Rare-earth Information Center NEWS

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

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Polymer Optical Waveguide Amplifiers

For optical telecommunications, a number of devices are required to direct the light signals to their proper locations with a minimum of signal loss. These devices, like splitters, couplers, multiplexers, demultiplexers, and amplifiers, can be made on one planar substrate, and this is called integrated optics. A review article, "Rare-earth doped polymers for planar optical amplifiers," by L. H. Slooff, A. van Blaaderen, A. Polman, Gs. A. Hebbink, S. I Klink, F. C. J. M. Van Veggel, D. N. Reinhoudt, and J. W. Hofstraat, *J. Appl. Physics* **91** [7] 3955-3980 (2002), covers two different methods of doping polymer waveguides with rare-earth ions.

An optical waveguide directs the signal forward and prevents the signal from straying through the surrounding material with the use of total internal reflection at the interfaces between the high refractive index guiding layer and the lower index cladding layer. The traditional optical conductor is the SiO_2-based optical fiber. Polymer materials are a low-cost alternative, with similar refractive indices that results in low coupling losses when used with traditional optical fibers. There are other optical losses that occur in the signal, such as absorption and scattering losses in the waveguide or intrinsic intensity losses. These losses can be made up for by using an optical amplifier, which is made by doping the guiding layers with an active element that results in optical gain. Nd and Er are especially suited for telecommunications applications as their transitions are at 1.34 μm and 1.53 μm, respectively, which are standard wavelengths for those applications. The only problem with using rare earths with polymers is that rare earth salts are not very soluble in polymeric matrices. The two approaches reviewed help provide solutions to the problem.

The first approach is to dissolve organic rare-earth complexes into a polymer matrix. Organic cage-like complexes can be used to encapsulate the rare-earth ion. The organic complexes mentioned in this article are polydentate cage complexes. They provide coordination sites to bind the Er^{3+} ion and stability to the compound. The cage format may also shield the Er^{3+} ion from impurities that can quench erbium's luminescence. Sample preparation is briefly covered, as is optical characterization and three possible luminescence quenching mechanisms. The optical gain calculation is also included. Terphenyl-based Nd^{3+} complexes with highly absorbing lissamine antenna chromophores are another option. The chromophore transfers its excitation energy to the rare-earth ion by a Dexter mechanism, thus reducing the quenching effects of the polymer. For these compounds, the preparation processes are mentioned, the luminescence properties are examined, and photodegradation over time is discussed. This approach also results in quenching of the luminescence. An optical waveguide system using these materials is described. It consists of two parallel waveguides to optimize the pumping of planar waveguide amplifiers.

The second approach is to dope silica colloids with Er^{3+} using ion-implantation. The silica colloids can then be deposited on a substrate and coated with a polymer film. The advantage of the silica colloids is reduction of some of the quenching problems associated with the previous polymer examples, and thus a longer luminescence lifetime is the result. There does appear to be some concentration quenching (at higher doping levels of Er), and some quenching from adsorbed water. The water adsorption problem is reduced when the colloids are coated with the polymer. The performance and optical characteristics of this approach are discussed.

The outlook for rare-earth doped polymer waveguide amplifiers is also analyzed. The article is supported by 6 tables, 23 equations, 37 figures, and 85 references. For more information on this topic, L. H. Slooff can be reached at the FOM Institute for Atomic and Molecular Physics, Kruislaan 407, 1098 SJ Amsterdam, The Netherlands, e-mail: slooff@ecn.nl. ▲

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Permanent Magnet and Power Electronics Conference

Permanent Magnet Systems and Power Electronics for Motion Control will be held September 9-11, 2002, at the Hyatt Regency Cincinnati Hotel in Cincinnati, Ohio. The conference is being hosted by Gorham Advanced Materials, Inc. The subtitle to the conference is *Global Markets, Applications, New and Emerging Technologies, and Business Opportunities*.

