Macromolecular complexes, whether they are interpolymeric ones or polymers complexed with low molar mass organic molecules, metal ions or particles participate in all fundamental aspects of life. They are as essential in the function of living organisms as in the development of new functional materials.

Of interpolymeric complexes those formed by polyelectrolytes are among the most complicated ones what comes to the factors affecting their formation and structure, as well as their properties under various conditions and the influence of stimuli from the surroundings. Polyelectrolyte complexes mediate the essential processes involved in the functions of living cells. The number of technological applications of charged polymers bound to each others is immense, ranging from water purification to cosmetics, biopharmaceutics and medicine. An impressive example of the use of polyelectrolyte complexes was the treatment of contaminated soil around the Chernobyl nuclear reactor after the catastrophic disaster in 1986. This example well showed the dynamic nature of the complexes, which e.g. may bind ions and glue contaminated soil into a solid crust. Polyelectrolyte complexes also show properties of polyampholytes.

Interpolymeric complexes may also build up due to stereochemical factors or via host-guest interactions. Cyclodextrins and calixarenes are known structural motifs, which may be utilized in host-guest complex formation and in building macromolecular complexes in a controlled manner.

Various aspects of the complexes between macromolecules and metals have been studied for several decades. Mechanisms of the complex formation, as well as the structures of the complexes are an important research problem as such but detailed knowledge of all these factors is needed for applications of the materials as catalysts, photoactive and electrically conducting materials. Macromolecular complexes are promising materials for high performance energy devices. There are several examples of the use of macromolecular metal complexes in cancer therapy. Because macromolecules may be tailored to contain several functionalities they may be used to bind various toxic metals or organic substances from water. Owing to the remarkable advances in the methods of polymer synthesis the construction of functional polymers to be used in advanced applications as controlled drug delivery or as carriers of active substances from magnetic nanoparticles to human growth factors.

Controlled methods of polymer synthesis have accelerated the growth of diversity of compounds based on macromolecular complexes. Dendrimers and hyperbranched polymers, as well as polymeric brushes comprise one important aspect in developing new materials. Both advanced synthesis methods and theoretical knowledge are needed for creation of materials with exactly needed properties. Another fast growing research area closely related to macromolecular complexes is that of hybrid nanocomposites. Recent advances in nanoparticle technologies have opened a new field of complex composite materials based, e.g. on gold, silver, or silica nanoparticles.

The 14th IUPAC International Symposium on MacroMolecular Complexes MMC-14 was organized on August 14–17, 2011 in Helsinki and followed the basic scientific design and tradition of the previous MMC symposia. MMC has been held in Beijing (1985), Tokyo (1987), New Jersey (1989), Siena (1991), Bremen (1993), Kuang-chou (1995), Leiden (1997), Tokyo (1999), New York (2001), Moscow (2003), Pisa (2005), Fukuoka (2007), and Conception (2009). The MMC-14 Symposium was for the first time organized in a Nordic country and was dedicated to the memory of Professor Eishun Tsuchida, the founder of the MMC Symposium series.

The conference series started as polymer-metal complex business but has evolved to cover all aspects of modern material science. Thus all the above mentioned aspects of macromolecular complexes were covered in MMC-14: macromolecule-metal complexes, metal nanoparticles, organic-inorganic hybrids, supramolecular complexes, self-assembled materials, and polyelectrolytes. Not only syntheses and characterization of the materials but also various properties and functions like conductive, photophysical, catalytic, electronic, optical and magnetic were discussed, as well as the applications of new materials. Biopolymers and their applications were well presented, this reflecting the modern trend to develop science based on polymers from renewable resources. A new element was included into the symposium programme, the coordination programming (a science of supermolecular structure and creation of chemical elements).

The MMC symposia have always been a meeting place for those who have already established themselves in the area of macromolecular complexes and for those who are newcomers. The MMC-14 Symposium gathered together over 170 scientists from 28 countries. Of the contributions, 34 have been collected into the present volume of Macromolecular Symposia. This collection well reflects the content of the conference.

Heikki Tenhu and Vladimir Aseyev

In memory of Professor Eishun Tsuchida (1930-2010)

Professor Eishun Tsuchida, Emeritus Professor of Waseda University and Honorary Chairman of The IUPAC Symposia on Macromolecule-Metal Complexes, passed away on 25 April 2010. Professor Tsuchida is recognized as one of the fathers of the macromolecular complexes. His interdisciplinary study on blood substitutes is also highly evaluated. Professor Tsuchida completed his doctorate degree in polymer chemistry at Waseda University in 1960, and was promoted to full professor in 1973. He was a very enthusiastic teacher with a broad mind and a sense of humor. He trained more than 100 doctor students and postdocs and 400 master students, who are now working in academia and industries worldwide. All of his colleagues and friends remember his friendly encouragement for research and his profound advice.

The concept and basis of ''Macromolecular Complexes'' were proposed and their molecular science was developed by his research group from the 1970's, as typical examples of the molecular-level performance of functional polymers or advanced polymeric materials. His science-based but ingeniously need-oriented approach has both provided insightful knowledge of various aspects of polymer science and opened up enormous new systems obtained by polymers and molecular assemblies. His macromolecular complexes are indeed versatile for producing materials that allow practical applications, such as metalloporphyrins as oxygen carriers, oxygen enriching membranes, conducting polymers, ionic conductors, electron-transfer mediators, polyion complexes, molecular assemblies, oxidative polymerization of phenols, and a room-temperature polythiophenylene synthesis using air-oxidation. Most of them are now under development and give a promising impact on related fields. His work widely ranged, but with a clear focus on the multi-electron transfer process in the macromolecular systems. For the last ten years, he devoted himself to the studies on synthetic oxygen-carrying fluids (blood substitute), such as hemoglobin-encapsulated vesicles and albumin hemes, by collaborating with medical scientists.

His interests and contributions were documented in his over 800 refereed publications and 30 books, which have been cited many times to yield a current Hirsch index of 53. He was invited to many universities as a guest professor and a visiting professor. He contributed to an educational policy proposal in Japan as a member of the Central Council for Education. After retirement of Waseda University in 2001, he served as a director of many research institutes including Research Institute for Production Development. Based on these accomplishments, he was awarded The Chemical Society of Japan Award for Creative Work for 1994, SPSJ Award for Outstanding Achievement in Polymer Science and Technology in 1990, and Purple Ribbon from the Government of Japan in 1998.

Reminiscing about the personality and achievements of Prof. Tsuchida on this occasion of MMC-14 is greatly appreciated.

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