RARE-EARTH INFORMATION CENTER NEWS

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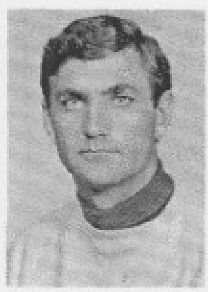
University of New South Wales Group


G. V. H. Wilson


D. H. Chaplin


S. J. Campbell


G. H. J. Wautenaar


T. J. McKenna

In 1972 a small group of workers led by Professor G. V. H. Wilson at the Physics Department, Royal Military College, Duntroon (University of New South Wales), Australia, began a study of gadolinium. The aim was to extend conventional AC susceptibility (X) measurements to low magnetic fields (<850A/m or <11Oe) by employing phase sensitive detectors, and to develop temperature modulation techniques. The main intention was to precisely characterize the magnetic behavior above and below the critical point of an order-disorder transition. Gd was chosen for initial studies because of departmental interest in rare earth magnetism and because it is a ferromagnet with a convenient room temperature Curie point.

K. R. Sydney, under the supervision of Professor Wilson and Dr. D. H. Chaplin, investigated the AC susceptibility, the thermal derivative of X (via temperature modulation experiments) and the DC magnetization of Gd near the critical temperature. The high sensitivity of the experiments enabled previously unobserved fine structure in the magnetization curves to be examined. Comparison between the techniques has led to a better understanding of the nucleation of domains whereby the behavior of the low-field AC susceptibility is well described by a simple model which includes a temperature dependent magnetic relaxation. In addition, the relaxation is associated with the onset of an impurity magnetic aftereffect.

G. H. J. Wantenaar and Dr. S. J. Campbell have developed both a technique of transient enhancement (TE) of AC susceptibility and an application of the AC specific heat method to bulk samples. By imposing a second time-varying field during AC susceptibility measurements, the TE technique enables the diffusion of domain-wall pinning centers to be studied, thus acting as a sensitive indicator of domain nucleation. This is a particularly important advantage for magnetic critical phenomena studies near T_c. Below T_c, TE has resolved the activation energies of different impurities in the gadolinium samples. This method is therefore considered a sensitive probe which can identify impurities in fer-

(continued on page 6)

Rare Earth Prize

Dean J. B. Gruber, Conference Chairman for the 14th Rare Earth Research Conference to be held June 25-28, 1979, at North Dakota State University, Fargo, ND (see page 3), has announced that the Conference will award, for the first time, the Rare Earth Prize to that individual deemed to have made outstanding contributions toward advancing rare earth science and/or technology. The prize will consist of a certificate, a medallion and possibly a cash award. The Conference organizers hope to establish a tradition for future rare earth research conferences by inaugurating the presentation of this award during the Plenary Session at the beginning of the Conference.

Nominations with supporting biographical data and a cover letter citing specific achievements should be sent to the Chairman of the Selection Committee, Professor W. J. James, Graduate Center for Materials Research, University of Missouri-Rolla, Rolla, MO 65401, no later than January 15, 1979.

Linear Actuators Improved

A. S. Rashidi, of the Crucible Magnetics Division of Colt Industries, has done a comparative evaluation of linear actuators which contain either alnico or samarium cobalt (Sm-Co) permanent magnet [*Control Engineering* **24**, (11) 56-8 (1977)]. The Sm-Co permanent magnet exhibited several advantages. Its higher coercivity allows for a reduction in the length of the magnet and permits the magnet to be used on the air gap boundary. Its higher energy product allows for a reduction in magnet volume resulting in a magnet which weighs eight

(continued on page 6)

Yb
1878

Congratulations to ytterbium on the 100th anniversary of its discovery by Jean-Charles Galissard de Marignac. Perhaps best known for his accurate determinations of atomic weights, Marignac began working with the rare earths in 1840. While a professor of chemistry at the Geneva Academy, he continued his research in a dimly lit laboratory. In 1878 Marignac heated some erbium nitrate obtained from gadolinite until it decomposed. From this material he extracted a red colored oxide which he called erbia and a colorless oxide that he named ytterbia after Ytterby, the town nearby where gadolinite was discovered. This was not the final step for ytterbium. One year later L. F. Nilson isolated scandia from ytterbia and twenty-nine years later in 1907, Georges Urbain separated ytterbia into two oxides which he called neoytterbia to preserve the name Marignac had given to the mixture, and lutecia. However, the name which Marignac had given has survived and today the element he discovered in 1878 is known as ytterbium.

