



# RARE-EARTH INFORMATION CENTER NEWS

ENERGY AND MINERAL RESOURCES RESEARCH INSTITUTE  
IOWA STATE UNIVERSITY / AMES, IOWA

Volume XXI

September 1, 1986

No. 3

## RE HANDBOOK #8

Volume 8 of the *Handbook on the Physics and Chemistry of Rare Earths*, edited by K. A. Gschneidner, Jr. and L. Eyring, has been published by North-Holland Physics Publishing. The book contains chapters 54-57 of the continuing handbook series and, as in the previous seven volumes, covers a wide spectrum of topics. The chapter titles and authors are: (54) "Intra Rare Earth Binary Alloys: Phase Relationships, Lattice Parameters, and Systematics," by K. A. Gschneidner, Jr. and F. W. Calderwood; (55) "Polarographic Analysis of the Rare Earths," by X. Gao; (56) "Inorganic Complex Compounds I," by M. Leskelä and L. Niinistö; and (57) "Implications in Organic Synthesis," by J. R. Long. They each contain an extensive bibliography to the original work on that subject.

In the first chapter, the authors present data on 70 binary intra rare earth systems. These data include, when available; phase relationships, lattice spacings, pressure effects, metastable solid solutions, and thermodynamic properties. The chapter concludes with the presentation, in color, of four generalized phase diagrams at atmospheric pressure and at pressures of 1, 2, and 4 GPa. Each diagram represents the phase relationships of 91 intra rare earth binary phase diagrams at that particular pressure.

In the next chapter, Gao presents a review on polarographic analysis of the rare earth elements, including a bibliography with 103 entries. She points out that prior to 1980 the technique was difficult but that recent developments have led to methods that are simple and easy to perform. These can be used to determine micromolar levels of individual ele-

(Continued in the next column)

## LAWRENCE AWARD

James L. Smith of the Los Alamos National Laboratory, Los Alamos, New Mexico, was one of six scientists selected to receive the 1986 Ernest Orlando Lawrence Memorial Award.

The Lawrence Award was established in 1959 to honor the memory of Dr. Lawrence who invented the cyclotron and established the two major laboratories at Berkeley and Livermore, California, that now bear his name. The awards are presented by the United States Department of Energy to U.S. scientists who, relatively early in their careers, have made meritorious contributions to the development, use, or control of atomic energy. The work may be in any area of science related to atomic energy, including medicine and engineering.

Dr. Smith, a solid state physicist, will receive his award for establishing the fundamentals of heavy fermions and their unusual electronic and magnetic properties, through groundbreaking experiments and the discovery of new materials. He will be 43 when he receives his award on September 11 in Washington, D.C.

UBe<sub>13</sub> was the first heavy electron compound discovered by Dr. Smith and co-workers and in the next eight months they discovered five more. Among the rare earth compounds he has worked with are CeCu<sub>2</sub>Si<sub>2</sub>, LaBe<sub>13</sub>, TmI<sub>2</sub>, YbI<sub>2</sub>, (Ho,Lu)Rh<sub>2</sub>B, and CeCu.

ments or the total amount of rare earths present.

The third chapter, written by Leskelä and Niinistö, details the inorganic, crystal, and physical chem-

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## 17th RERC NEWS

Dr. John Greedan gave a sigh of relief and passed his mantle of general chairman on to Dr. Bill Carnall as the 17th Rare Earth Research Conference (RERC) became history on June 12, 1986. The conference in Hamilton, Ontario, Canada, attracted 205 scientists and management personnel from 24 nations to the four days of meetings. John, as general chairman, and Bill, as program chairman (now general chairman of the 18th RERC), and their supporting casts deserve a round of applause for their efforts.

The conference opened with a talk by Dr. Karl A. Gschneidner, Jr., dedicating the meeting to the memories of Drs. Frank Spedding, Wallace Koehler, and Sam Legvold who had died since the 16th RERC in 1983. Incidentally, Hamilton, Canada, was the birthplace of Dr. Spedding.

