction revisited.** Agra-Koojman, DePa M.; Fisch, Michael R.; Kumar, Satyendra. *Liquid Crystals*. Apr2018, Vol. 45 Issue 5, p680-686. 7p. DOI: [10.1080/02678292.2017.1372526](https://doi.org/10.1080/02678292.2017.1372526).

**Understanding self ion damage in FCC Ni-Cr-Fe based alloy using X-ray diffraction techniques.** Halder Banerjee, R.; Sengupta, P.; Chatterjee, A.; Mishra, S.C.; Bhukta, A.; Satyam, P.V.; Samajdar, I.; Dey, G.K. *Journal of Nuclear Materials*. Apr2018, Vol. 501, p82-93. 12p. DOI: [10.1016/j.jnucmat.2018.01.035](https://doi.org/10.1016/j.jnucmat.2018.01.035).

**Analyzing shear band formation with high resolution X-ray diffraction.** Pagan, Darren C.; Obstalecki, Mark; Park, Jun-Sang; Miller, Matthew P. *Acta Materialia*. Apr2018, Vol. 147, p133-148. 16p. DOI: [10.1016/j.actamat.2017.12.046](https://doi.org/10.1016/j.actamat.2017.12.046).

**New insights into microstructural evolution of epitaxial Ni–Mn–Ga films on MgO (1 0 0) substrate by high-resolution X-ray diffraction and orientation imaging investigations.** Sharma, Amit; Mohan, Sangeeni; Suwas, Satyam. *Philosophical Magazine*. Apr2018, Vol. 98 Issue 10, p819-847. 29p. DOI: [10.1080/14786435.2017.1418094](https://doi.org/10.1080/14786435.2017.1418094).

**Simulation of SAXS patterns of hexa-n-alkoxy-2,3,6,7,10,11-triphenylene mesophase.** Camerel, Franck; Borière, Frédéric; Jeannin, Olivier. *Liquid Crystals*. Apr2018, Vol. 45 Issue 5, p688-702. 5p. DOI: [10.1080/02678292.2017.1376124](https://doi.org/10.1080/02678292.2017.1376124).

**Investigation of soot oxidation by coupling LII, SAXS and scattering measurements.** Yon, Jérôme; Lef, François-Xavier; Hebert, Damien; Mitchell, James Brian; Teuscher, Nadine; Garrec, Jean-Luc Le; Bescond, Alexandre; Baumann, Werner; Ourdani, Djoudi; Bizien, Thomas; Perez, Javier. *Combustion & Flame*. Apr2018, Vol. 190, p441-453. 13p. DOI: [10.1016/j.combustflame.2017.12.014](https://doi.org/10.1016/j.combustflame.2017.12.014).

**Anomalous grazing-incidence small-angle X-ray scattering of Ga<sub>2</sub>O<sub>3</sub>-based nanoparticles.** Revenant, Christine. *Journal of Applied Crystallography*. Apr2018, Vol. 51 Issue 2, p436-445. 9p. DOI: [10.1107/S1600576718001772](https://doi.org/10.1107/S1600576718001772).

**Structure evolution of polyethylene-plasticizer film at industrially relevant conditions studied by in-situ X-ray scattering: The role of crystal stress.** Chen, Xiaowei; Lv, Fei; Lin, Yuanfei; Wang, Zhen; Meng, Lingpu; Zhang, Qianli; Zhang, Wenwen; Li, Liangbin. *European Polymer Journal*. Apr2018, Vol. 101, p358-367. 10p. DOI: [10.1016/j.eurpolymj.2018.02.001](https://doi.org/10.1016/j.eurpolymj.2018.02.001).

**Polarization-dependent resonant inelastic X-ray scattering study at the Cu L and O K-edges of YBa<sub>2</sub>Cu<sub>3</sub>O<sub>7-x</sub>.** Magnuson, Martin; Schmitt, Thorsten; Duda, Laurent-C. *Journal of Electron Spectroscopy & Related Phenomena*. Apr2018, Vol. 224, p38-44. 7p. DOI: [10.1016/j.elspec.2017.07.005](https://doi.org/10.1016/j.elspec.2017.07.005).

**Features of crystallization behavior of natural rubber/halloysite nanotubes composites using synchrotron wide-angle X-ray scattering.** Waesath, Kamaruddin; Saitani, Silitisaiyidah; Ismail, Hanafi; Othman, Nadras; Soontaranon, Siriwat; Hayeremase, Nabil. *International Journal of Polymer Analysis & Characterization*. Apr2018, Vol. 23 Issue 3, p260-270. 11p. DOI: [10.1080/1023666X.2018.1438773](https://doi.org/10.1080/1023666X.2018.1438773).

**Trace elements in PM<sub>2.5</sub> in Shandong Province: Source identification and health risk assessment.** Zhang, Jingzhu; Zhou, Xuehua; Yang, Lingxiao; Wang, Wenping; Wang, Zhe; Wang, Jing. *Science of the Total Environment*. Apr2018, Vol. 621, p558-577. 20p. DOI: [10.1016/j.scitotenv.2017.11.292](https://doi.org/10.1016/j.scitotenv.2017.11.292).