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 | March 1, 1997 | No. 1

Farewell?

For those readers who have not sent us their mailing address since September 1, 1996, this issue will be your last. If you wish to receive future issues of the free *RIC News*, send your complete mailing address to:

RIC, 116 Wilhelm Hall, Iowa State University, Ames, IA 50011-3020 USA; Tel: 515 294 2272; Fax: 515 294 3709; ric@ameslab.gov (please note the corrected postal code).

If you know of someone who would like to receive the *News*, just send us their complete mailing address and we will be happy to add them to the list as well.

The new addresses that subscribers have sent us since September 1, 1996 will be reflected in the June 1, 1997 issue of the *RIC News*. ▲

Navistar + EOLYS = Cleaner Air

A cerium-based catalyst that is added to diesel fuel decreases particulate emissions while decreasing NO*x* and non-methane hydrocarbon levels that are present in exhaust gases. The new fuel additive, introduced by Rhône-Poulenc, is advertised under the name EOLYS. The fuel-borne catalyst improves the performance of conventional diesel traps currently used in exhaust systems. EOLYS significantly reduces the temperature of particulate combustion, which facilitates a continuous regeneration of the collected soot on the trap.

This "smokeless diesel" technology was developed jointly by Rhône-Poulenc and Navistar International Corporation, the world's largest manufacturer of diesel engines in the 160-300 HP (119-224 kW) range. The new technology reduces NO*x* and non-methane hydrocarbon emissions to 2.0 g/BHP-hr and particulate emissions to 0.01 g/BHP-hr. These emissions meet government-proposed diesel emission standards of 2004 which are set at 2.5 g/BHP-hr and 0.1 g/BHP-hr, respectively.

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Rare earth-based catalytic fuel additives are not new. In the mid 1980's, ceramic particulate traps that were manufactured by NGK and Corning were tested on mass transit buses in Athens, Greece. The buses used a cerium-based organosoluble additive in diesel fuel {*Rare Earths Monitor*, **III**, [3] 1,3 (1989)}. In the Greek study, cerium was added to fuel at a concentration of 25-50 ppm which enabled the buses to operate in excess of 100,000 km (61,000 mi) before the traps needed cleaning.

More recently, the February, 1993 issue of *China Rare Earth Information* reported that a two year study by the East China Technical Institute concluded that certain rare earths doped into diesel fuel resulted in increased fuel efficiency of 4-5% while decreasing particulate emissions by 20% {*RIC News*, **XXVIII**, [3] 7 (1993)}. The rare earths were reportedly added to the fuel using certain organic compounds.

The cerium ion acts to lower the combustion temperature of the fuel in the engine. This decreases the soot produced because the constituents of the fuel are more completely burned. Environmentally benign cerium oxide is then vented to the atmosphere via exhaust gases.

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ISO Upgrade

Shin-Etsu Chemical Co., Ltd., Takefu Plant, Takefu City, Japan, has been awarded the ISO-9001 certification, which was upgraded from the ISO-9002 certification, by Japan Quality Assurance Organization. Shin-Etsu was granted the accreditation on November 22, 1996. The company was found to be in compliance with the wide range of demands of a quality assurance system where the supplier designs and manufactures their own products. Shin-Etsu manufactures rare earth oxides, compounds, and rare earth permanent magnets. For more information, contact Fumihiko Saito, Shin-Etsu Chemical Co., Ltd., Magnetic Materials Research & Development Center, 1-5 Kitago, 2 Takefu City, Fukui, 915 Japan; Tel: 81 778 21 8141; Fax: 81 778 23 8538; s11118@sec.shinetsu.co.jp. ▲

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For more information on EOLYS technology, contact Jennie Collucci, Rhône-Poulenc, USA; Tel: 609 860 4625; Robert Carso, Navistar, USA; Tel: 708 865 3484; or Véronique Bienaymé, Rhône-Poulenc, 25, Quai Paul Doumer 92408 Courbevoie Cedex, France; Tel: 47 68 08 47/19 49; Fax: 47 68 14 44. ▲

Battery Seminar

The 14th International Seminar on Primary & Secondary Batteries will be held March 10-13, 1997 in Fort Lauderdale, Florida. The seminar will provide a unique working forum for individuals and groups from around the world who are interested in receiving a comprehensive review of the current status, and future outlook, of primary and secondary battery technology and application. The seminar will also host exhibitors.

