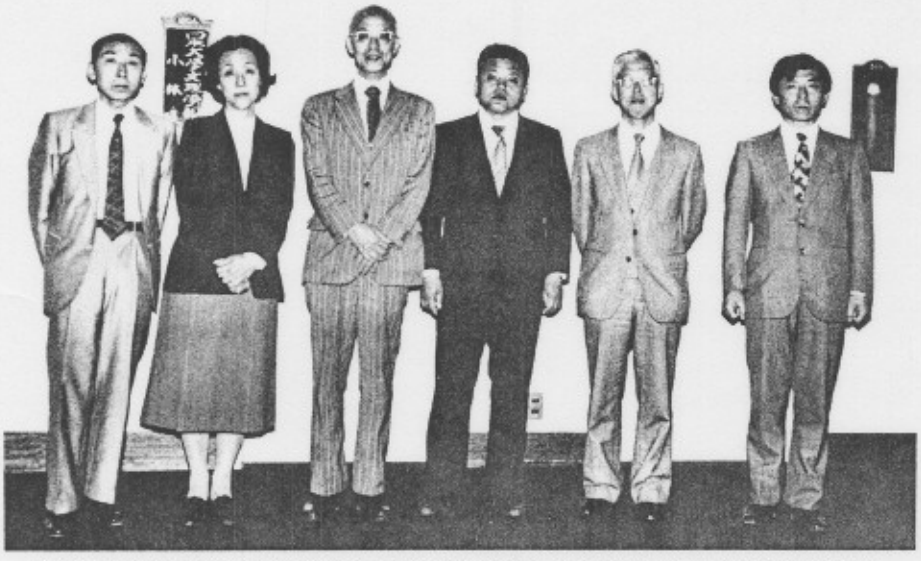
RARE-EARTH INFORMATION CENTER NEWS

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

Volume XVIII | September 1, 1983 | No. 3

Rare Earthers Around The World



Left to right: T. Abe, K. Sekizawa, S.-I. Kobayasi, S. Nagai, K. Kanematsu and S. Mochizuki

Nihon University, Tokyo, Japan

Spotlighted in our Rare Earthers Around the World feature is a group one year old. Individually active in the rare earth field for many years, the members joined forces in September 1982 to better utilize their theoretical and experimental expertise to investigate the electronic structures and properties of rare earth metals, alloys, and compounds. Special emphasis is on establishing the relationships between the band structures of various materials and their magnetic, electrical, and optical properties. All members are physicists with Nihon University and work in laboratories on three separate campuses. They meet several times a year to discuss their present work and plan their future investigative efforts.

The group leader is Professor S.-I. Kobayasi who is a member of the faculty of the College of Humanities and Sciences, Sakura-josui, Tokyo and of the faculty of the College of Science and Technology, Surgua-dai, Tokyo, with offices on both campuses.

Other members of the group are Professors K. Kanematsu and S. Nagai at the Physical Science Laboratories, Narashino, Chiba prefecture; Professor K. Sekizawa of the College of Science and Technology, Suruga-dai, Tokyo; and Assistant Professors T. Abe and S. Mochizuki of the College of Humanities and Sciences, Sakura-josui, Tokyo.

In collaboration with Professor M. Fukuchi and M. Matsumoto of Keio University, Professor Kobayasi is doing a self-consistent calculation of the energy band structure and Fermi surface of europium. He is especially interested in the relationship between the "nesting" of the Fermi surface and the helical spin ordering of europium at low temperatures, and in determining the changes in the Fermi surface induced by magnetic ordering, which will be directly pro-

(Continued on page 2)

γ-α CERIUM

Cerium is an archetypal narrow-band metal with archetypal valence instability in the fcc γ and α phases. With temperature and pressure, its electronic and magnetic properties exhibit variations that are especially pronounced because of the existence of the isostructural (isomorphic) $\gamma \rightarrow \alpha$ phase transition ending in a critical point, unique among elemental solids. In the pressure-temperature (P-T) plane a line of first-order phase transitions separates the low-density γ state from the high-density (collapsed) α state. The phase boundary ends at a critical point where one can no longer distinguish between the two states. J. W. Allen and R. M. Martin [*Phys. Rev. Lett.*, **49**, 1106 (1982)] showed that the free energy stabilizing the Kondo singlet state is important in the total energy and stability conditions for cerium and related solids. They developed a semiquantitative equation describing the $\gamma \rightarrow \alpha$ transition. From the temperature dependence of the free energy equation they predicted that the phase boundary could terminate in two critical points. The problem with cerium is that the predicted lower critical point is in a negative pressure region and is thus inaccessible. They predicted that if alloyed with lanthanum the point would move into an accessible positive pressure region.

