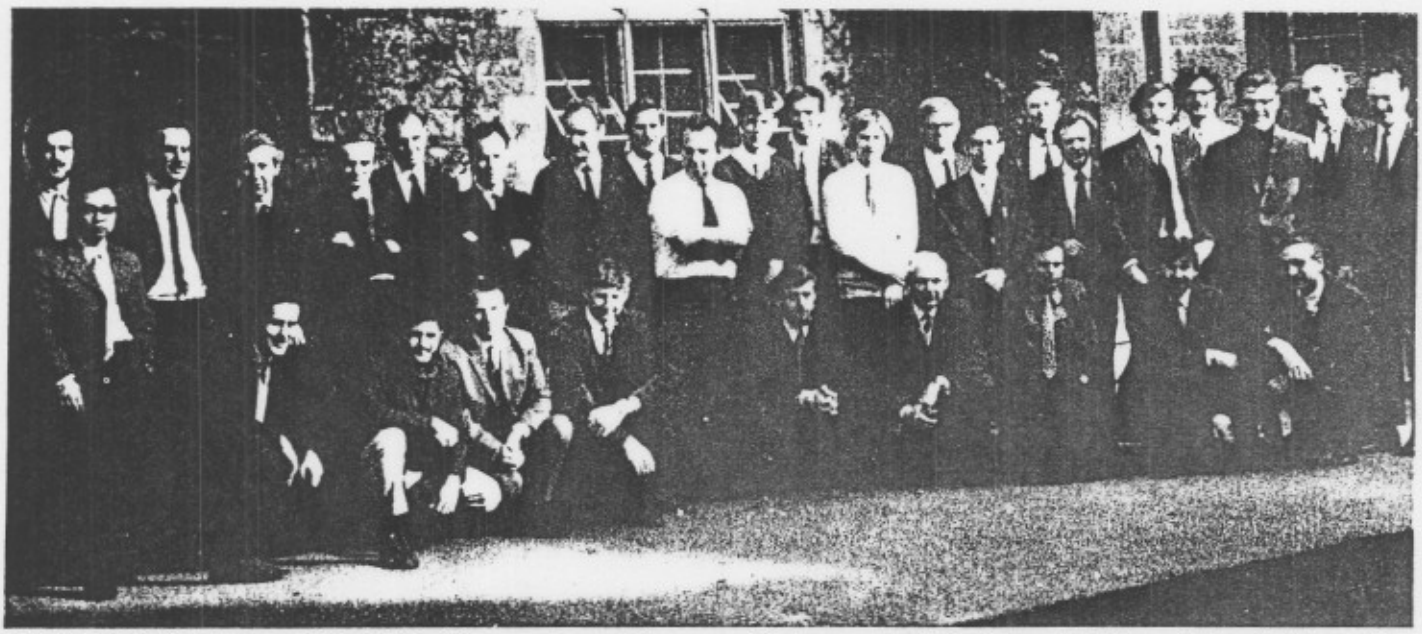
RARE-EARTH INFORMATION CENTER NEWS

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

Volume VII | September 1, 1972 | No. 3

Diversity Marks United Kingdom 4f Group



MARCH MEETING—Members of the British 4*f* group who posed for this group portrait at their March 1972 meeting. Standing from left are A. P. Young, Oxford; H. Fujimora, Loughborough; M. T. Hutchings, Harwell; B. Bleaney, Oxford; M. Whittaker, Metals Research, Ltd.; J. Crangle, Sheffield; J. Hunter, Durham; S. B. Palmer, Hull; J. Liesegang, La Trobe; K. N. R. Taylor, Durham; D. Melville, Southampton; F. A. Wedgwood, Harwell; K. Robinson, Oxford; P. Mattocks, Southampton; T. Egami, Sussex, I. R. Williams, Southampton; M. G. Hall, R. Levi and R. Jordan, all of Birmingham; H. Zijlstra, Philips, Eindhoven; W. E. Gardner, Harwell; and J. P. Jakubovics, Oxford. Kneeling from left are D. E. G. Williams, Loughborough; A. Nayyar, Imperial College; K. E. Davies, Rare Earth Products, Ltd.; J. B. Forsyth, Harwell; R. D. Greenough, Hull; W. D. Corner, Durham; M. S. S. Brooks, Portsmouth; E. W. Lee, Southampton; and D. M. S. Bagguley, Oxford. Photo courtesy of D. W. Jones, a group member from the Centre for Materials Science, The University of Birmingham.

