

Division II Report to Council and Bureau

Highlights

The activities of Division II are grouped into three broad areas:

Atomic Weights and Isotopic Abundances;
Molecular Inorganic Chemistry;
Solid State Inorganic and Materials Chemistry.

The Atomic Weights and Isotopic Abundances activities are very well coordinated and are thriving, in part through continuation of the original IUPAC Commission II.I “Commission on Isotopic Abundances and Atomic Weights”, but also with a sequence of highly-focused and funded IUPAC projects in this area, leading to important publications such as Revision of the Table of Atomic Weights. This work is vital to the Division and to IUPAC and has recently been extended to include a joint Task Force involving the Geological Union, IUGS, concerning resolution of discrepancies in the half-lives of long-lived radioactive nuclides, which are of direct relevance for geochronological dating purposes.

The molecular inorganic activities, which previously were, in part, responsible for the creation of the new Division on Nomenclature, are now witnessing a resurgence of activities associated with increased Division membership in this area, including important representation for the Division on the Federation of European Chemical Societies.

Solid state high-temperature materials chemistry has long been an activity of Division II and this is now broadened to encompass the much wider range of activities under the umbrella of Materials Chemistry. Several projects have been funded in this area, often in collaboration with other Divisions, together with workshops and conferences. The sub-committee on Materials Chemistry is run largely by Division II, with representation from other Divisions and represents an area that is evolving and expanding rapidly.

An extremely important activity for Division II, is the cross-union working party with IUPAP, on validation of the claims for, and naming of, new elements. In recent years we have seen the authentication and naming of elements 110 and 111; at the moment, the joint IUPAC/IUPAP Working Party is considering claims for seven new elements with atomic numbers in the range 112 to the widely-mooted island of stability at 118. At the moment, the Working Party has no formal recommendations to make, but a verbal update may be presented in Torino.

Overall, the Division is in excellent shape, with an enthusiastic membership, including new Titular Members who have already demonstrated much interest in the involvement of IUPAC activities. The age distribution of the Division membership is excellent, with almost everybody in the category of active researchers; geographical distribution is also excellent. The portfolio of projects held by the Division is good, with several completed projects, a significant number that are progressing well and a number that have only just started. A significant percentage of Division II projects are joint with other Divisions or with other Unions.

Discovery and Naming of New Elements

The joint IUPAC-IUPAP working party on the discovery and naming of new elements has been re-activated following a considerable number of publications concerning new elements with atomic numbers in the range 112 to 117. Currently, the working party is evaluating the literature to establish the authenticity of the claims for discovery of new elements.

Materials Chemistry Sub-Committee

Members of the Materials Chemistry Sub-Committee met in Seattle on August 14th 2006 – in conjunction with the Division II Committee Meeting. The Sub-Committee accepted a report from Project 2005-001-1-200. “Towards Defining Materials Chemistry” on a day-long meeting that had been held in London organised by the Royal Society of Chemistry. The Task Group will meet with members of the Sub-Committee at Turin prior to the meeting of the Sub-Committee and it is anticipated that the project will be concluded at that time.

The Sub-Committee also considered, and initiated, a project to produce a glossary of terms used in Materials Chemistry and nano-related terminology and explored means to bring an earlier project on experiments in solid-state chemistry to a conclusion.

The Sub-Committee noted that HTMC-XII the twelfth in the High Temperature Materials Chemistry Conference series would take place in September 2006 in Vienna and was already a success in terms of registrations. The next in the series HTMC-XIII will take place at Davis in the USA in 2009 organised by Alexander Navrotsky. The Sub-Committee accepted a bid from Thailand to host the Workshop in Advanced Materials WAM IV in August 2008: the status and location of WAM-IV is currently under review (June '07).

Finally the Sub-Committee requested that the Division II Committee consider its future in light of its progress since it was formed at the General Assembly at Brisbane.

Sub-Committee for Isotopic Abundance Measurements, SIAM

The Subcommittee on Isotopic Abundance Measurements (SIAM) recognizes that there are a number of elements for which significant publications need scrutiny. These include Zn, Ca, Mg, and Si, for which significantly different, high precision publications have recently been assessed by SIAM.

The task group will evaluate recently published isotope ratios and resulting atomic-weights. Detailed discussions and calculations will be carried out on any chemical element for which new isotope ratio information exists. Particular attention will be paid to authors' evaluations of uncertainty, the selection of materials for analysis, and the variability of isotope ratio measurements in these materials. The task group will then present their recommendations for adoption of best isotopic ratios and new standard atomic weights to the Commission on Isotopic Abundances and Atomic Weights at the General Assembly in Torino.

