Lithium Oxide Eliminates Voltage Spikes in Long-Life Thermal Batteries

Scientists at Sandia National Laboratories have eliminated voltage spikes in long-life lithium alloy/iron disulfide thermal batteries by adding lithium oxide to the cathodes. The spikes are detrimental because many of the electronic components powered by thermal batteries operate in a very narrow voltage range.

Used in weapons and spacecraft, thermal batteries can remain inactive for 30 years or more before discharging their energy. They produce power for periods ranging from a few minutes to one hour. Unlike conventional batteries, thermal batteries have solid electrolytes that remain chemically inert until they are melted.

Sandia's thermal batteries contain an electrolyte consisting of lithium chloride and potassium chloride mixed with a powdered binder of magnesium oxide. After it is melted by the ignition of a pyrotechnic train, the electrolyte conducts lithium ions from the anode to the cathode. Electrochemical reactions occur within milliseconds, bringing the battery to full power within two seconds. The battery ceases operation when the electrolyte re-solidifies or when the electroactive components are exhausted in a reaction.

Heat-related conditions, oxidized iron compounds, and lithium activity associated with the iron disulfide in the cathode all contributed to voltage spikes. Scientists first controlled the rate of heat input to the battery and carefully purified the iron disulfide. Ned Godshall, one of the researchers, then suggested adding lithium to the cathode before discharge to "fix" the lithium activity. Lithium sulfide and lithium alloys of aluminum or silicon were found to eliminate the spikes, but lithium oxide reacted more rapidly and completely.

Evaluation of the lithiated cathode material began about three years ago and led to the issuance of two patents to the U.S. Department of Energy. A patent for the concept was issued in Godshall's name. The other patent, issued in Ronald A. Guidotti's name, was for the process.

Case Western Awarded NSF Grant for Diamond Research

The National Science Foundation announced the award of a Materials Research Group (MRG) grant to Case Western Reserve University for research in diamond and diamondlike materials. The $1.44 million three-year grant, under the direction of Prof. John C. Angus, will support the research of a group of five faculty.

The purpose of the grant is to provide a fundamental science base for emerging technologies in the low-pressure growth of diamond and diamondlike materials. Particular emphasis will be placed on obtaining a basic understanding of the elementary chemical and physical processes taking place during nucleation and subsequent growth of diamond from the vapor.

One unusual aspect of the MRG at Case Western is its relationship to the Edison Polymer Innovation Corporation, a research and development corporation supported by Ohio's Department of Development and over 70 corporations.

Bearing Alloy Demonstrates Superior Performance

Performance tests conducted by New Hampshire Material Laboratory demonstrate that a high carbon/high chromium alloy labeled "DD" provides "both enhanced corrosion resistance and superior bearing performance in small rolling contact bearings."

The laboratory report cites tests under the direction of Frederick G. Hochgraf, which show that "small races and balls made from alloy DD have hardness and corrosion resistance that equal or are slightly superior to AISI 440C." The tests also showed that absence of primary carbides in alloy DD assures superior rolling contact fatigue life, superior surface finish, lower noise, and lower finishing costs.

Additional tests conducted by New Hampshire Ball Bearings Inc. (NHBB), whose overseas affiliate in the Minebea Group of companies developed the material, demonstrate that the life expectancy of bearings made of the DD alloy exceeds that of 440C material by up to 100%, depending on loads.

NHBB is seeking patent protection for DD and expects to receive aircraft and

https://doi.org/10.1557/S0883769400060875 Published online by Cambridge University Press

other certifications for the material. The company has moved to the DD material for miniature bearings produced offshore on the basis of its quality and expects to begin producing U.S. manufactured bearings made of this alloy sometime in 1991.

D. Shaw Receives International GaAs Award and Welker Medal

Don W. Shaw, director of the Materials Science Laboratory at Texas Instruments, received the International Gallium Arsenide Symposium Award and the Welker Medal at a recent ceremony held in conjunction with the 16th International GaAs Symposium in Karuizawa, Japan. Shaw was recognized for his work on elucidating the mechanisms of epitaxial crystal growth using chemical vapor deposition. He is the sixth American to be honored in the award's 14-year history.

Shaw joined the Central Research Laboratories of Texas Instruments in 1965 shortly after receiving his PhD. His research areas have included crystal growth and dissolution mechanisms, kinetics of vapor phase epitaxial growth, materials for solid state microwave devices, and preparation and properties of gallium arsenide. He was elected to the National Academy of Engineering in 1988, and is an associate editor of the *Journal of Crystal Growth* and a divisional editor of the *Journal of the Electrochemical Society*. Shaw serves on the committees of several professional societies and is a member of the Materials Research Society. He is one of the organizers for the 1990 MRS Spring Meeting symposium on epitaxial heterostructures.