British research workers who are directly interested in the rare earth metals collaborate as a coordinated, loosely organized group supported by a small grant from the Science Research Council (U.K.). This financing arrangement has proved to be a flexible and outstandingly successful method of encouraging cooperative effort in a field rapidly growing in importance. The close interaction of individual researchers resulting from this project has given rise to a stimulating association in which new and creative ideas can be discussed and encouraged from the initial stages. In addition, the range of interests of cooperating members is sufficiently wide that together they can develop projects of potential value.

An essential feature of the group's activities is the annual meeting held each March in Oxford. At this meeting, general policy is determined, new experiments are proposed and current work is reviewed. On these occasions workers carrying out the actual physical measurements can discuss their problems among themselves, with their colleagues from

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RIC FINANCE$

At the time this issue goes to press 20 producers, traders, mining companies and advanced technology corporations from all over the world have contributed or pledged to contribute to the support of RIC during the July 1972–June 1973 fiscal year. These companies are listed below. The number in parenthesis behind each contributor's name indicates the number of years that firm has supported RIC, including the current fiscal year.

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RIC Finances
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Cometals, Inc., U.S.A. (1)
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Indian Rare Earths, Ltd., India (4)
Leico Industries, Inc., U.S.A. (4)
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Michigan Chemical Corp., U.S.A. (3)
Mobil Research and Development Corp., U.S.A. (2)
Molybdenum Corporation of America, U.S.A. (5)
Rare Earth Products, Ltd., England (1)
Reactor Experiments, Inc., U.S.A. (3)
Ronson Metals Corp., U.S.A. (5)
Treibacher Chemische Werke, Austria (1)
United States Radium Corp., U.S.A. (3)

In addition to the above list of contributors, we (the staff) wish to acknowledge the Ames Laboratory of the U.S. Atomic Energy Commission and Iowa State University's Institute for Atomic Research for underwriting our indirect costs and paying a small fraction of direct costs.

In the past few years we have been attempting to increase industrial contributions to cover all of our direct costs. We are proud to note that many of our faithful benefactors have made substantial increases (as much as 80%). Furthermore, many other companies have responded favorably to our plea for help and have joined the

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M^3 Conference

D. Graham, Jr. and J. J. Rhyne, eds. (American Institute of Physics, New York, 1972) $17.50. The proceedings were formerly published in the March issue of the *Journal of Applied Physics.*

Many topics of interest to rare earthers were discussed at the meeting. Invited papers covered 1. technologies for memory heirarchy, 2. permanent magnet materials and applications, 3. magnetic recording, 4. bubble domain physics and materials, and 5. magnetic levitation of high-speed trains and magnetic filtration. Magneto-optics and spectroscopy of the rare earth garnets, NMR of intra-rare earth alloys, magnetic oxides, critical phenomena, and magnetic structure of various rare earth compounds were topics of contributed papers.

NASA Honors Haskin


Haskin

Prof. Larry Haskin, University of Wisconsin, has received the National Aeronautics and Space Administration (NASA) Exceptional Scientific Achievement Medal for developing rare earth chemistry for studying igneous processes on earth and the application of these techniques to lunar samples resulting in a better understanding of the geochemistry of the moon.

For the past two years Dr. Haskin has served on NASA's 12-member Lunar Sample Analysis Planning Team, which advises NASA on maintaining the scientific integrity of lunar samples and on their allocation to investigators.

Rare Earths

introduced by Alloy Metals Inc. The lanthanum addition enhances wettability and provides both a gettering and grain refining action. The two alloys, available in either powder or tape form, are said to be applicable to join many different base metals from very thin foils to thick sections and to be ideal for wide gap brazing. Cost savings are realized because they can be used where more costly gold and silver alloys have been traditional.

CERIUM DECOLORIZERS

Flint glass container plants are rapidly embracing a cerium decolorizing process first introduced in mid-1970. About 25% of the U.S. plants have adopted the cerium system that reduces glass decolorizing costs by as much as 50%. The new system eliminates completely the usage of arsenic and substantially reduces the amounts of selenium, cobalt and other costly decolorants. As with most rare earth uses, a little goes a long way; about 0.01% cerium is utilized in the decolorizing process.