The conference will cover the major techno-business issues related to current and emerging applications for permanent magnet systems and power electronics used in motion control. Coverage includes global markets, innovations and trends in R&D and manufacturing technology, and business opportunities. Specific topics to be discussed include linear and rotary actuators, sensors, cables and connectors, motion control electronics, brushless motors and motor control drive electronics, power electronics, and thermal management products. Key decisions that are made in the selection of high tech systems for motion control applications will be highlighted, and choices of components in the context of costs, design enablers, and competing and emerging technologies will be evaluated. The format of the conference will include presentations, panels, workshops, and open-forum Q&A sessions.

The objective of the conference is to bring together senior personnel in companies involved with research, design, manufacture, sales, and applications of permanent magnets and power electronics used in motion control systems and devices. The conference aims to facilitate producer-user contacts and to bridge knowledge gaps, both to the benefit of all participants.

The co-chairs of the conference are Burley Semones, Principal of MTM Consulting, and Walter Benecki, Consultant. A conference brochure will be available in June. To obtain a copy or for more information on the conference, contact Deedra Manter or Michael Concannon at Gorham Conferences, 209 Mosher Road, Gorham, ME 04038 USA, Tel: (207) 892-5445, Fax: (207) 892-2210, e-mail: gorham@goradv.com, or visit www.goradv.com. ▲

Conference Calendar

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

June '02

14th International Symposium on Boron, Borides, and Related Compounds (ISBB'02)
St. Petersburg, Russia
June 9-14, 2002
RIC News **XXXVI**, [3] 3 (2001)

July '02

The 23rd Rare Earth Research Conference
Davis, California, USA
July 13-18, 2002
RIC News **XXXV**, [2] 4 (2000)
RIC News **XXXVI**, [4] (2001)

5th International Conference on Solvothermal Reactions
East Brunswick, New Jersey, USA
July 22-26, 2002
RIC News **XXXVII**, [1] 2 (2002)

August '02

Applied Superconductivity Conference (ASC 2002)
Houston, Texas, USA
August 4-9, 2002
RIC News **XXXVI**, [3] 1 (2001)

17th International Workshop on Rare-Earth Magnets and their Applications
Newark, Delaware, USA
August 18-22, 2002
RIC News **XXXV**, [4] 3 (2000)
RIC News **XXXVI**, [4] (2001)

*this issue denotes a story on this conference appears in this issue of the *RIC News*.

September '02

Permanent Magnet Systems and Power Electronics for Motion Control
Cincinnati, Ohio, USA
September 9-11, 2002
* this issue

November '02

47th Annual Conference on Magnetism and Magnetic Materials (MMM 2002)
Tampa, Florida, USA
November 11-15, 2002
* this issue

July '03

International Conference on Magnetism (ICM'2003)
Rome, Italy
July 27-August 1, 2003
RIC News **XXXVI**, [1] 4 (2001)

August '03

Scandium Symposium
Oslo, Norway
August 17-23, 2003
RIC News **XXXVI**, [4] (2001)

5th International Conference on f-elements (icfe5)
Geneva, Switzerland
August 24–29, 2003
RIC News **XXXVI**, [4] (2001)

November '04

Rare Earths '04 in Nara, Japan
Nara, Japan
November 7-12, 2004
*this issue

MMM 2002

The 47th Annual Conference on Magnetism and Magnetic Materials will be held November 11-15, 2002 in Tampa, Florida, USA.

The conference will include all basic and applied science and technology related to the field of magnetism. The technical subject categories are Fundamental properties and cooperative phenomena, Magnetoelectronic materials and applications, Computational magnetics and imaging, Soft magnetic materials and applications, Hard magnetic materials and applications, Structured materials, Other magnetic materials, Magnetic recording, and Other applications and interdisciplinary topics. The abstract deadline is July 8, 2002, and abstracts must be submitted online.

For more information on the conference and abstract submission rules, visit http://www.magnetism.org. ▲

In Memoriam – Clifford Glenwood Shull

Clifford G. Shull was a 1994 Nobel Prize winner in Physics for his work in neutron scattering. He died March 31, 2001, of kidney failure.

Clifford Shull majored in physics at Carnegie Tech, and earned his PhD from New York University in 1941. For his dissertation he built a Van de Graaf accelerator and worked with the scattering of polarized electrons. After graduation, he went to work for Texas Company (which later became Texaco), where he worked with the characterization of catalysts used in making aviation fuel. His work there gave him much experience with x-ray diffraction and small-angle scattering used in studying powder samples.

