ERES NEWSLETTER

EUROPEAN RARE-EARTH AND ACTINIDE SOCIETY

Université de Lausanne, Institut de chimie minérale et analytique
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EDITORIAL

This is the last 1998 issue of your ERES NEWSLETTER. Your continuous interest in the Society is appreciated. We wish you a merry Christmas !

BOOK

Handbook, Volume 25

Started some twenty years ago, the series *Handbook on the Physics and Chemistry of Rare Earths*, edited by K.A. Gschneidner, Iowa State University and LeRoy Eyring, Arizona State University, is still vivid and has just published its 25th volume, covering chapters 165-167. The reviews contained in this volume continue the quest for a better understanding of the properties of lanthanide elements and of their compounds.

The first chapter reveals the effects of the addition of the rare earths on steel. These elements were introduced to the steel-making industry in the 1920's to affect deoxidization and desulfurization. Today it is possible to extend their usefulness to provide steels with desired characteristics. The description of why and how additions of the rare earths affect micro- and nano-structures in steels which provide these beneficial mo-difications is explored.

The second chapter analyzes ternary and higher-order nitride materials. The synthesis of ternary compounds is examined and the products are categorized by their composition and the nature of the chemical bonding they exhibit. The structures of the compounds are also presented.

The spectral intensities of f-f transitions in lanthanide compounds are discussed at length in the following chapter. The authors present an exhaustive consideration of the unique appearance of intraconfigurational electronic transitions in f-type materials, particularly the lanthanides.

The final chapter reviews the prodigious literature on the organometallic complexes of the f-elements. The authors consider the main classes of complexes of both the lanthanide and actinide organometallics, and synthesis and structure are dealt with in particular.

Handbook on the Physics and Chemistry of Rare Earths, Vol. 25, Elsevier Science Publishers : Amsterdam, 1998. Hardbound, ISBN : 0-444-82871-0, 508 pages Price: US$ 227.00.

SPEDDING AWARD
Call for nominees

The 9th *Frank H. Spedding Award* will be presented at the 22nd are Earth Research Conference, to be held July 11-15, 1999, in Argonne, Illinois. This prestigious award is given in recognition of distinguished contributions to the basic science and/or technology of rare earth materials. The award is presented by the Rare Earth Research Conference Incorporated, with the support of *Rhodia Rare Earths and Gallium*. The award has been presented previously to the following distinguished scientists :

1979	W.E. Wallace (USA)
1981	G. Bush (Switzerland)
1983	S. Legvold and W. Koehler (USA)
1986	A. Mackintosh and H. B. Moeller (Danemark)
1988	B.R. Judd (USA)
1991	K.A. Gschneidner Jr. (USA)
1993	L. Eyring (USA)
1996	G.R. Choppin (USA)

Nominations are sought from the world-wide rare-earth community. An individual may nominate more than one person for the award, or may propose a joint award for a group of leaders in a particular sub-field. Seconding letters are encouraged, especially if they cover information complementary to the nominating letter.

The nominations should be sent to Professor Larry Thompson, so that they are received by **April 15, 1999.** His address is :

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INDUSTRY

Treibacher : 100 years

The hundred year old history of Austrian based Treibacher started with Carl Auer von Welsbach, the famous chemists and inventor who launched rare earth industry. He was also the first to separate neodymium and praseodymium and he contributed to the discovery of ytterbium and lutetium. Auer von Welsbach invented the well-known gas mantle, the lighter flint and the incandescent electric lamp with a metal filament (Edison's lamp was using a carbon filament).

Auer started his industrial activities in Vienna but soon moved to Treibach

in 1898, located in Southern Austria, where he founded *Treibacher Chemische Werk AG*. Since this year, Treibacher activities have diversified into many areas such as :

- ferro alloys
- metal carbide powders
- recycling of industrial metal containing wastes
- sodium perborate and percarbonate,

but since the early days, rare earths have always been a key business for the company.

For almost a century, activities were carried out under the name *Treibacher Chemische Werk AG*. In 1994, a reorganization took place and the company at Treibach is now called *Treibacher Industrie AG*, with *Treibacher Auermet Produktionsgesellschaft m.b.H.* as a wholly own subsidiary.

