



# RARE-EARTH INFORMATION CENTER NEWS

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

Volume X

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No. 2

## Conference Explores Versatile Oxides

Are you looking for a particular magnetic, electric, or optical property? Then oxides may be your answer. H. P. R. Frederikse, in summarizing the International Symposium on Electronic Properties of Oxides: Applications and Science, noted that the relatively easy substitution of ions in oxide compounds enables the researcher to fabricate materials exhibiting all varieties of atomic and electronic characteristics.

An entire double issue of *J. Solid State Chem.* (Vol. 12, numbers 3 and 4, January 15, 1975) has been devoted to the proceedings of the Conference, held at Purdue University, West Lafayette, Indiana, U.S.A. from May 29 to June 1, 1974. Among the 56 papers presented, a number dealt directly with various rare earth applications.

W. D. Smith (pp. 186-92) reviewed the properties and uses of lead lanthanum zirconate titanate (PLZT) ceramics in electrooptic devices. Special emphasis was given to the comparatively new longitudinal devices (e.g. ferroelectric-photoconductors, alpha numeric displays, and matrix-address data input) which are particularly useful in information storage and display. Specific information on PLZT ceramics was included in P. S. Brody's (pp. 193-200) description of high voltage photovoltaic effects in ceramic materials.

R. R. Monchamp (pp. 201-6), B. C. Tofield *et al.* (pp. 207-12), and P. J. Harvey and J. B. Hallet (pp. 219-24) described and reviewed rare earth laser and fluorescence applications. Effects of various methods of fabrication of YIG (yttrium iron garnet) crystals on lattice constants, electrical measurements, and optical absorption were examined by P. K. Larsen and R. Metselaar (pp. 253-81).

A review of structural properties of oxidized perovskite materials

(e.g.  $\text{LaMnO}_{3.12}$ ) and an interpretation of catalytic activity of *d*-band perovskites (e.g.  $\text{RECoO}_3$  and  $\text{La}_{1-x}\text{Pb}_x\text{MnO}_3$ ) were discussed by B. C. Tofield (p. 270) and T. Wolfram and F. J. Morin (p. 291), respectively. Only abstracts were published for these two papers.

Thermal emission of electrons was proposed by Ph. Odier *et al.* (pp. 324-8) as a new analytical method for determining atomic point defects in oxides at high temperature. Unlike electrical conductivity, thermal emission was found to be dependent only on oxygen pressure and not on other carriers.

## New Tool for Geologists

$\text{Eu}^{2+}$  and  $\text{Eu}^{3+}$  are both stable under magmatic redox conditions. As the magma cools,  $\text{Eu}^{2+}$  exhibits an exceptional preference for the plagioclase feldspar over the liquid phase. This separation has been shown to be strongly dependent on both temperature and oxygen fugacity.

Making use of this anomalous partitioning behavior of europium, M. J. Drake has devised an empirical oxygen fugacity barometer [*Geochim. et Cosmochim. Acta* 39, 55-64 (1975)]. Calculations of oxygen fugacity, based on Drake's model, for various terrestrial and lunar samples were found to be in good agreement with direct measurements.

## HISTORY

A history of the development of research on the rare earths at Ames Laboratory, Iowa State University, is available from the Rare-Earth Information Center. Anyone interested in this report, which is written in layman's terms, should contact RIC and ask for the "Ames Laboratory Highlights 1972...1973."

## Gilman Elected to Academy

John J. Gilman, Allied Chemical Corporation, has been elected to the National Academy of Engineering. Election to the Academy is one of the highest honors that can



be accorded an American scientist or engineer in recognition of distinguished and continuing achievements in original research. One of 86 new members, Gilman directs the Materials Research Center where, among other things, YAG crystals are perfected for laser application.

## CONTRIBUTORS

Four firms renewed their support to the Center in the final quarter of FY 1975 bringing the total number of supporters to 35. Contributions were received from Companhia Industrial Fluminense, Brazil, contributing to the Center for the third year, Lim Fong Seng Sdn. Bhd., Malaysia, a four-time contributor, Nippon Yttrium Co. Ltd., Japan, contributing for the fifth time and Shin-Etsu Chemical Industry Co., Ltd., Japan, who has contributed to the Center six years.

