RARE-EARTH INFORMATION CENTER NEWS

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RARE EARTH RESEARCH IN INDIA


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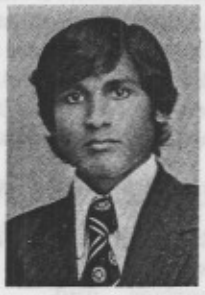
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N. Rao

University of Mysore—

Rare earth research was initiated in the hydrothermal laboratory of the Mineralogical Institute, University of Mysore, Mysore-570 006 India in 1973, under the leadership of Prof. M. V. Viswanathiah, Director of the Mineralogical Institute, in collaboration with the Inorganic and Physical Chemistry Laboratory, Indian Institute of Science, Bangalore. The first study was on the hydrothermal equilibria in lanthanide oxide-water systems and stabilization of the different rare earth oxides, oxyhydroxides and trihydroxides. In this study the basic P-T diagrams for all the R_2O_3-H_2O systems were established and it was found that only the oxides of heavier lanthanides (Er, Tm, Yb, Lu) are stable. This study also proved that impurities such as Na^+, NO_3 and CO_2 could be used as potential mineralizers as well as agents to bring down the temperature of equilibrium, and that cubic lanthanide oxide crystals could be grown under hydrothermal conditions. The growth of cubic oxide crystals under different alkaline as well as acidic mineralizers showed that HNO_3 is both a good mineralizer and an oxidizing agent. The grown cubic lanthanide oxide crystals have an unusual fibrous morphology which is explained on the basis of topotactic transformation of fibrous Ln-hydroxynitrates.

Hydrothermal equilibria in the R_2O_3-H_2O-CO_2 systems for all the lanthanides has been taken up and the different lanthanide carbonates have been synthesized. These were found to be isostructural with the natural mineral equivalents like bastnaesite, ancylites, tengerite, and solid solution phases of ancylite and tengerite.

After completing our investigation of the stability range of the cubic lanthanide oxides, we are extending our studies in the following fields:

(a) Hydrothermal equilibria in R_2O_3-Co_2O_3-H_2O systems and preparation of different $RCoO_3$ phases, with the main object of preparing materials suitable as permanent magnets. We are attempting to study the growth of crystals both under alkaline (NaOH, KOH) and acidic (HNO_3) media.

(b) Hydrothermal equilibria in R_2O_3-Fe_2O_3-H_2O systems and the stability range of different ferrite and garnet structures.

(c) Hydrothermal preparation of mixed lanthanide oxides, particularly the lanthanide oxides of the yttria group doped with Ce^{4+} and Eu^{2+}, with the object of preparing semiconducting materials of both p- and n-type.

Dr. T. R. Narayanan Kutty from the Indian Institute of Science, Bangalore, who is now in the Department of Electrical Engineering, University of Dortmund, West Germany, is an active associate of our research group.

Although our laboratory is quite young, we have ambitious plans for expansion, and we are willing to enter into international collaborative research programs on any of the specific fields of present research.

X-ray Screens Tested

New horizons in rare earth x-ray intensifying screen technology were examined by researchers at a meeting held May 20, 1977 at the Middlesex Hospital Medical School, London, England. Abstracts of papers on image requirements, speed and noise properties, evaluation techniques, user experience and implications for the future appear in the *Brit. J. Radiol.* **51**, 233-6 (1978).

Sc

1879

Congratulations are in order for the 100th anniversary of the discovery of scandium by L. F. Nilson. Scandium's story actually began in 1871 when D. I. Mendeleev published his treatise "Fundamentals of Chemistry" in which several as yet undiscovered elements were predicted. One of these predictions was eka-boron, atomic weight 45. Eight years later in 1879, while attempting to isolate ytterbium from gadolinite and euxenite, L. F. Nilson obtained 0.35 grams of a new rare earth which had a molecular weight of less than 131. The new element was named scandium to honor Scandinavia where the minerals were found. Atomic weight tests later confirmed that scandium and eka-boron were one and the same giving credence to Mendeleev's proposed periodic law of the elements. Since that illustrious beginning scandium has led a rather sedated existence finding little practical importance so that even today it is hardly more than a laboratory curiosity. Commercial applications have included use as a radioisotope tracer in oil well drilling and analytical work and in high intensity lamps.

