



NOVEMBER - DECEMBER 2023, ISSUE 124

WELCOME

The end of the year is fast approaching, a time for reflection and for looking forward. For those of us of a certain age—those who've lived through 1984, 1999 and 2001—the year 2024 seems like the title of a science fiction novel. Technology is advancing at a speed none of us could have anticipated in any of those earlier years. We can do things on our cell phones that would have taken a room-sized computer back then, if it was possible at all. Machine learning and artificial intelligence algorithms are opening doorways to new possibilities—and new concerns. The world is far smaller than ever in so many ways and yet the distances between us continue to grow in certain aspects, too.

One thing has become obvious: we need to do everything we can to preserve and improve life on this planet for future generations. This includes finding environmentally friendly approaches to areas such as manufacturing and synthetic processes, the disposal of all those batteries powering our personal devices once they reach the end of useful service, and the use of construction materials to reduce carbon dioxide in their atmosphere. Despite some grand ideas about the possibility of sending people to other planets, there is currently no Plan—or Planet—B in the foreseeable future.

Rigaku's Corporate Mission is to contribute to the enhancement of humanity through our community's scientific and technological development. As we speed toward 2024 and beyond, we look forward to providing the technological advancements you need for your journey of innovation.

VIDEO OF THE MONTH



Transformation of Argonne: Luxi Li
Argonne National Laboratory

The Advanced Photon Source at the U.S. Department of Energy's Argonne National Laboratory enables scientists to uncover the secrets of new materials and create breakthroughs in various research fields and industries.

In this video, Argonne physicist Dr. Luxi Li discusses how the upgraded APS will enable advances in battery design.
[Watch the video >](#)

UPCOMING EVENTS

Materials Research Society (MRS2023)
November 26, 2023 - December 1, 2023 Boston, MA
[Website](#)

SEMICON Japan 2023
December 13, 2023 - December 15, 2023 Tokyo, Japan

Elevate Your Semiconductor Experienced! Rigaku invites you to be a part of #SEMICONJapan2023, the pinnacle event that unites the semiconductor manufacturing supply chain for a journey through the latest insights, trends, and innovations driving the industry's digital transformation.

Explore groundbreaking applications powered by semiconductor technology, from reshaping the automotive industry to propelling the Internet of Things (IoT) into new realms. Witness the future unfold as we redefine what's possible.

Visit the Rigaku Booth #4427: Immerse yourself in a world of cutting-edge technology at our booth. Discover the precision and innovation that Rigaku brings to the semiconductor landscape. Engage with our experts, explore our solutions, and be part of the future of semiconductor metrology.
[Website](#)

Thermal Analysis Technical Seminar: Let's Evaluate Materials With TMA
December 19, 2023 Webinar
[Register](#)

