Rare-Earth Information Center NEWS

SUPPORTED BY INSTITUTE FOR ATOMIC RESEARCH
IOWA STATE UNIVERSITY / AMES, IOWA

Volume III | June 1, 1968 | No. 2

INTERNATIONAL HAPPENINGS—

RE's from Africa to Europe

AFRICA

The editor last February had the privilege of participating as the U.S.A. representative in a seminar on *"New Metals and Minerals"* sponsored by the United Nations Economic Commission for Africa at its headquarters in Addis Ababa, Ethiopia. The new metals were Be, Cs, Ge, Hf, Nb, Ta, Ti, Zr and the rare earths (including Y).

Ten African nations sent representatives to describe ore sources and particular problems as related to their own countries. There were also four representatives from the developed nations, France, Great Britain, U.S.A. and U.S.S.R. They presented papers on "Output, Demand and Trade Picture," "Geology, Exploration and Evaluation," "Technology and Uses" and "Processing, Extraction and Purification," respectively. The representatives of the four developed nations also advised the African nations concerning various questions as they arose during the seminar.

Several problems were thoroughly discussed. These included a need for more technically trained personnel in geology and mining engineering, more comprehensive surveying of new and old ore sources, and more marketing information, technological developments, and uses. It is hoped that the United Nations will publish the papers presented at this seminar.

There are many potential sources of rare-earth-bearing ores in these countries, however, the extent and nature of these deposits need further evaluation.

FRANCE

On my return to the United States, I stopped and visited three laboratories in the Paris area and

(Continued on Page 2)

Nd MEASURES FUEL BURN-UP

Neodymium isotopes, determined by a mass spectrometric isotope dilution technique, are used to measure the burn-up of irradiated nuclear fuels. This method was described by D. J. Savage and J. L. Drummond in a United Kingdom Atomic Energy Authority Report, TGR Report 1496 (D). Neodymium was chosen for its high fission yield and five stable fission-product isotopes.

A single column of anion exchange resin and a methanol-water-nitric acid solution was used to separate neodymium from other rare earths, fission products and fuel constituents. By varying several experimental conditions a simple, robust and rapid method was established. Different eluant concentrations varied the amount of neodymium adsorbed; and temperatures, although not critical, varied the elution rate. Small amounts of phosphoric or sulfuric acids prevented separation.

Because attempts to produce

(Continued on Page 3)

Industrial Support—

RIC News To Continue

Although RIC has discontinued operations as an AEC information center, *RIC News* will be published for at least another year by Iowa State University's Institute for Atomic Research.

The extension of *RIC News* was made possible through industrial grants to the Institute by five rare-earth producers. The cooperating firms are American Potash & Chemical Corp., a subsidiary of Kerr-McGee; W. R. Grace & Co.; Molybdenum Corporation of America; Research Chemicals Division, Nuclear Corporation of America; and Ronson Metals Corporation.

Under the arrangement the industrial grants will be used to defray production and mailing costs, and a portion of the editorial and production staff support of *RIC News*. The Institute will provide the remaining support.

Continuation of *RIC News* ensures the rare earth research and production community a publication for the interchange of ideas and information. No changes in format or editorial policy are anticipated at this time, according to Editor K. A. Gschneidner, Jr. The "Rare Earthers Around-the-World" stories will continue and readers are urged to submit contributions for this feature.

Although this Newsletter will

(Continued on Page 2)

RE's from Africa to Europe

(Continued from Page 1)

one laboratory in Stuttgart, Germany.

My first stop was at the rare-earth laboratory at Bellevue, France. This laboratory is supported by the Centre National de la Recherche Scientifique and is directed by Dr. F. Trombe. Some principal scientists working with Dr. Trombe are Drs. J. Loriers, J. C. Achard, P. Caro and C. Henry la Blanchetais.

Their laboratory is carrying out research on a variety of problems such as: phase diagram determinations, ion exchange studies, investigations of the fluorescence of various rare-earth dopants in garnets and oxysulfides, studies on the reduction of Eu, Sm and Yb oxides by various methods, the formation of rare-earth aluminates, the solubilities of rare-earth carbonates in water, the crystal chemistry of inorganic rare-earth compounds, magnetic susceptibility, thermal expansion, spectroscopy, and analytical spectrographic analysis.

