

IUPAC Polymer Division Report 2008-2009

Prepared by C. K. Ober, Division President

I. Highlights:

The Polymer Division of the International Union of Pure and Applied Chemistry is concerned with the science and technology of macromolecules and polymers. Its aims are:

- To facilitate international scientific exchange
- To cooperate with other international organizations
- To promote macromolecular and polymer science and technology at the international level, including education, conferences and the assessment of societal impact
- To define terminology and standards in macromolecular and polymer science and technology

The Polymer Division is organized into 6 subcommittees: i) Polymer Terminology; ii) Developing Polymer Materials; iii) Polymer Education; iv) Molecular Characterization of Polymers; v) Structure and Properties of Commercial Polymers; and vi) Modeling of Polymerization Kinetics and Processes. The activities of each subcommittee are well described by its title.

Of particular note, the Subcommittee on the Structure and Properties of Commercial Polymers is almost entirely made up of members from the chemical industry. The Subcommittee on Developing Polymer Materials is unique in that its goal is to generate new ideas at the forefront of polymer chemistry and to pass the resulting projects onto the other subcommittees. In addition there are small groups of Division members responsible for the Division Web Page and Electronic Publications, fostering International Cooperation focused on the IYC and for enhancing Industrial and International Relations.

During the last year and a half the Division has been actively working to achieve these goals. Some of the highlights of the past 18 months include:

Preparing for the International Year of Chemistry: At the recent IUPAC World Polymer Congress (WPC) and as a follow-up to IUMACRO-07, a mini-summit was held between the Polymer Division and representatives of several international polymer societies to discuss possible areas of co-operation. Attendees included representatives of the European Polymer Federation, the Japanese Society of Polymer Science, the Korean Polymer Society, and the

American Chemical Society. Several topics for greater co-operation were identified including education, the developing world and in sponsoring symposia aimed at younger polymer scientists. A meeting will be held at the Glasgow WCC with leaders of other polymer societies to build a joint program around the International Year of Chemistry. At the moment the current ideas include:

1) Joint symposia and conferences - There are a variety of possible topics including polymer education, the impact of polymers on society, etc. It might be very nice to hold joint programs at the meeting of the European Polymer Federation or with the Asian Pacific Federation as well as during the Puerto Rico IUPAC General Assembly. Joint symposia might be focused on younger polymer scientists. A direct result of prior discussions was the International Young Polymer Scientist Symposium held at MACRO 2008 in Taipei. We will explore particular topics or other ways to work together.

2) An enhanced web presence - the IUPAC Polymer Division has established an education web site that it is working to improve. Currently it rates very high in Google searches of “polymer education” and is continuing to climb. The web address is: <http://www.iupac.org/polyedu/> This web site links to educational web sites in over 4 continents and 8 countries and distributes without cost an educational CD that explains the basics of polymer chemistry. This web site is already linked to the CCE and IYC web pages. It might be appropriate, for example, to include video messages from distinguished polymer scientists representing different parts of the world celebrating IYC. This web site could also list events focused on polymers related to the IYC.

3) The value of polymers to society - the IUPAC polymer division has spoken with members of the polymer industry and they are interested in communicating the value of polymers to society. While this is a difficult year to talk to industry due to the economy, they might in future years (by 2011) be interested in supporting this.

IUPAC Visibility and Promotion of Polymer Chemistry: It has been the goal of the Polymer Division to increase its visibility to the scientific community, to increase its value to younger polymer chemists and to honour its most productive members. The division administers the IUPAC-Samsung Young Polymer Scientist Award, the “DSM Performance Materials Award (with the cooperation of IUPAC)” and the IUPAC-Polymer International

Award. Both the "DSM-IUPAC" and the "IUPAC-PI" Award were newly presented at the recent 2008 IUPAC World Polymer Congress. Division IV was directly involved in the selection of the award winners. Each award has been well received by the chemical community and the following polymer chemists were honoured: Craig Hawker (USA), DSM-IUPAC Award; Zhenan Bao (USA), IUPAC-PI Award; and Eric Cloutet (France), Samsung Award. Nominations for the DSM-IUPAC and the IUPAC-PI awards are underway with presentations expected for the 2010 World Polymer Congress to be held in Glasgow.

