

# Pittcon 2007: New Products and Technologies

**It has been a while since I have written a Pittcon new product review. I started these reviews originally way, way back when *Spectroscopy* first started. The first review (1) appeared in 1986 while Pittcon was still in Atlantic City, having moved a few years earlier from Cleveland. A subsequent review, appearing a couple of years later, reflected our arrival in New Orleans (2), home of coffee and beignets for breakfast . . . and a place for good food and good music! Since those early days *Spectroscopy* has grown and has changed and morphed a little. But the same spirit is there, and the annual reporting of new products from Pittcon has been retained.**

**John Coates**

I have been a little out of touch with the role of the article in recent years, and so I apologize ahead of time if my comments seem out of place or if I ruffle a few feathers. My recollection is that the old saying goes “you can satisfy some of the people all of the time, but only some of the people all of the time.” One does one’s best to capture the essence of new products, and one tries to differentiate what are really new products from products that might be just a slightly different flavor from a previous model. From time to time I would get an irate exhibitor writing to me, saying, “You missed our booth and you missed our brand new XXX product.” For that reason, in the past, I made the column cover two issues. I do not think that I have the luxury of that this time around. The second issue became my politically correct backup where missed exhibitors would be welcomed.

One difficulty that I experienced in the past was that I always worked, in days gone by, with one or another instrument company. Asking for the latest product information from companies was sometimes like squeezing blood out of a stone; there was always the suspicion that the material was being used for a subversive purpose, and the article was only an excuse. It never was that way, but that was always a perception (which we know to some is reality). This time around, I am now a freelancer (as a consultant), and getting the information from everyone was much easier — thank you. The information gathered for this column has come from two sources — from the on-line questionnaire and from personal contact with people at the show. Yes, I visited every booth. The reason for this long introduction is that I am preparing the audience for a very mixed bag, where my information content goes from a few comments extracted from the questionnaire to a full-

blown press release. Also, I have been quite strict — the products covered have to have a real spectroscopy connection. Gas chromatographs and general chemicals are not covered!

## **The Show and What Was Shown**

Pittcon 2007 started as a classic winter show in Chicago. Next year (New Orleans) will be warmer — we promise! Ice and snow on the weekend before Pittcon can be a catastrophe. We knew how things might progress when a small company that I was working with was told by FedEx that the shipment due on Friday was held back by a delivery exception and could not be delivered until Monday (although it had already arrived in Chicago!). I suspect that happened to a few companies, including some big ones. Everything mysteriously turned up on Saturday — a big thank you to whoever called the president of FedEx! The bottom line is that most of the equipment showed up by Monday for most companies, and most of the people managed to get to the show by Monday, although I do know of some people who did not make it.

One has certain impressions from a show in terms of what was hot and what is a potential direction for the instrument market. Back in the 1980s it was suggested by the then-president of PerkinElmer that the instrument business was really a blend of cottage industries. While the big players have morphed and changed, this description is still quite accurate today. With over 1000 exhibitors, there are many small companies, with some of the most innovative new products coming from these companies. This is reflected somewhat in this year’s Pittcon Editor’s awards. I was pleased to note three smaller companies that I have had opportunity to work with included in this list — you know who you are.

**The 2007 Editors' Award Winners****Gold** — Waters Corp.: Synapt HD-MS**Silver** — (Tie) Paraytec: ActiPix and  
Thermo Fisher Scientific: LTQ ETD**Bronze** — (Tie) Bruker: FT-IR and  
Horiba Jobin Yvon: Activa M**Honorable Mention**

Agilent: 7890 GC

Ametek: Apollo 40 SD

Aspectrics: EP-NIR

Axsun Technologies: Anavo

Bio-Rad: KnowItAllAnywhere

Bruker: RAID-AFM

Bruker AXS: Ultra-Bright X-Ray  
Source

CEM: Explorer Q

Cerno: Mass Works CLIPS

Dionex: RFIC

Eksigent: Express RT

Glass Expansion: IsoMist  
Programmable Temp. Spray  
ChamberHiperscan: SGS Scanning Grating  
NIR

InnovX: Alpha Series XRF

Labcyte: Portrait 630

Metrohm Peak: 850 IC

microSpectral Sensors: i-LAB

Nanoliter: Induction Based Fluidics

Shimadzu: Formula Predictor  
Software

Shimadzu: Axima TOF-TOF

Shimadzu: Stablo Ex

Spectro: ARCOS ICP-OES

Tiger Optics: Halo-H<sub>2</sub>O

Torion: Miniature GC-MS

The official theme of Pittcon reflected by the cover of the program was directed toward bioscience and biomolecular themes. While this was the official theme, it was interesting to note in the new products an increase in relatively sophisticated handheld instruments, for both molecular and atomic (elemental) spectral measurements, and a resurgence of well-established techniques such as Fourier transform infrared (FT-IR) and Raman, both of which are close to my heart. OK, I am a mole spec guy, and I am certain that I have missed other important and cutting-edge technologies in that generalization. For me, it was a touch of déjà vu because we started to see strong emphasis on FT-IR and a new focus on Raman back when these reviews started in 1986. I thought that FT-IR was becoming passé, but this year the focus seemed to be on smaller, more compact and easy-to-use benchtop and "portable" FT-IR systems. There were several significant introductions in this area at the show ... more later. Coming back to the handheld devices, near infrared (NIR) handheld spectrometers (Axsun and Polychromix) were featured for target applications that included carpet recycling and pharmaceutical raw materials and products.