For more information, contact: Thomas M. DeVita, Seminar Coordinator, Florida Educational Seminars, Inc., 23090 Glades Road, Suite 307E, Boca Raton, FL 33431 USA; Tel: 407 338 8727; Fax: 407 338 6887; ansum@aol.com; http://www.subcomm.com/FES. ▲

PM Design Course

Princeton Electro-Technology, Inc. will hold its 15th Technology Short Course on Permanent Magnet Design on March 17-19, 1997 at the Crowne Plaza Hotel, near the Detroit Metro Airport. The course will update attendees on the latest developments in materials properties and processes, magnet behavior, magnetic circuit design and behavior, and motor, actuator, and sensor design.

For more information, contact: Princeton Electro-Technology, Inc., 5874 NW 32nd Way, Boca Raton, FL 33496; Tel: 561 998 4249; Fax: 561 998 3286; drpeterc@concentric.net; www.magnetweb.com/events.htm. ▲

Fuel Cell Vehicles 97

A conference that will examine the opportunities and barriers in integrating fuel cell vehicles into the world automotive market, as well as global strategies for marketing current and future fuel cell technology for transport applications, will take place October 22, 1997.

The conference "Commercializing Fuel Cell Vehicles 97" will be held at the Le Meridien Frankfurt in Frankfurt, Germany. For more information, contact Melanïe Searle, Intertech Conferences, 411 US Route One, Portland, ME 04105 USA; Tel: 207 781 9800; Fax: 207 781 2150; info@intertechusa.com;http://www.intertechusa.com. ▲

Conference Calendar

*** A NEWS STORY THIS ISSUE**

March '97
The 14th International Seminar on Primary and Secondary Batteries
Fort Lauderdale, Florida
March 10-13, 1997
*This issue

15th Technology Short Course and Workshop on Permanent Magnet Design
Detroit, Michigan, USA
March 17-19, 1997
*This issue

April '97
Tenth International Conference on NdFeB Magnets
Chicago, Illinois, USA
April 16-18, 1997
*This issue (p. 5)

12th International Conference on Solid Compounds of Transition Elements
Saint-Malo, France
April 22-25, 1997
RIC News **XXXI**, [2] 3 (1996)

July '97
Nuclear Methods in Magnetism
Canberra, Australia
July 21-23, 1997
RIC News **XXXI**, [4] 2 (1996)

Workshop on High Coercivity Materials (Hc -M)
Perth,WA, Australia
July 23-25, 1997
RIC News **XXXI**, [4] 2 (1996)
*Also this issue (p. 5)

International Conference on Magnetism 1997 (ICM'97)
Cairns, Australia
July 27-August 1, 1997
RIC News **XXXI**, [3] 3 (1996)

15th International Colloquium on Magnetic Films and Surfaces (ICMFS'97)
Sunshine Coast, Queensland, Australia
August 4-8, 1997
RIC News **XXXI**, [3] 3 (1996)

August '97
5th International Conference on Research in High Magnetic Fields
Sydney, Australia
August 4-6, 1997
RIC News **XXXI**, [4] 2 (1996)

International Conference on Neutron Scattering (ICNS'97)
Toronto, Canada
August 17-21, 1997
*This issue (p. 5)

September '97
Third International Conference on Elements (ICFE3)
Paris, France
September 14-19, 1997
RIC News **XXXI**, [2] 3

October '97
Commercializing Fuel Cell Vehicles 9
Frankfurt, Germany
October 22, 1997
*This issue

August '98
15th International Workshop on Rare Earth Permanent Magnets and Their Applications
Dresden, Germany
August 30-September 3, 1998
*This issue (p. 5)

September '98
Tenth International Symposium on Magnetic Anisotropy and Coercivity in Rare-Earth Transition Metal Alloys
Dresden, Germany
September 4, 1998
*This issue (p. 5)

7th European Magnetic Materials Applications Conference (EMMA'9
Zaragoza, Spain
September 9-12, 1998
*This issue (p. 5)

October '98
Rare Earths '98
Freemantle, Western Australia, Australia
October 25-30, 1998
**This issue (p. 5)*

Solids Under Compression

A review of the progress that has been made in high pressure physics was written by Professor W.B. Holzapfel, Universität-GH Paderborn, Fachbereich Physik, Warburger Strasse 100, D-33095 Paderborn Germany, and appeared in *Rep. Prog. Phys.* **59**, 29-90 (1996). The paper places special emphasis on the recent developments in experimental techniques, pressure calibration, equations of state for simple substances and structural systematics of the elements. Short sections devoted to hydrogen under strong compression and general questions concerning new electronic ground states are also included.