International Research Funding Pilot Project: As an outgrowth of this educational effort, Division IV is planning a showcase project with the IUPAC Task Group on "International Research Funding in the Chemical Sciences" to examine the possible role of IUPAC in fostering international joint research projects. Discussions were recently held in December 2008 in Washington DC and a detailed plan for a call for proposals involving researchers of 3 or more countries was discussed. It is the goal to involve researchers and students from developing countries as part of the Div. IV educational efforts. A timetable has been set and a joint project is planned in this activity. We hope to have the call for proposals in place shortly and functioning so that we can hold a symposium of all participants during IYC or shortly thereafter.

II. Report of Division/Committee Activities during 2008 2009.

In all its activities, the Polymer Division strives to achieve several of its strategic goals simultaneously. For this reason, this report somewhat artificially divides its activities into the sub-categories that are the IUPAC strategic objectives.

a) IUPAC will provide leadership as a worldwide scientific organization that objectively addresses global issues involving the chemical sciences.

The creation, study and manufacture of polymers are actions of worldwide significance. Polymers are key elements in virtually all the major science and technology fields ranging from medicine to microelectronics to nanotechnology. Increasingly, the large-scale production of polymers is shifting to the developing world. For these reasons the Polymer Division, has targeted efforts in education of and involvement of chemists from these regions.

As an example, Division IV is working on two activities that we see as opportunities to address this. Our planned activities for the International Year of Chemistry, through our joint

activities with polymer societies, through our increased web presence and through our increased focus on symposia for younger scientists will help us better connect with the developed and developing region. In particular, the education subcommittee is developing new teaching material that it will distribute over the Internet. As another example, our pilot project with the IUPAC Task Group on “International Research Funding in the Chemical Sciences” on developing new models for research funding involves the engagement of developing countries. By encouraging the hiring of students and post-docs from developing regions as part of this multi-country effort, we hope to better train these researchers, raise their level of chemical expertise, build professional networks that are so important in the sciences and through this process make them more aware of IUPAC.

b) IUPAC will facilitate the advancement of research in the chemical sciences through the tools that it provides for international standardization and scientific discussion.

The Polymer Division works consistent with this goal through its sub-committees to identify current polymer trends and topical areas and help to develop standard definitions, processes, methods and materials. For example, the Terminology Subcommittee is refining the language of polymer chemistry and through its collaborations, working to develop terminology of materials chemistry as well. The Subcommittee on Structure and Properties of Commercial Polymers works with members of the chemical industry to standardize terms and methods related to the characterization of polymers. The Subcommittee on Modeling of Polymerization Kinetics and Processes is providing a wealth of scientific literature to standardize the known rate constants and mechanistic models for polymerization chemistry while the Subcommittee on Molecular Characterization of Polymers is developing a common framework for the analysis of polymers at the molecular level, for example, in the area of the molecular weights, molecular size and other properties of polymer molecules. These Subcommittees publish regular reports to disseminate this information to the polymer chemistry community.

Purple Book: In addition to the reports that the Division produces throughout the year as a result of its project system, the division is responsible for the Purple Book. An updated and enhanced version has just been published. As one of our most significant terminology projects the Division is justifiably proud. *Compendium of Polymer Terminology and Nomenclature*, IUPAC recommendations 2008 [RSC Publishing](#), 2009 [ISBN 978-0-85404-491-7] Congratulations to the editors, especially Prof. Richard Jones.

c) IUPAC will assist chemistry-related industry in its contribution to sustainable development, wealth creation, and improvement in the quality of life.