United Technologies/Argonne Sign Intellectual Property Rights Agreement

United Technologies Research Center (UTRC), East Hartford, Connecticut, has signed the first agreement regarding rights to intellectual property developed by the U.S. Department of Energy's Argonne National Laboratory, Illinois. The agreement concerns a joint research project between UTRC and Argonne's Superconductivity Pilot Center.

The agreement gives UTRC certain rights to inventions by Argonne scientists, in addition to the standard provision giving the U.S. government certain rights to UTRC inventions. The agreement was negotiated by the ARCH Development Corp., a private corporation created by Argonne and the University of Chicago to facilitate industrial access to intellectual property of Argonne and the university.

Specifics of the intellectual property agreement are proprietary, but it concerns rights to data and inventions arising from a joint research project between Argonne and UTRC to develop magnetic bearings using high temperature superconductors.

Applications Due for SPIE Educational Grants and Scholarships

SPIE, the International Society for Optical Engineering, will award more than $60,000 in grants to educational institutions and in scholarships to individual students in 1990. Applications for the awards will be accepted at SPIE through March 26, 1990.

The awards will range from $500 to $5,000 each. Grants to educational institutions are for academic use, including student travel and equipment purchases. Individual scholarship awards are for educational purposes, with final selections based on an assessment of the student's potential contributions to optical or optoelectronic applied science and engineering.

Applications for the 1990 awards are available by writing to: Warren J. Smith, SPIE Education Committee, P.O. Box 10, Bellingham, WA 98227-0010; telephone (206) 676-3290; fax (206) 647-1445.

Clarkson Breaks Ground for Advanced Materials Processing Center

Clarkson University officials broke ground on October 20 for what will be the largest building on the school's campus, the Center for Advanced Materials Processing (CAMP). Scheduled for completion in late 1991, the 173,500 ft² research center will integrate Clarkson's research facilities and laboratory space and encourage new collaborative efforts.

CAMP, an interdisciplinary, interdepartmental research initiative, has the primary mission of conducting innovative research on processing advanced materials of interest to industry. In 1986 and 1987, New York State appropriated $24.5 million to Clarkson for construction of the building.

The new facility will consist of two elements connected by a common area with reception and exhibit space. One element

https://doi.org/10.1557/S0883769400060875 Published online by Cambridge University Press

will house laboratories, offices of program directors, faculty researchers and staff, and also meeting rooms/classrooms. The other will contain a pilot plant, two darkrooms, several labs, and mechanical and electrical equipment rooms. Also to be located within the CAMP building is a Minority-Technology Development Center to coordinate public and private programs to increase minority participation rates of Blacks, Hispanics, Native Americans and others in science and engineering at Clarkson.

Cray Gives Supercomputer Time to NSF Science and Technology Centers

Cray Research, Inc. will donate 2,800 hours of supercomputer time, valued at approximately $4 million, to the National Science Foundation's recently established Science and Technology Centers (STCs). The company has reserved time on a CRAY-2 supercomputer to be made freely available to researchers at all 11 NSF Science and Technology Centers during the first year of the agreement.

Researchers at nearly all STCs, created to foster multidisciplinary research on fundamental research problems across the sciences, already use supercomputers to run model simulations that probe the physical world on scales ranging from the infinitesimal to the infinite. At the NSF Center for Photo-Induced Charge Transfer at the University of Rochester, for example, scientists use supercomputers to solve equations describing how light moves through and affects molecular clusters of materials that may be used in photographic films, copiers, printers, data storage, and photovoltaic processes. At the University of Illinois NSF Center for High Temperature Superconductivity, researchers are using supercomputers in efforts to describe superconducting states of matter. Rice University investigators are looking at new, more powerful ways to model the dynamics of the Earth's crust.

"By supporting the Science and Technology Centers program, Cray Research expects to accelerate the process of transferring technology from universities to industry, which we believe will have a positive impact on U.S. competitiveness," said Carlos Marino, director of Industry, Science and Technology for Cray Research. Cray Research contributes more than $9 million yearly to universities through its Research and Development Grant Program.

"Our success has depended on our ability to demonstrate the value of computational methods to research. Increasingly, computational research is being accepted as a third branch of discovery, complementing the traditional approaches of experimentation and theory," he continued.

A.S. Nowick Honored for Contributions to Study of Internal Dynamics of Solids

Arthur S. Nowick, professor of metallurgy at Columbia's School of Engineering and Applied Science, has been honored for his contributions to the study of inter-

https://doi.org/10.1557/S0883769400060875 Published online by Cambridge University Press

nal friction in solids. The International Conference on Internal Friction and Ultrasonic Attenuation in Solids (ICIFUAS) awarded him a medal and a citation for his achievements.