Treibacher Auermet is responsible for the production and marketing of rare earths. Its main fields of activity are currently the following :

a) *Hydrogen storage alloys*
The NiMH alloy is meant to replace the toxic cadmium metal in rechargeable Ni-Cd batteries. The environmental friendly alloy is used in batteries for laptop computers, cellular phones and video cameras; future use in electric vehicles is also expected.

b) *Rare-earths metals and alloys*
Thanks to its 100 year experience, the company has a leading position in the production and supply of *Mischmetal*. Treibacher is the most important trader of this metal for Chinese domestic needs. Besides, a number of other specialties are produced, including a mischmetal/zinc master alloy for *Galfan* (a trademark of Ilzro) and mischmetal wires. The company also produces several different rare-earth alloys.

c) *Lighter flints*
Treibacher is a producer of high quality flints with very stringent tolerances and remains the only independent producer of these flints outside China. Most flints enter the cigarette lighter market, but some specific flints producing special sparking effects are also manufactured.

d) *Rare earth oxides, salts and compounds*
Treibacher Auermet has positioned itself as a producer of "niche" products and of products for the glass, ceramic and catalyst industries.

Since the early days of the company, its business sustained a steady increase, year after year. In 1996 a subsidiary was started in Ravne, Slovenia, at about 60 km from Treibach to produce low cost, high quality rare-earth and other vacuum alloys. The plant is equipped with a large 2-ton vacuum induction furnace the capacity of which is 2000 tons/year. This enables the company to be competitive on the very cost conscious market of nickel metal hydride powders. During the last years, Treibacher Auermet changed its business line from a producer of basic rare-earth commodities to a producer of more sophisticated products. Nowadays, the company devotes a lot of efforts to remain a reliable partner for its customers by initiating joint developments of new and improved rare-earth containing products.

Historical landmarks

1898 Foundation of the company by Carl Auer von Welsbach

1903 Production of Mischmetal and flints

1916 Production of ferro alloys

1929 Treibacher becomes a public company

1941 Production of artificial abrasives

1950 Mischmetal for metallurgical uses

1951 Establishment of a sodium perborate plant

1955 SIPET SAS is founded in Padua and Milano

1959 Production of hard metal powders

1969 Production of vanadium pentoxide

1976 A Treibacher office is opened in Tokyo

1990 Production of Auerstore®, a hydrogen storage alloy

1991 Wienerberger becomes the majority shareholder

1994 Treibacher Auermet takes over all rare earth activities from the Treibacher group by merging three formerly independent Treibacher divisions

1995 ISO 9001 certification

1996 Foundation of the Ravne plant in Slovenia

Treibacher today

Treibacher is an industrial group belonging to Wienerberger, a large Austrian corporation (7 500 employees, yearly sales : 1.2 billion US$). Treibacher Auermet itself employs about 90 people, produces about 3 500 metric tons of commercial compounds per year and its sales amount to 35 million US$ per year.

Activities on the occasion of the 100th anniversary have been centered on a program for intense employee training and education, to strengthen orientation towards the need of the curtomers.

Further information can be obtained from Otto Bohunovsky, Commercial Managing Director.