J. D. Thompson *et al.* [*Phys. Rev. Lett.*, **50**, 1081 (1983)] report that if indeed one alloys La with Ce and adds a little Th to prevent the formation of the double hexagonal β phase one can obtain a P-T phase diagram with two critical points. Working with $Ce_{0.9-x}La_xTh_{0.1}$ they found that if x is too low the lower critical point is unaccessible and if too high (x =

(Continued on page 5)

Rare Earthers

Nihon University

(Continued from page 1)

portional to the conduction electron-4*f* electron interaction.

Professors Kanematsu and Nagai are studying the magnetic behavior of rare earth compounds and their hydrides. With the cooperation of K. Ito and K. Kobayashi, also of Nihon University, they are presently studying the magnetization of $(Y,Zr)Fe_2$, $(Y,Zr)Co_2$, and $(Y,Zr)Co_3$ and their hydrides using x-ray and Mössbauer measurements. Their objective is to determine the role of hydrogen in the magnetic properties of the compounds involved in the study.

Professor Sekizawa's main research field is the magnetic properties of rare earth intermetallic compounds. Her special interest in recent years has been the structural transformation in rare earth-thallium compounds with the CsCl type structure. To investigate the origin of this band Jahn-Teller type transformation, low temperature x-ray diffraction, specific heat, and magnetization measurements are presently underway.

T. Abe and S. Mochizuki are doing magnetization studies at low temperatures on the $(Gd,Y)Ni_3$ system with the goal of determining the sign and magnitudes of the s-f interactions in the system of weak itinerant ferromagnets, including the effect of rare earth element impurities.

S. Mochizuki also has an interest in rare earth oxides at high temperatures. In cooperation with S. Tateyama from Nihon University, he is measuring the electrical and infrared optical properties of CeO_2, ThO_2, and UO_2, studying ways to make "good" crystals, and discovering new applications.

One area of cooperation within the group is the calculation of the band structures of the rare earth thallium compounds by S.-I. Kobayasi and their theoretical application to the compounds that have been studied experimentally by K. Sekizawa. When S.-I. Kobayasi was asked for the reason behind the groups formation he stated, "More than anything else, we feel it very pleasant to meet as a group and talk about these 'fascinating' materials in which we have great interest." Let's hope they have many interesting and fruitful discussions.

PROCEEDINGS

Superconductivity

The proceedings of the *Fourth International Conference on Superconductivity in d- and f-band Metals* held in Karlsruhe, West Germany, June 28-30, 1982 are available. Edited by W. Buckel and W. Weber the proceedings contain 33 papers dealing with rare earth materials. Some of the other 85 papers contain information that may be applicable to rare earth containing materials. The 644-page, soft cover proceedings costs DM 40.00 (~U.S.$16.00) in Europe and DM 45.00 (~U.S.$18.00) elsewhere. If air mail delivery is desired add DM 12.00 (~U.S.$5.00) and order from Kernforschungszentrum Karlsruhe GmbH, Literaturabteilung, Attn. Mrs. Bruks, Postfach 3640, D-7500 Karslruhe 1, West Germany.

Fickle Valences

The 119 papers presented at the International Conference on Valence Instabilities, Zürich, Switzerland on April 13-22, 1982, were published in 1982 by North-Holland Publishing Company in a hard cover volume entitled, *"Valence Instabilities"*. The book contains 597 pages, was edited by P. Wachter and H. Boppart, and costs Dfl. 145.00 (Dutch Guilders) or ~U.S.$61.50. It can be ordered from Elsevier Science Publishers at the following addresses: P.O. Box 211, 1000 AE Amsterdam, The Netherlands or 52 Vanderbilt Avenue, New York, N. Y. 10017. This conference on valence instabilities, held for the first time outside the U.S.A. is a reflection of the intense activity in this area of study in Europe.

