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 XXXII | December 1, 1997 | No. 4

Search of the Month

A new feature of each issue of the *RIC News* will be a sample search from the Rare-earth Information Center Information Retrieval System (RICIRS). The RIC Database currently contains over 90,000 citations from books, journals, reports, and abstracts that deal with the science and technology of rare earth metals, alloys, and compounds.

The sample search below satisfies a request for information on the markets, applications, production, consumption, industry, and preparation of Sm-Co and Nd-Fe-B permanent magnets since 1996. This search utilizes the Boolean operand system with "+" = (or) and "*" = (and).

(MARKET-SURVEY + APPLICATION + PRODUCTION + CONSUMPTION + INDUSTRY + PREPARATION) * (PERMANENT-MAG + (SM,CO) + (ND,B,FE) + ND2FE14B) * (1996 +1997)

TERM	KEYWORDS INDEXED	NUMBER IN REQUESTS
MARKET-SURVEY	223	2
APPLICATION	4486	12
PRODUCTION	510	10
CONSUMPTION	75	2
INDUSTRY	206	6
PREPARATION	9011	20
PERMANENT-MAG	3275	29
(SM,CO)	388	7
(ND,B,FE)	1568	26
ND2FE14B	764	5
1996	2873	32
1997	1208	6

38 DOCUMENTS HAVE SATISFIED THIS REQUEST

The above Literature Search Report shows the key words used in the search, the number of times each appears in the data base, and that 38 documents since 1996 that contain information on the markets, applications, production, consumption, preparation, and industry of selected rare earth permanent magnets since 1996 were referenced in the search. More papers can be referenced by specifically requesting the chemical formula of the particular permanent magnet material.

The cost to receive the Literature Search List from this search, which is a complete listing of all 38 referenced documents, is available for US$80.00. Supporters can receive as many searches as needed for US$300.00 per year (corporate) or US$100.00 (individual).

As an added benefit, supporters receive the 2-page monthly newsletter *RIC Insight* which reports on the late-breaking news of rare earths and how these developments may impact the rare earth industry.

If you would like us to conduct a search for you, please send us your request: RIC, 112 Wilhelm Hall, Ames Laboratory, Iowa State University, Ames, IA 50011-3020 USA; Tel: 515 294 5405; Fax: 515 294 3709; ric@ameslab.gov. ▲

R&D's Scientist of the Year

Professor John H. Weaver, University of Minnesota, has been selected as *R&D Magazine*'s Scientist of the Year {*R&D Magazine*, **39**, [12], 31-5 (1997)}; www.rdmag.com.. Weaver received his Ph.D. in solid state physics from Iowa State University/Ames Laboratory in 1972. He has published more than 430 papers dealing with electronic properties of thin films and single crystals, thin-film overlayer growth on semiconductors, cuprate semiconductors, and molecular thin films, among others. His research has included more than 50 papers on rare earth metals and compounds, including yttrium, rare earth hydrides, samarium clusters, rare earth pnictides and chalcogenides, and the electronic and geometric structure of La-encapsulated fullerenes. ▲

Friedrich Hund 1896-1997

Six weeks after his 101st birthday, Friedrich Hund, the oldest survivor of the original quantum physicists, died in Göttingen, Germany. He is probably best known for his theoretical contributions to quantum physics, known as **Hund's rule**, which allots the lowest energy to the states of highest angular momentum. It is used to assign energy levels of the spectra of the lanthanide atoms and ions in a wide variety of condensed matter substances and gases as well as the calculation of magnetic moments due to 4*f* electrons in lanthanide materials. In the 1950's, he reported on the crystal structure and phases of various mixed rare earth oxide systems with uranium oxide, The Y_2O_3-ZrO_2 system, yttrium oxyfluoride, and the crystal structure of $NaYF_4$. ▲

The First Hawaii Battery Conference (HBC98) will be held on the Kohala Coast, Hawaii, January 5-7, 1998. HBC98 is intended as an international meeting on power sources for consumer and industrial applications and will focus on three areas of battery applications: Lithium and Li-ion batteries for consumer and industrial applications including electric vehicles; polymer electrolytes, anodes and cathodes for Li-ion batteries; and New concepts, alkaline manganese, NiMH batteries, and fuel cells.

Among the invited lectures will be Mr. M.A. Fetcenko, Ovonic Battery Company, speaking on advanced NiMH batteries, and Dr. David Shen, NEXcell battery Company, who will introduce NEXcell's NiMH battery for electric scooter applications.

