



# RARE-EARTH INFORMATION CENTER NEWS

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## Guest Book Review

by  
**L. ZEVIN**

*In the September 1, 1985 issue of the RIC News we announced the acquisition of a Russian book on the structural physics of rare earth intermetallic compounds. Shortly thereafter we received a letter from Dr. L. Zevin offering to review the book. We sent him a copy and recently received the following review.*

The book *Introduction to the Structural Physics of Rare Earth Intermetallic Compounds* was written in Russian by A. S. Pyushin and published in 1984 by the Moscow University Publishing Authority (Izdatelstvo Moskovskogo Universiteta). The price noted on the last page is incredibly low, equivalent to about 20 cents, but only 300 copies were printed. The book is 100 pages long and is divided into five chapters.

The first chapter is devoted to the crystal chemistry of intermetallic compounds of rare earths (R) and 3d-transition elements (B). It is based on the works of K. Buschow, N. Belov, and P. Krypyakevich. Structures of R-B compounds are developed from the basic  $RB_2$  (CaCu<sub>2</sub> type) by various stacking of close-packed R-B layers.

The theory of magnetostriction effects in R-B compounds is discussed in chapter 2 with emphasis on  $RB_2$  compounds of cubic C15 type structure (MgCu<sub>2</sub> type Laves phase). Possible space groups for magnetically ordering phases are given, and ways to calculate the lattice distortion caused by magnetic ordering are pointed out.

Application of X-ray diffraction methods to investigation of structure distortion below the magnetic ordering temperature is discussed in chapter 3. Both peak splitting caused by

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## SOURCE BOOK Nd-Fe-B MAGNETS

Due to the explosive growth of papers on the ternary Nd<sub>2</sub>Fe<sub>14</sub>B permanent magnet material it was decided that a good source of references was needed. The RIC has put together a bibliography from references in its data base as of April 24, 1986. The report, IS-RIC-9, "Source Book on Neodymium-Iron-Boron Permanent Magnets," contains 266 references on Nd<sub>2</sub>Fe<sub>14</sub>B, or with compositions close to this stoichiometry, or with alloys where other elements are partially substituted for the Nd, Fe, or B. Also included in this 112-page report is a key word and an author index to facilitate locating papers on a specific subject or by a specific author.

Sponsors should have received a complimentary copy(s) depending on their contributions. The cost of this source book is U.S.\$50.00 a copy and may be obtained by sending a purchase order to Rare-earth Information Center, EMRRI, Iowa State University, Ames, Iowa 50011, U.S.A. A 10 percent discount is available if payment accompanies the order (i.e. pay only \$45.00 a copy). Please make checks payable to the RIC Newsletter Fund. Checks should be made in U.S. dollars payable through a United States bank. The report will be sent as Library Materials in the U.S.A., Canada, and Mexico and Surface Printed Matter elsewhere. For first class delivery in the U.S.A., Canada, or Mexico please add U.S.\$2.00 per copy. For overseas air mail, please add U.S.\$4.00 per copy. Discounts are available for five or more copies. For information on the source book, or other questions, write, telephone (515)-294-2272, or telex 269266 the Information Center.

## RE's in the News NEW MARKET?

Researchers are continuing to work on a new way of using magnetic bubbles to store information that may be the harbinger of an expanded market for rare earths. The concept, envisioned in 1983, could lead to memory devices that are denser and much faster than magneto-optical disks. They would make use of Bloch lines, or tiny stripe-shaped magnetic domains in bubble materials. Each magnetic bubble can carry up to 100 bits of information, which makes memory densities of up to one Gbyte/in<sup>2</sup> possible. Mark Kryder of Carnegie Mellon University, a leading researcher in the field, explains the speed as resulting from the system being inherently parallel with many thousands of Bloch lines (stripes) being read at a time. It is predicted that another five years will be needed to develop the concept to where it could possibly be commercially feasible.

