

## Research Resources

A summary of new products and services for materials research...

**Ultra-Pure Electronic Gases:** Patented process produces germane, silane, disilane, and custom blends of these gases with hydrogen or inerts for use in the photovoltaic and semiconductor industries. Gases are available in steel or aluminum cylinders with manual or pneumatic cylinder valves fitted with VCR or CGA 350 regulator connections. Voltaix, Inc., P.O. Box 5357, 197 Meister Avenue, North Branch, NJ 08876; (201) 231-9060.

**Etch Application Note:** First of a series of application notes outlining advanced processes for Varian dry etch systems, this 15-page illustrated publication details an etch process for producing through-the-wafer vias in GaAs monolithic microwave integrated circuit (MMIC) devices with the ZLN-20 single-wafer ion etching system. Varian Associates, Inc., Semiconductor Equipment Group, 611 Hansen Way/G-105, Palo Alto, CA, 94303; (800) 544-4636.

**Advances in Magnetron Sputtering and Etching:** 236-page book includes chapters on the art of sputtering and etching process development, advanced aluminum metallization including planarization, refractory metals, and new sputter-coating applications such as tape automated bonding and bias sputtered quartz. Also available is the fourth edition of *The Book of Basics*, covering the five fundamental sciences of thin film technology. Materials Research Corporation, Route 303, Orangeburg, NY 10962; (914) 359-4200 ext. 351.

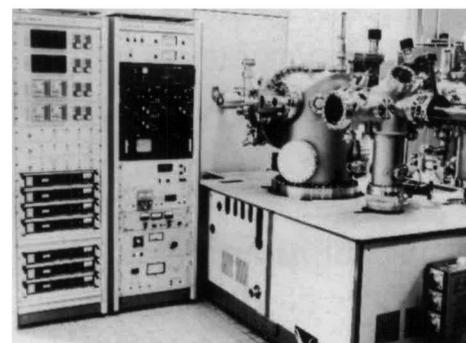
**AES/XPS Analytical System:** Versatile system performs AES, XPS, and profiling in the same spot without moving the sample, and features rapid-entry load lock and  $10^{-10}$  Torr base pressure with ion and titanium sublimation pumping. Options include computerization, x-ray excitation, and choice of many electron and ion sources. Riber Division of Instruments SA, Inc., 6 Olsen Avenue, Edison, NJ 08820; (201) 494-8660.

**SIMS/Ion Microprobe:** MIQ 256 features three ion sources (duoplasmatron, cesium, and gallium) focused on the same spot, ultrahigh vacuum ( $10^{-10}$  Torr during analysis), positive and negative secondary ion analysis, low extraction voltage, image processing (including false color enhancement and 3-D representation), submicron lateral resolution, and automatic multi-sample (or 2-inch sample) analysis. Riber

Division of Instruments SA, Inc., 6 Olsen Avenue, Edison, NJ 08820; (201) 494-8660.



**Gas Technology MBE System:** CBE 32 combines the advantages of classical molecular beam epitaxy and organometallic chemical vapor deposition. The package features precise and reproducible flux control, precise composition control, oval defect-free epilayers at high growth rates, hyperabrupt interfaces, accurate epilayer thickness control, and optoelectronic and transport properties. Also available: *MBE NEWS*, bimonthly publication covering latest results and product information. Riber Division of Instruments SA, Inc., 6 Olsen Avenue, Edison, NJ 08820; (201) 494-8660.

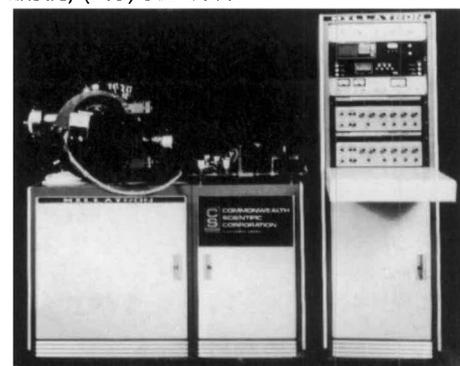


**High-Temperature Superconductivity Reprints:** 400-page volume contains 112 refereed papers originally published in *Physical Review Letters* and *Physical Review B* during the first six months of 1987, including the first paper describing the 95 K superconductors and covering materials preparation techniques, materials characterization (crystal structure, electron micrographs), superconductor parameters (critical current density, critical magnetic field, energy gap), and theoretical understanding. American Physical Society, Publications Liaison Office, 500 Sunnyside Boulevard, Woodbury, NY 11797; (516) 349-7800.