For more information, contact Dr. Arabinda N. Dey, ARAD Enterprises, P.O. Box 7118, Hilo, HI 96720 USA; Tel/Fax: 808 934 8580; e-mail: lithium@capecod.net. ▲

Cobalt 98

The current and future state of the global availability and price of cobalt and how these may impact the trends of consumption of cobalt metal, alloys and chemicals will be addressed in Gorham/Intertech's sixth international cobalt conference. "Cobalt 98: The Outlook for Cobalt in an Era of New Sources of Supply, New High-Volume Applications and Potentially Declining Prices" will be held January 26-28, 1998 at the Palm Beach Hilton in Palm Beach, Florida.

The conference will bring together cobalt producers, refiners, traders, recyclers and end users. Among the topics to be discussed will be what role increased production of cobalt in Cuba, Australia, Russia, Canada, Zambia, Congo, etc. will have on the future availability, price, and quality of this important metal.

For more information on *Cobalt 98*, contact Melanie Searle, Conference Coordinator, Gorham/Intertech Consulting, 411 US Route One, Portland, Maine 04105 USA; Tel: 207 781 9800; Fax: 207 781 2150; info@intertechusa.com; www.intertechusa.com. ▲

Conference Calendar

*** A NEWS STORY THIS ISSUE**

Note: Reach as many potential conference attendees as possible! Send us your conference announcement and we will publish it here. ▲

January '98

The First Hawaii Battery Conference (HBC98)
Kohala Coast, Hawaii, USA
January 5-7, 1998
*This issue

Military & Commercial Applications for Low Cost Cryocoolers-An Industry Assessment Workshop (M-CALC II)
Shelter Island, San Diego, California, USA
January 15-16, 1998
*This issue (page 3)

Cobalt 98
Palm Beach, Florida, USA
January 26-28, 1998
*This issue

March '98

The 15th International Seminar & Exhibit on Primary & Secondary Batteries
Fort Lauderdale, Florida, USA
March 2-5, 1998
*This issue (page 3)

International Forum on Rare Earths: Technology and Trade
Beijing, China
March 24-26, 1998
RIC News **XXXII**, [3] 4 (1997)

28èmes Journées des Actinides
Uppsala, Sweden
May 14-18, 1998
*This issue (page 3)

July '98

Strongly Correlated Systems (SCES98)
Paris, France
July 15-18, 1998
*This issue (page 3)

August '98

6th International Symposium on Magnetic Bearings
Cambridge, Massachusetts, USA
August 5-7, 1998
*This issue (page 3)

15th International Workshop on Rare-Earth Permanent Magnets and Their Applications
Dresden, Germany
August 30-September 3, 1998
RIC News **XXXII**, [1] 5 (1997)

September '98

Tenth International Symposium on Magnetic Anisotropy and Coercivity in Rare-Earth Transition Metal Alloys
Dresden, Germany
September 4, 1998
RIC News **XXXII**, [1] 5 (1997)

7th European Magnetic Materials & Applications Conference (EMMA'98)
Zaragoza, Spain
September 9-12, 1998
RIC News **XXXII**, [1] 5 (1997)

October '98

Rare Earths '98
Freemantle, Western Australia, Australia
October 25-30, 1998
RIC News **XXXII**, [2] 5 (1997)

M-CALC II

The Military & Commercial Applications for Low Cost Cryocoolers (M-CALC II) is the second Industry Assessment Workshop sponsored by the Electronic Industries Association. The goal of the Workshop is to develop an understanding of the industry's manufacturing capabilities for cryocoolers. The two-day workshop will run from January 15-16, 1998 and will be held at Humphrey's Half Moon Inn, Shelter Island, San Diego, California, USA.

For more information, contact Eric Samuelson, Electronic Industries Association, 2500 Wilson Boulevard, Arlington, VA 22201 USA; Tel: 703 907 7546; Fax: 703 907 7549; cryo@eia.org; www.eia.org/ieg/cryo. ▲

15th International Battery Seminar

The 15th International Seminar & Exhibit on Primary & Secondary Batteries will be held March 2-5, 1998 at the Broward County Convention Center, Fort Lauderdale, Florida. For more information, contact: Thomas M. DeVita, Seminar Coordinator, Florida Educational Seminars, Inc., 2300 Glades Road, Suite 307E, Boca Raton, FL 33431 USA; Tel:561 367 0193; Fax: 561 367 8429; ansum@aol.com; // www.subcomm.com/FES. ▲

28émes Journées des Actinides

The 28émes Journées des Actinides conference will provide a forum for informal discussions related to both fundamental and applied aspects of 5*f* chemistry and physics. There will also be a short school covering topics related to the conference. The conference will be held in the old university building in Uppsala, Sweden, May 14-18, 1998.