Sections included in the proceedings were Preface and Introduction; Ground State Properties; Lattice and Valence; Valence Changes; Photoemission; Spectroscopies; Kondo; Transport Properties; Magnetic Properties; and Mixed Valence Compounds.

The Fourth International Conference on Valence Fluctuations will be held August 27-30, 1984 at Köln (Cologne), West Germany. For more information see story on page 5 of this issue.

GMELIN HANDBOOKS

In a continuation of a series on *Gmelin Handbooks* from system number 39 we will review volumes **A5** and **B7** in this issue of the *RIC News*. The prices of volumes **A5** (475 pages) and **B7** (240 pages) are DM 1287 (~U.S.$500.00) and DM 619 (~U.S.$250.00), respectively. Information about the *Gmelin Handbooks* and addresses of their dealers may be obtained from Springer-Verlag, 4005-Marketing Gmelin, Heidelberger Platz 3, D-1000 Berlin 33, West Germany.

Geochemistry

Rare Earth Elements **A5** (1981) is the latest volume on the geochemistry of yttrium (Y) and the lanthanides (Ln) and specifically on total earth geochemistry and the magmatic cycle. **A5** begins with a compilation of the content of Y and Ln in the total earth and in the earth's crust and mantle. Also included is a small amount of data on isotopes, especially those associated with natural nuclear reactors.

The behavior of Y and Ln in the orthomagmatic phase is governed by their partition coefficients, both when magmas are being formed by melting processes and upon solidification of magmas. The influence of physical and chemical factors and of paragenesis on these coefficients and the influence of rare earth elements (REE) fractionation in magmatic rock-forming materials and accessories on the melt are discussed in the section on type of occurrence.

The content of Y and Ln, and where applicable their isotopic composition, in magmatic rocks is discussed in the next two sections. A listing of references in which the composition of standard rock samples have been reported and the method(s) used to make the analyses for the rare earths is included. Quartz-bearing, dioritic, syenitic, monzonitic, foid-bearing, and ultramafic are among the rock types discussed.

The next area of discussion is the relationships between the Y and the individual lanthanide contents and the content of the major components such as Na, Mg, Al, Si, P, K, Ca, Mn, and Fe. A review of the relationships between the rare earths and other trace elements such as Sc, Ti, V, Ge,

(Continued on page 6)

INTERNATIONAL RARE EARTH CONFERENCE

Materials and Chemistry

18-25 March 1985

Eidgenössische Technische Hochschule, Zürich, Switzerland

Honorary President: Professor Emeritus Georg Busch (ETHZ)

Steering Committee: E. Kaldis (ETHZ, chairman of the conference), F. Hulliger (ETHZ, secretary), O. Vogt (ETHZ, chariman of local organizing committee), J.-C. Bünzli (Lausanne, Switzerland), P. Caro (CNRS, France), L. Niinistö (Otaniemi, Finland), P. Wachter (ETHZ), P. Fischer (ETH Würenlingen) and H. R. Ott (ETHZ).

This major interdisciplinary conference is intended to provide a review on the present status of rare earth research and applications and to emphasize future developments. It will cover the following topics by means of plenary lectures, invited oral contributions and posters:

1. SOLID STATE SCIENCE
2. INDUSTRIAL APPLICATIONS AND ECONOMICAL ASPECTS
3. COORDINATION AND BIOINORGANIC CHEMISTRY

Topic 1 will include structural problems, thermodynamics, material synthesis and crystal growth, metallurgy, purification, luminescence and spectroscopy, geochemistry. A special *Symposium on Solid State Physics* will be organized by Professor P. Wachter within the frame of this topic.

Topic 2 will be devoted to catalysts, phosphors, organic additives, ceramics, materials for optical devices, magnetic materials, special alloys, hydrides.

Topic 3 will cover solution chemistry, thermodynamics, shift reagents, catalysis, coordination compounds, polynuclear complexes and clusters, bioinorganic chemistry, toxicity, medical applications.

To assist the steering committee and to receive further mailings please detach the following and send to Dr. E. Kaldis, Lab. für Festkörperphysik der ETH, 8093 Zürich, Switzerland.

