RARE-EARTH INFORMATION CENTER NEWS

INSTITUTE FOR PHYSICAL RESEARCH AND TECHNOLOGY
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REs in the LAND DOWN UNDER

Australia is blessed with many mineral resources, including rare earth deposits. Thus, it was a pleasure and a privilege for the editor to attend and participate in the Materials Technology and Profit Conference, organized by the Australian Department of Industry, Technology and Commerce (DITAC) and the Institute of Metals and Materials Australasia. It was also an opportunity to visit a few of the leading scientists and their institutions while in Australia.

Materials Technology and Profit Meeting

This conference, held November 16-18, 1987, in Melbourne, Victoria, focused on nine topics including the rare earths and high temperature superconductors. The topics were chosen because of Australia's abundant mineral resources and/or technical and scientific strengths in certain new technology areas.

In the rare earth session, the editor presented an overview entitled "Coming of the Rare Earth Age." This talk was followed by three papers on: (1) rare earth permanent magnets in electric motors by V. S. Ramsden; (2) corrosion protection using rare earths by B. R. W. Hinton, L. Wilson and N. E. Ryan; and (3) rare earths in pipeline steels by K. Davis.

Corrosion Inhibitors

The Hinton-Wilson-Ryan talk described some new exciting developments using rare-earth salts as inhibitors in aqueous solutions and rare-earth oxides as protective coatings. If their initial results hold up, this work could lead to developments that would have an enormous impact on the rare earth industry. Currently there is a great push to eliminate the use of chromates, Zn, Cd, and nitrites in corrosion protection, because they are either toxic (the first three) or, as in the case of nitrite coatings, can lead to the formation of cancer promoting nitroamines. These authors have found that rare earths are nearly as effective as chromates in inhibiting corrosion of Al alloys, mild steel and Zn in aqueous solutions. Furthermore, they have found that the corrosion resistance of rare-earth oxide coatings (~100 nm thick) on Al alloys, Zn, Cd, Mg and steel approaches that of chromates, have excellent adhesion, and can be applied quite simply in 30 to 90 seconds at

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1987 NOBEL PRIZE FOR PHYSICS

Karl Alexander Müller — *Johannes Georg Bednorz*

Karl Alexander Müller, 60, of Switzerland, and Johannes Georg Bednorz, 37, of West Germany, have been named as winners of the 1987 Nobel Prize for Physics by the Royal Swedish Academy of Sciences. These scientists from the IBM Zürich Research Laboratory in Rüschlikon, Switzerland, were recognized for their important breakthrough in the discovery of superconductivity in ceramic materials at temperatures significantly higher than any other known materials. Their report, published less than two years ago in *Z. Phys. B*, **64**, 189-93 (1986), about superconductivity at 35 K in a mixed oxide of La, Ba, and mixed-valent Cu triggered an unprecedented explosion of research activity.

In 1983, Müller, who had been working with oxides for many years, decided to work on oxides that might be superconducting. Using crystal-chemical arguments to narrow the search, Müller decided to concentrate on perovskites containing nickel or copper, and enlisted the help of Bednorz. After two years without success, they decided to synthesize a La-Ba-Cu oxide perovskite with copper in a mixed valence state, which had been reported earlier by Bernard Raveau and co-workers at the University of Caen. Luckily, their method of synthesis was subtly different and led to a mixture of phases rather than the pure phase they had been trying to make. One of these phases, also a mixed valence copper oxide with a perovskite-related structure, turned out to be the 35 K superconductor. The events that followed are now well known.

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MEETINGS

4th ICPMM

The 4th International Conference on Physics of Magnetic Materials (4th ICPMM), which is sponsored jointly by the Institute of Physics of the Polish Academy of Sciences and the Research Laboratory of "Polfer"—Plant of Magnetic Materials, will be held in Szczyrk-Bila, Poland on September 4-10, 1988.

The conference will cover oxides—magnetic and superconducting, rare-earth based hard magnetic materials, amorphous magnets, magnetic films, and spin glasses.

