



FEBRUARY 2020, ISSUE 80

## WELCOME

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Rigaku would like to take this opportunity to invite our readers to attend Rigaku Americas Corporation's 4<sup>th</sup> Regional Seminar on X-ray Microscopy. The event will take place on Wednesday, April 1, 2020 and will be held at University of Delaware in Newark, Delaware. In this seminar, you will learn the latest advances in X-ray microscopy, including an application of deep learning to X-ray CT image analysis, from the top-level innovators in the field. You can also participate in the workshop to learn the basics of X-ray microscopy and go on a laboratory tour. Registration is free but limited so please sign up [here!](#)

In March we have three major events: Pittcon, ARABLAB and analytica. [Pittcon](#) (The Pittsburgh Conference on Analytical Chemistry and Applied Spectroscopy) will take place in Chicago this year, March 1–5 (Rigaku booth 4725). [ARABLAB](#) will once again be held in Dubai and runs March 16–18 (Rigaku booth 166). [analytica](#), a leading trade fair and conference for laboratory technology, analysis, and biotechnology, will be held from March 31–April 3, at Messe München in Munich, Germany (Rigaku booth 431). Please stop by to visit and see what's new. A complete list of all upcoming events can be found [here](#).

The featured *Rigaku Journal* article this month covers the evaluation of crystalline polymer materials using a 2D-SAXS/WAXS system. The paper presents examples of analyzing polypropylene, polyethylene and polybutylene.

This month's XRD technical note discusses the evaluation of stress distribution by Micro Area XRD. The WDXRF application note presents the use of the "OXIDE-FB-PAK," a special analysis package for determination of oxide materials by the fusion method.

Another application note describes the analysis of nuclear power plant cooling water filters by EDXRF. Excessive metal content can contribute to corrosion in the cooling systems in power stations, but monitoring the cooling water for excessive metal content can help minimize corrosion.

The featured video presents an introduction to the X-ray computed tomography (CT) technique. Finally, a collection of news reports presenting the latest developments in materials science is also included.

Enjoy!

## UPCOMING RIGAKU EVENTS

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**PITTCON 2020**  
Booth 4725  
Chicago, Illinois  
March 1–5, 2020

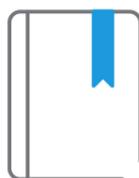
**ARABLAB 2020**  
Booth 166  
Dubai, UAE  
March 16–18, 2020

analytica 2020  
Booth 431  
Munich, Germany  
March 31–April 3, 2020

[VIEW MORE](#)

## FEATURED JOURNALS & REPORTS

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### Journals

#### **Evaluation of Crystalline Polymer Materials Using a 2D-SAXS/WAXS System**

*By Yukiko Namatame & Keigo Nagao, Rigaku Corporation*

In a crystal, atoms or molecules are arranged in a three-dimensional, repetitive pattern, and the properties of the crystal are determined by the chemical composition of the constituent atoms or molecules. The typical image of a crystal is a grain of a single crystal such as salt or alum, but many familiar materials, such as metals, ceramics, and crystalline polymers, are solids composed of microcrystals. These are called polycrystals, in contrast to single crystals.

[Read More >](#)

## FEATURED PRODUCTS

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#### **AutoMATE II**

Residual stress may be created during the manufacturing process of a material, or it may accumulate in a structure over many years in operation. In either case, this stress can have a serious negative effect on a product's quality, durability and lifetime. Accurate detection of residual stress is an important element of the quality control process and helps predict the service lifetime of products.

[Read More >](#)



#### **SmartLab®**

Rigaku SmartLab® is the newest and most novel high-resolution X-ray diffractometer (XRD) available today. Perhaps its most novel feature is the new SmartLab Studio II software, which provides the user with an intelligent User Guidance expert system functionality that guides the operator through the intricacies of each experiment. It is like having an expert standing by your side.

[Read More >](#)

## FEATURED APPLICATION NOTES

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### XRD

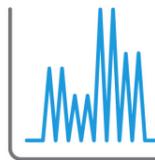
#### Evaluation of Stress Distribution in the Depth Direction of a Spring by Micro Area XRD

Rigaku Corporation

Shot peening is a surface treatment method mainly used to improve the durability and reliability of metal parts. Materials such as iron and ceramics are shot at the surface of metal parts at high speed to create compressive residual stress, which improves fatigue strength and durability against stress corrosion. Shot peening is applied, for example, to metal parts on aircraft and automobiles, and pressure vessels in chemical plants, etc., which are used continuously for a long time.