Raman is one of the oldest forms of optical spectroscopy, the effect being measured by its namesake C.V. Raman, the 1930 Nobel Prize winner. The technique has been one of the longest coming to full fruition, but we can say it has now arrived in full flurry with a number of offerings this year. Although they are not all new for the show, many have been refocused toward general and broader-based applications. And consistent with the theme, portable, we saw several systems from the truly handheld system from Ahura; small portable systems such as the system offered by B&W TEK; and the Raman imager, developed for NASA

by Headwall. For those larger companies that introduced new Raman laboratory-based products, more later; I am just addressing portability right now.

An applications theme that was fairly broad-brush was biofuels, with a number of instruments focused on the analysis of ethanol blends (with gasoline) and biodiesel (methyl esters of grain-seed oils). These are truly different materials from the traditional petroleum-based fuel products, where residual acids and unsaturation can become issues. When farming cooperatives start to become

mainstream at the gas pump, you know that the world of analysis has to change from the plant (or barn?) to the distribution chain. In terms of the final blends, we come back to NIR and FT-IR.

Although not explicitly new, along with the handheld theme there was a good showing of the "hair blower" style portable X-ray fluorescence (XRF) systems. One of the first products to market was the Niton system, now a Thermo company. However, today Niton is joined by a number of companies, such as Innov-X, in this rapidly growing market. Although early

applications involved lead detection and scrap metal sorting, the applications have widened, and the new regulated areas, such as the RoHS initiative, have created new roles for these instruments.

### **Optical Spectroscopy, UV-vis-NIR, and Fluorescence**

Hitachi HTA introduced two new double-beam UV-vis spectrophotometers: the U-1900 and the U-2900. Both units are programmed to provide outputs in absorbance and concentration. The U-2900 features a range of accessories and USB interfacing for easy data transfer to a PC or a storage device. The U-1900 is a stand-alone instrument, featuring an LCD screen, a keyboard, and built-in software. Both are GLP/GMP compliant (automated tests).

Cecil Instruments, a well-respected, veteran provider of spectrophotometers, exhibited the CE 7400S Aquarius double beam, UV-vis-NIR spectrophotometer. The CE 7400S features a truly symmetrical double beam configuration and is in full Pharmacopoeia compliance, with a fixed spectral bandwidth of <1 nm. The instrument is ideal for R&D and quality control, and it can be modified easily for tablet dissolution applications.

Thermo Fisher Scientific announced the Evolution 60, a cost-effective UV-vis spectrophotometer with a 1-nm spectral bandwidth. The instrument is designed for regulatory applications and is well suited for life science, QA/QC, and research laboratories, meeting all Pharmacopoeia requirements and featuring 21 CFR Part 11 compliant software. A range of accessories are available, including thermally controlled single cell accessory, a nanocell for measurements at ultralow volume (0.7–5  $\mu\text{L}$ ), and attenuated total reflectance (ATR)-based fiber-optic probes.

The miniaturization of spectrometers could be considered as another important theme for the current instrumentation market. With this theme, Avantes has introduced the AvaSpec-2048x14 and the AvaSpec-NIR256-2.5 fiber-optic, small footprint spectrometers. The 2048x14 provides high quantum efficiency and high UV sensitivity with this back-thinned CCD model. It features a 16 bit A/D and a USB high speed inter-

**Table I: Products introduced at Pittcon 2007**

Company	Location	Product
A2 Technologies	Danbury, Connecticut	Mobility Series (ML, MLp, and MLx spectrometers)
ABB Inc.	Quebec City, Canada	MB3000 FT-IR spectrometer
Advanced Chemistry Development, Inc. (ACD/Labs)	Toronto, Ontario, Canada	ACD Method Development Suite software
Agilent Technologies	Palo Alto, California	7890 GC; 6410 Triple Quad mass spectrometer
Ahura Corporation	Wilmington, Massachusetts	TruScan handheld Raman system
Ametek	Newark, Delaware	Apollo 40 SDD
Aspectrics	Pleasanton, California	MultiComponent 2750 analyzer
Avantes Inc.	Broomfield, Colorado	AvaSpec-NIR256-2.5 Spectrometer
Axiom Analytical, Inc.	Irvine, California	FFM-2021 NIR fiber optic-coupled gas cell; DPR-F and DMD-F fiber-optic-coupled ATR probes; FDR-800 series diffuse reflectance probes
Axsun Technologies	Billerica, Massachusetts	Anavo handheld NIR analyzer
B&W TEK	Newark, Delaware	BRC641E CCD spectrometer; MiniRAM II portable Raman spectrometer
Bio-Rad Laboratories	Hercules, California	KnowItAllAnywhere software
Bruker	Billerica, Massachusetts	FT-IR and RAID-AFM; Alpha FT-IR spectrometer
Bruker AXS		Ultra-Bright X-ray source
Cecil Instruments	Milton Cambridge, UK	CE 7400S Aquarius spectrophotometer
CEM	Matthews, North Carolina	Explorer Q microwave synthesis systems
Cerno Bioscience	Danbury, Connecticut	Mass Works CLIPS
Dionex	Sunnyvale, California	RFIC
EDAX	Mahwah, New Jersey	Hikari High Speed EBSD detector
Eksigent	Dublin, California	Express RT
EMCO High Voltage Corporation	Sutter Creek, California	Q Series miniature DC to high voltage (HV DC conversion)
Fiberguide Industries, Inc.	Stirling, New Jersey	V-groove arrays
FOSS NIRSystems	Laurel, Maryland	XDS MasterLab system
Fraunhofer Institute	Dresden, Germany	MEMS-based scanning grating system
Glass Expansion	Pocasset, Massachusetts	IsoMist Programmable temperature spray chamber accessory
Harrick Scientific Products Inc.	Pleasantville, New York	DaVinci Arm FT-IT accessory; MVP ProStar ATR accessory; New Horizon multiple reflection ATR accessory
Headwall Photonics	Fitchburg, Massachusetts	Multichannel Raman Discovery OEM component
High-Purity Standards	Charleston, South Carolina	Calibration standards
HiperScan	Dresden, Germany	SGS Scanning Grating NIR; ND1 evaluation module
Hitachi High Technologies America	San Jose, California	U1900 and the U-2900 spectrophotometers
Horiba Jobin Yvon	Edison, New Jersey	Activa M ICP-OES system; LabRAM IR <sup>2</sup> and LabRAM ARAMIS IR <sup>2</sup> FT-IR microscope systems; MASTER software
Innov-X	Woburn, Massachusetts	Alpha LZx analyzer; Mini-Spot portable analyzer
Labcyte	Sunnyvale, California	Portrait 630 reagent multispotter