For more information, contact, 28émes Journées des Actinides, Fysiska Institutionen, Box 530, S-751 21 Uppsala, Sweden; Tel: 46 18 4713621; Fax: 46 18 4713524; http:// www.fysik4.fysik.uu.se/~jda. ▲

SCES98

The international conference "Strongly Correlated Electron Systems" (SCES98) will be held July 15-18, 1998 in Paris, France. The main topics of the conference will be: heavy fermion systems including magnetic and superconducting systems, Kondo and non-Fermi liquid models, spin ladders, new *d*- and *f*-electron materials, strongly correlated semiconducting and insulating systems, Mott transitions, manganites, electronic properties of low dimensional materials and organic systems, high energy spectroscopies, correlations in high-T superconductors, interplay between superconductivity and magnetism, new superconducting materials, borocarbides, ruthenates, and others. The conference organizers encourage authors to submit abstracts on the latest topics and emerging subjects in these areas. Abstracts are due March 1, 1998.

For more information, contact Dr. Bernard Coqblin, Chairman of SCES98, Universite Paris-Sud, Batiment 510, 91405-Orsay, France; Tel: 33 1 69 15 60 94; Fax: 33 1 69 15 60 86; sces98@lps.u-psud.fr; www.CNRS-bellevue.fr/~sces98/. ▲

ISMB-6

Magnetic bearings have seen increased use in industry for the support of rotating shafts that are subject to forces. They provide the advantages of oil-free operation, low friction losses, long life, and enhanced vibration control. The many possible applications of magnetic bearings include uses in aircraft engines, compressors, robotics, steam turbines, turbomolecular pumps, space technology, flywheel energy storage devices, and vibration isolation.

The 6th International Symposium on Magnetic Bearings (ISMB-6) will be held August 5-7, 1998, in Cambridge, Massachusetts, USA. ISMB-6 will also include exhibits from firms displaying an array of hardware, peripherals, and services relating to magnetic bearings. For more information, contact Ms. Tana Herndon, Conference Coordinator, ISMB-6, Mechanical, Aerospace & Nuclear Engineering Department, Thornton Hall/MEC 105, University of Virginia, Charlottesville, VA 22903 USA; Tel: 804 924 3292; Fax: 804 982 2246; magconf@virginia.edu. ▲

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SCES '96 Proceedings

The proceedings of the international conference on Strongly Correlated Electron Systems (SCES '96) which was held in Zürich, Switzerland, August 19-22, 1996, is now available. The conference was attended by 380 persons from 27 countries with most of the attendees from Japan, followed by Germany, Switzerland, and the United States. The SCES conferences evolved from previous conferences on valence fluctuations, crystalline field conferences, conferences on anomalous rare earths and actinides, and highly correlated electron systems.

The proceedings of SCES '96 includes 310 papers from contributors who report on heavy electron phenomena, low carrier density rare earth systems, superconductivity in heavy fermions, cuprates and borocarbides, non-Fermi liquid behavior, metal-insulator transitions, magnetism in heavy electron systems, quantum phase transitions, low dimensional systems (including charge and spin density waves, and spin Peierls transitions) and magnetooptics. Both theoretical and experimental results of each topic is presented. Well over one-third of the total contributions

Continued on page 5, Column 3 ☛

Qi Long Enterprise (USA) Inc.

A fully-owned subsidiary of a major Chinese manufacturer of rare earths, Qi Long Enterprise (USA) Inc., has set up a factory sales outlet in Los Angeles, California in order to serve customers in North America and other regions. The company offers rare earth metals, oxides, hydroxides, fluorides and custom-made rare earth products.

For more information, contact Fan Luo, Qi Long Enterprise (USA) Inc., 3301 Ocean Park Blvd., #108, Santa Monica, CA 90405 USA; Tel: 310 314 2291; Fax: 310 314 9935; qilong@gus.net; www.qi-long.com. ▲

Baotou Steel & Rare Earth Co. (USA)

The offices of Baotou Steel & rare Earth Co. (USA) have moved. Their new address and contact numbers are: 1818 Gilbreth Road, Suite 223, Burlingame, CA 94010; Tel: 650 259 9618; Fax: 650 259 9608; Baotou@aol.com; www.baotou.com. ▲

Energen, Inc.

