ERES NEWSLETTER

EUROPEAN RARE-EARTH AND ACTINIDE SOCIETY

Université de Lausanne, Institut de chimie minérale et analytique
BCH, CH-1015 LAUSANNE (Switzerland)

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EDITORIAL

http ://WWW.UNIL.CH/ERES

The University of Lausanne has granted space to ERES on its WWW server, so that we are starting organizing a Web site. The home page lists the goals of the ERES and displays several buttons. One of those gives access to the member directory, organized country by country. For those members having e-mail address, a simple click on it will connect you. Bylaws and the conferences agenda appear upon clicking other buttons while the newsletter may be downloaded with the help of another icon. Related sites are also cited and a search engine facilitates your quest for information.

Please visit the site, which is still under construction and make your comments. They will help us improving it !

Jean-Claude Bünzli

1997 FINANCIAL STATEMENT

In 1997, the number of ERES members remained high, dropping slightly from 268 in 1996 to 256. One academic sponsor stopped his support, a decision consecutive to budget restrictions. The financial situation is quite satisfying as demonstrated by the following figures in Swiss francs.

Earnings

1996 dues cashed	60.--
1997 dues cashed	2457.50
1998 dues cashed	72.50
1999 dues cashed	42.50
2000 dues cashed	27.50
1996 interests	411.23
1997 interests	396.98
From ICFE-2	5000.--
Total	**8468.21**

Expenses

Bank costs, taxes	36.70
VISA costs	6.50
Taxes	12.45
Total	**55.65**
1997 result (profit)	**8412.56**

Assets

December 31, 1994 **17,220.88**
December 31, 1995 **26,746.06**
December 31, 1996 **32,822.21**
December 31, 1997 **41,234.77**

1996 interests were credited on January 3, 1997 only, so that they could not be taken into account in the 1996 financial statement. Moreover, the present statement lacks two positions : (i) dues cashed by ICFE-3 for fully-paying participants and (ii) the disbursed amount corresponding to the stipends given to young scientists to help them attend the conference. Since ICFE-3 accounts are not yet finalized, these two positions will appear in our 1998 financial statement.

We thank industrial and academic sponsors as well as individual members for their support.

BOOKS

Handbook, Vol. 24

Volume 24 of the *Handbook on the Physics and Chemistry of Rare Earths*, edited by K.A. Gschneidner Jr. and LeRoy Eyring appeared last year. The volume is mainly devoted to rare-earth materials.

The first chapter of the book (Nr 159), by Dowben, McIlroy and Li, describes the surface magnetism of the lanthanide metals as being significantly different from the bulk magnetism. One noteworthy feature is that the Curie temperature of the surface is significantly enhanced (5-10 %) from that of the bulk material. The preparation of amorphous nanocrystalline phases is discussed by McCormick in chapter 160. The technique can also be used to refine metals and compounds and to induce chemical reactions. In Chapter 161, Inoue presents a state of the art review on amorphous, quasicrystalline and nanocrystalline alloys in Al- and Mg-based systems. Most of the amorphous alloys are obtained as thin strips by rapid solidification techniques, but bulk alloys can also be prepared by casting. Chapter 161, written by Elschner and Loidl, is devoted to electron spin resonance as a tool for probing the local magnetic moments in a variety of materials. The probe site symmetry can be determined and the crystal field strength measured. In Chapter 163, Duc examines the exchange interactions and magnetocrystalline anisotropies in lanthanide-transition metal intermetallic compounds. The last chapter (Nr 164), written by Skolozdra, deals with the phase relationships, crystallography and crystal chemistry of binary and ternary rare-earth-tin materials.

Handbook on the Physics and Chemis-

try of Rare Earths, Vol. 24, Elsevier Science B.V., Amsterdam 1997. ISBN 0 444 82607 6, 582p.

http://www.elsevier.nl:80/inca/publications/store/5/0/5/2/1/5/.

Handbook Vol. 25

The volume is scheduled to appear in April 1998 and will be reviewed in our next issue.