A strategic goal of the division is to improve our links to the chemical industry. Two ways to do this are through our existing sub-committees. The Division IV Subcommittee on Polymer Structure-Property Relationships has an extraordinarily high level of industrial participation (over 90%). A major reason for this is that the round-robin style of data collection and sharing has an enormous benefit for industry. It is our plan to use the high industrial participation to reach out to industry and build further ties. Bob Stepto, former Division President, has also been appointed to serve as a new Industrial Liaison and has attended the sub-committee meeting to make connections to industry and also visited a trade organization located in Brussels to explain the role of IUPAC to the Polymer Industry. It has been recommended that he temporarily hold off on his efforts because of the economy, but we expect that later this year these and other actions will serve to further engage industry in our activities. We do expect that a strong interest voiced by industry to help with our educational efforts and participation in the IYC will lead to stronger connections despite the current economic situation. We would also like to work with COCI on this topic and expect to continue discussions started in Bratislava on this topic.

d) IUPAC will foster communication among individual chemists and scientific organizations, with special emphasis on the needs of chemists in developing countries.

The Polymer Division communicates with the polymer chemistry community through its publications, through the organization of conferences and through the internet using both the IUPAC website and its own Polymer Education website.

Publications: Since the reports of the Division subcommittees are mentioned above, I will only add that the Polymer Division has published many of its conference proceedings as part of the Macromolecular Symposia Series, through Wiley. This venue offers both an additional means of communication and also provides a modest income for the Division.

Conferences: The World Polymer Congress (June 2008, Taipei. Organizer: Prof. Show-An Chen) attracted more than 1,200 participants from 50 different countries. The IUPAC web site describing sponsored symposia lists the additional conferences sponsored by Div. IV. In addition the WPC 2010 will be held in the same venue as the current WCC. It would be good in future to better coordinate WCC and WPC locations so that these repeats do not occur. In

addition, several more conferences to be held in 2009 are in the process of being granted IUPAC sponsorship. WPC 2012 is expected for early July in Blacksburg, VA, USA and WPC 2014 is expected to be in Asia with the frontrunner for host being Thailand.

In the immediate past and current years, 12 sponsored conferences were or are scheduled. Just as the Torino WCC hosted the first technical sessions devoted to topics related to the Polymer Division interests, the Glasgow WCC will also host symposia organized by and related to Division topics. We are grateful to the Glasgow organizers for enabling us to do this. It is our ongoing goal to continue to carry out organization of polymer-focused symposia at future WCC.

Internet: IUPAC provides a website for provision of information about the organization. At present this website is inadequate for two reasons – it is just now becoming functional but still needs improvement. But it also misses a real opportunity to better communicate the benefits of chemistry to society. Perhaps this will change with the website planned for the International Year of Chemistry.

The Polymer Division educational website is slowly growing. Already it is one of the most highly ranked web sites at Google for polymer education. Originally planned as a tool to disseminate the contents of a CD on polymer science, it has now grown to include links to international polymer education web sites, it provides educational material created at Polymer Division conferences and workshops, it will provide links to the IYC web site as it develops and it will serve as a platform for additional Polymer Division IYC activities.

e) IUPAC will utilize its global perspective and network to contribute to the enhancement of chemistry education, the career development of young chemical scientists, and the public appreciation of chemistry.

The education sub-committee is energetically working on several activities. In addition to its web site mentioned above, in line with the strategic goals of the Polymer Division, it has a particular focus on educational activities for the developing world and especially younger scientists. It is developing links to polymer education groups across the globe. It is also a goal to use the web site to provide access to the educational material developed for IUPAC sponsored polymer division conferences. It has recently made available educational materials resulting from workshops and conferences through its web site.

As an outgrowth of this educational effort, Division IV is planning a showcase project with the IUPAC Task Group on “International Research Funding in the Chemical Sciences” to examine the possible role of IUPAC in fostering international joint research projects. Discussions were recently held in December 2008 in Washington DC and a detailed plan for a call for proposals involving researchers of 3 or more countries was discussed. It is the goal to involve researchers and students from developing countries as part of the Div. IV educational efforts. A timetable has been set and a joint project is planned in this activity. We hope to have the call for proposals in place shortly and functioning so that we can hold a symposium of all participants during IYC or shortly thereafter.