In 1949, Cliff visited Oak Ridge, where he met Ernie Wollan. At the time of his visit, Wollan had already built a two-axis neutron diffractometer. Cliff was excited about the work with neutron diffraction and scattering, and he began working at Oak Ridge two months after his visit. Once there, he and Wollan first worked to fully understand the scattering of neutrons by powder samples, which was followed by measuring the neutron coherent scattering amplitudes for almost all the elements and many isotopes. They also did some work with neutron patterns from single crystals. However, Shull and Wollan were most interested in magnetic materials, and they were able to show that neutron scattering experiments were key to understanding magnetic materials.

Shull left Oakridge in 1955 to go to MIT, where a new research reactor was being built. He became a Professor of Physics and remained there until his retirement in 1986. While at MIT he worked with polarized neutron diffraction and dynamical diffractions and the propagation of neutron waves in perfect crystals. His success as an educator can be measured by the distinguished careers of many of his students.

Besides the Nobel Prize, his other awards and honors include the Buckley Prize awarded by the APS, election to the National Academy of Sciences, and having one of the Crystal Islands between Antarctica and Australia named after him. Some of his work involved rare earths. A Clifford Shull Scholarship Fund has been established in his honor at Carnegie Mellon University. ▲

Magnetic Theory

The Quantum Theory of Magnetism, by Norberto Majlis, presents a detailed account of a significant amount of the theory involved in the study of magnetism. The author states in his forward that "this is an advanced level textbook" and this is not an understatement. The book assumes a background in quantum mechanics, statistical mechanics, and condensed matter physics, and it is obvious that this experience is necessary to get the most out of the text. The relevance of the work to the rare earths is evident from the first page; they are listed under the category of atoms with an unfilled electronic shell, and therefore are atomic systems with a permanent magnetic moment in the ground state.

The general topics of the book, as given by the titles of the chapters, are paramagnetism, interacting spins, mean field approximation, spin waves, Green's functions methods, dipole-dipole interactions, itinerant magnetism, indirect exchange, low dimensions, surface magnetism, two-magnon eigenstates, and other interactions. The discussions grew out of lecture notes prepared by the author for several graduate courses, and the text does indeed read like a lecture. According to the author, some subjects were necessarily excluded due to the limits of the text, and these include diamagnetism, the kondo effect, magnetic resonance, and disordered systems, among others. However, detailed descriptions of the mean field approximation, properties of low-dimension magnetic systems, the RKKY model, and surface magnetism are not likely to be found in other texts on magnetism. There are many exercises included in the text, and they are presented as such that their completion is requisite for complete understanding of the discussion.

This book would be of great use to anyone who desires in-depth theoretical treatment of magnetism. Each chapter contains many, and in some cases hundreds, of equations that help elucidate the modeling and description of the theory. Each chapter has a bibliography at the end, and there are two appendices to the book, one on group theory and the other on time reversal, and an index also accompanies the book.

The Quantum Theory of Magnetism is published by World Scientific Publishing Co. Pte. Ltd., P. O. Box 128, Farrer Road, Singapore 912805, with a USA office at Suite 1B, 1060 Main Street, River Edge, NJ 07661, and a UK office at 57 Shelton Street, Covent Garden, London WC2H 9HE. The book was published in 2000 and is ISBN 981-02-4018-X. ▲

Rare Earths '04

Rare Earths '04 in Nara, Japan will be held November 7-12, 2004, and is an international conference on rare earths sponsored by the Rare-Earth Society of Japan.

The program will integrate basic and applied multidisciplinary research that is centered on the *f*-elements. Forefront results will be featured in the form of oral talks and posters on topics in chemistry physics, and materials, earth, environmental, and biological sciences. Specific topics include, but are not limited to, spectroscopy, earth science, resources, industries, space science and technology, luminescence, solid states, organometallics, catalysts, heavy fermions, hydrogen storage materials, batteries, magnetism and magnetics, science and technology of ceria, ionic conductors, rare earths in bioscience, phosphors, separation, metallurgy, superconductors, ceramics, fuel cell systems, laser materials, theoretical calculations, combinatorial chemistry, analytical chemistry, coordination chemistry, solution chemistry, alloys and intermetallics, oxides, nonstoichiometries, lanthanides for molecular recognition, and high temperature or high pressure science.