## Applied Quantum Counter

Using temporal (time) discrimination J. R. Herrington, K. G. Sewell and W. B. Volz have developed a thermal imaging system based on a  $\text{PrCl}_3$  quantum counter in which performance is limited by the ambient temperature thermal background [*Appl. Phys. Letters* **26**, 226-8 (1975)]. In studying the time dependence of the fluorescent emission from the quantum counter the researchers observed two separate emissions. The initial emission occurred within the first 50 nsec after the laser pulse and was spectrally broad with no identifiable structure. The fluorescent emission started  $\sim 4.5$   $\mu\text{sec}$  after the pulse and lasted for  $\sim 20$   $\mu\text{sec}$ . To eliminate the first emission, the "noise" source, the display was "gated" OFF for  $\sim 1.5$   $\mu\text{sec}$  after the initial laser pulse and then ON for the next 20-50  $\mu\text{sec}$  and then OFF until the next laser pulse.

A contrast of 40% for a temperature difference of 5 C was obtained from this system. The minimum resolvable temperature difference is on the order of 0.4 C.

## Encore for Bivalent Holmium

In the March 1, 1975 issue of the *RIC News*, we reported the preparation of a relatively stable  $\text{Ho}^{2+}$  species by means of gamma irradiation [*J. Inorg. Nucl. Chem.* **36**, 1441-5 (1974)]. Now a more recent communication indicates that the bivalent state can also be produced chemically.

U. Löchner and J. D. Corbett [*Inorg. Chem.* **14**, 426-8 (1975)], in their study of the  $\text{Ho}-\text{HoCl}_3$  system, detected and established the existence of  $\text{HoCl}_{2.14}$ . The "slightly" stable phase forms peritectically at 551 C, only 8 degrees above the eutectic at 543 C, and exhibits no range of composition.

Preliminary investigations of the  $\text{Ho}-\text{HoBr}_3$  system and previous studies of the  $\text{Ho}-\text{HoI}_3$  system do not indicate the corresponding existence of  $\text{HoBr}_2$  and  $\text{HoI}_2$ , although they would be expected to be more thermodynamically stable than the

## Crystal Fields & Sm Ferromagnetic Compounds

In a recent paper S. K. Malik and R. Vijayaraghavan [*Pramana* **3**, 122-32 (1974)] have discussed the effect of crystal fields on the magnetic moment of  $\text{Sm}^{3+}$  in ferromagnetic samarium compounds. They showed that these crystal fields by admixing the excited 4f levels ( $J = 7/2$  and  $9/2$ ) with the ground level ( $J = 5/2$ ) may either enhance or quench the saturation magnetic moment of  $\text{Sm}^{3+}$  over the value of the free ion.

When the crystal field is strong the moment on the  $\text{Sm}^{3+}$  couples antiferromagnetically (antiparallel) with the magnetic moment on the magnetic transition metal ion (Mn, Fe, and Co) as is found for the heavy lanthanide-transition metal compounds. And when the crystal field is weak the moment on the  $\text{Sm}^{3+}$  couples ferromagnetically (parallel) with the transition metal moment, as is observed for the light lanthanide-transition metal compounds. Compounds exhibiting the former behavior are  $\text{SmFe}_2$ ,  $\text{SmCo}_5$ , and  $\text{Sm}_2\text{Co}_{17}$ , and exhibiting the latter behavior is  $\text{SmCo}_2$ .

The authors suggest that the permanent magnetic properties of  $\text{SmCo}_2$  might be improved by substitution of other "suitable" elements which might reduce the crystal field causing the Sm and Co moments to align parallel to each other. No specific "suitable" elements were suggested by the authors.

## Improves $\text{H}_2$ Separation ICM 76 Site Announced

D. Fort, J. P. G. Farr and I. R. Harris have developed an alternative to the standard Pd-Ag hydrogen separation membranes. In *J. Less-Common Metals* **39**, 293-308 (1975) they compare a Pd-8% Y alloy with the conventional Pd-25% Ag membrane. In an analysis of the permeability vs temperature and pressure the Pd-8% Y alloy showed higher permeability at the same differential pressure at temperatures above 200 C. The yttrium addition increases the tensile strength of the Pd-Y alloy which will allow the use of thinner membranes and higher differential pressures. Another feature of the new membrane is that it is less susceptible to surface poisoning by the hydrogen so surface bleeding is less important. Mild oxidation of the surface acts as an activation treatment although severe oxidation could result in failure along the grain boundaries because of yttrium depletion. Finally, the new membranes exhibit greater surface stability within an electrolytic solution of moderate acidity.

dichloride. Löchner and Corbett suggest that this anomaly may be associated with the small temperature interval observed between the eutectic and the peritectic point of the dichloride.

