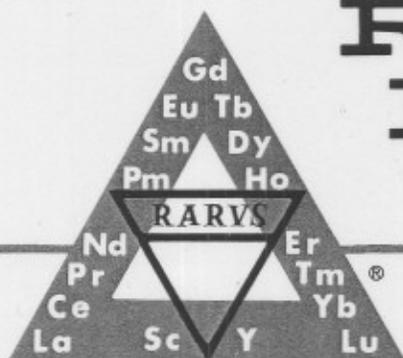


RARE-EARTH INFORMATION CENTER NEWS



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

Volume XVI

June 1, 1981

No. 2

SUPPORT

Fiscal year 1981 finished the same way that it started—strongly—with nine more companies renewing their support of the Center during the fourth quarter. This strong finish allowed us to "come from behind" and beat last year's effort by one with a total of 45 companies contributing to the cause. This quarter's companies are listed below. The number in parentheses is the number of years that company has supported RIC.

Aldrich Chemical Co., Inc., U.S.A. (2)
BOSE Corporation, U.S.A. (4)
British Flint & Cerium Manufacturers, England (9)
Colt Industries—Crucible Inc., U.S.A. (7)
Denison Mines Limited, Canada (9)
General Electric Company, U.S.A. (6)
GTE Sylvania, U.S.A. (9)
Hitachi Magnetics Corporation, U.S.A. (7)
Industrial Minera Mexico, S.A., Mexico (7)

RADIATION CONTROL

Application Report 8108 entitled "Abstracts of Major Work Concerning Rare Earths in Glass for the Control of Radiations" has just been released by Molycorp, Inc. The report divides the applications into the areas of ultraviolet, X-ray, gamma ray, infrared, fluorescence and luminescence, lasers, nucleonics and space, photosensitivity and polarization, and miscellaneous. Entries consist of a title, author(s), reference and a brief abstract of the article. A special section at the end of the report aids in locating entries by identifying the abstract number, rare earth involved, base glass and source of the reference. Copies are available free by writing to Molycorp, Inc., 709 Westchester Avenue, White Plains, New York 10604, or by calling telephone number (914) 997-8880.

Wilhelm Klemm Honored

A special issue, *Angewandte Chemie (International Edition in English)* 20, No. 1, 1-134 (1981), has been published which contains papers dedicated to Professor Wilhelm Klemm on the occasion of his 85th birthday. Over sixty percent of the issue consists of reviews that cover some aspect of rare earth chemistry. In pages 1 to 22 A. Simon reviews condensed metal clusters. H. Müller-Buschbaum reviews the production of high temperatures in the chemical laboratory and its application in lanthanide oxo-chemistry on pages 22 to 33. Homoatomic bonding of main group elements is the subject of H. G. von Schnering's review (pages 33-51) and R. Hoppe reviews recent progress in oxy- and fluorometallate chemistry (pages 63-87). The same papers are also published in the regular German edition of *Angewandte Chemie*, however, the page numbers and sequence of papers are different from the English language version.

Molecular Species

Molecular species in high temperature vaporization have been reviewed by K. A. Gingerich and published as chapter five, pages 345-462 in *Current Topics in Materials Science, Volume 6*, E. Kaldis, ed., North-Holland Publishing Co. (1980). The entire book is 480 pages long and costs \$87.75 (Dfl 180.00). Various experimental techniques for measuring high temperature species include high pressure mass spectrometric sampling, plasma and field desorption mass spectrometry, secondary ion and sputtered neutrals mass spectrometry, photoionization mass spectrometry, photoelectron and matrix isolation spectroscopy, chemiluminescent and related studies and high temperature electron diffraction by gases. The mode of vaporization of elements and binary metal compounds and empirical correlations of bond energies in both

New Materials Prize and the Academy

L. G. Van Uitert of Bell Laboratories, Murray Hill, NJ is the recipient of the 1981 American Physics Society's International Prize for New Materials. The prize cites Van



Uitert's key role in the discovery and development of a variety of new materials of vital importance to magnetic and optical technology. Rare earth compounds and alloys have frequently turned up in his research on microwave ferrites, garnets, lasers, phosphors, electro-optical devices and fiber optics.

