EXPOSITION HIGHLIGHTS

C&EN panelists and instrument industry editors pick **NEW PRODUCTS** that stand out

STU BORMAN, C&EN WASHINGTON

PITTCON IS KNOWN for its huge exposition of analytical and laboratory instruments from hundreds of companies. A panel of four academic advisers—specialists in atomic and molecular spectroscopy, chromatography, and mass spectrometry—helps C&EN sift through the many new products introduced at Pittcon each year to identify some of the most noteworthy ones. And instrument industry journalists who attend and cover Pittcon nominate and vote each year on the most innovative and promising new products. These two groups' selections are presented here.

Instruments highlighted by the four C&EN advisory panelists and instrument industry editors this year include a miniaturized mass spectrometry (MS) instrument, a bioinformatics system, a gas chromatography (GC) detector, a pair of miniature GC instruments, a handheld Raman analyzer, a new detector coating, a portable interferometer, a pH meter, a miniature nuclear magnetic resonance (NMR) spectrometer, and an optical microscope attachment.

In MS, Microsaic Systems' 4000 MiD small-footprint mass spectrometer based on an MS analyzer chip "was impressive," says C&EN Pittcon panelist Kermit K. Murray, an MS specialist at Louisiana State University (LSU). The instrument's MS analyzer can fit in the palm of a hand, Murray says, "but even more impressive are its quadrupole rods, which are each only about as big as the tip of your little finger"—much smaller than conventional rods. "The system is being targeted at bench chemists who could benefit from a mass spectrometer that is small enough to sit next to a reaction apparatus," Murray says.

Microsaic claims to be the only producer of MS instrumentation using microelectromechanical systems (MEMS) to enable MS on a chip. Two years ago, the company introduced an earlier model MEMS-based mass spectrometer, the 3500 MiD. MEMS technology makes the company's instruments smaller and lighter, enables them to consume less energy, and makes them easier to maintain and cheaper to run than conventional MS systems, Microsaic says.

Such a small and inexpensive instrument "may be like an iPad," Murray says, in that "you don't know how useful it is until you use it. I discussed with Microsaic representatives using the mass spectrometer in a distributed network of instruments for environmental or homeland security monitoring, and they agreed that this was an interesting possibility."

An exposition representative from Advion, which introduced another miniaturized mass spectrometer, the Expression CMS, at Pittcon last year, told Murray this year that the firm had gotten inquiries from universities wanting to use the system in teaching labs. "At LSU, instrument cost is a significant issue in our analytical lab class," Murray says, and small, inexpensive mass spectrometers will be easier to incorporate in the academic environment.

Murray notes that he was also impressed at this year's meeting with Shimadzu Scientific Instruments' i3D Enterprise Informatics Service, a system for processing, uploading, analyzing, and storing corporate instrumentation and research data in "the cloud"—on a secure Internet site.

"Getting resources where they are needed is what the Internet is all about," Murray says. By allocating powerful remote computing resources to analyze company data continuously, i3D eliminates the need for individual investigators and labs to each have their own powerful computers for processing of data on a much more intermittent basis. "Data transfer is fast, and computer clusters are relatively inexpensive, especially if they are used efficiently, so this approach makes a lot of sense," Murray says.

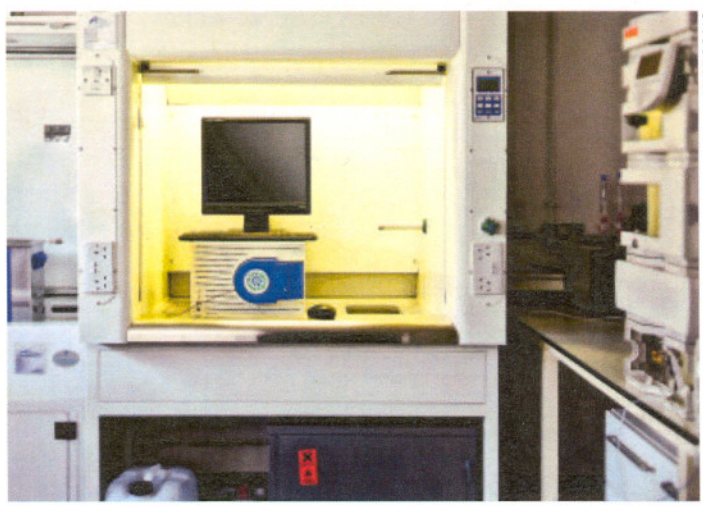
The i3D Enterprise Informatics Service is available to clients by an annual subscription. "I dislike the idea of an annual subscription," Murray adds, "but I think competition will keep the cost at a reasonable level."