(Detach)

Name _____ Title _____

Address _____

_____

_____

I am interested in participating in this conference and receiving further information. ☐

I intend to submit a contribution(s) ☐

Topic 1 ☐ Topic 2 ☐ Topic 3 ☐

Previous RE Conference Proceedings†

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. Michelson, 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.

Seventh Russian Conference on Rare Earth Metals, Moscow, USSR. September 12-17, 1972. *Rare Earth Metals, Alloys and Compounds* [*Redkozemelnye Metally Splavy i Soedineniya*], Izdatael'stvo Nauk, Moscow (1973). 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 10th Rare Earth Research Conference, Carefree, Arizona, April 30-May 3, 1973. CONF-730402-(P 1-2). Available from the National Technical Information Service, Springfield, VA 22151. $27.20.

Proceedings of the 11th Rare Earth Research Conference, Traverse City, Michigan, October 7-10, 1974. Available from Harry A. Eick, Department of Chemistry, Michigan State University, East Lansing, MI 48824. $25.00.

Proceedings of the 12th Rare Earth Research Conference, Vail, Colorado, July 18-22, 1976. Available from University Microfilm, 300 N. Zeeb Rd., Ann Arbor, MI 48106. LD-000328. $83.00.

Conference on Rare Earths and Actinides, University of Durham, Durham City, England, July 4-6, 1977. *Institute of Physics Conference Series Number 37*, W. D. Corner and B. K. Tanner, eds., Institute of Physics, London (1978). 22.00.

Thirteenth Rare Earth Research Conference, Oglebay Park, West Virginia, October 16-19, 1977. *The Rare Earths in Modern Science and Technology*, G. J. McCarthy and J. J. Rhyne, eds. Plenum Publishing Corp., New York (1978). $49.50.

French International Rare Earth Conference, September 4-7, 1978, St. Pierre-de-Chartreuse, France. *Physics of Metallic Rare Earths, J. Phys. (Paris) Colloque C-5* **40**, C5-1-404 (1979). 245 F.

Fourteenth Rare Earth Research Conference, Fargo, North Dakota, June 25-28, 1979. *The Rare Earths in Modern Science and Technology, Vol. 2.*, G. J. McCarthy, J. J. Rhyne and H. B. Silber, eds., Plenum Publishing Corp., New York (1980). $59.50.

Symposium at the Second Chemical Congress of the North American Continent (180th ACS National Meeting), Las Vegas, Nevada, August 25-26, 1980. *Industrial Applications of Rare Earth Elements*, (ACS Symposium Series 164). K. A. Gschneidner, Jr., ed., American Chemical Society, Washington, D.C. (1981). $35.00.

Proceedings of the Fifth International Workshop on Rare Earth-Cobalt Permanent Magnets and Their Applications, Roanoke, Virginia, June 7-10, 1981, Karl Strnat, ed. Available from the University of Dayton, Magnetics Laboratory (KL-365), Dayton, Ohio 45469, (1981). $35.00 plus postage.

Fifteenth Rare Earth Research Conference, Rolla, Missouri, June 15-18, 1981. *The Rare Earths in Modern Science and Technology*, Vol. 3, G. J. McCarthy, J. J. Rhyne, and H. B. Silber, eds., Plenum Publishing Corp., New York (1982). $59.50.

Fourth European Conference on the Physics of the Rare Earths and Actinides, Durham, England, March 28-31, 1982. *Journal of Magnetism and Magnetic Materials*, Volume **29**, B. K. Tanner and S. R. Hoon, eds., North-Holland Publishing, Amsterdam (1982). 260 Dutch Guilders (~$105.00).

Proceedings of the Sixth International Workshop on Rare Earth-Cobalt Permanent Magnets and Their Applications and Third International Symposium on Magnetic Anistropy and Coercivity in Rare Earth-Transition Metal Alloys, Baden, Austria, Aug. 31-Sept. 3, 1982, Josef Fidler, ed. Available from the Technical University of Vienna, Institute for Applied Physics, Karlsplatz 13, A-1040 Vienna, Austria, (1982). $40.00 plus postage.

Sixteenth Rare Earth Research Conference, Tallahassee, Florida, April 18-21, 1983. *Journal of Less-Common Metals*, (in preparation). G. J. McCarthy, J. J. Rhyne and H. B. Silber, eds. Elsevier Sequoia Publishing Co., Oxford, England.

