橋 THE BRIDGE

MATERIALS ANALYSIS eNEWSLETTER

NOVEMBER 2020, ISSUE 89

WELCOME

We hope everyone is managing to stay both safe and productive. We have several upcoming virtual events that we believe will be of interest.

For nearly 50 years, researchers from around the world have converged in Boston for the preeminent materials event of the year—the MRS Fall Meeting. Due to COVID-19, this year's meeting will be held virtually. Rigaku will be supporting 2020 MRS Virtual Spring/Fall Meeting & Exhibit with a virtual booth and workshop. We invite you to join us for a quick discussion of XRD solutions, including operando analysis, when Rigaku presents a talk on *XRD Solutions for Battery Research* on Dec. 3, from 10:00–10:15 AM EST.

Rigaku will also hold an *Advanced Topics in Practical Crystallography* lecture series Dec. 7–11, 2020. It will cover powder and PDF data collection and processing, high pressure cell data collection and processing, using EwaldSD, and non-spherical atom refinement with NoSpherA2. Registration information is available here.

Please join us on Wednesday, Dec. 16, at 1 PM CDT for a 3D look at injection molded and 3D printed plastic parts and mechanical or diecast metal parts. In the newest episode of the webinar series "X-ray Computed Tomography for Materials & Life Science," we will review industrial metrology and discuss when CT works better than traditional methods such as a Coordinate Measuring Machine (CMM). We will also discuss how to process CT images to obtain accurate dimensional analysis results. You can register here.

Previously in the series, we have shown the value of using X-ray computed tomography for everything from generic and brand name tablet comparison to drill-core pore network analysis. Be sure to check them out here if you have missed them.

Materials research is heavily dominated by the quest for smart, faster, brighter technology in smartphones and electronic automobiles. Rigakuas instruments are regularly used by industries manufacturing components for this type of technology, for example thin film analysis of semiconductor materials by XRD and XRF techniques.

Economies in Asia-Pacific regions are dependent on the availability of scandium, yttrium, and lanthanides, particularly those used in consumer technology components. Deep sea exploration has become vital in mapping the "international strategic landscape," and a recent discovery by Japan on the Pacific Ocean floor indicates that recoverable reserves are said to be 1,000 times more than on land. In the race to find these deep-sea minerals, China has broken its own deep-dive record in the Mariana Trench, as reported by Industrial News.

UPCOMING RIGAKU EVENTS

2020 MRS Virtual Spring/Fall Meeting & Exhibit
Nov. 27–Dec. 4, 2020
Virtual Event

CBRNe Convergence 2020
Dec. 1–4, 2020
Virtual Event

POLLUTEC
Dec. 1–4, 2020
Virtual Event

VIEW MORE

FEATURED JOURNALS & REPORTS

Journals

Introduction to Powder X-ray Diffractometry
By Keigo Nagao, Rigaku Corporation

Until the late 2000s, only scintillation counters (SC) were used as the detectors for general-purpose powder X-ray diffractometers. Thereafter, the core technologies that combine to create an X-ray diffractometer evolved dramatically. A one-dimensional (1D) detectorand subsequently a two-dimensional (2D) detectorcame on the market, followed by new optical devices such as multilayer mirrors, in which layering technologies of super-thin films were applied. Analysis software functionality also improved remarkably.
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FEATURED PRODUCTS

MiniFlex

New sixth generation MiniFlex benchtop X-ray diffractometer is a multipurpose powder diffraction analytical instrument that can determine: crystalline phase identification (phase ID) and quantification, percent (%) crystallinity, crystallite size and strain, lattice parameter refinement, Rietveld refinement and molecular structure.
Read More >

NEX DE

As a premium high-performance benchtop energy dispersive X-ray fluorescence (EDXRF) elemental spectrometer, the new Rigaku NEX DE delivers wide elemental coverage with easy-to-learn Windows®-based QuantEZ software.
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FEATURED APPLICATION NOTES

WDXRF

"Automatic Quant Application Setup" Applied to Calibrating Coal Fly Ash Fused Beads
Rigaku Corporation

Coal-fired power plants still account for a large proportion in the total power generation while the allow-carbon society is the apparent trend all over the world. When coal is burned in the boiler of a power plant, the ash called "coal fly ash" is absolutely generated in it and mostly recycled in the cement industry. In using the fly ash as a raw material of cement, it is very important to analyze the components accurately to ensure the quality of the products.
Read More >

EDXRF

Trace Elements in Aqueous Solution with UltraCarry®
Applied Rigaku Technologies

Elemental analysis of aqueous solutions into the low ppm and sub-ppm concentration ranges was demonstrated, using the advanced Cartesian geometry Rigaku NEX CG energy dispersive X-ray fluorescence spectrometer in conjunction with the patented UltraCarry® sample preparation technique.
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FEATURED VIDEO & USEFUL LINK OF THE MONTH

Inside the Most Powerful X-ray Source in the World

Located inside the Sandia National Laboratories in Albuquerque, New Mexico, the Z Pulsed Power Facility (or Z Machine) is the most powerful X-ray source constructed by humans.