Only the first 250 participants will be accepted. Information on registration forms and fees may be obtained from Dr. Marek Gutowski, Institute of Physics, Polish Academy of Sciences, Al. Lotników 32146, PL—02-668 Warsaw, Poland.

PROCEEDINGS

High Temperature Ceramics

Non-oxide Technical and Engineering Ceramics is the proceedings of an international conference held at the National Institute for Higher Education in Limerick, Ireland on July 10-12, 1985. The 474-page book was edited by S. Hampshire and published in 1986 by Elsevier Applied Science of London. Two-thirds of the more than 30 papers presented dealt with nitrogen ceramics with more than one-half of those concerned with sialons (Si-Al-O-N). Rare earth oxides, especially Y_2O_3, are often used in these ceramics as fluxing agents to facilitate densification. The high interest in this field is due to their potential as automobile engine parts. A recent study estimates that the U.S. market for advanced ceramics will reach $23.1 billion by 2005 compared to $2.1 billion in 1986. The book costs U.S.$104.50 and is available from Elsevier Applied Science Publishing, Crown House, Linton Road, Barking, Essex IG11 8JU, England, or in the U.S.A. and Canada, 52 Vanderbilt Avenue, New York, NY 10017.

Anomalous Rare Earths and Actinides

Volumes **63 & 64,** combined into one issue of the *Journal of Magnetism and Magnetic Materials* contain the proceedings of the International Con-

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ference on Anomalous Rare Earths and Actinides: Valence Fluctuation and Heavy Fermions held July 7-11, 1986 in Grenoble, France. Published in 1987 by North-Holland Physics Publishing, the 732 page journal costs Dfl. 736.00 (~ U.S.$327). The proceedings were edited by J. X. Boucherle, J. Flouquet, C. Lacroix, and J. Rossat-Mignod. It may be ordered from Elsevier Science Publishers B. V., P.O. Box 211, 1000 AE Amsterdam, The Netherlands or from Elsevier Science Publishing Company, 52 Vanderbilt Avenue, New York, NY 10017.

The journal contains 21 invited and 177 contributed papers. The conference aim was to develop an understanding of the "mystery" of hybridization effects on *f*-electrons in metals.

HORIZONS 1987

Rare Earth Horizons 1987 is the title of a soft cover book that contains the invited papers presented at a conference with the same name held April 27-28, 1987 at the National Measurement Laboratory in Lindfield, Australia. Rare Earth Horizons 1987 was convened because of the increasing importance of rare earths in the Australian economy, to raise awareness in Australia of their potential, and to highlight opportunities that exist. The aim was to promote collaboration between industry and research institutions on research and development aspects of rare earths.

Mr. Alan B. McCulloch, conference convenor, has offered to make these proceedings available free, as long as they last. For your copy, write to Mr. A. B. McCulloch, Innovation and International Division, Department of Industry, Technology and Commerce, P.O. Box 12, Belconnen ACT 2616, Australia.

Magnetic Materials

Materials Research Society (MRS) Symposia Proceedings volume **96,** entitled *High Performance Permanent Magnet Materials*, contains 8 invited and 17 contributed papers from the symposium held at the 1987 MRS spring meeting in Anaheim, California. The 362-page book is dedicated to the memory of René Pauthenet and was edited by S. G. Sankar, J. F. Herbst, and N. C. Koon. The book

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lists at U.S.$33.00 for MRS members and U.S.$41.00 and U.S.$48.00 for U.S.A. and non-U.S.A. non-members, respectively. It may be ordered from Publications Department, Materials Research Society, 9800 McKnight Road, Suite 327, Pittsburgh, PA 15237, U.S.A.

The symposium was held to assess the state-of-the-art of rare earth magnets, especially R-Fe-B magnets. Topics covered were of interdisciplinary nature, ranging from fundamental aspects, such as alloy make-up and synthesis, characterization, and crystal field effects, through technical issues such as magnet fabrication, coercivity mechanism, and magnet design considerations.

