RARE-EARTH INFORMATION CENTER NEWS

AMES LABORATORY

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EDITORIAL

We have received a number of interesting and encouraging letters concerning the first issue of RIC News and the establishment of the Center. We wish to thank those of you who took time to write those friendly letters and cards. In answer to some of your questions and comments we would at this time like to talk about some of the functions RIC *does not* do or plan to do in the foreseeable future. We do not plan to become an abstracting service, that is, to abstract articles, reviews, talks, books, reports, conferences proceedings, etc. There are a number of abstracting journals which perform these functions quite satisfactorily and we believe our entry into this area would be a duplication of effort.

We do not intend to store information concerning the properties of the rare-earth isotopes *per se* (i.e. half-lives, energy levels, radiations, cross sections, etc.). But information concerning some physical, chemical or metallurgical properties of a rare-earth element or compound obtained by using a particular isotope will be included in our files (e.g. a Mossbauer study of a particular rare-earth isotope in a compound to give the isometric shift and thus some information concerning electronic nature of the solid). Information about half-lives, energies, cross sections, etc. of rare-earth isotopes are available from our newly established sister information center, Isotopes Information Center (IIC), at the Oak Ridge National Laboratory at Oak Ridge, Tenn.

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A number of our subscribers and users have referred to us as REIC. Please! Our call letters are RIC. REIC are the call letters for our sister information center, Radiation Effects Information Center, located at the Battelle Memorial Institute in Columbus, Ohio.

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In private conversations with several scientists the editor has found that some people did not realize it was necessary to write to us in order to receive future issues of RIC News. If any of your co-workers have

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Proposes Periodic Table Changes

In the Aug. 1965 issue of the *American Journal of Physics*, (Volume 33, pp 637-640) Professor David C. Hamilton of the University of California at Los Angeles proposed in his paper, *Position of Lanthanum in the Periodic Table*, that lutetium should be substituted for lanthanum in the corresponding position in the usual periodic table. This interesting proposal is based on the relative nature of the melting points, crystal structures, atomic spectra and existence or non-existence of superconductivity of scandium, yttrium, lanthanum and lutetium.

We agree completely with Professor Hamilton that these data suggest a modification of the periodic table so that scandium, yttrium and lutetium are in the same column. Others, however, might argue that there are equally valid reasons why the periodic table should be left unchanged. The relative nature of the atomic volumes, compressibilities and chemical behaviors (e.g. the elution order of the ions as they come off of the ion exchange columns) of scandium, yttrium, lanthanum and lutetium support the popular periodic table with which we are all acquainted. The editor believes the choice of lanthanum or lutetium in the third column below scandium and yttrium will never be resolved to everyone's satisfaction. Perhaps the best compromise is to draw the periodic table as shown in the cover of our brochure.* We recommend Professor Hamilton's article to those who

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MEETINGS

DURHAM CONFERENCE

W. D. Corner, Chairman of the Rare-Earth Conference to be held at the University of Durham, Durham, England, Sept. 5-7, 1966, has announced the program of invited papers.

The work of seven scientists from five countries will be represented on the invited papers portion of the program. These scientists and their topics are listed below.

1. *Anisotrophy and Magnetostriction of the Rare Earths*, Dr. A. E. Clark, U. S. Naval Ordnance Laboratory, White Oak, Md., U.S.A.
2. *Spin Waves in Rare-Earth Metals*, Dr. P. Wolf, I.B.M. Research Laboratory, Zurich, Switzerland.
3. *Electronic Properties of Alloys and Compounds*, Prof. W. E. Wallace, University of Pittsburgh, Pittsburgh, Pa., U.S.A.
4. *Spectroscopy of Oxides and other Magnetically - Ordered Structures*, Prof. K. M. Hellwege, Technischen Hochschule, Darmstadt, Germany.

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Stability Increased With Cerium

Small quantities of cerium (0.02 wt %) have been reported by H. Ravner, C. M. Murphy and Dr. R. E. Kagarise, all of the U. S. Naval Research Laboratory, to give thermal stability to polydimethylsiloxane-type silicones, *Chem. and Eng. News 44*, 37 (April 1966).

They propose that the anion-propagated "unzipping" degradation mechanism is retarded by the regeneration of siloxane Si-O bonds through a complex containing Ce-O-Si linkages. The effectiveness of the cerium addition is reported to be greater when the relative dimethyl content is large.

