

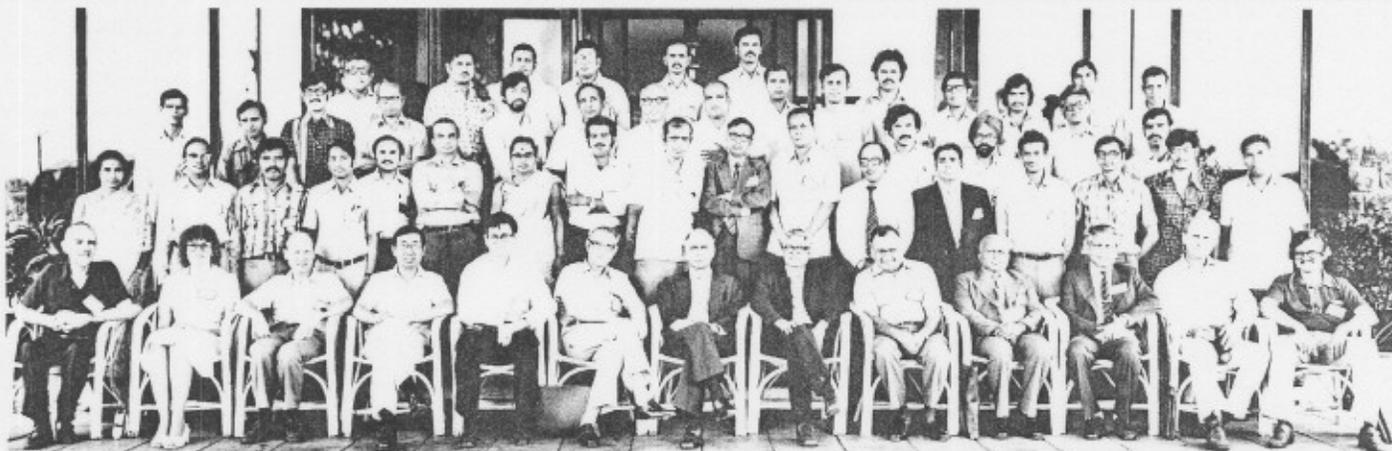
RARE-EARTH INFORMATION CENTER NEWS

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

Volume XV

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No. 2



Sitting: (L to R) R. S. Craig, C. Zinsser, K. A. Gschneidner, Jr., S. H. Liu, J. J. Rhyne, W. E. Wallace, M. A. Hadi, E. C. Subbarao, K. J. Strnat, B. P. Nair, T. K. S. Murthy, L. Eyring, G. Shenoy; **Standing 1st Row:** T. A. Padmavathy Sankar, K. P. Gopinathan, C. S. Menon, V. Ramakrishna Rao, T. G. Ramesh, R. Vijayaraghavan, M. Bose, P. N. Mohan Das, V. S. Arunachalam, C. V. Sundaram, G. S. Rao, G. K. Kelkar, S. G. Patil, G. V. Subba Rao, E. M. T. Velu, N. R. Bonda, G. Venkateswaralu; **Standing 2nd Row:** R. A. Tewari, A. Jain, R. Narayan, L. C. Gupta, A. K. Singh, S. Ramachandran, K. P. Gupta, D. B. Sirdeshmukh, H. S. Maiti, P. Ganguly, D. Bahadur, S. Singh, J. Gopalakrishnan, V. Rajasekharan Nair; **Standing 3rd Row:** M. Multani, S. H. Ghude, C. K. Gupta, T. S. Radhakrishnan, J. Chacko, P. K. Radhakrishnan, Y. N. S. Pillai, S. K. Malik, R. D. Kambalkar, T. S. Krishnan, T. V. Swaminathan.

RARE EARTHS IN INDIA

The editor was privileged to be a member of the nine man scientific delegation from the United States to attend and participate in the *Indo-U.S. Conference on Science and Technology of Rare Earth Materials* which was held in Cochin on March 3-8, 1980. Cochin is a sea port on the west coast near the southern tip of India. The fact that the main plant of Indian Rare Earths Ltd is located near Cochin in Udyogamandal was one of the reasons for the Conference being held in this local. Also the availability of a convention center—the Ambalamedu House of FACT (Fertilisers and Chemicals Trv.), located on an island amid the beautifully wooded hills a few kilometers outside of Cochin—was another important consideration. After the Conference many members of the U.S. delegation visited (separately) various universities, institutes of technology or science and research institutes throughout India.