Eu Photochemically Separated

A year ago we noted that T. Donohue had achieved the photochemical separation of europium using laser radiation [*RIC News* **XII**, (2) 4 (1977)]. Subsequent research has increased the understanding of this method of separation [*J. Chem. Phys.* **67**, 5402-4 (1977)]. Basically, europium is reduced with photons to the +2 state, and reacts to form an insoluble sulfate which is filtered from the solution to complete the separation. Donohue observed a much better reduction if Eu was irradiated in its charge transfer band. Also, the inclusion of sulfate ions in the solution allowed the precipitate to form homogeneously. No relation was observed between the separation factor and the light source or the wavelength. The separation factor varied from around 1 for Eu/Pr to > 200 for Eu/Tm and was related to the ionic radius of the Eu^{2+} ion. This type of separation could be of importance in the reprocessing of nuclear fuel, in that fewer chemicals are used which would reduce the amount of radioactive waste to be stored.

Fluorides and Chlorides

Various compounds of the rare earths with fluorine and chlorine are treated in books C3 and C5, respectively, of *System 39 The Rare Earth Elements, the Gmelin Handbuch der Anorganischen Chemie.* Both books contain the usual features which include English table of contents, preface and margin notes. In addition, book C5 has added a brief review in English at the beginning of each section.

Book C3 begins with a comprehensive review of the gaseous and solid phases in the rare earth fluoride systems. Information on the preparation, crystal data, chemical, thermodynamic, magnetic, electrical, and optical properties and applications of these compounds is presented. Comparative data are included for the rare earth fluoride oxides, fluoride hydroxides and fluoride nitrides. The alkali fluorometallates of the rare earths are also dealt with extensively since these compounds are candidates for several optical applications. Book C3 was published by Springer-Verlag in 1976, is 439 pages in length and costs DM 794(~$384.00).

Volume C5 treats the rare earth hydride chlorides, oxide chlorides, hydroxide chlorides, oxide hydroxide chlorides, chlorites, chlorates, perchlorates, chloride fluorides, oxide chloride fluorides, alkali chlorometallates, alkali oxide chlorides and alkali chloride fluorides. Emphasis has been placed on the preparation, crystallographic and thermodynamic properties of the oxide chlorides and the phase diagrams of the rare earth alkali chlorometallate systems. In addition to the material that is presented, this book serves the reader in showing how much information is not known about these systems. Published in 1977 by Springer-Verlag, Book C5 is 259 pages in length and costs DM 621 (~$300.00).

AIME FELLOWS

Dr. T. A. Henrie and Dr. C. J. McHargue have been named Fellows of the AIME (Amer. Inst. of Mining, Metallurgical and Petroleum Engineers) at the annual meeting held in Denver, Colorado, during February. Henrie has been active in rare earth metal preparation through electrowinning, while McHargue has studied the physical metallurgy of cerium.

Nd OPTICAL GAIN

R. R. Jacobs and W. F. Krupke have made the first observation of optical gain for trivalent rare earth molecular vapors using a neodymium chloride-aluminum chloride vapor complex [*Appl. Phys. Letters* **32**, 31-3 (1978)]. An optical gain of >.25%/cm was measured for the $Nd^{3+}: {}^4F_{3/2} \Rightarrow {}^4I_{11/2}$ transition at 1.06 μm which corresponds to an energy density storage of approximately 35 J/l which lasts for more than 10 μsec. The gain signal amplitudes were dependent upon the optical excitation intensity, the degree of overlap between the pump and probe laser beams and the NdAlCl vapor density. Intracavity losses were caused by etching, impurities and schlieren effects. The authors feel that this type of laser system will find application as an amplifier media for fusion laser systems because of its large energy density storage, potential for high overall efficiency, emission wavelengths in the visible and near-infrared regions and capability for high average power operation through medium flow and relaxation of the stringent system constraints dictated by the nonlinear optical properties of most solids.