face, and is ideal for low light, fluorescence, and UV applications. The NIR256-2.5 provides a full-range NIR spectrum from 1000 nm to 2500 nm. The high-speed USB interface provides a spectral sampling rate of 940 spectra/s, with data transfer in 1.56 ms. The company also introduced a combined deuterium-halogen light source, the AvaLight-DH-BAL, providing a continuous effective light source from 200 nm to 2000 nm.

As mentioned, smaller and more compact instruments now seems to be a popular trend. The company that must be credited for this trend is Ocean Optics, starting in the early 1990s with its miniature modular, fiber-optic-based array-based spectrometers. These instruments evolved from 1024 pixel-based systems to the current USB4000 with 4096 pixels. The latest products from this company featured at Pittcon include

the MMR Raman spectrometer, the USB2000-FLG fluorescence spectrometer, and the HR4000 high-resolution spectrometer, which is capable of a 0.02 nm spectral resolution.

A completely new concept in handheld spectrometers, known as the i-LAB (Editors' Award, honorable mention), was introduced by microSpectral Sensors. The system features a state-of-the-art, miniature solid-state spectral measurement engine that is not much larger than a 1-cm cube. This engine includes the solid-state source, the imaging optics, and the spectrometer, which is available in two versions, visible covering 400–700 nm, and near infrared covering the 600–1100 nm range. The unit contains significant data processing that can be preprogrammed by downloadable methods from a PC via a USB coupling. The company showed two versions, one for

liquid handling featuring a disposable sampler, and the other for surface measurements. The company announced intentions to expand the applications to include UV-excited fluorescence measurements later in the year.

Polychromix is one of several companies to have emerged successfully from the crash of the telecoms industry at the end of the 1990s. The company appeared for the first time in 2005 with two spectrometer modules, the DTS 1700 and the DTS 2500. These NIR fiber-based spectrometers are powered by a MEMS-based spectral engine. This engine provides a measurement technology that is closely related to Hadamard transform instruments that have been discussed over the years since the 1960s. These early systems feature compact optics that are readily transformed into a compact analyzer package, suitable for handheld applica-

**Table I (continued): Products introduced at Pittcon 2007**

Company	Location	Product
Labtronics, Inc.	Guelph, Ontario, Canada	LIMS-Link software
Lambda Solutions, Inc.	Waltham, Massachusetts	LSI high performance Raman system; Dimensional P1 and P2 spectrographs
Malvern Instruments	Southborough, Massachusetts	Spectral Dimensions SyNIRgi chemical imaging system
Meinhard Glass Products	Golden, Colorado	Fit Kit 3T press-on fitting; peristaltic pump tubing; high-pressure nebulizers
Melles Griot	Carlsbad, California	56 RCS laser assemblies
Mesophotonics	Southampton, UK	SE1000 spectrometer for Raman and SERS
Metrohm-Peak	Houston, Texas	850 IC
microSpectral Sensors	Wilton, Maine	i-LAB microspectrometer
Milestone Inc.,	Shelton, Connecticut	PYRO SA microwave ashing system
Nanoliter LLC	Henderson, Nevada	Induction Based Fluidics
Ocean Optics	Dunedin, Florida	MMR Raman spectrometer; USB2000-FLG fluorescence spectrometer; HR4000 high-res spectrometer
Paraytec	York, UK	ActiPix
PerkinElmer	Shelton, Connecticut	Spectrum 400 instrument; RamanStation 400 instrument
Phytronix Technologies, Inc.	Montreal, Quebec, Canada	LDTD ionization source
PI (Physik Instrumente) LP	Karlsruhe/Palmbach, Germany	PIFOC nanofocusing device
Polychromix	Wilmington, Massachusetts	Phazir handheld NIR spectrometer
Shimadzu	Columbia, Maryland	Axima TOF-TOF mass spectrometer; Formula Predictor Software; Stablo Ex
Smiths Detection	Danbury, Connecticut	IdentifyIR FT-IR platform; IlluminatIR FT-IR spectrometer
Spectral Dimensions	Olney, Maryland	SyNIRgi
Spectro	Littleton, Massachusetts	ARCOS ICP-OES
Starna Scientific	Hainault, UK	Calibration and wavelength reference standards
Symbion Systems	Irvine, California	Symbion-DX and RX version 1.2 software
TeraView	Cambridge, UK	TPS Soectra 1000 spectrometer and Imaga 2000 system
Thermo Fisher Scientific	Waltham, Massachusetts	LTQ X1 mass spectrometer; Evolution 60 spectrophotometer; LTQ Orbitrap mass spectrometer
Tiger Optics LLC	Warrington, Pennsylvania	Halo-H <sub>2</sub> O; Halo gas analyzer
Torion Technologies	Pleasant Grove, Utah	Miniature GC-MS system
Upchurch Scientific	Oak Harbor, Washington	Microbore PEEK tubing
Varian Inc.	Palo Alto, California	700-ES series ICP-OES instruments; 400-MR magnetic resonance spectrometer; 320-MS triple quadrupole spectrometer
VHG Labs	Manchester, New Hampshire	ICP-MS standards
Waters Corp.	Milford, Massachusetts	Synapt HD-MS mass spectrometer
XStream Systems	Vero Beach, Florida	XT250 system

