



# RARE-EARTH INFORMATION CENTER NEWS

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

Volume XI

No. 3

September 1, 1976

## 12th Rare Earth Research Conference

The highly interdisciplinary 12th Rare Earth Research Conference reached a successful conclusion on July 22 in Vail, Colorado with many conferees staying in the area a few extra days to enjoy the beautiful mountain scenery. The weather proved cooperative with respect to session attendance. The Conference was attended by approximately 175 with 23% representing 10 foreign countries.

Around 150 papers were presented in sessions on general and coordination chemistry, magnetics, bioinorganics, intermetallics, spectroscopy, halides, oxides, crystal growth, metallurgy and solid state physics. The program will not be published in the *RIC News* as for previous Conferences, but copies of the program are available from the Center upon request.

The current high interest in applied technology resulted in three sessions devoted to rare earth material applications. Discussion included nuclear uses, phosphors, permanent magnets, steel, fabrication, magnetic bubbles, energy storage, lasers, and discharge lamps.

Copies of the proceedings are available by writing to Dr. C. E. Lundin, Denver Research Institute, University of Denver, Denver, Colorado 80210. The cost for the 1120 page, paperbound, two volume set is \$40.00.

The chairman, date and site for the 13th Rare Earth Research Conference were selected and they are, respectively, W. E. Wallace, October 16-20, 1977 and Wilson Lodge, Oglebay Park, Wheeling, West Virginia, see page 3 for more details. Hope to see you there!

## NATIONAL HONORS TO RARE EARTHERS

Dr. John B. Goodenough, research scientist at the Massachusetts Institute of Technology, Lincoln Laboratory, Cambridge, Massachusetts, was among the 104



J. B. Goodenough

newly elected members to the National Academy of Engineering. Inclusion in this distinguished group, which now numbers 685, is one of the highest forms of recognition accorded to American scientists and engineers.

Author of two books and fifteen review chapters, Dr. Goodenough has also published over 100 scientific papers with particular emphasis on application of scientific developments to advanced engineering. Included in his research interests have been the electrical and magnetic properties of rare earth compounds such as europium and ytterbium hexaborides and perovskite type lanthanide-transition metal ternary oxides. Dr. Goodenough assumed the Chair of Professor of Inorganic Chemistry at Oxford University, Oxford, England, in August 1976.

### RE Conference in England

A conference on the Rare Earths and Actinides will be held July 4-6, 1977, at the University of Durham, Durham, England. The conference is being organized by the Solid State Sub-Committee of the United Kingdom Institute of Physics. Interested persons may contact Professor W. D. Corner, Conference Secretary, for further information at:

Science Laboratories  
University of Durham  
South Road  
Durham, DH 1 3LE  
England



H. Suhl

Dr. Harry Suhl, Professor of Physics at the University of California, San Diego, was recently named as one of 75 newly elected members to the National Academy of

Sciences, a highly coveted honor accorded to American scientists. The membership of the Academy now totals 1190 plus 157 foreign associates.

Dr. Suhl has authored or coauthored over 100 scientific papers, articles and books in addition to having served in an editorial capacity on several scientific journals. His research interests have included the study of superconducting rare earth compounds and magnetic properties of rare earth metals.

## CONTRIBUTORS

Fiscal year 1977 is upon us and it looks like it's going to be a good year (at least better than some we have had recently). Contributions have already been received from the following companies (the number in parentheses indicates the number of years the company has supported RIC):

Atomergic Chemetals Corp., U.S.A. (5)  
BBC Brown, Boveri & Co., Switzerland (5)  
Denison Mines Ltd., Canada (5)  
Foote Mineral Co., U.S.A. (5)  
Th. Goldschmidt AG, Germany (8)  
Leico Industries, Inc., U.S.A. (8)  
Metalurgica Corona, Ltda., Brazil (1)  
Molycorp, Inc., U.S.A. (9)  
Reactive Metals & Alloys Corp., U.S.A. (1)  
Transelect, U.S.A. (1)  
Treibacher Chemische Werke AG, Austria (5)

