



Rare-earth Information Center

NEWS

Center for Rare Earths and Magnetics
Ames Laboratory
Institute for Physical Research and Technology
Iowa State University, Ames, Iowa 50011-3020 U.S.A.

Volume XXXI

September 1, 1996

No. 3

Spedding Award Winner



Gregory R. Choppin (left) receives eighth Spedding Award from Rhône-Poulenc's Patrick Maestro.

Professor Gregory R. Choppin, Chemistry Department, Florida State University has been selected as the recipient of the eighth Frank H. Spedding Award. The award, sponsored by Rhône-Poulenc, was presented to Prof. Choppin in a ceremony at the 21st Rare Earth Research Conference held in Duluth, Minnesota, USA July 7-12.

G. R. Choppin started his *f*-element chemistry studies as a postdoctoral fellow under Professor Glen T. Seaborg at the Berkeley Radiation Laboratory, Berkeley, California. He was responsible for developing the separation process which led to the discovery of element 101, Mendelevium. He used the solvent α -hydroxyisobutyric acid, which remains an efficient separation agent to this day.

He continued his work on nuclear reactions at Florida State University and then started a successful research program on the complexation of *4f* and *5f*-elements in solution by the use of potentiometric and calorimetric titrations. Professor Choppin is known for his nuclear magnetic resonance work on aminopolycarboxylate complexes and on the behavior of *4f* and *5f* elements.

Continued in next column ◊

Solution Chemistry Group, Meiji University



Front row: T. Watanabe, K. Ikeda, Y. Nishimura, Prof. Suzuki, R. Kaneko, Y. Suzuki, and K. Mutoh; Back row: K. Mikoshiba, A. Shimofuku, T. Shimoda, T. Ohguchi, T. Kakizawa, S. Chiba, K. Kusunoki, Y. Ise, J. Ishida, and T. Oikawa.

The Solution Chemistry Group, Department of Industrial Chemistry, Meiji University, Kawasaki, Japan was established in 1972 by Prof. Yasuo Suzuki. The group is currently involved with determining the stability constants of rare earth complexes. Dr. Yasuo Suzuki earned the 1st Award of the Rare Earth Society of Japan in 1988 for his group's continuous contributions to the research on stability constants. The research project was extended to determine the precipitation behavior of hydroxides of 16 rare earths in aqueous solutions. Recent work with newer precision instruments are being conducted on various rare earth aqueous solutions, which may lead to a better understanding of the coordination and hydration behavior of rare earth ions in solution. The group will be dissolved in March, 1998 when Prof. Suzuki retires. ▲

He remains interested in *f-f* oscillator strengths, hypersensitivity and luminescence.

A prolific writer and contributor to *f*-element chemistry in his own right, he is the author, co-author, or editor of 350 scientific papers and 15 books. In addition, he has served, or is still serving, on numerous national and international committees.

RIC congratulates Professor Gregory R. Choppin on his accomplishments and for this well deserved honor! ▲

Thanks!

Upon my retirement as director of the Information Center and editor of the *RIC News*, I received a number of wonderful notes from friends throughout the world. I wish to express my deepest appreciation to all of you for taking the time from your busy schedules to send me your kind and thoughtful comments.

Yours,
Karl A. Gschneidner, Jr.

TERFENOL-D Technology Seminar

The TERFENOL-D Technology Seminar will be held September 16-17, 1996 in Ames, Iowa. The seminar will provide participants a background on TERFENOL-D technology and magnetostriction, as well as devices using TERFENOL-D. A wide variety of industrial applications will also be discussed. Potential applications of TERFENOL-D will be presented as well as current and future uses of TERFENOL-D technology.

For more information or to register for the Technology Seminar, contact Ms. Linda Hurley, ETREMA Products, Inc., 2500 North Loop Drive, Ames, IA 50010 USA; Tel:800 327 7291; Fax:515 296 7168. ▲

Gordon Research Conference on Superconductivity

The Gordon Research Conference on Superconductivity will be held January 12-17, 1997 at Harbortown Marina Resort, Ventura, California USA. One-half of the oral program is now set with the following topics to be discussed: basic theory, vortices, materials, photoemission, optical properties, d -wave - s -wave, normal state properties, charge and flux quantization, stripe phases, tunneling, and nickel borides.