CONFERENCE CALENDAR

1st International School on Excited States of Transition Elements
Ksiaz Castle, Wroclaw, Poland
June 20-25, 1988
RIC News, **XXII,** [3] 2 (1987)

6th International Conference on Crystal Field Effects and Heavy Fermion Physics
Frankfurt, West Germany
July 18-21, 1988
RIC News, **XXII,** [2] 2 (1987)

*4th International Conference on Physics of Magnetic Materials (ICPMM)
Szczyrk-Bila, Poland
September 4-10, 1988
This issue

18th Rare Earth Research Conference (RERC)
Interlaken, Lake Geneva, Wisconsin, U.S.A.
†September 12-16, 1988
RIC News, **XXII,** [3] 3 (1987)

1st International Conference on Metallurgy and Materials of Tungsten, Titanium, Rare Earths, and Antimony (W-Ti-RE-Sb'88)
Changsha, People's Republic of China
November 5-8, 1988
RIC News, **XXII,** [4] 2 (1987)

TMS-AIME Rare Earth Symposium
Las Vegas, Nevada, U.S.A.
February 27-March 3, 1989
RIC News, **XXII,** [2] 2 (1987)

†Date Change
*New Listing

High T_c Superconductors

There are so many conferences on this subject that we have made no attempt to list them individually in the *RIC News*. For information on these meetings you may contact the RIC or better yet, check the current issues of *High T_c Update*. To receive this publication, write to Ellen Feinberg, 12 Physics, Ames Laboratory, Iowa State University, Ames, Iowa, 50011, U.S.A.

REVIEW Si_3N_4

During recent years, a new generation of engineering ceramics have been developed which are expected to find wide use in high temperature applications. Due to a good combination of mechanical, thermal and thermo-mechanical properties, silicon nitride (Si_3N_4) is one of the most promising materials in this class. A review written by G. Ziegler, J. Heinrich, and G. Wötting [*J. Mater. Sci.* **22**, 3041-86 (1987)] is entitled "Relationship between Processing, Microstructure and Properties of Dense and Reaction-Bonded Silicon Nitride." Special emphasis is placed on the relationships between powder properties, process conditions, densification, and microstructure as well as the interdependence between microstructure and physical properties. One of the process variables discussed is the use of sintering aids such as CeO_2 and especially Y_2O_3.

Hydrogen Decrepitation

Since 1978, Dr. I. R. Harris' group in the Department of Metallurgy and Materials, University of Birmingham, Edgbaston, U.K., has been investigating the use of hydrogen in the processing of rare-earth-based magnets. The earliest work was concerned with the hydrogen decrepitation of the intermetallic $SmCo_5$. The term decrepitation is defined as "the separation of parts with a crackling noise," which is a good description of the break-up of the bulk ingot into relatively fine powder by the absorption of hydrogen. Sintered and polymer bonded magnets were producted from the hydrogen decrepitated (HD) powder. The clean surfaces of the HD-powder was an advantage with regard to the sintering process.

The next stage was the extension of the HD process to the production of the 2-17 ($Sm_2(Co,Fe,Cu,Zr)_{17}$)-type magnets. Again good quality sintered and polymer-bonded magnets were produced from the HD-powder.

The latest development in this work is the application of the process to the recently announced $Nd_2Fe_{14}B$ type magnets, which have the highest energy products within the family of permanent magnets. 1.2 Kg of a bulk $Nd_{15}Fe_{77}B_8$ (Neomax) alloy was powdered by hydrogen decrepitation and in collaboration with Mullard

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Conference Committee

At the 2nd International Conference on the Basic and Applied Chemistry of Lanthanides and Actinides (ICLA) in Lisbon, Portugal, a group of scientists met under the guidance of Professor K. W. Bagnall to discuss the coordination of international meetings. A committee was formed to act as a coordinating body between the various scientific groups that organize international meetings. The International Steering Committee is composed of representatives from ICLA; International Rare Earth Conference (IREC); Board of Directors of the Rare Earth Research Conference (RERC) of North America; and Rare Earth Societies from Brazil, China, and Japan. ICLA and IREC agreed to merge to form the International Conference on *f*-Elements (ICFE) and to hold their first conference in Leuven, Belgium, in 1990. Other conferences supported by the committee are the 18th RERC to be held in Lake Geneva, Wisconsin, U.S.A., in 1988, and a 1989 meeting in Tashkent, U.S.S.R. on the actinides.