†Published since 1973. For information on earlier conferences see *RIC News* **XIII** [2], 4 (1978) and **XVII** [1], 4 (1982) or contact RIC.

Thermodynamic Properties

Bureau of Mines Bulletin 672, "Thermodynamic Properties of Elements and Oxides" (1982), is the first in a series of compilations revising and expanding BM Bulletin 605, "Thermodynamic Properties of 65 Elements—Their Oxides, Halides, Carbides and Nitrides," published in 1963. It is part of the Bureau of Mines effort to provide information for use as guidelines in mineral technology advancement, pollution control, and energy economy. Expanded from 65 to 88 elements, Bulletin 672 includes data on the rare earth elements and their oxides. It was compiled by L. B. Pankratz and contains a section on applications by R. V. Mrazek. It can be obtained for U.S.$17.00 from the Superintendent of Documents, U.S. Government printing Office, Washington, D. C. 20402.

Cerium

(Continued from page 1)

0.16) the two points coalesce and only continuous transitions are expected. When x = 0.1 ($Ce_{0.8}La_{0.1}Th_{0.1}$) the authors found, using resistance measurements at various pressures, that the $\gamma \rightarrow \alpha$ transformation as a function of pressure and temperature terminates at two critical points. These critical points were difficult to locate precisely.

RIC News
(USPS 464-960)
Vol. XVIII No. 3 September 1, 1983

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

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

Telephone: Area Code 515-294-2272
FTS . . . 865-2272
K. A. Gschneidner, Jr. . . . Editor
Jennings Capellen . . . Staff Writer

Distinguished Professor

Dr. J. C. Corbett was recently awarded the title of distinguished professor in the College of Sciences and Humanities of Iowa State University, Ames, Iowa. Dr. Corbett received his Ph.D. from the University of Washington in 1952 and started his tenure at Iowa State University the same year. He has served as chemistry division chief and as program director for materials chemistry in the Ames Laboratory-USDOE and as chairman of the Department of Chemistry at Iowa State.

Dr. Corbett is well known for his work on bonding and structure in many novel compounds. Best known to rare earthers are his many papers on the preparation, bonding, and crystal structure of the rare earth halides, especially those with odd stoichiometries.

Magnetism: What Is It?

If domains, walls, bubbles, or magnetism in general have you in a disordered state then the book *Magnetism of Metals and Alloys*, edited by M. Cyrot, may return you to an ordered structure. The six chapters are lectures given at les Houches, France in February 1980 and updated in 1981 prior to publication. As the preface declares, the book is addressed to nonexperts in magnetism and the authors try to stay at a simple level in order to be understood by all physicists who need basic concepts of magnetism. Each chapter is well referenced to allow for a much more thorough investigation of magnetism if the reader desires.

Chapter one, "Itinerant Magnetism", is concerned with the magnetism of transition metals and their compounds. Chapter two and three deal with rare earth metals and intermetallic compounds. The first deals with "normal" rare earths, the second with the "anomalous" rare earths that can exhibit intermediate valences. Chapter four deals with magnetism of alloys that can be described as spin glasses, while chapter five deals with magnetism of amorphous metallic alloys. The final chap-

(Continued on page 6)

MEETINGS

Valence Fluctuations

The RIC has received the first announcement of the 4th International Conference on Valence Fluctuations. The conference will be held August 27-30, 1984 in Köln (Cologne), West Germany. The program will consist of invited and contributed papers dealing with the theoretical and experimental aspects of *f*-electron delocalization in compounds and in dilute alloys. Proceedings of the conference are to be published. For further information or to be put on the mailing list, contact the conference secretary, Dr. B. Roden, II. Physikalisches Institut, Universität zu Köln, Zülpicher Strasse 77, D-500 Köln 41, West Germany.
(For information on the availability of the proceedings of the third conference see separate story on page 2.)