Persons interested in the conference should contact D.K. Finnemore, Department of Physics, Ames Laboratory, Iowa State University, Ames, IA 50011-3160 USA; Tel:515 294 3455; Fax:515 294 0689; E-mail: finnemore@ameslab.gov. For registration contact app@grcmail.grc.uri.edu. ▲

Russian Materials Science Symposium

A Russian Materials Science Symposium, sponsored by Atomergic Chemetals Corporation, Farmingdale, NY, will be held October 8-10, 1996 at Hofstra University's Student Center, Hempstead, NY. Ten major Russian Materials Science Institutes will present exhibits and technical papers on various new and innovative technologies. For more information, contact Dr. Oleg Jouravlev, Tel:516 694 9000; Fax:516 694 9177; E-mail:babl281@prodigy.com. ▲

Conference Calendar

* A NEWS STORY THIS ISSUE

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)

TERFENOL-D Technology Seminar
Ames, Iowa, USA
September 16-17, 1996
*This issue

Magnetic Materials and Their Industrial Applications

Cardiff, UK
September 16-20, 1996
*This issue, page 3

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)

China: Opportunities for the Magnetic Materials Industry

Guilin, People's Republic of China
October 7-9, 1996
RIC News XXXI, [2] 3 (1996)

Russian Materials Science Symposium
Hempstead, New York, USA

October 8-10, 1996
*This issue

1st European Conference on Neutron Scattering (ECNS'96)

Interlaken, Switzerland
October 8-11, 1996
RIC News XXXI, [2] 2 (1996)

November '96

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

Honolulu, Hawaii, USA
November 6-8, 1996
RIC News XXXI, [1] 2 (1996)

January '97

Gordon Research Conference on Superconductivity

Ventura, California, USA
January 12-17, 1997
*This issue

February '97

Rare Earths: Science, Technology and Applications

Orlando, Florida, USA
February 9-13, 1997
RIC News XXXI, [2] 2 (1996)

April '97

12th International Conference on Solid Compounds of Transition Elements

Saint-Malo, France
April 22-25, 1997
RIC News XXXI, [2] 3 (1996)

July '97

International Conference on Magnetism 1997 (ICM'97)

Melbourne, Australia
July 27-August 1, 1997
*This issue, page 3

August '97

15th International Colloquium on Magnetic Films and Surfaces (ICMFS)

Sunshine Coast, Queensland, Australia
August 4-8, 1997
*This issue, page 3

September '97

Third International Conference on f Elements (ICFE3)

Paris, France
September 14-19, 1997
RIC News XXXI, [2] 3

ICMFS '97

The 15th International Colloquium on Magnetic Films and Surfaces (ICMFS '97) will be held at Sunshine Coast, Queensland, Australia, August 4-8, 1997. The aim of the colloquium is to bring together scientists working in the field of magnetic films and surfaces. The colloquium will include discussions of the following topics: preparation and structural characterization of magnetic thin films, electronic structure of surfaces, interfaces and ultrathin films, interlayer coupling and magnetic structure of multilayers, giant magnetoresistance and transport phenomena, magneto-optical phenomena, anisotropy, coercivity, and magnetization processes, new characterization, measurement and imaging techniques, nanomagnetism and microfabrication, and applications.

For more information, contact Professor T. Shinjo, Institute for Chemical Research, Kyoto University, Uji, Kyoto-fu 611, Japan; Tel: 81 774 32 2340; Fax: 81 774 33 1247; E-mail: shinjo@scl.kyoto-u.ac.jp. ▲

Magnetic Materials Short Course

A uniquely formulated short course "Magnetic Materials and Their Industrial Applications" will be offered September 16-20, 1996 by the Wolfson Centre for Magnetism and Technology, Cardiff, University of Wales, UK. The course will provide researchers with a practical knowledge of magnetic materials used in electrical, power, and electromechanical devices. The five-day course consists of five topics: 1) fundamentals of industrial magnetism and related principles, 2) properties and applications of soft magnetic materials for power devices, 3) applications of permanent magnet materials and computer aided design (CAD) for electromagnetic devices, 4) electrical steels and their applications in electrical machines, and 5) industrial magnetic measurements and design and applications of magnetic sensors and transducers.

For more information contact Mr. Paul Ling, Wolfson Centre for Magnetism Technology, P.O. Box 917, Newport Road, Cardiff, CF2 1XH UK; Tel\Fax: 44 1222 874 975; Ling@Cardiff.ac.uk; <http://www.cf.ac.uk/ukcc/engin/groups.html>. ▲

The International Conference on Magnetism 1997 (ICM'97) will be held July 27 - August 1, 1997 in Melbourne, Australia. ICM'97 will incorporate the Symposium on Strongly Correlated Electron Systems 1997. Several topics to be presented at the conference should interest some rare earthers: heavy fermion and intermediate valence systems, high T_c superconductors, new magnetic and superconducting materials, permanent magnets, and rare earth metals and compounds.

For more information, contact The Meeting Planners, I.C.M. '97 Conference Secretariat, 108 Church Street, Hawthorn Victoria 3122, Australia; Tel: 61 3 9819 3700; Fax: 61 3 9819 5978; E-mail: meeting@iaccess.com.au; <http://www.physics.monash.edu.au/~icm97/>. ▲

International Conferences Set

The International Steering Committee on *f*-Conferences meet at ICFE-2 and confirmed the locations and years of future broad-based rare earth conferences through 2002.