The committee hopes to avoid the overlap of international conferences on the general topic of *f*-elements and provide a date and location so that more specialized interests can schedule satellite conferences and symposia to allow scientists to attend more than one conference per trip. The hope is to cut down time away from the job and the travel expenses involved with the increasing number of conferences now being held. The feeling is that more people would be able to attend all the major conferences.

Present members of the committee would be up for re-election in 1990 at the ICFE Conference in Leuven. Provisions for flexibility and continuity are being worked out.

The members of the International Steering Committee for Conferences on *f*-Elements (ISCCF) are: Chair, Professor Lauri Niinisto, Helsinki University of Technology; Secretary, Professor Jean-Claude G. Bünzli, Inst. Chim. Miner. Analyst; Professor Gin-Ya Adachi, Osaka University; Dr. William T. Carnall, Argonne National Laboratory; Dr. P. Caro, C.N.R.S.; Professor R. Dieter Fischer, Universität Hamburg; Professor John E. Greedan, McMaster University; Professor Karl A. Gschneidner, Jr., Iowa State University; Dr. E. Kaldis, Lab. für Festköperphysik; Dr. I. A. Smirnov, A. F. Joffe Phys.-Techn. Inst.; Dr. P. A. Vigato, Istit. di Chim. e Technol. dei Radioelem. del CNR; Professor Geraldo Vincentini, Universidade de Sao Paulo; and Professor Xu Guangzian, Beijing University.

NEW BOOKS

RIC thankfully acknowledges the receipt of a variety of non-English books and pamphlets from various sources.

The following six books are in Russian:

1. *Kineticheskie Svoistva Metallov pri Vysokikh Temperaturakh* (Kinetic Properties of Metals at High Temperatures) by V. E. Zinov'ev (1984).

2. *Soedineniya Redkozemel 'nykh Elementov. Karbonaty, Oksalaty, Nitraty, Titanoty* (Compounds of the Rare Earth Elements. Carbonates, Oxalates, Nitrates, Titanates) edited by V. P. Orlovskii and N. N. Chudinova (1984).

3. *Soedineniya Redkozemel 'nykh Elementov. Sulfaty, Selenaty, Telluraty, Khromaty* (Compounds of the Rare Earth Elements. Sulfates, Selenates, Tellurates, Chromates) edited by L. N. Komissarova (1986).

4. *Atlas Infrakrasnykh Spektrov Fosfatov Kondensirovannyae Fosfaty* (Atlas of Infrared Spectra of Phosphates. Solid Phosphates) edited by I. V. Tananaev (1985).

5. *Ekzoticheskie Sverkhprovodniki* (Exotic Superconductors) by A. I. Buzdin and V. V. Moshchalkov (1986).

6. Numbers 22, 23 and 24 of *Redkozemel 'nye Poluprovodniki i Drugie Soedineniya RZM. Ukazatel' Otechestrennoi i Inostrannoi Literatury.* (Rare Earth Semiconductors and Related REM Compounds. Index of Russian and Foreign Literature) edited by V. P. Zhuze (1985 and 1986).

The next three books were published in Romanian, Portuguese-English, and German, respectively.

1. *Magneti Permanenti, Volume 1* (Permanent Magnets, Volume 1) by Emil Bruzo (1986).

2. *Quimica dos Lantanideos e Actindeos* (Chemistry of Lanthanides and Actinides) edited by G. Vicentini and L. B. Zinner (1986).