Following a short history of high pressure research, the author explains the use and operating parameters of various experimental methods. These include the primitive piston cylinder devices and strongly supported large anvil cells (LAC) that are constructed of sintered tungsten carbide, diamond anvil cells (DAC) that stretched the envelope of pressure and temperature ranges beyond LAC, and shock wave techniques. The LAC have been used in Mössbauer spectroscopy with isotopes such as ^{151}Eu, ^{153}Eu, and ^{170}Yb. Neutron diffraction studies have taken place using the advantages of DAC, as well as x-ray diffraction techniques. The DAC provides higher pressure-temperature conditions than LAC by heating the sample internally using miniature wires and using well-controlled laser heating. The sample is surrounded by thermal insulation to keep it from contacting the anvils, which may act as a heat sink. Insulation can be solid or fluid argon reaching 120 Gpa and 3000 K, or 62.5 Gpa and 5000 K. However, if solid transparent insulation is used, the *p-T* range can be extended to 200 Gpa and 4000 K. Shock wave techniques are briefly described.

Even the most advanced pressure system is meaningless without the means to measure a particular sample at a given set of conditions. Therefore, one must employ a sensor system that will accurately measure the pressure produced. A comparison of various luminescence pressure sensors , such as Eu^{3+}LaOCl,

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Unconventional Superconductivity

Recent theory proposes that the recently discovered high T_c Superconductors may in fact be "unconventional superconductors". That is, superconductors that have fundamentally different internal structure and arrangement from those "other" superconductors (those with T_c lower than 23K). Unconventional superconductivity was known previously to only occur in the heavy-fermion systems, such as in UPt_3 and UBe_{13}. A review by James F. Annett (University of Bristol, H.H. Wills Physics Laboratory, Royal Fort, Tyndall Avenue, Bristol BS8 1TL, UK) appeared in *Contemporary Physics*, **36**, [6], 423-437 (1996) which provides a compelling case that the High T_c superconductors are indeed unconventional. This, he argues, is due to their fundamental symmetry properties, and examines the basic concepts of symmetry applied to superconductors.

Heavy-fermion compounds such as

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Eu^{3+}LaOBr, Sm^{3+} and Eu^{3+}YAG, and Sm^{3+} luminescence materials are listed.

The majority of the paper describes the essential equations of state (EOS) for matter under strong compression. The author does this by first discussing general considerations which include EOS forms with their parameter relations and fit parameters, then advances to EOS for specific substances, simple metals, carbon group elements, molecular solids, noble gas solids, hydrogen, and compounds. This section is recommended to graduate students and those post-doctoral candidates who may find a review in this area helpful.

The paper concludes with a review of phase transitions and structural systematics of rare earth and actinide metals, semiconductor-metal transitions, hydrogen, melting, and transitions to new ground states. The author predicts that further developments of various high pressure techniques involving new analytical tools will affect many fields of solid state physics and, with their results, also the modeling in geo- and planetary sciences. ▲

NOAH Technologies Corp.

NOAH Technologies Corp. has moved their corporate headquarters, research, and manufacturing complex to a new location. Their new address is: NOAH Technologies Corp., 1 Noah Park, San Antonio, TX 78249-3419 USA; Tel: 210 691 2000; Fax (Sales/Purchasing): 210 691 2600; Fax (Production/Transportation): 210 691 2300. ▲

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UPt_3 and UBe_{13} are superconducting below 1K and have been studied extensively because they exhibit unconventional superconducting properties. However, recent experimental evidence indicates that the high-temperature variety of superconductors such as $La_{2-x}Ba_xCuO_4$ (T_c»35K) and $YBa_2Cu_3O_7$ (T_c»92K) all are unconventional superconductors as well. The author presents the key concepts of unconventional superconductivity and explains how it is determined during experimentation. This is accomplished by describing the concept of order parameter and how this is essential to understanding both conventional and unconventional superconductivity. Secondly, several key experiments are presented that are used to determine the symmetry of the superconducting state, which includes the measurement of the energy gap which provides the first evidence of something unusual in the superconducting state. Another method used to determine the symmetry of the order parameter is by using Josephson junctions. The special case of UPt_3 is discussed because it is the only known material that shows several distinct superconducting phases, which is decisive evidence for unconventional superconductivity. The review rounds out the discussion by mentioning some of the theoretical implications of unconventional superconductivity.