(Continued on page 6)

## Mixed Valence Compounds

Fundamental characteristics of homogeneously mixed valence compounds including theoretical and experimental bases for their understanding are discussed in a recent article by C. M. Varma [*Reviews of Modern Physics* 48 [2, Pt. 1], 219-38 (1976)]. Homogeneously mixed (or fluctuating) valence compounds have thus far been identified only for compounds of rare earths (Ce, Sm, Eu, Tm and Yb) and for the alpha phase of cerium metal. All of the rare earth ions in a homogeneously mixed valence compound exhibit a common valence which lies between the customary oxidation states of that particular rare earth, e.g. +2 and +3 for Sm, Eu, Tm and Yb and +3 and +4 for Ce. (Inhomogeneously mixed valence compounds, such as  $\text{Fe}_3\text{O}_4$ , at low temperatures, contain discreet  $\text{Fe}^{2+}$  and  $\text{Fe}^{3+}$  ions.)

According to the author, aspects of homogeneously mixed valence can be expected to be significant for transition metals, but it is the relative proximity of the 4f and 5d

bands in rare earths which are thought to lead to the unique thermal and magnetic properties displayed by these compounds. By applying pressure, appropriate doping, or changing the temperature, the 5d band can be moved closer to the 4f band until the two coexist at the Fermi level. At the crossover point, insulator to metal transitions are noted by changes in volume, resistivity and color. In addition, no magnetic ordering is found down to the lowest temperatures attainable in any of the homogeneously mixed valence compounds except for TmSe, which seems to order antiferromagnetically at about 2° K. Theoretical considerations and needs for further research are outlined by the author.

The review, including 73 references, is available for \$3.75 as Reprint No. 58 from:

American Institute of  
Physics  
Reprint Department  
335 E 45th Street  
New York, N. Y. 10017.

## The "Plot" Thickens

I. Fidelis has taken issue with S. P. Sinha concerning the relative value of plotting changes of properties in the lanthanide series versus the total angular momentum (L) instead of the atomic number (Z) [*Inorg. Nucl. Chem. Letters* 12, 475-83 (1976)]. Using the L values results in Sinha's "inclined W" plot [see *RIC News* XI, [2]3(1976)] while using Z values gives Fidelis' familiar "double-double effect."

Fidelis claims that the double-double effect defines the pattern of changes within the lanthanide series and has been established as an intrinsic and general feature of the f-electron element series. The extremely small differences between Eu and Gd and also Yb and Lu do not correspond to the extremely large differences between the L = 0 and L = 3 terms and therefore rule out the possibility of a linear relation in the case of the second and fourth segments of the "inclined W" plot. Fidelis notes that the double symmetry of the L quantum number is reflected in the double-double effect but not with regard to differences occurring in the series.

## Possible Monazite Link to Superheavies

Monazite figures importantly in new evidence reported by U.S. scientists at an American Physical Society Meeting in Quebec concerning the possible existence of super heavy elements 116 and 126 [*C & EN* 54, [26] 6 (June 21, 1976)]. Monazite crystals have been found containing rings of alpha radiation damage with diameters from 80 to 100 micrometers. These rings correspond to alpha energies on the order of 9.5 to 15 meV which are much more energetic than the alpha emissions from known natural elements. A breakthrough in the investigation occurred when it was discovered that an x-ray technique developed for studying air pollution could also be used in examining the monazite crystals. Using a tandem Van de Graaff accelerator the researchers probed the crystals with proton beams which had sensitivities of approximately a picogram. The result was x-ray energies which match very closely the theoretical predictions for the elements 116 and 126. While not conclusive this research adds one more piece to the puzzle in the search for the super-heavy elements.