3. *Bausteine der Erde. 3. Die Chemischen Elemente, Antimon-Wismut* (Foundation of the Earth. 3. The Chemical Elements, Antimony to Bismuth) (1976) German translation of a Russian book, *Popular Library of the Chemical Elements,* edited by I. W. Petrjanov-Sokolow.

For complete addresses of the members, contact Secretary ISCCF J.-C. Bünzli, Inst. Chim. Miner Analyst., 3 Place du Chateau, CH 10005 Lausanne, Switzerland or the Rare-earth Information Center.

FORREST CARTER

Dr. Forrest Carter passed away of cancer on December 20, 1987, at the age of 57. He was born in Indianapolis, Indiana, on April 29, 1930. He received a B.S. from Harvard in 1951 and a Ph.D. from California Institute of Technology in 1956.

He spent 1957-64 as a senior chemist at the Westinghouse Research Laboratories and then went to the Naval Research Laboratories where he spent the rest of his career. His interests included physical chemistry, crystallography, quantum mechanics, solid-state chemistry, and electron correlations.

He studied rare earth halides, carbides, sulfides, borides, and intermetallic compounds with iron, cobalt, nickel, etc. In 1986, he received a letter of appreciation from President Reagan for his pioneering role in molecular electronics.

Temperature Sensor

K. T. V. Grattan, A. W. Palmer, and C. A. Willson [*J. Phys. E*, **20**, 1201-5 (1987)] have constructed a fiber optic temperature sensor based on the change in fluorescence decay-time of 9 percent Nd doped glass with temperature. The temperature range covered was from −50 to 300°C. A different design eliminating the resin bond could expand this range. The Nd:glass is bonded to two optical fibers, one is used to excite the glass by laser radiation and the other transmits the resulting fluorescence to the detector which converts the decay-time to a temperature value.

Decrepitation

(Continued from page 3)

Magnetic Components and Lucas Research Laboratories, magnets with good energy products of around 255 kJ/m^3 (32 MGOe) were produced from the HD material. The possibility of incorporating the process into the manufacturing procedure is now being investigated as part of the C.E.A.M. (Concerted European Action on Magnets) program [*RIC News*, **XXI**, [1], 3 (1986)].

This latest development is reported in a paper authored by P. J. McGuiness and I. R. Harris of the University of Birmingham, E. Rozewndaal and J. Ormerod of Mullard Magnetics, and M. Ward of Lucas Research, which appeared in *J. Mater Sci.* **21**, 4107-10 (1986).

SUNRAYCER

A General Motors (GM) team was 1 of approximately 25 teams from all over the world, that designed, built, and ran solar powered cars for 3,200 km (1,950 miles) in the first international solar car race across a continent. The GM team named their entry the Sunraycer. Known as the World Solar Challenge, the race started on November 1, 1987, from Darwin on Australia's north coast and finished approximately a week later at Adelaide on the south. The first day, racers drove eight hours and after that, each day's race started exactly at 8:00 a.m. and stopped exactly at 5:00 p.m. The racing crews had to be self-sufficient and spent the night wherever they were at 5 p.m.

Sunraycer was powered by a new electric motor designed by GM's Research Laboratories. Utilizing six recently developed Magnequench III (Nd-Fe-B) permanent magnets, the motor had an efficiency rate of 92 percent, compared to 75-85 percent for standard electric motors. Each motor weighed 8.1 pounds and produced two horsepower, continuously, at 4,000 rpm.

The power to drive the motor was provided by 7,200 solar cells each 2 cm × 6 cm × 0.2 mm thick. The electricity was stored in 68 rechargeable silver zinc cells.

The racers were limited to a length of 6 m, a width of 2 m, and a height of 1 m. The GM racer weighed 360 pounds, ⅙ of which was the batteries.

Sunraycer finished the race in 44 hours, 54 minutes of actual driving time, some 20 hours ahead of the second place finisher.