The Indian delegation was 56 in

number and came from all parts of India. The twofold purpose of the Conference was to discuss the science and technology of rare earth materials and to identify possible areas of collaborative work between the scientists and engineers of the two countries. The first goal was easily realized with 20 review presentations (11 U.S. and 9 Indian) and 15 contributed talks and 11 poster presentations (all by the Indian scientists). The second goal was also achieved by laying the foundation in a few areas for cooperative joint research.

The contributed review papers were (listed in order of presentation): W. E. Wallace—surface chemistry and catalysis, C. K. Gupta and T. K. S. Murthy—extraction, K. A. Gschneidner, Jr.—preparation and purification of metals, J. J. Rhyne—amorphous alloys, R. Vijayaraghavan—nuclear magnetic resonance, E. C. Subbarao—superionic conductors and ferroelectrics, S. H. Liu—electron structure, L. C. Gupta—

valence fluctuations, S. K. Malik—crystal fields, R. S. Craig—hydrides, G. K. Shenoy (U.S.)—Mossbauer effect, Rhyne—neutron scattering, M. B. Maple—superconductivity and ferromagnetism, C. N. R. Rao—photoelectron spectroscopy, L. Eyring—defect structures in oxides, V. S. Arunachalam and S. Ramachandran—steel technology, K. Strnat—permanent magnets, K. P. Gupta—phase equilibria in R-Co systems, Gschneidner—phase relationships and alloy theory, and T. G. Ramesh—high pressure studies. All of the review papers will appear in a volume edited by E. C. Subbarao and W. E. Wallace. The availability, price, etc. will be announced by RIC as soon as this volume is published.

Much of the success of this Conference was due to the efforts of Prof. E. C. Subbarao, Conference Chairman, and his committee. The local arrangements and assistance of the staff of Indian Rare Earths were deeply appreciated, especially by the American delegation.

After the Conference the editor vis-

(continued on page 6)

CONTRIBUTORS

Five companies renewed their support of RIC during the fourth quarter of fiscal year 1980. This brings the total number of companies that contributed to the support of the Center to 44, 43 of which are sustaining members and one new company. All things considered, it was a good year for RIC and for the rare earth industry. This quarter's companies are listed below. The number in parentheses is the number of years that company has supported the Center.

Atomergic Chemetals Corp., U.S.A. (8)

Bose Corporation, U.S.A. (3)

Companhia Industrial Fluminense, Brazil (8)

GTE Sylvania, U.S.A. (8)

Industrial Minera Mexico, S.A. (6).

Working the bugs out. . .

or working out with the bugs is what R. S. Wilcox has been doing with the help of small samarium cobalt permanent magnets [*Science* 206, 1325-1327 (1979)]. Wilcox was studying the different modes in which the insect called the masked water strider (*Gerris remigis*) communicates. Apparently the male of the species can send both a high frequency (>90 waves per sec.) and a low frequency (3 to 10 waves per sec.) surface wave signal by vertical oscillations of its forelegs. The female of the species can only generate the low frequency signal. Wilcox was specifically studying whether or not the male masked strider can determine the sex of other water striders solely by the presence or absence of the high frequency signal. To accomplish this he glued a small samarium cobalt permanent magnet to the foreleg of a female water strider and then encircled the encounter area with a wire coil. Electromagnetic fluctuations from the wire coil caused vertical oscillation of the magnet to imitate the high frequency signal of the male. Wilcox found that when the magnet was activated the male water strider treated the female water strider as if it were another male thus confirming his hypothesis. Unfortunately this disproves the belief, held by many rare earthers, that samarium cobalt magnets can attract anything.

