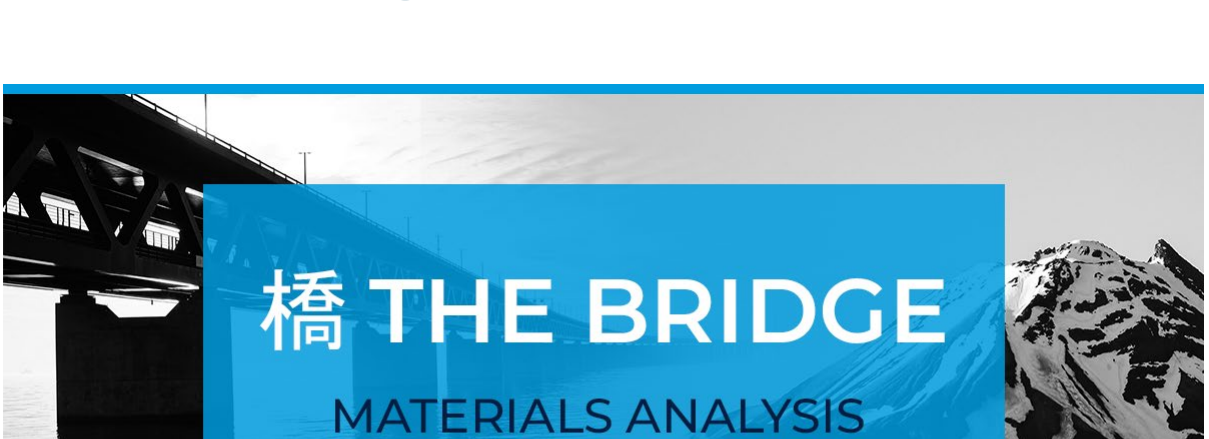


AUGUST 2023, ISSUE 121

WELCOME

The *Rigaku Journal* was first published in English in 1984. Most years since then, there have been two issues, one in Winter and one in Summer. In this issue of *The Bridge*, we highlight the articles contained in Volume 39, Number 2. In addition to two installments of our Powder X-ray Diffraction Basic Course series, there is an article discussing improvements in the throughput of X-ray topography and a product announcement for the XSPA-400 ER detector.

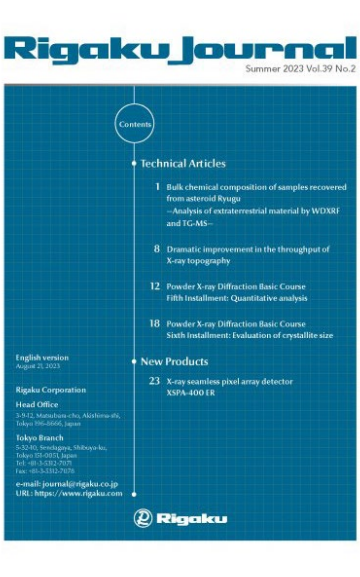
Last week saw a historic event in space exploration, with a lander named Vikram and a rover named Pragyan touching down intact in the southern polar region of the moon. The two robots, from a mission named Chandrayaan-3, make India the first country to ever reach this part of the lunar surface in one piece—and only the fourth country ever to land on the moon.

The "in one piece" qualifier is noteworthy. Russia's Luna 25 spacecraft didn't survive its landing attempt the previous week. Getting to the moon seems to be a well-understood process. It's the crucial final few miles that can be tricky.

Which makes the HAYABUSA2 expedition to collect samples from the surface of an asteroid all the more amazing. The spacecraft spent three and a half years en route to the Ryugu asteroid, where it deployed a pair of rovers to the surface that operated in microgravity conditions to make measurements. Then, an artificial crater was formed to eject particles from the surface that were collected and ultimately returned to Earth over a year later. Some of the analytical results performed on those samples are reported in the first *Rigaku Journal* article below.

In other space news, NASA re-established contact with the Voyager spacecraft after two weeks of radio silence. Voyager was launched over 45 years ago and has traveled 12.3 billion miles in that time. NASA called the process of sending commands beyond the recognized limits of our solar system to correct the antenna misalignment that caused the loss of contact an "interstellar shout." Message received!