For more information, contact Conference Chair Prof. Gin-ya Adachi, President of the Rare-Earth Society of Japan, Department of Applied Chemistry, Faculty of Engineering, Osaka University, 2-1 Yamadaoka, Suita, Osaka 565-0871, JAPAN, Tel: +81-6-6879-7353, Fax: +81-6-6879-7354, e-mail: kidorui@chem.eng.osaka-u.ac.jp, website: http://kidorui.chem.eng.osaka-u.ac.jp/RE2004.html. ▲

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Search of the Month

Ric Database Preliminary Report

keywords DyF3 ***AND*** ***keywords*** 1996 1999 1997 1998

Article

Phase diagrams of the NaF-Rf3 (R = Tb, Dy, Er) systems

(DY,F,NA) (ER,F,NA) (R,F) (R,F,NA) (TB,F,NA) 1996 DYF3 ERF3 FLUORIDE NAF PHASE-DIAGRAM RF3 TBF3

Mass spectrometric study of vaporization process and thermodynamic properties of Dyf3-Dy2O3 system

(DY,F,O) 1997 DY2O3 DYF3 SYSTEM THERMODYN-PROP VAPOR-PRESSURE VAPORIZATION

Thermal expansion of liquid and solid DyF3

(DY,F) (GD,F) (LA,F) 1998 CeF3 DENSITY DYF3 EuF3 FLUORIDE GDF3 HoF3 ionic-radius LAF3 liquid mol-volume NDF3 PmF3 PrF3 SMF3 solid structure TbF3 temp-dependenc THERMAL-EXPAN thermal-prop

Photolectric effects in silicon switching structures utilizing rare-earth fluorides

(CE,F) (DY,F) (ER,F) 1999 CEF3 DIODE DYF3 EMISSION ERF3 FLUORIDE PHOTOELECTRIC

Monday, May 20, 2002 ***Page 1 of 1***

This search above satisfies a request for information on DyF_3 from the years 1996 - 1999. Many more citations would have been referenced if other years had been included in the search.

The Database Preliminary Report, as shown above, is provided s an evaluative tool when the search is requested, and includes the keywords used for the search, the title of the article, and the other keywords associated with the reference, for each of the references found. The Database Report, which is sent when the search results are purchased, includes full reference information: our document number, title, authors, bibliographic reference, and keyword list.

The cost to receive the full report for this search is US$50.00. The minimum cost for any search is US$50.00, which includes the reference list for up to 25 matches, and any additional matches are available for US$2.00 each. That means that if a search turns up 30 matches, the full report would cost US$60.00. Supporters may receive as many searches as desired for US$300.00 per year for corporate memberships, or US$100.00 for individual memberships. For other support levels available, see "June 2002 Supporters" on page 8.

As an added benefit, supporters receive a 2-page monthly newsletter, the *RIC Insight*, that reports on late-breaking news of rare earths and how these developments may impact the rare earth industry. Corporate members can also have space on our website, providing additional exposure for their company and links to their own webpages.

If you would like us to conduct a search for you, please send your request to: Angela O'Connor, RIC, 112 Wilhelm Hall, Ames Laboratory, Iowa State University, Ames, IA 50011-3020 USA; Tel: 515-294-5405; Fax: 515-294-3709; e-mail: ric@ameslab.gov. If you would like to become a supporter of the RIC, send your name, address, telephone, fax, e-mail address, and your desired level of support to the above address or to LaVonne Treadway, RIC, 116 Wilhelm Hall, Ames Laboratory, Iowa State University, Ames, IA 50011-3020 USA, Tel: 515-294-2272; Fax: 515-294-3709; e-mail: crem_ric@ameslab.gov. ▲

Magnetic Susceptibility in Non-Fermi Liquids

N. Bernhoeft has written a review called "An analysis of the dynamical magnetic susceptibility in non-Fermi liquids," published in *J. Phys.: Condens. Matter* **13** R771-R816 (2001). This topical review presents a unifying model of the dynamical magnetic susceptibility in the non-Fermi liquid state at a finite temperature above a quantum critical point. The quantum critical point for strongly correlated, non-Fermi-liquid states occurs at T=0 K, where incipient phase transitions occur. However, since no experiment can be conducted at 0 K, small finite temperatures have to be related to the 0 K properties. The dynamical susceptibility plays a key role in providing elucidation.