Rare Earth Complexes

The Japanese Ministry of Education, Science and Culture has sponsored a four-year national priority research program in the fiscal years 1994-1997 titled : *Development of Studies on Rare Earth Complexes.* The objective of the program was to promote research in the whole area of rare earth chemistry, including (i) synthesis, structure, and properties of new compounds, (ii) catalytic activity of coordination and organometallic compounds, (iii) biomedical and clinical uses of rare-earth containing complexes, (iv) synthesis of new materials and development of novel separation processes.

Project leader, Professor Gin-ya Adachi from Osaka University has edited, with the help of professors T. Yamase, J. Inanaga, M. Komiyama, and K. Machida, an impressive 944-pages report on the research achievements attained during these last four years in Japan. The volume is divided into four parts (*cf.* above) and features 97 comprehensive short review articles written by researchers from universities, engineering schools and institutes of technology. It is completed by a bibliography listing 598 articles published or written during the course of the Program.

It is difficult to single out specific articles among this rich bundle of innovative reports. We would like, however, to mention some of the longer, more general articles. In the first part for instance, T. Yamase describes the synthesis, structural characterization and luminescent properties of six novel polyoxo-metaloeuropates, while Yuko Hasegawa analyses the factors controlling the stability of Ln(III) complexes with carboxylic acids, acridine and phenanthroline. In the second part, S. Kobayashi presents an extensive review of the use of rare earth triflates in organic synthesis. Reactions can be carried out both in organic solvents and in water thanks to these powerful Lewis acids, especially [$Yb(OTf)_3$]. In the third part of the book, M. Komiyama discusses the preparation of artificial restriction enzymes. Sequence specific DNases and RNases are obtained by conjugating lanthanide ions (as catalytic sites) with DNA oligomers (as sequence-recognizing sites). These artificial enzymes look promising as tools for biotechnology and gene therapy. In the last part of the book, Gin-Ya Adachi describes the development of new processes for mutual separation and recovery of rare earths via a dry chemical transport based on gaseous halide complexes as well as the preparation of luminescent complexes incorporated into composite materials.

Overall, the voluminous report is an excellent mirror of the present state of the art in lanthanide research, not only on a Japanese level, but simply worldwide.

New Development of Studies on Rare Earth Complexes, The Rare Earth Society of Japan, c/o Prof. Gin-Ya Adachi, Faculty of Engineering, Osaka University, Yamadaoka 2-1 Suita, Osaka 565, Japan.

CONFERENCES

ICFE-4 on tracks

During the second General meeting of ERES held on August, 17, 1994 in Helsinki during ICFE-2, members of the association followed a Spanish proposal to organize the year 2000 meeting in Madrid. Professor Regino Saez-Puche from Complutense Universidad has now set up his committee and decided upon the dates of the conference which will be held

September 17-21, 2000

in Madrid. Please book this week since 2000 will see many scientific meetings being organized !

Members of the local organizing committee are : R. Saez-Puche (Madrid, chairman), C.L. Otero-Diaz (Madrid), J. Fernandez (Bilbao), S. Bernal (Cadiz), J. Garcia Solé (Madrid), A. De Andrés (Madrid) and C. Cascales (Madrid).

SCES '98

The International Conference on Strongly Correlated Electron Systems (SCES '98) will be held in Paris, July 15-18. Dr. B. Coqblin and his collaborators from the *Laboratoire de Physique des Solides du CNRS* have set up a program in the line of the previous conferences held in Zürich (1996), Goa (1995), Amsterdam (1994) and San Diego (1993). It essentially concerns materials where strong electron correlation is important, mostly d-elements and f-elements. Frontier topics such as quantum oscillations, order parameter in superconductors, theory of « non Fermi » liquids, spin ladder materials, manganites, and ruthenates will also be covered.

Registration fees amount to FF 2500 if paid before May 1, 1998, otherwise FF 2900. For all enquiries, please contact Dr B. Coqblin (see page 4).

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INDUSTRY

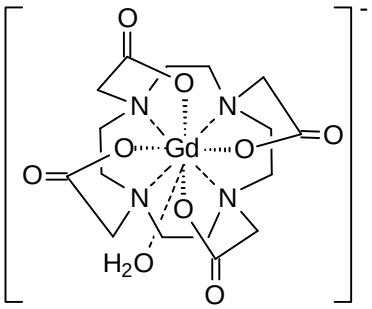
Guerbet S.A.