MORE MAGNETS

Researchers at the University of Dayton have discovered that a series of Sm (or Pr) - Co com-

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RIC News
Vol. VII, No. 3 September 1, 1972

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

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Second-Class postage
paid at Ames, Iowa.

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Magnetism Review

J. J. Rhyne and T. R. McGuire have emphasized current experimental results in relation to available theory in their review of the magnetic properties of rare earth elements, alloys and compounds, *IEEE Trans. Magnetics* MAG-8, 105-130 (1972).

Bulk magnetic measurements and related transport phenomena are discussed for a variety of materials including the rare earth metals, intra-rare earth alloys, ionic compounds such as the pnictides, chalcogenides and halogens, solid solution systems including magnetic semiconducting and insulating compounds, intermetallic compounds, and bubble domain materials. Tables present crystal structures, magnetic ordering temperatures, magnetic transition temperatures and paramagnetic Curie points for the materials discussed.

The authors give an over-all view of rare earth compounds, classifying them according to structure and magnetic properties. Topics covered include exchange interactions, magnetization processes, crystal field effects, magnetostriction, spin structures and their field dependence, optical effects and the effect of magnetic order on specific heat, resistivity, Hall effect, thermal conductivity and other properties.

Rare Earths in the News

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pounds doped with Fe–R_2 ($Co_{1-x}Fe_x)_{17}$–have energy products exceeding 60 MG and Curie temperatures greater than 600°C. These materials appear to be more promising as permanent magnets than the familiar RCo_5 compounds.

AUTO EXHAUST CATALYST

$Nd_{1-x}Pb_xMnO_3$, $PrCoO_3$ and similar compounds may be promising substitutes for platinum catalysts in the treatment of auto exhaust. Results announced by Bell Laboratories show that the RE compounds were more active than the commercial Pt catalyst in the conversion of CO to CO_2 and compared favorably in lifetime.

SCANDIUM COORDINATION CHEMISTRY

Most of the work on the coordination chemistry of scandium has been reported only during the last few years. The earlier lack of attention was caused by the difficulty of obtaining pure scandium. G. A. Melson and R. W. Stotz have thoroughly reviewed the research in this area in *Coord. Chem. Rev.* 7, 133-160 (1971).

In this review the coordination chemistry is discussed according to the nature of the donor ligand–neutral oxygen donor ligand, β-diketonates, carboxylates, alcoholates, hydroxyscandates, ammonia, primary, secondary and tertiary amines, complexes with both oxygen and nitrogen donor ligands, halide complexes and other miscellaneous complexes. The preparation and stability of the complexes as well as spectral and crystal data defining the coordination and stoichiometry of the complexes are presented. The authors point out the unusual scandium species such as some eight-coordinate complexes and one of the few paramagnetic compounds, Sc (bipyridyl)$_3$. In comparing the scandium complexes with the corresponding lanthanide complexes, the authors note that the size of the Sc ion is important in determining the stoichiometry and relative stability of the species formed.

The next few years, say the authors, will see a large increase in the number of scandium complexes synthesized including species containing Sc in oxidation states other than three and organoscandium compounds. However, physical measurements and structural characterization of existing species are still needed to resolve questions of stereochemistry, mode of bonding and stability.

CORRECTION

The form on p. 3 of some issues of the March *RIC News* listed the year of the 10th RE Conference as 1972 instead of 1973.

Sc Film Tuners

Scandium thin film targets are reported to be useful in tuning the primary beam of an ion microprobe, J. W. Guthrie and R. S. Blewer, *Rev. Sci. Instr.* 43, 654-655 (1972).

Spatial uniformity of the primary beam of an ion microprobe is important for surface and thin film analysis. Thin films of scandium metal, prepared by vacuum sublimation of Sc onto a polished sapphire substrate, show an immediate and striking color change when bombarded by energetic ions. The colored area, which reveals the position, shape and size of the beam and its current density uniformity, is much brighter and sharper than that of fluorescing KBr, commonly used as a tuning sample. Moreover, the spots or tracks resulting from various tuning parameter changes remain undegraded after the beam is removed allowing a photographic record to be made.