RIC Staff

Translation of RIC's statement of intent to "serve the scientific community by collecting, storing, evaluating and disseminating rare-earth information" from an abstraction to a reality comes about through the efforts of five members of the Ames Laboratory staff.

They include Karl A. Gschneidner, Director of the Center; W. E. Dreeszen, in charge of administrative services; W. H. Smith, production; Mrs. Virginia McGriff, secretarial services; and Mrs. Joan Smith, in charge of researching and replying to inquiries. No relation exists between the two Smiths on our staff except a shared interest in RIC activities.

RIC STAFF — Members of the RIC staff standing from left are W. H. Smith, W. E. Dreeszen and Karl A. Gschneidner, Jr. Seated from left are Mrs. Joan Smith and Mrs. Virginia McGriff.

Dr. Gschneidner divides his time between RIC, an Ames Laboratory research group, and teaching duties in the Iowa State University Department of Metallurgy. Mr. Dreeszen is the Ames Laboratory's Head of Information and Security. To him falls much of the administrative burden of the Center. Mr. Smith assists the Center in the production of RIC News, brochures and news releases.

Mrs. McGriff types replies to inquiries and in addition keeps track

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Rare Earth Distribution

A discussion of the consistency of rare earth distributions in crustal sediments and chondritic meteorites with regard to the primordial solar-system matter is given by Dr. L. A. Haskin and F. A. Frey of the University of Wisconsin in "Dispersed and Not-So-Rare Earths," *Science 152*, 299 (April 1966). Data concerning the rare earth content of various types of sedimentary and igneous rocks are compared with the chondritic distribution.

Mineral rare-earth contents and patterns and mantle abundances are also discussed. The authors suggest that "the average rare-earth pattern for the whole earth matches the chondritic pattern, and that the distribution characteristic of the upper crust is a result of geochemical differentiation."

Additional information on this subject may be found in a previous article, "Abundances of the Fourteen Rare-Earth Elements, Scandium and Yttrium in the Solar System (in Meteoritic, Terrestrial, and Solar Matter)," R. A. Schmitt and R. H. Smith, both of General Atomic Division of General Corp., and Larry Haskin, University of Wisconsin, *Rare Earth Research II*, K. S. Vorres, Ed., pp. 583-621, (Gordon and Breach, New York, 1964).

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* * *

Rare Earths In the News

CONTINUOUS POWER LASER

A sun-powered laser capable of delivering 1 watt continuously has been developed by American Optical Co. The new crystal laser incorporates a neodymium doped yttrium-aluminum garnet. When placed at the focus of a sun-tracking telescope, the laser absorbs some of the visible light and converts it to an intense narrow beam of light at 1.06 microns (infrared), according to its developer. The laser is said to be suitable for use as a communication transmitter.

RARE-EARTH SCIENCE KITS

The Lunex Co., Pleasant Valley, Iowa, has made available two Rare-Earth Experimental Science Kits intended for practical and low cost experimentation in high school and college science laboratories. One kit contains 5 gm samples of both the metals and oxides of lanthanum, praseodymium, neodymium, yttrium, samarium, gadolinium, dysprosium, holmium and erbium. The second kit includes 5 gm metal and oxide samples of the first four elements listed above. Both kits also include descriptive booklets and data sheets.

YTTRIUM PHOSPHOR IMPROVES MERCURY LAMP QUALITIES

Europium doped yttrium vanadate phosphor has graduated from the television picture tube to lighting applications, according to an announcement from the General Electric Co. This phosphor, which first found application in color television, is now being used as a coating material to improve the lighting characteristics and longevity of mercury vapor lamps.

TO CONSTRUCT Y_2O_3 PLANT

Yttrium Corp. of America, a newly formed subsidiary of Rio-Tinto Zinc Corp., London, and Molybdenum Corp. of America, has announced plans for building an yttrium oxide plant for the production of color television phosphors. The plant, which is located at York, Pa., will be supplied raw material from the Rio Algom Nordic Mine at Elliot Lake, Canada.

MEETINGS

(Continued from Page 2)

5. *Properties of Rare-Earth Garnets*, Dr. R. F. Pearson, Mullard Research Laboratories, Redhill, United Kingdom.
6. *Metallurgy of Rare Earths*, Dr. K. A. Gschneidner, Jr., Iowa State University, Ames, Iowa, U.S.A.
7. *Behavior of Rare-Earth Metals Under Pressure*, Dr. D. Bloch, Laboratoire d 'Électrostatique et de Physique du Métal, Grenoble, France.