French leader in contrast agents for medical imaging, the independent group Guerbet employs 1161 persons worldwide. It is comprised of five French companies and eleven subsidiaries in Europe, Brazil, and Japan. In 1996, the turnover of the group amounted to 1064 million French francs, 61% coming from international operations. Research expenditures were up to 106 million FF, indicating the willingness of the company to develop high technology products for X-ray, ultrasonic and magnetic resonance imaging. We present below two of the leading products from this company.

Dotarem® : the macrocycle for MRI

Magnetic resonance imaging relies on the differentiation of tissues thanks to the different longitudinal (T_1) and transverse (T_2) relaxation times of their protons. The rate of return to thermal equilibrium after radiofrequency excitation in a magnetic field, $1/T_1$, reflects the loss of energy to the environment, while $1/T_2$ is the rate of loss of signal due to the exchange of energy between protons, which brings them out of phase. Small quantities of transition metal ions can substantially reduce the relaxation times T_1 and T_2 and this ability depends on the number of unpaired electrons. Iron (Fe^{III}, $3d^5$), manganese (Mn^{II}, $3d^5$) and gadolinium (Gd^{III}, $4f^7$) are the most efficient relaxation agents. Shortening of the T_1 relaxation time occurs because the magnetic field associated with the spinning electrons oscillates at the frequency at which the water protons precess (Larmor frequency). Energy is thus transferred from the resonating protons, reducing the time during which the protons remain in the excited state. T_2, which is always smaller than T_1, may also be shortened in the process but the main effect is on T_1. Protons coming into contact with transition metal ions will therefore display a shortened T_1 and can be better differentiated from other protons.

Gadolinium salts administered intravenously exhibit acute toxicity, mainly because Gd^{III} binds proteins 10^3-fold better than calcium. Contractibility of muscles, mitochondrial respiration and coagulation of blood proteins may be affected. Binding of Gd^{III} to a strong complexing agent is one method of masking the toxicity of the ion while keeping its magnetic properties. Today, two lines of gadolinium chelates are available as MRI contrast agents, linear and macrocyclic chelates. Among the latter, $[Gd(DOTA)]^-$ proved to be the more efficient.



The DOTA ligand was synthesized in 1976 by H. Stetter and its complexing ability with lanthanide ions was investigated in 1978-80 by J.F. Desreux who demonstrated the perfect match between the DOTA cavity and Gd^{III}. D. Meyer, Head of the Chemical research at Laboratoire Guerbet started to become interested in this chelate in 1980 and developed the contrast agent known as DOTAREM® which represents one of the main Guerbet products. DOTAREM® is a 0.5 M solution of $[Gd(DOTA)(H_2O)]M$ (M = meglumine) and is administrated at a dose of 0.1 $mmol \cdot kg^{-1}$. It has no side effects and is rapidly eliminated from the body (plasma half-life : 1.3 hours). Applications range from neurological to abdominal and bone-joint examinations.

Endorem® : a superparamagnetic injectable contrast agent for MRI

Developed under license from Advanced Magnetics Inc. (USA), this contrast agent for de detection of liver tumors is the first example of injectable nanoparticles. The active ingredient is a suspension of iron oxide crystals (Fe_2O_3 and FeO_4) ; the crystals measuring 3-5 nm are arranged in a nanoparticulate structure with a diameter of 120-180 nm. The aggregates are stabilized by low molecular weight dextran. The degree of surface adsorption on dextran determines the size of the particles. Citric acid and mannitol complete the formula. Uptake of Endorem® by the cells of the reticulo-endothelial system (res, Kupffer cells of the liver) allows the tumors, which are devoid of res cells, to be clearly differentiated from normal liver. The diagnostic potential is then considerably improved.

Data given in the text stem from the 1996 annual and financial reports and from specific leaflets on contrast agents.
Florence Pivert, director of communication, P.O. box 50400, F-95943 Roissy Charles-de-Gaulle Cedex, France
Phone : (+ 33 1) 45 91 50 03.