Drs. Allan R. Mackintosh and Hans Bjerrum Møller were presented as co-winners of the 4th Frank H. Spedding Award. As with the award they shared, they presented a joint talk entitled "Foundations of Rare Earth Magnetism." Allan led off with the early history of magnetism, with emphasis on the contributions of Spedding, Koehler, and Legvold. He told of his interactions with the three and how they aroused his interest in the field. Hans then presented the history and findings of the late 1960's, the 70's, and 80's. Many of the discoveries discussed were a result of collaborative efforts of the two awardees. The Frank H. Spedding Award is given by the Rare Earth Research Conference Incorporated and was made possible by a grant from Rhone-Poulenc.

Seven minisymposia on solid state structures and bonding—organometallic chemistry; permanent mag-

(Continued on page 4)

## BUSINESS NEWS

### Grace to Separate Rare Earths

W. R. Grace & Company, Shin-Etsu Chemical Company, Limited, and Mitsui & Company, Limited, have announced a joint program for Grace to produce separated rare earths in the United States.

The Davison Specialty Chemical Division of W. R. Grace (Baltimore, Maryland) is expanding its Chattanooga, Tennessee, plant to provide the separation facilities. The plant will employ separation technology licensed from Shin-Etsu (Tokyo) and is scheduled to begin production during the first quarter of 1987. Mitsui, an international trading company, with offices in Tokyo and New York, will provide commercial assistance. The enlarged Davison plant will become one of the major suppliers of rare earth materials to Shin-Etsu.

### Joint Venture Remacor-Mitsubishi

REMACOR of New Castle, Pennsylvania, and Mitsubishi Metal Corporation of Tokyo have agreed to form a company that will supply materials used in making a new type of magnet. According to REMACOR President Joseph R. Jackman, the joint venture, as yet unnamed, will operate at the West Pittsburg plant of the Reactive Metals and Alloys Division of REMACOR.

The new company will be involved in research, development, manufacturing, and marketing of neodymium metal and alloys, especially for use in Nd-Fe-B permanent magnets. The neodymium magnet has been the subject of intense research by industry in the past three years. [See *RIC News*, XXI [2] 1 (1986)].

### New Chairmen

In a move toward privatization of industry, the French government replaced many key executives in France's top banks, insurance companies, and industrial concerns. Loik Le Floch-Prigent, appointed chair of Rhone-Poulenc in 1982 when the company became state owned, was replaced by Jean-René Fourtou. Fourtou has been president of a Paris based consulting firm since 1977.

(Continued in the next column)

(Continued from previous column) Rhone-Poulenc's sales in 1985 amounted to \$6.24 billion, up 51 percent from 1982 and is the third largest of French companies.

Jean Gandois, who Le Floch-Prigent replaced when the company became state owned, was appointed chair of Pechiney, a company active in the international metals business.

### Queen's Award

The Rare Earth Products Division of Johnson Matthey Chemicals has won The Queen's Award for Export Achievement in 1986. Based in Widnes, Cheshire, Rare Earth Products is involved in separating and preparing high purity metals, alloys, and compounds from partially-separated ores. Their export business showed a 104 percent increase in 1984 and a further 77 percent increase in 1985.

### RE's in the News New Materials

Eutectic composites are a new, or at least unusual, class of materials, according to developer G. Wayne Clark formerly of Oak Ridge National Laboratory. He has worked with binary and ternary composites with some unusual properties—melting points as high as 3000°C, fracture toughness twice that of the host components, and extremely high hardness. Some of the eutectics studied include  $Y_2O_3-TiB_2$ ,  $Y_2O_3-TiC$ , and  $Y_2O_3-TiC-TiB_2$ .

