

Review of Scientific Instruments New Products

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AFFILIATIONS

Center for Advanced Diffusion-Wave and Photoacoustic Technologies (CADIPT), 5 King's College Road, Toronto, Ontario M5S 3G8, Canada

In order to supplement manufacturers' information, this department will welcome the submission by our readers of brief communications reporting measurements on the physical properties of materials which supersede earlier data or suggest new research applications.

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NEW INSTRUMENTS AND COMPONENTS

Compact Fourier-transform infrared (FTIR) research spectrometer

Bruker has launched its Invenio S FTIR spectrometer for advanced routine laboratory analysis and spectroscopic research, replacing its Tensor spectrometer series. The Invenio S features Bruker's permanently aligned RockSolid interferometer, CenterGlow IR source, temperature-controlled deuterated triglycine sulfate detector, and fail-safe diode laser. The optional transit channel provides an additional, easily accessible sample space and allows instantaneous software-controlled switching between measurement techniques. System intelligence monitors the device configuration and the mechanical and electronic components, with quick self-tests performed automatically to ensure smooth operation. Integrated touch-panel operation facilitates intuitive guidance with typical workflows from routine to advanced research and development applications. The compact design provides bench space for external accessories that can expand the FTIR spectrometer's capabilities to include IR microscopy and imaging, thermogravimetric analysis, high-throughput screening, and vibrational circular dichroism. *Bruker Optics, Inc., 40 Manning Road,*

Billerica, Massachusetts 01821. (978-439-9899) <https://www.bruker.com>



X-ray analytical microscope

The XGT-9000 x-ray analytical microscope (μ XRF) from Horiba Scientific simultaneously performs elemental analysis and optical observation of samples without contacting or destroying them. Incorporating the company's proprietary x-ray technology, which Horiba claims has the highest resolution in the world, the XGT-9000 integrates the features of a high-resolution microscope and high-intensity x-ray beams. It can analyze elements in semiconductor integrated circuits and other micro-objects, accurately measure film thickness and adherence amounts, nondestructively analyze metal materials,

and screen foreign objects that until recently were difficult to observe. Foreign objects can cause problems in the production of lithium-ion batteries, food, and pharmaceuticals. The XGT-9000 can detect both visible foreign objects and invisible ones down to only several microns ($=1/1000$ mm) in size. It switches between high-speed analysis mode for rapid screening of foreign objects and detailed analysis mode using the microbeams first incorporated in earlier models. The XGT-9000 is equipped with three types of optical illumination: bright-field coaxial, dark-field, and transmission. Combining bright-field coaxial and dark-field illumination enables clear observation of samples with



flat or uneven areas, such as semiconductor wafers and films. Irradiating x-rays coaxially with optical observation images enables pinpoint analysis with no misalignment. Other improvements over preceding instruments include shortened analysis time, enhanced mapping and image processing, and ease of combination with other analysis equipment. The software package includes quantitative and qualitative chemical analyses, thickness determination, and image analysis features. *Horiba Scientific Division of Horiba Instruments, Inc., 20 Knightsbridge Road, Piscataway, New Jersey 08854. (732)494-8660) <http://www.horiba.com>*

Double-pulse lasers for laser-induced breakdown spectroscopy (LIBS)

Litron Lasers now offers its versatile Bernoulli LIBS series of pulsed neodymium-doped yttrium aluminum garnet lasers. With output energies up to 250 mJ at 1064 nm and repetition rates up to 30 Hz, the Bernoulli LIBS instrument contains two laser oscillators combined onto a single beam axis in a single head. The lasers are fitted with low-divergence optics to ensure a high degree of focusing and make them suitable for LIBS applications that use the double pulse technique. The compact, lightweight

lasers have fast-detachable connections; a vibration- and shock-proof, fully sealed laser head; ruggedized oscillators; and motorized safety shutters. Two motorized attenuators allow for independent energy adjustment of each laser. The Bernoulli LIBS lasers feature intelligent microprocessor control and monitoring of all laser parameters, and the LUCi remote interface makes them easy to use. *Litron Lasers Ltd., 8 Consul Road, Rugby, Warwickshire CV21 1PB, United Kingdom. (+44 (0)1788 574444) <http://www.litronlasers.com>*