Other activities include UNESCO/IUPAC polymer education workshops, held periodically in South Africa to offer training to young chemists from the developing world. The UNESCO/IUPAC Postgraduate Course in Polymer Science organized by the Institute of Macromolecular Chemistry, Academy of Sciences of the Czech Republic, in Prague also offers financial support and training for students from the developing world. Finally, each year the PolyChar conference offers a workshop aimed at students to better understand the methods of polymer characterization. Also important is the Samsung prize, recognizing the accomplishments of young polymer scientists, given at the World Polymer Congress. This and other prizes (see Other Information below) provide recognition of the accomplishments of polymer chemists.

f) IUPAC will broaden its national membership base and will seek the maximum feasible diversity in membership of IUPAC bodies in terms of geography, gender, and age.

The Polymer Division makes every effort to ensure that its membership is represented by chemists from all major regions of the earth. We have a tradition of rotating the leadership between Europe, the Asia Pacific region and the Americas. In order to maximize participation, our electoral process involves voting by Titular Members, Associate Members, National Representatives, Subcommittee Chairs, and project members. In this way all relevant persons can participate. We regularly involve 10 NRs in our activities. We are working hard to bring in younger members to participate in our leadership and as members of our subcommittees.

III. Other substantive information

Polymer Chemistry Awards: It has been the goal of the Polymer Division to increase its visibility to the scientific community, to increase its value to younger polymer chemists and to honour its most productive members. The division now administers the IUPAC-Samsung Young Polymer Scientist Award, the “DSM Performance Materials Award (with the cooperation of IUPAC)” and the IUPAC-Polymer International Award. Both the “DSM-IUPAC” and the “IUPAC-PI” Award were newly presented at the recent 2008 IUPAC World Polymer Congress. Division IV was directly involved in the selection of the award winners. Each award was a great success and the following polymer chemists were honoured: Craig Hawker (USA), DSM-IUPAC Award; Zhenan Bao (USA), IUPAC-PI Award; and Eric Cloutet (France), Samsung Award. Nominations for the DSM-IUPAC and the IUPAC-PI awards are underway for the 2010 World Polymer Congress.

IV. Tabular Material.

The following section provides information on the recently published *Purple Book*, Macromolecular *Symposia*, Polymer Division Conferences with IUPAC sponsorship and Division Created Technical Reports.

Purple Book - *Compendium of Polymer Terminology and Nomenclature - IUPAC Recommendations 2008* published by RSC, 2009 [ISBN 978-0-85404-491-7].

This new edition of the "Purple Book" is one of a series of books issued by IUPAC. It collects into a single volume the most important position papers on the nomenclature and terminology of several types of polymers, such as Regular Single-Strand Organic Polymers, Regular Double-Strand (Ladder and Spiro) Organic Polymers, and Irregular Single-Strand Organic Polymers. The scope has been extended to include papers on terminology for polymers. It is a handy compendium for scientists and is invaluable for those professionals working in this field.

Macromolecular Symposia - The following volumes have been published since the last biennial report as of March 30, 2009 by Wiley – VCH in 2008 – 2009, based on presentations in the sponsored conferences.

Macromolecular Complexes, Macromol. Symp. vol 270, Aug 2008
12th IUPAC International Symposium on Macromolecular Complexes (MMC-12) was held August 27-31, 2007 in Fukuoka, Japan

Editor: Naoki Toshima

Advanced Polymer Materials for Photonics and Electronics, Macromol. Symp. vol 268, July 2008

The conference Advanced Polymer Materials for Photonics and Electronics took place in Prague, 15-19 July 2007

Editor: Vera Cimrová

Nanostructured Polymers and Polymer Nanocomposites, Macromol. Symp. vol 267, June 2008

The conference Nanostructured Polymers and Polymer Nanocomposites took place in Prague, July 2007.