EDITORIAL

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not received a copy of this issue of RIC News, then his or her name is not on our permanent mailing list. If you know of anyone who would like to receive this and future issues, please let us know.

* * * * *

We are starting a new feature in the next issue which we are calling "RARE EARTHERS AROUND THE WORLD." We would like the various scientific research groups who are studying the rare-earth metals, alloys and compounds to send us a picture of their research group and a short description concerning their scientific investigations similar to the picture and write-up on RIC's staff (see p. 2, column 2). We hope that this feature will enable all of us who are working with the rare earths to become better acquainted with each other and the various research programs. This in turn we anticipate will increase interactions between scientists and lead to more productive developments.

Our initial intention is to include about three groups per issue of RIC News; however, we are not firmly committed to this number and it will depend a great deal upon your response. Future issues will also include some of the research groups from the Ames Laboratory. In order to have a little continuity in this feature we have listed below some ground rules. If there is some doubt on your part whether or not a rule applies to you, please write us and we will discuss the problem.

RULES GOVERNING SUBMITTED CONTRIBUTIONS TO THE "RARE EARTHERS AROUND THE WORLD" COLUMN

1. One glossy print of the scientific personnel in a group should be furnished. The print will be returned if requested.
2. A figure caption listing the names of all of the persons in the photograph is required.
3. A description of the group's program should be furnished. The description must be in English and is limited to 300 words.
4. Neither the photograph nor the description may contain anything openly commercial or of a strictly advertising nature.
5. In general a single individual will not be included.
6. This column is limited to scientific research groups, both basic and applied, and is intended to exclude scientific groups and personnel who are involved in production, quality control, marketing, administration, etc.
7. We reserve the right to edit and, if necessary, to reject any contribution. You will be notified of any editorial changes or rejections.
8. These contributions will be published on a first come-first served, space available basis.
9. Copy deadline is 30 days prior to publication dates which are March 1, June 1, September 1 and December 1.

Reproduced below is the program of the symposium on "The Chemistry of Lanthanide and Actinide Elements" for the New York Meeting of the ACS, Sept. 11-16. The program arrived after our copy deadline.

Symposium on the Chemistry of the Lanthanide and Actinide Elements

MONDAY MORNING

K. W. Bagnall. Recent Advances in Actinide and Lanthanide Chemistry. (Opening Lecture).

MONDAY AFTERNOON

Therald Moeller. Introductory Remarks.

Edgar F. Westrum, Jr. Developments in Chemical Thermodynamics of the Lanthanides.

P. Niel Yocum. Preparation and Identification of Divalent Lanthanide Ions as Dilute Solutes in Alkaline Earth Halide Solid Solutions.

John D. Corbett, Robert A. Sallach, Donald A. Lokken. Physical Characterization of the Metallic LaI_2 and CeI_2 and the Phase $LaI_{2.42}$.

LeRoy Eyring. Fluorite-Related Oxide Phases of the Rare Earth and Actinide Elements.

W. T. Carnall, P. R. Fields. Recent Developments in the Theoretical Interpretation of Lanthanide and Actinide Absorption Spectra in Solution.

D. M. Gruen, C. W. DeKock. Absorption Spectra of Gaseous Lanthanide Trihalide Molecules.

TUESDAY MORNING

Paul R. Fields. Introductory Remarks.

Mark Fred. Electronic Structure of the Actinide Elements.

N. Edelstein, W. Easley, R. McLaughlin. Optical and Electron Paramagnetic Resonance Spectroscopy of Actinide Ions in Single Crystals.

Henry R. Hoekstra, Robert H. Marshall. On Some Uranium-Transition Metal Double Oxides.

Cornelius Keller. The Solid-State Chemistry of Americium Oxides.

R. A. Penneman, L. B. Asprey, T. K. Keenan. Tetra- and Pentavalent Actinide Fluoride Complexes, Protactinium to Curium.

Conrad E. Thalmayer, Donald Cohen. Actinide Chemistry in Saturated Potassium Fluoride Solution.

T. W. Newton, F. B. Baker. A Review of the Kinetics of the Aqueous Oxidation-Reduction Reactions of Uranium, Neptunium, Plutonium, and Americium.

TUESDAY AFTERNOON

Richard Thompson, J. C. Sullivan. Redox Reactions of Neptunium(V).