The review presents the case for unconventional superconductivity in five main sections: symmetry and superconductivity, unconventional superconductivity, symmetry of high-T_c superconductivity, symmetry of the energy gap, and heavy fermion superconductivity. It is an excellent source for students and researchers alike who are studying or working in this fascinating field. ▲

High-T_c Improves Cellular Communications

A superconducting cellular filter, named Spectrum Master, recently completed field trials that demonstrated dramatic improvement in the quality of cellular telephone calls {*Superconductor Industry*, Spring, [7] (1996)}. Spectrum Master utilizes high-temperature superconductor technology which enables it to reject up to 10,000 times more out-of-band noise and interference while passing 35 percent more voice signal through than existing filters. The filter reduces the effective noise floor and extends the receive path range while allowing more cellular phones to access the system.

Cellular users will enjoy higher voice quality, fewer dropped calls caused by interference, less background noise and more usable channels. Spectrum Master is designed for cell sites in high-interference, and large metropolitan areas where cellular communications systems are heavily utilized.

The high-T_c superconducting filter was developed by Illinois Superconductor Corp. for Ameritech Cellular Services. The filter is physically located in the cell site between the antenna and the receiver preamplifier. Thus, it reduces the amount of background noise *before* it reaches the base station radios. Spectrum Master is viewed as a vast improvement in cellular communications because the original technology employed in conventional system filters has not changed significantly since the mid-1980's. ▲

El Gambusino

An ore body near Tacna, Peru, which contains cerium, lanthanum, neodymium, and other rare earths, is being considered for development and rare earth production. This alluvial sands ore body contains titanomagnetite and associated minerals. The mineral sands ore body is serviced by electrical power and is located near a railroad station with a rail yard, highways, airport, and a town with modern facilities. The transportation lines lead to a coastal shipping port.

For more information, contact Carlos Casaretto Forni, El Gambusino, Av. Dos de Mayo 808, Tacna, Peru; Tel: 51 54 713831/722112; Fax: 51 54 712788; cjcasaretto@principal.unjbg.edu.pe. ▲

Substrate Selection

High quality high temperature superconductors require suitable substrates for various applications. However, because the substrate is a passive component, that is, one that does not necessarily possess superconducting properties, it is often ignored or assumed to have negligible impact on the superconductor itself. The major issues governing the role of the substrate on high temperature superconducting (HTS) thin-film technology is addressed by J. M. Phillips, AT&T Laboratories, Murray Hill, NJ 07974 USA; jmphill@sandia.gov in *J. Appl. Phys.* **79** [4] 1829-48 (1996). The author also discusses many of the material classes and specific materials that have been studied for their suitability as substrates for HTS films.

Following a brief history of HTS, the author presents the current issues in the selection of substrates used to support superconductors. Although some substrate properties can be independent of the HTS properties, often the film must be epitaxial on its substrate, which requires specific requirements that must be fulfilled by the substrate material itself. In many cases it may be necessary for a film to be not only single crystalline, but the crystallographic axes of the film must have well-defined orientations with respect to the substrate.

From a practical standpoint, a good substrate must have the following characteristics: chemical compatibility with the HTS film, thermal expansion match, surface quality, substrate cleanliness and homogeneity, thermodynamic stability, and the ability to accept buffer layers, when needed. The substrate materials that are covered in the paper are perovskite-type structures, non-perovskite-structure oxides, semiconductors, metals, and other materials. Several figures illustrate the crystal structures of the most common HTS film materials: $YBa_2Cu_3O_7$, $Bi_2Sr_2CaCu_2O_8$, and $Tl_2Ba_2Ca_2Cu_3O_{10}$.

The potential and current uses that HTS materials offer are briefly listed and explained: the superconducting flux flow transistor, hybrid superconductor/semiconductor applications such as combining superconductors and semiconductors

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BIG YBCO

The growth rate of larger YBa_2Cu_3O (YBCO) superconducting single crysta has again been increased {*Japan Ne Mater. Rept.* **XI**, [1], 15 (1996)}. Thes crystals were grown using the solute-rich liquid crystal-pulling (SRL-CP) techniqu which results in continuous productio of large YBCO crystals. The SRL-C process has been recognized as the mo promising process for producing larg YBCO superconducting single crystal Previously, the growth rate using th process was quite slow, which inhibite the ability to produce large single cry tals. Eventually, the production of 15m x 15mm crystals was accomplished b using larger crucibles and a larger pr duction apparatus.