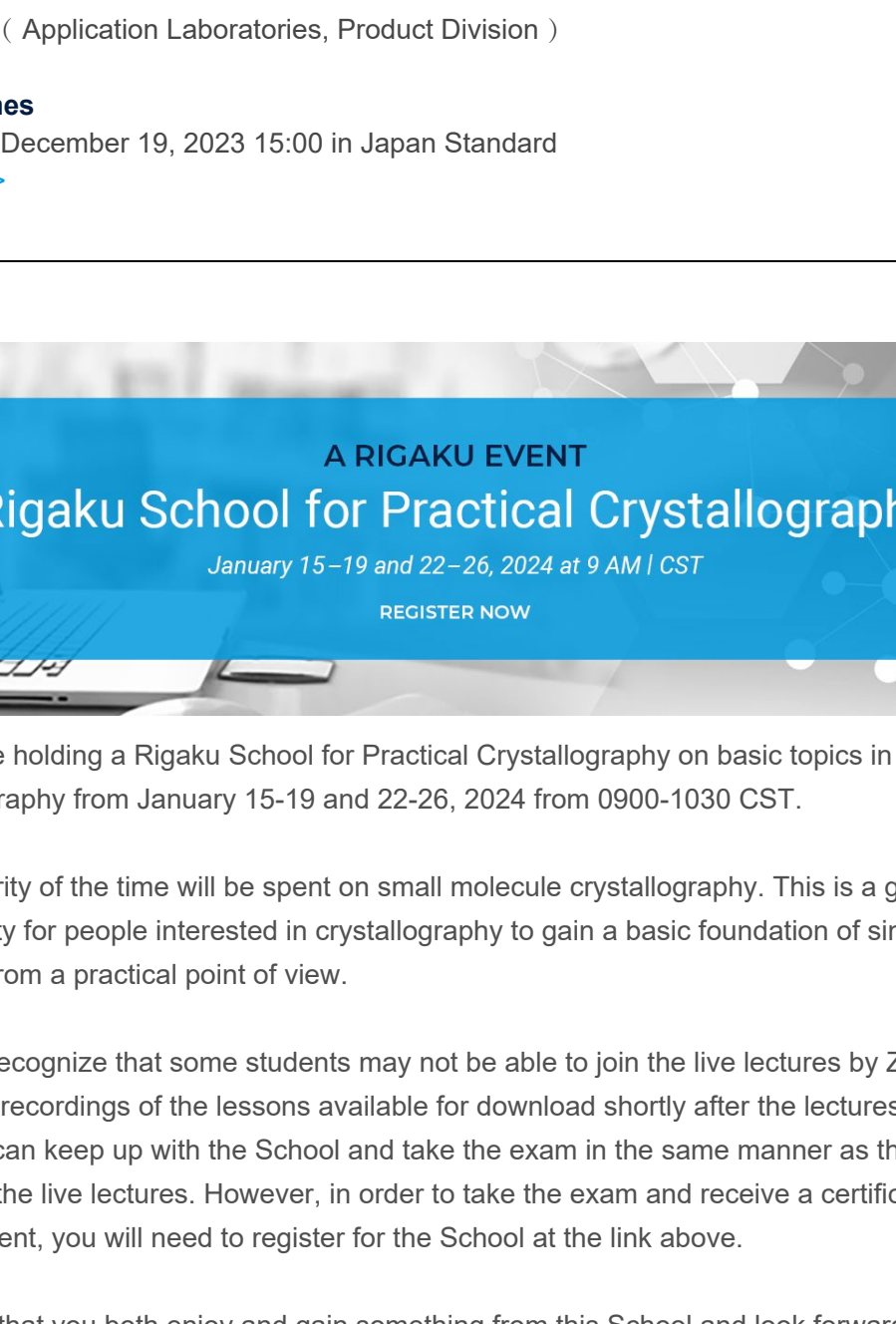
Rigaku School for Practical Crystallography 2024
January 15, 2024 - January 26, 2024 Online event
[Register](#)

Analytica 2024
The [analytica trade fair](#) will be held from April 9 to 12, 2024 in Munich, Germany. It presents innovative products, systems and applications from the entire laboratory value chain for industry and research.

The event brings together industry leaders, scientists and experts, providing a unique networking opportunity. The analytica conference, featuring world premieres and product highlights, allows attendees to interact with the scientific elite and explore the latest analytical findings.

Visitors can look forward to exploring Rigaku's innovative products, systems and applications, contributing to the event's comprehensive market overview.
[Website](#)

PRODUCT IN THE SPOTLIGHT



SmartLab Studio II
AI-powered phase identification, X-ray reflectivity analysis, and profile decomposition

AI has become an indispensable tool in various scientific domains, revolutionizing and accelerating research processes. X-ray diffraction and scattering analysis are no exceptions. The new AI modules for **SmartLab Studio II** can assist you in navigating complex data analysis processes. For example, AI can diagnose the causes of discrepancies between simulated and measured reflectivity profiles, identify minor phases without operator assistance, and decompose a diffraction pattern into individual phases even if the phases are not identifiable in databases.

[Read more >](#)

How does AI help me?

Phase Identification

This AI-powered module can improve your productivity when you often analyze similar samples but have difficulty identifying minor phases such as impurities, foreign materials, etc.

A trained network can perform phase identification more accurately than conventional search/match algorithms without any operator involvement or judgment.

X-ray Reflectivity (XRR) Analysis

This AI-powered module can suggest how to adjust your simulation model to improve the quality and accuracy of X-ray reflectivity (XRR) analysis.

A trained network can suggest what might be causing the discrepancy between the experimental and simulated profiles, such as a missing surface layer.

Correcting the simulation model based on the suggestion can improve the XRR fitting accuracy.

XRD Component Decomposition

This AI-powered module can separate an X-ray diffraction (XRD) pattern of an unknown mixture into multiple components and quantify each phase.