## COMPETITION?

A possible competitor for part of the data storage market has been demonstrated by scientists of International Business Machines' (IBM) Almaden Research Center in San Jose, California. The new systems use a laser technique for reading, writing, and erasing at capacities of 100 billion bits per square inch without destruction of information. The systems were invented by physicists R. M. Macfarlane and W. E. Moerner and physical chemist R. M. Shelby. They were aided by visiting scientists H. W. H. Lee and A. Winnacker. The technique uses lasers of different wavelengths to interconvert among ground, excited, and ionized states of metal ions or organic molecules in matrices and to detect the different

(Continued on page 3)

## PROCEEDINGS An/Ln Separations

*Actinide/Lanthanide Separations* contains 20 papers presented at an international symposium held December 16-22, 1984 in Honolulu, Hawaii, U.S.A. The 360-page book costs U.S.\$42.00 and was published by World Scientific Publishing Company Pte. Limited, Farrer Road, P.O. Box 128, Singapore 9128, Republic of Singapore.

The book was edited by G. R. Chopin, J. D. Navratil, and W. W. Schulz. The papers presented at the meeting stressed the developments in actinide separation methods since the last meeting in 1978 and include papers on new developments in lanthanide separation. The proceedings present a broad insight into the science of separating the *f*-elements.

Opening papers cover actinide-lanthanide group separations, followed by a group of papers reporting on new and promising extractants for actinides including such topics as automatic separations, separation by oxidation state, and separations of the early actinides. The last part of the book deals with plutonium and/or americium recovery using principally pyrochemical techniques. The papers in this volume, according to the editors, represent the state-of-the-art methodology in *f*-element separations in 1985. While rare earths are mentioned in only 11 of the 20 papers they may be present in radioactive wastes dealt with in other papers.

### $M^2S$

*Materials and Mechanisms of Superconductivity-M<sup>2</sup>S* is the title of the hard bound copy of the proceedings of the international conference of the same name, held May 29-31, 1985, at Iowa State University, Ames, Iowa, U.S.A. This conference was formerly called the Superconductivity in *d*- and *f*-Band Metals Conference. Edited by K. A. Gschneidner, Jr. and E. L. Wolf, the proceedings were published by North-Holland Physics Publishing Division of Elsevier Science Publishers B.V. of Amsterdam. They were reprinted from *Physica*, 135B, Nos. 1-3. The 533-page book, published in 1985, costs Dfl 303 (~U.S.\$115.00) including postage. It

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(Continued from previous column) is available only from Elsevier Science Publishers, P.O. Box 211, 1000 AE Amsterdam, The Netherlands.

The proceedings are dedicated to Professor T. H. Geballe of Stanford University on the occasion of his 65th birthday and in appreciation of his friendliness, enthusiasm, insight, and leadership in the development of superconducting materials.

While the change in name and expansion in scope of the  $M^2S$  conference reflects growth and changes in research emphasis, the central topics remain the same. These are the fundamental mechanisms leading to superconductivity and the materials and their properties, which exhibit or give rise to superconductivity. The papers are grouped into 10 chapters or subject headings. The headings and the number of papers in each are as follows: Heavy fermions (26); interfaces, thin films and multilayers (19); tunneling spectroscopy (7); pressure effects (7); amorphous and disordered materials (12); magnetism and superconductivity (10); A15 materials (9); ternaries, alloys, and new materials (19); basic interactions and new mechanisms (11); and low carrier density, one dimensional (5). Of the 125 papers presented, 40 are on rare earth compounds and 7 are on theory applicable to superconductors in general.

### Organometallic *f*-Element Chemistry

In September of 1978, a NATO Advanced Study Institute entitled Organometallics of the *f*-Elements was held in Italy, (see *RIC News*, XV, [3] [1980]). The need for a second such institute was established by the success of the first, by the scientific advances in the field, and by the enthusiasm shown by a poll of prospective attendees.