Fast submicron-resolution imaging of intact samples

Zeiss has introduced two advanced models to its Xradia Versa x-ray microscope family. The improved source and optics technology enable the Xradia 610 and 620 to deliver nondestructive imaging of intact samples without sacrificing resolution and contrast. With more x-ray photons available, the 600-series Versa microscopes provide rapid time-to-results on a broad range of sample sizes and types. Academic shared-use facilities and industrial users may benefit from the fast image acquisition of the versatile instruments that can serve more users with diverse requirements. Two major challenges in x-ray computed tomography are maintaining resolution on large sample sizes and with long working distances while simultaneously maximizing resolution and x-ray flux for greater throughput. According to Zeiss, both instruments address those challenges: They provide a high-power x-ray source for higher x-ray flux that leads to faster tomography scans and therefore up to 2× higher throughput than the 500-series Versa—without compromising spatial resolution. At the same time, the x-ray source stability and lifetime are enhanced. The Xradia 600-series Versa features 500-nm spatial resolution and 40-nm min voxel size. Since it maintains high resolution across large working distances, it can accommodate samples contained within environmental chambers and high-precision *in situ* load rigs. Materials science researchers can nondestructively characterize the three-dimensional (3D) microstructure of materials in controlled environments to understand the impact of factors such as heating or compression. The 600-series Versa can help users

investigating energy materials to study the complex multiphysics behavior within multiple solid and fluid phases and their related structural evolution, providing insights into the morphology of those structures and their behavior under operating conditions. Zeiss' "Resolution at a Distance" technology allows intact pouch and cylindrical cells to be imaged at high resolution and enables longitudinal studies of aging effects, across hundreds of charge cycles. Nondestructive imaging with the Xradia 600-series Versa can help electronics and semiconductor industry users visualize defects associated with semiconductor-package-level failures, such as cracks in bumps or microbumps, solder wetting problems, or voids in through-silicon vias. Typical applications in additive manufacturing include studying the detailed shape, size, and volume distribution of particles in powder beds to determine appropriate process parameters. Users in the raw materials industry perform multiscale pore structural analysis, including directly measuring *in situ* fluid flow. Zeiss claims that the new x-ray microscopes provide the most accurate 3D nanoscale support for digital rock simulations, laboratory-based diffraction contrast tomography, and multiscale imaging at fast run times. In life sciences, the Xradia 600-series Versa enables faster- and higher-resolution imaging and allows researchers to study soft tissue such as neural tissue, vascular networks, cellular structures, ligaments, and nerves; mineralized tissue such as bones; and plant structures such as roots and cellular structures. Zeiss x-ray microscopes are designed to be upgradeable and extendible as technology advances. *Carl Zeiss Microscopy GmbH, Carl Zeiss Promenade 10, 07745 Jena, Germany. (+49 3641 64-2646) <https://www.zeiss.com>*



Telecentric lenses

Techspec MercuryTL Liquid Lens Telecentric Lenses from Edmund Optics are suitable for gauging, measurement, and placement applications that require quick depth-of-field adjustment. They combine the unique features of telecentric lenses—such as eliminating parallax error—with the flexibility of liquid lenses. With its quick autofocus capabilities, the liquid lens focuses the telecentric lens electronically, changing its curvature faster than is possible with standard telecentric lenses. The integrated design lets users rapidly adjust the working distance while maintaining telecentricity, distortion, and image performance over the entire working-distance range. Four models offer primary magnifications from $0.15\times$ to $0.75\times$. The C-mount lenses are compliant with the Restriction of Hazardous Substances Directive. They feature a maximum camera sensor format of $\frac{1}{2}$ in. and an aperture of f/10. An Optotune industrial electric lens driver and Hirose cables, both sold separately, are used to control the electrical current to the liquid lens. *Edmund Optics, Inc., 101 East Gloucester Pike, Barrington, New Jersey 08007-1380. (800-363-1992 or 856-547-3488)*
<https://www.edmundoptics.com>

