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WELCOME

Inspired by nature.

With spring eagerly anticipated by those of us residing in the northern hemisphere, our thoughts often turn to nature and the return of color into our gardens and greenspaces. While the vivacity and vibrancy of the visual aspects of nature are appreciated by many, it is also incredible to contemplate just how many scientific discoveries have been influenced by naturea's properties on the microscopic scale.

There was a recent review article released on functional surface microstructures. It was a good reminder that the design of intricate surface patterns to create useful functionalities have commonly been inspired from investigations into biological surfaces. For example, the leaves of sacred lotus plants and their ability to repel water, also known as super-hydrophobicity, helped drive the exploration of wetting properties of a surface and the self-cleaning mechanism. Aquatic springtails and fire ants take advantage of capillary forces to assemble into colonies, enhancing buoyancy and reducing the risk of sinking. On a surface, these capillary forces can be harnessed to induce or enhance mobility and direct motion of a liquid droplet.

Biological surfaces not only repel but also have adhesive properties, with the gecko being the most celebrated example. The investigations of the gecko footpads show them to have an unusually hairy structure and it was later discovered that their adhesion is predominantly due to van der Waals interactions, although capillarity forces and electrostatic forces also participate.

The authors summarize their findings with the following statement: The understanding of microstructure effects is, at the present state, advanced but far from complete. Manipulation of wetting behavior has become a rich branch of modern applied physics, with far reaching implications, e.g. for water management, cooling systems, wind turbines and oil exploration and extraction.

Although not without their shortcomings, bioinspired materials continue to fascinate on both an engineering and chemistry front. Advances in surface analytical instruments, such as Rigakuas thin film analyzers and X-ray microscopes, have made research into this area more accessible.

UPCOMING RIGAKU EVENTS

Rigaku XRD Forum: Powder Diffraction
Mar. 2–4, 2021
Virtual Conference

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UPCOMING RIGAKU WEBINARS

Technical Seminar in Thermal Analysis Focusing on Pharmaceutical Applications
February 25, 12:30 AM CST
This webinar will focus on the pharmaceutical applications evaluated by common methods in thermal analysis such as STA, DSC, MTDSC and evolved gas analysis.
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X-ray Diffraction Measurements for Battery Research
March 3, 11 AM | CST
This webinar will discuss X-ray diffraction and scattering techniques and how to apply them to battery research. Techniques to be discussed will include operando measurement, bond valence sum from Rietveld refinement and pair distribution function (PDF).
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X-ray Computed Tomography for Soft Materials
March 10, 11 AM | CST
This webinar will discuss basics of X-ray computed tomography and how to apply X-ray CT methods to soft materials. Additionally, we will show 3D imaging results for pharmaceuticals, foams, composites and other soft material.
Read More >

Technical Seminar in Thermal Analysis Focusing on Ceramics, Metals and Other Materials
March 18, 12:30 AM | CST
This webinar will focus on general methods of thermal analysis in ceramics, metals, battery and other materials using STA, DSC and evolved gas analysis systems.
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FEATURED PRODUCTS

SmartLab®

Rigaku SmartLab is the newest and most novel high-resolution X-ray diffractometer (XRD) available today. Perhaps its most innovative 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.
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Simultix 15

For over 40 years, the Rigaku Simultix simultaneous wavelength dispersive X-ray fluorescence (WDXRF) spectrometer system has been widely used as an elemental analytical tool for process control in industries that require high throughput and precision, such as steel and cement. Nearly 1,000 Simultix XRF instruments have been delivered to customers around the world. Along with technological progress over these years, customer requirements have advanced and diversified as well. Simultix 15 WDXRF elemental analyzer was developed to meet these changing needs.
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FEATURED APPLICATION NOTES

X-ray Imaging

CT Observation of a Laminated Battery Cell by X-ray Microscopy
Rigaku Corporation

Batteries are made of diverse materials. Non-uniformity, impurities and defects within the battery structure negatively affect the performance, stability, and durability of the product. As batteries are repeatedly charged and discharged, their quality degrades due to changes in the internal structure. Therefore, to evaluate a battery's internal structure, a non-destructive observation technique is needed. By using an X-ray microscope, which can observe transparently the internal area of a sample, the micron structure within a laminated battery cell can be observed in a non-destructive manner.
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WDXRF

Cement Analysis by the Fusion Method on the Simultix 15 According to ASTM
Rigaku Corporation

Cement is one of the most important materials for construction. Many kinds of hydraulic cements with various physical properties, including Portland cement, are produced by changing the composition of clinker minerals; therefore, it is important to control the chemical composition of cement products and interim products. Since the fusion method can eliminate sample heterogeneity problems, such as grain size and mineralogical effects, it is possible to obtain high accuracy for cement samples and also to establish calibrations using a variety of materials.
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XRD

Observation of Dehydration Process of Hydrate by XRD-DSC Simultaneous Measurement Under Temperature and Humidity Atmosphere
Rigaku Corporation

The crystal systems of pharmaceuticals and foods may change due to factors such as temperature and humidity. The climate of Japan in particular exhibits extreme changes in temperature and humidity, with hot and humid summers, and dry, low-temperature winters, and these are poor conditions as an environment for synthesizing pharmaceuticals or storing foods. Therefore, there is a need to conduct measurement beforehand under various atmospheric conditions, and determine what sort of changes these materials undergo in the actual environment.
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EDXRF

Cl and S in Waste Oil and Used Oil
Applied Rigaku Technologies

Waste oil is the generic term for oil that has been contaminated. Used oil is the U.S. EPA designation for any petroleum or synthetic oil that has been used and become contaminated by physical or chemical properties. In both cases the oil is considered hazardous waste if the total chlorine level exceeds regulatory limits. Excessive chlorine in oil products can lead to corrosion during use or cause hazardous wastes and gasses when burned.
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FEATURED VIDEO & USEFUL LINK OF THE MONTH

Sticky Gecko Feet | Space Age Reptiles | BBC Earth

Sir David Attenborough narrates this fascinating investigation into the curious sticking power of the humble gecko.

Raman Playlist

A playlist featuring Rigakuas handheld Raman, the ResQ CQL. Learn how this award winning analyzer works to detect a range of hazardous substances in a series of short videos.

MATERIALS ANALYSIS IN THE NEWS

February 1, 2021: U.S. researchers introduce a scalable and robust approach to produce antireflective coatings for glass surfaces with desired optical and mechanical properties. The developed coating mimics the structure of a moth-eye cornea.

February 5, 2021: The reversibility of transition-metal coordination bonds affords broad control over the structural dynamics of materials. This review surveys the design principle underlying the utilization of this dynamic crosslink chemistry to engineer tunable mechanical properties in biological materials and protein and polymer hydrogels.

February 8, 2021: Researchers have used the principles of origami to create a parabolic structure from a flat surface using a shape-memory polymer.

February 12, 2021: The marriage between 2D semiconductors and ferroelectrics results in new functionalities, which could be expected to deliver massively enhanced device performance for existing complementary metal–oxide–semiconductor (CMOS) technologies and add unprecedented applications for next-generation electronics. Recent progress in using 2D semiconductor/ferroelectric hybrid structures to enable a rich variety of emerging device concepts is critically reviewed.

February 16, 2021: Optogenetics can be used to activate and study cells in a targeted manner using light. Scientists have now succeeded in transferring this technique to plants.

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