### Electroluminescence

Thin-film electroluminescence (EL) devices employing ZnS:Sm,P as the phosphor have been found to exhibit bright red emission. A brightness of 1000 cd/m<sup>2</sup> and an efficiency of  $8 \times 10^{-2}$  lm/w have been obtained in the devices annealed at 873 K. It is thought that P acts as a charge compensator for the Sm<sup>3+</sup> ions. [*Appl. Phys. Lett.* 48, 95-6 (1986)]

### Giant Resonance

The proceedings of a NATO Advanced Study Institute held June 16-26, 1986, at Les Houches, France, will be published. Entitled *Giant Resonances in Atoms, Molecules and Solids*, the Institute dealt with areas such as wave function collapse, excitation to 4f orbitals, 4f occupancy, the first order Mott transition between localized and itinerant behavior, and

(Continued on page 4)

## CONFERENCE CALENDAR

Bauxite Waste Tailings (Extraction of Rare Earths)

Kingston, Jamaica, West Indies  
October 26-30, 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 Inter-metallic 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)

18th Rare Earth Research Conference (RERC)

Interlaken, Lake Geneva, Wisconsin, U.S.A.

September 11-15, 1988

\*This Issue

## Bauxite Wastes

An International Workshop will be held October 26-30, 1986, in Jamaica to discuss environmentally safe methods of handling and disposing of bauxite wastes. Among the subjects to be covered are sampling and characterization techniques and extraction of rare earths, including scandium, and major metals.

The RIC only learned of this workshop in June and many of the datelines have expired. If you are interested, write or phone Dr. Arun Wagh, Physics Department, University of the West Indies, Mona, Kingston 7, Jamaica, West Indies. His phone is 927-6661, extension 278.

The workshop is supported by the International Development Research Centre, Ottawa, Canada, and the United Nations Industrial Development Organization, Vienna, Austria. It is organized by the Physics Department, University of the West Indies, the Geotechnical Research Centre, McGill University, Montreal, Canada, and by the Jamaica Bauxite Institute.

## PROCEEDINGS

### Spectroscopy

The proceedings of the 1st International Symposium on Rare Earths Spectroscopy (ISRES) was published in 1985 by World Scientific Publishing. Editors of the proceedings, entitled *Rare Earths Spectroscopy*, are B. Jezowska-Trzebiatowska, J. Legendziewicz, and W. Streck. The ISRES was held September 10-15, 1984, in Wroclaw, Poland, and was attended by 120 scientists from 16 countries.

The focus of the symposium was the presentation of new achievements in spectroscopy of rare earth ions in solutions and in solids and the possibility of their application in the field of laser technology. The book is divided into sections with the following titles: spectroscopy methods in structural study of lanthanide compounds (25 papers); intensities of *f-f* transitions, *f-d* transitions, hypersensitivity (13); luminescence of lanthanide ions (10); nonradiative processes in luminescent materials (9); two-photon transitions (2); and technology and materials (7).

The book has 675 pages and costs U.S.\$68.00. It may be ordered from World Scientific Publishing Company PTE. Limited, Farrer Road, P.O. Box 128, Singapore 9128. In the United States and Canada it may be ordered from Taylor and Francis Inc., 242 Cherry Street, Philadelphia, PA. 19106-1906.

#### RIC News

(USPS 464-960)

Vol. XXI, No. 3

September 1, 1986

#### Published

quarterly in March, June  
September and December

by  
Rare-earth Information Center  
Energy and Mineral Resources  
Research Institute  
Iowa State University  
Ames, Iowa 50011-3020

Second-class postage  
paid at Ames, Iowa

**Postmaster:** Send address changes to  
RIC News, Rare-earth Information Center,  
Energy and Mineral Resources  
Research Institute,  
Iowa State University,  
Ames, Iowa 50011-3020

Telephone: (515) 294-2272

Telex: 269 266

Telecopier: (515) 294-3226

(Xerox 295)-(Group 1, 2, or 3)

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## GMELIN HANDBOOK

The volume "Rare Earth Elements" C 9 deals with compounds of selenium with rare earths, individually or in combination. The compound types covered include the selenides, selenites, selenates, oxy-selenides, diselenite nitrates, selenide halides, selenide sulfides, sodium selenides, and alkali selenates of the rare earths. Published in 1985 by Springer-Verlag and containing 528 pages, the book costs DM 1,991 (~U.S.\$970.00). This volume of the *Gmelin Handbook of Inorganic Chemistry* from system number 39, as well as the preceding 28 volumes, may be ordered from Springer-Verlag, 4005-Marketing Gmelin, Heidelberger Platz 3, D-1000 Berlin 33, West Germany.

