RARE-EARTH INFORMATION CENTER NEWS

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15th RARE EARTH RESEARCH CONFERENCE

Mother Nature provided both good news and bad news for the attendees of the Fifteenth Rare Earth Research Conference held June 15-18, 1981 at the University of Missouri in Rolla, Missouri. The good news was that above normal rainfall provided a lush setting for walking to and from the meetings, the canoe trip and the picnics. The bad news was a flooded basement in the Thomas Jefferson Dormitory, where many of the conferees resided, caused an electrical outage that reduced or eliminated some of the creature comforts like air conditioning, lighting and even running water for a time. Fortunately rare earthers are a hardy bunch so that other than a few five o'clock shadows appearing before five o'clock Monday afternoon no ill effects could be detected. One hundred and seventy individuals participated in the Conference representing 18 countries. Of particular note were the large groups from both France and the People's Republic of China. Over half of the states in the U.S. had at least one representative.

Chinese conferees at picnic.
Photo courtesy of E. Morrice

About 170 papers were presented in both oral and poster sessions under the general topics of spectroscopy, magnetic properties, bioinorganic chemistry, solid state structures, technology, organometallic chemistry, general chemistry, solid state thermodynamics, metals and hydrides, and general solid state. A real effort was made this year to increase the participation of chemists and industry and the organizers were generally pleased with the response from chemists (ahem, perhaps next time, industry).

Homeward bound.
Photo courtesy of J. C. Achard

The proceedings of the Conference will be edited by G. J. McCarthy, J. J. Rhyne and H. E. Silber and published as a book entitled *The Rare Earths in Modern Science and Technology, Volume 3* by Plenum Publishing Corporation. Information concerning the publication of the proceedings will be announced in the *RIC News* as soon as this information becomes available. A list of the papers presented at the Conference is available from RIC upon request.

A rather unusual situation developed at the Fifteenth Rare Earth Research Conference. Two different groups made similar experiments on the compound, deuterized Y_6Mn_{23}, and amazingly—the results did not quite agree. Apparently the deuterium sites in Y_6Mn_{23} are location dependent although it has not been determined if

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FRANK H. SPEDDING AWARD TO BUSCH

Professor Emeritus Dr. Georg Busch of the Laboratory of Solid State Physics, Swiss Federal Institute of Technology ETHZ, Hönggerberg, Zürich, Switzerland has been chosen by the Rare Earth Research Conference to receive the second Frank H. Spedding Award. The award was presented to Busch at the Fifteenth Rare Earth Research Conference held June 15-18, 1981 at the University of Missouri at Rolla, Missouri. Busch is considered to be one of the modern day rare earth pioneers in Europe having introduced rare earth physics and solid state chemistry into Switzerland. His inquisitive nature and broad-minded approach led to the founding of multidisciplined groups that could answer questions concerning the optical properties, photoemission, transport phenomena, magnetism and XPS spectroscopy of many rare earth materials. His work with ferroelectric and semiconductor materials led him to the ear-

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$$ 1982 $$

The first three months of Fiscal Year 1982 are now history. Hopefully this year will turn out to be like last year which started out slowly but finished strongly. Like last year, although the quantity of responses is not as large as we would like, the quality has been, for the most part, very good. So far fourteen companies have contributed to the support of RIC and they are listed below. Of the fourteen companies, thirteen have renewed their support and there was one new addition to our family of benefactors. The number in parentheses is the number of years that company has supported the Center.

A/T Products Corporation, U.S.A. (2)
Davison Specialty Chemical Co., Subsidiary of W. R. Grace & Co., U.S.A. (14)
Foote Mineral Company, U.S.A. (10)
Th. Goldschmidt AG, Germany (13)
Indian Rare Earths Ltd., India (13)
Kolon Trading Co. Inc., U.S.A. (9)
Molycorp, Inc., U.S.A. (14)
Nissho-Iwai, Japan (1)
Reactive Metals & Alloys Corporation, U.S.A. (5)
Ronson Metals Corporation, U.S.A. (14)
Santoku Metal Industry Co., Ltd., Japan (12)
Shin-Etsu Chemical Co. Ltd., Japan (12)
V/O Techsnabexport, U.S.S.R. (5)
Treibacher Chemische Werke AG, Austria (10)

Surface Phenomena

G. K. Wertheim has provided a brief review on the application of core electron x-ray photoelectron spectroscopy (XPS) to the study of surface phenomena in noble and rare earth metals [*Materials Science and Engineering* **42,** 85-90 (1980)]. XPS has been used to study the surface phase transition on samarium metal and the compound $YbAu_2$. The necessary conditions for this type of phenomena occur in a compound where the rare earth is in the higher of two possible valence states and the empty 4*f* level lies close to the Fermi energy. Core electron XPS provides a window to the surface physics in these materials and should reveal similar rare earth compounds in the future.