The first section of the review presents the model. It covers the model analytical form of the dynamic susceptibility, inferential models for the distribution of relaxation rates, a brief explanation of the non-Fermi-liquid parameter, a discussion of the scaling of the dynamical susceptibility, and implications the model poses for bulk properties. The second section of the review shows the application of the model to several compounds. Of particular interest are $CeCu_{5.9}Au_{0.1}$ and doped rare-earth cuprates. After the conclusions end on page R803 comes three appendices, each providing more detail to the presentation of the model in the first section.

The review seems to provide thorough coverage to the topic. The text is supported by 13 footnotes, 22 figures, 47 references, and 97 equations. The footnotes provide additional comments or exceptions to the statements made in the discussion and work well as footnotes as they do not disrupt the flow of the paper.

For more information, N. Bernhoeft can be contacted at CEA-Grenoble, F-38054 Genoble Cédex, France. ▲

Anion–Conducting Glasses

The discovery of anion conduction in fluoride glasses has sparked an interest in study of fluoride transport in glassy materials. A short review of the subject, "Anion-conducting fluoride and oxyfluoride glasses," by N. I. Sorokin, was published in *Russian Chemical Reviews* **70** (0) 801-807 (2001).

The conduction in glasses is expected to be an improvement over conduction in crystalline materials, and glasses with high fluoride ion conductivity are especially attractive as solid electrolyte materials due to technological and cost effectiveness as compared to crystalline materials. They also attract attention as they are transparent in the IR region, possess low glass transition temperatures, and are promising materials for fiber optics. Theoretical calculations show lower optical transmission losses than in traditional silicate glasses.

Fluoride glasses tend toward crystallization. To prevent or slow this process, various metal fluorides are added. These additions also allow the chemical stability, thickness of the material, and the usable temperature range to all increase, while offering the chance to study the effect of each component on ion conduction and the mobility and concentration of charge carriers. The keys to anion transport are the formation of fluoride anions and the variation in the coordination number of the glass-forming cations. The changes in coordination number of the cations allow the movement of mobile anions. This review analyzes the results of studies of fluoride-ion-transport in glassy solid electrolyte. The results are grouped according to the type of the glass-forming fluoride.

The three main classes of fluorides addressed are MF_2, MF_3, and MF_4, and oxyfluorides are also discussed. In MF_2 the primary conduction mechanism is through an increase in mobile, non-bridging ions. The conductivity and structure of several of these glasses are mentioned. The MF_3 group includes glasses containing MF_3 or AF_2. The structure of these compounds is discussed, along with Raman spectroscopy, conductivity, and mobility along with how the addition of specific fluorides affects these properties. The MF_4 group includes fluorozirconate glasses. The Zr polyhedra can have variable coordination of 6, 7, or 8. Modifiers increase the conductivity, and increased concentration of the modifier increases conductivity. Also, the anion conductivity is dependent on the activation energy of the conductivity. The activation energy is influenced by the polarizability and the ionic radius of the cation. Several details of the effects of specific fluorides are included. Oxyfluorides are essentially mixtures of oxides with fluorides added to make the material glassy. The role of the fluorine can vary depending on the modifying cation and the fluoride content of the glass. Higher concentrations of the fluoride (greater than 30% to 50%) lead to anion conduction. Another section follows these that discusses the optimization of characteristics of fluoride-conducting glasses and prospects for their practical application.