[Read More >](#)

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### XRF

#### Fused Bead Analysis for Wide Concentration Ranges of Various Oxide Materials Using OXIDE-FB-PAK

Rigaku Corporation

The fusion method in X-ray fluorescence (XRF) analysis is an effective sample preparation technique for getting accurate analysis results of powder samples, since the technique eliminates heterogeneity due to grain size and mineralogical difference. In addition, the homogenization of material property by vitrification makes it possible to expand the calibration range by the use of synthetic standards of fused beads with reagents or by using diverse reference materials.

Rigaku provides an analysis package for various oxide materials by the fusion method, named "OXIDE-FB-PAK".

[Read More >](#)

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### EDXRF

#### Nuclear Power Station Cooling Water Filters

Applied Rigaku Technologies

Excessive metal content can contribute to corrosion in the piping used in the cooling systems in power stations. Corrosion is minimized by the selection of metal alloys used for the pipes and the chemistry of the cooling water itself. The cooling water is monitored for excessive metal content using both Millipore and Cation filters. The filters are then analyzed to determine concentrations of Fe and Cu, as well as other unwanted metals such as Ni, Zn and Pb. To meet the analytical demands of the industry Applied Rigaku Technologies offers the NEX DE EDXRF analyzer.

[Read More >](#)

## FEATURED VIDEO & USEFUL LINK OF THE MONTH

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### [Rigaku CT Webinar: X-ray Computed Tomography for Materials Science 1: Introduction](#)

An introduction to the X-ray computed tomography (CT) technique. Designed to show how X-ray CT works and how it can be applied to scientific research. It will include an introduction to the technique, instrumentation and application examples.



### [Search MatWeb for Property Information](#)

MatWeb's [searchable database of material properties](#) includes data sheets of thermoplastic and thermoset polymers such as ABS, nylon, polycarbonate, polyester, polyethylene and polypropylene; metals such as aluminum, cobalt, copper, lead, magnesium, nickel, steel, superalloys, titanium and zinc alloys; ceramics; plus semiconductors, fibers, and other engineering materials.

## MATERIALS ANALYSIS IN THE NEWS

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**February 3, 2020:** Scientists from the University of Bristol and Université Paris-Saclay have discovered a new class of material—[non-sticky gels](#). Until now gels have been made of particles that stick to one another to form a network. The research team, whose findings are published in the journal *Proceedings of the National Academy of Sciences*, have now shown that networks can form and persist without the particles sticking to one another if the particles behave as liquid crystals.

**February 3, 2020:** New research by engineers at MIT and elsewhere could lead to [batteries that can pack more power](#) per pound and last longer, based on the long-sought goal of using pure lithium metal as one of the battery's two electrodes, the anode. The new electrode concept comes from the laboratory of Ju Li, the Battelle Energy Alliance Professor of Nuclear Science and Engineering and professor of materials science and engineering.

**February 4, 2020:** [University of Chicago](#) scientists have created a [tough material able to stretch, heal and defend itself](#) – a synthetic tissue that can much more closely mimic biological skin and tissue than existing technology can.

**February 5, 2020:** 3D printers working in the millimeter range and larger are increasingly used in industrial production processes. Many applications, however, require precise printing on the micrometer scale at a far higher speed. Researchers at Karlsruhe Institute of Technology (KIT) have [developed a system](#) to print highly precise, centimeter-sized objects with submicrometer details at a so far unmatched speed.

**February 5, 2020:** In Massachusetts, [a scientist is preparing to take tricorders to Mars](#). Star Trek's Tricorder technology may have been a fantasy in the 1960s, but the instruments used to analyze, identify and record data have been manufactured for commercial use since the 1980s. Mount Holyoke College Kennedy-Schelkunoff, Professor of Astronomy Darby Dyar wants to perfect how those instruments identify materials in outer space.

**February 7, 2020:** A new reaction system can [detect X-rays at the highest sensitivity ever recorded](#) by using organic molecules. The system, developed by researchers at Nara Institute of Science and Technology (NAIST), Ikoma, Japan; and Centre National de la Recherche Scientifique (CNRS), Toulouse, France, involves the cycloreversion of terarylene, causing the molecule to switch reversibly between colorless and blue isoforms in the presence or absence of X-rays.