SIAM has a project that can be found at <http://www.iupac.org/projects/2005/2005-027-1-200.html> and whose objective is to evaluate isotope ratio publications between 2005 and early 2007, to determine "best isotope ratio measurements" for compilation and publication in a 2009 TICE, recommend "new" standard atomic weights, and publish "Atomic Weights of the Elements 2007" in Pure and Applied Chemistry, which will also include a table of relative atomic masses and half-lives of selected radionuclides.

Celebrating the Centenary of Mendeleev's Death

The Periodic Table is at the core of the activities of Division II and a universal icon of Chemistry. This year we celebrate the centenary of the death of its father, the great Russian chemist, Dimitri Ivanovich Mendeleev (Tobolsk, Siberia, February 7, 1834 – Saint Petersburg, February 2, 1907).

The Spanish Government named 2007, as the Year of Science. On this occasion, the Spanish Royal Society of Chemistry organized numerous activities to promote Mendeleev and its Periodic Table. Dr. Javier Garcia-Martinez, Associate Member of Division II, had an active role in this initiative designing a commemorative stamp, below, to celebrate Mendeleev's genius. 5 million stamps were issued by the Spanish Mail on February 2007.



From July 11 to 13, 2007, Universidad de La Rioja, Spain, is organizing the first History of Chemistry Summer School. As part of this activity, Prof. Pascual Roman Polo will present the lecture, *Mendeleev, Principles of Chemistry and the Periodic Table*. He will also review the activities carried out during the Year of Mendeleev.

The official journal of the Spanish Royal Society of Chemistry, *Anales de Química*, dedicated its first issue of 2007, to Mendeléev and Javier wrote a review paper on Philately and Chemistry, with special attention to Mendeléev [J. Garcia-Martinez, J.M. Salas Peregrín, *La Química através de sus sellos. Un estudio comparativo de la filatelia dedicada a Mendeleiev*. *An. Quim.*, 103, 53-57 (2007)] and designed the front cover of the magazine.

To promote the Periodic Table among young people, the University of La Rioja (Spain), organized the Periodic Table Design Competition open to any person worldwide. Both scientific and artistic aspects will be considered. One first prize and two runner-up prizes will be presented at the University in July 2007.

The book *Nomenclature of Inorganic Chemistry* (the IUPAC “Red Book”) Translated into Spanish

Prof. Pascual Román Polo and Miguel A. Ciriano translated the “Red Book” into Spanish. It is expected that the book will be available from June 7, 2007. This book contains the recommendations published by IUPAC at the end of 2006, and replaces the previous version

Nomenclatura de Química Inorgánica. Recomendaciones de 1990, by Luis F Bertello y Carlos Pico Marin.

News and Articles

The Periodic Table: Its Story and Significance by *Herbert D. Kaesz, Chemistry International* March-April 2007, pg 22, review of the book "The Periodic Table: Its Story and Significance" by Eric Scerri

The Periodic Table at a Glance by G.J. Leigh *Chemistry International* March-April 2007, pg 23. review of the book "The Periodic Table at a Glance" by Mike Beckett and Andy Platt
 "High Temperature Materials Chemistry" by Herbert Ipser and Adolf Mikula *Chemistry International* March-April 2007, pg 27

"Priority Claims for the Discovery of Elements with Atomic Number Greater than 111" by John Corish *Chemistry International* January-February 2007, pg 18

"Teaching High-Temperature Materials Chemistry at the University Level" by Giovanni Balducci *Chemistry International* November-December 2006, pg 26

"Definitions of Terms Relating to the Structure and Processing of Inorganic and Polymeric Gels and Networks", *Chemistry International* July-August 2006, pg 23

"Inorganic Chemistry-Metal-Nucleic Acid Interactions" *Chemistry International* July-August 2006, pg 37

Javier Garcia Martinez Wins Silver Medal of the European Young Chemist Award, IUPAC Wired *Chemistry International* March-April 2007, pg 13.

"Calibration of Organic and Inorganic Oxygen-Bearing Isotopic Reference Materials" by Tyler B. Coplen *Chemistry International* March-April 2006, pg 29

Priority Claims for the Discovery of Elements with Atomic Number Greater than 111 by John Corish *Chemistry International* January-February 2007, pg 18

Conferences and Workshops

The IUPAC conference series on High Temperature Materials Chemistry continues with number HTMCXII held in Vienna in September 2006. Plans are already in-hand for the next conference, HTMCXIII to be held in Davis, California in 2009.

The third workshop in advanced materials WAMIII was held in Stellenbosch, South Africa in September 2005 and was regarded as a great success. Division approval has just been given for the next workshop, WAMIV to be held in Thailand, probably, in 2008.