This decomposition does not require any knowledge or phase identification analysis of the sample and can be useful when comparing tens and hundreds of XRD patterns consisting of similar phases.

Explore the new AI functionality available.
[Read more >](#)

IN THE NEWS

November 8, 2023: Researchers at MIT have successfully trapped electrons in a pure crystal, marking the first time scientists have achieved an **electronic flat band in a three-dimensional (3D) material**. With some chemical manipulation, the researchers also showed they could transform the crystal into a superconductor.

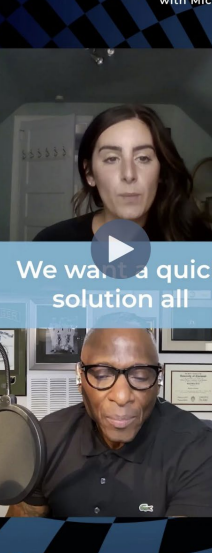
November 27, 2023: Researchers at the University of Tokyo have developed a method to **confirm whether carbon in concrete originates from the raw materials, or from carbon in the air which has been trapped when it reacts with the concrete to form the mineral calcium carbonate**. This method could be useful for the industrial sector and countries looking to offset their carbon emissions.

November 28, 2023: Many of the most promising new pharmaceuticals are hydrophobic by nature, resulting in poor bioavailability. Researchers at MIT have found a more efficient way of processing and delivering these drugs that could make them far more effective. The technique involves **initially processing the drugs in a liquid solution rather than in solid form**, which also should make it easier to combine multiple different drugs in a single pill. One key to the new process is the use of a hydrogel, a sponge-like material that can retain water and hold molecules in place.

November 28, 2023: By pressure-cooking birch leaves picked on their campus, physicists at Umeå University in Denmark have produced a **nanosized carbon particle with optical properties that may be used to produce semiconductors for optoelectronics**, such as organic LEDs for super-thin TV and mobile phone screens. The goal of this research is to create methods to manufacture organic semiconductor materials using renewable resources instead of relying on petrochemical compounds and rare elements.

November 29, 2023: Used lithium-ion batteries from cell phones, laptops and a growing number of electric vehicles are piling up, but options for recycling them remain limited mostly to burning or chemically dissolving shredded batteries. Researchers at Oak Ridge National Laboratory have improved approaches that **dissolve the battery in a liquid solution in order to reduce the amount of hazardous chemicals used in the process**.

RESEARCH PAPER PUBLICATION



Small Angle X-ray Scattering Study for Investigating the 3D Packing Structure of Pt Catalysts on Gd-Doped CeO₂ Supports for Fuel Cells
Rigaku's X-ray Research Laboratory

A 3D structural model for fuel cell catalysis systems is constructed, which consist primarily of Pt and CeO₂ nanoparticles, to fit observed small angle X-ray scattering (SAXS) patterns by using the reverse Monte-Carlo (RMC) method. The observed SAXS patterns are well reproduced by those of the simulations. Analysis of the SAXS patterns indicates that the number of nanometer-size Pt particles is much smaller than that of the introduced amount. This suggests that most Pt particles are not uniformly distributed in the catalysis system.
[Read more >](#)

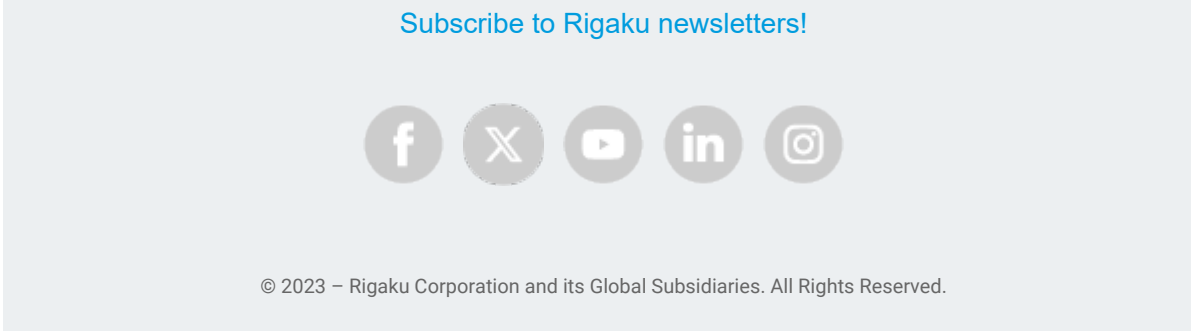
WEBINARS

Rigaku Webinar Series: Thermal Analysis Technical Seminar

This webinar is a beginner's course. The presentation will focus on the basic principles of thermomechanical analysis (TMA) and the different modes that are available based on sample shape and measurement objective. During the presentation, we will also highlight applications and show some videos on changing attachments. Different types of thermobalances and the advantage of a horizontal differential TG type. It will also include the important factors and precautionary measured when performing STA measurements.