Nowick, co-author of *Anelastic Relaxation in Crystalline Solids,* is a recognized authority on the damping of vibrations in materials and structures. His work has furthered understanding of the structure of material at the atomic level and has practical implications for durability of engineering structures.

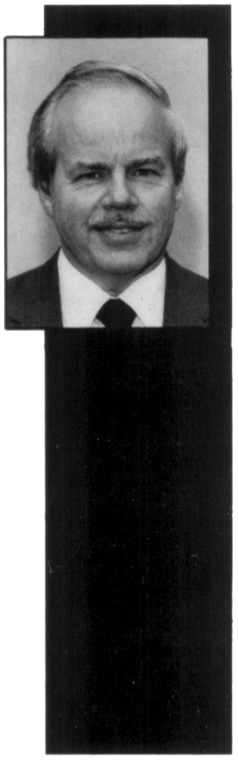
Nowick, who has taught at Columbia since 1966, earned his bachelor's degree at Brooklyn College and holds master's and doctoral degrees from Columbia University. In addition to his teaching duties, he has been editor of the materials science series for Academic Press. His research has been sponsored by the Department of Energy and the U.S. Air Force, among others. A member of MRS, he is also former chairman of ICIFUAS and a fellow of the American Physical Society and the American Institute of Mining Engineers.

IBM Demonstrates Densest Chip for High-Speed Computer Optics

Scientists at IBM Yorktown Heights have demonstrated two experimental computer chips for transmitting and receiving data over fiber optic lines at speeds of a billion bits per second. They believe the receiver chip is the densest optoelectronic chip ever reported.

One fingernail-size "receiver" holds 50 times more optical and electronic components than ever previously assembled on a chip for the optoelectronic receiving and processing of data. The receiver chip contains more than 8,000 transistors with characteristic features as small as 1 micron. The ability to provide the transmitting and receiving functions on a two-chip "set" creates the potential for more reliable, faster, and less expensive data communications, say the IBM scientists.

The new chips are made from gallium arsenide, and a GaAs injection laser array that employs quantum well technology is used to create the light pulses.



Herbert H. Johnson

Herbert H. Johnson, professor of materials science and engineering at Cornell University, died October 1, 1989 of cancer.

Johnson was an assistant professor of metallurgy at Lehigh University before joining the Cornell Faculty in 1960. He was also on the faculty at the Materials Science Center and the National Resource and Research Facility for Submicron Structures at Cornell. He was chairman of the Department of Materials Science and Engineering from 1970-1974 and director of the Materials Science Center from 1974-1984.

Johnson received his BS in physics in 1952 from Case Institute of Technology and his MS (1954) and PhD (1957) in physical metallurgy, also from Case. His research interests spanned hydrogen in metals, phase stability, thermodynamics of solids, and corrosion.

A fellow of the American Society for Metals, Johnson was also a member of The Mineral, Metals & Materials Society, American Physical Society, American Association for the Advancement of Science, and the National Academy of Engineering. He was a member and councillor (1986-1989) of the Materials Research Society and served in numerous advisory capacities for national laboratories, university and other educational panels, and industrial firms. He was chair (1987-1989) of the Solid State Sciences Committee of the National Research Council.

MRS Members Serve ASM International

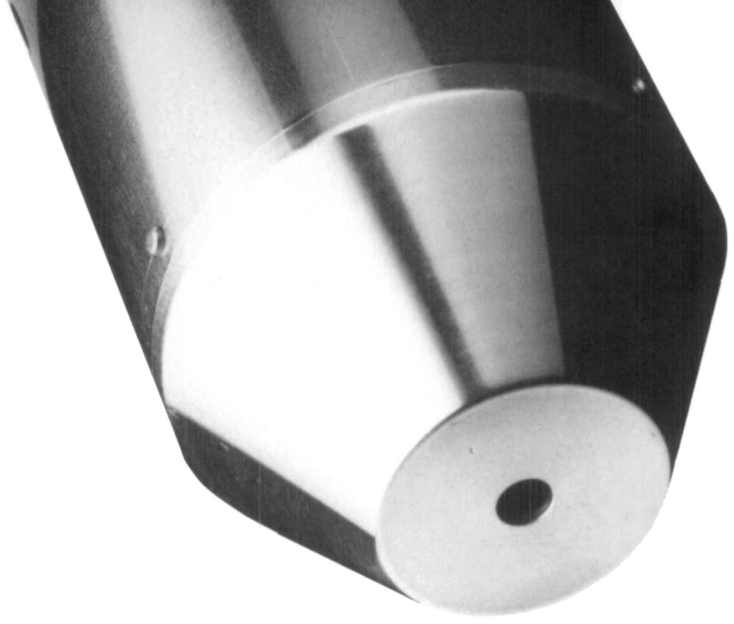
Three members of the Materials Research Society were selected to serve ASM International in various capacities.