**Refrigerator Cryostats Modular System:** Standard LH refrigerator cryostats, cooled by two-stage RGD 210 refrigerators, are suitable for cooling samples in the 10–300 K range. System converts from optical to magnetic experiments with optional add-on sets and has capacity for attaching user apparatus for specified purposes. Brochure contains detailed information on cold heads, compressors, vacuum pump connections, and sample holders used for optical, magnetic, and spectroscopy applications. Leybold Vacuum Products, Inc., 5700 Mellon Road, Export, PA 15632; (412) 327-5700.

**Valve Catalog:** Comprehensive 28-page catalog describes product line of vacuum, ball, gate, variable leak needle, and safety valves. Includes pressure unit conversion tables, valve system diagrams showing interchangeability of parts, technical specifications, dimensional data, and calibration curves. Leybold Vacuum Products, Inc., 5700 Mellon Road, Export, PA 15632; (412) 327-5700.

**Ion Beam Deposition of High T<sub>c</sub> Thin Superconductor Films:** System permits the independent control of three different oxides/ceramics on substrates, wire, or tape. Coating equipment will ensure the formation of materials under relatively low vacuum conditions,  $10^{-4}$  to  $10^{-5}$  Torr, and at temperatures up to 800°C. Three different ion sources are used to sputter transfer materials from any of six or eight different targets including yttrium, barium, or copper. A fourth source can be used for *in situ* oxygen enrichment by bombarding the surface with a low voltage, 50–100 eV oxygen ions. Coatings can be applied at 300 to 600 Å per minute, with thicknesses up to a few microns. An on-board computer can establish process menus and log data. Commonwealth Scientific Corporation, 500 Pendleton Street, Alexandria, Virginia 22314; (703) 548-0800.



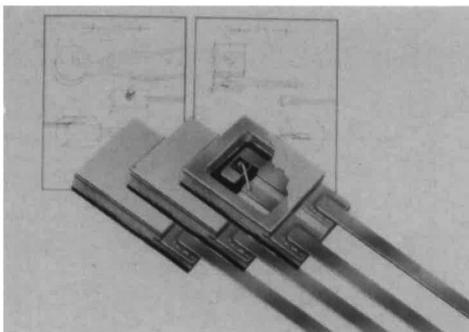
**Ion Cleaning Source:** Neutral ion beam source designed for precleaning operations in either the load chamber or process chamber of a sputter deposition system provides a gentle etching method of substrate cleaning prior to deposition. Low-energy operation prevents radiation damage on sensitive substrates and decreases contamination, and the fully neutralized ion beam prevents accumulation of electrical potentials on the substrate. A switched mode power supply regulates the ion current and acceleration voltage independently for accurate cleaning control. CVC Products, Inc., 525 Lee Road, P.O. Box 1886, Rochester, NY 14603; (716) 458-2550.

**ECR Plasma System:** Electron cyclotron resonance system for CVD and RIE processes produces efficient plasmas with rapid etch and low temperature/low pressure deposition rates. Flexible research system can be upgraded to pilot production or single-wafer processing by adding modules. The Ibex-9000 ECR features a turbo-pumped vacuum system, plasma chamber, work chamber and rotating 8 inch electrode, microwave power supply, and waveguide hookup to the plasma chamber. The microwave chamber can be mounted vertically or horizontally to the work chamber and includes two adjustable electromagnets producing a 1,500 gauss field. A removable gas cabinet is fitted with up to eight mass flow controlled gas lines. An optional computer controls operation of the system. Microscience, Inc., 41 Accord Park Drive, Norwell, MA 02061; (617) 871-0308.



