



# Rare-earth Information Center NEWS

Ames Laboratory  
Institute for Physical Research and Technology  
Iowa State University / Ames, Iowa 50011-3020 / U.S.A.

Volume XXXI

March 1, 1996

No. 1



Karl Gschneidner turning over Directorship of the Rare-earth Information Center to R. William McCallum on February 1, 1996.

## New Era Begins

After more than 30 years directing the Rare-earth Information Center, Dr. Karl A. Gschneidner, Jr. turned over the reins of RIC by the symbolic passing of the renowned RIC logo to his successor, Dr. R. William (Bill) McCallum in ceremonies held at Ames Laboratory January 31, 1996.

Bill McCallum received his bachelor degree in mathematics and physics from Carleton College, Northfield, Minnesota, in 1969 and his M.S. (in 1973) and Ph.D. (in 1977) in physics from the University of California-San Diego (UCSD), where he worked with Prof. M. Brian Maple. Following an National Science Foundation postdoctoral fellowship at UCSD, he became a staff member of the Institut für Festkörperforschung der Kernforschungsanlage Jülich in Jülich, Germany, from 1978 to 1982. From 1982 to 1986 he was a senior research physicist with Energy Conservation Devices in Troy, Michigan. In 1986 he joined Ames Labora-

tory, Iowa State University, as a senior metallurgist. He is also an adjunct professor of the Department of Materials Science and Engineering at Iowa State University.

Bill's interest in rare earth materials began with his thesis work on the interaction of superconductivity and magnetism in  $(LaPr)Sn_3$  and  $RMo_6Se_8$  materials. His research has been mainly in the area of magnetic and electronic properties of complex rare earth compounds with particular emphasis on high temperature superconductors and rare earth permanent magnet materials. Recently, his research has focused on the effects of processing on the microstructure and the extrinsic properties of superconducting and magnetic materials. Bill holds patents in such diverse areas as metal hydride batteries, quasicrystals and permanent magnets.

Prof. Gschneidner has been planning to step down for the past few years to devote

more time to research, but stayed on to help expand RIC's mission to include a research and technology component. The name of the Center is now the Center for Rare Earths and Magnetics (CREM) and it consists of three units: The Rare-earth Information Center, a Rare Earth Technology Unit and a Magnetics Research Unit. This change in RIC's objectives and expanded role was approved on January 17, 1996 by the Iowa Board of Regents. RIC's functions within CREM will essentially remain the same as in the past. Dr. W.R. McCallum will head CREM as well as RIC, while Dr. Timothy W. Ellis will supervise the Rare Earth Technology Unit and Dr. Karl A. Gschneidner will be in charge of the Magnetics Research Unit. A brief description of CREM and its three units can be obtained by contacting RIC. ▲

## Nominations Open for 8<sup>th</sup> Spedding Award

The 8th Frank H. Spedding Award will be presented at the 21st Rare Earth Research Conference, July 5-12, 1996, in Duluth, Minnesota. This prestigious award is given in recognition of distinguished contributions to the basic science and/or technology of rare earth materials. The award is presented by the Rare Earth Research Conference, Incorporated, with the financial support of Rhône-Poulenc Industries.

Nominations are sought from the worldwide rare earth community. An individual may nominate more than one person for the Award, or may propose a joint-Award for a group of leaders in a particular subfield. Seconding letters are encouraged, especially if they cover information complementary to the nominating letter.

Send nominations to Dr. Herbert B. Silber by April 15, 1996. His address is Chemistry Department, San Jose State University, San Jose, CA 95192-0101 USA; Tel: 408 924 4954; Fax: 408 924 4945; E-mail: hbsilber@sjsuvm1.sjsu.edu. ▲

## Polymer Bonded Magnets 96

The third international conference "The Business and Technical Outlook for Polymer Bonded Magnets 96" will be held on April 22-24, 1996 in Atlanta, Georgia, USA. The purpose of the conference is to bring together raw material suppliers, polymer compounders, magnet producers, equipment designers, end users and applications specialists to assess the business and technical outlook for polymer bonded magnets in the decade ahead. Emphasis will be on new products, new materials, new process developments and emerging new business opportunities. Extrusion, calendaring, injection molding and compression molding will be covered. Attendees will receive a balanced assessment of where the industry is heading and where the new business opportunities are.