- 1997 September 14-19, Paris, France, Jean-Claude Krupa and Pierre Porcher (ICFE-3)
- 1998 October, Perth, Western Australia, Dudley Kingsnorth
- 1999 USA, Lynne Soderholm (RERC-22)
- 2000 Madrid, Spain, Saez Puche (ICFE-4)
- 2001 Asia?
- 2002 USA, Susan Kauzlarich (RERC-23)

RIC News?

We are preparing a massive update of the *RIC News* mailing list. Since there are over 13,000 subscribers to the *News*, we have set a deadline of March 1, 1997 for those who wish to keep receiving the newsletter to send us an updated mailing address. **After March 1, 1997 we will drop all those subscribers who have not notified us that they wish to continue receiving the *RIC News*.**

If you wish to continue receiving the *RIC News* please send us your complete mailing

Continued in next column ◊

21st RERC

This summer from July 7-12, close to 200 scientists invaded the Duluth Entertainment and Convention Center in Duluth, Minnesota for the Twenty-First Rare Earth Research Conference. Located on Lake Superior in northern Minnesota, Duluth once served as a major port for shipping iron ore. It is now developing into a major tourist area which provided an excellent site for the conference which was chaired by Larry Thompson of the University of Minnesota, Duluth. The conference attendance was equally represented by foreign (99) and domestic (93) scientists. Twelve oral sessions contained 57 invited talks while 13 poster sessions added another 200 contributions.

The conference began with a plenary session in which the Eighth Frank H. Spedding Award, sponsored by Rhône-Poulenc Industries, was presented to Gregory R. Choppin of Florida State University (see front page).

Oral sessions included Photophysics Applications; Spectroscopy & Non-Linear Optics; Synthesis, Structure & Properties of Novel Solid State Compounds; Industrial Applications and Processes; X-ray and Neutron Scattering; Coordination Chemistry; Environmental Sciences; Superconductivity; New Developments in *4f* Magnetism; Solid State Electrolytes; and Medical Chemistry. The topics of the poster sessions reflected those of the oral sessions. All sessions were remarkably well attended as talks were designed to provide insight into each area for those of us outside any given area of specialization, as well as provide new material for the specialist.

The Proceedings will be published by Elsevier.

The Twenty-Second Rare Earth Research Conference will be held in 1999 in the Chicago area. It will be chaired by Lynda Soderholm of Argonne National Laboratory. The Program Chair is Susan M. Kauzlarich of the University of California, Davis. ▲

RIC News?/Continued ◊

address (We apologize to our new subscribers who have recently sent us this information).

Please send your subscription requests to: RIC, 116 Wilhelm Hall, Iowa State University, Ames, IA 50011-3020, or Tel: 515 294 2272; Fax: 515 294 3709; E-mail: RIC@ameslab.gov. We will post further announcements. ▲

Handbook Volume 20

Indian Rare Earths Ltd.

New Materials

Volume 20 of the *Handbook on the Physics and Chemistry of Rare Earths* completes the second decade of volumes of the *Handbook* that have been published since 1978. This volume focuses on the physical aspects of metallic compounds. Research efforts on metallic rare earth compounds started in earnest about 50 years ago and received a significant boost with the discovery of the RCo_5 permanent magnets about 12 years later. Since this time much has been learned about the structure as well as the electrical, magnetic and thermal properties of the 2500 or so binary rare earth metallic compounds. However, if one considers all of the possible true ternary compounds as well as the possible pseudo-ternary alloys formed by mixing two binaries, then indeed much more needs to be discovered. The four chapters in Volume 20 take us one step closer to the understanding of these materials.

The first chapter deals with the Fermi surfaces of rare earth (Y, La, Ce, Pr, Nd, Sm, Gd and Yb) intermetallic compounds. It begins with an introduction to the relevant theories required to describe the electrons near the Fermi surface and then to the basic experimental techniques to study these surfaces. Most of the chapter is devoted to a comparison of the experimental results with the band structure calculations for a large number of compounds. These include the Fermi surfaces of various rare earth-B, In, Sn, Al, Ga, Ni, Cu, Cu_2Si_2 and Ru_2Si_2 compounds in the simple cubic, bcc, hexagonal, tetragonal, and orthorhombic Brillouin zones.

The second chapter examines the world of thin films of rare earth metals, alloys and compounds. The three main topics covered are the pure metals themselves, metallic alloys and compounds, and metalloid compounds. The author explains the intricate world of these thin films by sharing with us various properties such as valence changes that occur during change of phase and includes information on crystallographic, electrical, magnetic, and optical properties.