RIGAKU JOURNAL



Rigaku Journal
SUMMER 2023, VOLUME 39, NO. 2

Bulk chemical composition of samples recovered from asteroid Ryugu
— Analysis of extraterrestrial material by WDXRF and TG-MS —
Hisashi Homma and Kazuko Motomura

Spacecraft HAYABUSA2 successfully collected a 5.4 g sample from the surface of asteroid Ryugu that was returned to Earth on Dec. 6, 2020. Analysis of the asteroid Ryugu sample was performed using a ZSX Primus IV wavelength dispersive X-ray spectrometer and a Thermo plus EVO2 TG-DTA8122 thermogravimetric differential thermal analyzer coupled with GC-MS (TG-MS).
Read more >

Dramatic Improvement in the Throughput of X-ray Topography
Kenta Shimamoto

Rigaku launched a high-speed X-ray topography system with the improved throughput of 10–20 wafers/hour (3–6 min/wafer). High-speed image acquisition is achieved using an uncollimated divergent beam and the HyPix-3000HE hybrid pixel detector. This technical note explains two major features that contribute to this improvement by dramatically reducing the time for alignment and the travel distance of the specimen to obtain topographic images of the whole area. This high-speed X-ray topography system is poised to play a key role in the quality control of wafers.
Read more >

Powder X-ray Diffraction Basic Course: Quantitative Analysis
Takahiro Kuzumaki

Powder X-ray diffraction is widely used as an analytical method to evaluate various crystalline materials. This paper describes the basics and evaluation examples of the RIR (Reference Intensity Ratio) method and the Rietveld method. In the RIR method, quantitative analysis is performed based on the integrated intensity of diffraction peaks and the RIR values registered in databases. The Rietveld method is a method for refining crystal structure parameters by fitting a calculated pattern obtained from lattice parameters, crystal system, atomic coordinates, etc., to a measured diffraction pattern using the least-squares method. The combination of the Rietveld method with the internal standard method, known as the PONKCS (partial or no known crystal structure) method, and the RIR method also enable quantitative analysis of amorphous phases.
Read more >

Powder X-ray Diffraction Basic Course: Evaluation of Crystallite Size
Masaaki Konishi

Powder X-ray diffraction (PXRD) can obtain a variety of information, not just a single piece of information. In the fifth installment of the powder X-ray diffraction basic course, quantitative analysis was described. This sixth installment describes the evaluation of crystallite sizes.

Evaluation of crystallite sizes using a FP (Fundamental Parameter) method can be corrected by calculating the width attributed to the equipment. This method can analyze crystallite sizes less than 300 nm with an accuracy of a few nm regardless of the optical system conditions and measurement instruments. Even for large crystallite sizes of 100–300 nm, it is possible to calculate highly accurate crystallite sizes and their distributions and, furthermore, to evaluate them accounting for crystallite anisotropy.
Read more >

XSPA-400 ER - X-ray Seamless Pixel Array Detector

The XSPA-400 ER (XSPA: X-ray Seamless Pixel Array, ER: Energy Resolution) is a next-generation 2D semiconductor detector with a higher energy resolution than conventional models. With this higher energy resolution, the XSPA-400 ER reduces X-ray fluorescence, which can be a significant source of background intensity for powder diffraction patterns on samples containing transition metal elements. In addition to 0D and 1D measurements, 2D measurements are also available. The 2D mode allows the user to observe Debye-Scherrer rings, which provide information about sample orientation and the existence of coarse particles. Furthermore, the 75 μm× 75 μm pixel size provides high spatial resolution. These features contribute to improved accuracy in quantitative analysis of trace crystalline phases, precise analysis of lattice constants, and 2D stress analysis of samples such as steel and battery materials that contain transition metal elements.
Read more >

VIDEO OF THE MONTH

Traditional quantitative analysis of solid form content in a solid sample is challenging, most notably in the production of representative standard calibration samples covering the concentration range of interest. In addition to weighing, mixing and homogeneity errors, the resulting boutique standards will likely be not representative of the unknown material being analyzed.

The ideal solution has always been a Standardless Quantitative approach that is representative and relevant to the materials being studied. Component analysis using equal area scaling can make this ideal quantitative analysis solution a reality.
Watch the video>

UPCOMING EVENTS

FEMS EUROMAT 2023
September 3 - 7, 2023 Frankfurt am Main, Germany
Website

34th Annual Electronics Packaging Symposium
September 6 - 7, 2023 Albany, NY, United States
Website

The Battery Show North America 2023
September 12 - 14, 2023 Novi, MI
Website

Contamination and Land Remediation Expo 2023
September 13 - 14, 2023 Birmingham, UK
Website

2023 Cornell Nano Fab (CNF) 46th Annual Meeting
September 14 - 17, 2023 Ithica, NY, United States
Website

MinWien2023
September 17 - 21, 2023 Vienna, Austria
Website

International Conference on Silicon Carbide and Related Materials (ICSCRM 2023)
September 17 - 22, 2023 Sorrento, Italy
Website