Superconductivity Conference

The third conference on superconductivity in *d*- and *f*- band metals will be held June 21-23, 1979 at the University of California, San Diego, LaJolla, California. The scope of the conference will be similar to the previous two conferences with primary emphasis on the basic physics of all relevant aspects of superconductivity in *d*- and *f*-band metals. There will be both invited and contributed papers and ample time for discussion. Parallel sessions will be avoided, if necessary, through the use of poster sessions. Contributors should send an abstract and a rough draft of their paper to Dr. J. K. Hulm, Westinghouse R & D Center, 1310 Beulah Road, Pittsburgh, PA 15235 by March 1, 1979. Authors of accepted papers will be notified by April 1, 1979.

EUCHEM Conferees

EUCHEM CONFERENCE

The Euchem Conference on the chemistry of the rare earths was held May 30-June. 2, 1978 at Espoo, near Helsinki, Finland. The Conference was sponsored by the Association of the Finnish Chemical Societies and attended by some 60 participants from 14 countries. The largest groups, outside the host country, came from France, Norway, Switzerland and Germany, but there were also some rare earth scientists from distant countries like the U. S., India and Iran. The early summer weather in Finland was favorable and the long, sunny days were enjoyed by the participants during and after the Conference.

The three topics discussed during the Conference included the systematics in the properties of the rare earths, coordination and complex formation, and nonmetallic rare earth materials. In each section there were three invited lectures and several short contributions from the participants. The total number of papers presented was 38 of which most were presented in the second section. There were many lively discussions during the conference, particularly concerning the systematics of rare earths. The proceedings of the Conference will not be published, however, some articles based on the plenary lectures have appeared in the Finnish chemical journal *Kemia-Kemi* **5**, [6] (1978).

Coordination Chemistry Review

A review devoted to the advances in the synthesis and study of the physicochemical properties and structure of lanthanide complexes achieved during the 1965-1975 period has been published by V. T. Panyushkin, Yu. A. Afanas'ev, A. D. Garnovskii and O. A. Osipov [*Uspekhi Khimii* **46**, 2105-38 (1977); Engl. Transl.-*Russ. Chem. Rev.* **46**, 1109-31 (1977)]. The topics covered are the characteristics of the complex formation reactions, synthesis of coordination compounds, thermodynamics of complex compounds, investigation of the molecular structures of the complexes and spectroscopic studies including fluorescence, absorption, infrared and microwave spectra. A systematic account is given of data mostly for organic oxygen- and nitrogen-containing ligands. Emphasis is focused on the application of the physical and physicochemical research techniques in the chemistry of lanthanide complexes. 484 references are cited.

Management Change for Indian Rare Earths, Ltd.

Indian Rare Earths, Ltd. has announced the appointment of Mr. M. A. Hadi as chairman and Managing Director following the retirement of Mr. N. D. Hansotia.

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LETTER

To the Editor:

The desire to reserve the symbols Pr and Ac solely as element symbols [F. Weigel, *RIC News* **XIII,** [3] 2 (1978)] is commendable but not practical. When praseodymium and actinium were discovered (1885 and 1899, respectively), the symbols Pr and Ac were already in common use along with Me, Et, Bz, etc. as symbols for radicals (see the abstract section of *J. Chem. Soc.* for 1884). Nomenclature in science is very much dependent upon priority of use and it was those who named these elements who created the duality of usage.

The IUPAC commission on the Nomenclature of Inorganic Chemistry "assumed" the role of approving names and symbols for newly discovered elements (1946-57) in the course of its efforts to express a preference in those cases where two names with corresponding symbols were being used for the same element. The corresponding commission for organic chemistry historically has not sought to develop new nomenclature but to codify existing practice. IUPAC through its Interdivisional Committee on Nomenclature and Symbols seeks to avoid conflicts in any new recommendations that it approves. However, it has not undertaken to adjudicate long standing inconsistencies. Further, the only bodies with power to enforce nomenclature restrictions are national rather than international in scope.