C. Musikas. A Contribution to the Study of the Oxidation Potential of the Berkelium (III)-(IV) Couple in Various Media.

L. E. Trevorrow, M. J. Steindler, D. V. Steidl, J. T. Savage. Condensed Phase Equilibria in the System MoF_6-UF_6.

Henry R. Hoekstra. Uranyl Metaborate.

J. L. Ryan. Octahedral Hexahalide Complexes of the Trivalent Actinides.

J. L. Ryan, W. E. Keder. Anionic Acetato Complexes of the Hexavalent Actinides and the Anion Exchange and Amine Extraction of Hexavalent Actinide Acetates.

F. K. Fong, M. A. Hiller, F. G. Krajenbrink. Ion-Complexing and Valence Change in Rare-Earth Doped CaF_2.

L. B. Asprey, J. S. Coleman, M. J. Reisfeld. Preparation and Properties of Some Tetravalent Praseodymium Compounds.

E. J. Wheelwright, F. P. Roberts, U. L. Upson, L. J. Kirby. Ion-Exchange Separation of Kilocurie Quantities of High Purity Promethium.

WEDNESDAY MORNING

J. B. Walker, G. R. Choppin. Thermodynamic Parameters of Fluoride Complexes of the Lanthanides.

R. E. Sievers, K. J. Eisentraut, D. W. Meek, C. S. Springer, Jr. Gas Chromatographic and Nuclear Magnetic Resonance Studies of Rare Earth Beta-Diketonates.

Daniel L. Ross, Joseph Blanc. Lanthanide Chelates as Laser Materials.

Stephen J. Lippard. Nuclear Magnetic Resonance Studies of Eight-Coordinate Rare Earth β-Diketonates.

L. C. Thompson, B. L. Shafer, J. A. Edgar, K. D. Mannila. Complexes of the Rare Earths. IX. N-Substituted Iminodiacetic Acids.

Byungkook Lee, M. D. Lind, J. L. Hoard. Stereochemistry of the Ethylenediaminetetraacetato Chelates of the Lanthanide Ln^{3+} Ions.

David Cousins, Alan Hart. Complexes of Lanthanide Nitrates with Triphenylphosphine Oxide and Triphenylarsine Oxide.

Eugene V. Kleber. Rare Earth Research Trends.

RIC Staff

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of our select group of permanent subscribers. Generating material for Mrs. McGriff is the job of Joan Smith. As RIC's only full-time staff member, Joan occupies her time with interpreting, researching and drafting replies to our requesters, and collecting and compiling new data as it becomes available.

Through the combined efforts of the RIC staff we hope to make RIC a valuable adjunct to the research efforts of rare earthers.

Mountain Pass Mine

Information concerning Molybdenum Corp. of America's Mountain Pass Mine, source of europium oxide for the television industry, was summarized in the California Division of Mines and Geology publication, *Mineral Information Service*, *18* (2), 23 (February 1966). Although the article highlights mainly the geological aspects of the mine, it also contains information for those who have interests in other areas.

Included in the article are a brief history of the mine, several geologic maps, the geology and mineralogy of the ore body, and sections on mining, milling and processing procedures.

THE MAP above locates the Mountain Pass Mine featured in a California publication, "Mineral Information Service," in February of this year.

Reports, Brochures, Booklets

GLASS

Since the publication of the previous issue of RIC News (March 1966), two brochures of interest to rare earthers have come to our attention. Molybdenum Corp. of America has available an eight-page brochure entitled "Rare Earths in the Glass Industry," which describes the theory and experimental results of glass decolorization. Included are sections concerning a comparison of the effectiveness of various decolorizing agents, glass coloration, and other applications of rare earths to the glass industry. Copies may be obtained from Molybdenum Corp. of America, 280 Park Avenue, New York, New York 10017.

METALS AND ALLOYS

Ronson Metals Corp., 45-65 Manufacturers Place, Newark, N.J. 07105, has compiled several bibliographies and/or information sheets regarding ferrous and non-ferrous alloys, gettering, and the uses of rare-earth metals in the electronic industry. These are available in the brochure "Rare Earth Metals and Alloys."

Volatile Chelates

Volatile chelates of thirteen trivalent lanthanides, yttrium and scandium have been prepared in 90 to 97% yields using 2,2,6,6-tetramethyl-3,5-heptanedione (H[thd]). Dr. R. E. Sievers and Lt. K. J. Eisentraut, Wright-Patterson Air Force Base, Ohio, report that the chelates are thermally stable, anhydrous and unsolvated compounds of formula $M(thd)_3$ in an article entitled "Volatile Rare Earth Chelates," *J. Am. Chem. Soc.* *87* (22), 5254 (November 1965).