The next day was spent visiting the solid state physics group at Orsay under Prof. J. Friedel. Unfortunately Prof. Friedel was not in Orsay during the week I was in Paris. However, I did have several interesting and informative discussions with his co-workers, Drs. A. Blandin, J. P. Burger, B. Coqblin and R. Reich.

Some of their studies concern the band structure and electron configurations of Ce and Yb at low temperatures and high pressures, metallurgy and preparation of the rare-earth metals and alloys, magnetic properties of solids, ordered stacking fault sequences in metals, and superconductivity of materials.

The third laboratory I visited in the Paris area was that of Prof. J. Flahaut who holds the Chair of Inorganic Chemistry in the Faculty of Pharmacy at the University of Paris. Prof. Flahaut and his colleagues, M. Guittard, M. Patrie, M. P. Pardo and P. Laruelle, are carrying out studies on the preparation, identification and structure of binary and ternary rare-earth sulfides, selenides, and tellurides. They have begun a program to measure the electrical resistivity, magnetic susceptibility, and thermoelectric power of these materials. They are also carrying out phase diagram studies, primarily of pseudo-binary alloys in ternary systems, such as the R_2S_3-MnS pseudo-binary in the R-Mn-S ternary system.

As an item of interest, the Chair of Inorganic Chemistry carries with it a museum which must be maintained by the holder of this chair. It is primarily in honor of Henri Moissan, who was awarded the 1906 Nobel Prize in Chemistry for the discovery of fluorine. Also located in the museum is Moissan's original high temperature furnace in which he prepared and studied many refractory compounds including some of the rare-earth carbides.

GERMANY

The last laboratory I visited was the Max-Planck Institut für Metallforschung in Stuttgart, Germany. I spent the greatest part of my time visiting with Drs. G. Petzow, D. Godel and H. E. Exner of the Institut für Sondermetalle, which is headed by Prof. E. Gebhardt; and with Prof. H. J. Engell, director, Drs. K. Schubert and H. J. Leamy, all of the Institut für Metallkunde. They are working on a variety of metallurgical problems including metallographic studies, powder metallurgy, the properties of nuclear metals, the crystal chemistry of metallic compounds, and imperfections.

RIC News To Continue

(Continued from Page 1)

continue to be published, the other functions of RIC, such as answering inquiries and compiling bibliographies will not be resumed.

Reduction in this year's federal appropriations forced the AEC to withdraw support of the RIC which it had established at the Ames Laboratory, Iowa State University in 1966 (*RIC News* Vol. III, No. 1, March 1968).

Europium From Nuclear Weapons

A lithium-drifted germanium detector has made it possible to include 1.7-year Eu^{155} as one of the environmental tracers in studies of circulation processes in nature reports the Danish Atomic Energy Commission, *Science* 157 [3787] 425 (1967).

Eu^{155} was first detected in 1957 in nuclear weapon debris of soils on Rongelap Atoll and later in global fallout. The aim has been to determine concentrations in ground-level air for a longer time period, and to estimate the weapon yield of Eu^{155} from simultaneous measurements of Ce^{144} and Sr^{90}.

Debris was collected on air filters by means of a centrifugal pump at 10^6 m^3/month. From 1961 to 1966, a 10 g portion of the filter was measured each month for Eu^{155} using the lithium germanium detector. Results showed a yield of 1400 atoms per 10^6 fissions, in close agreement for fast fission yields in U^{238}.

Report RE Uses

Several papers on rare-earth applications were presented in a special symposium at a Materials Conference sponsored by the Am. Inst. Chem. Engineers, March 31 - April 4, 1968, Philadelphia, Pa. The following seven papers were presented:

Glass Compositions, G. B. HARES, Corning Glass Works, Corning, N.Y.—optical glasses with high refractive indices and fluorescence of rare-earth ions in glass.

Rare-Earth Dopants for Crystalline Solid Lasers, R. J. PRESSLEY, RCA Laboratories, Princeton, N.J. — optical transitions of rare-earth ions in insulating solid crystals related to laser performance.

The Trivalent Rare Earths in Luminescent Materials for Television and Lighting, F. C. PALILLA, General Telephone and Electronics Laboratories, Bayside, N. Y.