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SCIENCE

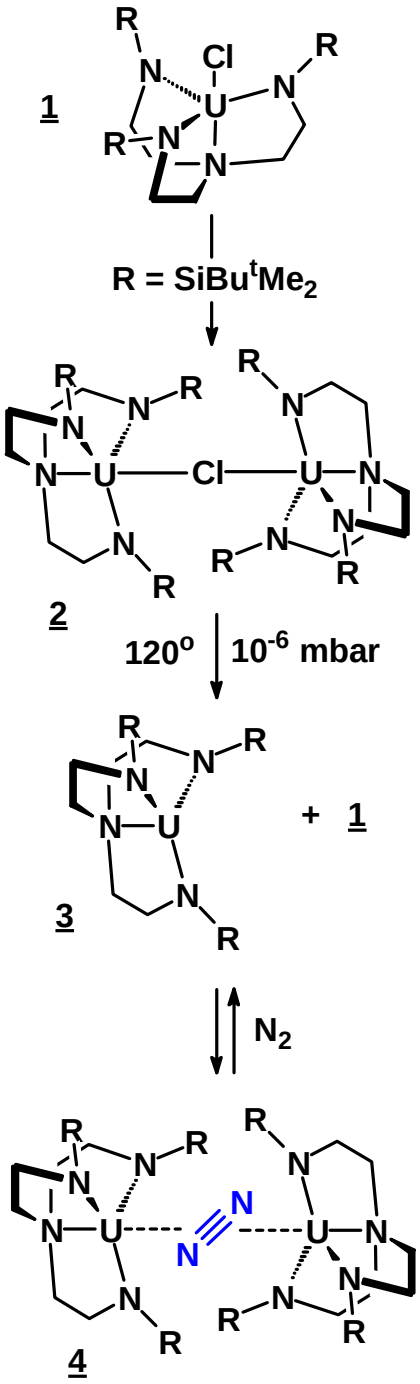
Dinitrogen chemistry benefits from f-elements

Dinitrogen chemistry remains a formidable challenge for the chemists, although substantial improvements have been made recently towards the activation of this simple and stable molecule.[1] Metal complexes containing dinitrogen as ligands are usually stabilized through π-backbonding and f-elements do not lend them easily to such electronic transfer. As a result, there are only two known complexes with Sm^{II} and until this year, no actinide complex was reported, despite the fact that coordinatively unsaturated trivalent uranium compounds (*e.g.* cyclopentadienyls) form adducts with carbon monoxide. This void is now filled.

Peter Scott from the University of Warwick and his coworkers have reported the isolation of a dinitrogen containing $uranium^{III}$ dimer. The tetravalent uranium complex **1** gives the mixed valence species **2** upon reaction with potassium in pentane, in which the chloride ion acts as a bridging ligand. Sublimation of **2** afford trivalent and deep purple complex **3**. When a solution of the latter in C_6D_6 is placed under an atmosphere of N_2 (slightly over 1 atm.), the color changes from purple to red and there is complete conversion into **4**. Nitrogen is released when **4** is submitted to a freeze-thaw process. The crystal structure shows dinitrogen bonded in a side-on bridging mode.[2]

Investigation of the U-N_2-U bond by quasi- relativistic non-local density functional mehods[3] in C_{2h} symmetry revealed a stabilization by sizable U→N_2(π) back-bonding. The calculated charge on the N-atoms of N_2 (-0.49) points to a metal-to-ligand electron transfer.

1. R.L. Rawls, *Chem. & Eng. News*, **1998**, June 22.
2. P. Roussel and P. Scott, *J. Am. Chem. Soc.*, **1998**, *120*, 1070.
3. N. Kaltsoyannis and P. Scott, *Chem. Commun.*, **1998**, 1665.



RARE EARTHS '98

Fremantle, Australia, 25-30 October, 1998

Close to 200 delegates from 25 countries had traveled a long way to attend the Rare Earths '98 conference in Fremantle, Western Australia last month. The long journey was worthwhile because the conference offered in five days a good overview of and an insight into the current developments in rare earth research, technology and markets. The Local Organizing Committee consisting of Dudley Kingsnorth (chair), Erica Jago (secretary) and six other Australian colleagues had performed together with the Program Committee chaired by Robert Woodward a superb job which resulted in a successful and enjoyable conference. Thanks are also due to the industrial sponsors, especially Rhodia Rare Earths and Gallium, for their generous support.

Western Australia - an El Dorado of industrial minerals and ores

One could not have chosen a more appropriate place for the conference than Western Australia because it is a major producer of industrial minerals, petroleum, and natural gas not only on a domestic scale but also world-wide. As pointed out by the Hon. Colin J Barnett, Minister for Resources Development, in his opening address of the conference, the value of Western Australia's mineral and petroleum industry exceeds US$12 billion per annum. This is much for a region of

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only 1.8 million inhabitants but, on the other hand, the area is huge: 2.5 million square km or some 80% of Western Europe.