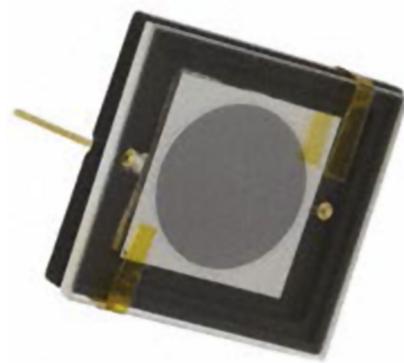


NEW DETECTORS, MEASUREMENTS, AND MATERIALS

Circular photodiode for electron detection

Opto Diode, an ITW company, has added a new photodiode suitable for electron detection to its AXUV detector family. The AXUV63HS1 model has a circular active area of 9 mm diameter (typically 63 mm²). It has a typical rise time of 10 ns

and a maximum dark current of 100 nA, with a minimum reverse breakdown voltage of 160 V. A cover plate protects the photodiode chip and the wire bonds. Storage and operating temperatures range from -10°C to 40°C (ambient) and from -20°C to 80°C in nitrogen or vacuum environments. The lead soldering temperature is 260°C . *Opto Diode Corporation, 1260 Calle Suerte, Camarillo, California 93012. (805-465-8700)* <https://optodiode.com>



Dual-channel digital multimeter (DMM)

The Keithley DMM7512 dual-channel $7\frac{1}{2}$ -digit sampling multimeter from Tektronix combines two independent, identical DMMs in a low-profile 1U-high, full-rack-width space-saving enclosure. The DMM7512 features built-in intelligence and, according to Tektronix, offers high density, measurement sensitivity, accuracy, and fast sampling. No separate instrument is needed to capture waveform parameters: DMM7512 users can capture transient signals and waveforms, including low-level waveforms such as battery drain currents, with the device's 1 MSa/s, 18-bit digitizer, which has a voltage sensitivity of $1\text{ }\mu\text{V}$ and a current sensitivity of 0.1 nA. Each DMM can record a waveform's full profile, trigger on various parameters, and store 27.5×10^6 time-stamped readings. For DC measurements on low-power components, the DMM7512 provides 10-nV, $0.1\text{-}\mu\Omega$, and 1-pA sensitivities. It supports high-accuracy, low-resistance measurements with offset-compensated Ohms, four-wire measurement, and dry circuit measurement. It also maximizes the test-uncertainty ratio for higher quality control with 1-year DC voltage accuracies as

narrow as 14 ppm. *Tektronix, Inc., 14150 Southwest Karl Braun Drive, P.O. Box 500, Beaverton, Oregon 97077. (800-833-9200)*
<https://www.tek.com>



Water-soluble, halogen-free solder paste

A new water-soluble solder paste from Indium is compatible with both tin-lead (SnPb) and Pb-free alloys. Halogen-free per IEC 61249-2-21 test method EN14582, Indium6.6HF is designed to provide high stencil-printing performance and minimize voiding in polychlorinated biphenyl assembly applications. According to the company, the solder paste exhibits superior wetting to various surface finishes, resulting in fewer voids and a reduction in the size of the largest voids. It also features high transfer efficiency, a long stencil life (up to 12 h), and excellent response to pause. It prints consistently at a wide range of speeds. A high tack value (>8 h) ensures consistent component-holding power and allows for high-speed component-placement operation. Indium6.6HF is cleanable up to at least 72 h after reflow. *Indium Corporation, 34 Robinson Road, Clinton, New York 13323. (315-853-4900)*
<https://www.indium.com>



**BIOINSTRUMENTATION
AND BIOTECHNOLOGIES****Automated digital microscope**

The latest offering in Thermo Fisher Scientific's line of cell imaging systems is the fully automated, precision EVOS M7000 fluorescence microscope system. The new model builds on its predecessors, the EVOS FL Auto and FL Auto 2 cell imaging systems. It features an upgraded XE3 computer, an ultrafast acquisition engine to deliver high-quality cell imaging and data, color and monochrome cameras, and a Quadro graphics card to reduce time acquiring and saving images. On a 50 × 50 scan with the monochrome camera, the EVOS M7000 microscope reduces average image acquisition time by 19 min and average saving time by 15.9 min when compared to the FL Auto 2. On a 1000-image scan with the color camera, it decreases average acquisition time by 7.76 min and average saving time by 21.5 min. Automation routines for multiwell plate scanning and image tile stitching with autofocus, Z-stacking, and time lapse can be set up with a few clicks of a button. Higher sensitivity allows for reduced light exposure for weakly stained samples and phototoxicity and photobleach reduction. *Thermo Fisher Scientific, 5823 Newton Drive, Carlsbad, California 92008. (760-918-0135)*
<https://www.thermofisher.com>