Larger crystals and a faster cryst growth rate was accomplished b carefully controlling the oxygen conter in the growth chamber while pulling th crystal. The oxygen content wa increased from an atmospheric conter of 20% to 100% in the apparatus. Thi not only increased the growth rate bu resulted in single crystals measurin 20mm x 20mm. The superconductin transition temperature of 92.7°K wa determined by SQUID measurement. The chips from these crystals may be use in electronics, including high and lo energy loss Josephson junction device The work was done at the Superconduc tivity Research Laboratory, ISTEC, 1C 13 Shinonome 1-chome, Koto-ku, Toky 135, Japan; Fax: 81 3 3536 5714. ▲

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in a single device, and in an integrate circuit, and combining superconductin circuits and semiconducting circuits int a complete system, such as in supercor ducting interconnects. These HTS in terconnects can increase both bandwidt and wiring density in a single syster Microwave applications such as filter and delay lines have been identified a potential niches for HTS devices and, a always, the hope that someday supercon ductors will be used for large curren transmission pathways.

The author points out that consider able work is needed in HTS substrate before this area matches the level of pro gress made in the films themselves. ▲

Rare Earths '98

The international rare earths conference, Rare Earths '98, will be held October 25-30, 1998 in Freemantle, Western Australia, Australia. The conference will feature the results of basic and applied research on the rare earth elements. There will be sessions on rare earths chemistry, mineral characterization, industrial applications and processes, medical applications, spectroscopy and nonlinear optics, superconductivity, batteries and hydrogen storage, catalysis, markets and processing, synthesis and properties of novel compounds, extraction and separation chemistry, and electroluminescence.

Abstracts are due April 1998 and can be either mailed to the address below or e-mailed to RE98@pd.uwa.edu (please indicate your chosen computer system and formatted word processor package as an attachment to the message).

For more information, contact The Materials Institute of Western Australia, 133 Salvado Road, Wembley, Western Australia 6014; Australia; Tel:61 9 387 9590;Fax:6193839639; E-Mail: RE98@miwa.org.au; Website: http://www.miwa.orh.au/IREC98/. ▲

NdFeB Conference

The tenth international business conference "Neodymium-Iron-Boron 97" will be held April 16-18, 1997 in Chicago, Illinois. The conference will include five sessions and one panel. The scheduled sessions are: supply, demand, and pricing of rare earth metals, compounds and NdFeB powders for bonded magnets; new NdFeB sintered and polymer bonded grades, new manufacturing technology, and quality control and consistency issues; the future of interstitial rare earth nanocomposite permanent magnets; the outlook for sintered and hot formed NdFeB magnet markets and applications and; the outlook for polymer bonded magnet markets and applications. The panel is an executive business forum: the outlook for the NdFeB Permanent Magnet Market Sector for 2000 and 2005.

For more information contact Jennifer Winch, Gorham/Intertech Consulting, 411 US Route One, Portland, Maine 04105 USA; Tel: 207 781 9800; Fax: 207 781 2150; info@intertechusa.com. ▲

Hc-M

The Workshop on High Coercivity Materials (Hc-M), a satellite conference of ICM'97, will be held July 23-24, 1997. The workshop will provide an informal arena for discussions centering on current topics of interest and technical issues related to high coercivity permanent magnets and magneto-optical recording magnetic materials. The technical sessions will include: theories of coercivity, modeling studies, materials preparation, novel high coercivity materials, domain imaging and visualization, and novel applications.

For more information, contact Dr. Liesl Folks, Secretary, High Coercivity Materials 1997, Department of Physics, The University of Western Australia, Nedlands, Western Australia, Australia, 6907; Tel: 619 380 2751; Fax: 619 380 1014; HCM97@pd.uwa.edu.au; http://www.pd.uwa.edu.au:80/Physics/Conferences/HCM97/. ▲

ICNS '97

The 1997 International Conference on Neutron Scattering (ICNS '97) will be held in Toronto, August 17-21, 1997. The conference will bring together scientists from around the world who share an interest in the application of neutron scattering techniques to problems in condensed matter physics. The sessions to be held at the conference include: biology, highly correlated electron systems, magnetism, polymers and complex fluids, materials science, surfaces and interfaces, instrumentation, industrial and novel applications, and glasses and liquids. The conference will also include a facilities conference program and plenary speakers.