Oxygen Sensors

W. C. Maskell has written a review entitled "Inorganic Solid State Chemically Sensitive Devices: Oxygen Gas Sensors," *J. Phys. E: Sci. Instrum.* **20**, 1156-68 (1987). The review concentrates on the scientific principles that govern the operation of the major device types, including potentiometric, amperometric, and coulometric sensors, and pump-gauge and impedance-based devices. Some of the electrolytes include ZrO_2-$YO_{1.5}$ mixtures, Bi_2O_3-Er_2O_3 mixtures, and those based on CeO_2. The review is well referenced with a bibliography of 50 entires.

CONTRIBUTORS

The third quarter of our fiscal year was much like last year. We received support from 20 sponsors, including one new family member. The total for the year reached 75, which is 2 behind last years pace. The Davison Division of W. R. Grace & Company became the fourth member of our 20 year club.

The 20 additions to our list of benefactors, with the number of years the sponsor has been a family member in parentheses, are listed below.

Alcan International Limited, Canada (2)
Anderson Physical Laboratory Incorporated, U.S.A. (2)
BOSE Corporation, U.S.A. (11)
Boulder Scientific Company, U.S.A. (1)
Davison Specialty Chemical Company, subsidiary of W. R. Grace & Company, U.S.A. (20)
Dow Chemical U.S.A., Texas Division, U.S.A. (2)
Electron Energy Corporation, U.S.A. (3)
Electro Technology Corporation, U.S.A. (2)
F. G. Jones Associates, Limited, U.S.A. (4)
Hitachi Magnetics Corporation, U.S.A. (13)
Hoeganaes Corporation, subsidiary of Interlake Incorporated (3)
Martin Marietta Laboratories, U.S.A. (3)
MCI-Megon, A.S., Norway (16)
NEOmagnets Pty., Limited, Australia (2)
Neomet Corporation, U.S.A. (2)
Philips Research Laboratories, The Netherlands (4)
SG Magnets Limited, England (3)
Sundstrand Aviation, U.S.A. (2)
Vacuumschmelze Gmbh, West Germany (4)
Vollbrecht Associates, U.S.A. (4)

New Spectroscopy Standards

Spex Industries, 3880 Park Avenue, Edison, New Jersey 08820, have expanded their line of analytical spectroscopy standards, including a complete line of rare earth elements. Standards are available for ICP/DCP, atomic absorption/graphite furnace AA, optical emission, and x-ray fluorescence. Aqueous single element solutions as well as mixtures are available. Rare earth compounds kits are available for preparation of custom solution standards.

RE HANDBOOK #9

Volume 9 of the *Handbook on the Physics and Chemistry of Rare Earths*, edited by K. A. Gschneidner, Jr. and L. Eyring, is available from Elsevier Science Publishers B.V., P.O. Box 103, 1000 AC Amsterdam, The Netherlands or from Elsevier Science Publishing Company, 52 Vanderbilt Avenue, New York, NY 10017, U.S.A. Published by North-Holland Physics Publishing in 1987, the 445-page book costs Dfl. 250.00 (~ U.S. $135) [subscription price is Dfl. 215.00 (~ U.S.$115).]

Four chapters are included in volume 9 and thoroughly cover four subjects having a wide spectrum of interest. The chapter titles and authors are: "Excited State Phenomena in Vitreous Materials," by R. Reisfeld and C. K. Jørgensen; "Inorganic Complex Compounds," by L. Niinistö and M. Leskelä; "Complexes with Synthetic Ionophores," by J.-C. G. Bünzli; and "Rare Earth Coordination Catalysts in Stereospecific Polymerization," by Zhiquan Shen and Jun Ouyang.

The chapter by Niinistö and Leskelä is a 230-page book within a book. It is a continuation of Chapter 56 that appeared in volume 8. Part II covers the chemistry and crystallography of rare earth phosphates, phosphites, arsenates, sulfites, sulfates, oxosulfates, selenates, selenites, oxohalogen compounds, vanadates, chromates, cyanides, hexacyanometallates, and aqua complexes.

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High T_c Superconductors

Are REs Out of High T_c Superconductivity?