The second NATO institute on the subject was held September 10-21, 1984 in Acquafredda di Maratea, Italy. Entitled *Fundamental and Technological Aspects of Organo-f-Element Chemistry* the institute brought together approximately 90 scientists from 14 countries for 12 days of lectures, seminars, poster sessions, and both formal and informal discussions. A comprehensive and meaningful picture of what is cur-

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(Continued from previous column) rently known about the organometallic chemistry of the *f*-elements evolved.

A monograph of the same title was published in 1985 by the D. Reidel Publishing Company, which contains a compilation of the principal lectures presented at *Fundamental and Technological Aspects of Organo-f-Element Chemistry*. Edited by T. J. Marks and I. L. Fragalá, the 414-page book costs Dfl 160 or U.S.\$56.00 and can be obtained from Kluwer Academic Publishers, at P.O. Box 989, 3300 AZ Dordrecht, The Netherlands, or 190 Old Derby Street, Hingham, Massachusetts 02043, U.S.A.

Each chapter is a review of the subject covered by the title and includes an extensive bibliography. The 11 chapter titles, with the number of references in parentheses, are as follows: "Organolanthanides: review and new developments" (228); "4*f*-Elements in organic synthesis" (85); "[8]Annulene derivatives of actinides and lanthanides" (90); "Actinide hydrocarbyl and hydride chemistry" (90); "Organoactinide complexes containing classical ligands" (95); "Frontier elements: connections with *f*-elements" (61); "Electronic structure and optical spectroscopy of *f* ions and compounds" (48); "NMR-spectroscopy of organo-*f*-elements and pre-lanthanoid complexes: some current trends" (141); "Photoelectron spectroscopy of *f*-element organometallic complexes" (39); "*f*-Element photochemistry" (40); and "New perspectives of lanthanides in catalysis" (42).

### Crucible Research Center

The Crucible Research Center, a division of Crucible Materials Corporation, was issued two U.S. patents dealing with new rare earth permanent magnet alloys during January 1986. One covers a permanent magnet alloy containing Sm, Co, Fe and Cu in which the copper content is reduced and partially replaced with zirconium while the strength of the magnetic is kept at an optimum level. The second covers a samarium cobalt magnet material in which a portion of the more expensive Sm is replaced by another rare earth. This also allows for cost savings in process control and eases the low oxygen content level requirements.

## MEETINGS

### Applications—Technology

Organized by M/S Indian Rare Earths Limited, a Symposium on Rare Earth Applications and Technology will be held September 25-26, 1986, in Bombay, India. Included in the objectives of the symposium are the following: (1) an assessment of the present use of rare earths in the country and some of the problems that confront the users; (2) a presentation of some of the new technological trends in the application of rare earths in other countries, (3) a projection of likely growth in the usage of rare earths, and (4) a discussion of areas wherein development and research efforts would most likely increase the production and application of rare earths.

While directed mainly at increasing uses and applications in India, the problems and solutions are likely to be applicable to other countries and companies. Sessions are to be included on resources and supply; processes for production; and applications in glasses, ceramics, metallurgy, chemistry, electronics, agriculture, catalysts, paints, phosphors, etc. The proceedings of the symposium are to be published.

For more information on registration and deadlines contact Mr. V. K. Verna, Convenor, Symposium on Rare Earths, Indian Rare Earths Limited, "Sherbanoo" 6th Floor, 111 Maharashi Karve Road, Bombay-400 020, India.