IN CHROMATOGRAPHY this year, C&EN panelist Daniel W. Armstrong of the University of Texas, Arlington, was intrigued by another Shimadzu product—Tracera, a GC system with an innovative detector. The universal detector, the BID-2010 Plus, is 100 times more sensitive than thermal conductivity detectors. "This could make the conventional thermal conductivity detector obsolete," Armstrong says.

The BID-2010 Plus uses helium plasma to ionize analytes as they emerge from the Tracera GC column. The ionized compounds are then detected at an electrode and processed as chromatographic peaks. Analytes, or analytical constituents, remain intact for other possible uses.

The detector's high sensitivity "permits parts-per-million-level trace component analysis not possible by thermal conductivity detection," Shimadzu says. The BID-2010 Plus also "easily detects compounds that respond poorly to flame ionization detectors, with less variation in relative response between compounds."

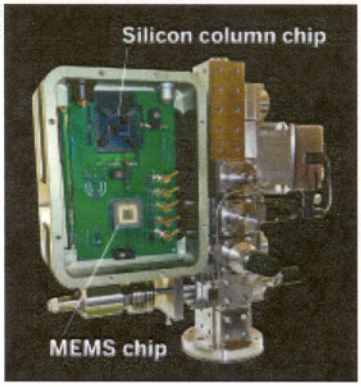
At Pittcon each year, journalists nominate innovative new products and vote to honor the best ones with first-, second-,



MICROSAIC

MICROSAIC The Microsaic 4000 MiD miniature mass spectrometer fits into a standard fume hood for applications like reaction monitoring.

APIX



APIX The interior of Max-One miniaturized gas chromatograph (8 inches tall), attached to sampling system.

and third-place Pittcon Editors' Awards. (C&EN did not vote.) This year, two miniaturized gas chromatographs introduced by Analytical Pixels Technology (Apix) tied (with an interferometer made by a different company) for the third-place award.

Apix' two miniaturized gas chromatographs, the GCAP and Max-One, use novel semiconductor detectors based on MEMS technology. GCAP, which weighs less than 22 lb, is designed for lab and field use. It separates compounds with detection limits better than 1 ppm without preconcentration and better than 1 ppb when a preconcentrator included with the instrument is used. Max-One, which weighs 13 lb, has detection limits in the range of 1 to 500 ppm and is optimized for multigas analysis in refineries and other environments where explosion-proof systems are required. Both instruments can use scrubbed ambient air as a carrier gas instead of conventional bottled helium and nitrogen, easing analysis and reducing operating costs, the company says.

IN MOLECULAR spectroscopy this year, a number of companies exhibiting at Pittcon continued a recent trend—developing handheld Raman analyzers, which are portable enough to be used for factory and field analysis. "Lots of companies are building them," says C&EN molecular spectroscopy adviser Sanford A. Asher of the University of Pittsburgh. But a notable introduction this year, he says, is an upgraded FirstGuard analyzer by Rigaku Raman Technologies, the first handheld Raman analyzer that operates at 1,064 nm.

Carrying out handheld Raman analysis at 1,064 nm "avoids much fluorescence interference that occurs at shorter wavelength excitation," Asher says, making it possible to identify analytes that cannot be detected at 785 nm, the wavelength used by conventional Raman analyzers. Raman detectors tend to produce too much "noise" (uncontrolled signal variations) at 1,064 nm. However, Rigaku addresses this problem by using a cooled InGaAs detector with better signal-to-noise performance than the standard charge-coupled device (CCD) detectors used in 785-nm systems. Working at 1,064 nm allows FirstGuard to identify "a significantly broader range of raw materials" than previous Raman analyzers, the company says.

Another noteworthy molecular spectroscopy development this year, says Asher, is Horiba Scientific's development of QExtra, a new antireflective coating for CCD detectors. CCD detectors provide high sensitivity and low noise for single-molecule imaging, Raman spectroscopy, fluorescence microscopy, and other spectroscopy applications. QExtra improves detector efficiency, the amount of measurable radiation that can be detected, over a broad spectral range and suppresses etalon effects, a wavy type of optical interference, Horiba says.

SENOVA SYSTEMS

pHit Scanner

The interferometer that tied with Apix' gas chromatographs for the third-place Pittcon 2013 Editors' Award also has molecular spectroscopy applications. The device, called Pie-in-a-Box, is "the first high-performance, cost-effective portable interferometer," according to its maker, Pie Photonics, of Tullamore, Ireland.