**Holotomographic
and fluorescence
imaging microscope**

According to Tomocube, its HT-2 microscope is the first to combine holotomography and 3D fluorescence imaging in one unit. Designed to enable long-term tracking of specific targets in live cells while minimizing stress, the HT-2 builds on the holotomographic technology introduced in the Tomocube HT-1. The 3D refractive index (RI) tomograms provide

morphological, chemical, and mechanical properties of cells, and the fluorescence imaging capability adds molecular specificity information. The highly detailed fluorescence images show the position of specific target organelles or structures in living cells, while consecutive measurements of time-lapse 3D RI tomography enable the monitoring of cells and their structures. The HT-2 incorporates a customizable three-channel light-emitting diode light source (385, 470, and 570 nm) and a motorized Z-drive with a step resolution of 150 nm to generate highly detailed Z-stack images. At the HT-2's core is the same patented, complex, digital micromirror device (DMD) optical light shaper used in the Tomocube HT-1. Consisting of several hundred thousand micromirrors arranged in a rectangular array, the DMD eliminates the need for moving parts in the lightpath and delivers stable performance during long-term studies. The TomoStudio software suite controls the functionality of the HT-2, facilitates fast imaging, and provides 2D/3D/4D visualization of the cellular images based on 3D RI distributions of the cells and tissues. *Tomocube, Inc., 2nd Floor, KHE Building, 48 Yuseong-daero 1184beon-gil, Yuseong-gu, Daejeon 34109, South Korea. (+82-42-863-1100)* <http://www.tomocube.com>

**NEW FACILITIES AND HARDWARE****Electronics for photoacoustic
imaging**

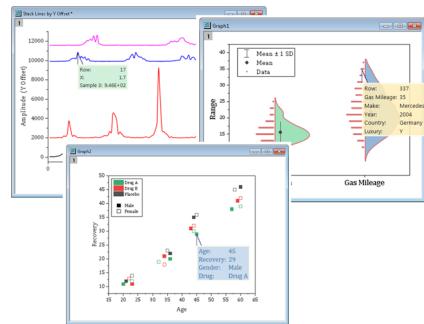
PhotoSound Technologies has released its Flash series of high-frame-

and sampling-rate data acquisition (DAQ) electronics optimized for demanding applications in photoacoustic imaging. The series' internal trigger generator allows external device triggering at defined frequencies. The continuous mode sends a trigger signal as soon as the previous acquisition is complete. Other features include integrated amplifier chips with digitally controlled gain, a noise-reducing variable gain amplifier, integrated preamplifiers, a combination of optical and electrical triggers, and low power consumption. Flash products are enclosed in durable, high-quality compact housings with industry-standard SubMiniature version A (SMA) connectors to match third-party hardware. The series can collect data at rates up to 6000 fps and 100 000 data points/frame/channel. Programmable Flash analog-to-digital converters (ADCs) come in 32-channel configurations with -4 to 45 dB gain and additional 40-dB gain through additional preamplification. Sampling rates up to 77 MSA/s and high-speed universal serial bus 3.0 connectivity provide for fast data acquisition. Units can optionally be connected in parallel to increase the channel count. SMA breakout boards are available for evaluation, testing, and development purposes. A software development kit (SDK) is offered for all ADC and DAQ units to integrate system functions into third-party software. *PhotoSound Technologies, Inc., 9511 Town Park Drive, Houston, Texas 77036. (713-401-9407)* <https://www.pst-inc.com>

**NEW LITERATURE
AND SOFTWARE****Data analysis and graphing
software**

The latest release of OriginLab's data analysis and graphing software, Origin and