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## CONFERENCE CALENDAR

Intl. Conf. on Anomalous Rare Earths and Actinides (I.C.A.R.E.A.)  
Grenoble, France  
July 7-11, 1986  
*RIC News*, XX, [2] 2 (1985)

3rd Intl. Conf. on Physics of Magnetic Materials (ICPMM)  
Szczyrk-Bila, Poland  
September 9-14, 1986  
*RIC News*, XX, [4] 3 (1985) and XXI, [1] 4 (1986)

Symposium on Rare Earth Applications and Technology  
Bombay, India  
September 25-26, 1986  
\*This issue

5th Intl. Conf. on Valence Fluctuation  
Bangalore, India  
January 5-9, 1987  
*RIC News*, XX, [4] 3 (1985)

2nd Intl. Conf. on the Basic and Applied Chemistry of the *f*-Transition (Lanthanide and Actinide) and Related Elements (2nd I.C.L.A.)  
Lisbon, Portugal  
April 6-10, 1987  
*RIC News*, XIX, [4] 3 (1984) and XX, [2] 2 (1985)

Intl. Symposium on Magnetism of Intermetallic Compounds (ISMIC)  
Kyoto, Japan  
April 20-22, 1987  
*RIC News*, XXI, [1] 4 (1986)

9th Intl. Workshop on Rare-Earth Magnets and Their Applications and 5th Intl. Symposium on Magnetic Anisotropy and Coercivity in Rare Earth-Transition Metal Alloys  
Bad Soden, West Germany  
August 31-September 3, 1987  
*RIC News*, XXI, [1] 4 (1986)

\*New Listing or Change

### In the News

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states.

The system of interest to rare earth scientists involves a barium chloride matrix containing 0.05 atom percent samarium (II). The 1 mm thick matrix is chilled to 4.2 K, which induces strains and imperfections in the crystals, forming a myriad of slightly different micro environments for the dopant ions. By using a red beam from a red tunable laser or the green or blue beams from an argon laser they can excite the samarium (II) ion; further ionize them to samarium (III); or free electrons from traps that reduce them back to samarium (II). Samarium (II) ions

## \*\* RECORD YEAR \*\*

The 1986 fiscal year is closing with a record number of sponsors on our list of family members. We are indebted to each for their support and wish we could thank everyone of you personally. The fourth quarter was the frosting on the cake as we received support from 22 sponsors bringing to 90 the number of sponsors for fiscal 1986. This breaks the old record of 69 set last year.

We received renewed support from 14 sponsors during the fourth quarter and added eight new members to our growing family. The fourth quarter sponsors, with the number of years of sponsorship in parentheses, are listed below.

Aldrich Chemical Company, Incorporated, U.S.A. (7)  
Allied Eneabba Limited, Australia (2)  
Bano Chemicals Limited, England (1)  
Bose Corporation, U.S.A. (9)  
Ceradyne Incorporated, U.S.A. (1)  
The Chinese Society of Rare Earth, People's Republic of China (1)  
Delco Remy, Division of General Motors Corporation, U.S.A. (2)  
GTE Laboratories, Incorporated, U.S.A. (14)  
ICD Group, U.S.A. (1)  
F. G. Jones Associates, Limited, U.S.A. (2)  
LTV Aerospace and Defense Company, U.S.A. (2)  
Martin Marietta Laboratories, U.S.A. (1)  
Materials Research Corporation, U.S.A. (1)  
Matsushita Electric Industrial Company, Limited, Japan (2)  
A/S Megon OG Company, Norway (1)  
MCI-Megon, A.S., Norway (14)  
Mitsui Mining and Smelting Company, Limited, Japan (2)  
RECOMA Incorporated, U.S.A. (2)  
Sundstrand Aviation, U.S.A. (1)  
United Technologies Research Center, U.S.A. (3)  
Williams Strategic Metals Incorporated, U.S.A. (4)  
Yue Long Chemical Plant, People's Republic of China, China (5)

fluoresce when scanned with the red laser beam while samarium (III) does not. The information is stored, read, and erased by the use of the proper sequence of scans with the various laser beams.