Editor: Libor Matejka

POLYCHAR-16 World Forum on Advanced Materials, Macromol. Symp. vol 277, March 2009

POLYCHAR 16 was held February 17th-21st 2008 in Lucknow, India

Editor: Michael Hess

IUPAC Conferences sponsored by the Polymer Division

17 February 2008

[POLYCHAR-16 - World Forum on Advanced Materials](#)

02 June 2008

[6th International Symposium on Molecular Order and Mobility in Polymer Systems](#)

29 June 2008

[Macro 2008 - Polymers at Frontiers of Science and Technology](#)

20 July 2008

[2008 Prague Meetings on Macromolecules - 48th Microsymposium "Polymer colloids: From design to biomedical and industrial applications"](#)

07 September 2008

[4th International Symposium on Macro- and Supra-molecular Architectures and Materials \(MAM-08\)](#)

08 September 2008

[10th Annual UNESCO/IUPAC Conference on Macromolecules & Materials](#)

15 February 2009

[Materials of the Future-Science of Today: Radical Polymerization](#)

20 April 2009

[PolyChar 17 - World Forum on Advanced Materials](#)

07 June 2009

[Frontiers in Polymer Science - International Symposium Celebrating the 50th Anniversary of the Journal "Polymer"](#)

28 June 2009
[2nd International Conference on Self-Healing Materials](#)

05 July 2009
[13th International IUPAC Conference on Polymers and Organic Chemistry \(POC-'09\)](#)

05 July 2009
[New Frontiers in Macromolecular Science: From Macromolecular Concepts of Living Matter to Polymers for Better Quality of Life](#)

12 July 2009
[European Polymer Congress 2009](#)

26 July 2009
[19th IUPAC International Symposium on Ionic Polymerization \(IP '09\)](#)

Technical Reports and Recommendations

Commission On Macromolecular Nomenclature

J. Alemán, A. V. Chadwick, J. He, M. Hess, K. Horie, R. G. Jones, P. Kratochvil, I. Meisel, I. Mita, G. Moad, S. Penczek and R. F. T. Stepto

Definitions of terms relating to the structure and processing of sols, gels, networks, and inorganic-organic hybrid materials (IUPAC Recommendations 2007)

[Vol. 79, Issue 10, p. 1801 \[Details + Abstract\]](#) [[Full text - pdf 295 kB](#)]

Commission On Macromolecular Nomenclature - Subcommittee On Macromolecular Terminology - Subcommittee On Polymer Terminology

Stanisław Penczek and Graeme Moad

Glossary of terms related to kinetics, thermodynamics, and mechanisms of polymerization (IUPAC Recommendations 2008)

[Vol. 80, Issue 10, p. 2163 \[Details + Abstract\]](#) [[Full text - pdf 269 kB](#)]

Subcommittee On Modeling Of Polymerization Kinetics And Processes

Sabine Beuermann, Michael Buback, Pascal Hesse, Frank-Dieter Kuchta, Igor Lacik and Alex M. van Herk

Critically evaluated rate coefficients for free-radical polymerization Part 6: Propagation rate coefficient of methacrylic acid in aqueous solution (IUPAC Technical Report)

[Vol. 79, Issue 8, p. 1463 \[Details + Abstract\]](#) [[Full text - pdf 246 kB](#)]

Subcommittee On Polymer Terminology

Robert F. T. Stepto

Dispersity in polymer science (IUPAC Recommendations 2009)

[Vol. 81, Issue 2, p. 351 \[Details + Abstract\]](#) [[Full text - pdf 164 kB](#)]

Subcommittee On Structure And Properties Of Commercial Polymers

Dick J. Dijkstra

Guidelines for rheological characterization of polyamide melts (IUPAC Technical Report)

[Vol. 81, Issue 2, p. 339 \[Details + Abstract\]](#) [[Full text - pdf 299 kB](#)]