Reports in late January-early February from Tsukuba, Japan, and Houston, Texas, U.S.A., and confirmed in San Jose, Calif., U.S.A., indicate that the rare earths are out and bismuth is in. The new high T_c superconductors ($T_c \simeq 80$ K) consist of Bi-Ca-Sr-Cu-O. One of the advantages of this new material is the lower costs of the component materials Bi_2O_3 vs. Y_2O_3 or R_2O_3, and CaO, SrO vs. BaO. The cost of the starting materials, however, is small compared to the cost of making and processing the superconductors into useful forms for various devices and applications. Ultimately, the superconducting properties, such as the upper critical field and critical currents, of these materials will be paramount in deciding whether or not these nonrare-earth high T_c materials will replace the rare earth materials. Our answer to the above question is the rare earths are not out.

Superconductivity Materials in Japan

High Temperature Superconducting Materials: The Current Situation is the title of a report prepared by the editors of the Japan Technical Information Service. The editor-in-charge was H. Nogawa. The report was published in English by ASM International, Metals Park, OH, 44073, U.S.A. The 191-page, paperback book costs U.S.$290.00 and is available from ASM International, Attention: R. L. Stedfeld.

The first 66 pages are devoted to a brief history and the basic points of superconductivity and highlights the contributions of Japanese scientists. The third section lists some technological problems and possible solutions involved in the industrial use and fabricating of high T_c superconductors. Possible uses are discussed as well as the problems of critical magnetic field and critical current density.

In section four, the problems anticipated in peripheral areas are discussed. These include supply of ingredients; the advantages of liquid nitrogen over liquid He, especially to Japan; and substrate or support ma-

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terials. The next two sections describe the research and development systems in the Japanese private section and the role of government in research and development.

Section seven discusses the situation in the United States and other parts of the world while the last three sections deal with standardization of, patents on, and markets for the ceramic high temperature superconductors.

Workshop

Superconductors in Electronics, Commercialization Workshop is the title of a hard cover book containing talks given at a professional meeting organized by Advantage Quest. The meeting was held September 14-15, 1987 in San Francisco, California.

The meeting was divided into six sections entitled: New High Temperature Superconducting Materials, Electronic Applications of the New Superconductors, Specialized Materials Technologies for Electronics Applications, Raw Materials for the New Superconductors, Cooling Technology for Potential Superconducting Systems, and Patent Law and Venture Capital Perspectives.

The 348-page book is available for U.S.$395.00, plus shipping, from Advantage Quest, 1110 Sunnyvale-Saratoga Road, Suite C2, Sunnyvale, CA 94087-2515, U.S.A.

New High T_c Use

Gerard Mourou of the University of Rochester's Laboratory for Laser Energetics says a single superconducting data transmission line could carry one trillion bits of information per second. This is 100 times better than present-day optical fiber systems. Mourou and his colleagues, working with yttrium-barium-copper oxide thin films grown on Y-doped zirconia substrates by Robert Buhrman's group at Cornell University, report that the 90 K superconductor can carry electrical pulses as short as 10-15 picoseconds without absorption or distortion.

BITNET MAIL

The Rare-earth Information Center can now be accessed on BITNET. Please use the following address: RIC@ALISUVAX. It will appear, with other information, in the mailing block on the next-to-last page of each issue of the *RIC News*.

Land Down Under

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temperatures just slightly above room temperature.

High T_c Superconductors

In the high temperature superconductivity session, D. R. Clarke (IBM, USA) presented the overview address, summarizing the state-of-the-art of these $RBa_2Cu_3O_x$ materials and what the major problems are. He also briefly described some of the many potential applications of these materials. Then J. M. Bell presented a review of the Australian research on these materials. Bell noted that there are 15 active research groups involving about 115 researchers. The other two papers presented at this session were by C. Adam, who spoke on "Strategy for the Development of High-Temperature Superconductors in Australia" and I. Harvey, who spoke on "Superconducting Devices and Applications."