The instrument is tiny and very portable—its longest dimension is 6.5 inches, and it weighs about 1.3 lb. And it has no moving parts or scanning elements, unlike most conventional interferometers. Instead of a scanner, it uses a 3,648-element CCD detector array to capture spatial interference patterns (interferograms). This information is then processed and used to measure spectral information for molecular spectroscopy and other applications.

The device provides resolution as fine as 0.5 nm at wavelengths ranging from 400 to 1,000 nm in the visible and near-infrared regions. Pie Photonics is working with partner companies to incorporate the device into instruments for Raman spectroscopy, laser-induced breakdown spectroscopy, surface plasmon resonance, and other techniques.

C&EN'S PITTCON 2013 adviser for atomic spectroscopy, Paul B. Farnsworth of Brigham Young University, didn't come across any earthshaking new atomic spectroscopy products at this year's Pittcon. But he was intrigued by an electrochemical device, the pHit Scanner, which manufacturer Senova Systems, of Sunnyvale, Calif., calls "the world's first calibration-free pH meter." Farnsworth is not the only one who showed interest in the new device: The pHit Scanner also won this year's first-place Pittcon Editors' Award.

Existing devices for measuring pH are based on glass electrodes, a type of ion-selective electrode. Glass electrodes are delicate and break easily, require frequent calibration and careful maintenance, and must be constantly hydrated when stored.

MAGRITEK

MAGRITEK The Spinsolve compact NMR spectrometer in a university chemistry laboratory.

The pHit Scanner throws away that design concept and instead uses a solid-state carbon sensor with covalently attached reduction- and oxidation-active compounds. When a voltage is swept across the sensor, the compounds gain or lose electrons at a voltage level that is dependent on the pH of the sample solution with which it is in contact. This relationship is constant and is stored in the pHit Scanner's firmware, obviating the need for periodic user calibration.

According to Senova Systems, the instrument has 0.01-pH unit resolution, about the same as the best conventional pH meters; is virtually maintenance-free; is nearly indestructible; and can be stored dry. pH meters are used routinely for product and

NanoTweezer

PETER CUTTS PHOTOGRAPHY

process monitoring and research in the pharmaceutical, biomedical, chemical, environmental, and food and beverage industries, as well as in academia.

"If the sensor is really as rugged as claimed, there should be a number of settings in which it will replace conventional glass electrodes," Farnsworth says. "Having spent thousands of dollars in my teaching labs replacing glass electrodes, I would certainly look at it for student use."

FARNSWORTH ALSO notes approvingly the recent development of smaller, simpler, and relatively inexpensive NMR instruments, the latest iterations of which are the new Spinsolve compact NMR spectrometer by Magritek, of Wellington, New Zealand, and Thermo Fisher Scientific's picoSpin 45, a rebranded version of an instrument introduced earlier by picoSpin, a company Thermo Fisher purchased last year. Miniaturized instruments like these "could be a real boon to small schools that need to teach NMR spectroscopy but can't afford conventional NMR instrumentation," Farnsworth says.

According to Magritek, the Spinsolve NMR spectrometer "has been designed to enable users to operate the system with very little training. Traditional NMR complexities are hidden and automated." The instrument enables reaction monitoring "almost in real time," the company continues. "The ability to make a meaningful measurement and get on and off the instrument in about one minute redefines how NMR can be incorporated into the teaching laboratory. With a single instrument in a class, each student can make a series of NMR measurements as they progress through their assigned sample preparation." Spinsolve will also be useful for research and process control applications, the company says.

Meanwhile, the second-place Editors' Award this year went to NanoTweezer by Optofluidics, of Philadelphia, an attachment for standard optical microscopes. NanoTweezer uses laser-trapping technology to enable handling of particles ranging in size from a few nanometers to a few micrometers, including individual viruses, cells, and inorganic nanoparticles, whereas conventional optical tweezers are limited to manipulating objects larger than about 100 nm, the company says.

NanoTweezer uses lasers in waveguides (optical fibers) to overcome the limitations of conventional optical tweezers. Particle-trapping force is proportional to particle size (smaller particles make trapping force much weaker) and proportional to the intensity gradient of the laser spot focused on a particle. The waveguide design enables brighter and smaller spots with larger gradients, enhancing the force sufficiently to enable trapping of smaller particles. The NanoTweezer's 1,064-nm wavelength is not significantly absorbed by biological nanoparticles or water and therefore does not tend to damage samples, Optofluidics says. ■