**February 7, 2020:** Employing X-ray tomography at the European Synchrotron Radiation

February 1, 2020: Employing cryo tomography and electron spectroscopy at the European Synchrotron Radiation Facility (ESRF) in Grenoble, international team of researchers were able to use neutrons and X-rays to [analyze the aging of lithium batteries](#) and detect deformations and discontinuities that develop during the charging cycles.

**February 7, 2020:** An international team of planetary scientists and geochemists from the United States and Switzerland have demonstrated that a technique called [atom probe tomography](#) can be successfully used to [characterize the composition and texture of single grains of lunar dust](#) at near-atomic resolution.

**February 10, 2020:** Biomedical engineers from [Rutgers University](#) have developed a "bio-ink" for [3-D printed materials](#) that could serve as scaffolds for growing human tissues to repair or replace damaged ones in the body.

**February 13, 2020:** A theoretical study suggests the counterintuitive idea that [the fastest way to heat specific types of materials may be by cooling them first](#). The idea parallels the Mpemba effect, in which hot water sometimes freezes faster than cold.

**February 13, 2020:** Researchers at the Georgia Institute of Technology have developed a new method, using atomic layer deposition, that could one day replace conventional pressure treating of wood as [a way to make lumber not only fungal-resistant but also nearly impervious to water](#)—and more thermally insulating.

**February 14, 2020:** A team from the Institute of Physics at the University of Freiburg has succeeded in observing in [real-time ultrafast quantum interferences—in other words the oscillation patterns—of electrons which are found in the atomic shells of rare gas atoms](#).

**February 18, 2020:** Advanced Research Center for Nanolithography (ARCNL) researchers Lars Loetgering and Stefan Witte, together with colleagues from Germany and the U.S., [reported on a method that enables the generation of soft X-ray beams with controlled orbital angular momentum \(OAM\)](#).

**February 18, 2020:** Researchers recently developed a technique that can be used to build carbon-nanotube-based fibers by creating chemical crosslinks; the technique [improves the electrical and mechanical properties of these materials](#).

**February 18, 2020:** [A researcher's use of crystal X-ray diffraction could change wastewater treatment](#). Concordia graduate student Victor Quezada aims to dramatically reduce our exposure to contaminants like pharmaceuticals and personal-care products. His research focuses on metal-organic frameworks that, with proper synthesis, could act as absorbents that remove the low-level contaminants missed by traditional treatment programs.

**February 19, 2020:** The Suzuki-Miyaura reaction is a well-known chemical process in which a reaction between organic boronic acids and aryl halides leads to the synthesis of "biaryl" compounds, which are important components of various drugs and chemical products. In a new study published in *ACS Catalysts*, a team of scientists from Japan, [has shown how this reaction can be made more efficient](#).

**February 19, 2020:** Scientists from [Argonne National Laboratory](#) and the University of Chicago [entangled photons across a 52-mile network in the Chicago suburbs](#), an important step in developing a national quantum internet.

**February 20, 2020:** [A team of researchers in Sweden has developed a new bioplastic](#) that, unlike traditional carbon-based plastics or other bioplastics, provides protection from the ultraviolet (UV) radiation. The researchers developed a biomass-based copolymer whose bisfuran structure was found to effectively prevent UV radiation from passing through a film made from the material.

**February 20, 2020:** [The USFDA is considering whether to extend the reporting of asbestos in talc](#) to all elongate mineral particles (EMP) with the same composition and crystal structure, according to a document currently undergoing public review. The report was written by the Interagency Working Group on Asbestos in Consumer Products (IWGACP) and published by the FDA.

**February 21, 2020:** Japanese space agency [JAXA](#) is gearing up for an ambitious [unmanned space expedition to explore Phobos](#), one of the two moons that orbit Mars. A probe will orbit and survey both of Mars' moons, while a rover tasked with collecting samples alongside other scientific experiments will land on Phobos. If all goes well, the spacecraft will return to Earth with the soil samples.

**February 21, 2020:** In manufacturing, controlling the three-dimensional shapes of macrocycles is critical. In a newly published study, a [University of Montreal](#) team led by chemistry professor Shawn Collins reports that they have succeeded in using a natural process called biocatalysis to [control the shapes of macrocycles](#), which is said, could be a boon for the making of pharmaceuticals and electronics.

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