EuroMOF
September 24 - 27, 2023 Granada, Spain
Website

WEBINARS

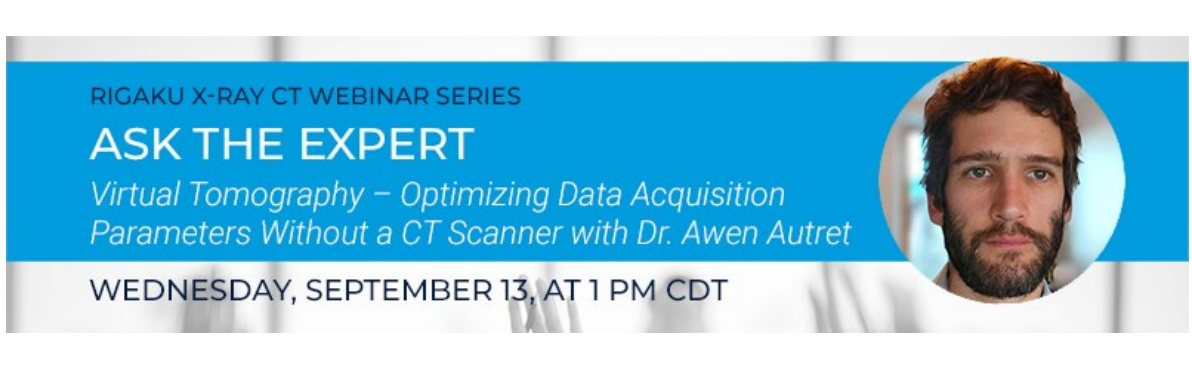
TOPIQ
QUICK WEBINARS BY RIGAKU

Rigaku's first installation of XtaLAB Synergy-ED in Europe was successfully completed this summer at the Institute of Chemical Research of Catalonia (ICIQ) in Spain. Their present study employs the XtaLAB Synergy-ED to investigate the solid state of pharmaceutical compounds, including characterization of:

- Hydrogen bonds in co-crystals/salts.
- New samples formed during a co-crystal screening.
- Co-crystals highly sensitive to radiation damage.
- Labile hydrates.
- The absolute configuration of chiral compounds.

In this webinar, Jordi Benet-Buchholz of ICIQ will share his experiences with XtaLAB Synergy-ED.

Date/time
Thursday, September 7, 2023 04:00 PM CEST
Register >



Did you know you can simulate radiographs and CT images based on the sample structure and CT scanner properties, such as the type of X-ray source and detector? This type of simulation can help you test and optimize data acquisition parameters without running actual scans and can save you time when you have limited machine time.

We will invite Dr. Awen Autret, R&D Engineer from NOVITOM, and ask him questions to learn how you can simulate X-ray images and where this technology can be useful.

Awen is a chief engineer who designed NOVITOM's simulation program. Join us live to participate in the discussion and ask him any questions you might have about X-ray image simulations

Date/time
Wednesday, September 13, 2023 at 1 PM | CDT
Register >

In this seminar, you will learn about various applications of X-ray micro computed tomography (CT) in geology and archeology from the top researchers making the most of X-ray CT in their fields. You can also participate in the workshop to see a demonstration of CT data collection and data analysis, followed by a tour of the Natural History Museum of Los Angeles County.

Date/time
Wednesday, September 27, 2023. Live Stream from 11:00 AM - 3:00 PM | CT
Venue
University of Southern California
Register >

IN THE NEWS

August 1, 2023: Researchers have come up with a new way to store electricity in cement, using inexpensive materials to turn the construction material into a battery to store renewable solar or wind energy. In theory, a house could store enough energy in its foundation to power the household and roads could power the electric vehicles using them. The small devices that have been created so far integrate carbon black into the cement mixture. Because carbon black repels water, the particles clump together into long strands in the concrete that behave like wires.

August 7, 2023: Manufacturers generally try to minimize cracks in batteries because they decrease overall lifetime. However, researchers at the University of Michigan have determined that cracks in the cathode of lithium-ion batteries can reduce battery charge time because of the extra surface area they provide, allowing the batteries to take in lithium ions more quickly.

August 14, 2023: Glass is part of our everyday lives, but it isn't a simple material, existing in a metastable supercooled state somewhere between liquid and crystalline solid. In a sense, it is frozen in a disordered state. Researchers at the Institute of Industrial Science at the University of Tokyo have used computer simulations to determine a new type of exotic compositional ordering that could influence whether a glass will form properly or become partially ordered.

August 16, 2023: LK-99, a lead, copper, phosphorus, and oxygen compound, was heralded —for a while—as a possible room-temperature superconductor, the first to work under ambient conditions. However, recent studies have shown that it is not a superconductor. Copper sulfide and other impurities in the crystal were responsible for the behavior attributed to superconductivity, according to researchers at the University of California, Davis.

August 23, 2023: Researchers in Austria have designed a new type of quantum computer using fermionic atoms—atoms that obey the Pauli exclusion principle—to simulate complex physical systems, such as the interaction of electrons in a molecule or quarks inside a proton. With these computers, some properties are intrinsically guaranteed at the hardware level, whereas with qubit-based computers, extra resources are required to simulate these properties.