## Focus on Rare Earth Permanent Magnets

The December 1975 issue of Th. Goldschmidt's *informiert*, volume 35, number 4, is devoted to the various aspects of rare earth permanent magnet technology. Nine articles by a number of experts in the field cover methods of production; analysis and composition control; successful fabrication of high coercive force and energy product mischmetal-based permanent magnets; current status in the development of rare earth-cobalt-iron permanent magnets; survey of magnetic and physical properties of commercially available rare earth-cobalt permanent magnets; principles of commercial permanent magnet manufacture and utilization in magnetic circuit designs for microwave tubes, image amplifiers and DC machines; and applications in animal and human surgical and medical procedures. Many tables, diagrams and interesting photographs are included in the 90 page booklet plus a four page insert with color photographs depicting production assemblies and commercial products of several magnet utilizing industries.

Copies are available free from:  
Th. Goldschmidt Products  
175 Main Street  
White Plains, N. Y. 10601

or from:  
Th. Goldschmidt, AG  
Chemische Fabriken  
Essen-Mannheim-  
Schöppenstedt  
4300 Essen 1  
Goldschmidtstrasse 100  
Postfach 17, West Germany.

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### RIC News

Vol. XI No. 3 September 1, 1976

published in  
March, June, September and  
December

by

Rare-Earth Information Center  
Energy and Mineral Resources  
Research Institute  
Iowa State University

Second-Class postage  
paid at Ames, Iowa 50011

Telephone: Area Code 515-294-2272

FTS . . . 865-2272

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Staff Writers

# 13th Rare Earth Research Conference

The 13th Rare Earth Research Conference will be held in Wilson Lodge, Oglebay Park, near Wheeling, West Virginia, about 50 minutes from Pittsburgh International Airport, during the period October 16-20, 1977.

The program will cover the following topics:

Spectroscopy, Solid State Theory, Magnetism— Fundamentals and Applications, General and Coordination Chemistry, Bioinorganic Chemistry, Materials Preparation and Processing, Crystal Growth, Catalysis and Surface Studies, Crystal Structure and Crystal Chemistry, Heat Capacity, Transport Properties, Metallurgy, Solid State Chemistry, Chemical Aspects of Oxides and Halides, Geology and Geochemistry, Industrial Processes, Industrial Applications.

It is our hope that we will have leaders in the field the world over participating in the conference. We hope to maintain the strong interdisciplinary character of the previous Conferences and to have substantial representations from government, academic and industrial institutions.

Planning will be greatly facilitated if each person who is interested in attending the conference will complete and return before November 15, 1976 the preliminary information form provided below.

(Detach)

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## 13th RARE EARTH RESEARCH CONFERENCE

Oglebay Park, near Wheeling, West Virginia, U.S.A.

October 16-20, 1977

Please complete the following and send before November 15, 1976 to:

Professor W. E. Wallace, Conference Chairman  
Department of Chemistry  
University of Pittsburgh  
Pittsburgh, PA 15260 U.S.A.

This form is for information only and carries no final commitment.

PLAN TO ATTEND  Yes  No

PLAN TO PRESENT PAPER  Yes  No

(Please type or print)

Special interest area(s) \_\_\_\_\_  
\_\_\_\_\_

Name \_\_\_\_\_

Address \_\_\_\_\_  
\_\_\_\_\_

## Previous RE Conference Proceedings

ASM-AEC Symposium on Rare Earths, Chicago, Illinois, November, 1959.

*The Rare Earths*. F. H. Spedding and A. H. Daane, eds., John Wiley and Sons, Inc., New York (1961). Reprinted and available from R. E. Krieger Publishing Co., Inc., P. O. Box 542, Huntington, NY 11743: \$16.50.

First Rare Earth Research Conference, Lake Arrowhead, California, October, 1960.

*Rare Earth Research*, E. V. Kleber, ed., Macmillan Co., 866 Third Avenue, New York, NY 10022. \$10.95.

Second Rare Earth Research Conference, Glenwood Springs, Colorado, September 24-27, 1961.