The next chapter will interest those researchers in academia and industry alike who are concerned with the preparation and properties of rare earth hydrides. The chapter is devoted to hydrogen in metals and their binary compounds RH_2 and RH_3 , including the RH_{2+x} phases. The author points out that one of the critical problems is the

Continued in next column ⇨

RIC is pleased to announce that another one of our supporters has earned the ISO 9002 quality standard. The Rare Earths Division of Indian Rare Earths Ltd., Udyogamandal, Kerala, India received the certificate of approval from Bureau Veritas Quality International (BVQI). The quality management system of Indian Rare Earths Ltd. was cited for its excellence in the manufacture and sale of commercial grade compounds. RIC congratulates the management, staff, and production personnel for this important certification. ▲

Handbook/Continued ⇨

purity of the starting rare earth metal itself as phase relations can be affected by impurities, and attention is therefore paid to the preparation of specimens and phase diagrams. Structural properties, kinetics and thermodynamic behavior, as well as electronic, magnetic and thermal properties are reviewed as well. Also examined is the profound influence of hydrogen on the magnetic properties by the mediation of RKKY interaction in these materials.

The fourth chapter updates the magnetic behaviors of lanthanide intermetallic compounds, an area which has seen many new developments in the past 15 years. The chapter is divided into two main parts. Part one concentrates on $3d$ magnetism where both the $3d$ metal and lanthanide element contribute to the behavior. Part two deals primarily with lanthanide $4f$ magnetism: crystal-field and exchange interactions in ferromagnetic compounds; metamagnetism and associated phase diagrams; and quantitative analysis of incommensurate magnetic systems.

The 464-page Volume 20 of the *Handbook on the Physics and Chemistry of Rare Earths* was published in 1995 and includes subject and author indices. The volume was edited by K.A. Gschneidner, Jr. and L. Eyring and is available for \$285.00 US (Dfl. 485.00). Customers in the USA and Canada should send their orders to: Elsevier Science Inc., P.O. Box 945, Madison Square Station, New York, NY 10159-0945 USA; Tel: 212 633 3650; Fax: 212 633 3680; elsewhere: Elsevier Science B.V., P.O. Box 211, 1000 AE Amsterdam, The Netherlands; Tel: 31 20 5803 642; Fax: 31 20 5803 598. ▲

The unique properties of rare earths continue to provide opportunities for improving the performance of equipment as well as for the manufacturing of new and better materials. The following new developments illustrate the important contributions that continue to be made by the rare earths in science and technology. The following announcements were published in *Japan New Mater. Rept.*, 10, [6] 5-6,10 (1995).

Superconductor lead

Nippon Steel Corporation and Tohoku University have jointly developed a yttrium-based oxide superconducting material that can be used to make wiring leads that can be used in strong magnetic fields. These electrical leads supply electricity from the power source to the superconducting magnet or other source and are cooled to -269°C .

Present leads are made of copper and allow large amounts of heat to be conducted into the superconducting equipment, resulting in a decrease in efficiency, largely because heat transfer causes liquid helium to evaporate. One solution was to utilize bismuth-based superconducting materials in the manufacture of leads; however, it is difficult to attain high current flows in strong magnetic fields.

The yttrium-based superconducting leads feature a ten-fold increase in current density as compared with bismuth-based superconducting leads. They allow a current flow of 500 A in a magnetic field of 40,000 gauss at a temperature of -196°C . The new material drastically cuts operating cost to 25% of that for copper leads because of the reduced evaporation of liquid helium. An additional benefit was discovered when it was realized that since the leads can be placed closer to the superconducting coils, the size of the entire superconducting magnet could be decreased.

Superconducting single crystal

The Superconductivity Industrial Research Laboratory has produced a yttrium-based superconducting single crystal which measures about 23mm on each side. The size of the crystal was increased by boosting the crystal growth speed while lengthening the crystal growth time. The laboratory was able to double crystal growth speed by carefully adjusting gas pressure.

Large superconducting single crystal

Continued on page 5

Transrapid

The US\$3.7 billion Transrapid project, which utilizes permanent magnets to levitate a train about six inches above a monorail and propel it, has been approved by the German government [*Wall Street Journal*, May 10, 1996]. The magnetically levitated train system will link Berlin and Hamburg and is scheduled to be completed by 2005. The train is over three times faster than conventional trains currently used in the 185-mile route. Transrapid trains are designed to make the same trip in less than one hour, and to serve at least 11 million passengers per year. ▲

New Materials/Continued ⇨

such as these may lead the way to less expensive superconducting substrates for electronics applications.

"Wet Processed" Nd-Fe-B magnets

A large-scale process for producing neodymium-iron-boron permanent magnets that feature a 13 percent increase in energy product over previous Nd-Fe-B types was recently announced by Hitachi Metals Ltd. The company reports that problems limiting the strength of these magnets include oxidation and the presence of oxygen after the formation of the magnetic material. The manufacture of these materials have, in the past, relied on a dry process that allows the oxygen content to be 5000 to 6000 ppm.