Speaker:
Jing Sun (Application Laboratories, Product Division)

Dates/times
November 26, 2023 - December 19, 2023 15:00 in Japan Standard
[Register >](#)



We will be holding a Rigaku School for Practical Crystallography on basic topics in crystallography from January 15-19 and 22-26, 2024 from 0900-1030 CST.

The majority of the time will be spent on small molecule crystallography. This is a great opportunity for people interested in crystallography to gain a basic foundation of single crystal analysis from a practical point of view.

We also recognize that some students may not be able to join the live lectures by Zoom. We will make recordings of the lessons available for download shortly after the lectures so that students can keep up with the School and take the exam in the same manner as those who attended the live lectures. However, in order to take the exam and receive a certificate of achievement, you will need to register for the School at the link above.

We hope that you both enjoy and gain something from this School and look forward to meeting you, virtually.
[Visit this link](#) to learn more about the program and lecturers.

Date/time
January 15, 2024 - January 26, 2024 at 9 AM | CST
[Register >](#)

BENEATH THE SURFACE: X-RAY ANALYSES OF BATTERY MATERIALS AND STRUCTURES
A Battery Webinar Series by Rigaku

Pair Distribution Function (PDF) Analysis for Everyday Battery Analysis
February 21, 2024 at 1:00 PM
[REGISTER NOW](#)

Did you know you can operando measurements of the X-ray scattering Pair Distribution Function (PDF) can help you see the changes in the local order/disorder within cathode and anode materials?

In the charge/discharge cycling of lithium-ion batteries (and other novel battery technologies), there is a continuous buildup of local disorder in the cathode and anode materials driven by the Li-ion mobility that will eventually contribute to battery failure and reduced operational lifetime.

Characterization of the nature and extent of this local disorder can lead to predictive insights into battery failure mechanisms.

In operando measurements of the X-ray scattering PDF can allow direct modeling of the changes in the local order/disorder within the cathode and anode material as well as for solid electrolytes if used.

In the webinar, we will investigate how best to collect in operando PDF data and discuss the optimum data processing approaches to give meaningful results. In particular, the use of Reverse Monte Carlo techniques to give physical representations of the locally disordered structure will be presented.

Date/time
Wednesday, February 21, 2024 - 13:00 CST
[Register >](#)

FEATURED APPLICATION NOTES

Analysis of Lead in Gasoline by ASTM D5059 BI SI Method
Applied Rigaku Technologies

Tetraethyl lead is an anti-knock agent added to gasoline, or petrol. Lead is a toxic metal that interferes with anti-pollution devices and contributes to lead poisoning. This application note details the performance for the measurement of lead (Pb) in gasoline as per ASTM D5059 using the Bi internal standard method Part C (ultra-low lead for MoGas, motor gasoline) and Part A (high Pb for AvGas, aviation gasoline).
[Read More >](#)

Fast Mineralogical Analysis in Blended Cements with Rigaku's MiniFlex XpC
Rigaku Europe SE

To address environmental concerns, traditional Portland cements are being replaced by blended cements with additives such as fly ash. Rigaku's **MiniFlex XpC**, designed for cement analysis, offers a fast and reliable solution. Its compact design allows for easy integration into automated laboratories. The EasyX software enables rapid analysis of mineralogical phases in less than three minutes. This application note showcases the MiniFlex XpC's efficiency in quality and process control of blended cements in industrial environments, highlighting its role in reducing CO2 emissions and improving sustainability.
[Read more >](#)

MiniFlex XpC for Clinker Application
Rigaku Europe SE

The **MiniFlex XpC** is Rigaku's latest X-ray diffraction (XRD) instrument for the cement industry, offering a compact design with the performance of a floor-standing instrument. It features a small goniometer stand, an 800 W X-ray tube and a high-speed 1D detector for accurate results. The MiniFlex XpC is suitable for automated laboratory environments, offering an intuitive touch interface and seamless integration.

