OCTOBER 2022, ISSUE 112

WELCOME

In the October issue of Rigaku's *Crystallography Times newsletter*, Jeanette Ferrara reviewed *Beyond Measure: The Hidden History of Measurement* by James Vincent, which explores how certain units of measurement came to be and how the development of these units say something about evolution at the time.

The book is relevant to Rigaku because, after all, we are all about measurement. Our instruments measure X-ray intensities, for example, and use them to determine the three-dimensional structures of substances, to perform qualitative and quantitative analysis of materials, to identify unknowns or examine the internal structures of common substances or to evaluate changes in compounds under a variety of conditions. While the units Rigaku probably doesn't appear on things in your home, it's a safe bet that a Rigaku instrument was used at some point during the development or manufacture of many of the products you own. The range and scope of what we measure is impressive: from the nanocaate at the way up to parts of automobiles on aircraft. These measurements help the manufacturers ensure that what they are making is what they think it is, in the correct form for its intended use, free of stress and strain, and in line with whatever specifications are required to make it work properly. Rigaku instruments are also used to ensure that substances meet environmental regulations or comply with many of the national and international standards that products are required to pass.

In this issue, we present a new X-ray detector, the XSPA-400 ER, which is used to improve scientists' ability to detect trace phases in samples in the presence of transition metals. This capability is especially important when measuring steel and iron samples, and also in a variety of industries, such as the production of battery materials, where identifying and quantifying trace components is critical.

The XRD application note featured in this issue is about ensuring that pharmaceuticals have the correct composition. The EDXRF application note is about making sure the constituents of cement are correct so this crucial construction material performs and lasts as expected. We also announce a joint webinar with Renishaw about many ways to characterize battery materials, a field that has become increasingly important in recent years. Rigaku Analytical Devices discusses how their handheld Raman analyzers can determine whether aging munitions are duds.

So many different fields of study, all courtesy of products from Rigaku.

IN THE NEWS

October 4, 2022: Billions of years ago, a version of our Earth that looks very different than the one we live on today was hit by an object about the size of Mars, called Theia. Most theories claim the Moon formed out of the debris of this collision, coalescing in orbit over months or years. A new simulation puts forth a different theory: the Moon may have formed immediately, in a matter of hours, when material from the Earth and Theia was launched directly into orbit after the impact.

October 24, 2022: A paper recently published in the journal *ACS Energy Letters* reviewed the role of isostatic pressing (ISP) in large-scale solid-state battery (SSB) production. ISP is a process that covers most of the processing conditions required for the large-scale production of solid electrolyte materials. ISP can be used to generate dense, thin solid electrolyte layers used in practical SSBs. Moreover, the technique offers a pathway toward the integration of the solid electrolyte, anode, and cathode layers into a tri-layer, dense system for commercial applications.

October 25, 2022: Solid-state batteries (SSBs), which have a simpler cell design and an anode-free arrangement, have been thought of as a potential next-generation storage concept for a few years. Pure lithium metal anodes in SSBs stand out for having the highest specific capacity and the lowest potential. However, their practical use in SSBs is still constrained by interface instabilities, the production of solid electrolyte interphase (SEI), a low critical current density, and separator penetration by lithium dendrites. Silicon has emerged as a promising anode material for SSBs, according to a paper recently published by two scientists from Germany.

October 25, 2022: Stradivarius violins produce elegant music with a level of clarity that is unparalleled by modern instruments, according to some musicians. And it's the finishing touches—mysterious treatments applied hundreds of years ago by Antonio Stradivari—that contribute to their unique look and sound. In a step toward unveiling the secret, researchers report on a nanometer-scale imaging of two of Stradivari's violins, revealing a protein-based layer between the wood and varnish.

October 25, 2022: In a study that confirms its promise as the next-generation semiconductor material, UC Santa Barbara researchers have directly visualized the photocarrier transport properties of cubic boron arsenide single crystals.

Podcast

As the Opioid Crisis continues to ravage the country, what is being done to solve the prevalence of these drugs in our communities? In this episode we are honored to be joined by Retired DEA Special Agent Steve Murphy.

Join us as we discuss:

- How has the war on drugs changed since his time in Colombia?
- The role China has played in the production and manufacturing of synthetic opioids
- How state supported injection sites are changing the conceptions of drugs use in America
- The failure of the Portugal model
- The importance of diplomatic engagement when it comes to solving the Opioid Crisis

Listen to podcast >

RECENT EVENTS

From October 18-21, 2022, we participated at the Cornell NanoScale Facility during the 2022 CNF Annual Meeting and 40th Anniversary Celebration. Thank you to the organizers, speakers, and students for sharing your experiences and initiatives.

