

RARE-EARTH INFORMATION CENTER NEWS



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Contributors

Third-quarter contributions were received from nine companies bringing the total number of benefactors for the year to thirty-six. This quarter's companies are listed below. The number in parentheses is the number of years the company has supported the Center.

American Metallurgical Products Co., U.S.A. (12)

Eastman Kodak Co., U.S.A. (4)

GTE Laboratories, Inc., U.S.A. (9)

Middlewest Investment Co., U.S.A. (3)

Mitsubishi Chemical Industries, Ltd., Japan (8)

Pokmen Company, Hong Kong (3)

Research Chemicals, U.S.A. (13)

Rhone-Poulenc-Chimie Fine, France (11)

Rhone-Poulenc, Inc., U.S.A. (1)

Help! The total number of benefactors this year is three less than at this time last year.

Calculations Tabulated

S. Fraga and J. Muszynska have assembled a great deal of calculated data into tabular form in a book entitled *Atoms in External Fields*. Data are included for the elements boron through nobelium on the topics of configurations, electric dipole polarizabilities for the majority of terms in each series, shielding potentials for the ground state configuration of the neutral atoms, probabilities of barrier penetration, shielded and unshielded values of the electric dipole transition probabilities, expectation values, and radial integrals of the ground state configurations of the neutral atoms for *g* factor evaluation. The book is 557 pages in length, costs \$119.50 (Dfl. 245.00), and is available from the Elsevier Scientific Publishing Company, P.O. Box 211, Amsterdam, The Netherlands, or 52, Vanderbilt Avenue, New York, NY 10017.

Cd Decreases Ce Toxicity

P. Arvela has found that the prior administration of a sublethal dose of cadmium significantly reduced mortality in male mice after a toxic dose of cerium was administered [*Toxicology Letters* 3, 303-9 (1979)]. There was also improvement of the impaired drug-metabolizing capacity in male and female rats that received the same treatment. This result is typical if the initial metal dose stimulates production of some agent, such as metallothionein, that forms a complex with the metal ions to take them out of the system. Arvela's study revealed that the cerium binds to the high molecular weight protein fraction in the rat liver cytosol, instead of the newly synthesized metallothionein. So, although decreased toxicity is observed, the mechanism behind the decrease is not known at this time.

Intergalactic Calling Card

"Hello, operator. Long distance, please." A long, long distance if you agree with D. P. Whitmire and D. P. Wright in their assessment of nuclear waste spectra as evidence of technological extraterrestrial civilization [*Icarus* 42, 149-56 (1980)]. They consider the possibility of other civilizations developing nuclear energy much the same as on earth. What if these civilizations used their sun as a nuclear waste repository? If nuclear wastes were deposited over a long period of time into the right type of star, the accumulating waste products should at some point produce an observable, anomalous emission pattern. The right type of star would be one with restricted core-photosphere mixing and low natural abundances of the elements produced in the nuclear waste. Based on the ratio of nuclear waste concentration to solar system abundance, the authors predict that

New Materials Prize



P. E. Duwez

R. H. Willens

Three scientists have been named co-recipients of the 1980 American Physics Society's International Prize for New Materials. They are P. E. Duwez of the California Institute of Technology, W. Klement, Jr. (not shown) of the University of California, Los Angeles, and R. H. Willens of Bell Telephone Laboratories. The three are being cited for their discovery that metallic glasses can be obtained by melt quenching, which holds promise for producing a vast source of metals with properties of unusual scientific interest and technical promise. Many new rare earth materials have been obtained by this splat-cooling process. Duwez was educated in Belgium and has been with the California Institute of Technology since 1941. Klement received his Ph.D. from UCLA in 1962 and is currently with the University of California at Los Angeles. Willens was with the California Institute of Technology before joining Bell Laboratories in 1966.

anomalously high concentrations of praseodymium and neodymium as indicated by the spectral emission of a star could be construed as evidence that the above-mentioned chain of events did occur. By using the sun in this manner, a civilization would not only be solving its nuclear waste problem but also sending a long-term message to the surrounding galaxies that they do/did exist.