For more information on ICNS '97, contact: Phyllis Green, Solid State Division, Oak Ridge National Laboratory, P.O. Box 2008, Oak Ridge, TN 37831-6033 USA; Tel: 423 576 1864; Fax: 423 574 4143; phg@ornl.gov. ▲

EMMA '98

The 7th European Magnetic Materials and Applications Conference (EMMA'98) will be held in Zaragoza, Spain, September 9-12, 1998. The con-

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ference will cover topics of magnetic materials including basic, applied, and technological aspects. The objective of the conference is to provide a forum for researchers to discuss recent results on basic magnetism, magnetic materials, and applications.

For further information, contact: Dr. Pedro A. Algarabel, Conference Secretariat, EMMA'98 Zaragoza, Departmento de Fízica de la Materia Condensada & ICMA, Facultad de Ciencias, Universidad de Zaragoza-CSIC, C/ Pedro Cerbuna 12, 50009 Zaragoza, Spain; Tel: 34 76 761213/14; Fax: 34 76 761229; emma98@posta.unizar.es. ▲

15th Workshop & Tenth Symposium

The 15th International Workshop on Rare-Earth Magnets and Their Applications will be held August 30-September 3, 1998, and the Tenth International Symposium on Magnetic Anisotropy and Coercivity in Rare-Earth Transition Metal Alloys will be held September 4, 1998, in Dresden, Germany.

The Workshop will concentrate on practical aspects on the processing and applications of rare earth magnets, including raw materials and resources, the fabrication of new magnetic materials, nanocrystalline rare earth-transition metal magnets, magnetostrictive materials and devices, magnetic sensors, magnetic circuit design, corrosion and corrosion protection, aging effects, instrumentation, standards, and test methods.

The Symposium will immediately follow the Workshop and will cover the fundamental topics of rare earth-transition metal alloys, including materials science, new compositions (RE-doped fullerenes, RE-transition metal boron carbides), gas phase interstitial modifications, novel processing techniques, physics of magnetic anisotropy, magnetic viscosity, and others.

Abstracts for either the Workshop or Symposium are due August 1, 1997. For more information, contact: Conference Secretariat, Deutsche Gesellschaft für Materialkunde e.V., Anja Mangold, Hamburger Allee 26, D-60486 Frankfurt; Tel: 49 69 7919-750; Fax: 49 69 7917733; 100775.1452@compuserve.com. ▲

SCES '95 Proceedings

The proceedings of the international conference on Strongly Correlated Electron Systems (SCES '95) which was held in Goa, India, September 27-30, 1995 is now available.

The proceedings contain 175 papers in eight chapters. The first chapter, Heavy-fermion superconductivity and related aspects, includes the influence of Gd impurities on T_c of UPt, the magnetic and superconducting phases of $CePd_2Si_2$, and other aspects of superconductivity. Chapter two, Superconductivity and magnetism in borocarbides, covers superconducting and magnetism in single crystal and polycrystalline $DyNi_2B_2C$, YNi_2B_2C, $ErNi_2B_2C$, and other rare earth borocarbide superconducting compounds, including $(YNi_{1-x}Co_x)_2B_2C$ and $TbNi_2B_2C$. The next chapter presents the most recent research results and scientific theory on Kondo lattice and heavy fermion behavior, magnetic ordering, superconductivity, mixed valence, quadrupolar ordering and other aspects in rare earth intermetallic compounds. Chapter four, Kondo insulators/semimetals, covers impure Kondo insulators, the effects of electrical resistivity and Hall effect in single crystals of CeRhSb, neutron scattering studies, and the Devil's staircase in Kondo semimetals. Chapter five, Non-Fermi liquid behaviour and unconventional Kondo effect, investigates $CeCu_{6-x}Au_x$ and $M_{1-x}U_xPd_3$ where (M=Sc, Y, La, Pr, Zr, Th). The next chapter contains papers that cover the topics of high-temperature superconductors, oxides and transition metal systems. The last two chapters deal with other aspects of correlated electron systems as well as the conference summaries.