The current global market for permanent magnets amounts to \$3.2 billion US. Polymer bonded NdFeB magnets will enjoy annual growth rates of 25-30% and are forecast to have annual sales exceeding \$2 billion US by 2005.

To receive a conference brochure contact Jennifer Winch, Gorham/Intertech Consulting, 411 US Route One, Portland, ME 04105 USA; Tel: 207 781 9800; Fax: 207 781 2150. ▲

## Conference Calendar

### \* A NEWS STORY THIS ISSUE

#### March '96

*Rare Earth and Transition Metals Integrated with Semiconductors*

St. Louis, Missouri, USA

March 18-22, 1996

\*This issue

#### April '96

*1996 MRS Spring Meeting, Symposium D: Rare Earth Doped Semiconductors*

San Francisco, California, USA

April 8-12, 1996

RIC News, XXX, [4] 2 (1995)

*The Business and Technical Outlook for Polymer Bonded Magnets 96*

Atlanta, Georgia, USA

April 22-24, 1996

\*This issue

#### MORIS '96

*Noordwijkerhout, The Netherlands*

April 29 - May 2, 1996

RIC News XXX, [3] 2 (1995)

#### July '96

*NATO ASI: Magnetic Hysteresis in Novel Magnetic Materials*

Greece

July 1-12, 1996

\*This issue

*Twenty First Rare Earth Research Conference (21<sup>st</sup> RERC)*

Duluth, Minnesota, USA

July 7-12, 1996

RIC News, XXX, [2] 1 (1995)

## APS March Meeting

The American Physical Society will hold its Spring Meeting March 18-22, 1996 in St. Louis, Missouri, USA and has scheduled a focused session entitled "Rare Earth and Transition Metals Integrated with Semiconductors". The session will concentrate on theory and experimental results on the fundamental understanding of rare earth-based and related transition metal-based systems; their structure; optical, electrical, and magnetic properties; excitation dynamics; interface characteristics; source materials; epitaxial growth approaches; and device potential.

For more information, contact Chris

*Continued in next column* ◊

#### September '96

*Fourteenth International Workshop on Rare-Earth Magnets and Their Applications and Ninth International Symposium on Magnetic Anisotropy and Coercivity in Rare-Earth Transition Metal Alloys*

São Paulo, SP, Brazil

September 1-5, 1996

RIC News, XXX, [1] 2 (1995)

*International Conference on Substrate Crystals and HTSC Thin Films (ICSC-F'96)*

Szczyrk, Poland

September 16-20, 1996

RIC News XXX, [3] 2 (1995)

#### October '96

*Solidification and Powder Processing of Rare Earth-Based Materials*

Cincinnati, OH, USA

October 6-10, 1996

RIC News XXX, [3] 2 (1995)

#### November '96

*International Conference on Giant-Magnetostrictive Materials (ICGMM'96)*

Honolulu, Hawaii, USA

November 6-8, 1996

\*This issue

## NATO ASI

The NATO ASI symposium "Magnetic Hysteresis in Novel Magnetic Structures" will be held July 1-12, 1996 on an island in Greece (location to be determined). For details, contact G.C. Hadjipanayis, University of Delaware, Department of Physics & Astronomy, Newark, DE 19716-2570; Tel 302 831 2736; Fax: 302 831 1637; E-mail hadji@udel.edu. ▲

Palmstrom, Chemical Engineering & Materials Science, 151 Amundson Hall, 421 Washington Avenue S.E., University of Minnesota, Minneapolis, MN 55455 USA; Tel 612 625 7558; Fax: 612 626 7246; E-mail palms001@gold.tc.umn.edu. ▲

## Ln/An Workshop Proceedings

A three-day workshop to promote the contact and cooperation between the disciplines of lanthanide and actinide research was held at Bühlerhöhe, Germany, July 28-30, 1994. In addition, it is recognized that there are at least two sub-communities that would benefit from increased cooperation - the solution and solid state groups. A major goal was to increase the interaction between these groups, as well as with other researchers of *f*-element science. The meeting was important because of the growing interest and potential economic importance of lanthanide and actinide materials in nuclear processing and handling of nuclear waste, as well as their increased utilization in medical, industrial, and research applications.