Van Uitert completed his undergraduate studies at George Washington University in 1949 and then received his Masters (1951) and PhD (1952) in chemistry from Penn State University and has been with Bell Laboratories since that time where he is currently supervisor of the Solid State Materials Synthesis Group.

National honors were also garnered by Van Uitert this year as he was elected to the National Academy of Engineering. Inclusion in this distinguished group is one of the highest forms of recognition accorded to American scientists and engineers.

homonuclear diatomic and heteronuclear molecules are examined. The review concentrates on the mode of vaporization and the equilibrium vapor composition over elements and binary metal compounds. Experimental dissociation energies of the gaseous elemental molecules and binary gaseous metal compounds have been tabulated. 664 references are cited. Approximately fifty percent of the chapter is devoted to rare earth materials.

Cerium Citrate Tested

Citing the possibility of greatly increased exposure of the public to rare earths if certain applications, such as rare earth complexes as anti-knock agents in gasoline, become a reality, J. B. Morganti, B. A. Lown, E. Chapin, R. B. D'Agostino and E. J. Massaro devised a series of investigations using mice to test the effects of acute exposure of cerium citrate on passive and active avoidance learning, social behavior and activity wheel behavior [*General Pharmacology* 11, 369-73 (1980)]. The cerium was administered to the test mice in 136 mg/kg(LD₅) and 173 mg/kg(LD₂₅) doses (i.e., a 100 kg mouse (or man) would receive 13.6 grams and 17.3 grams, respectively). Control mice were given an equivalent dose of sodium citrate. The activity wheel test revealed that four hours after administration of cerium the group ranking from highest to lowest activity was sodium citrate, LD₂₅-Ce, and LD₅-Ce. Over a seven day period the cerium citrate-injected mice displayed a comparatively depressed activity level. In order to test the effect of acute cerium exposure on higher brain processes, passive and active avoidance learning tests and social behavior observations were made. The authors conclude that the acute cerium exposure had no effect on active or passive avoidance learning in the mouse and no dramatic effect on the social behaviors studied. They did observe a depression of general activity.

Discovery & Separation

Discovery and commercial separation of the rare earths are the subject of a paper by J. Kaczmarek presented to the American Chemical Society, Las Vegas, Nevada, August 1980. His review touches on the discovery, composition and sources in nature of the rare earth minerals and ores, the major rare earth ore producers, and the various methods of ore beneficiation and rare earth separation, including ion exchange separation, liquid-liquid extraction and the Rhone-Poulenc separation process. Free copies of the paper are available from Rhone-Poulenc Chemical Company, Monmouth Junction, NJ 08852.

BURN TREATMENT

K. Bridges, J. S. Cason, D. M. Jackson, A. Kidson, E. J. L. Lowbury, and M. D. Wilkins have reported a study of topical chemoprophylaxis with cerium (cerous) nitrate cream [*Burns* 6, 231-4 (1980)]. In the study, a cream containing 1.74 percent cerium nitrate was compared with a cream containing 0.5 percent silver nitrate and 0.2 percent chlorhexidine gluconate in the treatment of burns. The first test was on patients aged 12 years or older with burns on less than 15 percent of the body surface. In the second test, patients aged 3 years or more with burns on up to 20 percent of the body surface were treated. In these trials the cerium nitrate cream was less effective than the silver nitrate-chlorhexidine cream as a prophylactic application to burns; however, none of the patients in either series developed invasive infection. The authors note that the cerium nitrate cream could be expected to have a better prophylactic action when applied on compresses and that a comparative study of this nature should illuminate any potential value of cerium nitrate as a topical prophylactic agent for the treatment of burns.