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14th Rare Earth Research Conference

The 14th Rare Earth Research Conference will be held at the Conference Center on the North Dakota State University campus in Fargo June 25-28, 1979. Fargo is served by five airlines. Winnipeg, Canada and Minneapolis, Minnesota are only 45 minutes away by air with frequent flights making direct connections to other national and international airlines. Interstate Highway I-29 (North-South) and I-94 (East-West) as well as Amtrak provide easy access to Fargo, an agricultural and distribution center for the Upper Midwest.

The program will include the following major topics:

General and Analytical Chemistry, Solutions and Solvation, Biochemistry, Geochemistry, Spectroscopy, Metallurgy, Crystal Growth, Intermetallic Compounds, Phase Studies and Diagrams, Solid State Physics, X-ray Diffraction, Neutron Scattering, Magnetism, Thermal and Transport Properties, Surface and Interface Phenomena, Rare Earth Technology, Industrial Processes, Uses and Applications.

The first Rare Earth research prize to be awarded at rare earth research conferences will be made at this meeting. For more information see the article entitled "Rare Earth Prize" on page 1.

We hope to have in attendance the leading experts in rare earth science and technology from around the world. We hope to maintain the strong interdisciplinary character of the previous conferences and to have substantial representations from government, academic and industrial institutions.

To assist the Program Committee in detail planning, please complete and return before September 1, 1978, the preliminary information form provided below.

(DETACH)

14th Rare Earth Research Conference

North Dakota State University, Fargo, North Dakota, U.S.A. June 25-28, 1979

Please complete the following and send before September 1, 1978 to:
Dean John B. Gruber
College of Science and Mathematics
North Dakota State University
Fargo, North Dakota 58102 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

SPOUSE ATTENDING? ☐ Yes ☐ No TOTAL NO. IN YOUR PARTY ____________

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, Hungtington, 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 Session 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 Elements 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^e. 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 the Institute of Physics, Distribution Center, Blackhorse Road, Letchworth, Herts SG6 1HN, England. £7.50 (except £3.75 for members of the Institute of Physics).

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 Splavy 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.

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

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

Garnet Preparation and Properties Reviewed

Citing many of the advantages of using magnetic domain devices rather than semiconductors for computer logic and memory, V. N. Dudorov, V. V. Randoshkin and R. V. Telesnin have reviewed the synthesis and physical properties of single crystal films of rare earth iron garnets [*Usp. Fiz. Nauk* **122,** 253-93 (1977); Eng. Transl.-*Sov. Phys. Usp.* **20,** 505-27 (1977)]. The requirements and problems encountered in liquid phase epitaxial growth of single crystal garnet films are discussed and methods of quality control during and after production are noted. Basic properties of the films including optical absorption, Faraday rotation, characteristic length, saturation magnetization, domain wall energy, coercive force, magnetic anisotropy, quality factor, exchange constant, ferromagnetic resonance and mobility of domain walls are discussed along with the different methods of measurement of these properties. Finally, the reproducibility and temperature stability of the principal magnetic parameters are examined. The authors note that higher domain wall velocities and a wider temperature range of stability of garnet properties are areas where progress can be made with additional research. 437 references were cited.

RE-O BONDS

C. Linares, A. Louat and M. Blanchard have undertaken a systematic study of the fluorescence spectra of the isostructural compounds of gadolinium, yttrium and lutetium phosphates, arsenates and vanadates doped with trivalent europium, to gain an insight to the character of rare earth-oxygen bonding [*Structure and Bonding* **33,** 179-207 (1977)]. From the experimental data, crystal field parameters and intrinsic parameters relative to europium-oxygen bonding are determined. Various theories including the point charge model, superposition model, angular overlap model, Jørgensen model and Kibler's model are compared and evaluated. The authors feel that additional optical studies like this one can reveal much useful information concerning rare earth-ligand bonding.