*Rare Earth Research*, J. F. Nachman, C. E. Lundin, eds., Gordon and Breach Science Publishers, Inc., 1 Park Avenue, New York, NY 10016. \$44.50.

Third Rare Earth Research Conference, Clearwater, Florida, April 21-24, 1963.

*Rare Earth Research II*, K. S. Vorres, ed., Gordon and Breach Science Publishers, Inc., 1 Park Avenue, New York, NY 10016. \$76.00.

Fourth Rare Earth Research Conference, Phoenix, Arizona, April 22-25, 1964.

*Rare Earth Research III*, L. Eyring, ed., Gordon and Breach Science Publishers, Inc., 1 Park Avenue, New York, NY 10016. \$77.00.

*Proceedings of the 5th Rare Earth Research Conference*, Ames, Iowa, August 30-September 1, 1965.\*

Book 1 (Spectra)	AD-627 221 [also CONF-650804- (Bk. 1)]
Book 2 (Solid State)	AD-627 222 [also CONF-650804- (Bk. 2)]
Book 3 (Chemistry)	AD-627 223 [also CONF-650804- (Bk. 3)]
Book 4 (Solid State)	AD-627 224 [also CONF-650804- (Bk. 4)]
Book 5 (Metallurgy)	AD-627 225 [also CONF-650804- (Bk. 5)]
Book 6 (Solid State)	AD-627 226 [also CONF-650804- (Bk. 6)]

Book 1 \$6.75. Book 2, \$5.50. Book 3, \$6.00. Book 4, \$5.00. Book 5, \$6.00. Book 6, \$4.50.

Symposium co-sponsored by the Division of Inorganic Chemistry and The Division of Nuclear Chemistry and Technology, 152nd ACS meeting, New York, New York, September 13-14, 1966.

*Advances in Chemistry Series No. 71 Lanthanide/Actinide Chemistry*, P. R. Fields and T. Moeller, symposium chairmen. Available from special issue sales, American Chemical Society, 1155 16th Street N. W. Washington, DC 20036 USA \$16.50.

*Proceedings of the 6th Rare Earth Research Conference*, Gatlinburg, Tennessee, May 3-5, 1967. CONF-670501.\* \$18.75.

*Proceedings of the 7th Rare Earth Research Conference*, Coronado, California, October 28-30, 1968. Sessions A-H CONF-681020-(Vol. 1) and Sessions I-M, CONF-681020-(Vol. 2)\*. \$21.25 for both volumes.

French International Rare Earth Conference, May 5-10, 1969. Paris and Grenoble, France

*Les Eléments des Terres Rares*, Tome I and Tome II, Bureau 3A-Service de Presse, Centre National de la Recherche Scientifique, 15 Quai Anatole France, Paris 7<sup>e</sup>, France. Tome I-price unknown, Tome II-107.50 F.

*Proceedings of the 8th Rare Earth Research Conference*, Reno, Nevada, April 19-22, 1970, available from Dr. R. Lindstrom, Reno Metallurgy Research Center, U.S. Bureau of Mines, Reno, NV, 89505, USA, \$17.00.

Conference on Rare Earths and Actinides, University of Durham, Durham City, England, July 5-7, 1971.

*Conference Digest No. 3, Rare Earths and Actinides, Durham 1971*, Institute of Physics, London, England (1971). Available from Dawsons of Pall Mall, Cannon House, Folkestone, Kent, England. £ 5 (except £ 3.50 for members of the Institute of Physics). Also available from International Scholarly Book Services, Inc., 10300 S. W. Hall Blvd., Beaverton, OR 97208. \$22.50.

*Proceedings of the 9th Rare Earth Research Conference*, Blacksburg, Virginia, October 10-14, 1971, available from Dr. Larry Taylor, Department of Chemistry, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061. USA. \$20.00

NATO Advanced Study Institute on Analysis and Application of Rare Earth Materials, Kjeller, Norway. August 23-29, 1972.