The proceedings to this workshop is published as "Topical Issue of the Comparative Science of the *f*-Elements" and appeared as *J. Alloys and Compounds*, Volume 223, [2] (1995). The issue is comprised of 16 papers that present interdisciplinary topics between the physics and chemistry, and between solid state science and solution chemistry. Among the topics presented in the volume are: systematics in lanthanide and actinide solids as well as structural systematics of 4*f* and 5*f* elements under pressure; crystal and electronic structure connections between the 4*f* and 5*f* transition metals; comparative aspects of the high-pressure behavior of lanthanide and actinide compounds; bulk and surface electronic structure of lanthanide metals; and comparison of the frequencies of crystallographic space groups in organo-lanthanide and -actinide compounds.

The 295-page "Topical Issue on Comparative Science of the *f*-Elements" is edited by U. Benedict and G.R. Choppin, and published by Elsevier Science Inc. The issue contains author and subject indices and is available for \$150.00 US. To order in North America, contact the Journal Information Center, 655 Avenue of the Americas, New York, NY 10010 USA; Tel: 212 633 3750; Fax: 212 633 3764; Elsewhere: Elsevier Science S.A., P.O. Box 564, 1001 Lausanne, Switzerland; Tel: 41 21 320 73 81; Fax: 41 21 323 54 44. ▲

**PROMETHIUM**, atomic number 61, was discovered in 1947 by J.A. Marinsky, L.E. Glendenin, and C.D. Coryell in the fission products of uranium. The name, from Greek mythology, was derived from Prometheus, who stole fire from heaven and gave it to man.

## ICN'94 Proceedings

The International Conference on Nitromagnetics (ICN'94) was held in Honolulu, Hawaii, June 15-17, 1994, and dealt with the ongoing research and development of nitrogen-modified hard and soft magnetic materials. The proceedings of ICN'94 contain 39 papers, of which 32 deal directly with rare earth magnetic materials.

ICN'94 was a response to three main areas of concern. First, new hard magnetic materials have been developed in a successive cycle every decade which led to the creation of new devices which had been previously thought of as impossible to create. The recent findings of the noteworthy magnetic properties by the interstitial modification of rare earth intermetallics with nitrogen and/or carbon, has driven many researchers to attempt to develop super-power magnets. Secondly, the metastable  $\alpha$ -Fe<sub>16</sub>N<sub>2</sub> is attracting its share of scientific interest because of the phenomenon of the giant magnetic moment of this nitride phase. Thirdly, since many materials containing nitrogen have a high magnetic permeability, with a fine structure and a high magnetic saturation, it is expected that their use will rapidly increase in the next generation of new hard magnetic materials.

The proceedings contains two chapters. The first chapter includes 32 papers that deal with hard magnetic materials and related phenomena. A review of bonded magnets in Japan will interest those who want to know the status of the state of the industry in that country. Studies on high performance Sm<sub>2</sub>Fe<sub>17</sub>N<sub>2</sub> permanent magnets, particularly production methods, alloy composition, and phase composition are included. The second chapter deals mostly with non-rare earth soft magnetic materials.

The proceedings of the International Conference on Nitromagnetics, ICN'94, were published as Volume 222 of *J. Alloys & Compds.*, (1995) and were edited by H. Kaneko and H. Uchida. The 202-page soft cover proceedings are available for \$299.00 US by contacting Elsevier Science S.A., P.O. Box 564, 1001 Lausanne, Switzerland; Tel: 41 21 320 73 81; Fax: 41 21 323 54 44. Customers in the USA and Canada may obtain information from Elsevier Science Inc., Journal Information Center, 655 Avenue of the Americas, New York, NY 10010, USA; Tel: 212 633 3750; Fax: 212 633 3764. ▲

## SCES '94 Proceedings

The International Conference on Strongly Correlated Electron Systems (SCES '94) was held in Amsterdam, The Netherlands, August 15-18, 1994. The scope of SCES '94 comprised the general features of electron and spin excitations of strongly correlated systems, specific properties of metallic systems (mainly heavy fermion compounds) and semiconductors, and some aspects of superconductivity. The conference was attended by about 310 scientists from 22 countries. A total of 330 papers were presented at the conference, with 254 being included in *Proceedings of the International Conference on Strongly Correlated Electron Systems SCES '94, Physica B 206/207* (February 1, 1995). Of the 254 papers in the *Proceedings*, 132 specifically contain information on rare earth alloys and compounds.