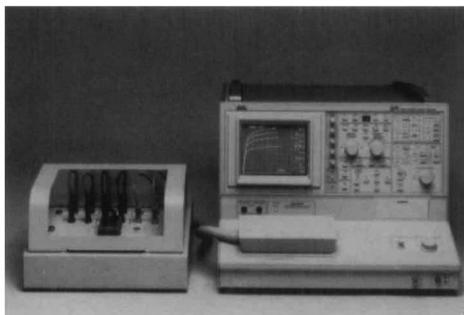
**Cryogenics Temperature Sensors:** Interchangeable sensors are available for use in the critical 1.4–475 K range. The sensors conform to a standard calibration curve to within one of four available tolerance bands, making each sensor interchangeable

with other DT-470 series sensors. Advanced thermal design and stability of the DT-470 series minimize errors occurring at cryogenic temperatures. Applications include: analysis of high  $T_c$  superconductor materials, measurement of aircraft and space vehicle inside/outside temperatures, thermometers for infrared and other types of cooled sensors, liquid natural gas level and temperature monitoring, and cryopump applications. Lake Shore Cryotronics, Inc., 64 East Walnut Street, Westerville, OH 43081; (614) 891-2243.



**Cubic Zirconia Substrates:** High-purity, single crystal, yttria-stabilized cubic zirconia (CZ) substrates for research on thin-film superconducting oxides can be supplied up to 50 mm diameter, x-ray oriented, or with random crystallographic orientation. Polished CZ wafers are available from stock or custom-fabricated. Ceres Corporation, 202 Boston Road, North Billerica, MA 01862; (617) 667-3000.

**Curve Tracer for High Power Semiconductor Testing:** Programmable curve tracer can be used to evaluate high power semiconductor devices at currents up to 400 A, 3,000 W, and 3,000 V. The instrument enables users to stimulate devices and then display, measure and store their DC parametric characteristics for further analysis. Both off and on parameters can be evaluated. Applications include component design and evaluation of two- to three-terminal devices, including power diodes, bipolar power transistors, power MOSFETs, and thyristors. Tektronix, Inc., P.O. Box 1700, Beaverton, OR 97075; (800) 547-1512; in Oregon, (800) 542-1877.



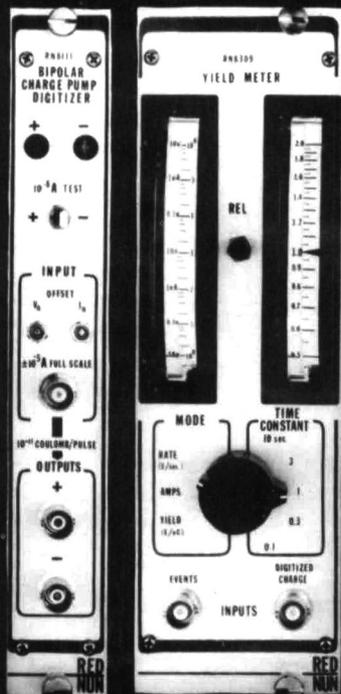
**Japan Technology Series:** Monthly series provides 100-word summaries, in English, of articles from 600 leading Japanese technical journals. The series is divided into 10 specialized editions: biosciences, business, chemistry, computers, electronics, energy, manufacturing, materials, telecommunications, and transportation. Each edition contains 400 to 500 summaries, including such key data as equations, formulas, and research results. Subscribers have access to photocopies of original published articles and full-text English translations at additional cost. University Microfilms International, 300 North Zeeb Road, Ann Arbor, MI 48106; (313) 761-4700.