MERITORIOUS AWARD

H. Nagai has received the Meritorious Honor Award of the Japan Institute of Metals in 1981 for his research efforts. Nagai obtained his Doctorate of Engineering in Metallurgy in 1971 from Osaka University and held the position of Lecturer in the Department of Materials Science and Engineering, Faculty of Engineering at Osaka University since 1971. In 1974 he held a post-doctoral position at the Ames Laboratory, Iowa State University, after which he returned to Osaka University where he currently holds the position of Associate Professor. Nagai's rare earth interests have taken shape in the form of research on the electrolytic preparation of rare earths, particularly gadolinium and yttrium, and the role of rare earths in improving the high temperature oxidation resistance of iron-20% chromium alloys.

IRON AND STEEL

Citing the need for a single reference that both describes the underlying fundamentals of desulfurization and uses these fundamentals to explain the desulfurization techniques currently in use, W. G. Wilson and A. McLean have written a book entitled *Desulfurization of Iron and Steel and Sulfide Shape Control*. Published in 1980 by the Iron & Steel Society of AIME, Warrendale, Pennsylvania, the book is 161 pages in length and costs $40.00 ($20.00 for AIME members).

Rare earths appear almost continuously throughout the book in discussions on the general aspects of sulfur behavior and removal from metals, alloys, compounds and slags, desulfurization techniques for iron and steel, and inclusion shape control. In treating inclusion shape control, the authors address the effect of inclusions on the Charpy V-notch energy, improvements in toughness, composition and morphology of inclusions, reoxidation effects, hydrogen tolerance and relative costs for desulfurization and shape control. An appendix contains twelve technical papers reprinted from the literature that deal with desulfurization and sulfide shape control.

Sm Confirms Lu Diet

Samarium (like many of us) has had a weight problem since 1969. In 1955, Sm's atomic weight was listed as 150.35 but in 1969 it was revised upward to 150.4±0.1. Hearing of lutetium's success with a high *proton* diet [*RIC News* **XII,** No. 4, 2 (1977)], Sm decided to give it a try. Amazingly the 1979 report of the International Union of Pure and Applied Chemistry, [*Pure & Appl. Chem.* **52,** 2349-84 (1980)], shows Sm checking in at a svelte 150.36±0.03! As more samarium applications come on line the weight savings may be substantial (maybe not).

Monazite Standard

New analytical data have been obtained for the Institute of Geological Sciences (IGS) monazite sample, IGS 36, according to B. Lister of the Geochemistry and Petrology Division of IGS [*Geostandards Newsletter* **5,** No. 1, 75-81 (1981)]. As many as eleven laboratories reported their analyses of the monazite and these data were further analyzed to determine the accepted standard values for individual rare earths, thorium and uranium concentrations, total rare earth oxide concentration and total rare earth and thorium oxide concentrations. The types of analysis employed in the study were gravimetry, volumetry, colorimetry, polarography, electrolysis, atomic absorption spectrometry, emission spectrometry, x-ray fluorescence and neutron activation analysis. The monazite used in the study was supplied by Associated Minerals Consolidated Limited, Australia.

Spedding Award

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ly realization that even the most accurate measurements were useless unless they were made on well characterized materials. His contributions to solid state chemistry in both growing and characterizing single crystals of rare earth materials are an outgrowth of this realization. As the Frank H. Spedding Award signifies, perhaps his most important contribution has been the inspiration, encouragement, and model of perseverance in scientific research that he has given to his students and colleagues alike.

Superconductors

The proceedings of the International Conference on Ternary Superconductors, held September 24-26, 1980 at Lake Geneva, Wisconsin, has been published as a single hard cover volume entitled *Ternary Superconductors,* G. K. Shenoy, B. D. Dunlap and F. Y. Fradin, eds., North-Holland, New York (1981). The book is 322 pages long and costs $49.50. Outside the U.S. and Canada the cost is $63.00.