The papers have been assigned to five chapters according to their content. The first chapter, "Electrons and Spins in Strongly Correlated Systems" includes the topics of Fermi surfaces of rare earth intermetallic compounds, spin fluctuations in paramagnetic compounds, and neutron scattering studies. Chapter two, "Metallic Systems, Mainly Heavy Fermions" is broken down into papers that report on theory, cerium compounds, ytterbium compounds, other rare earth systems, uranium compounds, and other actinide systems. The third chapter, "Superconductivity" covers miscellaneous research on superconductors and superconductivity, heavy fermion systems, and high-T<sub>c</sub> cuprates. The fourth chapter, "Semiconductors and Insulators; Metal-Insulator Transitions" covers, among other topics, optical spectra, transport properties, gap formation, thermal expansion of a Kondo insulator, and the thermopower of CeNiSn under a magnetic field. The conference summaries are contained in chapter five. The book contains author and subject indexes.

The 880-page hard cover *Proceedings of the International Conference on Strongly Correlated Electron Systems SCES '94* was published in 1995 and is available for \$465.00 US by contacting Elsevier Science B.V., P.O. Box 839, 1000 AV Amsterdam, The Netherlands; Fax: 31 20 485 2886. Customers in the US and Canada should contact Elsevier Science B.V., P.O. Box 945, New York, NY 10159-0945 USA; Fax: 212 633 3764. ▲

## EMMA '95 by R. Grössinger

Technical University of Vienna  
Vienna, Austria

The European Magnetic Materials and Applications Conference (EMMA'95) was held September 4-8, 1996 at the Technical University in Vienna. About 500 participants from 31 countries presented about 530 papers. The EMMA, originally founded as an European InterMag conference, has been opened to scientists from Japan, USA and other countries. 250 participants from the former Soviet Union took part at the EMMA conference, of which 153 were supported by the European Community, including the Austrian ministries of Science and Economy, and the Austrian Science Society. Another success of the meeting was the desired cooperation between industrial and university research as 15% of the participants came from industry. In addition, 20 companies presented their products at a local exhibition and by advertisements. The strong trend in international cooperation was evident by the fact that more than half of the papers were the result of international cooperation. More than 300 will be published in the proceedings which will appear as a future issue of *J. Magn. Magn. Mater.*

The goal of EMMA'95 was to have highly qualified speakers present papers on different subjects of applied and basic magnetism. Everybody had the opportunity to attend these lectures as parallel sessions were avoided. The more specialized papers were presented as posters, with about 130 posters which being presented each afternoon. The invited presentations were: nanocrystalline exchange-enhanced hard magnetic alloys; hard magnetic materials-mechanically alloying; numerical micromagnetics for granular magnetic materials; noise and stability of magnetic sensors; application of rare earth permanent magnets; magnetic anisotropy in thin films; modelling of interaction effects in fine particle systems; anisotropy magnetostriction and local chemical order in amorphous  $Tb_{1-x}Fe_x$  ( $0.1 < x < 0.55$ ) thin films; effect of magnetic structure on giant magneto-impedance in Co-rich amorphous alloys; high resolution magnetic imaging based on scanning probe techniques; high field studies at the Tsukuba Magnet Laboratories; magnetic interactions in  $ThMn_{12}$  type rare earth transition-metal compounds; heavy-Fermion alloy at magnetic instability; disordered

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## RARE EARTHS IN BAOTOU by J.-C. Bünzli

Université de Lausanne  
Lausanne, Switzerland

During a nice and sunny week of August, Baotou, the Inner Mongolian city with a population of more than one million, and which calls itself the Capital of Rare Earths, hosted the Third International Conference on Rare Earth Development and Applications (ICRE). More than 160 scientists attended the meeting, about 100 originating from China and 60 from foreign countries. Asia and Europe sent the largest delegations (23 and 22 members, respectively).