FEATURED APPLICATION NOTES

EDXRF

Titanium on Steel
Applied Rigaku Technologies

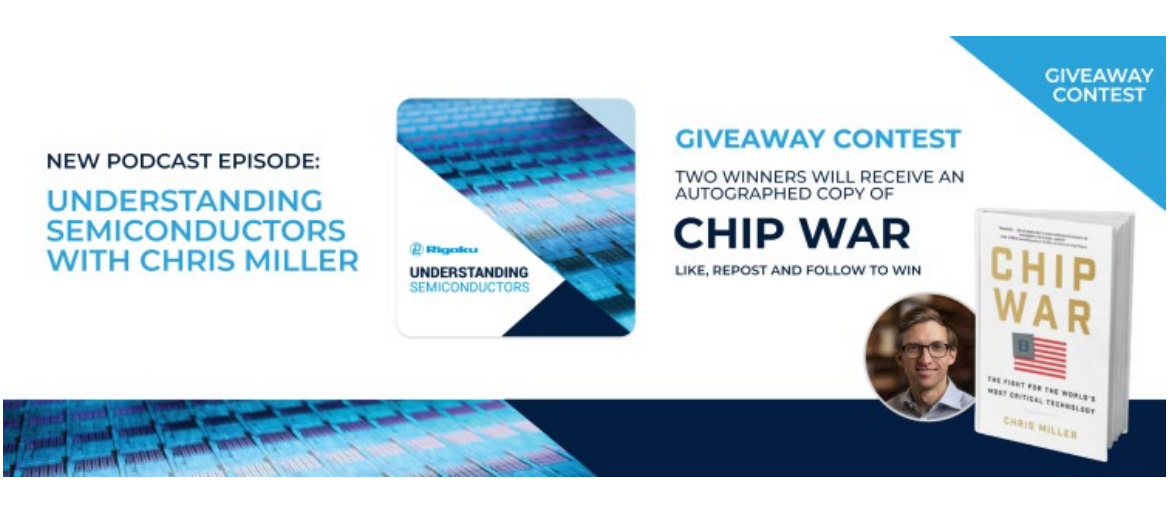
Aluminum and steel are often coated with a protective conversion coating, also called passivate or passivation coating, to prevent oxidation and corrosion of the base metal. Conversion coatings include chromium (Cr), titanium (Ti), vanadium (V), manganese (Mn), nickel (Ni), phosphorus (P), or zirconium (Zr). A phosphate coating may also be applied to minimize wear on cutting tools and stamping machines. Aluminum is often coated for use in aircraft parts, aluminum window frames, and other similar industries where the aluminum is exposed to weathering. Steel for the automotive industry is typically first galvanized with a zinc coating before the conversion coating is applied. Protected steel is also used for outdoor sheds and other similar uses where steel is exposed to weathering. Conversion coating also helps in the retention of paint for the final finished product.
Read More >

WDXRF

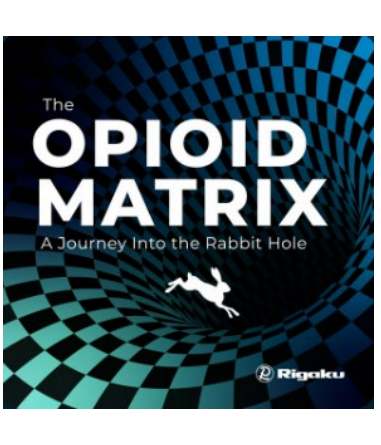
Quantitative Analysis of Blast Furnace Slag by Fusion Method on the ZSX Primus III NEXT
Rigaku Corporation

Blast furnace slag is formed when iron ore or iron pellet, coke and flux are melted in a blast furnace of the iron foundry. The rapid chemical analysis of a blast furnace slag is an important task to control the blast furnace. X-ray fluorescence spectrometers are the most common analysis tools to analyze powder samples in iron and steel making process. This application note describes blast furnace slag analysis using ZSX Primus III NEXT.
Read more >

PODCASTS



Join Markus Kuhn for this episode of *Understanding Semiconductors* with Chris Miller, the historian behind *Chip War: The Fight for the World's Most Critical Technology*. This conversation delves deep into the world of semiconductors as these two experts dissect how technology, geopolitics, supply chain, and resources play a role in semiconductor development and manufacturing.
Watch the episode>



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 >

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 >

The Pharma Lab Show is a podcast exploring the technologies, analysis, and innovation that goes into bringing the pharmaceuticals that allow humanity to live longer, fuller, healthier lives.

Each episode features interviews with industry leaders and experts who share how they are working tirelessly to bring these life-changing products into the world.
Listen to New Episodes >

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