Laser Glass Handbook Compiled

Neodymium-doped laser glass spectroscopic and physical properties have been compiled by S. E. Stokowski, R. A. Saroyan, and M. J. Weber [*Lawrence Livermore Laboratory (LLL) Report No. M-095* (November 1978)]. The compiled data have resulted from the ongoing research at LLL and other laboratories to determine the suitability of different neodymium-doped glasses for use in fusion lasers. The types of glass examined are silicate, phosphate, fluorophosphate, fluoroberyllate, borate, borosilicate, and miscellaneous. Data sheets for each glass consist of a composition diagram and table, a range of linear and nonlinear refractive indices and dispersion, and emission cross section and peak emission wavelength. The properties of a glass versus systematic composition variation are also illustrated if they have been studied.

The authors did not intend for this to be a comprehensive listing but instead have concentrated on the effects of different glass network-former and network-modifier ions on the optical properties of Nd³⁺; compositional series in which a single modifier ion, such as an alkali or alkaline earth, was varied; and specific compositional regions, to achieve a low nonlinear refractive index, a large or small stimulated emission cross section, and high energy storage.

Over 200 copies of the handbook have been distributed throughout the world to laboratories and researchers who are working with neodymium-doped laser glasses. The handbook will be updated semi-annually with additional and/or replacement pages as new data become available.

Proceedings Published

The Proceedings of the International Conference on Neutron Scattering and Magnetism, August 29-31, 1979 Julich, Federal Republic of Germany has been published in the *Journal of Magnetism and Magnetic Materials*, 14, 105-350 (1979). The Proceedings contain 64 papers on the topics of band magnetism, low dimensional systems, magnetic phase

(continued on page 5)

Dy Traces Pollution

W. D. Loveland has completed a study in which he has demonstrated several advantages of using a dysprosium diethylenetriamine pentaacetic acid (DTPA) complex as a river pollution tracer [Water Resources Research Institute-59 (July 1978)]. The Dy complex was introduced into the final effluent tank of a municipal sewage treatment plant which discharges directly into the river. Samples of river water at different locations in the river were then taken and analyzed for Dy tracer content. The use of Dy-DTPA complex circumvents two objections to methods currently being used, namely 1) the release of radionuclides into the environment and their long term (real or imagined) hazards and 2) the fact that there is no water discoloration as is the case when dyes are used. Other advantages include ease of analysis, detection sensitivity, non-interference of pollutants with analysis, low natural concentration of Dy in sediment and water, minimal adsorption on sediments, and the ability to "fingerprint" each source with a fixed ratio of tracer elements. Furthermore, Dy-DTPA is cost competitive. Loveland's results could indicate an increased involvement of the rare earths in the fight against water pollution.

Crystal Field Meeting

The Polish Academy of Sciences is sponsoring the IV International Conference on Crystal Field and Structural Effects in *f*-electron Systems, to be held September 22-25, 1981 in Wroclaw, Poland. The program will consist of invited and contributed talks concerned primarily with metallic and semimetallic materials. Papers dealing with nonmetallic materials will be considered for presentation. English is the recommended language and the program, abstracts, and proceedings will be printed in English. For more information contact the Institute for Low Temperature and Structure Research, Polish Academy of Sciences, 50-950 Wroclaw, P.O. Box 937, Poland, preferably by August 1, 1980.

15th Rare Earth Research Conference

The 15th Rare Earth Research Conference will be held at the Rolla campus of the University of Missouri on June 15-18, 1981. Rolla (gateway to the beautiful Ozarks) is located 100 miles southwest of St. Louis on Interstate 44. Public transportation is available from St. Louis to Rolla.

The program will include the following major topics: General and Analytical Chemistry, Solutions and Solvation, Biochemistry, Geochemistry, Spectroscopy, Metallurgy, Crystal Growth, Intermetallic Compounds, Phase Studies and Diagrams, Solid State Physics, X-ray Diffraction, Neutron Scattering, Magnetism, Thermal and Transport Properties, Surface and Interface Phenomena, Rare Earth Technology, Industrial Processes, Uses and Applications.

The second Frank H. Spedding Award for excellence in research and leadership in rare earth science and technology will be bestowed at this meeting. For more information see the article entitled "2nd Frank H. Spedding Award" on page 6.

We hope to have in attendance the leading experts in rare earth science and technology from around the world. We hope to maintain the strong interdisciplinary character of the previous conferences and to have substantial representations from government, academic, and industrial institutions.

To assist the Program Committee in detail planning, please complete and return before September 1, 1980, the preliminary information form provided below.