The key to the new technique that greatly reduces oxygen content in Nd-Fe-B magnets is the wet process. In this process, the powder grains are coated with oil to prevent oxygen contamination. This "wet process" allows the oxygen content in the final product to be reduced to 2000 ppm. When this process is carried out on a large scale, the energy product is increased by more than ten percent, to 52 MGOe. The new wet process magnets not only have a high uniformity, but also exhibit an improvement in elevated-temperature stability which can occur in electric motors.

Main applications will include small motors for CD-ROM drive units and hard disk drives in computers and electronic equipment for use in automobiles. Hitachi has spent about US\$10 million to build a dedicated production facility and expects to produce 5 mt of Nd-Fe-B permanent magnet material per month. ▲

Rare earth Shigeyuki Somiya was recently presented with the Distinguished Life Member Award of the American Ceramic Society. The award recognizes those individuals who have made significant contributions in the field of ceramics.

Shigeyuki Somiya is dean and professor at Nishi Tokyo University, Japan. He graduated with a B.S. degree from Tokyo Institute of Technology in 1952 and Dr.Sci.

in 1962, both in engineering. During 1957-59, we was with the Department of Geochemistry at Pennsylvania State University under the Fulbright exchange program. Somiya joined Tokyo Institute of Technology in 1959 and was named professor in 1968. In 1990, he joined Nishi Tokyo University.

Most of his research has been on high-pressure hydrothermal reaction processes in ceramic synthesis and phase equilibria, primarily with cerium and other rare earth oxide systems. Prof. Somiya holds 14 patents and is the author or coauthor of more than 500 papers and the editor of more than 90 books and proceedings. ▲



Shigeyuki Somiya

Terfenol "Dogbones"

An inverse flextensional sonar projector that utilizes the terbium-dysprosium-iron alloy Terfenol, has been designed by Lockheed Sanders for the U.S. Navy. The system provides a broadband response and a bandwidth equivalent to piezoelectric ceramic transducers that are three times larger. Since the terfenol system is one-third the size and weight of existing sonar arrays, much more acoustic power can be transmitted in order to locate underwater objects at greater distances.

Terfenol driven inverse flextionals, known as "Terfenol-D Dogbones" will provide the Navy with a lightweight solution to reduce low frequency sonar array size. "Dogbones" will also reduce the cost and handling system complexity for long term applications where high reliability, high

Rare Earth Elements and Their Applications

Rare Earth Elements and Their Applications is a book which provides a brief history, present status, and current uses of rare earths, their compounds and alloys. The book is broken down into two parts; Part One: Chemistry, Exploration and Extraction, and Part Two: Applications.

Part One is divided into five chapters: Introduction, Rare Earth Resources, Rare Earth Mineral Processing, Separation of Rare Earth Elements, and Preparation of Rare Earth Alloys and High Purity Compounds. Part Two contains twelve chapters which introduce the topics of: rare earths in iron and steel, application of rare earth in nonferrous metals, rare earth utilization in agriculture, lanthanides in catalysis, rare earth phosphors and magnetic materials, high temperature superconductors, rare earths in ceramics glass, dying and currying, and radioactivity and toxicity of rare earths.

The book provides a glimpse into the world of rare earths by presenting the material in a format that makes reading fast and easy. It superficially introduces the reader to many important elements of the world of rare earths while concentrating on China's contribution to the industry. It is recommended for undergraduate students involved in the field, or for the rare earth neophyte who needs a quick lesson on the uses of rare earths.

The 290-page hardcover *Rare Earth Elements and Their Applications* was edited by Z. Yu and M. Chen and was published in 1995 by Metallurgical Industry Press, Beijing. The book includes an author index and a list of references appears at the end of each chapter. To order a copy, contact Mrs. Ren Li-e, The Chinese Rare Earth Society, 76 Xueyuan NanLu, 100081, Beijing, China; Tel:86 010 217 3497; Fax:86 010 218 1018. The cost of the book including postage is US\$43.00. ▲

Terfenol Dogbones/Continued ⇨

power density, and broad system bandwidth are required.

For more information, contact Becky Jones, ETREMA Products, Inc., 2500 North Loop Drive, Ames, IA 50010 USA; Tel: 515 296 8030; Fax: 515 296 7168. ▲

Separations of *f* Elements

The 207th National Meeting of the American Chemical Society was held March 13-17, 1994 in San Diego, California. The symposium from this meeting provided the incentive and material for the book *Separations of *f* Elements* which was published in 1995. The book contains 18 papers of which 10 deal wholly or in part with rare earth separation from actinide and other compounds.