This review is very concise, with a lot of information in very little space. Only 1 table and 2 figures are used in the main text, but the accompanying 90 references would certainly be useful to fill the details. For more information, N. I Sorokin can be reached at A. V. Shubnikov Institute of Crystallography, Russian Academy of Sciences, Leninsky prosp. 59, 119991 Moscow, Russian Federation, Tel: (7-095) 330 78 74, Fax: (7-095) 135 10 11, e-mail: sorokin1@mail.ru. The original Russian version of the review appeared in *Uspekhi Khimii* **70** (9) 901-908 (2001), and was translated by T. N. Safonova. ▲

Consultant's Corner

To appear in our Consultant's Corner, any individual, company, or group must be involved in rare earth or rare-earth-related consulting activities. Just send us the appropriate information: contact name, company name, mailing address, Tel/Fax number(s), email, web address and areas of expertise.

News from Japan

Thanks to Kensuke Shimomura for the content and translations for this section.

The Nikkei Weekly, March 18, 2002: Casio Computer Co. had developed a small, long-life fuel cell for use in devices such as notebook computers. The new fuel cell is reported to last four times longer than current rechargeable batteries. That means a notebook computer can run for 20 hours, versus the 5 hours allowed by lithium-ion batteries. The fuel cell extracts hydrogen from methanol, and should be able to compete on a cost-basis once mass production begins. Casio plans to obtain approximately 120 patents for the technologies used in the fuel cells.

The Asahi Shimbun-Business, April 6, 2002: Honda Motor Co. has its new fuel cell powered car on the streets after getting approval for operation on public roads in February. The model that is out is merely an approximation of the FCX-V4 that Honda plans to have available for sale to the public in 2003. The car has a cruising distance of 315 kilometers, and a maximum speed of 140 kph.

The Japan Times, April 13, 2002: Honda Motor Co. and Sanyo Electric Co. are planning to jointly develop nickel-hydrogen batteries for use in Honda's hybrid vehicles. Sanyo is striving to become the largest supplier of batteries for hybrid cars. They already are developing batteries for Ford Motor Co. Honda's first hybrid cars use batteries from Panasonic EV Energy, which also supplies batteries for Toyota Motor Corp. Honda hopes to increase the fuel efficiency of their cars through using batteries developed by Sanyo, which is also known for its expertise in cell phone batteries.

The Rare Metal News, April 16, 2002: A venture between Sumitomo Special Metals Co. and Super Electronic Co., called Dongguan Sumitoku-Super Electronic Co., has completed construction of a plant in Dongguan, Guangdong Province, in March. Operations at the two-story, 6000 square meter plant were slated to begin by the end of April. The plant will produce Nd-Fe-B sintered magnets called NEOMAX, and will have an initial production volume of 20 million units per month.

The Nikkei Weekly, April 29, 2002: Toyota Motor Corp.'s cumulative worldwide hybrid vehicle sales numbers have topped 100,000, with 102,967 sold by the end of March. That represents 90% of the global market for environmentally friendly cars. The Prius passenger sedan was launched in Japan in 1997, in North America in 2000, and is now being sold in 20 countries. The Prius is the world's first mass-produced hybrid car.

The Nikkei Weekly, May 13, 2002: The storage and use of fuel cells have been heavily regulated in Japan in several laws and regulations, which designate them dangerous substances because of their use of hydrogen. Japanese industry is complaining that the regulations are interfering with Japan's ability to compete with the U.S.A. and Europe in the area of fuel cell applications. The government now plans to lift or ease restrictions that are hampering commercial development by 2005. The government will join forces with domestic automakers to set up five hydrogen refueling stations around Tokyo so the field-tests of fuel cell powered vehicles can be undertaken on public roads. The government will also add fuel cell powered vehicles to its official fleet in 2003. Besides automobiles, fuel cells can also be used in appliances and as an energy source for homes. ▲

Newsletter on the Web

A paperless alternative to receiving an electronic form of the *RIC News* via e-mail is to access our website: http://www.ameslab.gov/ric, where current and previous issues of the *RIC News* are available, along with general information about the Rare-earth Information Center and a list of our sponsors. ▲

Manganite Physics

Colossal magnetoresistive manganites, like $LaMnO_3$ have been known to exist since 1950. However, they were not well understood then, and study was abandoned until the 1990s. "The physics of manganites: Structure and transport," by Myron B. Salamon and Marcelo Jaime, was published in *Reviews of Modern Physics*, **73** 583-628 (2001), and reviews the early work done on these materials, the reasons the work was abandoned, and why they are so interesting now.