At Rigaku, we contribute to humanity's enhancement through scientific and technological development. Learn more about Rigaku Semiconductor Metrology Solutions at https://rsms.io/QCrqewsQO or email us to rsmd@rigaku.com

Semiconductor Metrology Solutions for:
· Wafer surface contamination analysis
· Film thickness/composition analysis
· Crystal defect/orientation analysis
· Nano process shaping assessment
· Crystal structure assessment of magnetic film/compound

NEW FEATURED PRODUCT

X-ray diffraction can be used to determine if there are trace crystalline phases in a sample. However, this analysis can be difficult when there are transition metals in the sample because these materials increase the overall background, making weak peaks harder to detect and quantify. The new XSPA-400 ER detector, which is available as an option on Rigaku's flagship SmartLab multipurpose diffractometer, as well the SmartLab SE, suppresses these increases in background intensity using high energy resolution, allowing highly sensitive measurements in samples such as iron and steel, as well as battery materials. The XSPA-400 ER, when integrated with the SmartLab Studio II software package, can easily switch between 0-, 1-, and 2-dimensional measurements under complete control, making it highly versatile and suited to measuring a wide range of samples, from powders and bulk materials to thin films. It is a photon counting detector with three response up to a very high count rate that can be used for operando, in situ, and 2D stress measurements, and more.
Read more>

FEATURED APPLICATION NOTES

How to Evaluate Solid Pharmaceutical Drugs (3) — Confirming Hydrates —
Rigaku Corporation

XRD

Solid pharmaceutical drugs are known to have different physical properties—such as solubility, bioavailability, and stability—depending on their crystal form. Although hydrates and anhydrides are related as so-called pseudo-polymorphs, they have different physical and chemical properties, such as stability regarding temperature, atmospheric humidity, pressure, etc. In general, for example, hydrates are known to melt faster than anhydrides. Confirming the presence or absence of pseudo-polymorphs and the differences in their properties is essential to maintain the quality of APIs and products, and to avoid problems in the formulation process.

This application note introduces the results of TG-DTA, powder X-ray diffraction, and simultaneous XRD-DSC measurements of theophylline (an asthma agent), anhydride and monohydrate. We also will introduce the measurements results of an antiallergic agent, nedocromil sodium, measured with a simultaneous XRD-DSC measurement system with a humidity generator attached.
Read More >

Analysis of Cement and ASTM C114 Qualification
Applied Rigaku Technologies

EDXRF

Cartesian Geometry EDXRF performance is demonstrated for the analysis of finished Portland cement and ASTM C114-18 qualification.

EDXRF is a simple analysis technique used in cement plants around the world. The technique is ideal for QA/QC throughout the cement production process. EDXRF can be used as a screening tool and a QA/QC analyzer to ensure proper quality of incoming feedstocks, raw meal mixture balances, the addition of gypsum, and throughout the manufacturing process, including analyzing alternative fuels and ULSD used for firing the kilns.

Rigaku NEX CG II complies with the performance required in ASTM C114 and makes an excellent backup analyzer to WDXRF or as the main analyzer when producing Portland cement.
Read More >

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

WDXRF

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 properly by utilization 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". This application note introduces OXIDE-FB PAK and demonstrates analysis results using this analysis package.
Read More >

JOINT RIGAKU WEBINAR

Preparation and Characterization of Battery Materials

Whether in quality control or research projects. Retsch mills and Rigaku devices are used throughout the value chain of battery materials. In this joint webinar Retsch and Rigaku present

- how to optimally prepare the sample for analysis
- how to analyze the physical and chemical composition of battery materials and the complete battery.

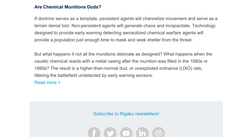
With numerous application examples – from the raw material to the recycling stage - we provide an overview of best practices in sample pulverization as well as XRD, XRF and CT analyses.

Topics

1. Application examples for
   - XRD of NCM and graphite
   - SXF of Graphite
   - XRD of Graphite
   - CT of battery
   - Milling of raw material, electrodes and recycling fractions
   - Sieving of battery material
   - Assisting steps e.g. pellet pressing and sample division
2. Live Demonstration of XRD measurements including sample preparation.
3. Question and answer session after the presentation.

Date/time
Thursday, November 24, 2022 - 02:00 CET
Thursday, November 24, 2022 - 09:00 CST
Register >

MATERIAL ANALYSIS



Are Chemical Munitions Duds?

If doctrine serves as a template, persistent agents will chemalize movement and serve as a terrain denial tool. Non-persistent agents will generate chaos and incapacitate. Technology designed to provide early warning detecting aerosolized chemical warfare agents will provide a population just enough time to mask and seek shelter from the threat.

But what happens if not all the munitions detonate as designed? What happens when the caustic chemical reacts with a metal casing after the munition was filled in the 1950s or 1950s? The result is a higher-than-normal dud, or unexploded ordnance (UXO) rate, litering the battlefield undetected by early warning sensors.
Read more >

Subscribe to Rigaku newsletters!

9009 New Trails Drive, The Woodlands, TX 77381, United States