SCIENCE

Combinatorial chemistry helps finding new rare-earth

phosphors

A new luminescent inorganic oxide, Sr_2CeO_4, has recently been identified by screening a combinatorial library of more than 25 000 members prepared by automated thin-film synthesis.[1] The one-dimensional phosphor has chains of edge-sharing CeO_6 octahedra isolated from one another by Sr^{II} cations. The emission appears blue-white (485 nm) and has a quantum yield of 0.48. Excited state lifetime, electron spin resonance, magnetic susceptibility and structural data suggest that luminescence originates from a ligand-to-metal Ce^{IV} charge transfer.

Using the same combinatorial thin-film technique, two researchers from Lawrence Berkeley National Laboratory have isolated a new phosphor which is a potential candidate to replace the widely used Y_2O_3:Eu^{III}. Formula of the new phosphor is $(Gd_{1.54}Zn_{0.46})O_{3-\delta}Eu_{0.06}$. Its emission maximum peaks at 621 nm, its photoluminescent quantum efficiency amounts to 86% and its color chromaticity is very good (x=0.656, y=0.344).[2] It proved to be an excellent X-ray and cathodoluminescent phosphor. Some other bright red and green thin film phosphors activated by Eu^{III} and Tb^{III} were also found while screening the 128-member library.

1. E. Danielson, M. Devenney, D.M. Giaquinta, J.H. Golden, R.C. Haushalter, E.W. McFarland, D.M. Poojary, C.M. Reaves, W.H. Weinberg, Xin di Wu, *Science* **1998**, *279*, 837.
2. X.-D. Sun, X.-D. Xiang, *Appl. Phys. Letters* **1998**, *72*, 525.

The ERES Newsletter is your newsletter. Please send articles on any topic of interest to the f-element community.

Next deadline: June 30, 1998

AGENDA

Major events on f-elements

RARE EARTHS '98
October 25-30, 1998

International Rare Earth Conference New Technologies for the 21st Century
Fremantle, Western Australia

Mr Dudley J. Kingsnorth
Materials Institute of Western Australia
133 Salvador Road
WEMBLEY 6014, W.A.
☎ (+61 9) 387 9590 Fax 387 9639
E-mail: RE98@wantree.com.au
http://www.miwa.org.au/IREC98/

22ND RERC September 1999
Twenty-second Rare Earth Research Conference
Chicago area, USA.

Dr Lynda Soderholm
Argonne National Laboratory
Chemistry Division, Building 200.
9700 S. Cass Avenue
ARGONNE, Illinois 60439 6014
☎ (+1 630) 252 4364 Fax 252 9289
soderholm@anlchm.chm.anl.gov

4TH ICFE Sep. 17-21, 2000
Fourth International Conference on f-Elements.
Madrid, Spain.

Prof. Regino Saez-Puche
Dept. Quimica Inorganica
Universidad Complutense
E-28040 MADRID, Spain
☎ (+34 1) 549 1850 Fax 394 4352

Specialized meetings

13TH Radiochemical Conference
April 19-24, 1998

Mariánské Lázné-Jáchymov

Dr Jan John
Department of Nuclear Chemistry
Czech Technical University
Fax (+42 2) 232 0861
radchem98@br.fjfi.cvut.cz

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28ÈMES JOURNÉES DES ACTINIDES
May 14-16, 1998

Uppsala, Sweden.

Dr Olle Eriksson
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http://www.fysik4.fysik.uu.se

SCES98
July 15-18, 1998

Paris, France

Strongly Correlated Electron Systems

DrCoqblin
Lab. Physique des Solides, CNRS
Université de Paris-Sud, Bât. 510
F-91405 Orsay, France
Fax (+33 1) 69 15 60 86
coqblin@lps.u-psud.fr

http://www.cnrs-bellevue.fr/~sces98/

FORUM ON RARE EARTHS
October 4-8, 1998

Beijing, China.

Prof. Yu Zongsen
The Chinese Society of rare Earths
Beijin 100081, P.R. China
Fax (+ 86 10) 62 18 10 18