1st Operational Magnetic Bubble Lattice Device

The first magnetic bubble lattice device which contains all the elements needed to read, write and store information in a hexagonal array of magnetic bubbles has been developed by researchers at IBM's San Jose, California Research Laboratory [*Metal Progress* **113,** 3 (March 1978)]. Yttrium iron garnet film which is 0.4 mm (1/64 in.) long is used to store information at a density of 8000 bits per square millimeter (5 million per square inch). This density is four times that of currently available devices and there is potential to go as high as hundreds of thousands of bits per square millimeter. "Zeros" and "ones" are coded into the magnetic structure of the domain wall surrounding each bubble. Information is read by detecting the motion of the bubble along a column. If it moves along the line of a column a "zero" is read and if it moves at a 30° angle from the column a "one" is read.

METAMAGNETISM

Physical properties of metamagnets are the subject of a review completed recently by E. Stryjewski and N. Giorano [*Advances in Phys.* **26,** 487-650 (1977)]. Metamagnets are defined as antiferromagnets which, upon application of a magnetic field, undergo first order magnetic phase transitions to a state with a relatively large magnetic moment. This article is further restricted to those materials which undergo a simple reversal in spin direction. Current theories on metamagnetism are briefly reviewed with a special section on demagnetizing effects. Experimental properties are discussed for two sublattice systems ($DyPO_4$, DySb, $TbPO_4$, $HoPO_4$), four sublattice systems ($TbAlO_3$, $DyAlO_3$, CeBi, CeSb, $DyVO_4$, $DyAsO_4$, EuSe), linear chain systems (Eu_3O_4) and garnets ($Dy_3Al_5O_{12}$, $Tb_3Al_5O_{12}$, $Ho_3Al_5O_{12}$). Tricritical and critical behavior are also discussed for $Dy_3Al_5O_{12}$ and $DyPO_4$. In addition, Appendix I contains information on miscellaneous metamagnetic materials, many of which contain rare earths. Appendix II lists in tabular form the bulk magnetic properties of the metamagnetic materials discussed in the review.

CONTRIBUTORS

Nine companies renewed their support of the Center and two companies became first year contributors in the final quarter of the fiscal year 1978 to bring the total number of companies to 46. For the second year in a row, a new record has been set as this year's 46 surpasses last year's record of 41. Contributors for this quarter are listed below (the number in parentheses is the number of years the company has supported RIC).

Allied Chemical Corporation, U.S.A. (6),
Bose Corporation, U.S.A. (1),
General Electric Co., Quartz and Chemical Products Dept., U.S.A. (3),
GTE Laboratories, Inc. U.S.A. (6),
Industrial Minera Mexico, S.A., Mexico (4),
Malaysian Rare Earth Corp. Sdn. Bhd., Malaysia (1),
A/S Megon, Norway (8),
Mischmetal and Flints Private, Ltd., India (2),
Nuclemon-Nuclebras de Monazita e Associados Ltda., Brazil, (6),
Union Carbide Corporation, Linde Division, U.S.A. (2)

RE-Fe Sound Transducer

A low-frequency, resonant, longitudinally vibrating piston-type underwater sound transducer has been used by S. W. Meeks and R. W. Timme to compare the relative merits of $Tb_{0.27}Dy_{0.73}Fe_2$ and the currently used PZT-4 ceramic [*J. Acoust. Soc. Am.* **62,** 1158-64 (1977)]. Unfortunately, they conclude that the rare earth-iron alloys pose no threat to the ceramics but that a complimentary role as a low-frequency high-power projector is possible. The rare earth-iron alloy had better transmitting voltage responses at low frequencies, but the ceramic transducer gave better transmitting current responses and had higher free-field voltage sensitivities. The biggest problems in this experiment for the rare earth-iron alloy were the eddy current and hysteresis losses which dissipated almost one-half of the input power. Additionally, the large magnetic fields which are needed might also saturate the magnetic return path. The authors were successful in developing a theoretical model to explain these effects.