The new address for Energen, Inc., is 17D Sterling Road, Billerica, MA 01821 USA; Tel: 978 671 5400; Fax: 978 670 9876; energen@tiac.net ▲

Pacific Materials Resources, Inc.

Stonegate International, Inc. has changed its name and address to: Pacific Materials Resources, Inc., 17640 NE 65th Street, Redmond, WA 98052 USA: 425 558 4000; Fax: 425 558 0505. ▲

ETREMA Receives Grant

Edge Technologies Rare Earth Magnetostrictive Alloys (ETREMA), a company located in Ames, Iowa, was recently awarded US$3.7 million to improve its product, Terfenol-D. Terfenol-D is a magnetostrictive alloy that expands and contracts in response to magnetic fields. The alloy gets its name from the materials that make up the alloy and the major sponsoring research organization: *Ter*bium-*Fe*-*N*aval *O*rdnance *L*aboratory.

The company will receive US$3 million from the Department of Defense (DoD) and US$700,000 from the National Institute of Standards and Technology (NIST) that will help the company research ways to lower the cost of Terfenol-D. It is hoped that the use of the alloy will eventually replace ceramic transducers in sonar systems that are currently used by the Navy, which will improve sonar performance. Another use of the product includes a novel wire bonding clamp that is to be used in precision, large-volume production applications in the semiconductor industry. ▲

Dy Spectra

The National Institute of Standards & Technology (NIST) is negotiating with the Office for Sponsored Research, Harvard University, to develop procedures for radiometric calibration of the NIST Fourier Transform Spectrometer (FTS). The agreement will also lead to experimental data and interpretive results on the measurements, energy level analysis, and gf values for the first two spectra of Dysprosium, Dy^{+1} and Dy^{+2}.

In addition to the radiometric calibration of the NIST FTS from 300 nm to 2 μm, the contract will call for measurement of Dy hollow-cathode and electrodeless lamp spectra with NIST FTS in order to confirm the energy level classification of previously classified Dy^{+1} and Dy^{+2} spectral lines observed with the NIST FTS and carry out searches and derive optimal values for additional energy levels and to derive branching ratios of observed Dy^{+1} and Dy^{+2} lines.

Since the Harvard group has demonstrated unique qualifying experience with FTS high-resolution spectroscopy, in completing radiometric calibrations and work on complex atomic spectra, they are considered for sole-source acquisition by NIST. For more information, contact Sandra Febach, Tel: 301 975 6326; Fax: 301 963 7732. ▲

Bonded Permanent Magnet Forecast

Gorham/Intertech Consulting is completing a two-volume multiclient study that will analyze the opportunities and challenges that face the global bonded magnet industry. Volume I, "Market Opportunities for Polymer Bonded Magnets" will analyze the recent growth of the bonded magnet industry and integrate this into current trends and recent developments that will provide a five year forecast for future rate of growth. Volume II, "Manufacturing Polymer Bonded Magnets" will enable subscribers to take advantage of these opportunities by providing a description of the key tech-

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Processing Equipment

The Swedish Terfenol Manufacturer, FEREDYN EUROPE AB, Uppsala, is offering some of its R&D and processing equipment for sale. The equipment is reported to be in excellent condition and has only been used for R&D purposes. The equipment consists of a vacuum melting and casting furnace of type VSG010 (Balzers AG) that has a melting volume of 1.6 L, which is equivalent to 15 kg of Terfenol, a vacuum/controlled atmosphere glove box and gas purification system, and a metal crusher of type BB-0 (Retsch AG) with a 70 kg/hr capacity.

For more information, contact Dr. Mirka Fahlander, Tel: 46 46 159476; Fax: 46 46 159476 or Mr. Ola Nordström, Wijk & Nordström AB, Box 1022, S-751 40 Uppsala, Sweden; Tel: 46 18 157680; Fax: 46 18 694157. ▲

Nd Scrap Wanted

GJK Metals is a metals recovery company that buys and sells all forms of rare earth metals and alloys. They are currently in the market for 80 tons of Neodymium scrap with approximately the following analysis: Nd = 28-32%, Dy = 3-4%, B = 3%, Fe = 60-66%. The company is also looking to find a buyer for 50 tons of 99.99% Cd balls and 50 tons of Cd sticks.

For more information, please contact George J. Korman, GJK Metals, #1 Alexandria Towne, Southfield, MI 48075 USA; Tel: 248 559 3117/248 559 2875; Fax: 248 559 5884. ▲

☛ *Bonded Magnet Forecast*

nologies involved, the processes and materials used, and a list of suppliers of the needed equipment and materials.

