

new products

Focus on vacuum and cryogenics

The descriptions of the new products listed in this section are based on information supplied to us by the manufacturers. PHYSICS TODAY can assume no responsibility for their accuracy. For more information about a particular product, visit the website at the end of the product description.

Andreas Mandelis

Residual gas analyzer

Vacuum processing is an essential element of chemical, metallurgical, and electronics-related procedures that require low pressure. They include vacuum furnacing, chemical vapor deposition, surface etching, and evaporative coating. Hiden's HMT residual gas analyzer (RGA) offers a single partial pressure gauge that operates through the full vacuum spectrum from the ultrahigh vacuum (UHV) to the millitorr



range. Applications include process gas trend analysis, vacuum background diagnostics, and leak detection. The integral dual detector enables monitoring

at high pressure by a Faraday detector and at lower pressures to UHV by an electron multiplier detector. The detector satisfies full conventional RGA specifications with partial pressure detection down to 2×10^{-13} mbar and a total dynamic range in excess of 10 decades. The process mode sets the analyzer parameters for high-pressure operation and optimizes system sensitivity for the specific process pressure. *Hiden Analytical Inc, 37699 Schoolcraft Road, Livonia, MI 48150, <http://www.hidenanalytical.com>*

Cryogen-free microkelvin refrigerator

Oxford Instruments and Royal Holloway, University of London, have developed a refrigerator capable of achieving microkelvin temperatures without using liquid cryogenics. The novel system may be suitable for research applications in quantum computing and condensed-matter physics. Oxford Instruments' Triton dilution refrigerator, which is integrated with a superconducting magnet, was combined with a nuclear demagnetization

stage developed by Royal Holloway. The refrigerator can maintain temperatures below 1 mK—the lowest recorded was 600 μ K—for more than 24 hours. To be able to measure such low temperatures reliably, Royal Holloway developed a current-sensing noise thermometer. The ultralow vibration characteristics of the dilution refrigerator prevent excessive heating of the coldest stage. The selection of PrNi_3 , rather than the more conventional high-purity copper, as the nuclear refrigerant helps reduce the effect of eddy-current heating. *Oxford Instruments plc, Tubney Woods, Abingdon, Oxfordshire, OX13 5QX, UK, <http://www.oxford-instruments.com>*

Cryogenic objectives

High spatial resolution spectroscopy measurements such as confocal micro-luminescence, fluorescence, and micro-Raman require high-quality apochromatic objectives. According to attocube systems, such objectives have not been available for operation at cryogenic temperatures. The company now offers low-temperature apochromatic objectives (LT-APOs) for broadband spectroscopy measurements in three spectral ranges from the visible to near-IR. When performing measurements at cryogenic temperatures, conventional room-temperature objectives cannot be used. Some simple aspheric lenses survive the thermal cycling, but at the cost of poor chromatic performance; the focal plane typically shifts by almost 50 μ m in a working range of 500–1000 nm. Optimized for 465–600 nm, 565–770 nm, and 700–1010 nm, the LT-APOs keep the focal plane within one depth of focus and take care of a uniform spot size. The intensity of emitters stays within 75–100%. *attocube systems AG, Koeniginstrasse 11a, 80539 Munich, Germany, <http://www.attocube.com>*



Cryogenic temperature monitor

Cryo-con has introduced the model 18i eight-channel cryogenic temperature monitor for use in industrial control systems. The compact monitor has industrial-grade security, Modbus protocol, user programmability, power over ethernet, internal data logging, and an easy-to-read display. Model 18i has eight identical, independent input channels. Each can support the same wide range of



sensor types. Inputs are not scanned or multiplexed. Silicon and gallium aluminum arsenide diode sensors use 10- μ A constant-current DC excitation to achieve their full temperature range. Positive temperature coefficient resistor sensors, including platinum and cryogenic linear temperature sensors and rhodium-iron resistance temperature detectors, use constant-current AC or DC excitation. The monitor includes built-in sensor calibration curves that support most industry-standard temperature sensors. *Cryogenic Control Systems Inc, 17279 La Brea, Rancho Santa Fe, CA 92067, <http://www.cryocon.com>*

Helium-3 cryostat

Janis Research has developed an enhanced top-loading helium-3 cryostat with the sample in a UHV environment. Model HE-3-TLSUHV-STM is an ultralow-temperature (ULT) system that is optimized for atomic resolution scanning tunneling microscope (STM) measurements. It can be integrated with a commercially supplied or user-built STM. A central UHV tube (32-mm diameter or larger) and gate valve provide top-loading access to the low-temperature, high magnetic field region for sample and tip exchange. Vertical, horizontal, 2D, and 3D vector field superconducting magnets are available and can be fully integrated. Applications include quantum computing and information, electronics, and nanoscale manufacturing. A ULT STM system can be used to observe or manipulate the



topography and electronic structures of atoms, islands, molecules, and surfaces. Typical materials studied include metals, semiconductors, thin films, and carbons such as graphene and carbon nanotubes. *Janis Research Company LLC*, 225 Wildwood Avenue, Woburn, MA 01801-2025, <http://www.janis.com>