Europhysics Prize



O. K. Andersen



A. R. Miedema

The European Physical Society's Hewlett-Packard Europhysics Prize for 1980 has been awarded to O. K. Andersen and A. R. Miedema for their outstanding achievements in solid state physics, specifically for the development of original methods for the calculation of the electronic properties of materials. Andersen, of the Max-Planck Institut für Festkörperforschung, Stuttgart, Federal Republic of Germany, has developed a method of calculating the electronic band structure of solids which incorporates simplicity, flexibility, physical clarity, and economy—in terms of both time and money. Miedema, of the Philips Research Laboratories, Eindhoven, The Netherlands, has devised an ingenious empirical model that allows the thermodynamic properties of alloys to be determined with great facility from the characteristics of the constituents. Because of the excellent predictive qualities, both approaches are receiving increasing attention worldwide and represent an important step forward. Application of both methods to rare earth materials resulted in surprisingly good agreement with experimental results.

Gaussian Basis Sets

Citing a lack in the literature, H. U. van Piggelen, W. C. Nieuwpoort, and G. A. van der Velde have calculated the Gaussian basis sets for the neutral rare earth atoms and their trivalent ions [*J. Chem. Phys.* **72**, 3727-30 (1980)]. Characteristics of the basis sets are described and the results are compared with numerical Hartree-Fock results. Good agreement is shown. The authors plan to use the sets in an *ab initio* self-consistent-field calculation of the electronic structure of rare earth compounds within the framework of the Hartree-Fock-Roothaan formalism.

Mild Preparation

P. Girard, J. L. Namy, and H. B. Kagan have developed a method for preparing SmI_2 and YbI_2 at room temperature under inert atmosphere and anhydrous conditions that gives quantitative yields [*J. Am. Chem. Soc.* **102**, 2693-8 (1980)]. The resulting products may be stored under nitrogen in a tetrahydrofuran (THF) solution or the solvent may be removed giving $\text{Sm}(\text{Yb})\text{I}_2 \cdot n\text{THF}$ powder. The products were characterized by titration, absorption spectra, and magnetic susceptibility measurements. The reactivity of the diiodides with a variety of functional groups was tested with the following results: epoxides and sulfoxides were deoxygenated; aldehydes were selectively reduced in the presence of a ketone; alkyl halides (tosylates) were converted to alkanes; tertiary alcohols were obtained from ketones and alkyl halides; and alkyl sulfonates and polyfunctional halides (tosylates) were selectively added to ketones. More reactions are being examined but with the results to date, the authors speculate that the divalent lanthanide derivatives could form a novel class of useful reagents for organic synthesis.

Magnetic Semiconductors

The Proceedings of the International Colloquium on Magnetic Semiconductors, held September 10-13, 1979 at Montpellier, France, have been published as supplement number C-5 of the *Journal de Physique* **41**, C5-1 to C5-382 (1980). Over 60% of the articles deal with rare earth borides, oxides, sulfides, selenides, and tellurides under the general topics of optics and photoemission, phase transitions and critical phenomena, local environment, transport, magnetic excitations, band structure, and theory. The aim of the Colloquium was to survey recent developments with magnetic semiconductors in the areas of magnetic solid solutions, optical study of critical phenomena, Raman scattering, and valence fluctuations. Copies of the Proceedings may be obtained from Les Editions de Physique, BP 112, Z.I. de Courtaboeuf, 91402 Orsay, France. The cost is 200 F.F. in France and 220 F.F. (~\$45.00) elsewhere.

1980 Teacher-Scholar

H. G. Brittain has been named one of the sixteen 1980 Teacher-Scholars of the Camille and Henry Dreyfus Foundation. The award consists of a grant made to an academic institution on behalf of a young faculty member in chemistry or closely related sciences, based on the individual's performance and promise in teaching and basic research. Brittain received his Ph.D. in 1975 from the City University of New York and currently holds the position of assistant professor of inorganic chemistry at Seton Hall University. Brittain's rare earth interest centers on lanthanide solution-phase coordination chemistry, particularly chiral lanthanide complexes. Using circularly polarized luminescence spectroscopy, he is attempting to find an empirical correlation between observed spectra and possible solution stereochemistries. This type of correlation would aid in the application of the lanthanide ions as structural probes for calcium-binding proteins.