Cobaltate Catalysis

T. Arakawa, A. Yoshida and J. Shiohara have studied the conversion of methanol to carbon dioxide on a number of rare earth cobaltates [*Materials Research Bulletin* 15, 347-52 (1980)]. Comparison of both the response ratio and the magnetic susceptibility versus temperature revealed SmCoO₃ to have the highest catalytic activity and also the largest population of low-spin Co(III) ions at room temperature. To further elaborate on this possible relationship they substituted the high-spin transition metals iron, magnesium or chromium for cobalt and observed drastically reduced catalytic activity. In substituting calcium, strontium or barium for samarium a small reduction in catalytic activity was seen, calcium having the greatest effect and barium the least effect in reducing the conversion rate. Various other factors were discussed.

Krypiakovich Dies

RIC has been informed of the death of Russian scientist, Professor P. I. Krypiakovich on December 21, 1980. Krypiakovich's main rare earth interest was in the crystallography of binary and ternary rare earth-transition metal intermetallic compounds. At the time of his death he held the chair of inorganic chemistry at Lvov State University, Lvov, U.S.S.R.

Plasma Display

T. Takahashi and O. Yamada have developed an alkali yttrium terbium metaphosphate glass which plays a double role in a new AC plasma display [*IEEE Transactions on Electron Devices* ED-27, 213-7 (1980)]. The glass acts as a major light emitter and a transparent insulative material. Unlike displays in which a phosphor is activated by ultraviolet radiation, the glass is predominantly excited by low-energy plasma electrons that match the *f-d* transition in the terbium ion.

RE's IN THE NEWS

FINE POWDER

Europium-doped yttrium oxide phosphor powders in the micron range are among the many materials being produced as fine powders at the Materials Research Laboratory at Penn State University under direction of R. Roy. In the 1950's Roy developed a process called evaporative decomposition of solutions (EDS). Interest in EDS was renewed when he learned that scientists in Vienna were using the process to produce large quantities of ultra fine, ultra pure powders. So far the materials produced have ranged from highly reactive cermets to quaternary oxide compounds.

Intense X-rays Produced

Samarium-cobalt permanent magnets have found yet another application in a device called an undulator that produces x-rays 100 times more intense than were previously available. The device, developed by K. Halbach of Lawrence Berkeley Laboratory, consists of 240 permanent magnets arranged such that a strong magnetic field which changes direction every 3 cm is produced. The undulator is being tested at the Stanford
(continued on page 4)

Environmental Problem

An environmental problem is under investigation at the site of a former rare earth processing plant, but don't worry, rare earths, radon-222 is the culprit. According to L. Jensen [*Health Physics* 39, No. 6, 1029 (1980)], the problem consists of a tailings pile, five sedimentation ponds and sledge dredged from the ponds on a site in West Chicago owned by Kerr-McGee Chemical Corporation. Kerr-McGee has been working with the Nuclear Regulatory Commission to stabilize the area but to date, attempts to decontaminate the site have been unsuccessful.

SmCo₅ Safe

The biological effects of the magnetic fields of implanted samarium-cobalt permanent magnets have been studied by R. Cerny [*J. Dental Research* 60, No. SIA, 648 (1981)]. Since these magnets have sufficient magnetic energy to be considered for use in dental prostheses or orthodontics, the effects of large implanted samarium cobalt magnets on mammalian tissues is of great interest. The magnets, which have a magnetic flux density of 0.1 tesla at the surface, were placed subcutaneously in the submandibular region of test rats. These rats and control rats (without magnet implants) were identically maintained for 104 days. Examination of blood and tissue samples at that time showed no unusual or harmful effects that could be attributed to the magnetic fields generated by the samarium-cobalt implants.

Laser Surgery

E. Karbe, G. Königsman and R. Beck have tested several lasers, including neodymium-doped and holmium-doped yttrium aluminum garnet lasers, versus conventional surgical instruments such as the electroscalpel, cryoscalpel and scalpel in operations on pig livers and dog kidneys [*Langenbecks Arch. Chir.* 351, 179-92 (1980)]. The purpose of the study was to gather information on the cutting effect, hemostasis, histopathology and healing associated with laser surgery. In addition to the Nd:YAG and Ho:YAG lasers, CO₂ and CO lasers were also tested. For tissue damage, the order from best to worst was CO₂, CO, Ho:YAG, Nd:YAG, however, for coagulative effect the order was reversed. Laser-cut surfaces healed in four to eight weeks with no complications. Charred tissue could be detected after eight weeks but apparently had no effect on scar formation. Major advantages of laser surgery include the contact-free incision which greatly reduces the possibility of infection, absence of electrical current to interfere with the heartbeat and the strong coagulative effect which reduces problems associated with blood loss.