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New Mössbauer Journal

A new journal entitled *Mössbauer Effect Reference and Data Journal,* edited by J. G. Stevens, V. E. Stevens and W. L. Gettys, has been initiated to aid researchers in locating Mössbauer references in other scientific journals. Each issue includes the reference listing, indexes for data, isotopes and subject material, a list of the authors' names and addresses, news of meetings of interest and occasionally an article written specifically for those researchers using the Mössbauer effect technique who are limited by time, experience and/or money and facilities. There are ten issues per volume and an index issue which contains the compiled reference listing for the entire volume. The Journal is available directly from the Mössbauer Effect Data Center. For additional information contact:

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4th RE-Co Workshop

The Fourth International Workshop on Rare Earth Cobalt (RE-Co) Permanent Magnets and Their Applications will be held May 22-24, 1979 at the Hakone Prince Hotel, International Conference Room, Hakone National Park near Tokyo in Japan. The program will include oral presentations and panel discussions of invited and contributed papers and possibly some poster sessions. Tentative subjects include theories and properties of RE-Co compounds and alloys, resources and refining of rare earth elements, materials for RE-Co magnets, and applications of RE-Co magnets including electronic, mechanical, medical and other new applications. A limited amount of space will be available for companies and organizations who wish to exhibit hardware or informational items. Interested parties should contact Mr. Kurino whose address is given below. Technical tours and a ladies program are also planned.

The number of participants is limited to 150 so register early. Payment of fees on or before February 28, 1979 receives a 10% discount. Registration and fees are 50,000 yen (U.S. $250) and includes a copy of the Proceedings, Program, Abstract Book and Reception fee.

For additional information contact either

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105 Japan,
or
Dr. Karl Strnat
2530 Ardath Court
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Conduction Electron Theory

The theory of the coupling between conduction electrons and magnetic or electric moments of $3d$ and $4f$ ions has been reviewed by L. L. Hirst [*Advances in Physics* **27,** 231-85 (1978)] with emphasis on a systematic treatment of the generalized coupling forms. The present review is restricted to the spherically symmetric case and does not include crystal field effects. Included in the symmetry analysis of k - μ couplings are irreducible tensors, partial-wave basis states, charge screening, unit tensor operators, the k-f coupling in tensor form, time reversal symmetry, equivalences among ionic unit tensors, the total coupling strength, comparison with conventional coupling forms and the T-matrix in irreducible form. Direct and exchange Coulomb couplings are considered as well as the various aspects of virtual-mixing coupling including the basic coupling mechanism, coupling with and without intrinsic splitting effects and contributions from two-electron mixing. Areas for application of this theory suggested by the author are in the interpretation of the relaxation of ionic moments (from electron paramagnetic resonance, Mössbauer, inelastic neutron scattering from crystalline electric fields), transport phenomena and the general Kondo problem in metals doped with rare earths containing unpaired $4f$ electrons.

Absorbs More Water

Faster than a paper towel! More powerful than a sponge! Able to absorb large quantities of liquid in a short period of time! Is it Superman? No—it's Super Slurper!!! Who or what is Super Slurper? According to M. O. Weaver, R. R. Montgomery, L. D. Miller, V. E. Sohns, G. F. Fanta and W. M. Doane, it is a base hydrolyzed starch-polyacrylonitrile graft copolymer which can absorb 600 to 900 grams of distilled water per gram of the copolymer [*Die Stärke* **29,** [12] 410-3 (1977)]. Cerium in the form of ceric ammonium nitrate plays a key role in the preparation of Super Slurper as it initiates graft polymerization of the various constituents. Recognized in 1975 as an IR-100 winner, Super Slurper has many potential applications including disposable diapers, surgical sponges, and soil additives.

NINE MORE AID RIC

Eight companies have renewed their support of the Rare-Earth Information Center and another company joined them for the first time during the third quarter of the 1979 fiscal year. Adding the nine companies listed below brings the number of RIC benefactors to date up to thirty-nine. The number in parentheses following each company is the number of years that company has supported the Center.

