RARE-EARTH INFORMATION CENTER NEWS

AMES LABORATORY
Iowa State University / Ames, Iowa 50010

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Editorial

As most of our readers are aware, RIC is planning a compilation of rare-earth producers and their products. This information we hope will be of assistance, not only to the RIC staff, but also to both the user and producer. Presently, the largest number of inquiries about a particular subject are those concerning the availability of a rare-earth chemical, metal or mixture. In general we know most of the companies which produce a particular product, but we may have overlooked one or two others, simply because we did not know the company manufactured this product. We hope that the survey will increase our knowledge concerning the availability of rare-earth materials. As soon as the compilation has been completed, we will announce it in a future issue of RIC News.

We are very appreciative to those of you who wrote concerning companies whose names were not on our list of rare-earth suppliers. Your response has brought to our attention about 30 more companies who are thought to supply rare earths. Most of these are located outside the United States. We will be glad to furnish the names and addresses of these companies to whomever desires a copy.

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As noted in our last issue of RIC News, we are starting with this issue the series, "Rare Earthers Around the World." You will find in the box located in the right hand column of this page, a listing of the groups which appear in this volume. The group write-ups and pictures are placed throughout the issue. We thank those of you who have sent in your contributions, and we are looking forward to receiving other contributions in the future.

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Hopefully, as you read this volume, the editor of RIC News will be completing his European trip. The itinerary includes visits to several academic institutions and one industrial research laboratory. Prior to returning I will be attending the Durham Rare-Earth Conference. In the December issue of RIC News we plan to include a brief summary of the Durham Conference and the visits.

Rare-Earth Fertilizers?

Rare earths in additions up to 10 ppm have been reported to benefit plant growth. H. H. Sharoubleem and N. E. Milad of A'in Shams University, Cairo, Egypt reported their findings on the Phaseolus vulgaris, a type of legume, in *Soil Science* 101 (2), 130-4 (Feb. 1966).

According to these experimenters, the result of the rare earth supplements obtained from monazite were: (1) increased water content of roots; (2) increased dry matter of tops; (3) a higher top to root ratio; and (4) a change in the amounts of various elements present in the plants.

With rare-earth additions of less than 5 ppm, the sodium, potassium, and nitrogen concentrations increased and the calcium, magnesium and phosphorus concentrations decreased. Rare-earth additions of more than 5 ppm caused the opposite effect, i.e., decreased the sodium, potassium and nitrogen concentrations and increased calcium, magnesium and phosphorus contents.

Rare Earthers Around The World

LUNEX TECHNICAL STAFF—Standing from left are O. F. (Joe) Isenberg, Dr. John Moriarty and James E. Humphreys. Seated are Mark Nelson and Janice Pelon.

Lunex Company Technical Staff

The research efforts of the Lunex Company technical staff are directed toward developing ways and means of producing large quantities of high-purity metals and compounds, and improving existing ferrous and non-ferrous alloys through the use of rare earths. Investigations of binary alloy systems to discover new intermetallic compounds and the characterization of their crystal structure are also of major interest to the group.

In addition, studies of magnetic and electrical properties of these materials are carried on by the Lunex technical staff.

Dr. John L. Moriarty is the research director at Lunex. He is in charge of both basic and applied research programs. O. F. (Joe) Isenberg, works superintendent, numbers among his many duties the development of new products. Research associate James E. Humphreys is responsible for directing the work of the analytical, metallographic and x-ray laboratories.

Two members of the Lunex technical staff are gaining a knowledge of fundamental research techniques while completing their undergraduate work at nearby Augustana Col-

(Continued on Page 3)

Rare Earths In the News

Promethium-147 Lighting

Another possible use for the rare earths has been announced recently. Major auto makers are considering the use of promethium-147 for the illumination of auto ignition key locks, windshield wiper knobs and gearshift indicators. According to 3M, major supplier of promethium-147 devices, such illumination would be permanent and reliable, as well as being less expensive than the electric bulb systems now in use.

More Enlightenment

Fluorescent lamps are now on the rare-earth bandwagon. According to Westinghouse, its new fluorescent lamps which use yttrium oxide and europium to supplement other phosphors have a significantly higher light output and a better color balance. The europium, as in color TV, is used to increase the brightness of the red color which previously was overpowered by the blue and green.

YIG Crystals

Bell Telephone Laboratories have developed a technique for growing yttrium ion garnet (YIG) crystals up to a half pound in size. The crystal is prevented from redissolving by draining the flux from the crucible which remains fixed in the furnace. Crystal nucleation and growth is encouraged by an oxygen stream which cools the crucible bottom.

RIC Staff Change

We are pleased to announce that Miss Kay Varnum has joined the RIC staff as a full-time secretary. Mrs. Virginia McGriff, who assisted RIC on a part-time basis, is now working full-time for the Ames Laboratory Publications Office.