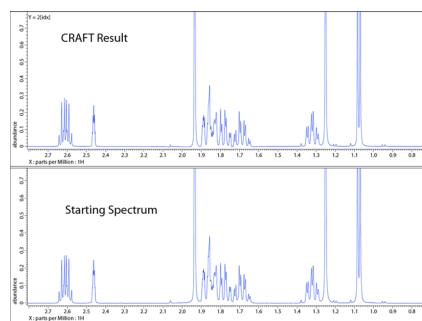
OriginPro 2019, offers more than 75 new features, apps, and improvements. A new Start menu with a search feature works similarly to the Windows Start menu. Users can type keywords or phrases to quickly find and launch menu items and free apps, search for Origin project files in recently opened folders, access documents, and more. Three new features—Data Highlighting, Plot Highlighting, and Data Point Tooltip—have been introduced to enhance interactivity with data in graphs. New graph types include violin plot, parallel plot, and cluster plot. Other new features include conditional formatting of worksheets and a workbook dialog with built-in templates. Among new apps are Graph Maker, Stats Advisor, and Design of Experiments. *OriginLab Corporation, One Roundhouse Plaza, Suite 303, Northampton, Massachusetts 01060. (800-969-7720 or 413-586-2013) <https://www.originlab.com>*



Nuclear magnetic resonance (NMR) spectrometer software

JEOL has expanded the quantitative and statistical analysis capability of its NMR spectrometers through a collaboration with the developer of the CRAFT (complete reduction to amplitude-frequency table) data processing technique. According to JEOL, the integration of CRAFT with JEOL's Delta NMR software lets users automatically and efficiently extract the best amplitudes and frequency from NMR data. In conjunction with the recent JEOL DELTA NMR software release 5.3.0, CRAFT for DELTA V1.0 provides direct time-domain-to-spreadsheet analysis and

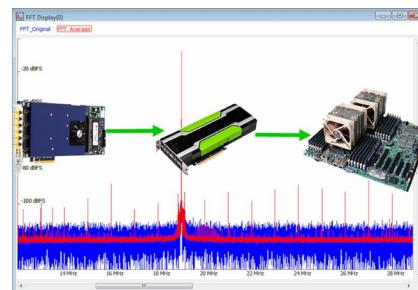
allows for more objective extraction of quantitative information for compounds of interest. It provides statistical analysis for metabolomics, reaction monitoring, or quality control. The software allows peaks that are too close to become completely resolved sinusoids in the time domain. Information on frequency, amplitude, phase, and decay rate is provided as numbers in a table. *JEOL USA, Inc., 11 Dearborn Road, Peabody, Massachusetts 01960. (978-535-5900) <https://www.jeolusa.com>*



Signal enhancement package for digitizers

Spectrum has unveiled digitizers with ultralong signal-averaging capabilities. According to the company, its new signal-averaging package, which combines a digitizer and a CUDA graphics card, revolutionizes the way that signals can be acquired and averaged. CUDA is a parallel computing platform and programming model created by Nvidia for general computing on graphical processing units (GPUs). The package uses Spectrum's CUDA Access for Parallel Processing (SCAPP) and latest digitizer products to harness the power of CUDA-based GPU cards. Through remote direct memory access transfers, SCAPP users can port data directly to the GPU, where high-speed time- and frequency-domain signal averaging can be performed without the length limitations typically found in averaging products. The package is suitable for applications that involve low-level signals or have signal details that are lost due to high amounts of noise. Such applications include mass

spectrometry, radar, LIDAR, sonar, radio astronomy, and biomedicine. *Spectrum Instrumentation Corp, 401 Hackensack Avenue, 4th Floor, Hackensack, New Jersey 07601. (201-562-1999) <https://spectrum-instrumentation.com>*



EPICS drivers for DAQ units

Teledyne SP Devices has announced that EPICS support for its ADQ14 and ADQ7 DAQ units is now included in its SDK. EPICS—the Experimental Physics and Industrial Control System—is a set of software tools, libraries, and applications developed collaboratively and used worldwide to create distributed soft real-time control systems for scientific instruments such as particle accelerators, telescopes, and other large scientific experiments. The driver is implemented using EPICS base as well as the Nominal Device Support v3 framework and EPICS layer from Cosylab. The installer also includes an operator interface example implemented as a graphical user interface in Control System Studio together with the BOY extension. *Teledyne SP Devices, 700 Chestnut Ridge Road, Chestnut Ridge, New York 10977. (914-598-6666) <https://spdevices.com>*