*Analysis and Application of Rare Earth Materials*, O. B. Michelsen, ed., Universitetsforlaget, Oslo, Norway (1973), available from Universitetsforlaget, P. O. Box 307, Blindern, Oslo 3, Norway or from Universitetsforlaget, P. O. Box 142, Boston, MA 02113. \$28.00.

*Proceedings of the 10th Rare Earth Research Conference*, Carefree, Arizona, April 30-May 3, 1973. CONF-730402-(P 1-2)\* \$27.20

Seventh Russian Conference on Rare Earth Metals, Moscow, USSR, Sept. 12-17 (1972). *Rare Earth Metals, Alloys and Compounds [Redkozemelnye Metally Splyvy i Soedineniya]* (Izdatel'stvo Nauk, Moscow, 1973) 355 pp. Cost is 1R, 81K (~\$2.00 U.S.) [14 papers in English, 5 in French and 67 in Russian]. Suggest contacting a book store dealing with Soviet publications.

*Proceedings of the 11th Rare Earth Research Conference*, Traverse City, Michigan, Oct. 7-10, 1974, available from Dr. Harry A. Eick, Department of Chemistry, Michigan State University, East Lansing, MI 48824, U.S.A., \$30.00

*Proceedings of the 12th Rare Earth Research Conference*, Vail, Colorado, July 18-22, 1976, available from Dr. C. E. Lundin, Denver Research Institute, University of Denver, Denver, CO 80210. \$40.00.

\*Available from the National Technical Information Service, Springfield, VA. 22151, USA.

## MMM Proceedings

The proceedings of the 21st annual triple M Conference held in Philadelphia, December 9-12, 1975 are available as the *AIP Conference Proceedings No. 29, Magnetism and Magnetic Materials—1975*. Edited by J. J. Becker, G. H. Lander and J. J. Rhyne, this cloth-bound single volume contains 693 pages, measures 8¼ in. by 11¼ in. and costs \$30.00.

Over 100 of the papers included in the proceedings deal with the rare earths. Included were topics on bubble translations, bubble domain physics, amorphous and disordered magnetism, spin excitations, narrow band magnetism, crystal fields, phase transitions, critical dynamics, domain walls, transport and electronic properties. Other papers dealt with bubble materials, rare earth-transition metal alloys, dilute alloys, chalcogenides, materials preparation, hard magnetic materials, insulators, bubble devices and applications.

Three papers presented at a special tutorial session are included. These dealt with growth induced anisotropy, magnetic recording theory, and the application of Josephson junctions to computer storage and logic elements to magnetic measurements. Also, for those of you having difficulty going back and forth between Systeme Internationale (SI) units and the cgs or Gaussian units a talk was given which defined equivalent units and included a handy table of conversion factors.

## Unified Numbering System

A recent publication of the Rare-Earth Information Center, IS-RIC-8, *Commercial Rare Earth Metals and Alloys Covered by the Unified Numbering System (UNS)*, by K. A. Gschneidner, Jr., defines and explains the system and its advantages with special reference to rare earth containing materials. The UNS was developed under the direction of the Society of Automotive Engineers (SAE) and the American Society for Testing and Materials (ASTM) for identifying metals and alloys. Copies of the 15 page report may be obtained free from the Rare-Earth Information Center, Energy and Mineral Resources Research Institute, Iowa State University, Ames, Iowa 50011.

## Distinguished Professors



V. A. Fassel



C. A. Swenson

Distinguished Professorships in Science and Humanities have been conferred by Iowa State University on Ames Laboratory rare earthers V. A. Fassel and C. A. Swenson. The appointments recognize exceptional teaching and research activities and are accompanied by a \$500 honorarium. Recipients carry the title for the rest of their careers.