tions. This concept is realized in the Phazir, a handheld “hairdryer-styled” or “power-tool styled” NIR spectrometer. In its current form, the analyzer covers a range of applications from aerospace to pharmaceuticals to materials recycling (current use in carpet fiber recycling).

The Anavo (Editors’ Award, honorable mention) is a handheld NIR analyzer based on Axsun Technologies proprietary miniature spectrometer platform. The analyzer is fully integrated and includes a display and battery pack, and is fully ruggedized for field use. The latter is important because the system is being promoted for waste recycling of both plastics and fabrics (carpet fibers). The standard mode of application is in diffuse reflectance for carpets, plastics, and powders (including pharmaceutical raw materials). A dip probe interface is also available for liquid applications.

FOSS NIRSystems demonstrated its

XDS MasterLab, an automated transmission or reflectance analysis system based on a tray containing samples in vials, or tablets. The system is reported to be rapid and accurate, and provides nondestructive chemical analysis down to microgram levels in the laboratory and during a manufacturing process.

A micro-scanning mirror, based on a concept similar to the technology used in DLP, has been introduced by Hiper-Scan. The company offers an evaluation module, the MD1, for people wishing to use the technology for laser beam switching and similar applications. The Fraunhofer Institute is well known for its long history in spectroscopy. The institute is offering a MEMS-based scanning grating system in the form of a fiber-optic-based spectrometer platform. The system is designed for NIR applications and has the ability to cover ranges from 1100 nm to 2500 nm.

The Tiger Optics, Halo gas analyzer (Editors’ Award, honorable mention) is designed for rapid and accurate measurement of molecular contaminants in semiconductor, industrial, specialty, and process gases. The analyzer, based on cavity ring-down spectroscopy (CRDS) is a compact and cost-effective gas analyzer for selected analytes, including moisture, methane, acetylene, hydrogen cyanide, formaldehyde, and ammonia. The Halo is the first mini-CRDS analyzer providing sensitivity in the range of parts per billion to parts per million. The analyzer operates calibration free and requires no consumables.

Chemical imaging is now an important area for spectroscopy, and this is exemplified by the SyNIRgi System produced by Spectral Dimensions and offered by Malvern Instruments. A new component for this system is the availability of transmission illumination. Ben-

efits of the system include the solid-state design with no moving parts, making it ideal for QA/QC, near-line, and at-line applications. The key for the applications is the high-speed 2D imaging, with as many as 81,920 NIR spectra acquired in 2 min. A wide range of applications exist for pharmaceutical materials, including content uniformity, blending efficiency, polymorph distribution, and many others. Other suggested applications include agricultural products, household products, grains, polymers, and advanced materials analysis.

### **Infrared and FT-IR Spectroscopy**

PerkinElmer introduced two new spectrometer products – the Spectrum 400 combined NIR–mid-IR research-grade instrument, with the spectral range selected at the push of a button, and the RamanStation 400, a push-button Raman instrument that provides a full-range, high-resolution spectrum in a single acquisition. Both instruments focus on simplicity, so the highest quality data can be produced by a nonspecialist. This theme is echoed in the company's new Spectrum Express software.

A novel-designed FT-IR spectrometer, the MB3000, was introduced by ABB Bomen. The original MB1000 was introduced in the mid-1980s, and it has evolved as a spectrometer platform over the years into a number of dedicated analyzers in the form of benchtop and on-line process monitoring systems. This is an important heritage, based on NASA instrumentation experience, because it has helped to define FT-IR as a viable, ruggedized process analyzer platform. It defied the myth that FT-IR is a fragile technology. The MB3000 continues this heritage by providing a cost-effective benchtop instrument with top-mounted sample access. The instrument is available in mid-IR (MB3000) and NIR (MB3600) formats. The systems are operated via the easy-to-use Horizon MB software.

Claimed the world's smallest FT-IR, the Bruker Alpha was awarded the Bronze Pittcon Editors' Award. The Alpha's footprint takes up a 22 cm × 30 cm space (about 8 in. × 11 in.), and it weighs about 7 kg (about 13 lb). The Alpha offers full FT-IR sampling flexibility with user-exchangeable QuickSnap sampling modules, which permits the analysis of almost any kind of sample (solids, liquids, or gases). Dedicated transmission, ATR, and external and diffuse reflection FT-IR sampling modules are available.