Handbook Translated

A book entitled *Handbook of Refractory Compounds* by G. V. Samsonov and I. M. Vinit'skii that was originally published in Russian by Metallurgiya (Moscow) in 1976 has been translated to English by K. Shaw and published by IFI/Plenum (New York) in 1980. The authors define refractory to mean metals, alloys, and compounds with melting point between 1500 and 4000° C. The handbook contains information on refractory aluminides, beryllides, borides, carbides, nitrides, phosphides, silicides, and sulfides of all the elements including the rare earths in tabular form. Properties covered include stoichiometry, crystallographic, thermal, thermodynamic, electrical, magnetic, optical, mechanical, chemical, and refractory properties. One chapter covers the applications of refractory compounds and an appendix contains phase diagrams of some binary systems. Each category is further (continued on page 4)

Rare Earther Dies After Rescue

D. R. Gustafson died June 25, 1980 after rescuing his daughter and her friend from the surf near Panama City, Florida. He was 43 years old. Dr. Gustafson received his B.A. in physics and mathematics from the University of Minnesota at Duluth in 1959 and his Ph.D. in physics from Iowa State University in 1964. From ISU he went to Wayne State University, where, at the time of his death, he held the position of professor and chairman of the department of physics. Gustafson's rare earth research centered on the use of positron annihilation to investigate the properties of the rare earth metals.

IR-100 Update

Another rare earth application in the top 100 significant new technological developments in 1980, as determined by *Industrial Research*, has come to our attention. This brings the total to six [see *RIC News XV*, No. 4, 1 (1980)]. The latest application incorporates yttrium oxide in an oxide dispersion-strengthened nickel-base superalloy. According to T. K. Glasgow of the Lewis Research Center, and Y. G. Kim, L. R. Curwick, and H. F. Merrick of the Inco Research and Development Center, the mechanically alloyed system possesses outstanding high-temperature strength properties. Application possibilities include turbine blades in gas turbine engines.

OXIDE PLASTICITY

A comprehensive review of the dislocation motion and high-temperature plasticity of single-crystal binary and ternary oxides has been published by T. Bretheau, J. Castaing, J. Rabier, and P. Veysseyre [*Advances in Physics* 28, 829-1014 (1979)]. The review covers the topics of oxide characteristics, examination of the mechanical tests, mechanical behavior of the different types of oxides, microscopic models of the deformation mechanisms, and observation of deformation microstructures. The only rare earth data presented are for yttrium oxide and yttrium iron garnet. In attempting to understand what controls the choice of slip systems in oxides, the authors found that no general rule exists, i.e., exceptions to most criteria can be found. A better understanding of dislocation core structure, climb, and multicomponent diffusion is stressed. The application of transmission electron microscopy to the study of dislocations is also reviewed. Three hundred forty-six references are cited.

NEEDS LESS POWER

It has been known for some time that information can be written thermomagnetically and retrieved via the Kerr- or Faraday-effect in optical storage systems consisting of magneto-optic films of amorphous rare earth transition metal alloys that have uniaxial anisotropy. H. Heitmann, I. Sander, M. Urner-Wille, and K. Witter have developed a combination of an amorphous magneto-optic film with a photoconductor sandwiched between transparent electrodes (AMOPS) which requires less light power for writing [*J. Magnetism and Magnetic Materials* 21, 233-8 (1980)]. The combination consists of a substrate, an $\text{In}_2\text{O}_3 \cdot \text{SnO}_2$ electrode, a $\text{CdS} \cdot \text{Cu} \cdot \text{Cl}$ photoconductor, an $\text{In}_2\text{O}_3 \cdot \text{SnO}_2$ electrode, and a GdFeBi amorphous film. For switching, a voltage is applied to the electrodes and laser light acts as a trigger to switch an ohmic heat by generation of photoconductivity at the storage site. This reduces by a factor of 100 the amount of laser power needed for writing when compared to direct laser heating. The AMOPS set-up unfortunately reduces the

Buckley Award



D. E. Eastman

W. E. Spicer

D. E. Eastman and W. E. Spicer are the co-recipients of the 1980 Oliver E. Buckley Solid State Physics Prize. The prize, endowed by Bell Laboratories, is to recognize and encourage outstanding theoretical or experimental contributions to solid state physics, and consists of a certificate and stipend. The two are being cited for their effective development and application of photoelectron spectroscopy as an indispensable tool for the study of the bulk and surface electronic structure of solids. Much of their study has focussed (so to speak) on rare earth materials. Eastman received his Ph.D. in 1965 from the Massachusetts Institute of Technology and currently manages the photoemission and surface group at IBM's Thomas J. Watson Research Center, while Spicer obtained his Ph.D. from the University of Missouri in 1955 and is currently with the Physics Department of Stanford University.