Rigaku's **SmartLab Studio II software suite**, which includes Rietveld refinement, enables comprehensive measurement and analysis of cement materials. The EasyX software provides a fast three-step process for phase quantification. It also offers statistical information on sample measurements. The MiniFlex XpC is ideal for fast and reliable analysis of cement materials in high-precision environments with minimal infrastructure requirements. It supports both semi- and fully automated setups.
[Read more >](#)

PODCASTS

The Battery Lab is a podcast empowering the researchers powering the future. Every episode features insights from the industry experts, leading academics and cutting-edge research advancing batteries — and society — to the next level of safety and efficiency. From raw materials to analysis to state-of-the-art designs, if you care about fueling the future, you've come to the right place. Welcome to the Battery Lab!
[Listen to New Episodes >](#)

Understanding Semiconductors: Modern Metrology from Lab to Fab, is a podcast for engineering leaders in characterization, metrology, process, and analytics, looking for discussion around semiconductor metrology challenges. Each episode will feature a conversation with technology experts about problems facing the semiconductor metrology industry.
[Listen to New Episodes >](#)

The Opioid Matrix is a podcast for anyone looking for the latest information in the illegal drug supply chain—beginning to end. Each episode will feature a discussion with industry experts about the current opioid crisis, including drug trafficking, drug manufacturing, drug identification, drug addiction, as well as the role of government, law enforcement, new health and social programs, and more.
[Listen to New Episodes >](#)

Nurturing Resilience: Breaking Free from Victim Mentality
It's okay to not feel okay.
In this episode, we welcome back **Dr. Geri-Lynn Utter**, a Clinical Psychologist and the author of **Mainlining Philly: Survival, Hope and Resisting Drug Addiction**, as well as her new book, **AfterShock: How Past Events Shake Up Your Life Today**.

Dr. Utter specializes in individuals struggling with substance use disorders and other psychiatric illnesses. Her experiences, dating back to her own childhood, provide unique insight into the nature of addiction, and have given her the tools to offer solutions to those addicted, as well as those who love them.
[Listen Now >](#)

Faith, Community and Collaboration in the Fight Against Substance Addiction with TJ Ward of Project Opioid
U.S. DEA seizures reveal a chilling reality - 60% of the pills taken off the streets pack a lethal dose of fentanyl.
Our special guest, **TJ Ward**, a man of faith and a visionary in the fight against substance use disorder, shares his powerful insights and experiences. TJ is the current Director of Advocacy at Project Opioid North Florida. Project Opioid North Florida is part of a statewide initiative funded by the Florida Blue Foundation to drastically reduce the number of opioid-related fatalities in our communities by bringing together key leaders to address the crisis.

We discuss the role of faith in recovery, the importance of addressing mental health alongside addiction, and the need for collaboration and outreach to vulnerable communities. We explore the impact of substance use disorder on individuals, families, and society as a whole, while also discussing potential solutions, such as education, policy change, and innovative treatment approaches.
[Listen Now >](#)

Operation Fast and Furious: Arming Mexican Cartels with U.S. Weapons with Pete Forcelli
Weapons are hitting the streets and killing Americans. They're fueling cartel and domestic drug trafficking violence. We have layers of complex problems that are all surrounded by policy decisions, which seem to be enabling criminal activity.

In this episode, **Peter Forcelli**, retired Alcohol, Tobacco and Firearms (ATF) executive and author of **The Deadly Path**, sheds light on the world of firearms trafficking. We explore the stark reality of crime-ridden parks in New York City housing projects, where children live in fear and are locked inside their homes for safety. But it doesn't end there. Pete takes us to the heart of the matter - the prosecution, or lack thereof, of gun crimes.

We uncover the startling truth behind ATF, Operation Fast and Furious, a whistleblower's account that reveals a pattern of allowing firearms to flow into Mexico, leading to a staggering number of guns in the wrong hands. And as we discuss the impact of this operation and its consequences, we also touch on the current crisis of fentanyl and the arming of Mexican cartels with U.S. military spec weapons. This episode will leave you questioning the state of our justice system and the policies that guide it.
[Listen Now >](#)

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