The proceedings appear as *Physica B* Volumes **223 & 224** (1996) and is available in hard cover. The 660-page book is priced at US$659.00 and can be ordered from the Customer Support Department of Elsevier Science at the following addresses: 655 Avenue of the Americas, New York, NY 10010 USA; Tel: 212 633 3730 (toll free: 888 437 4636); Fax: 212 633 3680; usinfo-f@elsevier.com; P.O. Box 211, 1000 AE Amsterdam, The Netherlands; Tel: 31 20 485 3757; Fax: 31 20 485 3432; nlinfo-f@elsevier.nl; 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. ▲

RE-Doped Semiconductors II

Rare Earth Doped Semiconductors II is Volume **422** of the Symposium Proceedings series that is published by the Materials Research Society. The Proceedings is from the Symposium of the same title held April 8-10, 1996 in San Francisco, California, USA.

Forty eight papers are presented in 4 Parts: Incorporation Methods and Properties; Structural, Electrical, and Optical Properties, Excitation Mechanisms; and Electroluminescence and Integration. The papers include reports on rare earth doping using molecular beam epitaxy, chemical vapor phase deposition, ion implantation, and ion-assisted deposition. Experimental results show that rare earths can be incorporated in high enough concentrations in Si and III-V semiconductors that they can be useful electronic devices. However, more work needs to be done in order to optically activate these ions, excite them efficiently, and to reduce the nonradiative processes that quench the luminescence at high temperatures. Most of the symposium dealt with the implantation and utilization of Er-doped devices, but Yb, Tm, and Nd-doped materials are also included.

As a result of research on the relation between impurities and rare earth dopants, it was concluded that complexes may form which increases the solubility of the rare earths. This acts to decrease the mobility of the rare earth ions, which prevents segregation and precipitation. Impurities may also improve the electrical defects.

The 366-page hard cover *Rare Earth Doped Semiconductors II* will serve as a handbook for those active in the field of rare earth doped semiconductors. The book was published in 1996 and is available by contacting the Materials Research Society, 9800 McKnight Road, Pittsburgh, PA 15237-6006 USA; Tel: 412 367 3003; Fax: 412 367 4373; info@mrs.org. The cost for MRS members is US$65.00, nonmembers (US) US$74.00, and US$85.00 for foreign orders. Prices include shipping. ▲

Carl Mosander, the Swedish chemist who is credited with the discovery of lanthanum, yttrium, erbium, and terbium, was born in 1797.

"Giant" Kerr Rotation in CeSb

In 1877, J. Kerr described the rotation of a plane of polarized light when it was reflected from the polished surface of a ferromagnet {*Phil. Mag.*, **3**, 321 (1877)}. Even though the plane of light was only rotated several degrees, this magneto-optical effect, or Kerr rotation was enough to gain the researcher world wide renown. Later, researchers were able to generate a small optical signal by altering the magnetization of the magnet with an external field. This method can be improved by using lasers and advanced signal detection methods in order to detect even small Kerr rotations. In fact, this effect is used in rare earth-transition metal films for erasable information storage.

Recently, the discovery of 'giant' Kerr rotation, originally reported by R. Pittini *et al.*, *Phys. Rev. Lett.*, **77**, 944 (1996), is reviewed by J.A.C. Bland, Cavendish Laboratory, University of Cambridge Cambridge CB3 0HE UK, in *Nature*, **383** 3 October 1996, p. 391. The previous record for Kerr rotation in CeSb was 14° but Pittini's group observed a rotation in excess of 90° in the material. The peak effect occurs with incident infrared light that has an energy of 0.46 eV. The importance of the discovery lies in the fact that theoretical calculations have previously determined that the maximum amount of rotation should be no greater than 90°.

Magneto-optical information storage is retrieved when a laser reads the rotation. The resolution of the information is determined by laser wavelength. Magneto-optic recording requires specific magnetic properties, including an internal magnetic field (anisotropy field) which is perpendicular to the plane of the magnetic film and the Curie temperature must low enough to allow the medium to be "written" by a laser pulse. In addition, the magnetization of the material must be stable so as not to be erased by external magnetic fields.

The discovery by Pittini *et al.*, though interesting, has drawbacks. The giant Kerr rotation occurs in single crystal CeSb in high magnetic fields and low temperatures. In addition, the 0.46 eV energy of the peak magneto-optical rotation requires

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NEOLIT®

A permanent magnet material based on Nd-Fe-B, and licensed by Magnequench (USA), is being produced and marketed by Thyssen Magnettechnik GmbH. The company produces the magnets in various shapes, sizes, and magnetic properties to fit specific applications. Corrosion protection by using different coatings are also available.