Fassel joined the Ames Laboratory staff in 1941 as a spectroscopist, worked on the Manhattan Project and established an analytical spectroscopy laboratory for the analysis of rare

earth and other elements. He became deputy director of the Ames Laboratory in 1969 and continues to hold that post. His research has earned numerous awards including the Medal of the Society of Applied Spectroscopy, the Spectroscopy Society of Pittsburgh Award, the Hasler Award and the Anachem Award.

Swenson joined the Ames Laboratory and Iowa State faculty in 1955 and became chairman of the physics department in 1975. He has made significant contributions to solid state physics and is particularly noted for his precise measurements in the fields of low temperature thermometry and thermal properties of solids (including rare earth materials) and liquids below room temperature. His professional service includes the thermometry committee of the International Committee on Weights and Measures and a committee of the National Materials Advisory Board of the National Research Council.

## Heat of Formation Predicted

A. R. Miedema and co-workers have developed a model for predicting the sign of  $\Delta H$  for binary alloys of transition metals which recently was extended to predict numerical values of  $\Delta H$  for the alloys [*J. Less-Common Metals* 41, 283-8 (1975); 46, 67-83 (1976); *Proc. 12th Rare Earth Research Conf. II*, 838-46 (1976)].

The model is based on two effects. The discontinuity in density of electrons at the boundary between dissimilar atoms is the first effect. The second is the difference in the chemical potential for electrons in the two different atoms. The chemical potential is derived from the work function and the electron density is approximated from a ratio of the bulk modulus and the molar volume. An additional term is included if transition metals are alloyed with polyvalent non-transition metals. The author claims that the model, which assumes that crystal structure and entropy effects are relatively unimportant, predicts the sign of  $\Delta H$  for binary systems with 99% accuracy. Miedema notes that since the majority of elements are metals this model could possibly predict the heat of formation for a large part of the binary combinations of the elements.

## Mechanical Alloying

J. S. Benjamin has described a new alloying method which circumvents the reluctance of some metals to form alloys [*Scientific American* 234, [5] 40-8 (1976)]. Conventional powder metallurgy is limited by the fineness of powder that can be produced, the impurities introduced when lubricants are used and the tendency of fine metal powders to spontaneously ignite.

Advantage is taken of the fact that certain mixtures of metals tend to form metal composites when milled in the absence of a lubricant. By using ball mills which generate higher energies it is possible to accelerate the formation of metal composites, to eliminate the dependency of final powder homogeneity on initial powder size, and to avoid the hazards of fine powders. The composite particles have a layered structure. The size of the starting powder is not critical and there is little contamination from the steel balls.

Until now it was not possible to combine the properties of nickel-base alloys and dispersion-strengthened nickel. Conventional preparation of a nickel-base superalloy containing chromium, aluminum, titanium and yttrium oxide resulted in an inhomogeneous

(Continued on page 6)

## Oxidation Resistance Increased

Nickel—20 wt. % chromium alloys containing dispersed  $Y_2O_3$  and/or  $La_2O_3$  which was prepared by the mechanical alloying technique (see "Mechanical Alloying" page 5 of this issue) were tested for oxidation resistance by H. T. Michels [*Met. Trans. A* 7A, 379-88 (1976)]. Isothermal and cyclic oxidation resistance tests in dry air at 1000, 1100 and 1200° C were made on these alloys and also on a commercial alloy and an alloy prepared in the laboratory but with no rare earth content. It was found that even a small amount of dispersoid, < .1% improves the oxidation resistance of the Ni-Cr matrix compared to the commercial alloy. Better scale adhesion was also observed for the rare earth-doped alloys.

The author suggests that the metal oxides improve the oxidation behavior of the Ni-Cr alloy by altering the defect structure of the protective  $Cr_2O_3$  scale. That is, the trivalent La or Y ions fill vacant cation sites, thereby reducing cation vacancies and thus decreasing the diffusion of Cr to the surface of the alloy. Other suggested effects include decrease in porosity, reduction of oxide-scale grain size and improved chemical bonding at the oxide-metal interface.