Conference Proceedings

We have seen two recently published conference reports, which contained articles of interest to rare earthers. There are three papers dealing with the rare-earth metals in the book *Optical Properties and Electronic Structure of Metals and Alloys*, F. Abeles, editor, North-Holland Publishing Company, Amsterdam and John Wiley, New York (1966), and one paper in *Transactions Vacuum Metallurgy Conference 1965*, L. M. Bianchi, editor, American Vacuum Society, Boston (1966).

The results of recent optical studies on the rare-earth metals are summarized by C. Schuler, IBM, Zurich Research Laboratory, pp. 221-236. His data show that the room temperature optical properties of the trivalent metals differ from those of the divalent metals Eu and Yb. The results are discussed in terms of the recent band structure calculations. The effect of magnetic ordering at low temperature on the optical properties was also studied.

The optical properties of Gd and Tm as deduced from the band structure calculations are discussed by Dimmock and Freeman, Massachusetts Institute of Technology, and Watson, Brookhaven National

(Continued on Page 4)

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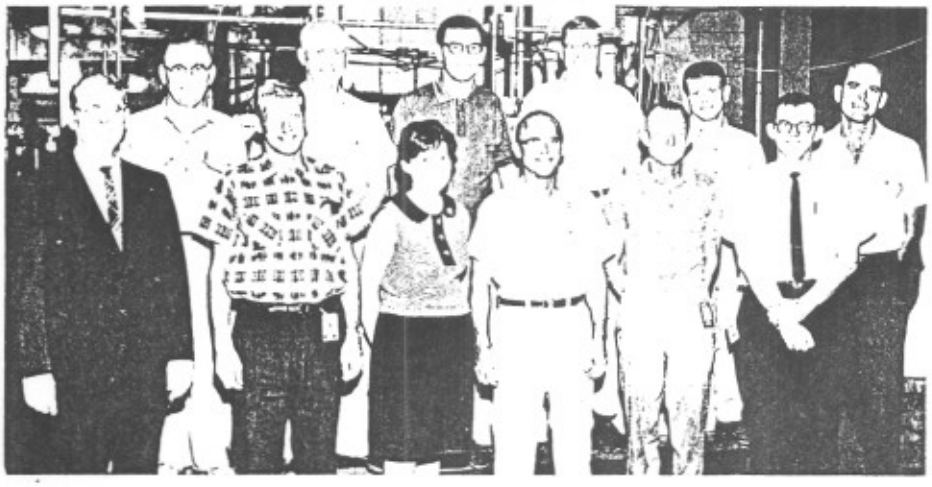

ION-EXCHANGE GROUP — In the front row from left are Dr. Jack E. Powell, James Farrell, Maureen Matkovich, Roy Whetstone, Bill Carroll and Christopher Devine. In the back row from left are Ben Storby, Vernon Munson, Dr. Glyn Rowlands, Marvin Adolphson and Douglas Johnson.

Ames Laboratory Ion-Exchange Group

The research activities of Physical and Inorganic Chemistry Group II of the Ames Laboratory, Iowa State University, are related to the separation of rare earths by ion exchange with primary emphasis on screening potential eluting agents by determination of stability constants of rare-earth chelate species. The group is headed by Dr. Jack E. Powell, senior chemist.

Solid chelate compounds are also prepared and tested with respect to solubility, stoichiometry and hydration. Four graduate assistants, Maureen Matkovich, Christopher Devine, Marvin Adolphson and Douglas Johnson are currently studying a variety of α-hydroxycarboxylate and dicarboxylate chelates of the rare earths. Associate James Farrell is similarly engaged and, in addition, writes the computer programs which are used in calculating the stability constants.

Dr. Glyn Rowlands, post-doctoral associate, has been working jointly with Dr. Powell on the correlation of stability constant data and is currently making direct determinations of the rare-earth separation factors which are operative in several interesting ion-exchange elution systems.

Promising chelate systems are eventually investigated on a modest scale to evaluate their potential as eluants in the separation of rare earths. As a by-product of these operations pure rare-earth oxides are made available to other groups in the laboratory. Harvey Burkholder, assistant chemist, is general supervisor of the rare earth-separations pilot plant, which is operated by technicians Roy Whetstone, Bill Carroll, Ben Storby and Vernon Munson. Part of the pilot plant is presently being operated at elevated temperatures (95° C.)

ADDRESS CHANGE

Word has come from Michigan Chemical Corporation that their general offices are now located at 2 North Riverside Plaza, Chicago, Illinois 60606. The firm's telephone number is 312 263-0580.

LUNEX COMPANY

(Continued from Page 2)

lege in Rock Island, Ill. They are Janice Pelon and Mark Nelson, both seniors majoring in chemistry. They are employed on a part-time basis as research assistants.

MEETINGS

Red Letter Days

May 3-6, 1967 are red letter days for Rare-Earth Researchers. These are the dates for the Sixth Rare-Earth Conference to be held at Gatlinburg, Tennessee. This conference is being sponsored by the Air Force Office of Scientific Research and the Oak Ridge National Laboratory.