QH21A

The need for high strength magnesium casting alloy with greater temperature stability than currently available alloys has lead to the development of a magnesium-silver-neodymium-thorium-zirconium alloy designated QH21A according to W. H. Unsworth [*Light Metal Age* **35** [5/6] 14-6 (1977)]. The desired properties result from the ability of silver and neodymium to form a stable hardening precipitate. This action is further enhanced by the addition of thorium, although for optimum mechanical properties and acceptable casting characteristics the neodymium-thorium ratio must be tightly controlled. The new alloy is readily weldable with reasonable freedom from microshrinkage and its properties are not influenced by section thickness. Temperature stability is such that operating temperatures can be increased up to 120° F (50° C) over previously used alloys and the strain fracture toughness is 50% higher. In fact its high temperature yield strength at 480° F (250° C) allows QH21A to compete effectively even against high strength aluminum-base alloys. With these developments the author notes that magnesium casting alloys should satisfy the requirements of aerospace designers for the forseeable future.

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romagnets and thus aid the continuing struggle for purer rare earth materials.

Current research on gadolinium concerns full characterization of the magnetic aftereffect and examination of low-field hysteresis. The latter studies are proving to be very productive and should result in a better understanding of the fundamental cause of magnetic hysteresis. Also, the current critical exponent analysis of the low-field susceptibility measurements will result in a value for the critical exponent γ obtained from truly field-independent data. T. J. McKenna is applying these well-established techniques to order-order transitions, specifically on the rare earths terbium and dysprosium. The preliminary thermal modulation results on terbium, which has both ferromagnetic and antiferromagnetic transition temperatures separated by only 8 K. are quite interesting.

$(NC_4H_4N)[Yb(C_5H_5)_3]_2$

μ-Pyrazine-bis [tris (cyclopentadienide) ytterbium (III)] has the distinction of being the first pyrazine-bridged complex of an *f*-transition element to be prepared according to E. C. Baker and K. N. Raymond [*Inorg. Chemistry* **16,** 2710-4 (1977)]. The complex is remarkably thermally stable and sublimes at 75° C, which places it among the more volatile of all the lanthanide compounds. Structurally the complex resembles tris-cyclopentadienide complexes of the actinide series. Simple Curie-Weiss behavior was exhibited by the magnetic susceptibility and no evidence was found of any magnetic interaction between the two metal centers or reduction of magnetic moment due to *f*-orbital covalency. This and the consistancy of the bonding parameters suggest to the authors that an ionic formulation of the bonding would be more appropriate in this case in contrast to suggestions of covalent bonding made for related compounds.

REers ON THE MOVE

Molycorp has announced the addition of H. H. Cornell and G. A. Ratz to their metallurgical service group. Both Cornell, formerly operations and product development coordinator at Molycorp's Washington, PA, ferroalloys production unit, and Ratz, formerly senior research engineer at U.S. Steel's Technical Center at Monroeville, will work out of Molycorp's Pittsburgh offices at Gateway Center, concentrating on the increasing variety of steelmaking and foundry needs for rare earth additions.

Linear Actuators
(continued from page 1)

times less than an alnico magnet. This reduction in weight means an improved (decreased) response time for the linear actuator. The Sm-Co permanent magnet used in these experiments was actually a series of rectangular blocks arranged to form a radially oriented ring. The author feels as soon as the technology is developed to produce one piece radially oriented Sm-Co magnets, the cost and performance advantages will become even more attractive.

RE's in the News

REs Aid Crystal Studies

Rare earths in the form of X-ray intensification screens have been incorporated into diffraction cassettes for Laue and Precession photography by researchers at the Polaroid Corporation. The rare earth screens are twice as sensitive as the currently used screens which allow for a 50% reduction in exposure time.

EIO's WITH Sm-Co

Researchers at Varian Canada have developed an extended interaction oscillator (EIO) which uses samarium cobalt permanent magnets. The samarium cobalt magnet reduces the EIO's weight by ~ 67% and physical size by around 33%. Applications could include airborne and missile radar systems where reliability, weight and size must be optimized.

W. G. Wilson, formerly manager of market development of ferroalloys at Molycorp, has taken a position with American Metallurgical Products Company as managing director of rare earth activities.

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