(DETACH)

15th Rare Earth Research Conference

University of Missouri-Rolla, Rolla, Missouri

June 15-18, 1981

Please complete the following and send before September 1, 1980 to:

Prof. W. J. James
Materials Research
University of Missouri-Rolla
Rolla, MO 65401 U.S.A.
Phone: (314) 364-4352

This form is for information only and carries no final commitment.

PLAN TO ATTEND Yes No

PLAN TO PRESENT PAPER Yes No

SPOUSE ATTENDING? Yes No

TOTAL NO. IN YOUR PARTY _____

Special interest area(s) _____

Name _____

Address _____

Previous RE Conference Proceedings†

French International Rare Earth Conference, May 5-10, 1969, Paris and Grenoble, France

Les Éléments des Terres Rares, Tome I and Tome II, Bureau 3A-Service de Presse, Centre National de la Recherche Scientifique, 15 Quai Anatole France, Paris 7^e, France. Tome I—price unknown, Tome II—107.50 F.

Proceedings of the 8th Rare Earth Research Conference, Reno, Nevada, April 19-22, 1970, available free from Reno Metallurgy Research Center, U.S. Bureau of Mines, Reno, NV, 89505, USA.

Conference on Rare Earths and Actinides, University of Durham, Durham City, England, July 5-7, 1971.

Conference Digest No. 3, Rare Earths and Actinides, Durham 1971, Institute of Physics, London, England (1971). Available from the Institute of Physics, Distribution Center, Blackhorse Road, Letchworth, Herts SG6 1HN, England. £7.50 (except £3.75 for members of the Institute of Physics).

Proceedings of the 9th Rare Earth Research Conference, Blacksburg, Virginia, October 10-14, 1971, available from Dr. Larry Taylor, Department of Chemistry, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061, USA. \$20.00

NATO Advanced Study Institute on Analysis and Application of Rare Earth Materials, Kjeller, Norway, August 23-29, 1972.

Analysis and Application of Rare Earth Materials, O. B. Michelsen, ed., Universitetsforlaget, Oslo, Norway (1973), available from Universitetsforlaget, P.O. Box 307, Blindern, Oslo 3, Norway or from Universitetsforlaget, P.O. Box 142, Boston, MA 02113. \$28.00.

Proceedings of the 10th Rare Earth Research Conference, Carefree, Arizona, April 30-May 3, 1973. CONF-730402-(P 1-2). Available from the National Technical Information Service, Springfield, VA 22151, USA. \$27.20.

Seventh Russian Conference on Rare Earth Metals, Moscow, USSR. Sept. 12-17 (1972). *Rare Earth Metals, Alloys and Compounds* [*Redkozemelnye Metally Splavy i Soedineniya*] (Izdatel'stvo Nauk, Moscow, 1973) 355 pp. Cost is 1R, 81K (~\$2.00 U.S.) [14 papers in English, 5 in French and 67 in Russian]. Suggest contacting a book store dealing with Soviet publications.

Proceedings of the 11th Rare Earth Research Conference, Traverse City, Michigan, Oct. 7-10, 1974, available from Harry A. Eick, Department of Chemistry, Michigan State University, East Lansing, MI 48824, U.S.A., \$25.00

Proceedings of the 12th Rare Earth Research Conference, Vail, Colorado, July 18-22, 1976, available from University Microfilm, 300 N. Zeeb Rd., Ann Arbor, MI 48106. LD-000328, \$83.00.

Thirteenth Rare Earth Research Conference, Oglebay Park, West Virginia, October, 1977. *The Rare Earths in Modern Science and Technology*, G. J. McCarthy and J. J. Rhyne, eds., Plenum Publishing Corp., New York (1978), \$49.50.

Conference on Rare Earths and Actinides, University of Durham, Durham City, England, July 4-6, 1977. *Institute of Physics Conference Series Number 37*, W. D. Corner and B. K. Tanner, eds., Institute of Physics, London (1978). £22.00.

French International Rare Earth Conference, September 4-7, 1978, St. Pierre-de-Chartreuse, France. *Physics of Metallic Rare Earths, J. Phys. (Paris) Colloque C-5 40*, C5-1-404 (1979), 245 F.