Projects related to Education and Public Awareness

Teaching high temperature materials chemistry at University

The proposed project will provide a resource book of topics in the area of properties and behaviour of high temperature materials for those teaching materials science or physical or inorganic chemistry at various levels. The recommended topics will be accompanied with a bibliography of helpful references and a short introduction or explanation, including the areas of application.

The development of high temperature materials chemistry (HTMC) as an increasingly important field of scientific and technological research is due to the continuous demand for new materials and the need for systematic knowledge of their physical and chemical behaviour under the conditions required by the new technologies, for example in space and energy technologies. These materials, such as oxide and non-oxide modern multifunctional ceramics, intermetallics, etc which offer interesting technical applications for surface coatings, electronic components, advanced turbines

etc, are prepared through high temperature processing (e.g. transport reactions, CVD, combustion synthesis, laser ablation and deposition) and must be stable under extreme thermal and chemical conditions. HTMC now encompasses many fields of science and technology and its advancement has seen a synergic interchange between basic and applied research with the application of thermodynamics, kinetics and a variety of physical, chemical and modeling techniques to investigate processes and behaviour of materials at temperatures as high as 3000K and even up to 5000K. The results of over than 50 years of studies demonstrated that the general behaviour of materials and reactions at high temperatures differ, often dramatically, from those we are educated to expect at near room temperature. HTMC topics are rarely addressed in chemistry and materials science programs at university. Therefore, to fill the gap it is important to introduce the concepts underlying the behaviour of materials and chemical bonding at high temperatures to students of chemistry and materials science

IUGS-IUPAC Task Group

The Inorganic Chemistry Division has established a link with geochemists via a joint Task Group (that was approved and funded in October 2006) between the International Union of Geological Sciences (IUGS) and IUPAC. The objective of this Task Group is to resolve discrepancies in the values of decay constants (reciprocals of radioactive half-lives) of long-lived radioactive nuclides that are used by geo-chronologists for the dating of geological materials with those decay constant values that were previously recommended by IUPAC.

In preliminary work to the major objectives, the Task Group has had an article accepted for publication in the journal, *Quaternary Science Review*, entitled "Convention on the use of Systeme International (SI) units in Earth Sciences" by Renne et al. This paper attempts to correct the inconsistent use of Systeme International (SI) units that deal with age determinations used in the geological sciences.

Membership of European Association for Chemical and Molecular Sciences EuChemS

The European Association for Chemical and Molecular Sciences (EuCheMS) takes over the role and responsibilities of the Federation of European Chemical Societies and Professional Institutions, founded in 1970. This European Association for Chemical and Molecular Sciences promotes co-operation in Europe between non-profit-making scientific and technical societies in the field of chemistry whose membership consists largely of individual qualified chemical and molecular scientists and whose interests include the science and/or practice of chemistry.

This European organization of chemists had his first meeting (the 1st European Chemical Congress) on August 27-31, 2006 in Budapest. Over 3,000 participants from more than 50 countries worldwide attended the very successful 1st EuCheMS Chemistry Congress. Among the plenary presentations were talks by Jim Feast, President, RSC, on Chemistry Research in Europe and Dieter Jahn, President, GDCh on The future of chemical research in Europe.

The 2nd EuCheMS Chemistry Congress will be held in Torino, 16-20 September 2008 and its aims are: i) to promote chemistry and chemical sciences at the cutting edge; ii) to foster collaboration among scientists in research, industry, education in support of chemistry in the European Research Area and worldwide; iii) to enhance the image of chemistry .

The EuCheMS has also creates an EuCheMS Working Party on Inorganic Chemistry and Division II has nominated Luis Oro as IUPAC representative.

Industry relationships

The major Industrial links of Division II and IUPAC with the Chemical Industry run via the standing committee: COCI (Committee on Chemistry and Industry) which deals with issues of importance in chemistry-related industries. COCI emphasizes sharing best practice globally and focuses on capacity building in the developing world.

(1) Meetings

COCI normally holds two meetings each year: strategic and program planning meeting (2006:North Carolina, 2007:Lyndhurst UK); annual meeting (2006:Chicago, 2007:scheduled for Turin).

(2) Programs

The Health, Safety and Environmental Program: Safety Training Program (STP) funded by IUPAC-UNESCO-UNIDO has been running since 1993. In 2005-6 eight trainees were accepted and trained at AstraZeneca. COCI collaborated in organizing a conference on Occupational Health and Safety in East Africa held September 2006 in Nairobi, Kenya.