The first paper presents a brief history of the separation of *f* elements which should be interesting and useful to students and others interested in this field. Other topics presented include: separation of rare earths from fission products, extraction of Eu³⁺ using thio and amine extractants as well as dithiophosphinic acids and tributylphosphate, and separation of Eu from Am by solvent extraction from aqueous phosphonate media. One entry covers the use of selective inorganic ion exchangers for separating rare earths while another describes the factors which influence the efficiencies of multistage separations of lanthanides. A paper entitled "Magnetic Separation for Environmental Remediation" will interest those who would like to know more about how high gradient magnetic fields are used to separate ferromagnetic and paramagnetic particles from diamagnetic host materials.

The 277-page hard cover *Separations of *f* Elements* was edited by K.L. Nash and G.R. Choppin and is available for US\$95.00 by contacting: Plenum Publishing Corp., 233 Spring St., New York, NY 10013-1578 USA; Tel: 800 221 9369. ▲

Graduate Student Award

The Materials Research Society (MRS) presented its 1996 Spring Graduate Student Awards to eight young scientists on April 8, 1996 at the Society's Spring Meeting in San Francisco, California. The awards honor and encourage graduate students whose academic achievements and materials research display a high order of excellence and distinction. Of the eight awardees, Tristan Haage, Max-Planck-Institute für Festkörperforschung, Germany, was recognized for "Tailoring the Microscopic Defect Structure in YBa₂Cu₃O_{7-δ} Thin Films." RIC congratulates Tristan Haage and the other seven awardees for their accomplishments. ▲

Baotou Earthquake

Last May an earthquake occurred in Baotou, Inner Mongolia, China, which is where the large rare earth mine, Baiyunebo, and the Chinese Rare Earth Information Centre (CREIC), are located. The Director of CREIC, Mr. Junxi Yan, sends us this message:

"You may have heard about the strong earthquake in May in Baotou and the loss of life and injuries. Many friends sent fax messages to us right after the quake, showing concern about the disaster and their intention to provide humanitarian aid. We thank you for your care.

Thank goodness, all of our staff survived but the tragedy caused severe damage to CREIC's properties and aftershocks are still on everyday. We decided to accept humanitarian aid which will be of great help for returning our work to normal. Please remit your donation to the following account: Yan Junxi, R. Fund, Baotou Branch of the Bank of China, No. 50, Gangtei Street, Kunqu, Baotou, Inner Mongolia 014010, P.R. China." ▲

We've Moved!

The change in RIC leadership will lead to other changes which will expand our scope and mission while improving the information services that we provide to our clients. Late last winter, the Rare-earth Information Center became the Rare Earth Information Unit of the Center for Rare Earths and Magnetism (CREM). However, we will still keep the well-known name, Rare-earth Information Center (RIC). In May, the Center's offices and collection of over 82,000 books, journals, reports, patents, theses, files, various computers and office equipment, furniture, and staff were moved to our new location. Our new address is: Rare-earth Information Center, Center for Rare Earths and Magnetism, 116 Wilhelm Hall, Iowa State University, Ames, IA 50011-3020 USA. All other contact numbers remain the same: Tel: 515 294 2272; Fax: 515 294 3709; E-mail: ric@ameslab.gov.

A special CREM/RIC *Thank You* goes out to RIC staff members Lisa Durhman, Sarah Schmidt, and Clifford Lee for their strong backs and iron wills during the intense move. ▲

PUMA Trap

The majority of pollutants from automobile exhaust are released during the warm-up period prior to the engine attaining proper operating temperature. Corning Inc., Corning, New York, has introduced an emissions control system that reduces hydrocarbon emission by as much as 88% below the current standards set by the federal government during engine start-up.

The new system is known as a Passive Underbody Main Adsorber (PUMA). The PUMA consists of a zeolite adsorber that is positioned inline between two three-way catalytic converters. This set-up controls not only hydrocarbon emissions, but also oxides of nitrogen (NO_x) and carbon monoxide.

The PUMA operates by trapping hydrocarbon compounds from the cold exhaust gases in the adsorber. When the engine warms up and exhaust gases reach 275°C, the hydrocarbons are desorbed and oxidized by the second converter. The system is reported to have achieved nonmethane hydrocarbon emissions of 0.03 g/mi, which is below the strict California vehicle standard of 0.04 g/mi that will go into effect in 1997. The PUMA trap is durable because emissions were unchanged even after 100,000 miles. Corning expects PUMA to be available commercially in 2000. ▲

Rare Earth Bulletin

The unusual and useful properties of rare earths make them increasingly interesting in a number of important areas. Valuable work on them is scattered throughout the literature of chemistry, physics, metallurgy, crystallography, and mining. *Rare Earth Bulletin* searches the world's journals for reported work on the lanthanides, scandium and yttrium; translates it where necessary, and summarizes it in abstract form six issues per year.