## 2nd RE-Co Workshop Proceedings Available

The *Proceedings of the 2nd Workshop on Rare Earth-Cobalt Permanent Magnets and Their Applications* is available by writing to: University of Dayton, School of Engineering (Attn: Mrs. Fox, KL-365), 300 College Park Avenue, Dayton, Ohio 45469. The 400 page, paper-bound proceedings contains 30 full papers and 7 abstracts or digests. The cost is \$25.00. Overseas airmail postage, when requested, will be an additional \$6.00.

### Contributors

(Continued from page 1)

Wako Bussan Co., Japan (8)

We are happy to note that three companies have joined RIC's family of benefactors for the first time this year and that most companies were able to increase their contribution from a year ago. Let us hope this initial response indicates a year of growth ahead for the rare earth industry.

### Mechanical Alloying

(Continued from page 5)

product with none of the desired properties. Mechanical alloying was able to disperse the yttrium oxide so well that the distance between oxide particles along the same weld was equal to the distance between welds. The finished product showed good strength at both moderate and high temperatures and in addition had superior corrosion resistance.

The strength of the method lies in the fact that it is not limited to nickel-base alloys and makes possible the preparation of homogeneous multi-component composites which could not be prepared by any other method.

### New Russian RE Volumes

In the last six months we have received the following Russian books. *Khimiya Nestekhiometricheskikh Okislov* [*Chemistry of Nonstoichiometric Oxides*], Yu. D. Tret'yakov, Izdatel'stvo Moskovskogo Universiteta, Moscow (1974)—only a few pages of this 364 page book deal with the lanthanide oxides (12),  $Y_2O_3$  (3) and  $Sc_2O_3$  (2). *Splavy Redkikh Metallov s Osobymi Fiziko-Khimicheskimi Svoistvami* [*Alloys of Rare Metals With Special Physico-Chemical Properties*], E. M. Savitskii, V. F. Terekhova, I. A. Markova, editors, Izdatel'stvo Nauka, Moscow (1975)—about 20% of this volume deals with  $RCo_x$  and  $RFe_x$ , with x generally = 5, and another 45% deals with other rare earth materials. Both volumes are entirely in the Russian language.

*Redkozemel'nye Poluprovodniki. Tekushchaya Bibliograficheskaya Informatsiya 2* [*Rare Earth Semiconductors. Current Bibliographic Information, No. 2*], V. P. Zhuze, editor, Fiziko-Tekhnicheskii Institut im. A.

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~~W E DRUESZEN  
Iowa State University  
201 Spedding~~

## MAGNETIC BUBBLES

*Magnetic Bubbles*, volume 14 in the series of monographs on selected topics in solid state physics published by North-Holland Publishing Co. and American Elsevier Publishing Co., provides a valuable introduction to the theory, properties, and interaction of cylindrical magnetic domains and the materials which support them. Coauthored by A. H. Bobeck and E. Della Torre, the 222 page volume contains both qualitative and quantitative descriptions of cylindrical domain models, factors affecting bubble mobilities, characteristics of orthoferrite materials and uniaxial garnets, and possible utilization of magnetic bubbles in devices such as light modulators, hologram generators and digital memories. Including 134 references and author and subject indexes, this informative book may be purchased for \$28.95 from

American Elsevier  
Publishing Co., Inc.  
52 Vanderbilt Avenue  
New York, N. Y. 10017  
or for Dfl. 75.00 from  
North-Holland Publishing  
Co.  
335 Jan Van Galenstraat  
P. O. Box 103  
Amsterdam-W  
The Netherlands  
or through your bookstore.

F. Ioffe, Akademii Nauk SSSR, Leningrad (1975). We have also received No. 3, which has the same title, editor and publisher as No. 2, except that it was published in 1976. The second bibliography on semiconductors has 575 citations while the third has 978, and the references are printed in their original language—English, Russian, French, etc.