

**REPORT ON THE MEETING OF THE INTERDIVISIONAL
SUBCOMMITTEE ON MATERIALS CHEMISTRY, ISMC,
CORNELL UNIVERSITY, ITHACA, NY
17 OCTOBER 2009**

Present: Len Interrante (Div. II), Dick Jones (Div. IV), Chris Ober (Div. IV), Michel Rossi (Div. I), Tony West (Div. II), Angela Wilson (Div. I).

Purpose: This meeting was held at the behest of Division II, with the concurrence of Divisions I and IV, in order to provide an in-depth analysis and discussion of the current status of materials chemistry in IUPAC and, more specifically, to: (1) determine the future structure and function of the Interdivisional Subcommittee on Materials Chemistry, and (2) discuss/envision the possibility of a new 'Materials Chemistry Division' within IUPAC.

Background: A Subcommittee on Materials Chemistry was established by Division II after the demise of "Commission 2.4" on High Temperature Materials in the wake of the reorganization of IUPAC in 2000. Several Commission 2.4 Projects were continued after that, with the participation and support of Division I (Physical Chemistry). Later Projects on polymeric materials, originating in Division IV, were cosponsored by Division II and became part of the scope of this Subcommittee. For much of this time, Division II member John Corish served as Chairman, until his election as Treasurer of IUPAC, whereupon Tony West assumed this role. Throughout this period, Subcommittee meetings were attended primarily by Division II members, and Divisions I and IV members became occasional participants when meetings were held as part of the biennial GA's. During off-years, the Subcommittee continued to meet without participation of other Divisions. Thus, the predominance of Division II members at all of the meetings ensured that this Subcommittee would remain largely 'inorganic' in scope and Project focus.

Throughout much of this time, it was recognized that the true scope and importance of the growing field of 'materials chemistry' was not being adequately addressed by this Subcommittee and, in 2005, a Project entitled "What is Materials Chemistry?" was begun, with Prof. Peter Day as the Project Leader. The goals of this Project were:

"to 'assemble, collate and disseminate information about the scope of the newly-emerging discipline of materials chemistry, leading to an authoritative definition of the subject within the family of chemical sciences' and further, as a corollary, 'to recommend to IUPAC how this new discipline might best be represented within the IUPAC structure'."

This Project is now completed with two publications [Chemistry International, May-June 2009, pp. 4-8; Pure Appl. Chem., 81(9), 1707-1717(2009)] and a proposed definition of materials chemistry resulting: *Materials chemistry comprises the application of chemistry to the design, synthesis, characterisation, processing, understanding and utilisation of materials, particularly those with useful, or potentially useful, physical properties.* Moreover, it was concluded that:

“materials chemistry impacts on, and requires input from, many of the traditional Divisions of chemical science (physical, organic, inorganic, polymer etc) as defined by IUPAC. It can also be argued that its ubiquity and importance both for science and industry merit a more prominent status in the IUPAC structure. At present the interests of the subject are overseen by the Subcommittee on Materials Chemistry, which is formally placed under the Inorganic Chemistry Division. We argue that this arrangement no longer responds adequately to the size and reach of the materials chemistry community, which encompasses a broad range of materials and disciplines. Indeed, although the Subcommittee on Materials Chemistry was intended from the outset to function as an interdisciplinary committee, with members from Divisions other than Division II, it has proven difficult under the current structure to attract to its meetings (especially off-year meetings) a sufficiently broad representation from other Divisions.

The Project WG suggests that IUPAC address the present deficiency by establishing a cross-divisional Committee that would work with all the current IUPAC Divisions to develop and co-sponsor new projects, in the area of chemical education, nomenclature, terminology, health and safety, etc., that will increase the recognition of the current and future importance of this field within the international chemistry community.”

In response to this call for a change in the status of materials chemistry within IUPAC, the members present at our meeting in Glasgow decided to reconstitute the Subcommittee on Materials Chemistry in a manner that would make it truly “Interdivisional” in scope and function. Len Interrante agreed to take on this task as interim chairman of this Subcommittee. Based on initial discussions with members of Divisions I and IV, two members of each Division were designated to serve as initial members of the reconstituted Subcommittee and a meeting was scheduled for October 17, 2009 at Cornell Univ. in Ithaca, NY to discuss the future of the Subcommittee, and of materials chemistry, within IUPAC and to come up with ideas for some proposed Projects that would recognize the truly interdisciplinary nature of this field.

Agenda

- 1- Greetings and announcements from the meeting host (Chris Ober)
- 2- Introductions and discussion of the Agenda (Len Interrante)
- 3- The history of ‘Materials Chemistry’ in IUPAC and the Interdivisional Subcommittee on Materials Chemistry (ISMC) (Tony West)
- 4- A brief summary of the origins of ‘materials chemistry’ and its evolution as a distinct sub-field of chemistry (Len Interrante)
- 5- The Project: “Towards Defining Materials Chemistry” and its conclusions (Interrante, West)
- 6- Other current and recent materials chemistry-related Projects in Division II (West)

- 7- Reports from Division I and IV representatives on their recent/current materials chemistry-related Projects
- 8- Discussion of the future structure and operation of the ISMC (all)
- 9- Discussion of the option of a new 'Materials Chemistry Division' in IUPAC (all)
- 10- Examples of potential Projects for the 'new Division' that might be best pursued under an 'independent' Divisional structure (all)
- 11- Any other business