The strategic study will begin January 1, 1998 and will be completed by June, 1998. For more information, contact J. Scott Stephenson, Director, Technical Marketing Studies, Intertech Corporation, 411 US Route One, Portland, ME 04105 USA; Tel: 207 781 9800; Fax: 207 781 2150; info@intertechusa.com; www.intertechusa.com. ▲

Holographic Recording

The major advantage of optical memory storage is that an entire page of information can be retrieved at one time, instead of one bit at a time as with other memory technologies. The bit-parallel format that optical memory allows may not only lead to data transfer rates in excess of 10^9 bits per second, but to fast access times as well. This compares favorably with other parallel optical recording techniques such as photorefractive and persistent spectra hole-burning (PSHB) materials which, unless further breakthroughs are forthcoming, are still slower than existing semiconductor memories that are used to store and retrieve single-page 1000 x 1000-bit data. A new scheme for parallel data storage using coherent time-domain optical memory (TDOM) was proposed and shown to be practical via experiment by X.A. Shen and R. Kachru of Molecular Physics Laboratory, SRI International, Menlo Park, CA 94025 USA; Tel: 415 859 3638; Fax: 415 859 6196 {*J. Alloys Compounds*, **250**, 435-438 (1997)}.

The researchers used a Eu^{3+}-doped Y_2SiO_5 crystal to store and retrieve four wavelength multiplexed single-page volume time-domain (spectral) holograms in a single spatial location. The images were written by a laser beam with reference and read pulses that were 14 µs in duration with a peak power of 100 mW (the image-bearing pulse was 50 µs at 7mW). Since Eu^{3+}:Y_2SiO_5 has two distinct optical sites for the $^7F_0$ - $^5D_0$ transition, and with about 5000 frames of image per optical site, a total of 10,000 frames per spatial spot (2 optical sites = 1.0 x 1.0 x 7.0 mm in the experiment) is possible. Therefore, for a frame that consists of 500 x 500 bits, it is projected that the storage capacity could be as high as 2.5 Gbits per focal volume, or 36 x 10^{10} bits/cm^3. The authors also suggest that potential input/output times could be as high as 3.4 x 10^9 bits/sec. Even though these performance estimates were derived from extrapolation, they are intriguing since the results were not obtained under optimum conditions and were probably hindered somewhat by equipment limitations. ▲

21st RERC Proceedings

The proceedings to the 21st Rare Earth Research Conference, held in Duluth, Minnesota, USA July 7-12, 1996 have been published as Volumes **249/250** of *J. Alloys and Compounds* and is entitled *Rare Earths 1996*. Following a special contribution by Prof. Gregory R. Choppin, the recipient of the Eighth Frank H. Spedding Award, the proceedings presents papers that are grouped into the same areas as the conference symposia: coordination chemistry; environmental sciences; medicinal chemistry; synthesis, structure and properties of novel solid state compounds; spectroscopy and non-linear optics; photophysics applications; industrial applications and processes; solid state electrolytes; X-ray and neutron scattering; superconductivity; and new developments in 4*f* magnetism. As an improvement in previous conferences, the program sought to achieve a balance between chemical and physical topics, which reflected an increased emphasis on applications of the lanthanides.

Some of the contributions that deal with industrial applications and processes include holographic recording using rare earth-doped solids, melt processed superconductors, corrosion protection of Al-Mg alloys, and wet-and-dry mechanical milling of Terfenol-D, among others. An environmental study of the mobility of rare earth elements indicate that aqueous fluids in the earth's crust affect the stability of these substances which may require improved methods of radioactive waste disposal in the future. Several papers that deal with rare earth ions in medical diagnostics such as Eu^{3+}, Gd^{3+}, and Tb^{3+} as well as rare earth chelates and complexes that are used in nuclear magnetic resonance imaging (NMR) and luminescent materials reveal that these substances are increasingly essential for advanced technologies in medicine. Indeed, the future seems bright for rare earths in the medical field.

The 679-page *Rare Earths 1996* was published in 1997, is quality hard cover bound, and was edited by L. R. Morss, L. E. DeLong, M. F. Reid, and

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☛ *SCES Proc. from page 3 Column 3*

deal with rare earths as constituents in systems, or with rare earth compounds directly.

Most of the papers dealing with low-carrier and mixed valence systems contain results of Ce-based compounds. Magnetization studies of CeNiSn, $CeAl_3$ and related alloys, and electrical resistivity studies of Ce ternary alloys are also included. Nuclear Magnetic Resonance (NMR), magnetic ordering, and optical properties studies of rare earth-boride superconductors, from $(Lu_{1-x}Yb_x)Ni_2B_2C$ to $Y(Ni_{1-x}M_x)_2B_2C$ (M= Co, Cu, Pd, Pt) are also included.