In the program Public Appreciation of Chemistry COCI provide industrial perspective on the activity of IUPAC. In 2006 an article was published in Chemistry International. A CD-ROM on educational material has been prepared in the Chinese language. The NAO/Company Associates Recruitment and Retention Program has continued in collaboration with the Secretariat to recruit company associates and national representatives. It has given recommendations for actions. New company associates have been successfully recruited in USA, UK and Kuwait. In the Trade Association Program, the participants are making connections with trade associations, government and non-government organizations like UNESCO and ICCA to assist NGO and IGO in collaboration with these organizations. Division and Standing Committee Collaboration Program aims at recruiting representatives from divisions and committees to COCI and vice versa.

(3) New projects

Two new projects have recently been accepted by IUPAC:

- a. Chemistry in a Changing World – New Perspectives Concerning the IUPAC Family (Jonas Unger)
- b. Responsible Application of Chemistry (Bernhard West)

(4) Conference

A conference entitled Chemistry in a Changing World – New Perspectives Concerning the IUPAC Family was held in March 2007 in Gothenburg, Sweden (no details available as yet). The World Chemistry Leadership Meeting will be organized in Turin 2007 with COCI participation.

(5) Other COCI and Industrial Issues

A new “COCI Corner” column in Chemistry International has been started and will continue. The latest issue of “IUPAC Projects of Interest to Industry” has been published and sent to NAOs and CAs worldwide.

In most International Conferences of inorganic chemical nature, industrial delegates participate on an equal basis, and in some cases – at the discretion of the local organizers – special sessions on industrial aspects are organized, such as at the 2006 ICCC in Cape Town.

Division II Project Update (April 2007)

(i) Live Projects

1999-049-1-200 Voronin *Thermodynamic characterization of high-temperature superconductors in the yttrium-barium-copper-oxygen system*

Hope to receive a final report this year.

2000-024-1-200 Balducci *Teaching High Temp Materials Chemistry*

Planned end date changed to 31-Dec-07

2001-015-1-100 Stanbury *Standard potentials of radicals*

No change since August 2006.

2001-019-1-200 Walczyk *Guidelines for mass spec measurements*

Planned completion is by the end of 2007.

2003-031-1-200 Berglund *Isotopic Compositions of Selected Elements*

Planned completion date, Sept 2007.

2003-033-1-200 Wieser *Determination of Atomic Weights Using New Analytical Techniques*

On schedule. Planned end date is 1-May-2008.

2003-034-1-200 Kniep *Classification, Terminology and Nomenclature of Borophosphates*

Project may be terminated.

2005-001-1-200 Day *Towards Defining Materials Chemistry*

Second Task Group meeting in Torino, August 2007.

2005-022-1-200 Brand/Coplen *Calibration of Organic and Inorganic Oxygen-bearing Isotopic Reference Materials*

On schedule; a progress meeting planned in Prague in May 2007.

2005-027-1-200 Berglund *Evaluated Published Isotope Ratio Data (2005-2007)*

On schedule. First meeting planned for July 2007, Pisa.

2005-043-2-400 Ober *Terminology for self-assembly and aggregation of polymers*

No change since August 2006

2006-016-1-200 Renne *Recommendations for Isotope Data in Geosciences*

On schedule--recently funded.

2006-025-1-200 Holden *Assessment of fundamental understanding of isotopic abundances and atomic weights of the chemical elements*

On schedule--recently funded.

2006-028-1-400 Ober *Terminology for conducting, electroactive and fieldresponsive polymers*

On schedule--recently funded.

2006-046-1-200 Karol *Priority claims for the discovery of elements with atomic number greater than 111*

On schedule.

(ii) Abandoned Projects

Four projects were abandoned (generally because of illness or death of project leaders):

2000-02-2-100 Yi Hua Ma

Standardization of methods for the characterization of inorganic membranes

2000-020-2-200 Prof. Meral Kizilyalli

Collecting, Testing and Dissemination of Experiments in Solid State and Materials Chemistry

2000-022-1-200 Prof. Hans-Peter Boehm

Characterization of carbon materials

2001-042-1-200 Prof. Ebihara

Review of Isotopic Abundances in Extraterrestrial Materials: Part 1.

(iii) Projects close to completion.

The following four projects have been or will be completed by December 31, 2007. Additional project(s) may be completed this year.

2001-019-1-200 Walczyk *Guidelines for mass spec measurements*
2002-049-2-200 Loss (Taylor) *A new comprehensive report on the isotopic compositions of
the elements for global users communities (RICE phase I)*
2003-031-1-200 Berglund *Isotopic Compositions of Selected Elements*
2005-022-1-200 Brand/Coplen *Calibration of Organic and Inorganic Oxygen-bearing
Isotopic Reference Materials*
2003-006-1-100 Harris *NMR Chemical Shifts: Updated Conventions. Completed.*

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