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**EMMA '95/Continued from previous column** ◊

magnetism and spin glasses; nanocrystalline soft magnetic materials; and advances in FeSi properties and their interpretation.

The topics presented at the EMMA showed a balanced mixture of applied and basic research on the field of magnetism. The subject of applied magnetism covered hard and soft magnetic materials and introduced a new family of nanocrystalline materials, which exhibits outstanding and interesting magnetic properties. The new material is comprised of nanosized crystals which are embedded in a matrix. Improved properties are obtained because the magnetic coupling overcomes the grain boundaries, which leads to better magnetic properties such as lower coercivity for soft magnetic materials or an enhanced remanence for hard magnetic materials.

The significance of new production technologies, such as rapidly quenching or mechanical alloying, was demonstrated. A deeper understanding of the magnetic properties of thin films should lead to a breakthrough for new applications. The importance of magnetic recording in electronics applications is unquestionable. New effects such as magneto-impedance of soft magnetic amorphous materials make these new materials candidates for highly sensitive magnetic field sensors. Besides these applied topics, basic studies, such as heavy Fermion systems, were discussed and also included an overview on magnetically disordered systems.

The intensive exchange of information and research results between the attending scientists, along with the different presentations, may lead to new joint research ventures and helped make the EMMA'95 a successful conference. ▲

Baotou is situated about 150 km south of the famous Baiyunebo mineral deposit, a resource containing an uncommon mixture of iron, rare earth, niobium and scandium ore. This deposit is the largest rare earth deposit in the world, with a proven reserve of 3 million tons of rare earths. The Baotou Iron & Steel Company (BISC) which employ 120,000 workers produces 3.5 million ton of steel per year. During these operation 30,000 tons of rare earth concentrate are generated, which contains between 49 and 59% of rare earth oxides.

The opening ceremony of the Conference took place on Monday, August 21 in the Baotou International Convention Centre. The attendees heard speeches by Zhou Chuandian, President of the Chinese Society of Rare Earths (CSRE), Hu Zhong Mayor of Baotou, and Zeng Guoan, General Manager of BISC, as well as plenary lecture by professors LeRoy Eyring (Arizona State University), Jean-Claude G. Bünzli (University of Lausanne), Gin-Ya Adachi (Osaka University) and Yan Chunhua (Beijing University). The next day, the Conference moved to the Qing Shan Hotel, where the participants were hosted, and where three parallel sessions were held: New Materials Rare-Earth Chemistry, and Rare-Earth Resources and Metallurgy. The oral sessions were well attended, whereas the poster sessions had less attractivity since many authors did not dare to present their contribution.

In addition to a well designed scientific program, the attendees enjoyed many social events. A dinner was offered by the Municipality of Baotou, which was one of the main sponsors of the meeting, two local singing and dancing performances were held in the Baotou Municipal Theater, with special reference to the 3rd ICRE. Moreover, several visits were organized: the BISC, the Rare-Earth Research Institute, the Luyuan Cashmere Factory, and the Municipal Exhibition Hall where an exhibit on rare earth extraction and applications was organized in 1994 to celebrate the 200th anniversary of the discovery of yttrium. Finally, a forum gave the occasion to more than 100 delegates to hear about the major Chinese rare earth companies and to discuss with their leaders.

The atmosphere was very friendly and attendees will long recall the warm hospitality of Inner Mongolia and the fruitful scientific exchanges. The CSRE counts more than 3,000 individual and 60 corporate members. Its officers have come up with a fine job in organizing the 3rd ICRE in Baotou. ▲

## Electroluminescence in Rare Earth Phosphors

Since the first powder electroluminescent phosphor was produced in 1936, there have been many developments and uses of phosphors for a multitude of industrial, commercial and consumer applications. Currently, there is a large portion of the worldwide rare earth market that is related to phosphors and electroluminescent materials, which generates considerable interest in this field.