The early work on manganites was conducted in the 1950s. Much of the work done resulted in conclusions that were made again in later work, but were not explained in the same manner or not fully understood. The review presents the early developments, and points out where later research provided clarification and how certain behaviors were explained differently. Early theories are discussed, including double exchange and those regarding magnetic and transport properties, such as band structure, polaron transport, and the Hall effect. However, all the different aspects of these materials were not considered simultaneously, so research in this area dwindled.

The rediscovery of the manganites came in the mid-1990s, when the metal-insulator transition close to room temperature, and thus the maximum sensitivity to external fields, was investigated. These features renewed interest in the material, and much work has been done to understand the mechanisms involved. It was pointed out that theoretical explanations in the past did not hold up quantitatively. And from this is was realized how complex the problem of the manganites really is, and how interesting to condensed matter physics they are. The review lays out the present understanding of the physical properties of manganites as measured with state of the art experiments and analyzed using modern theories.

This is a thorough review of a very interesting topic. The main point is to show the variety of possible states and the transitions between them, and to show how useful manganites are to the general understand-

Continued on page 7

Treibacher Acquires Meldform Assets

Treibacher Auermet Prod. Ges. mbH and Meldform Rare Earths Ltd. have reached an agreement to transfer Meldform's Rare Earths Assets to Treibacher effective February 28, 2002.

Meldform Rare Earths Ltd. has been supplying a diverse range of rare earths to a worldwide market since 1986, and has established itself as one of the leading suppliers with a strong emphasis on customer service and quality. These qualities and Meldform's established supply relationships with China and the CIS complement Treibacher.

Treibacher Auermet Prod. Ges. mbH is part of the Austrian-based Group Treibacher Industrie AG. Treibacher has a one hundred year history in the development and production of rare earths, and their core strengths include research and development, relationships with customers and suppliers worldwide, sophisticated rare earths plants in Austria and Slovenia, and experience in global marketing. Treibacher currently produces 6000 mt of rare earths annually.

The acquisition of Meldform's Rare Earths Assets assists Treibacher in their strategy to continue their leadership in the worldwide rare earths marketplace. For more information, contact Alexander Bouvier, Managing Director, Tel: ++43 4262 505 570, e-mail: alexander.bouvier@treibacher.at, website: www.treibacher-auermet.com. ▲

Continued from page 6

ing of what makes a metal or an insulator. The last four words of the review are "remains to be found," which leaves the door wide open to more research. The review is supported by 2 tables, 23 equations, 59 figures, and 226 references.

For more information, Myron B. Salamon is at the Department of Physics and Materials Research Laboratory, University of Illinois at Urbana-Champaign, Urbana, Illinois 61801 USA, and Marvel Jaime is at MST-NHMFL, MS E536, Los Alamos National Laboratory, Los Alamos, New Mexico 87545 USA. ▲

Magnetism and Heavy Fermions

Heavy fermion systems are defined as metallic compounds and alloys that contain 4*f* or 5*f* ions and that exhibit enhanced effective conduction electron masses at low temperatures. The 4*f* or 5*f* ions usually are Ce, Pr, Yb, or U. *Magnetism in Heavy Fermion Systems*, edited by Harry B. Radousky, is a series of review papers that look at, as the title of the book suggests, magnetic behavior in heavy fermion systems. Several experimental and one theoretical paper make up the book, which also includes an index and a separate list of relevant review papers.

The introduction to the book is written by Douglas E. MacLaughlin. It provides a definition of exactly what a heavy fermion system is and introduces some of the specific characteristics (superconductivity, magnetism, and non-Fermi liquid behavior) that make heavy fermion systems so interesting. The introduction also supplies a summary of each of the remaining chapters of the book. The remaining chapters of the book are, in order, "Heavy Fermion Superconductors," by Lu Zhang and R. N. Shelton, "Muon Spin Relaxation Studies of Small-Moment Heavy Fermion Systems," by Robert H. Heffner, "Neutron Scattering From Heavy Fermions," by R. A. Robinson, "*f*-Electronic and Magnetic Behavior Between Atomiclike and Fully Itinerant: Random Localized Magnetism and Heavy Fermions," by B. R. Cooper, and "Magnetism in the Pr Containing Cuprates," by H. B. Radousky. Each is complete review paper with equations, figures, tables, and references.