Magnetically coupled Roots pumps

Pfeiffer Vacuum has introduced ATEX-certified Roots pumps with a magnetic coupling. ATEX directive 94/9/EC describes the equipment and protective systems permitted in an explosive environment. Vacuum pumps in the OktaLine ATEX series are suitable



for processes in explosive areas or for evacuating explosive gases in chemical and process technology and industrial applications,

coating, the semiconductor industry, and R&D. The hermetically sealed pumps have very low leakage rates of less than 7.5×10^{-9} torr l/s. The magnetic coupling makes it possible to omit the shaft sealing rings, which require frequent maintenance and are inherent weak points when pressure surges occur. Pumps in the OktaLine ATEX series are resistant to pressure surges of up to 1600 kPa (12 000 torr). The magnetic coupling prevents a gas exchange between process-related internal and external atmospheres. *Pfeiffer Vacuum Inc*, 24 Trafalgar Square, Nashua, NH 03063-1988, <http://www.pfeiffer-vacuum.com>

Motorized miniature vacuum actuator

Physik Instrumente has introduced two vacuum-compatible versions of its compact N-470 PiezoMike precision screw-type actuator family. The N-470.V (HV) and N-470.U (UHV) actuators are based on an inertia stick-slip drive. When at rest, the drive is self-locking, so it requires no electric power and generates no heat. It holds the position with a maximum force of 100 N. The PiezoMike design provides excellent long-term positioning stability of the optical path with reliable



start-up even after long downtimes. High holding force and resolution are achieved by combining piezo actuators with a mechanical rotation or thread translation. The actuators are vacuum compatible to 10^{-9} hPa. *Physik Instrumente LP*, 16 Albert Street, Auburn, MA 01501, <http://www.physikinstrumente.com>

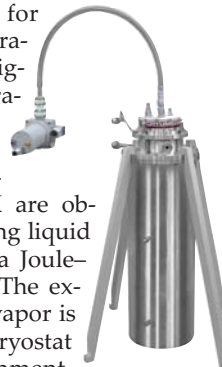
Ultralow vibration probe station

Advanced Research Systems has developed a new ultralow vibration cryogenic probe station for nanoscience applications. It uses the company's 1.1-W closed-cycle cryocooler, which has an ultralow vibration interface that uses a helium exchange gas to provide a probing environment with nanometer-scale vibrations and sample temperatures as low as 5 K. The system can be equipped with piezoelectric sample stages for nanometer-scale sample tracking and positioning. It can be fitted with up to seven of the company's standard probe arms for DC, RF, microwave, and fiber-optic applications. *Advanced Research Systems Inc*, 7476 Industrial Park Way, Macungie, PA 18062, <http://www.arscryo.com>



Cryostat for applications below 2 K

Many applications, including high-field nuclear magnetic resonance magnets, low-temperature detectors, and cooling stages for subkelvin refrigerators, require refrigeration to temperatures in the range of 1–2 K. In some cases, temperatures below 2 K are obtained by pumping liquid helium through a Joule-Thomson valve. The exhausted helium vapor is vented from the cryostat into the environment, and costly refills of the liquid helium are periodically required. Cryomech has eliminated the need for the refills by



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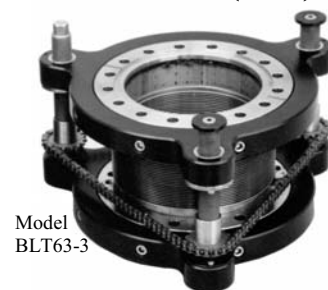
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1. 
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developing a continuous closed-cycle 1-K cryostat. The device combines the Cryomech 4-K pulse-tube cryocooler with a pumping recovery system built around a dry pump that maintains the necessary vacuum for operation below 2 K without introducing significant contamination into the helium stream. For reliquefaction, the system exhaust is routed back to the cryocooler. *Cryomech Inc, 113 Falso Drive, Syracuse, NY 13211, <http://www.cryomech.com>*