For more information, contact Mr. Joachim Krebs, Thyssen Magnettechnik GmbH, Ostkirchstrasse 177, D-44287 Dortmund, Germany; Tel: 49 231 4501 0; Fax: 49 231 4501 224. ▲

Marlow Industries Inc.

Marlow industries is a producer of high performance thermoelectric products for military and commercial markets. All aspects of thermoelectric device production, from materials development, fabrication, and testing, is done at the Dallas plant. The company is strongly research oriented and is now investigating rare earth intermetallic compounds, rare earth pnictides, and rare earth-filled skutterudites.

For more information, contact George S. Nolas, Marlow Industries Inc., 10451 Vista Park Road, Dallas, TX 75238 USA; Tel: 214 503 3363; Fax: 214 341 5212; www.marlow.com. ▲

Chori America, Inc.

Since Chori was established in Japan in 1861, it has grown to an international company that now offers rare earth concentrate, oxides, metals, compounds, and permanent magnet materials to customers worldwide. Recently, Chori opened an office in the U.S., Chori America, Inc.

For more information on the company's products and services, contact Mr. Lu Xie, Chori America, Inc., One Penn Plaza, 54th Floor, New York, NY 10119; Tel: 212 971 1858; Fax: 212 736 6392; XL123@aol.com. ▲

☛ *"Giant" Kerr from page 6*

a reading wavelength in excess of 1 μm, which is too long to be used in high-density recording. Since the giant effect was observed in single crystals, the effect may diminish in thin films of CeSb. However, specialty applications of the material could be realized, such as in field-controllable optical switches, which require a large optical rotation. ▲

Supporters 1997

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Since the December issue of the RIC News went to press, RIC has received support from 3 new family members and renewed support from 15 other organizations and individuals. The supporters from the second quarter of the 1997 fiscal year 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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1996 in Review

In 1996, RIC published four eight-page issues of the *RIC News* which was sent to over 13,000 readers worldwide. Additional copies were sent to individuals, industry and universities upon request. Of the 13,036 *RIC News* subscribers, 5,381 were from the U.S.A. and 7,655 were from other countries, which makes the newsletter a truly international publication. Twelve two-page issues of the monthly *RIC Insight* were published and sent to our 216 financial supporters (the *RIC Insight* is sent as a benefit to corporate supporters who contribute at least US$300.00 per year and individual supporters who contribute at least US$100.00 per year). Financial supporters are encouraged to utilize our data base services free of charge. We also welcome donations in any amount to help pay publishing, printing, and mailing costs.

We answered a total of 583 information requests from universities, laboratories, individuals, government, and industry from 34 countries on six continents. Almost three-fourths of the information requests originated from industry, and over one-third came from foreign countries. A total of 108 IS-RIC publications were distributed to people who requested them. ☛

Review ☛

In 1996, we added 2,433 new documents to the RIC data base bringing the total number of coded articles to 81,384. We currently have over 46,000 different key words in our data base to search from, and nearly 63,000 authors. By the end of 1997, our goal is to provide over 85,000 quality computer-coded documents to our users for reference. ▲

Hans Nowotny (1910-1996)

Professor Hans Nowotny died October 5, 1996. He is best remembered by rare earthers for his work in the 1940's on crystal structures of rare earth binary alloys and compounds, primarily of aluminum. His work continued with studies in other binary and ternary systems, mostly with scandium. Most recently, he was involved in magnetoresistance in magnetic and nonmagnetic rare earth compounds. ▲

Melvin H. Mueller (1918-1996)

Melvin H. Mueller died in Elmhurst, Illinois, on June 28, 1996. Dr. Mueller was active in actinide structural research and also worked on Ce-Bi compounds, magnetic structures, and neutron diffraction studies of various rare earth binary compounds. ▲

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RIC News

Vol. XXXII, No. 1 March 1, 1997

Published
quarterly in March, June,
September, and December
by
Rare-earth Information Center
a Unit of the
Center for Rare Earths and Magnetics,
Ames Laboratory,
Institute for Physical
Research and Technology,
Iowa State University,
Ames, Iowa 50011-3020

Postmaster: Send address changes to:
RIC News, Rare-earth Information Center,
Ames Laboratory,
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