The Alpha's QuickSnap sampling modules can be exchanged without the use of tools, and each sampling module is automatically and uniquely recognized by the Alpha FT-IR spectrometer.

As indicated, there seems to be a resurgence in infrared instrumentation, including portable FT-IR instruments. A relatively new company with a long pedigree (from Spectra-Tech to SensIR), called A2 Technologies, has introduced a range of FT-IR instruments known as the Mobility Series. These products are designated the world's "toughest" FT-IRs. These are based on a small, lightweight FT-IR engine that is integrated into three packages: the ML, the MLp, and the MLx. All are described as portable and feature the FT-IR integrated with a rugged diamond ATR sampling head. The systems are optimized for the measurement of liquids, powders, pastes, and gels.

Smiths Detection (originally SensIR) featured their integrated portable FT-IR platform with the IdentifyIR. The product's durable design and small footprint make it ideal for rapid analysis and identification in a range of operating environments, including organic synthesis laboratories, crime scenes, and a broad range of field locations. Applications range from pharmaceutical products, to elicit drug material characterization, to the identification of weapons of mass destruction (yes, an early ancestor of this system was used in Iraq!). Another prod-

uct featured by Smiths Detection was the IlluminatIR, an FT-IR that is added as an accessory to a research-grade microscope. The system provides all the normal performance characteristics of an FT-IR microscope, with imaging performance down to 10- $\mu$ m samples.

For nearly two decades, traditional FT-IR based on the Michelson interferometer has been considered the standard method for the measurement of infrared spectra. Just a couple of years ago, however, a new company called Aspectrics emerged with a new concept of measur-

ing spectra using a technique that is analogous to the measurement of infrared spectral frequencies from a CD (3). The technique is known as encoded photometric infrared (EP-IR) spectroscopy and is used now used in several commercially available products. The latest product, the MultiComponent 2750 analyzer (Editors' Award, honorable mention), covers the 1375–2570 nm spectral range, which is broader than most commercial NIR analyzers. The system allows for high-speed scanning, at a rate of 100 scans/s, which results in a high sample throughput, real-time quality control monitoring, and extreme sensitivity through spectral averaging. The combination of high-speed operation with a rugged construction, and prealigned and preindexed optics, enables the EP-NIR system to meet the requirements of the demanding process environment.

Symbion DX and RX, version 1.2 analytical instrument control, has been released. In common with earlier versions, this software provides a standardized applications development, networking, and on-line monitoring environment for all process analytical technology (PAT) requirements. Both products (DX and RX) can be interfaced to a wide range of spectrometers and other analytical instruments, input-output devices, and chemometrics software. They provide control, sequencing, and networking, thereby managing the measurement process from application development to routine on-line operation. The company has also announced a partnership with Labtronics, Inc. to enable connectivity with LIMS, via the LimsLink software. The two companies will cooperate to offer integrated solutions.

Axiom Analytical, Inc., a well-established provider of standard and customized accessories for process analytical applications, has recently introduced three new products: the FFM-202I fiber-optic coupled NIR gas cell, the DPR-F and DMD-F fiber-optic coupled ATR probes, and the FDR-800 series diffuse reflectance probes. The FFM-202I cell is intended for traditional spectroscopy applications, unlike the use of laser applications of the earlier designs. The cell is robust and is designed for "clean-in-place," where the body of the cell can

be removed and cleaned, and returned in place with minimum realignment. The new ATR probes are intended for mid-IR FT-IR applications and feature silver halide-based optical fibers. Finally, the diffuse reflectance probe has been designed to monitor pharmaceutical products within a dryer or blender while viewing the sample through the viewing port (window). The sample areas are between 6 mm and 12 mm in diameter, and the measurements can be made through glass up to 15 mm in thickness.

Harrick Scientific is one of the most respected names associated with infrared spectroscopy accessories. The company continues to provide new products, including the new DaVinci Arm, a unique articulated optomechanical FT-IR accessory designed for analyzing samples that are too large to fit inside the standard instrument sample compartment. It allows analysis by external reflection and ATR techniques. The company's new MVP-Pro Star is the industry's most affordable diamond ATR accessory. This 45° single-reflection, horizontal configuration ATR employs an unbreakable monolithic diamond IRE. Because zinc selenide is not used in the ATR element or transfer optics, the spectral range extends from the mid- to the far-infrared. Harrick's latest offering is a multiple reflection ATR accessory, the New Horizon. This compact FT-IR accessory provides a high optical throughput and is well suited for rapid analysis of liquids, pastes, powders, and thick films.

TeraView offers two products: the TPS spectra 1000 and the TPI imager 2000. The TPS spectra 1000 operates in the range of 2–120  $\text{cm}^{-1}$  (0.06–3.6 THz). The sample compartment of this spectrometer accepts most available infrared sampling accessories for solids, liquids, and gases. Spectra in this terahertz region provide absorption bands normally associated with hydrogen bonding vibrations and crystal structure lattice vibrations. Applications include determination of crystalline structures, polymorphs, hydrates, and solvates. The Imaga 2000 is an applications-specific system for the pharmaceutical industry for the three-dimensional measurement of tablets and capsule cores. The properties measured include uniformity,

thickness, distribution, and coverage of simple and complex (multilayer) coatings, as well as structural features such as cracks, dislocations, and delaminations of coatings.