Over 72% of the 61 papers deal with rare earth compounds. The general topics covered include structure of cluster compounds, properties of Chevrel phase compounds, properties of ternary borides, new classes of ternary compounds and theory of coexistence of superconductivity and magnetism. The questions and comments that followed each presented paper are also included in the proceedings.

For easy access to information the book contains compound, author and subject indices and a list of conference attendees with their addresses.

Rare Earth Symposium

A symposium on the rare earths has been scheduled for November 9-11, 1981 at the University of Saõ Paulo, Saõ Paulo, Brazil. The symposium is sponsored by the Saõ Paulo Academy of Sciences and will cover topics which include recovery and separation of the rare earths, coordination chemistry, spectroscopy, general properties and applications. For more information contact Professor G. Vicentini, University of Saõ Paulo, C.P. 20780, Saõ Paulo, Brazil.

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GALVANIZATION

The International Lead Zinc Research Organization, Inc. (ILZRO), a cooperative research arm for lead and zinc mines and smelters throughout the world, has announced research on the use of a zinc-aluminum-mischmetal alloy for galvanizing steel. The types of steel treated included rimming steel, concast steel and aluminum-killed steel. Eight steel companies, Ziegler, Maubeuge, Usinor, Arbed, Stelco, New Zealand Steel, Cockerill and British Steel, participated in the test which found the mischmetal-doped alloy exceeding conventional galvanizing materials in performance criteria that included corrosion resistance, ductility, weldability and paintability. The new alloy also showed excellent edge and scratch protection.

Ion Stabilization

D. E. Hobart, K. Samhoun, J. P. Young, V. E. Norvell, G. Mamantov and J. R. Peterson have been successful in stabilizing praseodymium(IV) and terbium(IV) in aqueous carbonate solution [*Inorg. Nucl. Chem. Letters* **16,** 321-8 (1980)]. The absorption spectra of the tri- and tetravalent species and the oxidation potentials of the R(IV)/R(III) couple were also measured. Similar results were obtained when praseodymium and terbium were oxidized both electrolytically and chemically with ozone. To stabilize the IV state the solution had a hydroxide ion concentration of about one molar. A very practical application which is already being used for cerium(IV) would be the separation of praseodymium(IV) and terbium(IV) from the trivalent lanthanides.

15th RERC

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the latitude contribution is more important than the longitude effect. The two groups have agreed to exchange samples so, hopefully, by the time the next conference rolls around these effects will be clearly defined.

Ah yes, the next conference has tentatively been set for April 1983 at Florida State University in Tallahassee, Florida. G. R. Choppin has been selected as the chairman for the 16th Rare Earth Research Conference. Hope to see you all there!

Hume-Rothery Award

A. R. Miedema has been named as the recipient of the 1981 William Hume-Rothery Award. Created in 1972 by the Metallurgical Society of AIME, this annual award honors an outstanding scientific leader for scholarly contributions to the science of alloys. Miedema is being cited for his ingenious empirical model that allows the thermodynamic properties of alloys to be determined with great facility from the characteristics of the constituents.

Miedema received his Ph.D. in physics from Leiden University in 1960 and then joined the staff there working on various studies all of which were conducted at temperatures below 1 K. From 1964 to 1971 he was a professor in experimental physics at the University of Amsterdam. In 1971 he joined the Philips Research Laboratories, Eindhoven, where he is currently the director of research. Current research interests include the quantitative prediction of energy effects in metal physics and metallurgy. Application of Miedema's model to rare earth materials has shown excellent agreement with experimental observations.

Axle Steel Treated

Having previously studied the effects of rare earths on improving the impact strength of rail steels, S. K. Kang and K. V. Gow decided to examine the effect of rare earths on the fatigue strength of axle steel [*Metallurgical Transactions A* **12A,** 907-10 (1981)]. The only difference in the microstructure of the treated versus untreated steel was the round shape of the rare earth inclusions instead of ellipsoid or rod-like inclusions. No appreciable change was observed in either tensile strength or impact strength however the fatigue strength of the rare earth-treated axles was significantly higher than the conventional steel. The actual improvement mechanism is not completely understood but it was noted that the rare earth inclusions were less active in both crack initiation and propagation than untreated inclusions.