This book is not meant to be a complete treatment of the topic of heavy fermion systems. However, the references throughout the book can be investigated for more complete coverage. This book does serve as an excellent starting point for a variety of approaches to the problems of heavy fermion systems. *Magnetism in Heavy Fermion Systems* is copyright 2000 and is part of the Series in Modern Condensed Matter Physics. It is published by World Scientific Publishing Co. Pte. Ltd., P. O. Box 128 Farrer Road, Singapore 912805, with the USA office at Suite 1B, 1060 Main Street, River Edge, NJ 07661 and the UK office at 57 Shelton Street, Covent Garden, London WC2H 9HE. The book's ISBN is 981-02-4384-0. ▲

Nitride Phosphors

Contributed by Dr. H. T. Hintzen

Lighting industry is revolutionized by the development of a new type of lamps based on UV/blue emitting GaN LEDs in combination with luminescent materials to obtain the desired colour. Besides enabling strong miniaturisation and integration, these lamps have a high efficiency and long life time. A prerequisite for the required luminescent materials is a high absorption of UV/blue radiation, combined with a high conversion efficiency.

Several conventional materials have been considered for this purpose, like $Y_3Al_5O_{12}$:Ce, $BaGa_2S_4$:Eu and SrS:Eu. Recently, novel nitride phosphors have been invented by Eindhoven University of Technology (The Netherlands) which show very promising performance in this respect (H. T. Hintzen, J. W. H. van Krevel and G. Botty, European Patent EP 1 104 799 A1). The materials are based on Eu^{2+} doped alkaline-earth silicon nitride host lattices, like $Sr_2Si_5N_8$:Eu. Besides an unusual long-wavelength Eu^{2+} emission above 600 nm, these phosphors show strong absorption far into the visible range up till about 475 nm. As a consequence the materials are strongly yellow-orange-red coloured, making them attractive as potential environmental friendly alternatives for the toxic Cd containing pigments.

For more information please contact Dr. Bert Hintzen, Eindhoven University of Technology, Laboratory of Solid State and Materials Chemistry, P.O. Box 513 (STO 2.26), 5600 MB Eindhoven, The Netherlands, Tel.: +31 40 2473113, Fax: +31 40 2445619; e-mail: h.t.hintzen@tue.nl. ▲

La_2O_3 is used in X-ray image intensifying screens.

The RIC Needs YOU

The Rare-earth Information Center (RIC) was founded in 1966, and since that time, it has been providing a valuable service to the rare earth community. The RIC collects scientific and technical articles, books, patents, and other information that pertains to the rare earth elements and rare earth compounds. It also maintains a database that stores the reference information for these publications along with keywords to make easy retrieval of information possible. The RIC also has two periodical publications: the *RIC News* and the *RIC Insight*. The *RIC News* is published quarterly, and contains information relevant to the rare earth community, including book and article reviews, conference announcements, and news on developments in rare earths from around the world. The *RIC News* is available free of charge in several formats. The *RIC Insight* is a monthly publication with a more editorial slant, and contains more current information on the rare earths with a focus on industry. The *RIC Insight* is available only through membership in the RIC.

The RIC is also a non-profit organization, and we rely on member support for continued operation. Currently member support accounts for about 25% of our operating budget. We need to increase this level. We are appealing to you to consider supporting the Rare-earth Information Center financially. Annual individual support levels start at $100, and annual corporate support levels begin at $300. Your support of the RIC not only benefits us, it benefits you. As a supporter, you not only receive a subscription to the *RIC Insight*, but you are also entitled to unlimited searches of our database. Database searches are normally a minimum of $50 (for up to 25 references), so receiving free searches can be a large benefit. We are also now offering the appearance of corporate logos in the *RIC News* to our corporate supporters, with the number of yearly appearances dependent on support level.

Please consider contributing to the Rare-earth Information Center, we depend on you! ▲

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Since the March issue of the RIC News, we have received renewed support from 16 organizations and individuals.

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