The Status of Europium Compounds for Reactivity Control in

(Continued on Page 4)

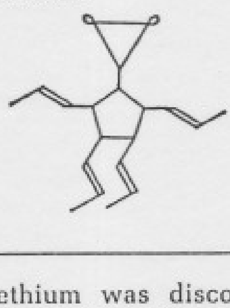
Supernatural Symposium

(A joint Symposium on Supernatural Products conducted by Britain's Chemical Society and the Royal Institute of Chemistry yielded the abstract below. It is reprinted from *Chemical and Engineering News*, Vol. 45, No. 22, May 22, 1967, p. 86. Copyright 1967 by the American Chemical Society and reprinted by permission. —Ed.)

"The recovery and identification of some supernatural elements and compounds" was deemed to be the most spirited abstract on the basis of its snigger coefficient: i.e., the number of times the editor of *Chemistry in Britain* sniggered while reading the entry. A copy of the published abstract, written by S. A. Krafa, Dr. Phil. Supernat., was kindly forwarded to *News Scripts* by Dr. Adalbert Farkas.

Two elements which the author found to be the major constituents of the superatmosphere were "hellium, element 2 with an extended 1-shell, and paradoesyum, an isopunic form of element 59." The author is careful to point out that because of levitation, the elements mentioned congregate at opposite superworld poles. Here they attain temperatures inversely proportional to their atomic numbers.

Also recorded for the first time is the structure determination of the leprachaunes. Through spectral analysis it was found that they are comprised of "individual molecules of the dichetaune derived from leprachane, 1-cyclopropyl-2,3,4,5-tetrapropenyl-cyclopentane . . ." Or in visual form:



Promethium was discovered in 1947 by J. A. Marinsky, L. E. Glendenin, and C. D. Coryell in the fission products of uranium.

Hansen To Top Ames Lab Post

R. S. Hansen F. H. Spedding

Dr. Robert S. Hansen on July 1 will become Director of the Ames Laboratory of the U. S. Atomic Energy and of Iowa State University's Institute for Atomic Research. He is presently Chief of the Laboratory's Chemistry Division and Chairman of the Iowa State Chemistry Department.

Dr. Hansen will succeed Dr. Frank H. Spedding who has been Director of the Institute for Atomic Research and the AEC's Ames Laboratory at Iowa State since their formation after World War II.

Dr. Spedding will continue on the staff of Iowa State as a Distinguished Professor of Sciences and Humanities. After he relinquishes his administrative duties on July 1 he will devote his time to his research in chemistry, metallurgy and physics.

Dr. Spedding, 65, organized and directed the work of Iowa State scientists in 1942 to develop a process to process high-purity uranium in quantities needed for the nation's atomic energy project. As an outgrowth of that World War II project, Iowa State in 1945 formed the Institute for Atomic Research and two years later the AEC established the Ames Laboratory to continue the research programs begun by Dr. Spedding and his associates during the war.

Dr. Hansen, 49, joined the Iowa State faculty in 1948 after receiving the Ph.D. degree from the University of Michigan, where he had earlier earned B.S. and M.S. degrees. He became Chief of the Ames Laboratory's Chemistry Division and Chairman of ISU's Chemistry Department in 1965.

The new director received the American Chemical Society's Kendall Company Award in 1966. He is a member of the ACS, American Physical Society, Faraday Society, and American Association for the Advancement of Science.

Publications Available

Free from RIC are:

1. IS-RIC-1, Rare Earth Products Catalog;
2. Color Chart of RM and RM_2 Compounds; and
3. Fraternal Fifteen, an elementary introduction to rare earths.

Back numbers of *RIC News* are available as follows:

Vol.	No.	Pages	Source
I	1	4	a
	2	8	a
	3	4	a
	4	8	a
II	1	8	a
	2	10	a
	3	4	a
	4	4	RIC
III	1	4	RIC

[a]Xerox copies from Iowa State University Library, Reference Department, Ames, Iowa 50010. Charge is $.10/page; minimum charge each order is $1.00.

Nd Measures Fuel Burn-Up

(Continued from Page 1)

Nd^+ were unsuccessful, NdO^+ ions were utilized to determine burn-up.

The variation coefficient of burn-up was 2% or better, considering all aspects of the experimental procedures.

RIC News

Vol. III, No. 2 June 1, 1968

published in
March, June, September and December
by
Rare-Earth Information Center
Institute for Atomic Research
Iowa State University

* * *

Second-Class postage
paid at Ames, Iowa.