BUSINESS NEWS

More Catalysts

W. R. Grace's Davison Chemical division has announced three projects designed to expand their cracking catalyst additive manufacturing facilities. Curtis Bay, Maryland, Lake Charles, Louisiana, and South Gate, California, have been chosen for the multimillion dollar additions. Start-up is scheduled for early 1982.

Nationalization, New Plant, Newsletter

The title indicates three very different subjects but the thing that brings them together here is Rhone-Poulenc, France's leading chemical company. As such, it has been named by French Prime Minister Pierre Mauroy as one of the eleven companies slated for nationalization under France's newly elected government. Even before nationalization Rhone-Poulenc was undergoing a major restructuring program to shift the emphasis of its product line. That brings us to the new rare earth separations plant under construction in Freeport, Texas. This plant will double Rhone-Poulenc's capacity to produce separated rare earths. First phase operations are expected to be online towards the end of 1981. More information about the plant may be obtained from a small newsletter entitled the Rhone-Poulenc Freeport Report. Copies are available from: Mr. J. Spooner, Rhone-Poulenc Inc., Box 125, Monmouth Junction, New Jersey 08852.

Wilhelm Klemm Honored

Déjà vu? Yes, sort of. In the June 1981 issue of the *RIC News* we reported that *Angewandte Chemie* had published a special issue dedicated to Professor Klemm on the occasion of his 85th birthday. It has since come to our attention that the *Journal of the Less-Common Metals* has also published a special issue, volume **76,** number 1/2 (1980), in honor of Professor Klemm. Nine of the thirty-one articles deal with various rare earth materials including iodides, fluorides, oxyfluorides, sulfides, ammonium complexes and alloys and intermetallic compounds of the rare earths with palladium, ruthenium and magnesium. Topics include preparation, thermal expansion, magnetic susceptibility, valence behavior and phase relationships.

NUCLEAR WASTE

The proceedings of a workshop to summarize advanced activities and formulate requirements of nuclear waste disposal for the future, which was held May 13-15, 1980 at Gatlinburg, Tennessee, have been published. Entitled *Alternate Nuclear Waste Forms and Interactions in Geologic Media*, the proceedings were edited by L. A. Boatner and G. C. Battle, Jr. and published in 1981. The length of the paper-bound volume is 387 pages. Copies are available from the National Technical Information Service, 5285 Port Royal Road, Springfield, Virginia 22161, for $20.00 (microfiche: $3.50). While the entire proceedings are of general interest to rare earthers, five of the twenty-five presented papers deal with the incorporation of wastes in naturally occurring materials like the mineral monazite. The long term stability of monazite in geological environments has been reported to be 10^9 years which makes it and its analogs some of the most promising candidates for long term nuclear waste storage.

Valence Fluctuation

Valence fluctuation phenomena are the subject of a review by J. M. Lawrence, P. S. Riseborough and R. D. Parks [*Reports on Progress in Physics* **44,** 1-84 (1981)]. The authors present a relatively thorough review of both the experimental and theoretical aspects of the valence fluctuation problem. Experimental properties covered include phase diagrams for the valence transitions, magnetic ordering, thermodynamic and transport behavior, spectroscopic behavior, Fermi liquids and common extrinsic effects. Theoretical topics include approximate solutions for the ground state, charge and spin fluctuations, the electron-phonon, electron screening and magnetic interactions, double exchange, the Kondo lattice, valence transitions and the essentially localized model.

R_2M_{17} Magnet Future

R. W. Lee has examined many of the factors that will eventually decide the future applicability of rare earth-transition metal 2:17 permanent magnets [*J. Appl. Phys.* **52,** 2549-53 (1981)]. The development of the 2:17 compounds is briefly reviewed. The state-of-the-art is examined highlighting both the advantages of the 2:17's such as lower cobalt content, better Curie temperature and saturation magnetization and the disadvantages, primarily low coercivity. New avenues including 1:7 and 2:15 stoichiometries, zirconium or magnesium substitutions, and precipitation hardening mechanisms are examined. The author concludes that only in applications where a design absolutely requires use of the highest energy product magnet available, i.e. material and manufacturing costs are only a secondary consideration, will the use of rare earth cobalt permanent magnets go unquestioned. In all other cases the 1:7, 2:15 and 2:17 stoichiometries with substitutions for both cobalt and samarium will have to compete with less costly alternatives.

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