Rare Earth Bulletin is interdisciplinary in nature, drawing on recent research that has been published in the worldwide rare earth periodic literature. Each issue also contains conference proceedings, agency reports and book reviews. The cost to receive *Rare Earth Bulletin* is £165 in Europe, and £178 elsewhere, which includes airmail delivery. For more information or to order your subscription, contact: Subscriptions Department, Multi-Science Publishing Co. Ltd., 107 High Street, Brentwood, Essex CM14 4RX, UK; Tel: 44 1277 224 632; Fax: 44 1277 223 453. ▲

Stanford Materials Co.

Stanford Materials Company now has a web site on internet which can be accessed at: <http://www.stanfordmaterials.com>. The web page lists various rare earth products with prices as well as information on a variety of non-ferrous metals, alloys, and oxides, ferro-alloys, and ceramic materials.

For more information, contact: Stanford Materials Co., 120 West Third Avenue, Suite 1110, San Mateo, CA 94402 USA; Tel: 415 348 3482; Fax: 415 348 4263; E-mail: info@stanfordmaterials.com. ▲

The UK Magnetics Society

The UK Magnetics Society serves the academic, industrial, and research communities involved in the field of magnetism and magnetic materials. The Society publishes *Magnetics*, a biannual international newsletter that contains recent information on magnetism conferences, developments in magnetism and magnetism, and book reviews. For more information, contact the editor, Margaret Swadling, The UK Magnetics Society, Berkshire Business Centre, Post Office Lane, Wantage, Oxon OX12 8SH, UK; Tel: 44 1235 770 652; Fax: 44 1235 772 295; E-mail: 100520.655@compuserve.com. ▲

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Joel Calhoun Staff Writer

Treibacher Expands Production

Treibacher Auermet GmbH, a subsidiary of Treibacher Industrie AG, Austria, recently acquired a 2,000 tpy (tonnes per year) capacity vacuum induction furnace. The furnace is located in the Ravne na Koroskem works of Slovenske Zelezarne d.d. (SZ, Slovenian Iron Works), Slovenia, a few kilometers from the Austrian/Slovenian border, near the Treibach works. The new furnace will be operated by Treibacher Auermet Ravne d.o.o., a newly formed subsidiary of the company.

Treibacher will use the new furnace for the increased production of nickel metal hydride alloys for NiMH batteries. These alloys replace toxic cadmium rechargeable batteries. Treibacher Auermet is the largest producer of these alloys outside of Japan. Other rare earth alloys may also be produced. For more information, contact Dr. Alexander Bouvier; Tel: 43 4262 505 570; Fax: 43 4262 2898. ▲

MTT

Motion Tech Trends (MTT) is a marketing and technical consulting firm that serves the electric motor and motion control industries. MTT provides marketing and technical consulting services and is devoted to the gathering, organizing and analysis of technical information for the industry.

The company's most recent publication is "Brushless Market Model", a statistical analysis of the industry 1995 and 2000. The report was published in May, 1996, and covers the following topics: technical and market trends, complete update and forecast for over 70 market segments for brushless motor and drive technologies, motor vs. drive markets shown separately in all 70+ detailed market segments for both forecasted years, two forecasts, 1995 and 2000, for motors and drives separately, and for dollar value and units separately. The report also includes a discussion on trends in the electric motor and motion control marketplace.

"Brushless Market Model" presents much of the data in the form of charts, graphs and tables which facilitates interpretation of the data that is contained in the report. For more information, contact George Gulalo, MTT Corporate Offices, 1520 Centinela Ave., Inglewood, CA 90302 USA; Tel: 310 674 3445; Fax: 310 674 3463. ▲

1996 Hume-Rothery Award

Professor William L. Johnson, California Institute of Science and Technology, has been awarded the 1996 Hume-Rothery Award for career accomplishments in materials science.

Professor Johnson has more than 220 publications to his credit, with many of his most recent papers dealing with rare earth binary glass compounds.



William L. Johnson

His earliest research determined the superconducting properties and phase separations of metallic glasses. He also conducted systematic studies of crystal-to-glass transformations in metallic materials induced by hydriding, as well as solid state diffusion reactions in metal layers. He was also able to demonstrate the formation of nanophase metallic metals and intermetallic compounds by mechanical alloying and attrition. Professor Johnson has served as Principal Editor of the *Journal of Materials Research*, as Editor of the *International Journal of Rapid Solidification*, and is currently an Associate Editor of the *Journal of Applied Physics and Applied Physics Letters*. ▲

Meldform Metals Ltd.

Meldform Metals Ltd. recently acquired a majority interest in Less Common Metals Ltd. Less Common Metals Ltd. specializes in the melting and casting of rare earth metals, particularly samarium-cobalt alloys. Furthermore, the company has restructured into two distinct limited liability companies: Meldform Rare Earths Ltd. and Meldform Germanium Ltd.