Luminescence

The International Conference on Luminescence-1984 (ICL'84) will be held August 13-17, 1984 at the University of Wisconsin, Madison, Wisconsin. ICL'84 will emphasize the universality of luminscence spectroscopy in all areas of science and technology. Some topics covered are novel applications and techniques of luminescence; excitations and collective efforts; coherent and nonlinear spectroscopies of solids; and luminescence and spectroscopy of insulators and semiconductors and disordered and amorphous systems. Final call for papers will be February 1984 with submission by March 15, 1984. For information or to be put on the mailing list contact: William M. Yen, Chairperson—ICL'84, Department of Physics, University of Wisconsin, Madison, Wisconsin 53706 (Telephone (608) 263-7475/Telex: 265452).

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The Rare-Earth Information Center has lost its copy of *Chemistry of the Lanthanons*, by R. C. Vickery. If you have a copy you would like to donate or to sell to the center please contact Karl Gschneidner, Jr., director RIC.

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$$ 1984 $$

port are listed below with the number of years of sponsorship in parentheses.

Atomergic Chemetals Corporation, U.S.A. (12)
A/T Products Corporation, U.S.A. (4)
Companhia Industrial Fluminense, Brazil (11)
Ferro Corporation, Transelco Division, U.S.A. (8)
India Rare Earths, Ltd., India (15)
Molycorp, Inc., U.S.A. (16)
Reactive Metals and Alloys Corporation, U.S.A. (8)
Reactor Experiments, Inc., U.S.A. (14)
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Gmelin Handbooks

(Continued from page 2)

Rb, Sr, Zr, Hf, and U is followed by a special section where the relationships of the halides and oxygen-18 with the rare earth contents are discussed. A section devoted to identifying various magma types, and rock groups by using these relationships and the relationship of the REE to each other follows.

The last two chapters "Pegmatic Phase Aplites" and "Pneumatolytic-Hydrothermal Phase" cover the transport of REE and their deposition as rare earth minerals, as well as chemical and physical factors influencing the fractionation of the rare earth elements. In the chapter on the penumatolytic-hydrothermal phase, alteration and replacement of rare earth minerals, and rare earth containing minerals and the behavior of REE during metasomatic alteration of magmatic rocks and country rocks are discussed in length.

Rare Earth Elements, **B7** (1979) contains the chapters "Reactions of

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Ions in Solution" and "Electrochemical Behavior". The first chapter vents. The chapter continues with sections on hydrolysis, precipitation reactions, coprecipitation, and redox reactions. The latter section comprises over 60 percent of the chapter and is devoted to the description of the redox reactions of Ce, Pr, Sm, Eu, Tb, Ho, Tm, and Yb in both aqueous and nonaqueous solutions. According to the publisher, ion exchange and solvent extraction, which would normally be in this chapter, will be treated in a special volume. Also a systematic description of complex forming reactions will appear separately.

The second chapter of volume **B7** is on the electrochemical properties of Sc, Y, and the lanthanides. It deals with electrodeposition, polarography, electrolytic polishing, and other aspects of electrochemistry. It treats the behavior of the rare earth elements in aqueous, nonaqueous, and organic solutions as well as in melts.

Magnetism

(Continued from page 5)

ter may well be the first read as it is a description of the magnetization processes.

The 608-page book was published in 1982 by North-Holland Publishing Co. and is available for U.S.$74.50 (Dfl. 175) from Elsevier Science Publishers, P.O. Box 211, 1000 AE Amsterdam, The Netherlands, or 52 Vanderbilt Avenue, New York, N. Y. 10017, U.S.A.

Bubbles Bubbles

Rather than just make a second printing, it was decided to make an updated and corrected second edition. Recent progress is incorporated into a new final chapter with up-to-date references and the other chapters left as they were except for corrections.

The first chapter is an introduction to the field of magnetic bubbles, gives an overall perspective to the field, and an understanding of the scope and organization of the rest of the book. The subsequent chapters describe the properties of magnetic bubbles and their physical origin; the preparation and properties of materials suitable for bubbles; the different forms of devices that have been made using bubbles and the manner in which these devices operate; the relationship of the magnetic characteristics of bubble materials to the operating parameters of practical devices; applications of bubble devices and examples of product configurations; and a discussion of future prospects. Although written as a text book for a one semester course in bubble technology, it serves to educate and give a springboard for future research to anyone who is seriously involved in bubble research and development or is thinking of entering the field. Published in 1981 by Springer-Verlag, Berlin Heidelberg New York, the 345-page soft cover book costs U.S.$35.00.

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