The electroluminescence of rare earth doped materials are reviewed in a paper by M. Godlewski and M. Leskelä entitled "Excitation and Recombination Processes During Electroluminescence of Rare Earth-Activated Materials". The review appeared in *Crit. Rev. Solid State Mater. Sci.*, 19, [4], 199-239 (1994) and places emphasis on the basic physics of electroluminescence processes by the direct and indirect excitation of nonradiative and radiative recombination of rare earth ions. The structures of various electroluminescent structures are reviewed as well.

Although the basic physics of high-field electroluminescence is not very well known, the physical processes that are responsible for generating electroluminescence in a device are: 1) generation of charge carriers, 2) acceleration of charge carriers in the electric field, 3) excitation of the activator ions by various mechanisms, 4) relaxation of the excited state toward the ground state, and 5) outcoupling of the emitted light from the device. A common configuration for electroluminescent thin films is the layering of materials to form a miniature "sandwich" to make a metal-insulator-semiconductor-insulator-metal structure. This sandwich is then deposited on a glass substrate. Although there are many phenomena occurring in these structures, such as electric fields in semiconductors, tunnel emission, avalanche, etc., the authors in this review have concentrated on excitation and relaxation processes.

The paper describes the general properties of rare earth ions, selection rules for rare earth excitation and recombination, phosphor materials used in electroluminescence, emission spectra of blue phosphors, heating and impact excitation mechanisms and processes, lumocens (complex centers that are essential for impact excitation in electroluminescent structures), ionization processes and transitions, carrier trapping and bind-

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The International Conference on Giant-Magnetostrictive Materials 1996 -Fundamentals and Application- (ICGMM'96) will be held November 6-8, 1996 at the Tokai University Pacific Center, Honolulu, HI, U.S.A. Since the last meeting in 1992, there have been many new advances in bulk giant magnetostrictive materials (GMM), and the research and development of micromachine technology has made remarkable progress. In addition, micromachine technology and microelectronics are becoming increasingly integrated, yielding a new concept of "Microsystem Technology" in which GMM thin films may play an important role.

The conference will cover topics including: 1) fundamental aspects of magneto-elastic interactions, *A<sub>f</sub>-d* interactions and giant magnetostriction, and electron models; 2) Terfenol-D, new materials and composites, production and machining processes; 3) new devices and systems, design and requirement for application; 4) thin films, preparation and production processes, characterization, magnetic and magneto-elastic properties, methods of measurement and assessment of magnetostriction, application and devices; and 5) simulations and models, material design, components and systems, numerical and empirical models, and magnetic circuit design.

For more information, contact Mr. Tsunehisa Kurino, Secretariat of ICGMM'96, The Society of Non-Traditional Technology, 1-2-8, Toranomon, Minato-ku, Tokyo 105, Japan; Tel: 81 3 3503 4681; Fax: 81 3 3597 0535; E-mail: sntmto@po.iijnet.or.jp. ▲

**Electroluminescence** | *Continued from previous column* ↻

ing, and photoluminescence excitation mechanisms. Nonradiative recombination processes such as one-center Auger recombination and thermal and electric field-induced deactivation are covered as well.

The paper includes two tables which contain information on the electronic configuration of the ground state of the lanthanides as well as the emission, luminance, luminous efficiency, and color coordinates of rare earth thin film electroluminescent phosphors. Twenty-three figures illustrate various properties, structures, and processes of electroluminescence that the authors thoughtfully included in the review. The paper includes 167 references. ▲

## National Technology Awards

Each year, since its establishment by Congress in 1980, a National Medal of Technology is awarded in honor of technological achievement. The nation's highest honor in 1995 went to three IBM researchers for "their discovery and development of a new class of amorphous magnetic materials that are the basis of erasable read-write, optical storage technology, now the foundation of the worldwide magneto-optic disk industry."

Praveen Chaudhari, Jerome J. Cuomo and Richard J. Gambino of the IBM Thomas J. Watson Research Center, Yorktown Heights, New York, invented the rare earth-cobalt based magneto-optic storage alloys that are the basis for the worldwide \$2 billion US market for erasable optical storage. Their work has had a major impact on the computer industry and the businesses that it serves.