In several areas, WA is a major producer on a world scale. For instance, her iron ore production (150 Mt/a) represents 15% of the world production as does the nickel production (120 kt/a). Rutile and ilmenite productions are likewise in the 10-20% range; in industrial diamonds the market share is 80%. Western Australia experienced a gold rush in the 1890s and still the gold production at 230 t/a represents more than 10% of the world's total. Rare earth deposits (monazite in heavy sands and the more recently assessed Mt. Weld ore) are also huge but their exploitation is currently on hold.

Rare Earths in Western Australia

Rare earths are not currently produced in WA although two projects are under consideration and have already received the necessary environmental approvals.

Rhodia Pinjarra Pty Ltd (formerly Rhône Poulenc Chimie Australia) has a proposal to build a monazite processing facility for rare earth concentrate production in Pinjarra where they currently have a $50 million sophisticated plant to produce 30 t/a gallium. Due to unexpected oversupply in the world gallium market the plant was closed in July 1997 but the production will restart as soon as the market conditions improve.

The conference excursion on Thursday had the future Rhodia Rare Earths plant site as its main goal. The participants of the tours had a chance to visit either the Cable Sands Processing Plant or the Westralian Sands Mining operations - both potential suppliers of monazite to Rhodia. Another natural resource of Western Australia: a local winery at Capel Vale provided wine tasting and lunch.

The Mt. Weld deposit, located some 1,000 km east of Perth, belongs to Ashton Mining Ltd and is a complex ore body containing mainly low radioactivity monazite and cerianite (CeO_2) as rare earth minerals. The resource contains approximately 1.3 Mt of ore with an average REO content of 23.6%. Mr Dudley Kingsnorth from Materials Institute of Western Australia gave an interesting presentation on the current status of the project which aims to produce 12,000 t/a of monazite concentrate at Mt. Weld. The concentrate would then be processed and separated into rare earth oxides with CeO_2 and other cerium compounds as main products. The processing plant is planned for Meenar, about 100 km east of Perth. The Australian Nuclear Science and Technology Organization has been working for some years to optimize the cerium solvent extraction process described by Karin Soldenhoff in another oral presentation at the conference.

Highlights of the programme

The program was organized into two parallel streams of oral sessions interrupted by poster sessions during coffee and tea breaks. Altogether 83 oral presentations were given and an equal number of contributions were shown as posters. The three largest sessions were those under the topics: Photophysics & Spectroscopy, Coordination Chemistry and Luminescence.

Each day was commenced by a plenary lecture. Because of China's leading position in rare earth production and resources, two of the plenary lectures discussed China's rare earth industry. Dr. P V Gundy, from Advanced Materials Resources, Toronto, gave an interesting account of their experience in developing a business in China as the first foreign company allowed to operate there. Dr. Jun Xi Yan (China Rare Earth Information Centre, Baotou) gave an excellent overview of the past, present and future of China's rare earth industry; his outstanding knowledge of the industry was shown in the enthusiastic manner in which he responded to questions.

The two other plenary lectures dealt with new applications of rare earth materials (Dr. R W McCallum, Rare Earth Information Center, Ames, Iowa) and radio lanthanides in nuclear oncology (Dr. J H Turner, Fremantle Hospital, Australia. For all plenary sessions there was a 'full house' for the presentations, another example of the commitment of delegates to broaden their understanding of rare earths.

Proceedings

The refereed manuscripts will be published in a special issue of the *Material Science Forum* to form a permanent record of the conference. It is expected that the conference issue, edited by Prof. R Woodward, will contain some 800 - 1000 pages and come out of press early next year, possibly in February.

Next rare earth conferences

During Rare Earths '98 an invitation together with the first printed announcement was extended to the delegates to attend the 22nd RERC next year at Argonne National Laboratory (http://chemistry.anl.gov/rerc). Also the plans for the next conferences (2000 in Madrid, 2001 in Brazil) are well advanced and the first announcement of the Brazilian meeting was distributed by Professors Lea Zinner and Geraldo Vicentini (http://www.iq.usp.br/geral/congress.htlm).

Lauri Niinistö

AGENDA

Major events on f-elements

22ND RERC	**July 11-15 1999**
4TH ICFE	**Sep. 17-21, 2000**
Brazil 2001	**September 2001**