Klaus M. Zwilsky, staff director of the National Materials Advisory Board since 1981, was installed as ASM's president for the 1989-1990 term. Zwilsky spent six years in industry before he entered government service in 1964 as chief of the Alloy Development of the Navy Ships Research and Development Center. From 1967 to 1981, Zwilsky worked for the Atomic Energy Commission and its successor organizations, the last eight years as chief of the Materials and Radiation Effects Branch, Office of Fusion Energy. He helped establish the U.S. Fusion Materials Program.

Stephen M. Copley, a professor in the Departments of Materials Science and Mechanical Engineering and also the Kenneth T. Norris Professor of Metallurgical Engineering at the University of Southern California, was elected to serve ASM as vice president and trustee for the 1989-1990 term. He will automatically become president of ASM for the 1990-1991 term. At the University of Southern California, Copley has served three terms as chairman of the Materials Science Department and has developed degree programs in materials engineering and manufacturing engineering. Since organizing the National Science Foundation sponsored workshop on "Needs and Opportunities for Basic Research on Laser-Materials Interactions" in 1976, he has concentrated his research in that area.

Jagdish Narayan, professor of electronic materials in the Department of Materials Science and Engineering, North Carolina State University, Raleigh, North Carolina, was named a fellow of ASM International. He was honored "for pioneering research in transient thermal processing and for development of novel materials, structures and relationships between defects and physical properties of materials." Narayan's most recent research involves the deposition of superconducting thin films that can carry 6 million amperes at 77 K. Formerly director of materials research (1984-1986) at the Microelectronics Center of North Carolina, Narayan has served MRS as a meeting chair (1984), councillor (1985-1987), and symposium organizer for the 1989 MRS Fall Meeting symposium on high temperature superconductors. □

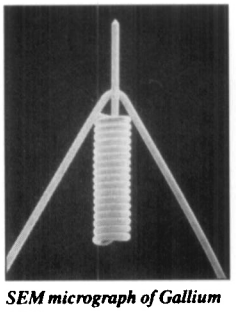
https://doi.org/10.1557/S0883769400060875 Published online by Cambridge University Press



We've Made It Easier To Focus Your Energies On A Nano Scale.

Focused Ion Beam Columns

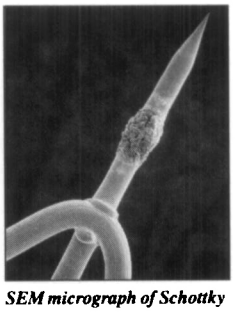
Choose a single-lens 25KeV gun that delivers spot diameters down to 100nm. Or a two-lens gun that puts up to 3 A/cm² on a spot as small as 25nm. Our high-stability liquid metal ion sources are simply the best in the business.



SEM micrograph of Gallium LMI source.

FEI Focused Ion Beam Columns are designed for use in Time-of-Flight SIMS, Auger Depth Profiling, Quantum Structure Fabrication, SIMS Imaging, Micro Cross-Sectioning, Integrated Circuit Repair, and Area- Selective Material Deposition, among others.

Focused Electron Beam Columns



SEM micrograph of Schottky field emission cathode.

Choose a single-lens 25KeV gun that delivers spot diameters down to 50nm. Or a two-lens gun that puts up to 3000 A/cm² on a spot as small as 15nm. Schottky cathodes provide improved field emission with excellent current stability and high brightness.

FEI Focused Electron Beam Columns are designed for use in Scanning Auger Microscopy, In Situ SEM, Electron Beam Lithography, E-beam Induced Deposition and RHEED, among others.

FEI focusing columns install easily on virtually any vacuum system.
Standard flange mounts are 4½-inch or 6-inch Conflat type.
Beam diameter is relatively insensitive to working distance, providing easier access to your specimen without sacrificing beam performance, even on very crowded vacuum systems.
For more information, call or write today.
You'll find FEI's 18 years of research and successful applications of field emission technology make it easier than ever to focus your energies.

FEI Company
19500 N.W. Gibbs Drive, Suite 100
Beaverton, OR 97006-6907
(503) 690-1500 FAX (503) 690-1509

https://doi.org/10.1557/S0883769400060875 Published online by Cambridge University Press