Fourteenth Rare Earth Research Conference, Fargo, North Dakota, June 25-28, 1979. *The Rare Earths in Modern Science and Technology, Vol. 2*, G. J. McCarthy, J. J. Rhyne and H. B. Silber, eds., Plenum Publishing Corp., New York (to be published in 1980)

†Published since 1970. For information on earlier conferences see *RIC News* XIII [2], 4 (1978) or contact RIC.

lanthanides under reductive conditions [pages 941-952 in *Fundamental Research in Homogeneous Catalysis*, Vol. 3, M. Tsutsui, ed., Plenum Press Corp., (1979)]. Cost of the entire volume is \$75.00.

The major thrust of their study was to discover a new type of chemistry for the lanthanides with possible potential for catalytic applications. In focusing on the synthesis and isolation of complexes in which the lanthanide metal is in the +1 or 0 oxidation state, they were successful in preparing five new compounds which represent the first isolable organometallic species obtained from alkyne-metal atomization reactions. Furthermore, all five were successful as hydrogenation catalysts at room temperature under one atmosphere of hydrogen in converting 3-hexyne to hexane. The authors claim this to be the first example of homogeneous catalytic activation of hydrogen by a complex of an *f* orbital element. Further studies are in progress.

Proceedings

(continued from page 2)

transitions, disordered magnetic systems including spin glasses, crystal field effects and magnetic structures, and new techniques including polarized neutrons. This volume costs \$75.90.

their topics is given below. In case of two authors, the individual whose name is italicized will present the paper.

"Overview—RE Markets Today, History of Application" E. Greinacher

"The Rare Earths in Ductile Iron" *H. F. Linebarger*, T. K. McCluhan

"The Rare Earth Metals in Steels" L. A. Luyckx

"Rare Earths in Oxide Dispersion Strengthened Superalloys" J. S. Benjamin

"Industrial Applications of Pure Rare Earth Metals and Related Alloys" K. E. Davies

"The Use of Rare Earths in Glass Compositions" L. W. Riker

"Polishing Compounds" R. V. Horigan

"The Use of Rare Earth Elements in Zeolite Cracking Catalysts" *E. W. Albers*, J. S. Magee

"Rare Earths in Non-cracking Catalysis" G. Kim, *A. W. Peters*

"Nuclear Applications of Rare Earths" R. L. Crowther

"Availability and Commercial Preparation of Rare Earths" J. Kaczmarek

"Use of Rare Earths in TV and Cathode Ray Phosphors" *J. R. McColl*, F. C. Palilla

"Lamp Phosphors" W. A. Thornton

"Rare Earth X-ray Phosphors for Medical Radiography" J. G. Rabatin

"Bubble Domain Memory Materials" J. W. Nielsen

"Yttrium Iron Garnets for Microwave Applications" *L. P. Domingues*, A. L. Hunt

"High Energy Permanent Magnets and Their Use" R. Parker

"Applications for Rechargeable Metal Hydrides" *E. L. Huston*, J. J. Sheridan, III

"Oxygen Sensors" F. L. Kennard

"PLZT Electrooptic Ceramics and Devices" G. H. Haertling

"Rare Earths—Future Applications" J. G. Cannon

Copies of abstracts of these talks are available from the Rare-Earth In-

formation Center. Anyone interested in attending the Symposium should also contact RIC for additional information.

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1979 IR-100

Competition was apparently pretty tough as only one rare earth product was able to make it into the top 100 list of significant new technical products in 1979 as determined by *Industrial Research/Development* (20, No. 10 (1979)). This year's place winner is a neodymium-doped fluorophosphate laser glass developed at the Lawrence Livermore Laboratory (LLL) by M. J. Weber, S. E. Stokowski, and E. P. Wallerstein, LLL; T. Izumitani, Hoya; P. Vergano and C. Rapp, Owens-Illinois; K. Mader and N. Neuroth, Schott; and W. Haller, National Bureau of Standards. A small nonlinear refractive index allows high intensity laser beams to be propagated through the glass with little spatial distortion. The planned use of this glass in the large Nova Laser system will achieve almost twice the performance per unit cost. The Nova system is attempting to determine the feasibility of producing thermonuclear energy by implosion of fuel with laser light.

formation Center. Anyone interested in attending the Symposium should also contact RIC for additional information.