The discussion of the rare earth selenides takes up over three-quarters of the book (413 pages). The presentation of comparative data on the selenides takes 64 pages and the presentation of data on the individual selenides 349 pages. The largest individual sections are on the selenides of thulium (81 pages) and europium (97 pages).

The study of EuSe reveals a complex magnetic behavior. The entire picture is still not settled despite the extensive magnetic investigations and the additional studies involving Raman effect, NMR and modulated optical spectra. Maybe the large amount of data and literature references gathered together in this *Handbook* will lead to a more complete understanding of the phenomena.

The valency of Tm in TmSe can be shifted from purely trivalent on the Se-rich edge of the homogeneity range (Tm<sub>0.87</sub>Se) to an intermediate valence in nearly stoichiometric TmSe. A further shift toward divalent Tm may be attained by alloying with EuSe. As with the magnetic behavior of EuSe, the behavior of TmSe has evoked much study with many questions still unanswered. The theoretical models proposed are similar to those of the pressure-induced intermediate valence state of SmS which was reviewed in "Rare Earth Elements" C 7.

The 115 pages devoted to the balance of the compound types are devoted mostly to their preparations, their crystallographic properties, and their thermal stability and

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## RONALD D. PARKS

The RIC has learned of the death of Ronald D. Parks on April 17, 1986, at the age of 51. With his death, the rare earth community has lost an innovative, hard-working researcher and teacher at the peak of his potential.

Dr. Parks was born on February 9, 1935, in Kansas City, Kansas. He attended Kansas State University, graduating in 1956 with highest honors. He went to Stanford University, received his Ph.D. in 1961 under William Little and spent a year with him as an NSF postdoctoral fellow. His dissertation dealt with the competition between superconductivity and magnetism, an area in which he was active from time to time the rest of his career. While at Stanford, Parks and Little demonstrated flux quantization in a multiply connected superconductor through resistivity measurements, a classic effect that bears their names.

From 1962 to 1979, Dr. Parks was associated with the University of Rochester. He became a full professor in 1968 and while at Rochester he established one of the world's best low temperature research laboratories. His interests included superconducting flux flow and flux quantization, phase transitions in magnetic and liquid metallic systems, and valence instabilities. He edited the two volume compendium *Superconductivity* (1969) and in 1976 he organized the first international conference on valence instabilities and edited the proceedings, *Valence Instabilities and Related Phenomena*.

In 1979 he became head of the physics department at Polytechnic Institute of New York. His research involved mixed valence systems and ternary systems of Ce and Eu with silicon and another metal, including the heavy fermion system CeCu<sub>2</sub>Si<sub>2</sub>.

In 1984 Dr. Parks took a position as professor and, despite his worsening health, worked until about a month before he died. He will be remembered for his remarkable spirit, imagination, and inventiveness. He demonstrated to his students the excitement and fun of research and he will be sorely missed.

decompositions.

Volumes C 9 and C 7 give a comprehensive survey of the chalcogenides of the rare earths and should prove valuable in new experiments, both basic and applied.

## \$\$ 1987 \$\$

The encouraging influx of new sponsors has continued into fiscal 1987. Two new companies have joined our growing family of sponsors as we head into our 21st year of operation. With 17 previous family members renewing their support, it brings to 19 the list of supporters for the first two months of the new fiscal year and gets us off to an encouraging start.

The 19 companies responding early, with the number of years they have been supporting the RIC in parentheses, are listed below.