Resources for Materials Science and Engineering

NanoHUB.org is the premier cyber-community for computational nanotechnology research, education, and collaboration. This page offers Resources for Materials Science and Engineering.

MATERIALS ANALYSIS IN THE NEWS

October 21, 2020: Geological investigations of low-temperature young deposits on the Styrian Erzberg provide paleoclimatology with new data on the Earth's history and its development. The mineralogical composition of the rock samples analyzed in the investigation was determined by X-ray diffraction and the chemical properties were defined using high-resolution electron microscopy.

October 27, 2020: The appropriately named diabolical ironclad beetle can take a shelling thanks to the incredibly crush-resistant architecture of its exoskeleton, which could serve as the blueprints for designing tougher materials and stronger connections between different material types.

November 5, 2020: A research group led by scientists from the U.S. Department of Energy's (DOE's) Brookhaven National Laboratory used a form of X-ray scattering that has not—until now—been widely used to study a particular group of high-temperature superconductors. The researchers investigated a specific arrangement of electric charge that arises in cuprates: an ordered pattern of electrons known as a charge-density wave (CDW).

November 5, 2020: Scientists have discovered a spongy form of calcium carbonate (CaCO3), a material found in limestone, chalk, marble and the shells of mussels and other shellfish. While most forms of calcium carbonate are hard minerals, this new form is soft and absorbent.

November 6, 2020: Researchers in the U.S. have uncovered a structure where rhenium had been misidentified as cadmium, yet had acceptable refinement standards for publication. Atoms with similar atomic numbers can be hard to differentiate using X-ray diffraction but such unprecedented confusion between atoms with a shift in atomic number of 27 may mean that misidentified structures could be a more widespread concern than previously realized.

November 9, 2020: Northwestern Engineering researchers have developed a new computational approach to accelerate the design of materials exhibiting metal-insulator transitions (MIT), a rare class of electronic materials that have shown potential to jumpstart future design and delivery of faster microelectronics and quantum information systems.

November 9, 2020: Modern life relies closely on plastics, even though the petroleum-based production creates serious environmental challenges. Researchers in China have developed a method to manufacture a biorespired plastic alternative that is strong, tough, and heat resistant.

November 9, 2020: Scientists at the U.S. Department of Energy's (DOE) Brookhaven National Laboratory, Stony Brook University (SBU), the Materials Project at DOE's Lawrence Berkeley National Laboratory (Berkeley Lab), the University of California, Berkeley, and European collaborators have developed a new way to decipher the atomic-level structure of materials based on data gleaned from ground-up powder samples. For the study, X-ray powder diffraction experiments were performed at the ALBA synchrotron in Barcelona, Spain. They describe their approach and demonstrate its ability to solve the structure of a material that shows promise for shuttling ions through sodium-ion batteries in a paper published in the journal *Chemistry of Materials*.

November 11, 2020: Thermoelectric materials use the temperature difference between both sides of the material to create an electric current. Organic thermoelectric materials could be used to power wearable electronics or sensors; however, the power output is still very low. An international team has now produced an n-type organic semiconductor with superior properties that brings these applications a big step closer.

November 12, 2020: Finding new, low-cost ways to make better metal alloys and composites is one of the holy grails of the materials research world. Scientists at the U.S. Department of Energy's Pacific Northwest National Laboratory (PNNL) are finding a lot of success using solid phase processing approaches to create materials with improved properties.

November 12, 2020: The quest for high-throughput intelligent computing paradigms and the ever-increasing volume of digital information has led to increased demand for high-speed and low-power-consuming next-generation electronic devices. The "forgotten" world of antiferromagnets (AFM), a class of magnetic materials, offers promise in future electronic device development and complements present-day ferromagnet-based spintronic technologies.

November 12, 2020: Scientists at Tokyo Institute of Technology (Tokyo Tech) synthesize sub-nanometer particles with precisely controlled proportions of indium and tin using specific macromolecular templates called dendrimers. Through a screening process spanning different metallic ratios, they discovered unusual electronic states and optical properties originating from size-miniaturization and elemental hybridization. Their approach could be a first step in the development of sub-nanoparticles with unique functionalities and characteristics for electronic, magnetic and catalytic application.

November 12, 2020: Scientists are identifying promising "caloric materials" that undergo big temperature changes when placed under pressure and other forces. Many materials exhibit small temperature changes under certain forces, but researchers have been hunting for materials that undergo large shifts, ideally from as little added energy as possible. Among other materials, certain metal alloys have shown promising results under strain; some ceramics and polymers respond well to electrical fields; and inorganic salts and rubber look promising for pressure.

November 13, 2020: Japanese scientist Masatoshi Koshiba, a co-winner of the 2002 Nobel Prize in physics for his pioneering contribution in the field of astrophysics, has died at the age of 94. Koshiba, a distinguished professor at the University of Tokyo, confirmed the existence of cosmic neutrinos by devising and using a detector called Kamiokande, composed of photomultiplier tubes in a cylindrical water tank placed 1,000 meters underground in Gifu Prefecture, central Japan.

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