A. Blandin

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K. A. Gschneidner, Jr. ...Editor
Bernie Evans...Staff Writer

2nd Frank H. Spedding Award

The Frank H. Spedding Award, first presented at the Fourteenth Rare Earth Research Conference in 1979, is given in recognition of distinguished contributions in the field of rare earth science and/or technology. Nominations are now being sought from the worldwide community of scientists and engineers for the 1981 Award to be made at the Fifteenth Rare Earth Research Conference, June 15-18, 1981. An individual can present more than one candidate for consideration. Seconding letters are encouraged, particularly if they present significant information not covered by the nominator.

Forms for use in making nominations can be obtained from Dean J. B. Gruber, Executive Secretary of the Frank H. Spedding Award Committee, North Dakota State University, Fargo, North Dakota 58108 U.S.A. (701) 237-7411. Nomination forms, including seconding letters and other supporting documents, must be in the hands of the Executive Secretary by January 31, 1981.

5th RE-Co Workshop

The Fifth International Workshop on Rare Earth-Cobalt Permanent Magnets and Their Applications will be held June 7-10, 1981 at the Hotel Roanoke, Roanoke, Virginia. Organized by the University of Dayton, the Magnetic Materials Producer's Association and the Inland Motor Division of the Kollmorgen Corporation, this workshop will follow much the same format as the earlier workshops. The June date was chosen so that interested parties could attend both the Workshop and the 15th Rare Earth Research Conference (see page 3 for details) during the same trip. This could be the last opportunity for local scientists to attend for several years since the next two workshops are tentatively planned for late August 1982 near Vienna, Austria and September 1983 in Peking, The People's Republic of China. For more information write to K. J. Strnat, Magnetics Laboratory, KL-365, University of Dayton, Dayton, Ohio 45469.

RE's in India

(continued from page 1)

ited three institutions before returning to America. The first was the Indian Institute of Technology—Madras, where Prof. G. Aravamudan and Dr. G. V. Subba Rao and their co-workers served as hosts. Their research efforts involving rare earths are concerned with 1) preparation and magnetic and electrical conductivity measurements on mixed rare earth oxides such as perovskites and pyrochlores, and 2) the preparation and properties of the superconducting Chevrel phases.

The next visit was with Prof. R. Vijayaraghavan, Dr. S. K. Malik and their co-workers at the Tata Institute of Fundamental Research in Bombay. Their research efforts are primarily concerned with nuclear magnetic resonance and magnetic susceptibility studies of a variety of rare earth intermetallic compounds and alloys, especially Ce mixed valence systems and intermetallic hydrides.

The final visit was with Dr. C. V. Sundaram, head of the Metallurgy Division, and his staff at the Bhabha Atomic Research Center in Bombay. Dr. Sundaram's staff is involved in a large variety of problems in all areas of metallurgy and ceramics. Their main interests in the rare earths are the preparation and purification of the metals, and they are planning to expand their efforts in this area in the next few years.

It was a memorable and interesting two weeks—the exposure to a new culture, the variety of different flora, the face-to-face meeting with

BUSINESS NEWS

New Company Formed

Union Minerals, a wholly owned subsidiary of Union Oil of California, is participating in a joint venture with four Norwegian companies to investigate a large carbonatite deposit in the Fen area in eastern Norway. The mineral deposit contains rare earths, niobium and other elements of potential economical interest. The new company is named K/S A/S Fenco and is a limited partnership.

New Address and Expansion

Molycorp, Inc. has relocated to 709 Westchester Avenue, White Plains, NY 10604. Their telephone number is (914) 997-8880. Additionally, Union Oil of California, of which Molycorp is a wholly owned subsidiary, has announced a multimillion dollar program to increase Molycorp's production of separated rare earths. The program will include the installation of several new solvent extraction circuits at the Mountain Pass, California location, a new samarium metal production plant in Washington, Pennsylvania and modifications at their rare earth processing plant in York, Pennsylvania to increase capacity for high purity chemical compound preparation.

scientists whose scientific works previously were known only from the journals, and the renewal of old friendships.

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