Amsterdam, The Netherlands, will host the 1976 triannual International Conference on Magnetism (ICM 76) sponsored jointly by Stichting Chemische Congressen XI, the International Union for Pure and Applied Physics, the Koninklijke Nederlandse Chemische Vereniging, and the Nederlandse Natuurkundige Vereniging. The scope of ICM 76, to be held in the RAI International Congress Center, September 6-10, 1976, will be similar to the previous conferences in the series.

Further information may be obtained from:

C. J. Schinkel  
Natuurkundig Laboratorium der  
Universiteit van Amsterdam  
Valekenierstraat 65  
Amsterdam-C, The Netherlands.

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### RIC News

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# 12th Rare Earth Research Conference

The 12th Rare Earth Research Conference has been scheduled for July 18-22, 1976, at the Kiandra/Talisman Lodge, Vail, Colorado 81657. The general plan of the Conference will follow that of earlier conferences.

The program will include sessions on Bioinorganic Chemistry, Solid State Chemistry, General Chemistry, Solution Chemistry, Coordination Chemistry, Metallurgy, Industrial Applications, Spectroscopy, Physics, Magnetic Properties, and Crystal and Molecular Structure. We hope that this conference can maintain the international flavor of the preceding ones.

Planning will be assisted greatly if each person who is interested in attending will complete and return before August 1, 1975, the preliminary information form included below.

(Detach)

## 12TH RARE EARTH RESEARCH CONFERENCE

Vail, Colorado, U.S.A.

July 18-22, 1976

Please complete the following and send before August 1, 1975, to:

Dr. Charles E. Lundin  
 Denver Research Institute  
 University of Denver  
 Denver, CO 80210 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., 60 Fifth Avenue, New York, NY 10011, \$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., 150 Fifth Avenue, New York, NY 10011, \$42.50.

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., 150 Fifth Avenue, New York, NY 10011, \$49.75.

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

*Rare Earth Research III*, L. Eyring, ed., Gordon and Breach Science Publishers, Inc., 150 Fifth Avenue, New York, NY 10011, \$64.75.

*Proceedings of the 5th Rare Earth Research Conference, Ames, Iowa, August 30-September 1, 1965*, available from the National Technical Information Service, Springfield, VA 22151, USA.

|                      |                                     |
|----------------------|-------------------------------------|
| 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, \$7.60, Book 2-6, \$5.45 each.

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, \$11.00.

*Proceedings of the 6th Rare Earth Research Conference, Gatlinburg, Tennessee, May 3-5, 1967*, CONF-670501. Available from the National Technical Information Service, Springfield, VA 22151, USA, \$13.60.

*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). Available from the National Technical Information Service, Springfield, VA 22151, USA, \$10.00 each volume.

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).

*Proceedings of the 9th Rare Earth Research Conference, Blacksburg, Virginia, October 10-14, 1971*, available from Dr. Alan Clifford, 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, \$28.00.

*Proceedings of the 10th Rare Earth Research Conference, Carefree, Arizona, April 30-May 3, 1973*, available from Dr. T. Moeller, Department of Chemistry, Arizona State University, Tempe, AZ 85281, U.S.A., \$30.00.

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.

## MEETING

### A Magnetic Attraction

Undoubtedly influenced by the approaching United States bicentennial celebration in 1976, the organizers of the 21st Annual Conference on Magnetism and Magnetic Materials have selected the Benjamin Franklin Hotel in downtown historic Philadelphia, Pennsylvania, USA, as the site for this year's meeting. To be held December 9-12, 1975, the program will include, in addition to the customary technical symposia and invited and contributed papers, a special tutorial session of general interest.

Papers are being solicited on 20 separate categories covering recent research and technological developments in all aspects of magnetism. Additional information and instructions for submitting abstracts, which are due August 15, 1975, may be obtained from:

B. Stein  
Sperry Univac  
P.O. Box 500  
Blue Bell, PA 19422, U.S.A.

### XeF<sub>2</sub> Oxidation Yields Rare Earth Tetrafluorides

V. I. Spitsyn, Yu. M. Kiselev and L. I. Martynenko, pursuing their previous success in producing TbF<sub>4</sub> via XeF<sub>2</sub> oxidation of the trihalide [*Zhur. Neorg. Khim.* 18, 1125 (1973); English transl., *Russ. J. Inorg. Chem.* 18, 593-4 (1973)], have extended their investigations to Ce, Pr, Nd, Sm, Gd, Dy, Ho, Er and Yb fluorides, [*Zhur. Neorg. Khim.* 19, 1152-4 (1974); English transl., *Russ. J. Inorg. Chem.* 19, 628-9 (1974)]. Only CeF<sub>4</sub> could be prepared by XeF<sub>2</sub> oxidation although PrF<sub>4</sub> has been prepared by other techniques.