The 1,082-page proceedings was published as *Physica B Condensed Matter*, Vols. **230-232** (1997). Complete author and subject indices are included. SCES'96 is available for (US$1,068.00) and can be ordered from the Elsevier Science. Customers in Europe should send their orders to: P.O. Box 211, 1000 AE Amsterdam, The Netherlands; Tel:31 20 485 3757; Fax:31 20 485 3432; nlinfo-f@elsevier.nl; in the Americas: P.O. Box 945, New York, NY 10159-0945 USA; Tel:1 212 633 3750; Fax:1 212 633 3764; usinfo-f@elsevier.com; in Japan: 20-12 Yushima 3-chome, Bunkyo-ku, Tokyo 113; Tel: 81 3 3836 0810; Fax:81 338394344; forinfo-kyf04035@niftyserve.or.jp. ▲

H. B. Silber. The proceedings contain author and subject indices and is available for US$1000.00. Copies can be ordered from the Elsevier Science customer service department nearest you. Customers in Europe should send their orders to: P.O. Box 211, 1000 AE Amsterdam, The Netherlands; Tel:31 20 485 3757; Fax:31 20 485 3432; nlinfo-f@elsevier.nl; in the Americas: P.O. Box 945, New York, NY 10159-0945 USA; Tel:1 212 633 3750; Fax:1 212 633 3764; usinfo-f@elsevier.com; in Japan: 20-12 Yushima 3-chome, Bunkyo-ku, Tokyo 113 Japan; Tel: 81 3 3836 0810; Fax:81 3 3839 4344; E-mail: forinfo-kyf04035@niftyserve.or.jp.

N.B. *The Twenty-Second Rare Earth Research Conference is planned for a location near Argonne, Illinois, USA in 1999.* ▲

Handbook Volume 23

The 23rd Volume of the *Handbook on the Physics and Chemistry of Rare Earths* series covers, in six chapters, the various physical aspects of a wide range of rare earth materials, from lanthanide complexes to the occurrence and chemistry of rare earths in sea water.

Chapter one (number 153 in the series) summarizes recent developments in the use of paramagnetic lanthanide complexes to induce chemical shifts in the nuclear magnetic resonance (NMR) spectra of organic compounds. The past few years has seen an increase in the use of lanthanide complexes in magnetic resonance imaging (MRI) employed in medical diagnostics and detection. Studies of stereochemically rigid complexes derived from indole-edta, benzyl-edta, and macrocyclic ligands with pendant arms (R[dota]-complexes) are included. The next chapter deals with cage-type ligands which encapsulate the lanthanide ions and serve as antenna which absorb light and then transfer the energy to the lanthanide ion. The theory and application of the consequences of antenna-to-ion energy transfer and its relationship to supramolecular chemistry are discussed in deatail. The authors discuss how these complexes are used in fluorimmunoassays and DNA hybridization assays.

In keeping with what has become a *Handbook* tradition, "Rationalization of crystal-field parameterization" presents both calculated and experimental spectroscopic properties of rare earth, and rare earth-doped compounds. An impressive overview of the literature which reports on the spectroscopic properties of trivalent lanthanide ions doped into crystalline host matrices, including references, is included. There are helpful indices at the end of the chapter, one of which contains selection rules for induced electric dipole and magnetic dipole transitions for seven crystal groups.

Chapter 156 in the series is a comprehensive and systematic review of everything you ever wanted to know about binary, ternary, and quaternary rare earth phosphides. The authors present the preparation, phase diagrams, structure, and chemical and physical properties. They also review the crystallochemical regularities, the nature of the interaction between components in ternary systems, and structural relationships in rare earth phosphide systems.

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Rare earth metal-containing halide vapors and vapor complexes (MX-RX_3 and MX_2-RX_3) [M= non-rare earth metal, R= rare earth metal] are finding increasing utility and diversity of applications in lighting, energy storage media for high-power laser systems, and for the development of recycling/separation processes. The next chapter reviews the thermochemical properties and structural trends of simple rare earth halides together with the characterization of gaseous homo-complexes. Vapor complexes in binary systems of rare earth halides with (principally) alkali halides that have been determined by absorption and fluorescence spectroscopy is summarized.