Phosphor Efficiency

Evidence gathered by D. J. Robbins, B. Cockayne, B. Lent and J. L. Glasper on terbium-activated garnet phosphors lends support to a recently developed theoretical model of relative phosphor efficiency [*Solid State Communications* 36, 691-3 (1980)]. The cathodoluminescent efficiencies of terbium-doped yttrium-aluminum and yttrium-gallium garnets were measured as a function of terbium concentration and then compared to get a relative efficiency rating of the two phosphors. The theory calculates the relative efficiency using the lattice band-gap, the high and low frequency dielectric constants and the highest LO phonon frequency of the host lattices. Although the absolute magnitude of the calculated efficiencies was low, the calculated relative efficiency agreed quite closely with the observed relative efficiency of the phosphors. The authors believe they have confirmed the physical basis of the theory. If so, the model could prove to be very useful in the development of new phosphor materials.

Magnetic Phenomena

A two-volume set entitled *Fizica Fenomenelor Magnetice (Physics of Magnetic Phenomena)* has been written by E. Burzo and published by the Editura Academiei Republicii Socialiste, România. Volume One is 307 pages long and was published in 1979. Volume Two is 368 pages long and was published in 1981. Both books are written in Romanian and accompanied by an English abstract and table of contents. The price of the set is unknown.

Volume One consists of six chapters that address the general problems of magnetism, classical methods of studying magnetic properties, the origin of magnetic moments, group theory and its application to magnetic symmetry and the crystalline field, diamagnetism, paramagnetism and magnetic behavior of conduction electrons.

Volume Two contains three chapters which are devoted to ferromagnetism, antiferromagnetism and complex magnetic structures. Topics covered in examining each type of ordering include the Ising and molecular field models, spin waves, the series expansion and Green function methods, band model, the Friedel, Anderson and Wolff models, Kondo effect, spin fluctuations and representative magnetic materials. Throughout the set, experimental observations are compared with theoretical predictions. A great deal of the materials cited, discussed and analyzed in these two volumes involve the rare earths.

PHYSICS MEETING

The Fourth Durham Conference on Rare Earths and Actinides has been scheduled for March 29-31, 1982 at the University of Durham. The scope of the Conference will cover any aspects of the physics of the rare earths and actinides. The proceedings will be published in a special issue of the *Journal of Magnetism and Magnetic Materials*. The deadline for receipt of abstracts is December 21, 1981 and March 1, 1982 is the deadline for registration and receipt of papers. For more information write to Dr. S. R. Hoon, Physics Department, University of Durham, South Road, Durham, DH1 3LE, England.

RIC News
(USPS 464-960)

Vol. XVI No. 2 June 1, 1981

published
March, June, September and
December

by
Rare-Earth Information Center
Second-Class postage
paid at Ames, Iowa 50011

Postmaster: send address changes to:
RIC News, Rare-Earth Information Center,
Energy and Mineral Resources Research
Institute,
Iowa State University, Ames, Iowa 50011

Telephone: Area Code 515-294-2272
FTS...865-2272

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Magnetic Bubbles

The current state of theory and experimental techniques used in understanding the dynamics of magnetic domain walls and magnetic bubbles has been reviewed by F. H. de Leeuw, R. van den Doel and U. Enz [*Reports on Progress in Physics* 43, 689-783 (1980)]. The specific topics addressed include wall motion in both the linear and non-linear regions, basic properties of bubble materials, saturation velocity, peak velocity, wall and bubble mobility, wall mass, hard bubbles, wall state transformations and wall damping by diffusion and by anisotropic impurity ions in ferri-magnetic insulators. The equations of motion, horizontal Bloch lines in a thin film and stray field of a bubble are covered in the appendices. Bubble technology and device application are not covered in this review. One hundred ninety eight references are cited.