Outcome of the Meeting

Overall, it was felt that the meeting was highly successful in reaching its objectives. The need for a Subcommittee that was truly interdivisional in structure and function, with equal representation from each participating Division, was recognized and enthusiastically endorsed by all the members present. Most of the members viewed this revitalized Subcommittee as an intermediate step toward the eventual goal of a new Division of Materials Chemistry (or an overarching Standing Committee), however, one or two of the members expressed some reservations regarding the creation of such an independent structure in the near-term and what effect it might have on the existing Divisions. The following specific suggestions were made:

- In order to focus and expand the activities in materials chemistry within IUPAC it was decided to increase the visibility of this undertaking by including the **listing of the Subcommittee on the web pages of Divisions I and IV and also undertake to have it listed under "Committees" on the IUPAC website.**
- We should **extend an invitation to other Divisions to become active members of the Subcommittee.** The Analytical Division (Div. V) and COCI were identified, in particular, as possible additional participants in the SC.
- We should prepare **a master list of recent and current materials chemistry-related projects within IUPAC.**
- The Subcommittee needs to **develop and submit new projects to be part-funded by the Divisions and part by the Projects Committee.**
- We need to **expand membership of the materials chemistry community within IUPAC through project involvement by outside people** by attracting the attention of colleagues at large to the existing opportunities within the Subcommittee.
- It could be very useful to **include Nano- as an integral part of materials chemistry.**
- It is also important to **recognize the important connections between materials and the biological and medical sciences** (medical sutures, 3-D tissue scaffolds, implants and prosthetics, drug delivery, biochemical assays, etc.) as represented by IUPAC's Division VII (Chemistry and Human Health).

- High profile activity in Materials Chemistry could lead to **greater recognition of IUPAC among younger chemists** and its role in advancing international cooperation in chemical science and technology.
- It would be useful to **list some forefront scientific and technological issues that a new Materials Chemistry Division would be best suited to address.**
- **We need off-year meetings as well as meetings associated with the GA.** It was suggested that we rotate our off-year meetings to be associated with the off-year meeting of one of the three core Divisions, starting with Division I. Our next meeting was scheduled for 2010 in Zurich, on April 23, immediately before the off-year Division I meeting there. For the present, as was the case with this meeting, the participating Divisions should cover their members' cost for attending these off-year meetings; however, support through Projects will also be sought.

Actions:

1. New proposal to survey the current range of Materials Chemistry activities within IUPAC and further investigate the option of a Materials Chemistry Division or Standing Committee within IUPAC. **Len/Tony.**
2. To prepare a Mission Statement with milestones. **Michel.**
3. To prepare a proposal for a Materials Chemistry education website. **Dick/Chris.**
4. To prepare a report of our meeting for CI. **Dick.**
5. To reserve time for a meeting on July 28, 2011, Puerto Rico. **Len.**
6. To make arrangements for our next meeting in Zurich, April 23, 2010. **Michel.**
7. To invite COCI to send a representative to our Zurich meeting. **Len.**
8. To consider ways to increase the involvement of younger chemists in the activities and Projects of the Subcommittee. **Angela.**
9. To propose, create and maintain materials chemistry-relevant CRITICALLY evaluated databases, for such key materials types and properties as: hydrogen storage materials, semiconductor nanoparticles, carbon nanotubes, dental materials; thermoelectric figure of merit, photovoltaic efficiency, etc. To come up with specific project suggestions/possible leaders for discussion at our next meeting. **All.**
10. To follow the lead of Division I in "tackling energy-related problems". To come up with project suggestions/possible leaders for our next meeting in Zurich. **All.**
11. To consider a new project strategy "identification of best practice in Materials Synthesis, Processing and Characterisation", with projects based on specific materials groups, e.g. thermoelectrics, solar-cell materials, lithium battery materials, electroceramics. **Tony/Len.**

Looking to the Future: Depending upon the proposal volume, number of completed projects and number of constituent members representing a scientific community rallied around the subject area of materials chemistry it will then be decided whether or not to apply for the status of a separate Materials Chemistry Division or Standing Committee that comes with its own budget and representation in the Bureau. The discussion whether or not to apply for such a status will be postponed for a few years, until we have had sufficient time to assert ourselves within IUPAC in terms of a significant number of completed projects and the constitution of a scientific

community centered around materials chemistry. This latter point is considered to be crucial for the viability of materials chemistry research that has its home in a proper IUPAC Division that deserves this name. Here, the overlap with the research activities of the nanoscience and biological sciences communities seems of crucial importance.

Proposals: In addition to the “classical” materials properties, synthesis, characterization and utilization proposals received so far it is planned to reach out to the nano- and biological sciences as far as materials chemistry subjects are concerned in an obvious attempt to represent their concerns and research needs in the newly constituting entity. If successful, this will profoundly alter and extend the nature and the constituency of the materials chemistry community in the future.

Several types of proposals will most likely be considered in the framework of the planned activities.

- Nomenclature/terminology questions
- Monographs on properties, good-laboratory practices (GLP) -type concerns
- Data base proposals or more restricted sets of selected materials: report on material properties, synthesis, characterization, etc.
- Specific examples: in the area of energy storage and generation, *fuel cells* (membrane properties, proton diffusivities, aging and deterioration phenomena, chemical corrosion,); *photovoltaics* (efficiencies, photocatalytic corrosion, aging effects); novel (lightweight) *battery technology*;...