Employing both an open reaction method and a hermetically sealed system, the Russian scientists observed that whereas CeF<sub>4</sub> was obtained by either procedure, TbF<sub>4</sub> resulted only from reaction in the closed system. The yield of CeF<sub>4</sub> was also reported to be greater when the fluorination was carried out in a sealed container.

Optimum temperatures of

### LANTHANIDES AND ACTINIDES REVIEWED

Students, inorganic and nuclear chemists in both research and industrial laboratories, as well as libraries, will be interested in a new paperback review, *Themen zur Chemie der Lanthanide und Actinide*, edited by W. Müller and K. Maas [Dr. Alfred Hüthig Verlag, Heidelberg, West Germany (1974), DM 16.80 (~\$7.00)]. The 244 page book is written in German and contains numerous diagrams, tables and over 500 references, including many from 1973.

Among the wide variety of topics treated, the reader will find discussions on: 1) the electron configuration of the lanthanides and actinides, 2) their natural occurrence, 3) preparation and properties of the metals, 4) compounds of the transuranium elements, 5) analytical methods for the determination of the rare earths, 6) the analytical chemistry of the actinides, 7) uses and industrial importance of the rare earths, and 8) energy production through nuclear fission and special applications of the actinides.

### Localized Moments Review

A review of the experimental bulk properties of alloys and intermetallic compounds with respect to the formation of localized moments in metals has been conducted by C. Rizzuto [*Rep. Prog. Phys.* 37, 147-229 (1974)]. Rare earth alloys and compounds are among those reviewed. Experimental data include magnetic properties, resistivity, specific heat, superconductivity, thermoelectric power, thermal conductivity, thermal expansion, compressibility, de Haas-van Alphen and Hall effects and optical properties. The metals are considered to be non-interacting with each other. Trends in the data are observed and parameters are defined to aid in comparison with theory.

200-350 C for Ce and 300-350 C for Tb were observed. Under these conditions, complete conversion of the CeF<sub>3</sub> occurs, but only 60% of the TbF<sub>3</sub> is reacted. However, repeating the fluorination process on the 60% sample resulted in an ~98% TbF<sub>4</sub> specimen.

### Solid Oxide Electrolyte

In a search for oxide materials for use in solid electrolyte applications H. L. Tuller and A. S. Nowick chose to study (CeO<sub>2</sub>)<sub>1-x</sub>(Y<sub>2</sub>O<sub>3</sub>)<sub>x</sub> [*J. Electrochem. Soc.* 122, 255-9 (1975)]. By observing the conductivity of the oxide solution as a function of temperature and oxygen partial pressure they were able to determine the electrolytic domain where the mixed oxide behaves as an ionic conductor with transference number  $\geq 0.99$ .

The doped ceria was found to have higher conductivity and lower activation energy for anion vacancy migration than the more common calcia-stabilized zirconia (CSZ). Furthermore, no polarization effects were found at low temperatures in doped ceria. These results suggest fuel cell applications for the yttria-doped ceria at temperatures lower than those where CSZ can be used.

### RE's Provide Creep Resistance

The rare earths may have a role to play in the worldwide quest for ways to conserve the limited supply of fossil fuels and curb pollution while continuing to keep the wheels of industry moving. A partial solution may be the development of high temperature heat engines which would be more thermally efficient and provide more complete combustion of the fuel.

Because of their greater resistance to thermal shock as compared to other ceramics, SiC and Si<sub>3</sub>N<sub>4</sub> based ceramics have been suggested as possible refractory materials for high temperature heat engines capable of operating at temperatures greater than 1100°C, the current limit for even the most extraordinary metal alloys [A. L. Robinson, *Science* 187, 1185-7 (1975)]. However, one of several obstacles to adopting these materials for high temperature applications has been the onset of creep from 1200 C to 1400 C. The addition of rare earths, namely Y<sub>2</sub>O<sub>3</sub> and more recently Ce<sub>2</sub>O<sub>3</sub> [K. S. Mazdiyasi and C. M. Cooke, *J. Amer. Ceram. Soc.* 57, 536-8 (1974)], has been found to markedly improve the creep resistance of SiC and Si<sub>3</sub>N<sub>4</sub>.