Chaudhari received his doctoral degree from Massachusetts Institute of technology in 1966. He joined IBM that year and has been a key figure in some of the company's most advanced science and technology developments. Cuomo received his M.S. from St. John's University in 1960 and his Ph.D. from Odense University in Denmark in 1979. He is now a Professor in the Materials Science and Engineering Department at North Carolina State University, Raleigh. Gambino received his M.S. degree from the Polytechnic Institute of New York in 1976 and is now a professor in the Materials Science and Engineering Department at the State University of New York at Stony Brook. ▲



Praveen Chaudhari



Jerome J. Cuomo



Richard J. Gambino

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Praveen Chaudhari



Jerome J. Cuomo



Richard J. Gambino

## Molycorp Technical Services

The Technical Services department of Molycorp, Inc. has moved to a new address. The Manager of Technical Services, Edmund C. Barnum, can be reached at: Molycorp, Inc., a Unocal Company, 376 South Valencia Avenue, Brea, CA 92621 USA; Tel: 714 577 1755; Fax: 714 577 2783. ▲

## RE Metals and Oxides Available

Charlotte Square Capital Ventures announces the availability of rare earth metals and rare earth oxides. For a complete listing of rare earth metals and compounds for sale, contact the company at the following address: 1300 Bristol Street North, Suite 200, Newport Beach, CA 92660 USA; Tel: 714 252 0400; Fax: 714 252 1405. ▲

## Neomet Corporation

The following personnel changes took place November 16, 1995 at Neomet Corporation: President - Mr. Takehiko Nagai; Executive Vice President - Mr. Thomas M. Mackey. For more information contact Neomet Corporation, P.O. Box 425, Edinburg, PA 16116 USA; Tel: 412 667 3000; Fax: 412 667 3001. ▲

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## Baotou Steel & Rare Earth Co. (USA)

Baotou Steel & Rare Earth Co. (USA) Inc. and China Metallurgical Import and Export Baogang Co. (USA) announces that Mr. Guowei Yin has accepted the position of President. The companies offer rare earth metals, alloys and compounds to markets around the world. Baotou Iron & Steel Co. owns the Baiyunebo rare earth deposit in Inner Mongolia and the rare earth production facilities in Baotou, and the Baotou Research Institute of Rare Earth (BRIRE). The U.S. subsidiary, Baotou Steel & Rare Earth Co. (USA) is located in California and offers rare earth oxide, concentrate, mixed and individual rare earth compounds, rare earth metals and alloys, including mischmetal, silicide ferroalloy and permanent magnet materials. The company can also provide the China Rare Earth Information Center's newsletter *China Rare Earth Information* to readers around the world.

For more information, contact Mr. Weiji Cui, Baotou Steel & Rare Earth Co. (USA), 520 El Camino Real, Suite 228, San Mateo, CA 94402 USA; Tel: 415 343 6644; Fax: 415 343 6266. ▲

## New President at BRIRE

Mr. Wang Ziren has been appointed the new President of Baotou Research Institute of Rare Earth (BRIRE), the Vice President of Baotou Iron and Steel Company (BISC) and the Director of BISC Rare Earth Group. He is responsible for overall rare earth research, development and production of rare earths at BISC. He succeeds Ms. Hu Yulin, who was promoted to Vice President of BISC.

Mr. Ziren has worked for BISC since 1966 as a metallurgist and later as a senior engineer. He was Vice-Controller of BISC in 1985, then served as Manager of the refinery plant of BISC and the Chief Controller of BISC in 1991 where he was in charge of the organization and coordination of rare earth production at BISC. ▲

## Telex Services No Longer Available

The Rare-earth Information Center will no longer be able to receive messages via Telex as we no longer subscribe to Telex Services. The Center can still be reached by writing to our address listed on the masthead; by telephone: 515 294 2272; Fax: 515 294 3709; or E-mail: RIC@ameslab.gov. ▲

## Allan Roy Mackintosh (1936-1995)

Professor Allan Mackintosh, 59, died December 20, 1995 following an automobile accident near Risø, Denmark. Prof. Mackintosh had devoted much of life to the study of the behavior of electrons in solids, and made major contributions to our understanding of the electrical and magnetic properties of rare earth metals.