### Raman Spectroscopy

As we would expect, the traditional long-time world supplier of Raman instrumentation, Horiba Jobin Yvon, also offered new products for Pittcon. The OEM group of Horiba Jobin Yvon has introduced OEM miniature Raman components and systems. These systems,

designed around the miniature CP20 spectrograph, provide high-end spectroscopic performance in a compact 2-in. cube package. The system provides for a selection of CCDs and PDAs, as well as lasers (532 nm, 785 nm, and so forth) for customization for an optimum Raman system. Application areas include analytical chemistry, medical analysis, and semiconductor manufacturing.

At the other end of the scale, Horiba Jobin Yvon introduced the latest in a series of combined Raman and FTIR microscope systems, the LabRAM IR<sup>2</sup>

and the LabRAM ARAMIS IR<sup>2</sup>. These new systems provide an extensive range of microanalysis facilities on a single benchtop instrument. The LabRAM ARAMIS IR<sup>2</sup> includes full FT-IR and Raman mapping capabilities, made possible by use of the LabSPEC 5 software, which enables a complete 2D chemical image to be derived from both Raman and FT-IR spectra. SameSPOT technology ensures that optical, Raman, and FT-IR images are generated from the same sample position. The system can accommodate a range of temperature and

humidity cells so that polarized light microscopy (PLM), Raman, and FT-IR can be used to study important applications such as pharmaceutical polymorphism and salt screening.

Ahura has been known for sometime for its handheld Raman system (the Defender) for HazMat and homeland security applications. This system has revolutionized thinking of the role of Raman, as being the first truly handheld, fully integrated systems. The company has expanded the role of this system, in the form of TruScan, for rapid materi-

als identification, with a focus on pharmaceutical raw materials, actives and excipients, and formulated products, including blister packs.

In line with the expanding Raman theme, Mesophotonics introduced the SE1000 spectrometer for Raman and surface-enhanced Raman spectroscopy (SERS). The company claims that the system offers research-grade performance in a cost-effective, user-friendly system. Additional functionality is provided by the SERS component for trace level analyses, with the unique Klarite substrates.

Renishaw unveiled its new StreamLine hardware and software, which is designed to allow users to produce Raman chemical images at faster speeds than previously possible. The StreamLine option is available for Renishaw's inVia Raman microscopes.

B&W TEK featured a couple of new products, including its BRC641E miniature back-thinned CCD spectrometer for UV-vis-NIR applications, and its MiniRam II portable Raman spectrometer. The BRC641E is a fiber-optic coupled array spectrometer (2048 pixels) that can be configured for optimum performance, with spectral resolution ranging from 0.4 nm to >10 nm, depending on spectral range selected. It is a plug-and-play device with USB connectivity. The MiniRam II operates with a Raman shift range of 175–3100 cm<sup>-1</sup>, and it is based on a 300-mW, 785-nm solid-state laser. It is lightweight and portable, with a rechargeable battery pack.

Headwall Photonics, a recent recipient of the Frost and Sullivan Product Innovation Award, presented its HyperSpec imaging products. These are a fourth-generation product featuring the company's patented aberration-corrected, concentric imaging design. Headwall is yet another company offering new high-performance products for Raman spectroscopy. The Multichannel Raman Discovery is an OEM component for spectral imaging and chemical sensing. It is a new family of high-performance, portable Raman spectrometers. The system meets the critical performance requirements for pharmaceutical, medical, and forensic applications. Headwall has just announced a strategic collaboration to provide a cost-effective solu-

tion for material identification with ChemImage, a company specializing in hyperspectral chemical imaging for Raman and fluorescence applications.

Lambda Solutions, Inc. ( $\lambda^S$ ) has introduced the LSI high-performance Raman system, which includes the LS1-FT (flow through) for on-line fluid monitoring applications. The system is reported to provide exceptional sensitivity via its proprietary optical design and its RamanSoft realtime monitoring software. The company also showed its Dimension-P1 and P2 ultrahigh performance spectrographs configured for Raman applications. The P1-XL offers the highest performance with a choice of Raman shift ranges (150–3300  $\text{cm}^{-1}$ , 5- $\text{cm}^{-1}$  resolution, and 150–2075  $\text{cm}^{-1}$ , 3- $\text{cm}^{-1}$  resolution), with a  $1340 \times 100$  (or 400) pixel CCD array. The standard configuration features a 785-nm laser, but alternative lasers are available at 830, 632.8, and 532 nm.

### Mass Spectrometry and Magnetic Resonance

Waters' Synapt High Definition MS (HDMS) system won the 2007 Pittcon Editors' Gold Award for the best new product. Used in small molecule research, protein characterization, metabolite identification, and biopharmaceutical applications, the Synapt HDMS system is the first mass spectrometer of its kind to combine high efficiency, ion mobility-based measurements and separations with high performance quadrupole, time-of-flight mass spectrometry. The additional dimension of sample separation afforded by the system provides increased specificity and sample definition. Visualization and manipulation of the multidimension data produced by the system is performed by DriftScope Mobility Environment software. Operational control is provided by Waters MassLynx software.

The laser diode thermal desorption (LDTD) ionization source for mass spectrometry applications was introduced by Phytronix Technologies, Inc. This plug-and-play device can be installed on any mass spectrometer and allows for rapid thermal desorption of the sample followed by atmospheric pressure chemical ionization (LDTD-APCI). It is impor-

tant for liquid chromatography–mass spectrometry (LC–MS) applications where it eliminates the risk of cross-contamination often associated with the use of LC, and it reduces the background noise induced by the mobile phase.