## HANDBOOK ON PHYSICAL PROPERTIES OF RE'S

The Gmelin-Institute's *Handbuch der Anorganischen Chemie* moved one step closer to the completion of its several volume *System No. 39, Rare Earth Elements* with the introduction of Part B3, *Scandium, Yttrium, Lanthanum, and the Lanthanides: Physical Properties of the Metals*. This 344 page volume, the first section of Part B to be published, covers the crystallographic, mechanical, thermal, electrical, magnetic, and optical properties of the pure metals. Over 200 diagrams and numerous references including several from 1974 contribute to the detailed presentation of experimental results in these areas.

The complete review of the rare earths by Gmelin-Institute will encompass three parts, each of which is composed of two or more sections. Part A, Sections 1 and 2, discuss the terrestrial and extraterrestrial history, occurrence, and behavior of the rare earths and of scandium, respectively. Part A1 is a 1970 reprint of the original 1938 edition, supplemented with English translations of the table of contents and marginal notes. For a review of Part A2 see *RIC News* 9 [2], 1 (1974).

Three sections of Part B will comprise the coverage of the pure metals. In addition to Part B3 reviewed above, volumes B1 and B2 will describe, respectively, their chemistry and their atomic and nuclear properties.

Part C is devoted to compounds of the rare earths. Section C1, covering the hydrides and oxides of Sc, Y and the rare earths, was reviewed in the *RIC News* 9 [4], 2 (1974) and is the only portion available to date.

All of the volumes are written in German with English translations of the tables of contents, forewords, and marginal notes. Those which are currently available, namely

|                   |                   |
|-------------------|-------------------|
| Part A, Section 1 | DM 65; \$26.60    |
| Part A, Section 2 | DM 254; \$103.70  |
| Part B, Section 3 | DM 457; \$186.50  |
| Part C, Section 1 | DM 591; \$241.20, |

## Pacemaker's Life Extended

Ronson Metals Corporation has announced the use of a thorium-aluminum-mischmetal alloy as a getter for a nuclear-powered cardiac pacemaker. This alloy is able to combine with all of the active gases over a wide temperature range and aids in maintaining a vacuum in the range of .1 micron necessary for optimal performance and longer life of the device.

The pacemakers currently in use are powered by mercury batteries which have a life span of 18 to 30 months. The surgical procedure to replace a pacemaker is relatively simple but does involve expense and risk to the patient. Thus, the ten year life expectancy of the new pacemakers made with mischmetal alloy getters constitutes another milestone in biomedical technology.

## REers on the Move

B. R. Cooper, formerly with General Electric Research and Development Laboratories, Schenectady, NY, has been named the Claude Worthington Benedum Professor of Physics at West Virginia University, Morgantown.

J. B. Gruber, formerly chemical physics professor at Washington State University, has become the dean of the college of sciences and mathematics and professor of physics at North Dakota State University in Fargo.

may be obtained from  
Springer-Verlag New York Inc.  
175 Fifth Avenue  
New York, NY 10010,

or their offices in Berlin or Heidelberg, or through your bookstore.

**Rare-Earth Information Center  
Energy and Mineral Resources Research Institute  
Iowa State University  
Ames, Iowa 50010**

## RE's in the News

### Nd MINI-LASER

Synthetic neodymium pentaphosphate crystals with fraction-of-a-millimeter dimensions have favorable lasing characteristics. Researchers at the Max-Planck Institute for Solid State Physics, Stuttgart, report that the crystals do not require grinding, have a pump threshold of 600  $\mu$ watts, are rugged, stable, impervious to radiation and have high laser efficiency. Oxygen and phosphorus shielding permits higher density of the Nd ions by suppressing the proximity effects.

### MONITORS NUCLEAR REACTORS

Alloys of rare earths with cobalt could be used to monitor nuclear reactors in the future. According to Dr. A. E. Miller of the University of Notre Dame the high magnetostriction properties of these alloys would enable them to detect the acoustic signals produced by a crack in a nuclear reactor tube. These alloys are stable at 980 C so the reactor could be monitored while in operation.

## Awards to Three

Three rare earth physicists, J. J. Rhyne, B. F. DeSavage, Jr. and A. E. Clark, were honored with Meritorious Civilian Service Awards by the U.S. Navy during the year-end ceremonies at the Naval Surface Weapons Center's White Oak Laboratory in Silver Spring, Maryland. All three are involved in research concerned with magnetic rare earth compounds.