Aran Isles Chemicals Incorporated, U.S.A. (3)  
 A/T Products Corporation, U.S.A. (7)  
 Companhia Industrial Fluminense, Brazil (14)  
 Davison Specialty Chemical Company, Subsidiary of W. R. Grace & Company, U.S.A. (19)  
 Denison Mines Limited, Canada (15)  
 Gesellschaft für Elektrometallurgie, West Germany (2)  
 Globe Metallurgical Incorporated, U.S.A. (3)  
 Hitachi Magnetics Corporation, U.S.A. (12)  
 Kobe Development Corporation, U.S.A. (1)  
 Lanthanide Research Corporation, U.S.A. (3)  
 Nippon Steel Corporation, Japan (1)  
 Nippon Yttrium Company, Limited, Japan (8)  
 Nissho Iwai American Corporation, U.S.A. (6)  
 P. T. Koba Tin, Indonesia (2)  
 Reactor Experiments Incorporated, U.S.A. (17)  
 Research Chemicals, U.S.A. (19)  
 Santoku Metal Industry Company, Limited, Japan (17)  
 Sumitomo Light Metal Industries, Incorporated, Japan (3)  
 Vacuumschmelze GmbH, West Germany (3)

### In the News

(Continued from page 2)  
 intermediate valence phenomena.

### Neutrons

Researchers at Lawrence Livermore National Laboratory of Livermore, California, have created the first fusion neutrons with the Nova laser system, according to Erik

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Storm, deputy associate director. The researchers fired the laser and focused 18 kJ of laser light onto a hollow glass sphere containing D<sub>2</sub> and T<sub>2</sub>. A one ns pulse produced a 50 ps fusion burn and created 10<sup>13</sup> neutrons (28 J of fusion energy), one-half of the predicted yield.

## ERRATUM

An error in *RIC News*, XXI, [1] 2 (1986) has been brought to our attention. The workshop mentioned in the story entitled "Present-Future Nd-Fe Magnets" was held October 25, 1984, and not as we reported October 24, 1985.

### 17 RERC

(Continued from page 1)

nets, especially Nd-Fe-B intermetallics; heavy fermion metals; lasers in rare earth spectroscopy; mixed valence compounds; and coordination chemistry—were incorporated into the main conference.

The refereed papers from the lectures and posters will be published in special volumes of *The Journal of Less-Common Metals*. The *RIC News* will review the proceedings when they are available to the public. Attendees will receive the proceedings as part of their registration fee.

General chairman of the 18th Rare Earth Research Conference, Bill Carnall (Argonne National Laboratory), has informed us that the 18th RERC is scheduled for September 11-15, 1988, and will be held at Interlaken, Lake Geneva, Wisconsin, U.S.A. The *RIC News* will have more details as they become available.

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### RE Handbook

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istry of complex borates, carbonates, silicates, germanates, and nitrates, and their derivatives. The ligands may have 1, 2, or 3 different positive elements associated with them, e.g. Na<sub>2</sub>LiYSi<sub>6</sub>O<sub>16</sub>. Solid state aspects of the trivalent compounds are emphasized and include their applications in science and industry. The authors have another paper dealing with the phosphates, arsenates, etc., which will appear in the next volume of the *Handbook*. To illustrate the extent of work being done on these complexes, the chapter has a bibliography with 662 entries.

In the last chapter, Long describes the relatively young field involving the use of rare earth ions and compounds in organic synthesis. Long points out that the unique properties of the lanthanides—contracted and shielded 4f levels and large ionic size—have led to new approaches for forming both standard and unique organic molecules. Many of these compounds are of commercial value or have potential applications.

This volume contains an errata section that lists errors found in the first seven volumes of the *Handbook*.

Volume 8 was published in 1986 and contains 382 pages. Orders from Canada and the U.S.A. should be sent to Elsevier Science Publishing Company, Inc., P.O. Box 1663, Grand Central Station, New York, N.Y. 10163. The cost is U.S.\$89.00. Other orders should be sent to Elsevier Science Publishers, P.O. Box 211, 1000 AE Amsterdam, The Netherlands, with the price being Dfl. 240.00. Subscriber prices for the series are U.S.\$75.50 and Dfl. 204.00.