The final chapter in the volume "Marine chemistry and geochemistry of the lanthanides" reviews the occurrence of lanthanides in the world's oceans and the processes that control the distribution of these elements in sea water. The authors describe the physical chemistry of lanthanides in the oceans, including solution chemistry and complexation. Particular attention is given to research on the lanthanide geochemistry of marine basins, pore waters, and hydrothermal waters.

The 664-page hard cover Volume **23** was published in 1996, is available for NLG 445.00 (US$279.00) and can be ordered from the Elsevier Science customer service department nearest you. Customers in Europe should send their orders to: P.O. Box 211, 1000 AE Amsterdam, The Netherlands; Tel:31 20 485 3757; Fax:31 20 485 3432; nlinfo-f@elsevier.nl; in the Americas: P.O. Box 945, New York, NY 10159-0945 USA; Tel: 1 212 633 3750; Fax: 1 212 633 3764; usinfo-f@elsevier.com; in Japan: 20-12 Yushima 3-chome, Bunkyo-ku, Tokyo 113 Japan; Tel: 81 3 3836 0810; Fax: 8 133 839 4344; E-mail: forinfo-kyf04035 @niftyserve.or.jp. ▲

HDDR on $Sm_2Fe_{17-x}Ga_x$

Among the best rare earth-permanent magnet materials known, the interstitially modified Sm-Fe-C compounds can exhibit an energy product up to 176 kJ m^{-3}. This makes them attractive for commercial applications, but their magnetic properties decrease during the high temperature processing of the magnet material. To stabilize the excellent magnetic properties during the high temperature fabrication process, Ga can be partially substituted for Fe to form $Sm_2Fe_{17-x}Ga_x$ which improves high temperature performance.

The high-temperature behavior of the alloy was improved by a team from Institute für Metallische Werkstoffe, IFW Dresden, D-01171 Dresden, Germany (corresponding author is K-H. Müller; khm@ifw-dresden.de). The researchers employed the hydrogenation disproportionation desorption recombination (HDDR) process on Ga-rich Sm-Fe-Ga which was modified by reactive grinding in a hydrogen atmosphere {*J. Phys. D: Appl. Phys.*, **30**, L51-4 (1997)}.

They initially formed a prealloy by arc melting Sm, Fe, and Ga together, then added Fe again in an induction furnace to form samples with compositions $Sm_2Fe_{17-x}Ga_x$ (x = 0, 1, 2). After homogenizing the samples in argon-filled quartz tubes at 1050°C for 72 hours, the samples were crushed to form particles, then ball milled. Annealing was performed at 700°C and 800°C for 1 hour to facilitate HDDR of $Sm_2Fe_{17-x}Ga_x$, followed by carburizing at 500°C for 16 hours in CH_4. According to the authors, this is the first time that a complete HDDR process was carried out on $Sm_2Fe_{17-x}Ga_x$ where $x \geq 1$. Demagnetization values of the powder samples that were embedded in epoxy resin were subsequently measured by a vibrating sample magnetometer. X-ray diffraction measurements revealed that the samples were completely disproportionated into a mixture of nanocrystalline samarium hydride and α - (Fe,Ga) after reactive grinding. The Ga acts to stabilize the alloy, decreasing oxidation during sample preparation. The resin-bonded samples of the reactively ground samples showed magnetic coercivities of up to 1.8 Tesla. ▲

Mag-Optical Handbook

The commercial utilization of optical data storage devices based on magneto-optical media have been available only in the last ten years. But in that brief time, have come to represent the premier method of storing huge amounts of information in a cost-effective and efficient format that can easily be used by the average consumer. The technology has progressed through several generations of international standard format products, and is today firmly established as a dependable, reliable, and extendible method for writable/erasable, high density optical storage. The methods and technology of mag-optical information storage is employed for storing computer data, audio and video recordings, and other digitized information. A new book by Noyes Data Corporation *Handbook of Magneto-Optical Recording: Materials, Subsystems, Techniques* is a reference source dealing with these technologies.