Because of the significant volatility differences of the complexes, separation by gas chromatography is possible, especially for the rare earths lanthanum to dysprosium. On the basis of retention behavior the authors suggest that the volatility decreases with increasing ionic radii of the trivalent ions.

PERIODIC TABLE

(Continued from Page 1)

have not seen it since he makes some valuable remarks concerning this point. Dr. Hamilton is to be commended for his forthright expression of his views.

* We did not propose this form of the periodic table to solve this question. We borrowed it from Fig. 3, Page 7 of the U. S. Atomic Energy Commission's booklet, *Rare Earths-The Fraternal Fifteen*, first published in Dec. 1964.

New Books

RARE EARTH RESEARCH III

The proceedings of the Fourth Rare Earth Research Conference held April 22-25, 1964 at Phoenix, Arizona have been compiled into the book, *Rare Earth Research III*, LeRoy Eyring, Ed., (Gordon and Breach, New York, 1965), 749 pp. The reference edition of this work is priced at $39.50 while the professional edition sells for $19.50.

As with the other books concerning earlier conferences, this book contains current research in the chemistry, physics and metallurgy of the rare earths. Specifically, it consists of the following sections: magnetic and electrical properties of rare-earth compounds, properties of the metals and their alloys, optical properties, solution chemistry, and solid state chemistry of rare-earth materials.

It is unfortunate that the conference proceedings required two years to the date to reach the hands of the scientists. Basically, production delays accounted for the late issuance, since it required nine months to get the book out after the page proofs had been assembled. Still, special attention to this book should be given by those interested in the current research of prominent workers in these fields.

Letters

To the Editor:

We have considerable interest in the use of rare-earth elements as the attached circular will show you ("Studies on the Application of Radioisotope Techniques in Stream Pollution Problems in the Pulp and Paper Industry"). We are presently applying the use of rare-earth elements to problems in the tagging of paper mill fibers in process and pollution control studies. If your readers have an interest in receiving a copy of this, we would be glad to mail them upon receipt of their names and addresses.

I would like to communicate with anyone who has an interest in the application of the tagging of paper-fibers or any other kind of fibers using the rare-earth elements and to receive copies of papers on this particular subject.

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Coordination Chemistry

A 50-page review of the complexing chemistry of rare-earth metals and yttrium is available in *Chemical Reviews 65*, 1-50 (January 1965). The article, "The Coordination Chemistry of Yttrium and the Rare Earth Metal Ions," by Therald Moeller, D. F. Martin, L. C. Thompson, R. Ferrus, G. R. Feistel, and W. J. Randell, all of the University of Illinois, concerns the classification, stabilities, bonding and applications of rare-earth complexes. In addition, the scandium and actinide coordination chemistries are viewed in the light of rare-earth coordination chemistry.

The 651 references at the conclusion of this review provide ample opportunity for the interested reader to find additional information on this subject through 1962 and into early 1963.

New Assault on Absolute Zero?

The use of rare earths to attain temperatures of 10^{-4} to 10^{-5}°K has been suggested by Al'tshuler, Kazan' State University, USSR, *JETP Letters 3*, 112 (1966). Presently it is possible by using salts containing rare-earth ions with an odd number of 4*f* electrons (in particular cerium magnesium nitrate) to reach temperatures of about 10^{-3}°K by adiabatic demagnetization technique. Because several of the trivalent rare-earth ions with an even number of 4*f* electrons have nuclear spins greater than zero and large values for the hyperfine interaction (the interaction between the nuclear magnetic dipoles and the electron dipoles), these two properties should enable us to reach these low temperatures. Al'tshuler suggests two methods: one for rare earths with large nuclear spins ($I > 3/2$) and the other for rare earths with small spin values.

If salts of praseodyium ($I = 5/2$) or holmium ($I = 7/2$) are maintained at pumped liquid ^{3}He temperatures (~ 0.5°K) and magnetic fields of 2×10^4 Oe are used, then adiabatic demagnetization of these materials should permit one to attain 10^{-4} to 10^{-5}°K. If salts of thulium ($I = 1/2$) are cooled to about 10^{-2}°K by conventional magnetic demagnetization techniques using a paramagnetic salt, it might be possible to reach 10^{-5}°K by rotating the salt from 0 to 90° with respect to the magnetic field so that the gyromagnetic factor decreases from approximately 70γ to γ, where γ is the free atom value of the gyromagnetic ratio.