Dr. Wallace C. Koehler, conference chairman, has issued a call for papers. Interested individuals should submit an abstract to the conference chairman by December 1. Further information may be obtained from Dr. Koehler, ORNL, Oak Ridge, Tennessee 37831.

Mineral Facts and Problems

Excellent reviews of "capsule" background information on scandium, yttrium and the lanthanides appear in the Bureau of Mines Bulletin 630, *Mineral Facts and Problems,* 1965 ed. Two chapters by John G. Parker entitled "Rare-Earth Elements," and "Yttrium," and a chapter, "Scandium," by Donald E. Eilertsen include such information as size, organization and geographic distribution of the industry; definitions of terms, grades and specifications; technology of these elements, including their geology, mining, processing, separation and metal preparation; uses, statistical information, production, resources, prices; and future outlook and problems.

Preprints of the chapters may be obtained from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402, at a cost of $.05, $.10, and $.15, respectively for the chapters "Scandium," "Yttrium," and "Rare-Earth Elements."

New Books

Berzelius' Biography

A recent biography (1966) by Dr. J. Erik Jorpes of the Royal Carolinian Medico-chirurgical Institute on the life and work of the eminent Swedish chemist, Jac. Berzelius, has been translated into English by Barbara Steele. This well-written and beautifully illustrated book describes, in addition to Berzelius' scientific endeavors, the "state of the art" of chemistry in Europe during Berzelius' lifetime and his relations with his co-workers and other prominent researchers.

Among Berzelius' notable achievements is the discovery of cerium by the joint efforts of Berzelius and Hisinger. The role played by Berzelius in the discovery of the other rare-earth elements is also included.

A copy of the book, *Jac. Berzelius: His Life and Work*, may be obtained from Almqvist and Wiksell, Stockholm, Sweden.

MAGNETISM 1965

A review of papers published in 1965 on the magnetic properties of the rare-earth metals, alloys and compounds is given in *Magnetism and Magnetic Materials: 1965 Digest*, R. L. White and K. A. Wickersheim, Eds. (Academic Press, New York).

The most important paper regarding the rare earths is chapter 5, a nine-page review containing 60 references, by C. E. Olsen of the Los Alamos Scientific Laboratory. In this chapter, the general and theoretical papers are reviewed, along with those dealing with the experimental results reported on the rare-earth metals, alloys and intermetallic compounds.

Additional information concerning the magnetic and superconducting properties of the rare earths including their alloys and intermetallic, semimetallic and inorganic compounds will be found scattered throughout in all but four of the remaining eighteen chapters.

Portable X-Ray Source

K. L. Krabbenhoft and F. L. Green evaluated five different rare-earth isotopes as possible portable radiographic sources for clinical diagnostic uses. They concluded that Yb^{169} proved to be the most practical of all the isotopes evaluated up to that time. [Am. J. Roentgenology, Radium Therapy, Nucl. Med. *90*, 123 (1963)].

PROCEEDINGS

(Continued from Page 2)

Laboratory, pp. 237-245. Estimated energies of transitions between bands which have been magnetically split are compared with the energies in the infrared spectra observed in magnetically ordered Dy and Ho.

The last paper by Blodgett, Spicer and Yu, Stanford University, pp. 246-256, deals with the band structure of Gd as deduced from photoemission and optical studies. Their results are compared with the theoretical calculations of Dimmock, Freeman and Watson, noted above.

In the conference proceedings of the 1965 Vacuum Metallurgy Conference, pp 99-135, K. A. Gschneidner, Jr., Iowa State University, describes the use of vacuum metallurgy in the preparation and purification of rare-earth metals. Also included in this paper is a listing of the current best values (1965) of some of the physical properties of the rare-earth metals.

An Yttrium-Cobalt Permanent Magnet

A recent study of the magnetic properties of YCo_5 by K. J. Strnat and G. I. Hoffer, (Wright-Patterson Air Force Base, Ohio) indicated that this compound may become one of the best permanent magnet materials available. The energy product, the product of the magnetic induction and magnetic field intensity, of YCo_5 is 29.2×10^6 GOe, approximately three times larger than the best magnets available today. Furthermore, its high Curie temperature (630°C), extremely high room temperature anisotropy constant (5.7×10^7 erg/cm^3) and good corrosion resistance are all favorable for the use of YCo_5 as a fine particle permanent magnet.

The biggest drawback is the cost of this material, which is estimated to be about $30 per pound, as compared to $1.25 to $10 per pound for Alnico magnets. The authors suggest that the substitution of cerium or mischmetal or didymium for all or part of the yttrium would lower the cost.

The details of the technology and economic considerations are to be found in an Air Force Materials Laboratory report, AFML-TR-65-466, which should be available from the Clearinghouse for Federal and Scientific Technical Information, Sills Building, 5285 Port Royal Road, Springfield, Virginia 22151.

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