For more information, please contact: Tony Bayley, Meldform Rare Earths Ltd., York Way, Royston, Herts SG8 5HJ UK; Tel: 44 1763 248 915; Fax: 44 1763 249 312, or Dave Kennedy, Less Common Metals Ltd., Unit 3, Prenton Way Industrial Estate, Prenton, Merseyside, UK; Tel: 44 151 609 0350; Fax: 44 151 609 1190. ▲

HOLMIUM, atomic number 67, was discovered independently by P.T. Cleve and J.L. Soret in 1879. The name holmium is derived from the Latinized word for the city of Stockholm, Holmia.

MOSCOW - 1996**K. A. Gschneidner, Jr.**

Moscow State University (MSU) has a long tradition of magnetic research, and it has been one of the leading centers for magnetism in the world in the last half of this century. Magnetocaloric studies were already being carried out over thirty years ago at MSU by Prof. K. P. Belov who worked on lanthanide garnets and Gd metal between ~1965 and ~1975. These experiments were followed-up studies carried out by Profs. S. A. Nikitin and A. S. Andreev from ~1975 to ~1990 who used an electromagnet which had a maximum magnetic field of 1.5T. They examined single crystal lanthanide metals and also some polycrystalline lanthanide-lanthanide alloys. In 1981, A. M. Tishin started his graduate work on the magnetocaloric effect using a 6T superconducting magnet under the supervision of Prof. Nikitin. In 1990, Dr. Tishin started his own group and developed a pulse field method for studying the magnetocaloric effect in fields up to 5T.

Prof. R. Z. Levitin is carrying out research on the magnetic properties on rare earth Laves phase compounds RM_2 , where M = Mn, Co, and Cu. Prof. P. N. Steschenko is working on the magnetic resonance of thin films of rare earth intermetallic compounds. Prof. O. V. Snigirev is working, together with Dr. Tishin, on two dimensional magnetism of lanthanide multilayers (1 to 20 layers), such as Dy-containing stearic acid, using a scanning SQUID microscope to map out a square of area 8mm on an edge with a resolution of 50 μ m. Prof. A. N. Vasil'ev is carrying out research on a new type of magnetic material, $CuGeO_3$, which exhibits a spin Peierls transition, which is the magnetic analog of the shape memory materials, (e.g. nitinol).

The A. A. Baikov Institute of Metallurgy, the Russian Academy of Sciences (RAS) is located about 5 miles from Moscow State University. I had visited this Institute in 1969, and a few of the staff members who I had met in 1969 are still there today. These include Dr. G. S. Burhkanov, who is the head of the rare earth and refractories group, and Dr. O. D. Christyakov, who also works in this group. Their prime interest is preparing high purity rare earth and refractory metals and single crystals thereof. The rare earth metals, which they make today, are now of a comparable purity with the routinely prepared Ames Laboratory metals (~99at.% pure with respect to the entire

Continued in next column ⇨**Supporters 1997**

★★★★★★★★★★★★★★★★★★★★

Since the June issue of the RIC News went to press, RIC has received support from three new family members, and renewed support from 32 other organizations and individuals. The Supporters from the first quarter of fiscal year 1997 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.

Benefactor (\$10,000 or more)**Donor** (\$4,000 to \$9,999)**Sponsor** (\$2,000 to \$3,999)

CERAC, Inc., USA (21)

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The Chinese Society of Rare Earth, PRC (11)

The Society of Non-Traditional Technology, Japan (8)

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Astronautics Corp. of America, USA (11)

Dexter Magnetic Materials Division, USA (11)

Edge Technologies, Inc., USA (8)

Moscow/Continued ⇨

periodic table). The refractory metals (i.e. W, Nb, Ta) are much purer than the rare earth metals, approaching 5 nines purity and with resistance ratios ($R_{295}/R_{4.2}$) of 65,000. They can grow refractory metal single crys-

Energizer Power Systems, USA (8)

GFS Chemicals, Inc., USA (4)

Industrias Nucleares do Brasil A. A., Brazil (23)

Metal Mining Agency of Japan, USA (8)

North-Holland Physics Publishing (a Department of Elsevier Science Publishers), The Netherlands (8)

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R.E.M. s.p.r.l., Belgium, (3)

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Paul D. Deeley, USA (1)

J. J. Lin, USA (2)

Gary D. Sandrock, USA (2)

Nicolas Viñas, Argentina (3)

Level of Support Not Disclosed

Department of Industry, Science, and Technology, Australia (9)

tals several cm (~1 inch or more) in diameter and up to 30 cm (~12 inches) long using a plasma-arc technique. In addition to the pure metals they have prepared binary alloy single crystals of W-Rh, Mo-Rh, W-Mo and W-V, and also of refractory compounds such as TiB, NbC, HfC. ▲

Rare-earth Information Center**Ames Laboratory****Institute for Physical Research and Technology****Iowa State University****Ames, Iowa 50011-3020**