Allied Chemical Corporation, U.S.A. (7),
Bose Corporation, U.S.A. (2),
British Flint and Cerium Manufacturers, England (7),
Companhia Industrial Fluminense, Brazil (7),
General Electric Company, U.S.A. (4),
GTE Laboratories, Inc., U.S.A. (7),
Industrial Minera Mexico, S.A. (5),
Lunex Company, U.S.A. (9),
Pokmen Company, Hong Kong (1).

WELD FILLER

Research by R. S. Brown and J. B. Koch of the Carpenter Technology Corporation has resulted in the development of a solidification crack resistant weld filler metal for a stabilized fully austenitic alloy [*Welding Journal* **57**, [2] 38s-42s (1978)]. Holding the plate thickness, groove configuration, filler metal dimensions, feed rate and welding parameters all constant, the composition of the weld filler alloy, ER 320, was varied to determine the effect of various alloy components upon cracking. The elements studied were Nb, Ce + La, Si, P and Mn. In the first four cases, reduction of the element concentration resulted in reduction in the amount of weld cracking. Reduction of Mn content resulted in increased weld cracking. Based on this and other evidence from fissure bend and corrosion tests, the authors developed an experimental alloy within the composition range of: 0.025% max. C, 1.5 - 2.0% Mn, 0.10% max. Si, 0.010% max. P, 0.005% max. S, 19.5 - 21.0% Cr, 33.0 - 35.0% Ni, 2.0 - 3.0% Mo, 3.0 - 3.5% Cu, 8 x C min. - 0.35% max. Nb and 0.01% max. Ce + La which exhibited superior solidification cracking resistance and equal intergranular corrosion resistance to that produced from the use of ER 320.

Optical Spectra Overview

In *Optical Spectra of Transparent Rare Earth Compounds,* S. Hufner offers an elementary treatment of the major areas in the field of the spectroscopy of transparent rare earth solids. Different chapters are devoted to free ions, trivalent ions in the static crystal field, trivalent rare earth ions in a phonon field, energy transfer, magnetic interactions, hyperfine interactions, Jahn-Teller systems, divalent rare earth compounds: the europium chalcogenides, rare earths in glasses and rare earth lasers. The underlying physics of selected examples are explained and theoretical results are applied for the interpretation of experimental data. The optical spectra of the rare earths in transparent solids have become important in the investigation of magnetism, the Jahn-Teller effect and mixed valence states and this monograph presents, from the experimentalist's viewpoint, a timely overview of the most important findings in these areas. Published by Academic Press, New York in 1978, the book is 256 pages long and costs $24.00.

MM Paper Available

A paper entitled "Trends in the Use of Mischmetal" has been presented by I. S. Hirschhorn at the American Society for Metal's Advisory Technical Awareness Council Meeting held in September 1978 in Cleveland, Ohio for the purpose of examining new and emerging technology in the 1980-1985 time frame. The paper discusses current mischmetal uses and predicts increased usage in the future in the production of continuous cast steel, free-machining steel and rare earth-cobalt permanent magnets. Copies of the paper are available from the Ronson Metals Corporation, 45-65 Manufacturers Place, Newark, NJ 07105, U.S.A.

1978 IR-100

Two rare earth applications cracked the top 100 list of significant new technical products of 1978 as determined by *Industrial Research/ Development* magazine [**20**, [10]107-8 (1978)]. A brief description of the two products, both of which come under the energy and power category, are given below.

Alloys of the general formula $Ca_{1-x}MM_xNi_5$ (MM = mischmetal) have been developed by G. Sandrock, of the International Nickel Company, which can absorb and desorb large quantities of hydrogen at room temperature and moderate pressure. When compared with compressed gas cylinders, these alloys use 25% of the volume, 75% of the weight and less than 10% of the pressure to store an equivalent amount of hydrogen. Other advantages are greater safety and ease of recharging. Possible applications include fuel storage for hydrogen powered vehicles and hydrogen purification systems.

G. V. Brown of NASA-Lewis Research Center has developed a high efficiency practical magnetic heat pump which uses gadolinium as the working fluid in a regenerative thermodynamic cycle [also see *RIC News* **XI**, [4] 3 (1976)]. His invention makes magnetic cooling possible over a broad temperature range including room temperature. Possible applications include liquefaction of air and natural gas.

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