Thermo Fisher Scientific unveiled the Thermo Scientific LTQ XL linear ion trap mass spectrometer equipped with electron transfer detection (ETD). The LTQ ETD won the Silver Editors' Award. This ion fragmentation technology generates important peptide structure information, not available from conventional

fragmentation methods, and provides significant advantages for protein–peptide characterization and for sequencing of proteins and peptides. The company also launched application-specific software for the LTQ Orbitrap hybrid mass spectrometer. The company indicates that this software offers the following advantages for proteomics and pharmaceutical users: differential expression analysis, *de novo* sequence analysis, and metabolite identification.

Varian featured several new products, including the 400-MR magnetic reso-

nance spectrometer and the 320-MS triple quadrupole mass spectrometer. The 400-MR is intended for nonspecialists and provides state-of-the-art performance for molecular characterization and quantitative analysis. Complex data acquisition processes for molecular structure elucidation are made available at the push of a button. The 320-MS provides femtogram detection limits for molecular weights as high as 2000 Da, for the identification of a wide range of compounds. Applications range from the determination of pesticide residues in food and agricultural products to the measurement of drug metabolites in blood and urine.

Agilent Technologies presented its model 5975 GC/MSD system, which combines the capabilities of the Agilent 7890A GC system with the ability to detect trace level compounds in complex matrices. The system is the first instrument to feature Agilent's Trace Ion Detection capability, which reportedly reduces chemical noise and improves peak shape and spectral fidelity. This system is designed to be combined with Agilent's Deconvolution Reporting software (DRS) and databases, which enable detection of compounds even when they are coeluted.

### Elemental and Atomic Spectroscopy

Varian also presented the 700-ES series of inductively coupled plasma optical emission spectroscopy (ICP-OES) instruments. The 700-ES series is an entry-level instrument designed for routine applications in application areas ranging from environmental to pharmaceutical, and is ideal for educational institutions and for industries that need to comply with environmental regulations.

Horiba Jobin Yvon introduced the ACTIVA M (Bronze Editors' Award), a multiline ICP-OES analysis system. This system combines high instrumental performance with advanced software. The benefit of multiline analysis is the efficient use of the ICP data from a full-range, 120–800 nm spectrum. It includes validation of line selection and verification of unexpected spectral and non-spectral interferences. The innovative software, M.A.S.T.E.R. (Multiline Analy-

sis, Selection Tool for Enhanced Reliability) and S.O.S. (Statistical Outlier Survey) uses a new proprietary ICP-based Database, featuring not only wavelengths but also ionization level, line width, limit of detection, and dynamic range of each line. M.A.S.T.E.R. performs a multiline selection according to the concentration range of each element and the matrix influence, and greatly simplifies the development and validation of new applications or changes in routine applications.

Handheld and portable XRF instruments have taken a major part of the X-ray analysis market. Innov-X, one of the major players in the portable XRF analyzer market, introduced several models, some handheld and some configured for in-line/on-line measurements. The Innov-X Alpha LZX features vacuum technology that enables the measurement of light elements, including Mg, Al, and Si, as well as 25 other elements. A version of the portable analyzer, called the Mini-Spot, includes a targeting laser that can be used to pinpoint a measurement area down to a 3-mm diameter. This is particularly important for electronics-related applications for RoHS compliance. Two versions for on-line applications are the On-Board SEA-Mate for the analysis of metals in engine oils, from large engine applications (such as marine and power generation engines), and a special probe for petrochemical, mining, and plating applications, as well as for scrap metal sorting.

The molecular structure fingerprint of a sample can be obtained by the XT250 supplied by XStream Systems. This system utilizes energy-dispersive X-ray diffraction (EDXRD) to produce a structural-related fingerprint. Applications include material characterization for drugs, dry chemicals, food products, and explosives, as well as counterfeit detection (including pharmaceuticals).

EDAX featured its Hikari High Speed EBSD detector for use on any scanning electron microscope. The detector provides simultaneous electron backscatter diffraction–energy dispersive X-ray for positive phase identification, correlation of materials properties with microstructure, and texture measurements using a scanning electron micro-

scope (no XRD required). It is claimed to be the fastest detector in its class on the market.

Glass Expansion featured its IsoMist Programmable temperature spray chamber accessory (Editors' Award, honorable mention), a wireless-controlled (Bluetooth) Peltier temperature-controlled spray chamber operating from –10 °C to 60 °C for ICP-OES and ICP-MS. The system provides for high-stability environmental applications, metals in volatile organic solvents, and low detection limit applications with limited volume samples.

Milestone featured its microwave ashing systems, including the PYRO SA, which is specially engineered for sulfate ashing procedures. It allows for the addition of H<sub>2</sub>SO<sub>4</sub> to samples directly into the microwave muffle furnace without a preliminary charring step. It eliminates operator exposure to acid fumes. Applications include mercury in coal.

### Software

To use a full isotope fingerprint to unambiguously identify an unknown compound's formula from mass spectral data with a single or triple Quad instrument, it is necessary to resolve the masses to better than unit mass. This is now achievable with the introduction of MassWorks CLIPS (calibrated lineshape isotope profile search), a new software product from Cerno Bioscience (Editors' Award, honorable mention). The software provides rapid and reliable elemental composition from the quadrupole mass spectral data.