Mackintosh was born in Nottingham, England in 1936 and received his education from Nottingham High School and Peterhouse, Cambridge. His doctoral research was carried out in the Cavendish Laboratory where he investigated the Fermi surface of metals. After leaving Cambridge, he worked at Ames Laboratory, Iowa State University as an Associate Professor from 1960-66, then moved to the Technical University of Denmark where he became a Research Professor from 1966-70. From 1970-1995 he was a Professor of Physics at the University of Copenhagen. During the years 1971-76 he was the Director, Risø National Laboratory and then from 1986-1989 was Director, Nordic Institute for Theoretical Physics.

Mackintosh and J. Jensen were authors of the classic text *Rare Earth Magnetism* which was published in 1991, the same year that he was elected a Fellow of the Royal Society. ▲

## Thomas E. Leontis (1917-1995)

Thomas E. Leontis, 78, died May 29, 1995. He earned his M.E. from Stevens Institute of Technology and his M.S. and Ph.D. in Metallurgy from Carnegie-Mellon University. He was affiliated with Dow Chemical Company in Midland, Michigan for 27 years where he supervised research on magnesium. In 1971, he joined Battelle Memorial Institute as Manager of the Magnesium Research Center until his retirement in 1982. He published over 30 research papers in journals and was an internationally known authority on magnesium technology. Rare earthers will recognize his work on the phase relationships and properties of cerium- and rare earth-magnesium alloys. ▲

*SAMARIUM*, atomic number 62, was discovered by Lecoq de Boisbaudran in 1879 and was named after a Russian mine official, Colonel M. Samarski.

## Werner Zinn (1929-1995)

Prof. Dr. rer. nat. Werner Zinn, one of the world's leading scientists in the research of magnetism, especially of the many different kinds of thin magnetic films, died April 13, 1995.

Werner Zinn graduated with a degree in physics in 1958 from the University of Würzburg, Germany, and started his scientific career as a research assistant. In 1960 he joined the Siemens research laboratories in Munich where he created a laboratory for NMR and Mössbauer spectroscopy. In 1971 he became full professor at the University of Cologne and became director of the Institute of Solid State Research at the Kernforschungsanlage Jülich.

In addition to his expertise in permalloy films, Werner Zinn also studied garnets and ferrites. He contributed to the basic understanding of Eu-chalcogenides as nearly ideal Heisenberg systems. His interest in magnetic semiconductors at low temperatures paid off with the discovery of the first non-metallic spin glass system (Eu/SrS). The indirect exchange coupling between ferromagnetic layers through a non-magnetic interlayer was also discovered by Prof. Zinn and his co-workers, as was the Giant Magneto-Resistance (GMR). GMR is expected to play a major role in future magnetic information storage technology. ▲

## David R. Torgeson (1936-1995)

David R. Torgeson, 59, of Ames, Iowa, died December 5, 1995 of a heart attack. Mr. Torgeson earned a bachelor's degree from Luther College in 1958 and a master's degree from Iowa State University in 1960. He was a research physicist with the Ames Laboratory where he had been employed for 38 years. His research interests included: atomic and ionic motion in solids; hydrogen diffusion in crystalline and amorphous metals, alloys, and insulators (including a variety of rare earth materials): lithium and sodium ion diffusion in borate and sulfate glasses and other "fast ion" conductors. Another area of interest included the application of nuclear magnetic resonance and nuclear quadrupole resonance techniques to the study of high temperature superconductors, disordered materials, quasicrystals, and intermediate range order in solids. ▲

## Supporters 1996

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Since the December, 1995 issue of the RIC News went to press, RIC has received support from 4 new family members, and renewed support from 30 other organizations and individuals. The Supporters from the third quarter of fiscal year 1996 who wish to be listed, grouped according to their appropriate category, and with the number of years that they have contributed to the Center in parenthesis, are listed below.

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