Russian Acquisitions

New Russian books received by RIC include *II. Vsesoyuznaya Konferentsiya po Fizike i Khimii Redkozemel'nykh Poluprovodnikov, Tezisy Dokladov* [Second All-Union Conference on the Physics and Chemistry of Rare Earth Semiconductors, Summary of Lectures], Akademiya Nauk SSSR, Fiziko-Tekhnicheskii Institut im A. F. Ioffe, Leningrad (1979).

RE News

(continued from page 2)

Linear Accelerator Center. When accelerated electrons are exposed to the magnetic field of the undulator they radiate high intensity x-rays with energies up to 2000 eV. Applications of these x-rays are being examined.

PLZT IMPROVED

C. E. Land and P. S. Peercy of Sandia Laboratories have discovered that implanting PLZT (lanthanum-doped lead zirconium titanate) with hydrogen, helium, argon or neon ions results in a 10,000 times improvement of the ceramic's photosensitivity. They believe that the ions cause surface structure disorder which decreases conductivity while increasing the density of trapping sites and the efficiency of the photoexcitation process.

PROCEEDINGS

Indo-U.S. Conference

The proceedings of an Indo-U.S. conference on the Science and Technology of Rare Earth Materials held at Cochin, India on March 3-8, 1980 have been published in two parts. The invited lectures have been collected into a book entitled *Science and Technology of Rare Earth Materials*, E. C. Subbarao and W. E. Wallace, eds., Academic Press, Inc., New York (1980). The book is 448 pages long and costs \$29.00. The topics covered include extraction and purification, phase relations, electronic structure, theory and applications. Nineteen papers are included.

Eleven of the contributed papers were published in a special issue of the *Bulletin of Materials Science* 2, No. 3, 151-219 (1980). Essentially the same topics are covered. Materials studied include the rare earth metals, R-Co alloys, garnets, perovskites, pyrochlores and mixed valence compounds.

Metal Hydrides

The proceedings of the International Symposium on the Properties and Applications of Metal Hydrides held April 7-11, 1980 at Colorado Springs, Colorado have been published as a two volume set entitled *Metal Hydrides 1980, Vols. 1 & 2*, G. G. Libowitz and G. D. Sandrock, eds., Elsevier Sequoia S.A., New York (1980). Volume 1 is 384 pages long, Volume 2 is 476 pages long and the set costs \$171.45. The proceedings also appear as the *Journal*

Laser-Induced Coercivity

J. J. Croat, A. R. Chraplyvy and J. F. Herbst have produced magnetically hard regions in a soft magnetic host by using focused laser radiation [*Applied Physics Letters* 37, 962-4 (1980)]. This discovery was an outgrowth of their investigation of the magnetic properties of a praseodymium-cobalt alloy that was crystallized from an amorphous state by annealing. They found that samples prepared in this fashion exhibited room temperature coercivities that were larger by a factor of three over samples prepared by traditional powder metallurgy techniques. A $\text{Pr}_{0.27}\text{Co}_{0.73}$ alloy, after being annealed at approximately 415°C, had a room temperature coercivity of 6.8 kOe. Using laser irradiation, they were able to selectively anneal small portions of the sample and, in so doing, create localized regions of high coercivity in a soft magnetic host. Possible applications of these materials could include magnetically coded security keys and read only memories.

of Less-Common Metals, Volumes 73 and 74 (1980).

Almost 50 percent of the articles deal with rare earth-hydrogen materials under the general categories of thermodynamics, kinetics, nuclear magnetic resonance studies, Mössbauer studies, superconductivity, Laves (RM_2) and Hauke (RM_5) phase intermetallics, crystal structures and phase relations, electronic properties and band structures, general theory, miscellaneous hydride systems, and applications.

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