La Stimulates Crystal Growth

The growth of thinner elongated SiC crystals is enhanced by the presence of La_2O_3. The growth rate increases in the longitudinal direction and decreases in the transverse direction, according to G. Verspui, W. F. Knippenberg and G. A. Bootsma, *J. Crystal Growth* 12, 97-105 (1972).

The effect was found to be dependent on the temperature and amount of La_2O_3 present. The critical temperature for a few grams of La_2O_3 was 2450°C. Below this temperature normal, platelike crystal growth occurred and above this temperature no growth occurred.

Other rare earths in the form of oxides, chlorides, carbides or silicides also changed the growth mode of SiC.

Welcome New RIC Subscribers

During the past few months we have made a massive mailing to scientists and engineers who have published work on rare earth materials. As a result our *RIC News* family has grown from about 1800 to 2400–welcome aboard. We hope our new readers will find the *RIC News* informative, interesting and useful. You can help make it timely by sending us information about new developments you are involved in, and even sending a contribution to our feature "Rare Earthers Around the World."

Reprints of your publications are essential to keep us informed and to help us answer information inquiries. If you need some help let us know–we will do what we can to assist you.

RIC SYMBOL

Many of our new readers, and even some of our old ones, may be intrigued by the RIC symbol. It is apparent that the rare earths are arranged in the two arms of the triangle in descending order according to the number of unpaired 4*f* electrons. The remainder of the symbol may not be as obvious, so we have reprinted the following from the first issue of the *RIC News*, May 1, 1966:

No doubt you alchemy buffs may be wondering, "Is the history of the discovery of the rare earths, as recorded in our texts, wrong? Did the alchemists know about these 'unusual soils' centuries before Lt. Arrhenius' discovery in 1787?" No, we at RIC must confess we did not make a new find in the history of the discovery of the rare earths.

The truth is, we took poetic license and combined the alchemist's symbol for earth, "terra," (an inverted equilateral triangle with a cross bar) with the Latin word for rare *(rarus)* to generate the symbol we have incorporated into our letterhead and brochure.

U. K. 4*f* Group

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theoretical physics, and with the teams whose effort is directed towards the production of high purity materials and good quality crystals. The personal contacts established at these meetings and the freedom of discussion encouraged by their informal atmosphere has enabled the separate research teams, from widely different locations in the United Kingdom, to work together with mutual understanding and sympathy. These meetings have also provided opportunities for visiting colleagues from abroad to meet with their friends in the United Kingdom. Two recent and welcome guests from the United States were Professors Sam Legvold and S. H. Liu from Iowa State University.

ACS Award to Mooney

Mooney

Richard W. Mooney, vice president and general manager of GTE Sylvania's Chemical and Metallurgical Division, has won the 1972 Eugene C. Sullivan Award presented by the Corning Section of the American Chemical Society. Dr. Mooney was cited for his outstanding achievements in chemistry and industry.

Mooney's research has included work in lamp phosphors and fundamental process variables involved in phosphor manufacture, including those of the rare earth series.

Improved IR Quantum Counter

Measurements conducted on oxygen-fired $CdF_2:Er^{+3}$ indicate that this material could be used to construct an uncooled infrared counter having a minimum detection power of 3.6×10^{-14} W at 1.53 μm, which is appreciably better than the currently available detectors sensitive at this wavelength. These results were reported by N. E. Byer, T. C. Ensign and W. M. Mulaire, *Appl. Phys. Letters* 20, 286-288 (1972).

The green radiative efficiency of CdF_2 single crystals doped with 0.1 mol% ErF_3 was increased from 1.9 to 52% by selective generation of trigonal (C_{3v}) symmetry at the Er ions by oxygen compensation. This was accomplished by firing at 800°C for 20 h in dry oxygen.

RIC Finances

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RIC family of supporters. These actions have brought us closer to our goal–but we still have not reached it.

Perhaps you can help us reach our goal. Many companies have funds to support professional and scientific activities, while others consider their contributions to RIC as part of their advertising expenses. If you think your company can help, please write us–we will be glad to pursue the matter further. Contributions to the Center range from about $100 to well over $1000–any contribution large or small is deeply appreciated.

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