The *Handbook* is a collection of contributions from twenty experts in the field of magneto-optical recording. These experts, representing a wide variety of institutions and their own perspectives, report on the many aspects of magneto-optical recording, including materials, techniques for achieving the recording function, and storage device subsystems. The *Handbook* presents, in fourteen chapters, the current state of the art in mag-optical data recording. Following a brief but insightful introductory chapter that covers the basics of mag-optical recording and trends in the marketplace for these technologies, the *Handbook* establishes a pace and breadth of information on the topic that will convince most who are working in this field that the book should be included as an important constituent of their reference library. Consecutive chapters cover heads and lasers, servos and actuators, media substrates and format, magneto-optical thin film recording materials in practice, materials characterization, writing and erasing in magneto-optical recording, the magneto-optical readout process, sources of noise in magneto-optical readout, modeling the magneto-optical recording processes, testing, drive packaging, data reliability and errors, and the outlook for magneto-optical recording (the final chapter presents a crystal-ball perspective by examining trends in information processing systems, magnetic storage and mag-optical dives as well as advanced mag-optical media and heads. Magnetic and optical super-resolution [GdFeCo, TbFeCoAl, and TbFeCo films], and advances in near-field optics reveal how recording densities of 100 Gbit/in^2 can be realistically achieved).

Continued in next two columns ☛

The *Handbook* is highly recommended for anyone from with at least an active interest in the field of mag-optical recording, to students, researchers and engineers who are working on developing magneto-optical storage media for the future.

The 947-page hard cover cloth-bound book was published in 1997, was edited T.W. McDaniel and R.H. Victora ☛ and can be ordered from: Noyes Data Corporation, 369 Fairview Avenue, Westwood, NJ 07675 USA; US$125.00. ▲

Rare Earth Prices 1960-1994

A compilation of the prices of rare earth metals (except promethium) from 1960 through 1994 was conducted by James B. Hedrick, U.S. Geological Survey, 983 National Center, Reston, VA 20192 USA; Tel: 703 648 7725; Fax: 703 648 7722; jhedrick@usgs.gov. The paper, "Rare-earth metal prices in the USA ca. 1960 to 1994" appears in *J. Alloys and Compounds*, **250**, 471-81 (1997). The article includes a brief history of the production, commercial uses and economics of these metals. The prices listed are quoted on a kilogram basis and are given in US dollars on both an actual and constant dollar basis. ▲

RIC Database

The total number of documents referenced in our system is now over 90,000. The documents are stored as citations in the RIC data base and represent books, journal articles, government, company, and laboratory reports, patents and theses which contain information on rare earth metals, their alloys and compounds. A typical citation from a search contains the author(s) name(s), title of paper or contribution, reference line, and keywords that we have assigned to the citation after we have reviewed the document (see below).

MAJOR-SOSIAS;MA
Rare earths: an industry review and market outlook
Elements, Vol. 6, [2], 10-19 (1997)

1997	RARE-EARTH	INDUSTRY	MINERAL
RESERVES	PRODUCTION	CONSUMPTION	MINING
APPLICATION	IMPORT-EXPORT	CATALYST	PERMANENT-MAG
CHINA	UNITED-STATES	JAPAN	PRICES
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The minimum cost to receive the results of a computer search is US$50.00 (for 25 citations and US$2.00 for each citation over 25 per search). However, many organizations become supporters which allows them to not only receive as many searches as needed for one year, but as an added benefit, they receive the monthly two-page newsletter *RIC Insight*. *RIC Insight* provides a provocative view into recent developments of rare earth science and technology and how these may impact the rare earth industry. The cost to become a supporter is US$100.00 for an individual, or US$300.00 for a corporate membership.

Send requests to: Rare-earth Information Center, 112 Wilhelm Hall, Iowa State University, Ames, IA 50011-3020 USA; Tel: 515 294 5405; Fax: 515 294 3709; ric@ameslab.gov. ▲

Transfermium Elements Named

The International Union of Pure and Applied Chemistry (IUPAC) recently announced that its Commission on Nomenclature of Inorganic Chemistry (CNIC) has presented a list of recommended names for elements 101-109. The list is a revision of the provisional recommendations that were initially proposed in 1994. The new names that will soon become internationally accepted are:

Element	Name	Symbol
101	Mendelevium	Md

after *Mendelev* who formulated the periodic table

102	Nobelium	No

in honor of Alfred *Nobel*

103	Lawrencium	Lr

in honor of Ernest O. *Lawrence*

104	Rutherfordium	Rf

after Lord Ernest *Rutherford*

105	Dubnium	Db

in honor of the *Dubna* Laboratory

106	Seaborgium	Sg

in honor of physicist Glenn *Seaborg*

107	Bohrium	Bh

in honor of physicist Niels *Bohr*

108	Hassium	Hs

from Gesellschaft für Schwerionenforschung's (GSI) location in the German region of *Hesse*

109	Meitnerium	Mt

in honor of physicist Lise *Meitner*

▲

RIC News

Vol. XXXII, No. 4 December 1, 1997

Published
quarterly in March, June,
September, and December
by
Rare-earth Information Center
a Unit of the
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