Of course one of the problems is measuring the temperature as one nears absolute zero, but Professor Al'tshuler also has described a technique to measure these extremely low temperatures.

Although this is an exciting proposal, it should be noted that Professor Simon of the Clarendon Laboratory of the University of Oxford reached a temperature of about 10^{-5}°K ten years ago by using the hyperfine interaction in copper after cooling down to 10^{-2}°K by means of adiabatic demagnetization of a paramagnetic salt, N. Kurti, *Phys. Today 13*, 26 (1960). Perhaps by combining several of these techniques in tandem and using rare-earth salts it may be possible to obtain temperatures even lower than 10^{-5}°K. Are many of you cryogenic-rare earthers going to take up the battle cry, "Onward to Absolute Zero"?

Sees Magnetic Applications for The Rare Earths

The potential applications of the rare earths in magnetic materials has been explored by Dr. S. Methfessel of IBM's Thomas J. Watson Research Center, *IEEE Trans. on Magnetics*, Vol. MAG-1, 144 (1965).

The topics covered in this article are: (1) a comparison of magnetic behaviors of the rare-earth and iron group elements; (2) magnetic properties of metallic rare-earth metals, alloys and compounds; (3) possible ways to increase the Curie temperatures of these metallic materials; and (4) magnetic properties of non-metallic rare-earth compounds, particularly the rare-earth ferrites and garnets, and europium monochalcogenides.

Dr. Methfessel concludes that it is difficult to predict the future use of these metals, since they are too new to be properly evaluated, but he feels that their low Curie temperatures, usually less than room temperature, will be a handicap in their utilization.

Furthermore, he notes that as a result of systematic scientific studies, a better understanding of the magnetic nature of materials will be obtained. This should lead to the development and improvement of magnetic materials with useful properties for commercial application.

Rare Earths at High Pressures

Recently we saw a copy of the proceedings of the high pressure symposium held in Tuscon, Ariz. in April 1965, *Physics of Solids at High Pressure*. C. T. Tomizuka and R. M. Emrick, Eds., (Academic Press, New York, 1965).

Five of the papers in this volume may be of interest to rare-earth scientists. Three papers are based on experimental studies and two are theoretical in nature.

Robinson, Milstein and Tan, University of California at Los Angeles, pp. 272-297, reviewed the progress of their studies of the magnetic properties of gadolinium, terbium and dysprosium. Professor Vereschagin of the USSR, pp. 460-466, discussed many aspects of his broad research program including his studies of lanthanum and cerium. The third experimental paper is by A. Jayaraman, Bell Telephone Laboratories, pp. 478-495, who summarized most of his recent research on the crystal structures, pressure-temperature (one-component) phase diagrams and melting phenomena of the rare-earth metals.

The theoretical paper by Blandin, Coqblin and Friedel, University of Paris, pp. 233-251, discusses the electronic configurations on the basis of the virtual bound state model of the rare-earth metals, and the effect of pressure on these configurations. The last paper is by W. Kohn, University of California at San Diego, pp. 561-566, who briefly mentions that his theoretical model is capable of explaining the electronic change on proceeding at high pressures from the γ-Ce (normal cerium) to α-Ce (collapsed form) at the critical point.

Can You Help?

The Research Materials Information Center (RMIC) at Oak Ridge National Laboratory is seeking information as to the availability of a number of research materials.

Among the materials on the list distributed by RMIC are several in the rare-earth family. *All the materials listed are desired in single-crystal form except those marked by an asterisk.*

If you have any information concerning the availability of these materials, please correspond directly with Dr. T. F. Connally, Research Materials Information Center, Oak Ridge National Laboratory, Post Office Box X, Oak Ridge, Tenn. 37830. We would appreciate a carbon copy of your information.

Material	*Purity*	*Specifications*
^{176}Lu	—	—
Rare Earths	> 3N	—
*Rare Earth Bromide	3-4N	—
*$Sm(II)SO_4$	3N	Polycrystalline and powder
$YAlO_3$ and $YGaO_3$	— / —	Approx. one cubic centimeter, impurity or doped with rare earths

Rare-Earth Information Center
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Application to mail at second-class postage rates is pending at Ames, Iowa