* * *

Telephone: Area Code 515 294-2272

K. A. Gschneidner, Jr. .... Editor
Charla Bertrand and W. H. Smith
Staff Writers

Rare Earths In the News

ALLOY DEVELOPMENT

A cobalt-base alloy developed by Union Carbide is said to have excellent oxidation resistance, high temperature strength and post-aging ductility. The oxidation resistance of the alloy results from the addition of small amounts of La (0.08%) which modifies the oxides that form at high temperatures and significantly reduces over-all oxidation of the alloy.

In other alloy development work, interest continues in Mg-10Y alloy despite its present high cost. The promise of a 50,000 psi yield strength keeps this alloy in the forefront.

THULIUM POWER

Sanders Nuclear Corp. has received a $241,000 Atomic Energy Commission contract to continue research on thulium-170 oxide as a fuel for isotopic power devices. Sanders has financed work on the potential isotopic fuel for seven years and in 1967 used the fuel to power a 300-milliwatt generator.

MORE RARE EARTHS

Molycorp has begun production of pure gadolinium oxide at its Louviers, Colo., plant by a liquid-liquid ion exchange process. It is reported that 5000 pounds per month of 99.9% gadolinium oxide can be produced in this manner. Molycorp started rare-earth production at the Louviers plant in late 1967 and has been producing lanthanum, neodymium and praseodymium oxides since then.

LANTHANUM LAMP

A phosphor lamp coating, specially activated lanthanum fluoride, converts invisible infrared radiation into visible light. The coating is expected to find immediate use in the industry's first gallium arsenide solid-state lamp. It was developed by the General Electric Lamp Division.

MEETING

FRENCH SET RE CONFERENCE

The French are sponsoring an international conference on the rare earths, with the emphasis on the rare-earth metals, alloys and compounds in the solid or liquid state. The sessions are scheduled to be held on May 5-6, 1969 in Paris and on May 7 and 8 in Grenoble. The co-chairmen of this conference are Dr. F. Trombe, Laboratoire des Terres Rares, CNRS, Bellevue, France and Prof. L. Néel, University of Grenoble, Grenoble, France.

Speeds Promethium Processing Time

The processing time for separating promethium from rare-earth fission products can be cut in half by substituting nitrilotriacetic acid (NTA) for diethylenetriaminepentacetic acid (DTPA). This efficient and economical method was developed by E. J. Wheelwright and T. R. Myers of Battelle-Northwest, according to a report in *Chem. Eng. News 46* [16] 11 (1968).

The use of NTA overcomes two major deficiencies in DTPA which are: (1) the yttrium elution position and (2) the slow rate of band advance.

With DTPA yttrium elutes between Sm and Pm which requires increased Pm recycling. Use of NTA shifts the elution order so that Y is removed from the critical Sm-Pm-Nd zone.

With NTA a 100% increase in band advance rate is achieved while maintaining separation efficiency equal to DTPA. Moreover, NTA costs half as much as DTPA.

DTPA and NTA also play important roles in alternate cation-flowsheets for simultaneous recovery and purification of Pm, Am, and Cm. According to Dr. Wheelwright, this recent work is the first demonstration on a kilocurie scale in recovering radioisotopes from spent reactor fuels.

Report RE Uses

(Continued from Page 2)

Nuclear Reactors, R. J. BEAVER and M. M. MARTIN, Oak Ridge National Laboratory, Oak Ridge, Tenn. — using Eu compounds for controlling excess reactivity in thermal reactors.

Metallurgical Applications of the Rare-Earth Metals, I. S. HIRSCHHORN, Ronson Metals Corp., Newark, N. J. — uses of mischmetal in lighter flints, sparking metal products, stainless steels, and electrical resistance alloys; of cerium in liquid nuclear reactor fuels; and of didymium in magnesium alloys.

Rare Earths in Petroleum Cracking Catalysts, R. L. KOFFLER, W. R. Grace & Co., Baltimore, Md. — improved yields of gasoline and other petroleum products.

Rare-Earth Improved Zirconia Refractories for Hypersonic Wind-Tunnel Storage Heaters, L. L. FEHRENBACHER, Wright-Patterson Air Force Base, Ohio — properties and behavior of yttria and mixed rare-earth stabilized zirconia at temperatures up to 2200°C.

Rare-Earth Information Center
Institute for Atomic Research
Iowa State University
Ames, Iowa 50010

Second-Class postage paid at Ames, Iowa.