**New Technology Week:** Weekly "Newspaper of Superconductors, Materials Sciences, Power Electronics and High Energy Physics" covers: technological breakthroughs; R&D funding; government R&D policy; new contracts and grants from NSF, DOE, NASA, and DOD; employment opportunities in science and industry; new patents, meetings, conferences, and symposia. Also included are interviews with top researchers, executives, and government officials, as well as profiles of laboratories, corporations and agencies. King Communications Group, Inc., 627 National Press Building, Washington, DC 20045; (202) 638-4260.

**Chemistry of High-Temperature Superconductors:** More than 100 contributors from major worldwide research groups examine current progress and understanding of superconductivity from the point of view of solid-state chemistry. This 349-page book covers theory, materials preparation and characterization, structure-property relationships, surfaces and interfaces, processing and fabrication, applications, research needs and opportunities. American Chemistry Society, Distribution Office Dept. 246, P.O. Box 57136, West End Station, Washington, DC 20037; (800) 227-5558.

**Cambridge Report on Superconductivity:** Presents information and analysis of commercial applications of the latest technological advances—from concept to cash flow. Reports probe economic and technical opportunities; directions of industry and research leaders; progress in Japan, Europe and Israel; novel financial arrangements; impact of increasing government involvement; competitive implications of corporate research and joint venture developments; and investment options. Cambridge Report on Superconductivity, One Kendall Square, Suite 2200, Cambridge, MA 02139-9953; (800) 527-0230.

# Ion Beam Analysis Pair



RN8111 — True bipolar response current integrator with 10 pico-Coulomb quantization spanning  $-10\mu\text{A}$  to  $+10\mu\text{A}$ . Features sensitivity and accuracy and no range switching.

RN8309 — A rate meter designed for tuning and alignment. Displays **event rate**, **beam current**, and **yield** (events/nano-Coulomb) and on a separate scale the ratio of the rate, current or yield to the stored value.

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**INSTRUMENT CORP.**

P.O. BOX 100, WESTFIELD, N.J. 07091

**(201) 233-5427**

## Editor's Choice

Figures appearing in the EDITOR'S CHOICE are those arising from materials research which strike the editor's fancy as being aesthetically appealing and eye-catching. No further criteria are applied and none should be assumed. When taken out of context, such figures often evoke images beyond and unrelated to the original meaning. Submissions of candidate figures are welcome and should include a complete source citation, a photocopy of the report in which it appears (or will appear), and a reproduction-quality original drawing or photograph of the figure in question.



To the untrained eye, it could be anything—a close-up view of the tentacles of a sea anemone, the stamens at the heart of a flower, a ruptured multistranded electrical cable, or Nicalon<sup>1</sup> fibers protruding from the fracture surface of a reinforced magnesium-aluminum-silicate ceramic. The last is, of course, the case. The 100-micron scale marker in this figure from C. H. Drummond, III<sup>2</sup> shows that the silicon carbide fibers are from 10 to 15 microns in diameter. Passing a continuous fiber through an alkoxide-derived slurry of the Mg, Al and Si hydroxides, winding into tapes which are then fired ( $<50^{\circ}\text{C}$  to burn out organics), hot pressing to density, and crystallizing the silicate glass (to a cordierite phase), produces a ceramic composite with superior toughness (80–110 ksi in flexure and 70–80 ksi in direct tension). It fails gracefully rather than catastrophically as its brittle counterpart would.<sup>3</sup> The subtleties such as additions of oxides of lithium, niobium and zirconium to promote densification, nucleate crystallization and form the right fiber-matrix interphase layer so the pull-out (evident in the figure) occurs naturally are what make this advanced material really work.

<sup>1</sup>Nicalon is a trade name of Nippon Carbon Company (Japan) for an off stoichiometric silicon carbide yarn distributed in the U.S. by Dow Corning.

<sup>2</sup>*Phase Transitions in Condensed Systems—Experiments and Theory*, edited by G.S. Cargill III, F. Spaepen, and K-N. Tu, (Mater. Res. Soc. Symp. Proc. 57, Pittsburgh, PA, 1987), p.227.

<sup>3</sup>Technical details were graciously provided by the original source of the micrograph, E. Hermes, Wright-Patterson AFB, Ohio.