Australian National University, Canberra

At the Australian National University, the editor visited Professors A. M. Stewart (Solid State Physics) and B. Hyde (Chemistry). Professor Stewart is making heat capacity measurements on various magnetic materials, including Sm metal near the 107 K antiferromagnetic ordering temperature. He found that the heat capacity curve is rounded and does not exhibit the usual sharp λ-like peak that is found in magnetically ordered substances at the Néel or Curie temperature.

Stewart and Hyde are also carrying out joint research on the new high temperature $RBa_2Cu_3O_x$ (1:2:3) superconductors. Professor Hyde's group is involved in the preparation and Professor Stewart's group make the physical property measurements. They are determining the factors that control oxygen uptake during cooling, and the effect of exposure of the 1:2:3 superconductors to air and water on the superconducting properties.

University of New South Wales, Kensington (Sydney)

At the University of New South Wales, Professors K. N. R. Taylor (School of Physics) and K. E. Easterling (School of Materials Science) head the largest group of Australian scientists working on the high T_c superconductors.

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Taylor has been successful in raising the superconducting transition temperature of $YBa_2Cu_3O_x$ from ~90 K to ~140 K by exposing their samples to a N_2 atmosphere. Several other groups were skeptical of the University of New South Wales' results but Taylor and his group vigorously defend their results. Taylor stated that the temperature at which the N_2 is introduced into the sample is critical: the N_2 must be a gas (not liquid), i.e. T >77 K, and the upper temperature cannot exceed 80 K. This means there is a critical window of ~2 K whereby the N_2 gas can be introduced to give this ~50 K rise in T_c. They have succeeded in raisisng T_c by ~10 K by the introduction of He and S into the $YBa_2Cu_3O_x$ lattice, while Ar is nearly as effective as N_2 in increasing T_c.

Professor Easterling and Dr. S. X. Dou (a visiting scientist from People's Republic of China) have studied the effect of alloying agents on T_c especially to find a material that stabilizes the oxygen content so one can avoid the low temperature O_2 treatment. They found that Sc and V substitutions have little effect on T_c; a slight lowering is observed when Ti, Cr, and Mn are added (~5 K decrease); ~10 K lowering is observed for Ni additions; and significant decreases (≥30 K) are found for Fe and Zn substitutions. When 0.2 wt. percent Pt is added as a fine powder to the $YBa_2Cu_3O_x$ they find that it promotes grain growth, and eliminates or increases the spacings between the twins in this material; however, higher Pt contents are deleterious, especially to the critical current density.

CSIRO Division of Applied Physics, Lindfield (Sydney)

The last stop in Australia was spent visiting several scientists from

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the Division of Applied Physics of CSIRO. Drs. G. White and S. J. Collocott are interested in the low temperature behavior of solids—heat capacity, thermal expansion, etc.—including $YBa_2Cu_3O_x$ and related materials. Other CSIRO scientists visited were: Dr. John Lowke, who heads the Division of Applied Physics, and has an interest in rare earth permanent magnets; and Drs. John Macfarlane, Harold Welsh, and Bob Driver, who work on the 1:2:3 superconductor. Macfarlane is a physicist and makes some of the physical property measurements, while Welsh and Driver are chemists involved in preparing the samples and studying their chemical behavior. The CSIRO group have measured the heat capacity, thermal expansion, Hall effect, and parametric inductance behavior of these 1:2:3 materials. In the heat capacity study at low temperature, <6 K, they have observed Schottky type anomalies that are due to the presence of magnetic lanthanide impurities, in particular Dy, which was present in their starting Y_2O_3 at a level of 230 wt. ppm. Hall effect measurements above and below the superconducting transition temperature showed a decrease of the Hall coefficient by a factor of 20 when the sample became superconducting.

APOLOGY

We wish to apologize to the American Ceramic Society and to our readers for any inconvenience we caused by the wording of our story "Ceramic Superconductors" that appeared on page 1 of our December 1, 1987, issue of the *RIC News*. The sentence concerning its availability should have read: "This volume is free to current subscribers of *Advanced Ceramic Materials* as part of their 1987 subscription."

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