M M M

The 27th Annual Conference on Magnetism and Magnetic Materials is scheduled for November 10-13, 1981 at the Sheraton-Atlanta, Atlanta, Georgia. The program will consist of both invited and contributed papers on the experimental and theoretical research in magnetism, the properties and synthesis of new magnetic materials, and advances in magnetic technology. Abstracts for contributed papers should be received by Dr. H. C. Wolfe, American Institute of Physics, 335 East 45th Street, New York, NY 10017, by July 20, 1981. The Proceedings will be published in the *Journal of Applied Physics*. Registration fee is about \$70.00 with a reduced rate for students.

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Meetings of Interest

5th RE-Co WORKSHOP

The Fifth International Workshop on Rare Earth-Cobalt Permanent Magnets and Their Applications, to be held June 7-10, 1981 at the Hotel Roanoke, Roanoke, Virginia, is starting to take its final form. Six sessions and eight special lectures are planned. Session topics include electro-mechanical applications of rare earth-cobalt (R-Co) magnets; electrical and electronic applications of R-Co magnets; magnetic bearings, vehicle levitation, and load support; magneto-mechanical force and torque devices; properties of commercially available R-Co magnets; and new materials and processes. The eight special lectures will cover permanent magnets in the conventional automobile, permanent magnet traction motors for electric and hybrid vehicles, use of R-Co magnets in tracted vehicles, R-Co magnets in dental and medical prostheses and surgical applications, property measurement and use-related testing of R-Co magnets and other high-coercivity/high-energy product magnets, coercivity and microstructure of R-Co magnets, R-Co magnet research and development in the People's Republic of China, and recent R-Co magnet developments and their place in the spectrum of modern materials. Additionally, there will be a discussion forum on magnetic properties and their measurement, and raw materials supply and industrial uses of R-Co magnets. There will also be an R-Co product show for displaying machines, devices, test equipment, and informational literature. For more information, contact 5th REPM Magnet Workshop, c/o K. J. Strnat, KL-365, University of Dayton, Dayton, OH 45469.

Chalcogenides

An International Symposium on the Chemistry and Physics of Sulfides, Selenides, and Tellurides in Solids has been planned for September 14-17, 1981 at the Faculty of Pharmaceutical and Biological Sciences of the Université René Descartes, Paris, France. This multidisciplinary conference will cover relationships between structures, mixed valence compounds, electronic

Handbook. . .

(continued from page 2)

subdivided; e.g., the discussion of mechanical properties contains data for tensile, bending, impact, and compressive strength; modulus of elasticity; compressibility; and various hardness values (mineralogical scale, Rockwell, Vickers, and microhardness). Eight hundred forty-five references are cited. The handbook is 555 pages in length and costs \$75.00.

properties such as magnetism, superconductivity, charge density waves, and phase transition, ionic conductors, glasses and radiation absorption and emission including luminescence, laser, and solar energy. French and English are the official languages and the Proceedings will be published in the *Annales de Chimie*. For more information write to Professor J. Flahaut, Laboratoire de Chimie Minérale et Structurale, Faculté des Sciences Pharmaceutiques et Biologiques, Université René Descartes, 4, avenue de l'Observatoire, F-75270, Paris Cedex 06, France.

Conference Dates Changed

The dates for the International Conference on Valence Instabilities [See *RIC News* XV, [4] 2 (1980)] have been changed from September 28-October 1, 1981, to April 13-16, 1982. For more information, contact P. Wachter, Swiss Federal Institute

Temperature Measurement

Recent developments in optical temperature measurement have been reviewed by K. A. Wickersheim and R. V. Alves [*Industrial Research/Development* 21, [12] 82-9 (1979)]. Of particular interest is the blending of phosphor and fiber optic technologies to obtain a non-contact temperature sensor. The principles behind the application are: 1) if you have two phosphors that quench at widely different temperatures and fluoresce at distinguishable wavelengths, and 2) if the emission of a mixture of the two phosphors can be separated and measured, then 3) the temperature can be inferred from the ratio of the two intensities. If neither phosphor is allowed to saturate, then the measurement is independent of the intensity of the exciting radiation. Rare earth phosphors, particularly europium-doped gadolinium-, lanthanum-, and yttrium-oxysulfides, are ideally suited to this application since they exhibit sharp-line emission spectra and a useful temperature-dependent range. $Gd_2O_3S:Eu$ is useful in the 0° to 100°C temperature range; $Y_2O_3S:Eu$ extends the range to 320°C and $La_2O_3S:Eu$ falls between the two. The authors compare the various techniques, discuss possible applications, and suggest future directions for the technology.

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