## Rare Earthers

### Wilhelm Karl Klemm

The scientific world lost one of its pioneers in the early study of the rare earths with the death of Professor Wilhelm Klemm on October 24, 1985, at about 90 years of age. Professor Klemm was born in Buhrau in what was then Germany in 1896. He received his Ph.D. degree from the University of Breslau, Germany (now Wrocław, Poland). During his tenures at Institutes of Inorganic Chemistry at Technische Hochschule Danzig (now Gdansk), the University of Kiel, and the University of Münster, he investigated the crystal chemistry of the rare earth metals as well as their intermetallic compounds. He also did work on the halides and phosphides of the rare earths. Among the honors received by Professor Klemm were the Lavoisier medal from the French Academy of Chemistry and the Liebig medal.

### Wallace Koehler

We were saddened to hear of the death of Wallace Conrad Koehler who passed away on April 1, 1986. Better known as Wally, he was not only a scientist but a playwright, an actor, and a student of languages. He was born in Chicago on August 25, 1920, and received his bachelor and master degrees from the University of Chicago. While there he worked on the Manhattan Project to develop the atomic bomb and was present to measure the radiation exposure at the start up of the first atomic pile for controlled fission of uranium.

Dr. Koehler started working at the Oak Ridge National Laboratory in 1949 and earned his Ph.D. degree from the University of Tennessee in 1953. He helped pioneer and develop the use of neutron diffraction (scattering) in the study of the properties of solids. He was recognized throughout the world as one of the leading experts and was an authority on the magnetic structures of rare earth elements. His research played an important role in understanding high-field permanent magnets and in developing magnetic oxides for various applications. He has served as the director of the National Center for Small Angle Scattering Research established in 1978 at Oak Ridge. The center utilizes both x-ray and neu-

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tron scattering techniques.

Among the honors awarded to Dr. Koehler was the Frank H. Spedding Award in 1983. The award was named for the pioneer in rare earths who was also present at the first nuclear chain reaction on December 2, 1942, under the stands of Stagg Field at the University of Chicago.

### Alcoa Research Award

Hans H. Stadelmaier of North Carolina State University's materials engineering faculty was recently honored by being named a recipient of an Alcoa Foundation research award. This award is presented annually by the university's School of Engineering for outstanding research accomplishments.

Dr. Stadelmaier, research professor of materials engineering, received the award for his achievements over the past five years and especially his significant fundamental, theoretical, and experimental contributions to the area of metal alloy behavior. Since 1978, he has investigated the crystal structures, phase diagrams, and other properties of alloys involving the rare earths, a transition metal, and either carbon or boron. He has done considerable work on the new Nd-Fe-B permanent magnet material.

### Crucible Materials Corporation

The new Crucible Materials Corporation began operating December 20, 1985, as a privately held business. It was acquired from Colt Industries and has the same operating divisions as before: Specialty Metals, Trent Tube, Magnetics, Compaction Metals, and the Research Center in the

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### Book Review

(Continued from page 1)

symmetry changes and intensity variations of the split component caused by shifts of R-atoms are observed, and useful graphs are presented.

Some examples, mainly from the original authors' works, are given in chapter 4. One can see why good information on magnetic phase transition may be extracted from the old x-ray diffraction method: characteristic behavior of thermal expansion indicating the transition temperature, symmetry of the ordered phase showing the direction of magnetic ordering, shift of R-atoms, magnetostriction coefficients, etc.

The last chapter is devoted to an experimental study of magnetic ordering of  $R_2B$  and  $RB_2$  compounds. An interesting example of the phase composition and fine structure of a  $(Tb_{0.8}Gd_{0.2})_2Co$  alloy crystallized under normal and zero gravitational fields (the latter on the Salut-6 satellite) is presented.

The content of this book corresponds to its title. It seems to be useful for research scientists and graduate students if, of course, they can manage Russian.

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United States, and Crusteel Limited in England. The management structure is also intact with Board Chairman Vincent H. Callahan, President John L. Vensel, and Division Presidents Warren Bickerton, Frank Petro, John DuPlessis, William Eisen, Edward Dulis, and Max Brown.

To quote Chairman Callahan, "The best thing about the new Crucible is that essentially, it's the old Crucible."

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