Rotary vane vacuum pumps

Edwards has launched a series of single-stage, oil-sealed rotary vane pumps that provide stable vacuum performance. According to the company, the optimized oil return system eliminates the pressure fluctuations often seen in single-stage pumps, thus improving product quality and yielding consistent process results. The pump mechanism on the new ES pump has been refined to produce a better quality



of vacuum; the pumping speed is maintained even at lower pressure and extends the operating pressure range. The pump runs cooler and has a longer oil lifetime than comparable oil-sealed vacuum pumps. The ES pump is designed for a wide range of applications, including heat treatment and coating. The pump has five variants: ES65, ES100, ES200, ES300, and ES630. They can be used individually or with the EH range of mechanical booster to increase performance and ultimate vacuum. *Edwards Ltd, 6416 Inducon Drive West, Sanborn, NY 14132, <http://www.edwardsvacuum.com>*

Cryoelectron microscopy accessories

Two new products for cryoelectron microscopy applications are available from FEI: a phase-plate solution and the Titan Halo transmission electron microscope. Available on most TEM platforms from FEI, the phase plate is a stable, durable device to increase the contrast of sensitive biological samples. It addresses the historical shortcomings of traditional TEM phase-plate tech-



nology by delivering a reliable, contrast enhancement solution for structural biology applications. Its long life—at least four months—and stability permit extended experiments. The Titan Halo TEM provides high-quality optical performance with enhanced flexibility for multiscale applications in life and biomaterials sciences. With the new products, users can see more detail in biological specimens and potentially gain greater insight into the fundamental processes of living systems at the molecular scale. *FEI, 5350 Northeast Dawson Creek Drive, Hillsboro, OR 97124, <http://www.fei.com>*

Cryostation microscope

Montana Instruments has released its Cryostation microscope for variable temperature imaging. It is suitable for users studying nitrogen-vacancy centers and quantum dots and those implementing the techniques of photoluminescence and confocal imaging. The microscope objective holder is built into the radiation shield for minimal drift and vibration. The custom vacuum-compatible 100× Zeiss objective with 0.90 numerical aperture and a working distance of 310 μm is under vacuum but kept at room temperature. The microscope is built into the same sample platform as the Cryostation, which allows easy access to and customization of the sample space. Its operating temperature range is 3.5–350 K. In active cooling mode, sample drift is less than 1 $\mu\text{m}/\text{degree}$ and less than 50 nm when stable. *Montana Instruments Corporation, 151 Evergreen Drive, Bozeman, MT 59715, <http://www.montanainstruments.com>*

Portable degas system

A portable degas system from MV Products can be tailored to customer requirements, with a choice of vacuum pumps, gauges, chamber sizes, feedthroughs, and more. The MV four-gallon system is self-contained in a 20-inch-square mobile cart and operates on



115-V power, making it a versatile solution for small degassing, encapsulating, potting, and drying applications. Offered with a choice of vacuum pumps to pull a 15- to 29-inch mercury (Hg) vacuum, it has a clear, 1-inch-thick Lucite top for viewing and includes a 0- to 30-inch Hg Bourdon dial gauge, isolation and vent valves, a stainless steel chamber, and an on/off switch. The system comes standard with a dry piston, five-CFM vacuum pump. It can be ordered with an oil-lubricated, two-stage rotary vane pump or a dry-running scroll pump. *MV Products, Mass-Vac Inc, 247 Rangeway Road, P. O. Box 359, North Billerica, MA 01862-0359, <http://www.massvac.com>*

Turbomolecular pumps

Oerlikon Leybold Vacuum has designed a line of turbomolecular pumps with integrated drive electronics especially for processes with small backing pumps. The Turbovac 350 i and 450 i are suitable for ultrahigh vacuum applications and for integration with compact pump system solutions. According to the company, the pumps offer a speed for light gases that is up to 60% higher than that in comparable products and a compression level approximately 100 times as great as that in products of the previous generation. Designed with classic rotors, the Turbovac T 350 i and T 450 i feature high gas throughput, fast run-up time, and insensitivity to particulates. They are optimized for process applications and high gas loads. *Oerlikon Leybold Vacuum GmbH, Bonner Strasse 498 (Bayenthal), 50968 Cologne, Germany, <http://www.oerlikon.com/leyboldvacuum>*

new literature

Feedthrough selection guide

The Kurt J. Lesker Co has launched a new feedthrough selection guide on its website. According to the company, it helps users quickly and easily select the correct power, instrumentation, thermocouple, liquid, gas, liquid nitrogen, ceramic break, or fiber-optic feedthrough for their specific application requirements. Once the desired feedthrough has been defined, the part's detailed drawing, number, and price are displayed. *Kurt J. Lesker Company, 1925 Route 51, Jefferson Hills, PA 15025, <http://www.lesker.com>* ■