Advanced Chemistry Development, Inc. (ACD/Labs) continues to provide software and databases for the spectroscopic community. A new system extends beyond spectroscopy to include LC data for LC-MS systems. The product, known as the ACD/Method Development Suite for LC-MS, saves up to 80% in development and optimization and provides automated peak tracking for LC-MS data.

### Components, Accessories, and Reagents

Too often our focus is on instruments and accessories; however, electronic components are also an important

aspect of the instrument industry. EMCO High Voltage Corporation featured the Q Series of ultraminiature DC to high voltage (HV DC) conversion. The devices supply from 100 V up to 5000 V in only 0.125 in.<sup>3</sup> and up to 10,000 V in 0.614 in.<sup>3</sup>! These component-sized converters are ideal for applications requiring minimal size and weight, including photomultiplier tubes, light sources, piezo-actuated devices, electrophoresis, printers, and igniters.

Melles Griot showcased new models of its 56 RCS series of high-performance diode laser assemblies. The products are designed for both OEM and end-user applications. They offer analog and high-speed modulation capability with a bandwidth in excess of 300 MHz (<1 ns rise/fall time). According to the company, the assemblies provide far-field beam circularity of greater than 95%, precisely controlled beam divergence, and accurate beam waist location. The new models are designed with a 0.7-mm beam diameter to simplify external fiber coupling with commercially available components.

SPEX CertiPrep introduced its pipette washer, which is made for washing Class A volumetric pipettes. The polyethylene-constructed washer can hold up to 23 pipettes at a time with rows of conical shaped plastic pipette holders that are connected to a water line. When the valve is turned on, the water fills each pipette, shoots out of the pipette tip, and rains a shower of water over the outside of the pipettes, thoroughly cleaning both the inside and outside of the pipettes. The water line can also be connected to a vacuum line for drying pipettes faster. Pumps and basins are also available for situations in which a water or vacuum line is inaccessible.

Too often we fail to include information about the enabling components in our laboratory measurements, which includes the important areas of standards and reagents. VHG Labs introduced a new range of ICP-MS standards formulated for use with EPA methods 200.8 and 6020. These include internal standards, tuning solutions, calibration standards, spiking solutions, CRQL solutions, and interference check samples. Each standard is accompanied by

a certificate of analysis. Besides these products, VHG Labs also featured NIST-certified single element standards for ICP-OES, water in oil standards for Karl Fischer, and a performance testing program for oil analysis.

Another company producing ISO-certified, NIST-traceable standards for ion chromatography was High-Purity Standards. The calibration standards available include bromide, chloride, fluoride, nitrate, phosphate, and sulfate. These are single component standards with a concentration of 10,000 mg/L. The company also offers calibration standards for EPA environmental water analysis trace metal standards on filters, for industrial hygiene and ambient air monitoring, and Karl Fischer water standards (in acetic acid).

GFS Chemicals has added Patent Blue Violet dye and Amaranth Red dye standards to their In-Spec product line, now offering 14 different standards. The goal of GFS is to provide a solution for customers in a variety of applications for the pharmaceutical industry, including DNA–RNA research applications.

Finally, while on the subject of reference materials, Starna Scientific (UK) featured its calibration and wavelength reference standards. These include benzene vapor, in a sealed cuvette, and various rare earth glasses as UV and visible wavelength reference standards — holmium oxide, didymium (UV), and samarium (UV).

In most fiber-optic applications, precise fiber alignment is extremely important. Even small alignment errors can lead to substantial energy losses. Fiber-guide Industries, Inc. introduced its V-groove arrays. These provide a way to manufacture assemblies with precise alignment of fiber-optic arrays, with an alignment accuracy of less than one micron. The company also featured its hard clad silica fibers with high numerical aperture and increased fiber strength.

PI (Physik Instrumente) LP, presented its PIFOC nanofocusing devices for use in combination with standard microscopes (Nikon, Olympus, Leitz, and so forth) for single molecule spectroscopy and microscopy. These devices feature ultrafast piezo-actuated z-axis focusing drives with 10x speed and focusing

accuracy.

Upchurch (part of IDEX Health & Science group), a company known for its high-performance connectors, couplings, and valves for liquid, featured a microbore PEEK tubing for use with nano and micro LC for LC-MS applications. The 25- $\mu\text{m}$ -bore tubing (available in 1/16-in., 1/32-in., and 360- $\mu\text{m}$  o.d. sizes) is rated to 7000 psi and is used to decrease band broadening caused by transfer in the tubing.

Meinhard Glass Products provides accessories for ICP-OES and ICP-MS sample introduction. Products featured include the Fit Kit 3T, a press-on fitting that provides a tight seal between the solution capillary and the liquid transfer tube of a glass concentric nebulizer; flared-end peristaltic pump tubing, which is ideal for mixing tees for internal standards and buffers; and new high-pressure (50 psi) nebulizers in quartz and borosilicate glass for ICP-OES and ICP-MS sample introduction.

## Finale

I have presented a broad range of information on products in this article. Not all of these are new — I know that. One has to make a mark in the sand and say from this point on the products represented are new. My best guess is that the mark starts, for the most part, sometime early in 2006. For me, if that is 95% of the cases, then these are deemed as new products. There is not enough room here to do justice to the products, but I hope I have provided a taste of what's out there.

## References

- (1) J.P. Coates, *Spectroscopy* **1**(5), 14–19 (1986).
- (2) J.P. Coates, *Spectroscopy* **3**(4), 14–19 (1988).
- (3) J.P. Coates, *Spectroscopy* **20**(1), 32–41 (2005).

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